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How Art as a Vehicle for Ideas-Based Ideologies Can Facilitate the Understanding of Climate Change and Help People Explore a Speculative and Sustainable Future

Wenwen Liu, Teesside University, United Kingdom
Robert Burton, Teesside University, United Kingdom
Simon McKeown, Teesside University, United Kingdom

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Abstract
Climate change is impacting on all aspects of contemporary life. Many artists provide a compelling vision for speculative futures, awakening a creative consciousness using imagined worldviews. This paper presents my practice-based research that aims to establish how visual art can engage with issues-based concepts and ideologies through the presentation, re-presentation, and interpretation as a framework for engaging with climate change issues and realigning society to sustainable futures. This paper takes theory, and artistic practice as methods means to respond to themes and issues of climate change. In the context of practical research, the arts-based approach and art theory research alternate between planning, theoretical research, practical action, reflection, and evaluation. Through digital art, this study creates a discursive space that relates to daily life, where people can deeply understand the interconnecting relationships between humans and the planet; simultaneously, it also shows people an achievable ecological future and encourages people to think and find an existence conducive to all. This existence is not the present, but a possibility for human beings to explore the future through the reshaping and reimagining of the present.

Keywords: Climate Change, Digital Art, Sustainability, Speculative Future, Practice-Based Research

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1. Introduction

With the accelerated development of economic globalization, many GHG and pollutants produced by human activities have caused a severe climate crisis. They not only destroy the balance of the natural ecological system and the symbiotic relationship between the earth and human beings, but also bring about negative socio-economic and political consequences to all countries in the world [28],[40], [54]. The International Plant Protection Convention (IPPC), World Meteorological Organization (WMO), United Nations Sustainable Development (UNSD), United Nations Environment Programme (UNEP), and United Nations Development Programme (UNDP) all reveal the harm of climate change and its serious consequences [28], [61]-[63]. Climate pollutants impact on all aspects of the Earth, such as food shortage, the decline of biodiversity, sea-level rise, and extreme weather, destroying human life, the national economy, and the earth's ecological environment. The climate issue is complicated because it involves politics, economics, culture, and society. It needs to be widely viewed and co-governed on a global scale. It needs to go deeper into the social ecology and the human spiritual ecology to reimagine contemporary life for sustainable futures [40].

In view of the climate problem, more and more influential artists have constructed new ways to express ecological ideas within their practice and respond to the environmental crisis [4], [11], [17]-[20], [27]. At the individual level, artists such as John Sabraw, Eve Mosher, Zaria Forman and Tomás Saraceno adapt art forms to express the consequences of human social activities on climate change [16], [31], [57], [58], [65]. These artists utilise creative expression in invoking emotional resonance for our global futures. Through their works, audiences appropriate through various visual language messages about coexistence and harmonious life with the planet and our natural resources. At the community level, through art activities, projects such as *Cape Farewell*, *GoodPlanet Foundation*, and *Aerocene* engage audiences in unique ways, actively encouraging people to participate in solving environmental problems, changing people's behaviour and attitudes towards the environment [8]-[10]. At the social level, art can be combined with other disciplines to convey knowledge about climate change to people from a unique perspective. It informs and engages relationships between humans and the natural environment and builds ecological intelligence [49], [55]. Concisely, art as a visual language engages, informs, and transforms at a social level, community level, and individual level.

Through six case studies, this paper critically engages creative and artistic languages as transformative vehicles in the space of climate change and global environmental challenges. As artist Bergit Arends proposes that "*environmental change can be identified by artists through the use of archives, its materials, structures and procedures*" [3]. Consequently, artists can develop narratives between events in time, between environmental space and creative archives, thereby creating a new vision in the space of environmental issues and ecological concerns. Art-making constructs narratives and metaphors that tell transformative stories within the space of climate change. Creative approaches affect people's values and feelings; ultimately, they may lead to a process of change at the individual level. Inspiration, as an incentive factor in the process of change, helps people make changes more excitingly and positively [3][10]. Creative narratives and metaphors influence people's thinking and values and deepen their understanding of key issues in the space of climate change. Due to the development of society and culture, the discourse on speculative futures has gradually attracted human attention. What is the future? It is a concept that does "not-yet-exist" but is about to appear [5], [6]. Tomorrow is the future of today, while the present is the future of the

past. Throughout the development of human history man has tried to attain a better life that is always becoming and revealing [1], [6], [7], [26], [36], [51] Indeed, these possibilities are a state in which the world itself exists and a state of existence in the future of new things [7], [21], [26].

This paper is practice-based research. In the early stage, it mainly focuses on the representative work of influential artists, such as *7000 Oaks* by Joseph Beuys, *Wheatfield — A Confrontation 1982* by Agnes Denes, *The Weather Project* by Olafur Eliasson, *the AMD conversion project* by John Sabraw, *HighWaterLine* by Eve Mosher, *Antarctica* by Zaria Forman, *the Nine Wave* by Cai Guo-Qiang, *the Aero-Solar Museum* Tomás Saraceno, *Underwater Sculpture Park* by Jason deCaires Taylor, *Waters of a lower register* by Allison Janae Hamilton, *Human Sensor* by Kasia Molga and so on. The purpose is to deeply understand how they express and participate in environmental problems in the language of art; how to transmit knowledge or information related to ecological issues or sustainability through art; how to influence people's attitudes, experiences, morality, and values through artistic emotion; and how to influence and shape the audience's response to the concept of long-term sustainable development and ecological thought through artistic experience. Through in-depth reflection on the works of these artists, I believe that visual narration and visual metaphor play a great role in changing lives in the space of climate change. Specifically, the expression of art can be connected with other disciplines to explore materiality and deepen people's understanding of environmental or ecological problems such as climate change [2], [17], [30], [32], [33], [35], [46]. The emotional exchange of art can change people's attitudes towards the environment and natural ecology, change the relationship between humans and non-humans, and shape sustainable values [15], [22], [25], [49]. The transcendence of art can help people look back on the past, face the present, look forward to the future, redesign the current life and realize the future [12], [14], [15], [38], [39], [41]. Through art to build an environment that is related to human daily life, can promote communication between people and climate change, thereby shaping, changing, and promoting a speculative and sustainable future.

2. Materials and Methods

2.1. Research process

The theoretical and philosophical ground of this study encompasses the ecological thinking on '*hyperobjects*' of Timothy Morton and Ernst Bloch's concepts of '*speculative materialism*' and '*ontology of not-yet-being*'. Bloch believes that art as a unique way of life carries a core track of hope [5], [21]. It reveals current issues and reviews historical experiences and lessons of the past. It is an infinite laboratory of potentiality. Morton believes that climate change is unfathomable; people can only experience parts or consequences of it as an object. The ambiguous metaphorical qualities of art express in sensual ways what is challenging to express in words. It gives a glimpse of what exists "beyond or between our normal categories" [39]. In a word, climate change is closely related to humans, and it is closely related to the present and future. Through metaphorical visual language, we can rethink the present and speculate about the future.

2.2. Aesthetics research and interdisciplinary research

This project conducts simultaneously interdisciplinary theoretical perspectives and visual research on the representative works of artists engaging in climate change. The focus of

aesthetic research is the language of artistic creation, artistic cognition, artistic emotion, and the aesthetic experience of artistic creation. The purpose is to integrate multi-disciplinary issues better to explore further and answer this project's research questions, thereby seeking an effective way to strengthen the communication between humans and the natural ecosystem and improve people's understanding of the environment and future life.

Many scientists reveal climate change to people through meteorological data, but this data cannot give people an intuitive feeling. To narrow the gap between climate science and art, a range of artists have developed interdisciplinary approaches to deepen an understanding of climate change. *Atmospherics/Weather Works (2003)* (figure 1) by Andrea Polli, *Wind Map (2012-present)* (figure 2) by Martin M. Wattenberg, and *Wind of Boston: Data Paintings (2017)* (figure 3) by Reflik Anadol create a perceptual language for emotional communication [23], [43], [45], [52]. They present new perspectives and new ways of understanding data that enhance the perception and consciousness of the changing climate.

Figure 1: *Atmospherics/Weather (2003)* Works by Andrea Polli collaborator
Dr Glenn Van Knowe.
It aims at converting meteorological data collected in 1991 into sound using algorithms to convey emotional content or emotion, thereby improving human understanding of the power behind data and the impact of climate change. The advantage of this work is that
it not only makes boring data interesting but also integrates the artist's
emotional content or emotion.

wind map
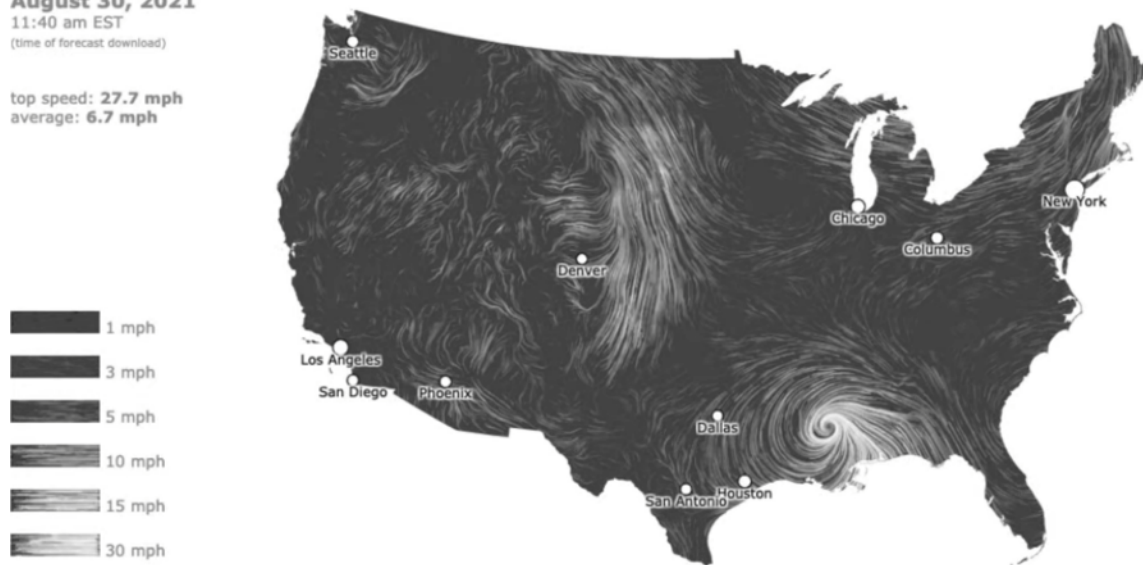
Figure 2: *Wind Map (2012-present)* by Martin M. Wattenberg.
It visualizes the airflow data in the cold winter in the US, showing the impact of climate change on American daily weather.
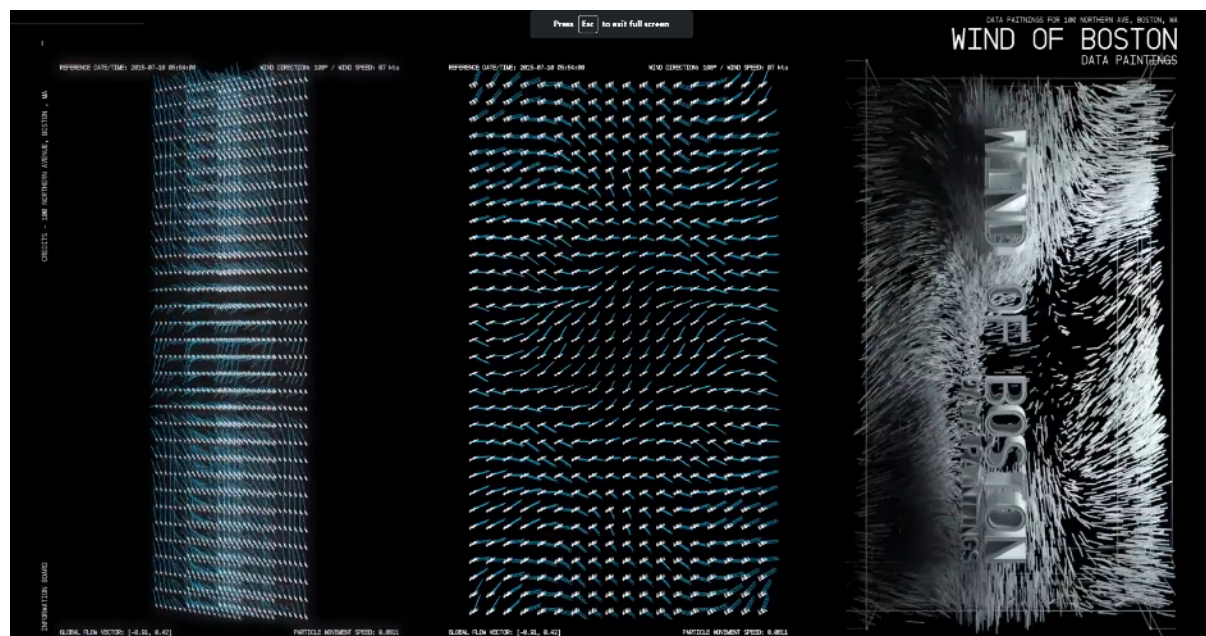
Figure 3: *Wind of Boston: Data Paintings (2017)* by Reflik Anadol.
By developing a series of customized software and using algorithms, it visualizes the one-year data set collected from Boston Logan Airport. It triggered a series of works exploring climate change and the beauty of nature and conveyed information about specific climate change.

According to Laurie Frick's research, 25% of global emissions come from food. In *What We Eat (2020)* (figure 4), she intuitively shows the impact of dietary behaviour on climate change [18], [37]. In contrast, Paolo Cirio, in his work, states that the one hundred significant oil, gas, and coal producers have generated over 70% of greenhouse gas emissions, causing considerable problems in human society, ecosystems, and their endangered species. His work

Climate Tribunal (2021) (figure 5) represents the legal responsibilities of fossil fuel companies and asks for public participation in this complex subject [48]. As a comparison with Frick and Cirio, Ursula Endlicher develops *Light and Dark Networks (2020)* (figure 6) to show her concerns with climate change from both human and natural factors [13], [24]. Frick, Endlicher and Cirio have established an environmental narrative using data to question global capitalism and economics and its effect on the global. All these artists encourage people to think about their relationship with climate change and seek solutions. Moreover, through their creative art practice, they explain the causes of climate change and dialectically affect people and transform society through cultural transformation.

Figure 4: *What We Eat (2020)* by Laurie Frick.
Through collecting the carbon dioxide content data of each food eaten by thousands of people from the United States, France, and Britain, Frick converts these data into colourful patterns to and converts these data into colourful patterns to design this work.

Figure 5: *Climate Tribunal (2021)* by Paolo Cirio.
It is designed through interventions on canvas, fabric, and paper and features scientific and economic data, legal documents, and biological research.
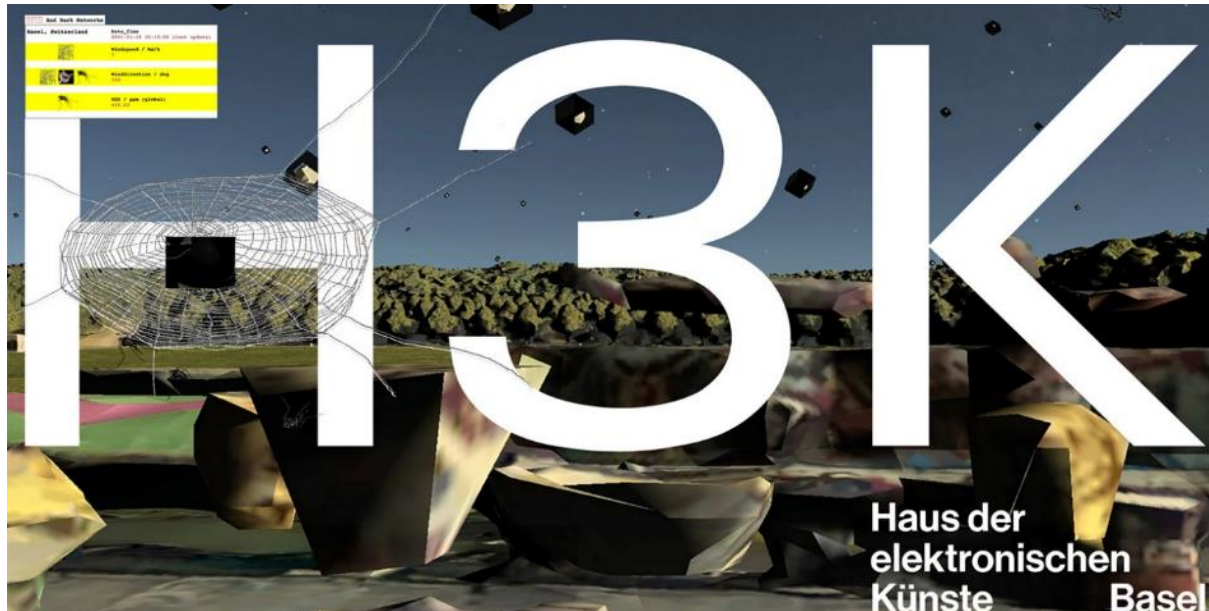
Figure 6: *Light and Dark Networks (2020)* by Ursula Endlicher.
It shows two online "data performances" that change due to different artificial or natural parameters and transmit digital codes into materials such as spider's web and mushroom.

Responding to climate change, Jer Thorp designed the *Herald/Harbinger (2018)* (figure 7) to illustrate the interrelationship between human activity in Calgary and the natural system of the Bow Glacier in the Canadian Rockies, and let people realize how close they are to the impact of the climate crisis [9], [29]. In 2017, hurricane Maria destroyed power supply

facilities in Puerto Rico, causing power cuts to at least 3.5 million people and about 3000 deaths. Based on this, Nathalie Miebach uses two narrative types from nature and human society in her work *The Burden of Every Drop (2017)* (figure 9), in which metaphor plays an important role. Through this work, Miebach explained the storm through materials, installation and colour that are not just visual but haptic, affecting the viewer through the senses [11], [44]. Thorp and Miebach combine art and other disciplines to explore materiality and a deepening people's understanding of climate change and its ecological issues.

Figure 7: *Herald/Harbinger (2018)* by Jer Thorp cooperated with
Ben Rubin, Shah Selbe, and Dr Jeffrey Kavanuagh.
By using the same method as a cardiotocograph to capture the sounds of
the Bow Glacier to collect real-time data). Then, through algorithm coding,
these data were visualized to create this public data sculpture.
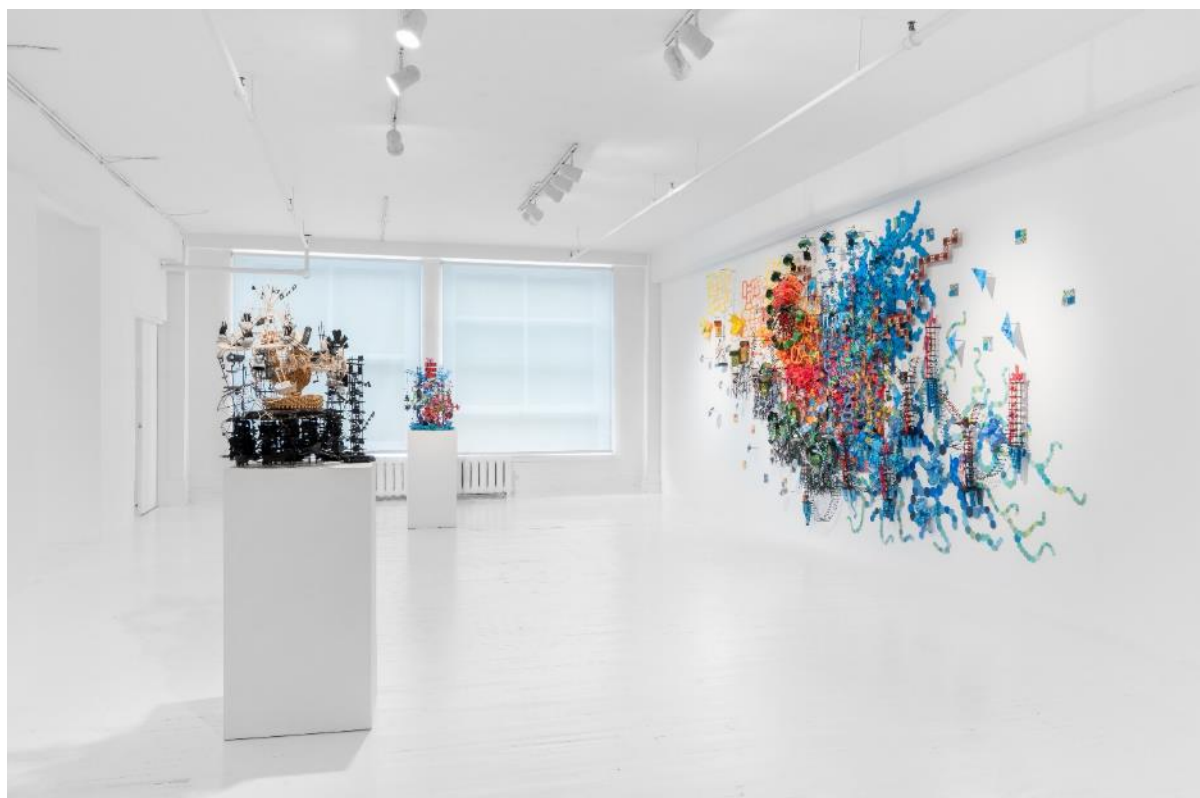
Figure 8: *The Burden of Every Drop (2017)* by Nathalie Miebach.
It combines weather and other numerical data with anecdotal information from
news reports about the aftermath of the storm, displaying the impact of
climate change on human society and survival.

Everything is interconnected, as Morton stated. Climate change is related not only to the present, but also to the future and the past (figure 9). *Deep Sea (2011)*, created by Dr Kirell Benzi, shows the past history and envisages what the future will look like, thereby drawing people's attention to global warming [34]. Similarly, Cristina Tarquini's *Diving into an Acidifying Ocean (2020)* (figure 10) explores the impact of climate warming on marine organisms from the past to the future [20], [56]. Timo Aho, Pekka Niittyvirta's work *Coastline Paradox (2020)* (figure 11) talks about how cities, countries, and continents are being affected by global warming [19]. In a sense, these three works show the responsible practices of the creative and the use of art to transform through the aesthetic experience; art as an innovative tool with the function of education, communication, dissemination, and transformation, concentrating creative expression toward positive, creative speculative futures.
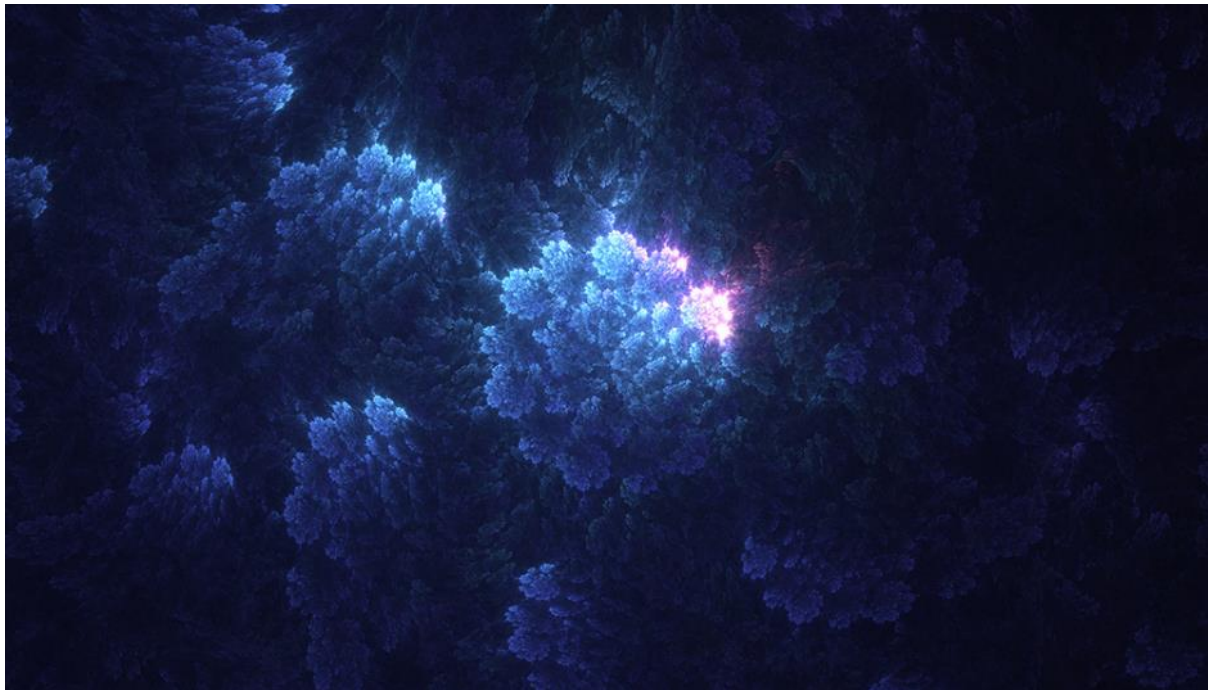
Figure 9: *Deep Sea (2011)* by Dr Kirell Benzi.
It uses algorithms to visualize the data of the sea level from January 1993 to
April 2018, proving that global warming is not a theory but a real fact.
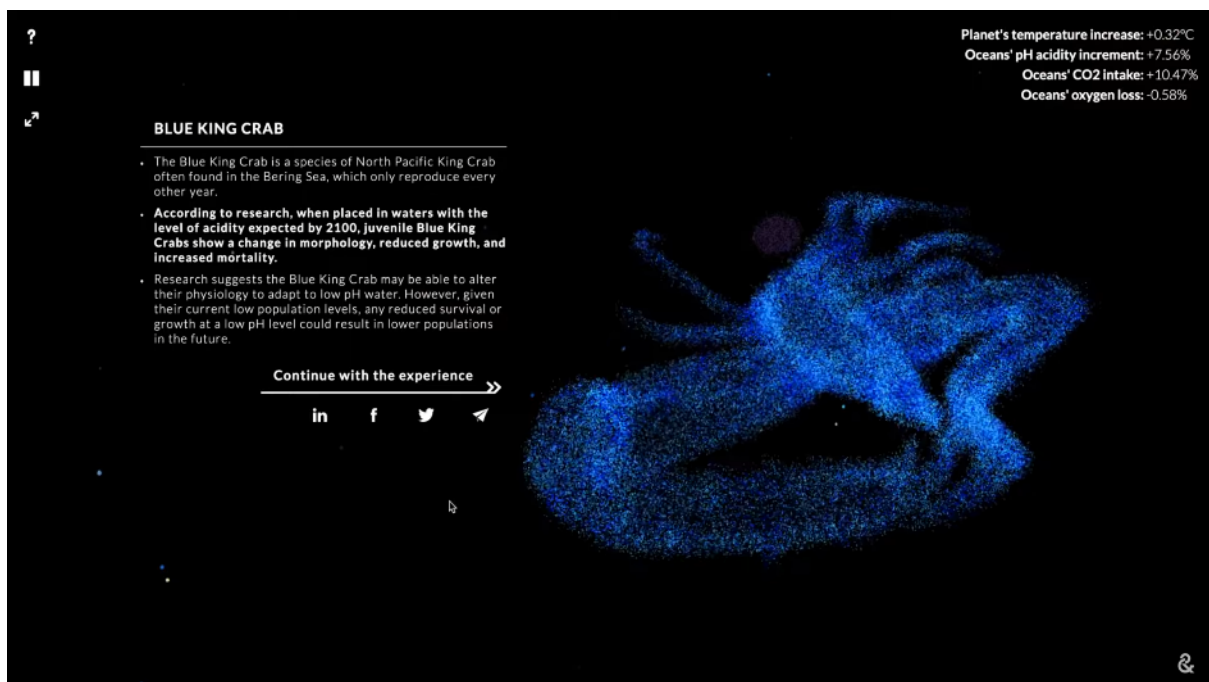
Figure 10: *Diving into an Acidifying Ocean (2020)* by Cristina Tarquini in collaboration with
Google Arts & Culture, visualizing data obtained from the National Oceanic and
Atmospheric Administration to explore the destructive impact of carbon dioxide levels on
marine animals and species from before the industrial revolution to 2100,
and a new marine organism born in the Anthropocene era.

Figure 11: *Coastline Paradox (2020)* by Timo Aho, Pekka Niittyvirta, in collaboration with Google Arts and Culture, Clare Brooks.

To fight against climate change, some artists use art to explore solutions. For instance, *88 cores (2017)* by Peggy Weil (figure 12) predicts future climate and environmental changes by detecting past climate and environmental changes [12], [47]. Moritz Stefaner's *Project Ukko - Climate service for seasonal wind forecasts (2020)* (figure 13) presents an understanding of the future variability of wind energy resources and bridges the gap between energy practitioners and the climate science community [50], [60]. In short, artists have integrated the concept of global thinking into art. Through art, they show a power beyond their survival essence, as well as a possible world and a speculated future.

Figure 12: *88 cores (2017)* by Peggy Weil. By using the data of ice cores collected in the
National Ice Core Laboratory, drilled between 1989 and 1993 as part of
the Greenland ice sheet project.
It emphasizes the key role of ice Nuclear Science in human exploration and
understanding of the earth's past and future climate and tells people that
human beings will coexist with climate change in the foreseeable future.
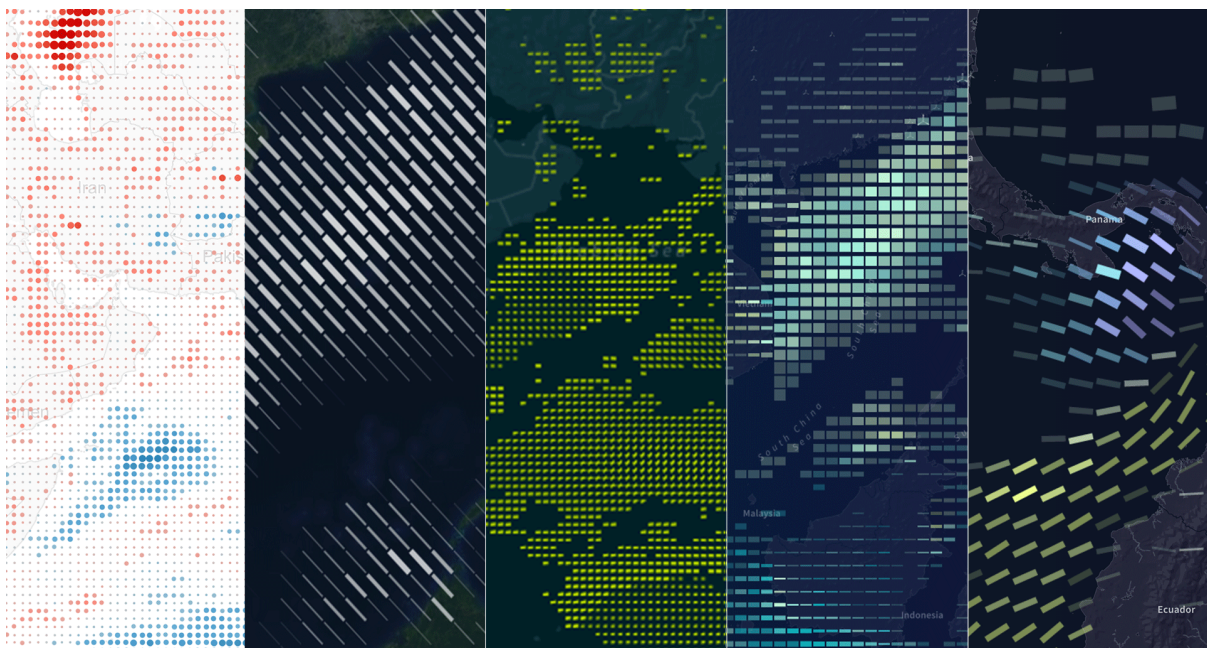
Figure 13: *PROJECT UKKO - Climate service for seasonal wind forecasts (2020)*
by Moritz Stefaner.
He believes that both the natural environment and human society are vulnerable
to climate change, and the progress of climate science is creating
an unprecedented potential to provide longer-term climate and weather forecasts
in the coming months, seasons, and decades.
This work is created for users in the wind power industry to explore
the probabilistic wind speed prediction of future seasons provided
by the resilience prototype.

3. Results and Discussion
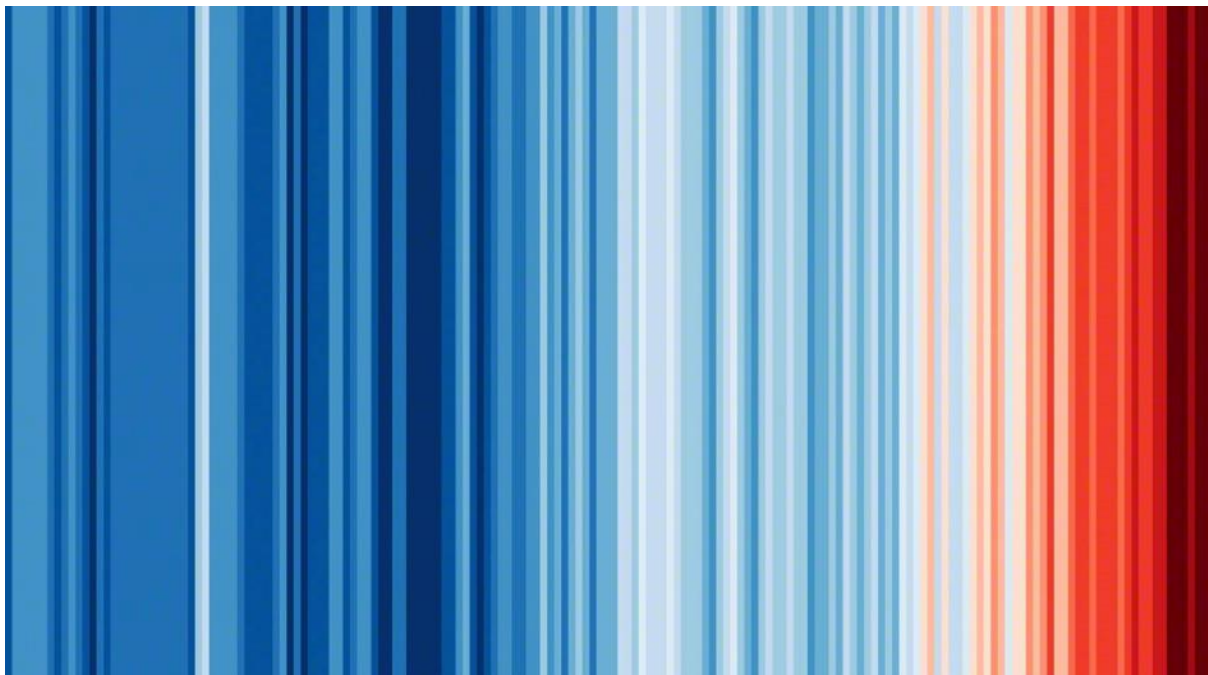
Figure 14: *Climate Stripes: Warming Stripes (2018)* by Ed Hawkins.

Figure 15: *Pollution Pods (2017-present)* by Michael Pinsky.

Climate Stripes: Warming Stripes (2018) (figure 16) and *Pollution Pods (2017-present)* (figure 17) are some of the projects that have made significant contributions to climate change in recent years [42], [53], [55]. This paper has brought together critical theory and contextual thinking within a visual framework. This method not only combines art with

interdisciplinary thinking to expand multi-disciplinary questions but further explores how visual and creative narratives and metaphors engender creative transformation in the space of climate change. The power of climate education is brought into play through artistic practice. Creative intention combined with specific climate issues integrates personal and collective emotion, transforming individuals and audiences and shaping sustainable thinking within global societies [59], [64]. In summary, art as an ideological metaphor and new approaches to narrative visual storytelling, when viewed through a methodological interdisciplinary lens, can deepen the understanding of climate change and form new insights and positive visualisation for speculative futures. Through art, artists can build imaginative spaces to rethink and refigure that contemplatively reimagine daily life, encourage people to reflect on their lives and behaviours and question their relationship to the planet, and the climate and promote sustainable values; integrating global thinking into art asks one to review the past, face the present and look forward to the future in the process of re-imagining and re-worlding to realize a sustainable and speculative future.

Acknowledgements

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The Effectiveness of Integrating Metal and Textile to Creating Contemporary Artworks Inspired by Egyptian and Saudi Heritage

Nouf Alsuwaida, University of Ha'il, Saudi Arabia
Lobna Abdel Aziz Mohamed Bayoumi, University of Kafr El-Sheikh, Egypt

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Abstract
Heritage expresses the link between human beings, their land, and their culture. It correlates the present with the past and promises the future. It means gaining knowledge, experience, and skills and provides the opportunity to create, develop, and innovate. Thus, this study investigated the effectiveness of integrating metal and textile to create contemporary artworks inspired by Egyptian and Saudi architecture heritage. It also addressed a geographical and historical introduction to Saudi Arabia and Egypt and reviewed some traditional folk crafts, code, decoration color, and symbolic meanings. Then the researchers, on the practical side, designed four innovative designs and applied them to the art using some of the decorations, the popularity of Egyptian and Saudi heritage, and the development of a range of modern designs and artworks. The research adopted the descriptive and experimental method and practical procedure by designing, borrowing, and inspiration—analysis of specific traditions and the methods of their ornament. Recommendations are given for practical ways other art and design faculty can build their art from heritage.

Keywords: Metal, Textile, Egyptian and Saudi Heritage

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Introduction

Heritage expresses the connection of man to his land and culture. It connects the present with the past and heralds a bright future. It is a means of acquiring knowledge, experience, and skill and allows innovation, growth, and renewal. Heritage represents individual and group identity, sense of place, and belonging (Smith, 2022). In other words, heritage is the culture that is transmitted from one generation to another. Heritage is based on the results of civilization in all fields of human activity, and the social and economic heritage includes the kind of life that our ancestors lived in their customs and traditions and the clothes they wore.

The Saudi vision (2030) encourages designers to search for new sources full of material folklore & heritage that had not previously been studied. It provides the framework that the Ministry of Culture adopts in support of the Kingdom's cultural sector, which identifies three central objectives: 1) Promoting culture as a way of life, 2) Enabling culture to contribute to economic growth, and 3) Creating opportunities for international cultural exchange (https://www.moc.gov.sa/ar).

Heritage has a significant developmental role that many experts have studied and stressed that governments have a considerable role in achieving that developmental role. Research by Aljahani, (2019) express that every society knows its own identity that distinguishes it from other cultures. Heritage has a position in the world and its relations with other communities according to that identity produced by the cultural factor, developed and accumulated for history and the cultural heritage, both moral and material.

Material culture is handicrafts and traditional tangible production of industrial products made from natural raw materials such as clay, wood, leather, fiber, and metal. Traditional culture is considered one of the most important material cultures in societies. (Yang, others el., 2018). However, material culture is the transformation of raw material into a specific form that serves a purpose for Saudi society, such as folk arts, crafts, buildings, clothing, and food (Al-Bassam, 1985).

In general, heritage is a source of inspiration and quotation for designers. Suppose they neglect the value of heritage as a source of inspiration for contemporary designers. In that case, they will thus overlook a treasure with innovative designs that the designer refers to as the architectural heritage. There are many architecture heritage designers can inspire from such as a historic building, a town site, an important archeological site, or a work of monumental sculpture or painting (Aljahani, 2019).

Research by Al-Bassam (1985) emphasizes that we must pay attention to reviving the heritage of these people for fear of losing the features that distinguish society from others and our distinctive identity. Likewise, Egypt and Saudi Arabia are considered one of these Islamic societies. Along with this, the current research aimed to investigate the effectiveness of integrating metal and textile to create contemporary artworks inspired by Egyptian and Saudi architecture heritage. It also addressed a geographical and historical introduction to Saudi Arabia and Egypt and reviewed some traditional folk crafts, which included code, color, and symbolic meanings of architectural heritage. Thus, the researchers designed and applied four innovative designs that developed a range of modern artworks by integrating metal and textiles inspired by Egyptian and Saudi architecture heritage. Thus, this research answered the following question:

1.   What is the effectiveness of implementing innovative artistic designs in a textile and metal style from the Saudi and Egyptian architectural heritage sources?

Literature Review

Heritage is the cultural elements transmitted from one generation to another. Heritage refers to the results of civilization in all fields of human activity, and social and economic heritage includes the kind of life that our ancestors lived in their customs and traditions, such as building (Alzahrani, 2022). The current research focused on architectural heritage (building) as one of the traditional folk crafts. Then, researchers analyzed the code, decoration color, and symbolic meanings in both Saudi and Egyptian architecture heritage.

Saudi Arabian Architecture Heritage

Location

Saudi Arabia is located in the Middle East. Saudi Arabia is bordered by the Red Sea to the west, Yemen and Oman to the south, the Persian Gulf, Qatar, and United Arab Emirates to the east, and Kuwait, Iraq, and Jordan to the north.

On the other hand, this study includes the three regions of the Kingdom which are central, western, and southern (Ahmed, others el., 2022). The following figure (1) shows the map of Saudi Arabia.

Figure 1. The Map of Saudi Arabia

The architectural heritage

Architectural heritage is unique and has standard features reflecting the Islamic culture. The characteristics include fabric, design, shape, materials, layout, surroundings, and external and internal features. The forms are ideas and feelings of the Saudi artist with values in the social and cultural environment (Alzahrani, 2022). As well as that, the artistic traditions of Islam are apparent in a rich system of ornamentation applied to art and architecture. Islamic ornamentation includes three predominant types of decoration calligraphy, vegetal motifs, and geometric patterns. Figural forms of humans or animals are not typical in response to Qur'anic commandments against idolatry. Instead, abstract shapes of decoration are used to

create visual statements about religious ideas and express the logic in the Islamic vision of the universe. (Jowers, others, 2010).

The Saudi architectural heritage belongs to four regions which are central, western, southern, and eastern. Each region has its unique urban style in addition to the Islamic style (Ghazala, 2021). Thus, the traditional buildings vary according to the geographical and climatic environment diversity. There are flat and mountainous areas, desert, and coastal environments. Thus, this study included the three regions of the Kingdom (central, western, and southern). The researchers analyzed the traditional buildings in the Kingdom of Saudi Arabia with Textile techniques as follows:

- The Najdi style. Najdi style (Najdi Houses) is central to Saudi Arabia. Diriyah includes a distinct heritage architecture, containing many aesthetic values that make it a fertile material for creativity in the art of painting (Almogren, 2020). The wooden doors in the heritage Saudi architecture are overlapping, opposite, symmetrical decorative, and geometric shapes. The decoration in those doors depends on the geometric and plant decoration to a large extent, such as the triangle, the circle, the square, the intersecting lines, the simulation of roses, leaves, palm fronds, and bunches of grapes. The colors used are bright colors such as yellow, blue, red, green, and black (Alsoliman, 2019).

- The Al-Asiri style. Asiri style (Algatah), the southern of Saudi Arabia. The Asir region of Saudi Arabia has a rich heritage that is deeply influenced by the charming nature of the place. Asir is characterized by the art of "Al-Kutt Al-Asiri," A'siri's cat, aesthetic calligraphy, inscription, and composition created by specialized women who have memorized this art from generation to generation. This art is characterized by using natural and bright colors such as blue, orange, green, white, and black (Korban, 2020).

- The Hijazi style. Hijaz style (Hijaz houses) The Western of Saudi Arabia. The Roshan is a boxy or polygonal wooden protrusion extending from the front of the house to overlook the external space and has different shapes (Alitany, 2014). Al-Rawashin was famous in the Hijaz region, especially in the city of Jeddah and Makkah, and it is considered a heritage and historical area (Ghazala, 2021).

Textile (Weaving)

Yarns are made into fabrics or textiles through many different processes. Weaving is the most common method used. There are three basic weaves: plain, twill, and satin. All other weaves are a variation or a combination of these weaves (Marshall, 2000).

The predominant design type is found throughout the Arabian Peninsula. Plain weave is the simplest and most used in Saudi Arabia, such as Bedouins, Asir, and Baha. The loom and soft wool yarn are used for the weaving process (Ross, 1994). As shown in Figure (3), each warp yarn passes alternately over one and then under one filling yarn for the whole length of the fabric. Two adjacent warp yarns interlace exactly opposite. One warp yarn goes under the same filling yarn as the first and second. Fabrics require two harnesses to weave the body of fabric because the weave repeats every two ends (Johnson & Sarkar, 2015). Indeed, the current research picked one basic weave, which was a plain weave to create artworks.
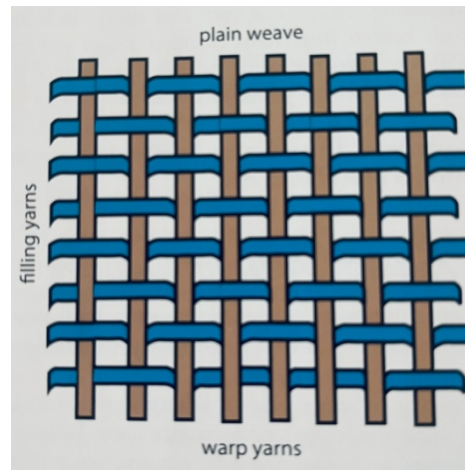
Figure 2. Plain Weave

Egyptian Architecture Heritage

Location

Nubia is the region in southern Egypt along the Nile River to northern Sudan. Most of Nubia is located in Sudan, and about 25% of it is located in Egypt. It is called the country of gold because the name Nubia is derived from the word (Nub), which means gold in the ancient Egyptian language (Fathy, 2010).

Figure 3. The Map of Egypt.

The Architecture Heritage in El Nuba

The researchers analyzed some traditional buildings in El Nuba (Egypt) with metal works. The symbol is one of the most important elements of folklore in general and the Nubian in particular, and the symbol is characterized by flexibility in order to coexist with cultural change and the diversity of concepts (Ibrahim, 2013). The symbols on the heritage buildings in Nubia were different. The decorations in the Nubian heritage were used to fulfill symbolic goals that the artist seeks to confirm through many beliefs that date back to early periods of time; these beliefs appear in many aspects of Nubian life, and the belief in the presence of

people who have the ability to "envy" represents a large In the Nubian culture, where all measures are taken to ward off the harm of the envious eye, such as the use of scorpions, crocodiles, lions, birds, fish, star and crescent, camels, plant and engineering reptiles, and others (Shehata, others., 2013).

Metallurgy

Metallurgy is a process used to extract metals in their pure forms, such as diamonds, gold, iron, bronze, and copper (DebRoy, others. ela, 2021). The ancient Egyptians found minerals 5000 years ago, where the luster contributed to the growth of civilization; even every era was called a typical metal. In 1995, the World Minerals Organization (WMO) developed a definition that says that a mineral is a chemical element or compound that is crystalline, formed as a product of geological processes (Khalil, 2014). However, the most prominent metal art techniques are casting, cutting, engraving, filigree, stamping, and direct forming in metal artworks.

Figure 4. Mineral in Egypt

Based on the literature reviewed, this study focused on the effectiveness of integrating metal and textile to create contemporary artworks inspired by Egyptian and Saudi architecture heritage. In addition, it expressed a geographical and historical introduction to Saudi Arabia and Egypt. Then, it reviewed some traditional folk crafts, including Islam ornamentation, color, and symbolic meanings in architectural heritage. Thus, the researchers designed and applied four innovative designs that developed a range of modern artworks with decorative units to benefit the production of art pieces using textile and metal techniques.

Methodology

The research followed the descriptive analytical method in studying the concept of Egyptian and Saudi Heritage. Although there are different folk heritage, the researchers chose traditional art architecture, including three buildings from Saudi Arabia and three from Egypt. Then, the researchers analyzed the code, decoration color, and symbolic meanings for each building in both countries to integrate metal and textile to create contemporary artworks inspired by Egyptian and Saudi Heritage buildings. In Saudi Arabia, the researchers included three styles of buildings which were: 1) Hijaz style, 2) Najdi style, and 3) Asiri style. In Egypt, the researchers had three styles of buildings from Nubian cultures.

Design Stages

The artist-designers can see something around them those others do not see, so they derived their ideas and designs from many sources that they considered to be sources of inspiration and provide them with innovative designs .Heritage architecture is one source of citation for

designers in their artworks. Before designing from Heritage, researchers were following sixth design stages:

First stage

It was the first identification stage, where designers stood in front of the heritage and dealt by studying and analyzing so that the process of merging between the designers and heritage was taking place to adapt it to serve design goals.

Second stage

It was the next stage in which the artistic heritage was assimilated and understood by the designers, which made them begin to formulate a new contemporary art form in line with the era's requirements, which required some addition to reformulating these elements and units.

Third stage

Absorbing the heritage, in which the designers stood on the best technical formulas for the design elements and methods of implementation. The designers started with the artwork after choosing and determining their final image. Thus, the final composition carries with it the spirit of the age and past fragrance.

Fourth stage

Objective inspiration meant taking inspiration from the heritage, which was not to transfer the heritage in a literal way or as it was, but rather the designer chose objectively from the heritage.

Fifth stage

Aesthetic inspiration in form and subject, as heritage has two sides of the form or the outer frame. The other side expresses the artwork's content, subject, and main idea. The basic components were the main elements, such as lines, colors, symbols, and meanings.

Sixth stage

Applying, which was the final state that the designers reached for the desired image of the artwork affected by heritage, in which the artwork reached climax to combine originality and contemporary.

Results and Discussion

The result answers the research question, which was "What is the effectiveness of implementing innovative artistic designs in a textile and metal style from the Saudi and Egyptian architectural heritage sources?" During the study, researchers created artworks inspired by Saudi and Egyptian architectural heritage by integrating metal and textile. After designing, researchers applied some of the traditional decorations' symbols, colors, shapes, lines, and motifs. The result showed four innovative designs that created a range of modern artworks with decorative units to benefit the production of art pieces using textile and metal techniques which were: a necklace, a bag, a hat, and a portrait. Each design includes three

demonstrates which describe the process. The following demonstrates how each design is applied:

Design 1

Techniques name:
- Textile (plain weave beads), Table (1).
- Metal silver, (crocodile forming), Table (2).

Tools & materials: Bead (green, brown, silver, purple), Loom, needle, Plastic threads.

The name of design piece: A necklace, Table (3).
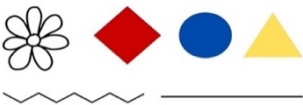
Country	Saudi Arabia
Description	Najdi style (Najdi Houses) The central of Saudi Arabia (Woody door)
Architecture heritage source	
Unity	
Analysis unity	- Vegetal motifs: Flowers and roses. - Shape: Triangle, circle, square, diamond, and dots, - Lines: Straight and zigzag. - Color symbol: Red: Strength, courage, and work. Blue: Calm and patience. Sand and brown: Natural from desert and color of sand. Yellow: Wisdom, optimism, hope, memory, and intelligence

Table 1: Source for Textile

Country	Egypt (Nuba)
Architecture heritage source	
Unity	
Analysis unity	-Figural form of animal: Crocodile -Symbol of crocodile: Strength and protection -Symbol of green color: Giving, growth, and goodness

Table 2: Source for Metal
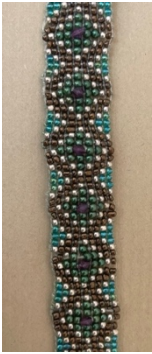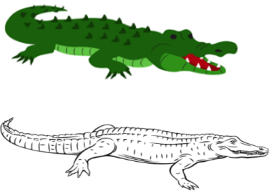
Country	Saudi Arabia	Egypt
Techniques: -Textile (plain weave beads) -Metal silver, (crocodile forming). Tools & Materials: - Bead (green, brown, silver, purple), loom, needle, plastic threads. - Metal silver.		
Final project of the necklace		

Table 3: Apply Source (1), (2)

Design 2

Techniques name:
- Textile (Threads plain weave), Table (4).
- Metal work (silver), Table (5)

Tools & materials: Loom, woolen threads (black, beige, white), blue beads.

The name of design piece: Bag, Table (6)
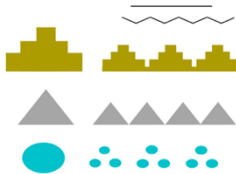
Country	Saudi Arabia
Description	Najdi style (Najdi Houses) The central of Saudi Arabia.
Architecture Heritage Source	
Unity	
Analysis unity	-Islamic ornamentation (reptation) -Shape: Triangle, circle, square, and dots -Lines: Straight and zigzag. - Sambal of sand color: Natural from desert, earth, and sand.

Table 4: Source for Textile
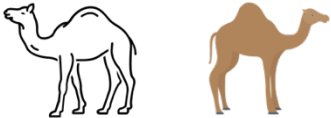
Country	Egypt (Nuba)
Architecture Heritage Source	
Unity	
Analysis Unity	-Figural form of animal: Camel. -Sambal of camel: Endurance and patience. -Sambal of sand color: Natural from desert, earth, and sand.

Table 5: Source for Metal
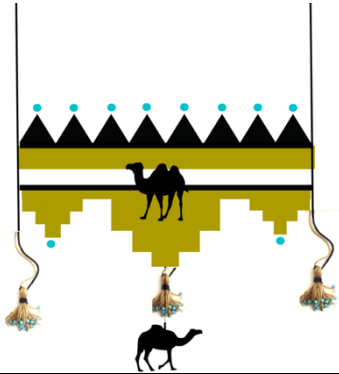
Country	Saudi Arabia	Egypt
Techniques Name: -Textile (Threads plain weave). -Metal work (silver). Tools & Materials: Loom, woolen threads (black, beige, white), blue beads.		
Design		
Final Project of the Bag		

Table 6: Apply Source 1, 2

Design 3

Techniques name:
- Textile (Threads plain weave & Crochet), Table (7).
- Metal brass (Crocodile forming), Table (8).

Tools & materials: loom, woolen threads (black, beige, white, red), brown bead.

The name of design Piece: A hat, Table (9)

Country	Saudi Arabia
Description	Alqatah style (Asiri Houses) The Southern of Saudi Arabia.
Architecture Heritage Source	
Unity	
Analysis unity	Vegetal motifs: Leaves and plant. -Shape: Triangle, circle, square, and dots. -Line: Straight and zigzag. Symbols: -Leaves: Goodness and fertility -Line: Flowing water -Colors: Red, yellow, green, wait, blue

Table 7: Source for Textile
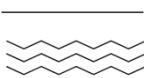
Country	Egypt (Nuba)
Architecture Heritage Source	
Unity	
Analysis unity	Figural form of animal: Crocodile. Shape: Triangle, circle, square, and dots. Lines: Straight and zigzag. Symbols: Leaves: natural, crocodile: strength and protection. Green color: Giving, growth and goodness.

Table 8: Source for Metal

Country	Saudi Arabia	Egypt
Techniques Name: -Textile (Threads plain weave & Crochet). - Metal brass (Crocodile forming). Tools & Materials: Loom, woolen threads (black, beige, white, red), brown bead.		
Design		
Final project of the hat		

Table 9: Apply Source 1, 2

Design 4

Techniques name:
- Textile (ribbon plain weave), Table (10).
- Metal silver (Fish &plant forming), Table (11).

Tools & materials: loom, stain ribbon (green, brown, pink), green & brown beads.

The name of design piece: The portrait, Table (12)
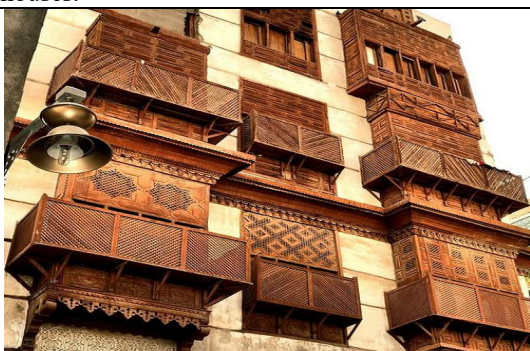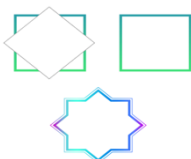
Country	Saudi Arabia
Description	Hijaz style :The western of Saudi Arabia. Al-Rawashin is woody window in Hijaz houses.
Architecture Heritage Source	
Unity	
Analysis Unity	Ornamentation: Islamic geometric patterns. Symbol color: Brown: natural from desert, earth, and sand.

Table 10: Source for Textile
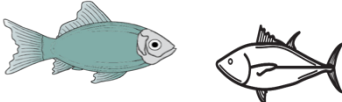
Country	Egypt (Nuba)
Architecture Heritage Source	
Unity	
Analysis Unity	Figural form of animal: Fish. Symbols: Fish: Goodness, hope, and reproduction. Blue color: Cold.

Table 11: Source for Metal

Country	Saudi Arabia	Egypt
Techniques Name: -Textile (ribbon plain weave). - Metal silver (Fish and plant forming). Tools & Materials: Loom, stain ribbon (green, brown, pink), green and brown beads.		
Design		
Final project of the portrait		

Table 12: Apply Source 1, 2

Conclusion

The study investigated the effectiveness of integrating metal and textile to create contemporary artworks inspired by Egyptian and Saudi architectural heritage. It also addressed a geographical and historical introduction to Saudi Arabia and Egypt and reviewed some traditional folk crafts (architectural), code, decoration color, and symbolic meanings. The researchers designed four artworks applied to the art and used some of the decorations and development of various modern designs and artworks inspired by Egyptian and Saudi architectural heritage**.** The result showed four innovative designs that developed a range of modern artworks with decorative units to benefit the production of art pieces using textile and metal techniques. There were three architectural heritage ornamentation in art and design which include:

- Islamic geometric patterns which included principles, symmetry, repetition, balance. The patterns could be seen to be composed of simple polygons such as squares, triangles and stars.
- Vegetal motifs such as flower, rose, plant, and leaves.
- Figural forms of humans or animals such as crocodile, camel, and fish.
- Elements of design such as line, shape, color.

- Symbol or meaning ornamentation such as color, vegetal motif, and figural form of animals.

Recommendations

- Explore heritage for more sources in Art & Design.
- Integrate Heritage into teaching and learning.
- Include architectural heritage in curriculum higher education.
- Build community among students and faculty in learning types of heritage in different countries.
- Consider a lifestyle that achieves the distinctive personality of the heritage, which helps raise the status of the Kingdom of Saudi Arabia and Egypt internationally.

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Contact email: nalsuwaida@hotmail.com
                 lobna7376@yahoo.com

Best Practices for Teaching a Course on Culture for EFL Undergraduate Students in Japan and Abroad: Based on Literature Review From 2016 to 2021

Gota Hayashi, Tokyo Keizai University, Japan

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Abstract

This literature review examined academic papers written in Japanese and English on how courses on culture for EFL (i.e., English as a foreign language) undergraduate students in Japan and abroad were taught, and suggestions for teaching that scholars and educators have for educators and administrators. The databases used were CiNii, ERIC, and ProQuest with full text search for all databases. The researcher identified 38 relevant articles for integration in the paper, after reading through and annotating 54 papers that were not overlapping. The researcher found that academic papers available on culture instruction at the undergraduate level for EFL in Japan focused on sources outside of the classroom such as short-term study abroad programs, long-term study abroad programs, video-conferencing and interaction with students from other countries who are also learning EFL, and social network services to educate students about culture. On the other hand, culture instruction at the undergraduate level for EFL abroad focused on activities in the classroom, particularly, having students learn about culture through movies, comics, and works of literature. Implications for administrators and educators involved with or are about to be involved with designing or teaching undergraduate courses on culture in Japan or abroad particularly in EFL contexts will be discussed based on literature review.

Keywords: Teaching, Undergraduate Students, Japan, Abroad, English as a Foreign Language

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Introduction

Inda (2019) investigated 300 first year university students in Tokyo, Japan, on the intercultural education they receive during English classes in middle school and high school and found that 71 percent did not have opportunities to learn cultures aside from the United States and the United Kingdom. Inda points out that if instruction to improve intercultural competence is difficult to deliver at the middle school and high school levels, it might be necessary to make up for the missed hours of instruction during college. EFL teachers and researchers have noted that culture and language are two sides of the same coin and are intertwined (Chaya & Inpin, 2020; Bagui & Adder, 2021). However, the idea of making up for missed hours suggest that linguistic competence is being prioritized over cultural competence within EFL. Osada (2016) investigated undergraduate students' attitudes toward other cultures at a university in Japan (N=123 with 104 freshmen, 14 juniors, and 5 seniors) who are aiming to become elementary school teachers and found that preservice teachers are concerned about their lack of knowledge of other cultures and their lack of confidence in reading and writing in the target language. This paper attempts to identify the best practices for teaching a course on culture at the undergraduate level in Japan and abroad based on a literature review of papers published between January 1, 2016 to June 11, 2021. This paper will be relevant to educators and administrators in charge of or are about to teach a course on culture at universities in Japan and abroad. According to Regmi et al. (2010), studies available in English are often excluded from systematic reviews because of language restrictions. Additionally, Sunol and Saturno (2008) argued that research conducted in languages other than English is less available and referenced than those published in English. This paper will compare how culture is taught for EFL undergraduate students at Japanese universities against how culture is taught for EFL undergraduate students abroad. The EFL context abroad serves as a reference point for evaluating how culture is taught at the undergraduate level in Japan within EFL and illuminate distinct features of cultural instruction. That will allow for drawing implications for educators and administrators both in Japan and abroad.

Defining culture

Culture, the central construct of this paper will be defined hereafter, first, focusing on a broad definition of culture, second, focusing on what culture means within Japanese people, and finally, focusing on what intercultural means and the definition of Intercultural Communicative Competence, a construct that appears throughout this paper and existing literature on EFL pedagogy. Culture will be broadly defined as a system of ideas that control the attitude and behaviors of humans both individually and in groups (Jawas, 2020). Culture is perceived by the Japanese people as something that is internal and external. Bonnah (2020) explains that Japanese people speak of "touching culture" (p. 120), and argues that it is a discourse schemata that shapes their behavior. Bonnah relates the concept of touching culture to the Japanese concept of self and the other (i.e., *uchi* and *soto*). As Gómez (2018) argued, being intercultural means confronting elements of deep culture such as social behaviors and norms, lifestyles, politeness, as well as personal and collective ideologies about values, class, race, gender, money, education, work, and human rights. Intercultural Communicative Competence (i.e., ICC) means the ability to communicate effectively and appropriately with people from different cultures, and the ability to be aware of cultural diversity (Banjongjit & Booonmoh, 2018). While it is a time-consuming task, enhancing the components of ICC is crucial for helping learners deal with deep, complex, and controversial ideologies and beliefs (Gómez, 2018).

Teaching culture at the undergraduate level in Japan

First, technology has been utilized to connect students inside and outside of the classroom. Bonnah (2020) scaffolded culture in class through Gallery Walks (i.e., works of art found on the Internet) over a semester, along with Twitter responses to these cultural activities outside of class. Bonnah argued that students demonstrated their acquisition of ICC when some students decided to go beyond the class assignment and decided to choose works of art not shown in class to make comments about them or made that work of art's image their desktop background. According to Bonnah, using Twitter as a conduit of expression can help students accumulate culture over time. Tabata, Jones, and Anzai (2019) used Skype for (1) a read-through of a movie entitled *Mr. Fox* after gaining permission from the movie director, and (2) home-country presentations on PowerPoint with Japanese university students, Japanese high school students, international students from China and Vietnam, and Indonesian university students. According to Tabata, Jones, and Anzai, read-through activities have a script that students can practice beforehand and including students other EFL learners can be a tool to communicate interculturally.

Second, a five-day intensive English camp for first-year undergraduate students majoring in English and Cultures in Japan in which they were only allowed to speak English (Noguchi, 2019) was another strategy employed by universities in Japan for students to build their ICC. Noguchi found that the five-day camp had contributed to decreasing some students' anxiety and increasing their perception of communicative competence. The researcher points out that compared with studying abroad, participating in an English camp is more economical and safer for young English learners.

Third, having students experience short-term study abroad for two to four weeks as part of the curriculum was another strategy employed for building students' ICC. In terms of preparation for studying abroad, Cutrone (2020) examined 20 first-year students at a national university in southern Japan who studied abroad for 3.5 weeks and found that the students who received explicit instruction on listenership behavior generally outpaced the group that received implicit instruction in terms of their pragmatic competence. In terms of outcomes of short-term study abroad, Nakasato (2017) analyzed nine undergraduate students' essays attending Okinawa Christian University after their 2-week cultural exchange and study abroad in Hawaii's Kaua'I Community College and found that students: (1) understood more about their own culture, (2) learned not to be ethnocentric (3) became more interested in cultures abroad, (4) developed their understanding of the differences in education between Hawaii and Japan, and (5) understood how Japan could emulate Hawaii in terms of educators not being so critical of students but more encouraging. In terms of affect, students learned empathy, tolerance, sensitivity, flexibility, and openness. Finally, students learned to reciprocate, communicate proactively, and value human interaction through the intercultural experience. With these results, Nakasato believes that Okinawa Christian University should continue to refine the contents of the study-abroad program. Similarly, Isa (2016) examined how three types of short-term study abroad programs: (1) intensive language program, (2) early childhood care and education and (3) volunteer work-study had an impact on college students' levels of confidence. The researcher found four factors to be prominent including: self-affirmation, ability to build interpersonal relationship, sense of capability, and ability to recover from emotional setbacks. Members of the overseas volunteer work-study group scored high on confidence building, especially the ability to build personal relationships and the ability to recover from emotional setbacks. However, Isa also noted that the participants indicated how whatever they engage in, they feel their lack of competence. Isa thinks that this

comes from culture shock and hardships the participants experienced during their study abroad. Finally, Ikeda (2020) documented the effects and self-perceived changes that occurred as a result of studying abroad in the Philippines by drawing on a case study of 103 Japanese university students on a four-week intensive English language program. The study found that among common themes that emerged was a shift in focus from grammatical form and accuracy to communication-oriented goals of learning. Additionally, consensus was reached about students' perceived improvement in oral communication skills and more comfort in using English. In Ikeda's study, 80 out of 98 students responded positively to the statement: "I was able to improve my test-taking skills (for TOEIC, IELTS, etc.)" (p. 7). Students boosted their highest achieved TOEIC scores with 39 more students having reached the 600-point benchmark compared to pre-departure.

Suggestions for teaching culture at the undergraduate level in Japan made by researchers in the existing literature

First, Saki (2017) suggests three approaches to teaching local ethnic diversity in the EFL classroom. Three approaches include: (1) beyond-the-textbook approach such as with current events in local newspapers, media coverage of certain topics, documentaries, and movies; (2) fieldwork, which could include interviewing people and conducting surveys; (3) in-class activities such as role-plays, games, debates, and discussion of case studies. Saki notes that the benefits of teaching about domestic ethnic diversity to Japanese university students include: strengthening students' intercultural awareness and cultural consciousness, raising students' intercultural sensitivity, and developing students' skills to prevent intercultural conflict before it occurs.

Second, Koshiyama, Aliponga, and Hou (2019) suggest creating a multilingual and multicultural environment by having an English and Japanese hybrid class. The researchers examined whether an English and Japanese hybrid class created a multilingual and multicultural environment by having 32 students who were a mix of Japanese and international students taking a Japanese Civilization class take pre-instructional and post-instructional surveys. The international students were from China, Korea, the Philippines, Indonesia, and Vietnam. The results show that Japanese students as well as international students all had positive perceptions of class contents and instruction in Japanese and English. The researchers point out that based on the results of the study, English and Japanese hybrid class provided meaningful and purposeful opportunities for creating multilingual and multicultural learning environment for all groups and students. The researchers point out that contextualizing the class materials to relevant and appropriate topics and themes, such as social and cultural characteristics and issues of Japan, utilizing both English and Japanese during instruction, and utilizing the hybrid language materials provided meaningful and purposeful uses for creating a multilingual and multicultural learning environment.

Third, Cutrone (2020) and Tanabe (2019) suggest that students participate in short-term study abroad programs. Cutrone points out that short-term study abroad can serve as an important motivational tool, as it shows students why they need English and inspire them to study more and or attempt longer sojourns abroad in the future. Tanabe's interview study of four female Japanese exchange students who studies at the University of Pécs in Hungary for a year suggests that visiting Hungarian homes and social networking with locals and international students played a major role in their cultural development necessary for constructing a critical self. Tanabe points out that the experiences also shaped their understanding of their own contexts where they are from. However, one of the participants in the Study, Yuuna, was

critical of her own context post return, as she felt she could not feel the value of her new skills she acquired in Hungary.

Teaching culture at the undergraduate level abroad

Reports of how movies were used in teaching culture in the EFL classroom has been reported in China, Hungary, and Thailand. For China, Liu (2020) has used movies to teach about culture in five phases: (1) input and noticing through cultural introduction (e.g., rules for proposing marriage in general), (2) reflection, through thinking about conflicts (e.g., comparison of Chinese and Western concepts of love and marriage), (3) output, through cultural inquiry (e.g., teachers asking further questions such as why weddings are held at Church for western weddings), (4) noticing again through cultural contrast (e.g., etiquette in Chinese and Western weddings), and (5) reflection, though skill training (e.g., interviewing parents and grandparents about their wedding and explaining how the student plans for the students' own wedding). With EFL cultural instruction through movies in Hungary, Tanabe (2018) had students answer ICC related questions about movies that they were assigned to watch, and had them fill out ICC self-evaluation sheet at the end of the seminar. Along with movies, Tanabe had students submit two drafts of a research paper, which was an interview study about intercultural communication. Tanabe's study found that although students were conscious of certain aspects of other countries' culture and conventions of communication, they were less confident about the knowledge of their own and other countries' national culture in a broader sense. With EFL cultural instruction through movies in Thailand, Chaya and Inpin (2020) investigated the effects of Movie-Based Mobile Learning (MBML) instruction for improving Thai EFL university students' speaking skills and Intercultural Communicative Competence (ICC) and examined their attitudes toward them. The study involved first-year university students learning General English in the Faculty of Nursing at a private university in Bangkok. The study found that Movie-Based Mobile Learning instruction developed Thai university students' speaking skills and Intercultural Communicative Competence. With ICC, mean scores on the post-ICC of the experimental group were significantly higher than those of the pre-ICC in all three aspects of ICC, which included: awareness towards diverse cultures, intercultural knowledge, and the skills of interpreting and relating to other cultures.

In Thailand, songs were also used in the EFL classroom to increase students' ICC (Ayuthaya, 2018). Forty-three third and fourth-year students at one university in Bangkok over a course of 17 weeks in an English through Songs course were examined. The researcher found that songs can be an effective technique to incorporate ICC into classroom practice and increase ICC levels while also boosting L2 learning motivation. All participants reported that they increased motivation to learn English and cultural knowledge both inside and outside of class, felt more enjoyment, and were more relaxed and willing to go to class than before.

Finally, reading was mentioned as a strategy for improving EFL students' ICC, particularly in Columbia, Iran, and Saudi Arabia. First, for Columbia, Gómez (2018) conducted a case study analyzing how a group of EFL learners in Colombia built critical intercultural awareness through the discussion of cultural events at reported in the media including *The New York Times, U.S. News,* and *The Telegraph*. The researchers found that the EFL learners not only gained new knowledge about beliefs, values, and behaviors that cause conflict in other cultural communities but also compared them critically to their own culture. Gómez claims that integrating news in EFL education can be a salient instructional method to help EFL speakers become more critical intercultural individuals through topics related to deep culture.

According to Gómez, learners started to become interested in global issues through the course. Second, for Iran, Rezaei and Naghibian (2018) investigated the role of literary texts in the development of Iranian English language learners' ICC through thirteen students in the researchers' fourteen-session course of American English Short Stories at Sharif University of Technology in Iran. The research found that even those who were very critical in class, developed a more positive attitude toward both their own and western cultures. The researchers claim that the course has been successful in imparting a more international view. Third, for Saudi Arabia, Hazaea (2020) reported findings on the development of critical intercultural awareness among EFL students in a critical reading enrichment course for first-year male Saudi university students. The researcher found that participants demonstrated balanced intercultural awareness associated with the discourse of food diversity, appreciated cultures of the self and others, and demonstrated appropriate intercultural knowledge. Hazaea points out that as a result of training students to analyze intercultural texts, they could gain skills to analyze and interpret intercultural discourse.

Suggestions for teaching culture at the undergraduate level abroad made by researchers in the existing literature

Two major themes related to teaching culture at the undergraduate level abroad have been identified in the literature from 2016-2021 (i.e., eight papers on ProQuest and eleven papers on ERIC). They include: (1) suggestions for administrators and teachers (Altan, 2018; Arcagok & Yimaz, 2020; Chen & Bang, 2020; Jawas, 2020; Mai, 2021; Lee, 2020; Lei, 2021; López-Rocha, 2016; Manuel & Dimas, 2019; Weda & Atmowardoyo, 2021; Sundh, 2018; Vo, 2017) and (2) suggestions for teaching culture related to speaking, listening, reading, and writing (Almuhailib, 2019; Cheewasukthaworn & Suwanarak, 2017; Gómez, 2018; Maliki, Lamkhanter, & Housni, 2017; Namaziandost, Sabzevari, & Hashemifardnia, 2018; Pinzón & Norely, 2021; Rana Khan, 2018). The two major themes will be explained in separate sections hereafter.

Suggestions for administrators and teachers

Jawas (2020) claims that teaching of culture must extend beyond factual learning. In classrooms, related to this point, Manual and Dimas (2019) point out that it is the teacher's job to promote language learning by having them use their own words that ultimately unveils the complexity and richness of culture. When using textbooks, Mai (2021) points out that although current curricula use the original varieties of English such as British or American English to guide learners, that does not mean that varietal features of the languages should be ignored. Mai suggests that language teachers should act as gatekeepers to correct learners' errors while being aware of the language variations and learn to distinguish between errors and variants to nurture language learners' reactivity. López-Rocha (2016) points out that ICC teaching should be interactive in order to foster interactions and discussions that lead to self-awareness, openness, and transformation.

Altan (2018) suggests that pre-service teachers be proactive in attempting to understand more about foreigners and learn from them through interactions to build their own ICC. Arcagok and Yizman's (2020) study that involved pre-service teachers as participants elicited specific suggestions from pre-service teachers for building intercultural sensitivity, which included: (1) introducing different cultures in programs, (2) providing a course on culture as an elective course, (3) including pen friendship programs, (4) introducing articles, (6) assigning reading tasks, and (7) adding courses that cover language and culture. Sundh (2018) suggests teachers

who are teaching preservice teachers to use video-conferencing as a tool to establish contacts among preservice teachers in different locations and to develop intercultural understanding. Some topics that may be discussed are teaching and learning at schools, teacher education at universities, and teachers' working conditions (Sundh, 2018). Sundh points out that teachers facilitating video conferencing do follow-up activities to ensure that interaction among preservice teachers do not lead to simplifications and misunderstandings. Lee (2020) examined the current state of a cross-cultural distance learning program CCDLP) for learning English in the EFL context that has been running since 1998 among four universities in Korea, Japan, and Taiwan, and with 58 respondents mostly Korean females responded that interacting with students at other universities was helpful. However, Lee points out that the program and courses need to be regularly monitored for quality control. Lee suggests that checklists be made and surveys be administered to students and the faculty involved.

As for curriculum, which is related to administration, Lei (2021) suggests that universities emphasize ICC development in teaching, and provide more opportunities to communicate interculturally for pre-service English teachers. López-Rocha claims that ICC needs to be incorporated in the language curriculum if educators hope to help students develop an appreciation for the language and culture studied, an awareness of culture, and the development of skills that allow students to be competent and adaptable communicators. Chen and Bang (2020) point out after investigating how preparation for study abroad affects the academic success of East Asian undergraduate students in the U.S. universities based on interviews from 12 participants who were from China, Hong Kong, South Korea, and Taiwan that neither the preparation programs in their homelands nor ESL programs in the United States offered courses related to American culture, and students fail to realize the importance of understanding American culture until they come to the United States. On a macro level, Weda and Atmowardoyo (2021) underscores the importance of Cross-Cultural Competence as a cornerstone to build social harmony and peace in a multicultural society.

Suggestions for teaching culture related to speaking, writing, listening, and reading

For speaking, one teacher who was a participant in Cheewasukthaworn and Suwanarak's (2017) investigation of sixteen Thai EFL teachers' perceptions toward ICC suggested that if students are curious about understanding more about the culture of the interlocutor and respect foreign cultures and knowledge of the learners' own cultures, students can talk about multiple topics. This suggests the importance of input to motivate students to speak. Similarly, for reading, Mailiki, Lamkhanter, and Housni (2018) point out that "[u]ntil readers are willing to engage in appreciating the cultural values in the text, mediating between their own culture and the newly introduced traits through the text, they will never enjoy other human learning experiences" (p. 97). Gómez (2018) proposed the use of genre-based learning through two samples of genres, how the skills of discovery, interpreting, and relating can be articulated, complemented, and enhanced gradually through critical thinking tasks. Pinzón & Norely (2021) suggest that EFL teachers should "begin with short stories, comics, recipes, menus, songs, or excerpts taken from books to get students accustomed to having contact with 'real' language" (p. 44). Almuhailib (2019) suggests that teachers can have students (1) compare texts of students' L1 to the target language and (2) understand L2 cultural norms, expectations, beliefs, and ways of thinking including notions of gender equality, individualism, and understanding issues from multiple contrasting perspectives. Almuhailib points out that each written language has its own unique rhetorical patterns in terms of style, structure, and content. For example, Almuhailib points out that in some languages such as Arabic, the audience is given the burden of understanding the text, while in other languages,

such as English, the writer is expected to clearly explain concepts to the audience. For listening, Namaziandost, Sabzevari, and Hashemifardnia (2018) point out that Iranian EFL course books do not sufficiently get students ready for intercultural communication because they focus on language forms and do not improve students' awareness of the target language culture. The researchers point out that language learners wanting to enhance their listening comprehension should have exposure to target culture materials. Rana Khan (2018), based on an investigation of 75 non-native English teachers (N=38) and native English teachers (N=37) at various universities and colleges, private and public points out the importance of incorporating materials and activities in which speakers with different accents are included. Rana Khan also emphasizes the importance of mutual intelligibility between the teacher and the student.

Implications for undergraduate level EFL teachers and administrators in Japan

For educators teaching EFL at the undergradute level in Japan, suggestions for building ICC from scholars and educators abroad suggest that educators themselves become interested in other cultures, recognize the importance of including various cultures and accents, and learn to recognize opportunities to educate students about culture while building students' linguistic competence. Some of the ways that educators can consider building students' intercultural competence are using movies, songs, comics, and works of literature for students to become interested in culture outside of their own. These sources of listening and reading can be used as tools to then have students work on their writing skills based on reflection, and speaking skills through discussions and presentations.

For administrators in EFL, it is important to consider whether EFL faculty members from diverse cultural backgrounds are hired, and given the departmental goals, whether it would make sense to establish a required or elective course on culture. What universities abroad a particular university in Japan is affiliated with can inevitably shape EFL courses and extracurricular offerings. The inevitable impact of all the pieces of the curriculum makes periodic faculty meetings for all EFL faculty to understand the curriculum and what other faculty are doing in their classes reasonable. Allocating time for faculty meetings can assist administrators in refining the curriculum to align with departmental aims.

Implications for undergraduate level EFL teachers and administrators outside of Japan

For administrators of EFL programs at the undergraduate level abroad, what can be considered from how culture is taught at the undergraduate level in Japan is providing educational opportunities outside of the classroom including opportunities for short-term study abroad programs lasting two to four weeks and longer exchange programs. Similar to the suggestions for Japanese undergraduate programs, periodic faculty meetings for faculty members to understand what other EFL teachers are doing in their classrooms, and for faculty members to teach with the understanding of the curriculum is recommended.

With teaching culture in class, along with the use of movies, songs, comics, and works of literature, educators might also consider having students engage in fieldwork in which they are asked to interview those outside of the classroom and write papers based on fieldwork based on a synthesis of the cultural concepts taught in class, readings introduced in class, students' own review of literature and film on a certain aspect of culture, and findings from fieldwork. If short and long-term study programs are to be included as part of the curriculum, such inclusion should be considered when teachers prepare for EFL courses for building

linguistic and cultural competence. Teachers might also consider ways to create a multicultural and linguistic environment in their courses on culture.

Conclusion

This paper compared how culture is taught for EFL undergraduate students at Japanese universities with how culture is taught for EFL undergraduate students abroad. The comparison was made in order to identify best practices for teaching a course on culture for EFL undergraduate students in Japan and abroad based on a literature review from 2016 to 2021. In Japan, at the undergraduate level, much of cultural teaching has relied on opportunities outside of the classroom, including study abroad programs (Cutrone, 2020; Ikeda, 2020; Isa, 2016; Nakasato, 2017) and intensive English camp (Noguchi, 2019). On the other hand, undergraduate level teaching of culture abroad has had a focus on teaching about culture through movies (Chaya & Inpin, 2020; Liu, 2020; Tanabe, 2018) and reading (Gómez, 2018; Hazaea, 2020; Rezaei & Naghibian, 2018). Suggestions from Japan have included teaching about local ethnic diversity (Saki, 2021) and creating a multilingual and multicultural environment (Koshiyama, Alipoga, & Hou, 2019), and having students participate in short and long-term study abroad programs (Cutrone, 2020; Tanabe, 2019). On the other hand, suggestions for cultural teaching at the undergraduate level abroad fell into two categories: suggestions for administrators and teachers, and suggestions for teaching culture related to speaking, listening, reading, and writing. Implications for teachers and administrators were also made based on the literature from 2016 to 2021.

The best practices for teaching culture in both Japan and abroad undergraduate-level EFL contexts include: (1) having administrators consider whether to include or maintain a course on culture as an elective or a requirement based on departmental goals, (2) having administrators consider hiring faculty from various cultural backgrounds to teach courses on culture, (3) having administrators consider options for opportunities for students to learn about culture outside of the classroom including: (a) short-term study abroad programs, (b) long-term exchange programs, and (c) short-term English camps that can be a more economical alternative to study abroad programs. Administrators may also consider (4) diversity in students' cultural and linguistic backgrounds for class placement. Additionally, (5) setting up periodic faculty meetings for teachers is recommended for administrators to understand their EFL teachers teach culture, and if they have stand-alone courses on culture, how that is taught by each faculty. This relates to suggestions for teachers, which is to have teachers (1) participate in periodic faculty meetings to understand how culture is being taught by other EFL faculty members and to understand students' opportunities to learn about culture through the university's outside of class programs such as exchange programs. Another suggestion is to (2) consider various ways to teach about culture prior to finalizing course syllabi, which includes, teaching through movies, reading comics, news, literary works, having students engage in fieldwork and write research papers, preparing students for study-abroad programs or short-term intensive English camps if their institutions have such programs, and having students write, discuss, and make presentations. Finally, teachers may opt to (3) conduct action research in their own classrooms to continue to improve their skills of teaching about culture and to fill the gap of existing literature, that can contribute to the improvement of teaching for teacher-researchers in their own cultural contexts and abroad.

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The Role of Design: A Humanitarian Approach and an Opportunity to Prepare Students for the Real Working World

Carla Cadete, Lusófona University of Porto, Portugal

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Abstract

This study aims to contextualise and describe a pedagogical practice developed in the Academic curriculum at Lusófona University of Porto (ULP) in the first semester of 2021/22 with students from the 2nd year of Communication Design bachelor. *A pencil for a school* is a solidarity campaign to help build a school in the village of Matsinho, in the province of Manica, Mozambique. This is a project carried out by *The Big Hand*, a non-governmental organisation (NGO) that promotes the well-being of children living under unfavourable environmental conditions, ensuring their access to education, healthcare and nutrition. The campaign's briefing includes a pencil, a set of posters, a roll-up, a T-shirt, and a label for a can to collect donations. To complement the project developed in Design classes, a free one-day workshop was held, in which students had the opportunity to talk with the President of the NGO, ask questions and share ideas. This article emphasises the responsibility of educators in preparing young students and future designers to be able to face contemporary challenges, using their skills as an alternative method of intervention in social issues and realising the role of design in promoting positive change. It also offers a solid opportunity to prepare graduates for the real working world and encourage engagement through innovative practice. It also proved to inspire the new generation of designers to have an empathetic mentality and do not work only for commercial purposes but also for social needs.

Keywords: The Role of Design, Pedagogical Practice, Design Educators, Real Working World, A Pencil for a School

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Introduction

At Lusófona University of Porto (ULP), we believe that design students must develop sensitivity to social problems. A way for students to work with real projects helping those most in need.

A pencil for a school is a solidarity campaign to promote and help build a school in the village of Matsinho, province of Manica, in Mozambique. This is an action carried out by *The Big Hand,* a non-governmental organisation (NGO) that promotes the well-being of children living under unfavourable environmental conditions, with particular attention to orphan girls, ensuring their access to education, healthcare, nutrition, water and basic sanitation. *The Big Hand* believes that children raised in a healthy environment can change the world. It believes in a world where all children are treated with dignity, in a world that protects its children, guaranteeing them access to nutrition, water, sanitation, health, shelter, information and quality education that allows them to reach their full potential and in that way they contribute to their community and the world. It is a citizens' organisation that aims to transform children's lives through its child-centred pedagogical model. It works in partnership with communities, local organisations and governments. The Big Hand builds "friendly schools" based on UNICEF's best practices. This campaign started from the collaboration between the Academy (ULP) and *The Big Hand*. For this purpose, a partnership protocol was established between both institutions. The campaign's briefing includes a pencil, a set of posters, a roll-up, a T-shirt, and a label (for a can) to collect donations. The sale of a pencil costs €1 and goes towards building the school.

To complement the project developed in Design classes, a free one-day workshop was held, in which students had the opportunity to talk with the President of the NGO, ask questions and share ideas. The workshop was an optional activity. However, all students joined enthusiastically. These proactive initiatives beyond the classroom context are essential to developing a sense of responsibility and commitment to the proposed projects.

A pedagogical practice that proved to be valuable in integrating students into a project of social nature, and this way influenced the new generation of designers to have an empathetic method of think and working towards humanitarian causes. A project that engaged students and generated enthusiasm. Simultaneously, through design, it has contributed to making a positive difference in the future and dreams of these children – a solidarity campaign to build a school in Mozambique.

The role of design in promoting social change and preparing students to work with real projects helping those most in need - literature review

Today's society faces complex challenges for which social design is responsible for mediating, such as migration, climate change, population ageing, chronic diseases, poverty, loss of biodiversity, and reduction of natural resources, that require new solutions where Design should assume an important role. According to Resnick (2009), we live in transitional times, and design has a vital role to play, "Social Design is a recent field of study where the primary motivation is to promote positive social change within society—initially inspired by the writings of William Morris, Buckminster Fuller, Victor Papanek, and others (...)" (Resnick, 2019, p.3).

Papanek (2004), Margolin (2014), Resnick (2019), Frascara (2019), and other authors argue that the ways of understanding and acting in the reality from which we structure and conduct the world need to be fundamentally restructured to address the critical nature of these challenges.

Papanek held conferences at universities worldwide, inspiring generations of students and promoting social debate and playing a significant role in disseminating social design principles. Victor Papanek and Victor Margolin were pioneers in need to involve students in real-world projects, preparing them as future designers invested in causes that would attempt to solve issues present in society. According to Papanek, "Some of us can, through schools, bring our students into direct and continuous contact with real people's real needs in a real world instead of manufacturing needs for them." (Resnick, 2019, p.61)

According to Margolin (2014), if the social projects we're involved in the pedagogical objectives, students eventually believe that they would be able to carry out work inside and outside of the classroom, "one of the school's greatest achievements, as it responds to the essential problem of finding a place for Design in a system that satisfies social needs, instead of satisfying the market." (Margolin, 2014, p.65). The author gives the project Design for Democracy as an example. Students of Illinois University redesigned the ballot paper as ballot boxes and brochures with informative material, among other communication methods. As states Margolin (Margolin, 2014, p.141). This project was vital in educating young students to understand how their creations can be a means to change the way we live as citizens positively. The universities should promote more writing, lectures, relationships, and debates to encourage and alert citizens with new methods of social practices. In a conference at OCAD in Toronto, Margolin (Margolin, 2014, p.3). Introduced the concept of "citizen-designer" because the designer plays multiple roles, each with its own political and social dimension. For these roles, he called "Action Matrix", which he gives three levels: the micro-level is the individual action, where he includes issues such as art schools and universities; the intermediate level mediates between the individual; and the macro-level consists of the government, international organisations and big corporations. Resnick states (2019):

> Social design is the practice of design where the primary motivation is to promote positive social change within society. Initially inspired by the writings of William Morris, R. Buckminster Fuller, Victor Papanek, and others, the 'social' in social design's agenda is to encourage designers and creative professionals to adopt a more proactive role to effect tangible change to make life better for others rather than to sell them products and services they neither need nor want, which has been the primary motivation for commercial design practice in the twentieth century. (p.39)

Frascara recognises three areas of design practice for improving our overall quality of life: "design that works to make life possible, a design that works to make life easier, and design that works to make life better." (Resnick, 2019, p.186)

A Pencil for a School is an initiative that offers a concrete opportunity for design students' immersion in a specific context by working with a real project, learning and helping those most in need. According to Krucken & Mouckrek, "(…) understanding sociocultural aspects and figuring out the role (and responsibility) of design in promoting change. By interacting and reflecting on the praxis, this experience promotes a "learning by doing together" approach." (Krucken & Mouckrek, 2008, p.133)

Moholy-Nagy, in his book *Vision in Motion,* argues, "Designing is not a profession but an attitude." (Moholy-Nagy, 1947, p.42). The author recognised Design as "a powerful force in society by acting as an efficient and ingenious agent of change, free from commercial constraints." (Rawsthorn, 2020, p.9)

Design played an essential role as a social agent of change, raising community awareness, generating support to build a school in Mozambique, and impacting children's education and future. As said Mandela, "Education is the most powerful weapon you can use to change the world."[1]

A Pencil for a School–Work Methodology

In the first semester of 2021/22, students from the first year of Communication Design Bachelor in the module of Communication Design I were challenged to develop an advertising campaign to raise funds for building a school in the village of Matsinho – *A pencil for a school*. The action is aimed at all people living in Portugal.

Client: *The Big Hand* an NGO based in Lisbon, Portugal.

Briefing: The advertising campaign must include a pencil, three posters in A2 format (420X594 mm), a roll-up (2060x900mm), a T-shirt, and a can design for collecting donations and an Instagram post.

Students had four weeks to work on this project (2 classes a week/3 hours each class). The time available for carrying out the project was too short. To overcome the problem, it was decided to create groups: five teams, each consisting of two students and a free one-day workshop to complement the project developed in the Design classes. The creative process was done through the *Design Thinking* methodology and began in the following order: *problem definition, ideation, prototype and implementation (problem-solution)*.

1. First-term – *Problem definition:* At the beginning, the client delivered the briefing and the essential material to carry out the campaign: a set of photographs from the local (Matsinho village) and from the children; a dossier with all the activities carried out by the Association since the beginning of its foundation (2008); *The Big Hand* logo and the logos from the partners who support the movement. The process began with the briefing. The objectives were taken into account: the target (children from 6-18 years old), available time (four weeks), proposal (advertising campaign to raise funds for the construction of a school), and a schedule with dates for the first-term, mid-term, and final-term assessment.

2. Mid-term – *Ideation and Prototype:* ideas were generated with tools such as words, images, colours and shapes through brainstorming, keywords, action verbs, brain dumping, a mind map and a mood board. Students presented the creative process and a set of ideas, with several drawings registered in the sketchbook. An exercise that starts with a divergent approach to creating an extensive range of options (Figs.1, 2, 3, 4 and 5).

Each proposal's strengths and weaknesses were analysed to find the most effective way of fulfilling the initial goal. Design tools, such as colour, contrast, balance, typography, legibility, composition, scales and materials, were considered considering that the campaign

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[1] One speech, Madison Park High School, Boston, 23 June 1990, reported in various forms.

will contain a message that needs to be strong but easily understood. This phase was vital to guide students' work and advise them accordingly, as practice-oriented initiatives are crucial in Design teaching. This phase requires exceptional guidance from the teacher, as the teacher's experience allows them to draw attention to certain aspects that often go unnoticed by younger students. Students had some difficulty composing the graphic elements in the roll-up because it is extended support in height but narrow in width. This is why, at this stage, an interim presentation and evaluation were carried out, where these factors are highlighted and usually surpassed. During the creative process, meeting groups are held to facilitate dialogue and share ideas, rather than issuing instructions. Creating a collaborative class is a way to learn through engaging students, sharing insights, and gathering feedback from the group. A collaborative process where everyone involved benefits from a positive discussion where solutions are found and sometimes lost ideas are rescued.

The Workshop

To complement the project developed in the Design classes, on the 17th of December 2021, a free one-day workshop took place at ULP, from 9:30 until 17.30. The workshop took place during the ideation phase. Students had the opportunity to talk with the President of the NGO through a video conference through the Zoom platform and have a chance to ask questions, share ideas and listen to the client's opinion. During this day, teamwork had the opportunity to try different solutions and techniques – analogic, digital or both, always guided by the form teacher (Fig.6).

Positive aspects: Teamwork and the workshop were additional benefits – a creative learning space where students with their peers and the tutor work together to find design solutions. A practice that generated students' engagement with the project.

In addition, they are allowing for a close relationship between the teacher, students and the client. A collaborative learning environment similar to a design studio where students and lecturers are engaged in learning and teaching through a real-life problem. During this activity, teams tested ideas in an exploratory process to increase the number of solutions and find the best one. Also, the fact that the proposed work is intended for a real client and, in particular, with a humanitarian purpose increased the dedication and commitment of the students and encouraged them to work closely together to create the best design proposed.

These proactive initiatives beyond the classroom context are essential to developing a sense of responsibility and commitment to the proposed projects.

The workshop was an optional activity. However, all students joined enthusiastically.

Papanek wrote in an article for Icongraphic nº 9, "Let me close by quoting a proverb from China that sums up why design and design education must be directly tied to meaningful work and participatory life: I hear, and I forget, I see, and I remember, I do, and I understand." (Resnick, 2019, p.62)

3. Prototype: Testing ideas through an exploratory process. In this term, after testing their ideas, students presented the advantages and disadvantages of each possible solution in a convergent approach. According to Brown, "If the convergent phase of problem-solving is what drives us toward solutions, the objective of divergent thinking is to multiply options to create choices." (Brown, 2009, p.67)

4. Final-Term – *Implementation (problem-solution)*: The final solution was developed, finished, and presented with the creative process and with all the steps justified accordingly. The final assessment considered creativity, relevance, impact, and legibility (Figs. 7, 8, 9, 10, 11, 12, 13, 14 and 15).

After the teacher carried out this evaluation in the classroom through an oral presentation, a session was scheduled with the client where students presented their proposals; one was selected to be implemented.
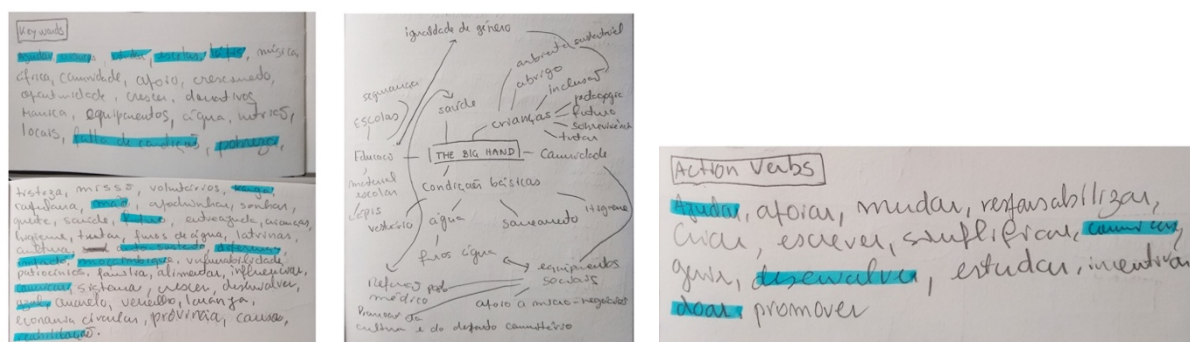
Figs.1, 2 and 3 – Ideation phase: Keywords, mind map, action verbs. Work from Hugo Carvalho and Pedro Herbstrith Saboya (left to right)
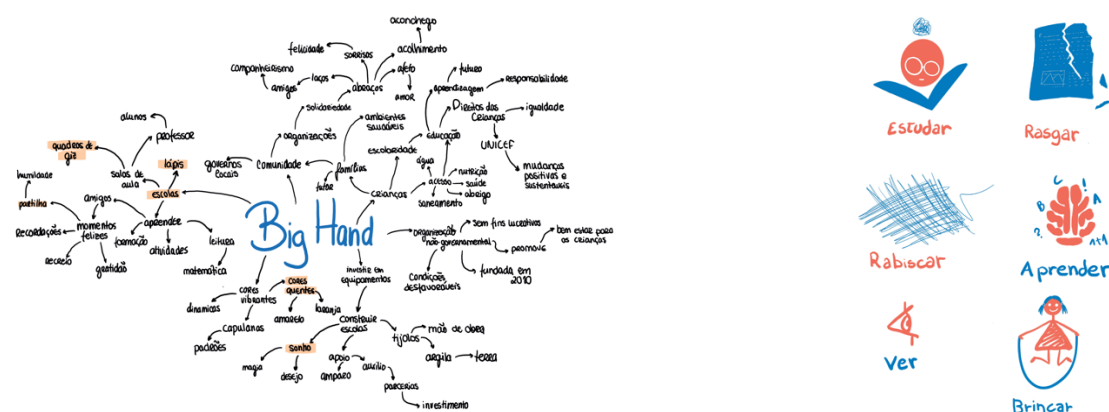
Figs. 4 and 5 – Ideation phase: Mind map from Catarina Mendes and Inês Ferreira (left image). Visual brain dumping from Catarina Mendes and Inês Ferreira (right image)

Figs. 6, 7 and 8 – Prototype phase on workshop testing hand shapes; posters and pencil mockup, work from Hugo Carvalho and Pedro Herbstrith Saboya (from left to right)

Figs. 9 and 10 – Posters and roll-up mockup, work from Sarah Nogueira and Danielly Correa

Figs. 11 and 12 – Can design for collecting donations and roll-up mockup, work from Catarina Mendes and Inês Ferreira
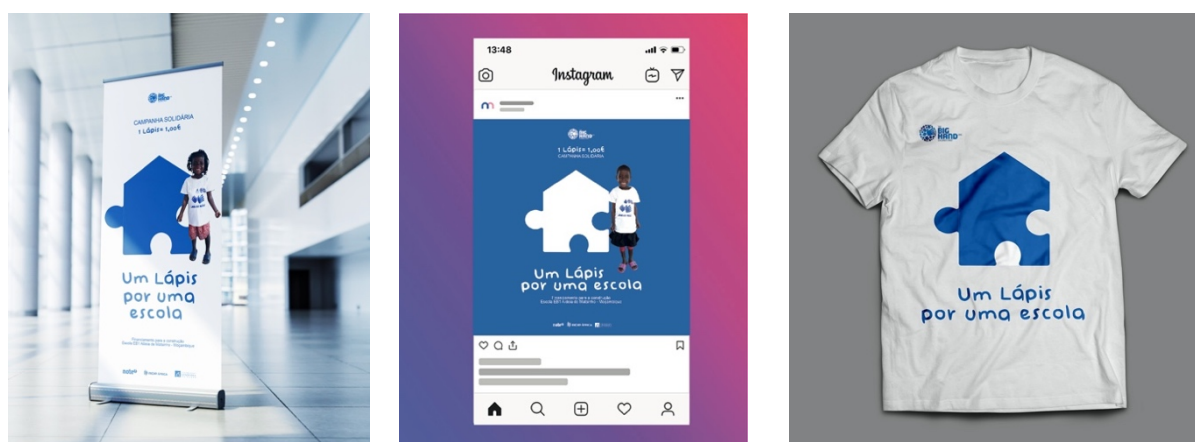
Figs. 13, 14 and 15 – Roll-up, Instagram post and T-Shirt mockup, work from Gustavo Santos and Luís Gois

Final Considerations

At Lusófona University of Porto (ULP), we believe that design students must develop sensitivity to social problems. A way for students to work with real projects helping those most in need, and allows them, among other things, to find good use of their skills in praxis.

These proactive initiatives beyond the classroom context are essential to developing a sense of responsibility and commitment to the proposed projects. Also, for *The Big Hand,* the possibility of obtaining a range of proposals for free.

With this project, students and lecturers create interactive knowledge and learn through reflection in action by working together and sharing ideas, testing solutions, and displaying the results. In addition, design played an important role as a social agent of change, raising community awareness, helping to generate support for building a school and making a positive difference in the future and dreams of these children. Also, this pedagogical practice proved to be valuable in integrating students into a project of social nature, and this way influenced the new generation of designers to have an empathetic mentality and not work only for commercial purposes but also towards humanitarian causes in their future careers. Collaborative work and an excellent opportunity for students to see their work printed and disseminated and to provide support for a social program – a campaign to raise funds for building a school in Mozambique.

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Intercultural Attitudes, Preferences for World Music and Artworks From Different Cultures in the Context of Contemporary Music Pedagogy and Art Pedagogy[1]

Snježana Dobrota, Faculty of Humanities and Social Sciences, University of Split, Croatia

Abstract

This research examines the influence of age / year of study on intercultural attitudes of students, their preferences for *world music* and artworks from different cultures, along with the relationship between intercultural attitudes, preferences for *world music* and artworks from different cultures as well as the impact of visits to the theater / classical music concerts and art exhibitions on the preferences for *world music* and artworks from different cultures. The research was conducted on a sample of students attending the Faculty of Humanities and Social Sciences at the University of Split. The questionnaire used in the research was composed of the following four parts: *The General Data Questionnaire*, *The Munroe Multicultural Attitude Scale Questionnaire* (Munroe & Pearson, 2006), *The Musical Preferences Questionnaire* and *The Visual Art Preferences Questionnaire*. The results confirm that senior university students compared to students at the lower study level have developed certain aspects of intercultural attitudes and show greater preferences for *world music* and artworks from different cultures. The influence of going to the theater / concerts of art music and art exhibitions on the formation of preferences for *world music* and artworks from different cultures has also been confirmed. Finally, the results of the research confirmed the connection between intercultural attitudes and preferences for *world music* and artworks from different cultures. The paper presents the implications of the obtained results for the concept of music pedagogy and art pedagogy theory and practice aimed at shaping the intercultural attitudes of pupils and students.

Keywords: Intercultural Attitudes, *World Music* Preferences, Preferences for Artworks from Different Cultures, Music Pedagogy, Art Pedagogy

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[1] The paper relies on a part of a research carried out within the Institutional Project of the Faculty of Humanities and Social Sciences, University of Split, entitled *The Contribution of Art Education to the Development of Students' Intercultural Sensitivity and Intercultural Attitudes*.

Introduction

Modern world global migrations lead to changes that necessarily reflect in education, which is being increasingly shaped in the direction of multicultural education. According to Banks and Banks, "as a concept, idea, or philosophy, multicultural education is a set of beliefs and explanations that recognizes and values the importance of ethnic and cultural diversity in shaping lifestyles, social experiences, personal identities, and educational opportunities of individual groups and nations" (Banks & Banks, 1995, 28).

Art education has a special role in the context of intercultural education, as it has the potential to strengthen an individual's self-esteem, promote group identity, reduce stereotypes, and eliminate various prejudices. As Clark (1996) points out, art education can change social relationships because all arts, including fine art, music, etc. are part of visual culture and therefore reflect multiple dimensions of culture.

Analyzing the definitions of different aspects of interculturalism, we come across a number of terminological ambiguities (Schwartz & Bilsky, 1987; 1990). Chen and Starosta (1997) thus state that intercultural sensitivity represents an affective aspect of intercultural communication, as opposed to intercultural awareness, as a cognitive aspect of intercultural communication, and intercultural adroitness, as a behavioral aspect of intercultural communication. Multicultural attitudes are based on the factors of presumed knowledge and beliefs, the emotional ties associated with such knowledge and the beliefs, and the behavioral actions displayed owing to both (Banks, 1999). The starting point in designing *The Intercultural Attitudes Questionnaire (The Munroe Multicultural Attitude Scale Questionnaire)* (Munroe and Pearson, 2006) is Bloom's taxonomy of educational objectives, i.e, the cognitive, affective, and psychomotor domains. In his *transformative approach* to designing the intercultural curriculum,[2] Banks (1999) notes the importance of using all aspects of Bloom's taxonomy. He transfers them to the components which form the intercultural attitude, which is based on *knowledge* about an object, on affective speech or *care* about the object, and *action* taken in relation to the object. A number of authors believe that the programs of intercultural education that limit the formation of intercultural attitudes only at the level of knowledge, without care and action, are totally insufficient (Arnold, 2000; Carlson, 1997). Thus, in his transformative approach to intercultural curriculum reform, Banks emphasizes the importance of students' progress from the level of knowledge to the level of care and action (Banks, 1999). In this way, the structure of the curriculum itself changes, and pupils and students are encouraged to observe phenomena from different ethnic perspectives and points of view.

Research objective, problem and hypotheses

The aim of the research is to examine the influence of age / year of study on intercultural attitudes of students, their preferences for *world music* and artworks from different cultures, along with the relationship between intercultural attitudes, preferences for world music and artworks from different cultures as well as the impact of visits to the theater / classical music concerts and art exhibitions on the preferences for world music and artworks from different cultures.

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[2] Banks speaks about the four approaches to the intercultural curriculum reform: *the contributions approach, the additive approach, the transformation approach, and the social action approach.* Only the two latter approaches enable pupils and students to develop critical thinking and truly get to know and understand different cultures (Banks, 1999).

In accordance with the above objective, the following research problems were defined:

1.   to examine whether the age / year of study has an impact on students' intercultural attitudes.

2.   to examine whether the age / year of study has an impact on the preferences for *world music* and artworks from different cultures.

3.   to examine whether going to the theater / concerts of classical music and art exhibitions has an impact on the preferences for *world music* and artworks from different cultures.

4.   to examine whether there is a connection between intercultural attitudes, preferences for *world music* and artworks from different cultures.

Based on the defined research objective and research problem, the hypotheses were set as follows:

H1: Students at the higher study level, in relation to students at the lower study level, have more developed intercultural attitudes.

H2: Students at the higher study level, in relation to students at the lower study level, show greater preferences for *world music* and artworks from different cultures.

H3: Students who often go to the theater / concerts of art music and art exhibitions show greater preferences for *world music* and artworks from different cultures.

H4: Students with more developed intercultural attitudes show greater *world music* preferences.

H5: Students with more developed intercultural attitudes show greater preferences for artworks from different cultures.

Research method

Participants

The study was conducted in Split on a sample of 292 participants, including first, second, third, fourth, and fifth year students attending the Faculty of Humanities and Social Sciences at the University of Split. First, second, and third year students form one group (N = 145), and fourth and fifth year students form another group (N = 147) (Table 1).

Table 1. The sample structure (N = 259)

GENDER	N	AGE	N
M	3	**1st, 2nd, 3rd year students**	145
F	289	**4th, 5th year students**	147
Total		**292**	

Research instrument and procedure

For the purpose of the research, we constructed a questionnaire. In the first part, *The General Data Questionnaire,* sociodemographic data on participants were gathered (gender, year of study, visits to the theaters / concerts of art music and art exhibitions). The second part, *The Intercultural Attitudes Questionnaire (The Munroe Multicultural Attitude Scale Questionnaire)* (Munroe & Pearson, 2006), contains eighteen statements with which we examined three aspects of intercultural attitudes: knowledge, care, and action. Each statement was accompanied by a 1–6-point rating scale (1 = I strongly disagree; 6 = I strongly agree). By checking the factor structure of the scale using exploratory factor analysis (EFA) employing principal components method with varimax normalized rotation, on the three predefined factors, a relatively similar factor structure compared to the original was confirmed. Six particles had significant saturations on the first factor, five particles on the second factor, and four particles on the third factor. These factors explain 37% of the variance. The psychometric characteristics of the questionnaire are shown in Table 2.

Table 2. The psychometric characteristics of *The Munroe Multicultural Attitude Scale Questionnaire*

Statement		
Know	**Care**	**Act**
1. I realize that racism exists.	I am sensitive to respecting religious differences.	I do not act to stop racism.
2. I know that social barriers exist.	I am sensitive to differing expressions of ethnicity.	I actively challenge gender inequities.
3. I understand religious beliefs differ.	I am emotionally concerned about racial inequality.	I do not actively respond to contest religious prejudice.
4. I understand sexual preferences may differ.	I am sensitive towards people of every financial status.	I respectfully help others to offset language barriers that prevent communication.
5. I understand that gender-based inequities exist.	I am not sensitive to language uses other than English.	I do not take action when witnessing bias based on people's preferred sexual orientation.
6. I accept the fact that languages other than English are spoken.	A person's social status does not affect how I care about people.	
7. I don't understand why people of other cultures act differently.		
Cronbach α	0.69	0.61	0.54
M (sd)	33.87 (2.75)	19.10 (4.23)	13.46 (3.97)
ra nge	20-36	5-30	4-24
Mean inter-item correlation	0.32	0.24	0.23
KS d	0.23, p <0.01	0.08, p <0.01	0.08, p <0.01

The third part is *The Musical Preferences Questionnaire.* The task of the participants was to listen to a piece of music and assess on a 1–5-point Likert-type scale (1 = I don't like it at all; 5 = I really like it) how much they liked a certain music fragment.

A compact disc was made containing ten music fragments of *world music*, lasting for about one minute each. The CD was constructed exclusively for the purposes of this research, and the criteria for the selection of music fragments were the defined research problems. The psychometric characteristics of the questionnaire are shown in Table 2.

Table 3. The psychometric characteristics of *The Musical Preferences Questionnaire*

No.	Musical example
1.	Cesária Evora: Angola
2.	Summit (Uganda): Ekibobo
3.	Guajira guantanamera (Cuba)
4.	Hijos del Viento (Music of the Andes)
5.	Kalyi Jag: La Romnjasa
6.	Les Greres Guisse (Senegal)
7.	Julian Avalos (Peru): Mujer Mágica
8.	Ricardo Lemvo & Makina Loca (Cong): Biloló
9.	Goran Bregovic: Time of the Gypsies (Ederlezi)
10.	Carlos Puebla (Cuba): Y en Eso Llegó Fidel
Cronbach α	0.79
M (sd)	39.17 (5.57)
range	21-50
Mean inter-item correlation	0.29
KS d	0. 08, p <0.01

The fourth part is *The Visual Art Preferences Questionnaire.* The task of the participants was to observe the picture and assess on a 1–5-point Likert-type scale (1 = I don't like it at all; 5 = I really like it) how much they liked a certain artwork.

The research used a Power Point presentation with ten artworks from different cultures. The presentation was created exclusively for the purposes of this research, and the criteria for the selection of artworks were the research problems. The psychometric characteristics of the questionnaire are shown in Table 4.

Table 4. The psychometric characteristics of *The Visual Art Preferences Questionnaire*

No.	Visual artwork
1.	Liu Bang: A portrait painting of Emperor Gao of Han (China)
2.	Kitagawa Utamaro, Comb, multicolor woodblock print (Japan)
3.	Frida Kahlo: Self-Portrait with Monkey (Mexico)
4.	Irma Stern: Portrait of a West African girl (South Africa)
5.	Twins Seven Seven: The Blessed Family (Nigeria)
6.	Zaya: Meditation Road (Mongolia)
7.	Reza Abbasi: Youth reading (Iran)
8.	Sun Mu: Run (North Korea)
9.	Vicente Manansala: Madonna of the Slums (Philippines)
10.	Barrington Watson: Conversation (Jamaica)
Cronbach α	0.82
M (sd)	36.02 (6.32)
range	17-50
Mean inter-item correlation	0.32
KS d	0.06, p <0.01

The participants were explained the purpose of conducting the research, were guaranteed anonymity, and asked to answer questions honestly. After completing the first and second parts of the questionnaire, the participants were instructed how to assess how much they liked the music and art samples, without being told which music and art samples were included.

Results and discussion

H1: Students at the higher study level, in relation to students at the lower study level, have more developed intercultural attitudes.

To examine the influence of age / year of study on students' intercultural attitudes, the Mann-Whitney U-test was calculated (Table 5). The results indicate the absence of differences among students of different years of study with regard to one aspect of intercultural attitudes (knowledge). Regarding the other two aspects of intercultural attitudes (action, care), a difference was noticed, with senior students having more developed aspects of intercultural attitudes. This partially confirmed the hypothesis.

The results obtained are partly in line with the results of Neto (2006) who emphasizes the importance of intercultural teaching at the higher education level for increasing ethnic tolerance and self-esteem of Portuguese students. Furthermore, by conducting similar research on a sample of American students, Probst (2003) stresses the importance of intercultural education for developing intercultural tolerance, but also for overcoming gender stereotypes.

Table 5. Differences in students' intercultural attitudes with regard to age / year of study

Year of study	C			IN			z			p		
	F1*	F2*	F3*	F1	F2	F3	F1	F2	F3	F1	F2	F3
1st, 2nd, 3rd year	5.83	3.76	3.12	10413.00	9085.50	8532.00	0.36	2.18	2.96	0.72	0.03	0.00
4th, 5th year	5.82	3.98	3.46									

* F1 = know ; F2 = act ; F3 = care

H2: Students at the higher study level, in relation to students at the lower study level, show greater preferences for world music and artworks from different cultures.

To examine the influence of age / year of study on the preferences for *world music* and artworks from different cultures, two Mann-Whitney U-tests were calculated (Table 6). The results show that students at the higher university study level, compared to students at the lower university study level, show greater preferences for *world music* and artworks from different cultures. This confirmed the hypothesis.

The increase in music and art preferences with age can be partly explained by the maturation of participants, but also by the influence of teaching music and art during primary and secondary school and higher education. Howard (2018) also talks about the positive impact of music education on the development of *world music* preferences, especially emphasizing the possibility of getting to know different cultures and developing tolerance towards them

during music education. Furthermore, starting from UNESCO's proposal "learning how to live together", Da Silva and Villas-Boas (2006) talk about the positive impact of visual art education on students' perceptions of cultural differences and on the development of positive attitudes towards different ethnic and cultural groups.

Table 6. Differences in *world music* preferences and preferences for visual artworks from different cultures with regard to age / year of study

Year of study	C		IN		z		p	
	WMP *	PADC *	WMP *	PADC *	WMP *	PADC *	WMP *	PADC *
1st, 2nd, 3rd year	3.79	3.48	7470.50	8616.00	4.42	2.83	0.00	0.00
4th, 5th year	4.19	3.75						

* WMP = world music preferences; PADC = preferences for visual artworks from different cultures

H3: Students who often go to the theater / concerts of art music and art exhibitions show greater preferences for world music and visual artworks from different cultures.

To examine whether going to the theater / concerts of art music and art exhibitions affect the preference for *world music* and visual artworks from different cultures, two Kruskal-Wallis tests were conducted (Table 7). The results confirm that preferences for *world music* and visual artworks from different cultures differ significantly depending on how often students go to the theater / concerts of classical music and art exhibitions. Namely, students who sometimes and often attend such events to a greater extent prefer *world music* and visual artworks from different cultures. This confirmed the above hypothesis.

Dobrota and Reić Ercegovac (2017) explored the relationship between musical preferences on the one hand, and music instruction and various informal influences, on the other. A significant correlation was observed between the frequency of attending classical music concerts and the preferences for classical music, jazz, and *world music*.

Table 7. Differences in world music preferences and preferences for visual artworks from different cultures with regard to the frequency of going to the theater / classical music concerts and visual art exhibitions

Going to the theater / classical music concerts	C	H (2, N = 292)	P	Going to the exhibitions	C	H (2, N = 292)	p
never	3.71	33.44	0.00	never	3.50	27.81	0.00
sometimes	3.96			sometimes	3.77		
often	4.61			often	3.98		

H4: Students with more developed intercultural attitudes show greater preferences for world music.

To examine the relationship between intercultural attitudes and preferences for *world music*, correlations between these variables were calculated (Table 8). The results confirm that participants who have more positive intercultural attitudes (action, care) show greater *world music* preferences. This confirms the final hypothesis.

The results are consistent with the results of Dobrota (2016) who conducted research on a sample of students and confirmed the existence of a relationship between certain aspects of intercultural attitudes and *world music* preferences. Similar results were obtained by Fung (1994) on a sample of students of music.

Table 8. The relationship between intercultural attitudes and *world music* preferences

Variables	M	SD	IA* F1 know	IA* F2 act	IA* F3 care	*World music* preferences
IA* F1 know	5.64	0.46	1.00	0.08	-0.02	-0.05
IA* F2 act	3.82	0.85	0.08	1.00	0.26*	0.14*
IA* F3 care	3.36	0.99	-0.02	0.26*	1.00	0.18*
World music preferences	3.92	0.56	-0.05	0.14*	0.18*	1.00

* IA = intercultural attitudes

H5: Students with more developed intercultural attitudes show greater preferences for visual artworks from different cultures.

To examine the relationship between intercultural attitudes and preferences for artworks from different cultures, correlations were calculated between the three aspects of intercultural attitudes and preferences for artworks (Table 9). The results confirm that participants with positive intercultural attitudes (action, care) show greater preferences for artworks from different cultures, thus confirming the final hypothesis.

The obtained results can be explained by the fact that during visual culture and visual art education, students participate in collaborative learning, i.e. they work together on an artwork (Allison, 1995). This reduces the feeling of individualism and strengthens the sense of belonging to the group, which can also strengthen students' intercultural attitudes.

Table 9. Relationship between intercultural attitudes and preferences for visual artworks from different cultures

Variables	M	SD	IA* F1 know	IA* F2 act	IA* F3 care	Preferences for visual artworks from different cultures
IA* F1 know	5,64	0,46	1.00	0.08	-0.02	0.06
IA* F2 act	3,82	0,85	0.08	1.00	0.26*	0.27*
IA* F3 care	3,36	0,99	-0.02	0.26*	1.00	0.15*
Preferences for visual artworks from different cultures	3,60	0.63	0.06	0.27*	0.15*	1.00

* IA = intercultural attitudes

Conclusion

The results of this research confirmed the influence of age / year of study on two aspects of intercultural attitudes (care, action), preferences for *world music* and artworks from different cultures. The influence of going to the theater / concerts of art music and art exhibitions on the formation of preferences for *world music* and artworks from different cultures has also been confirmed. Finally, the connection between the two aspects of intercultural attitudes (care, action) and the preference for *world music* and artworks from different cultures has been confirmed.

The obtained results clearly indicate the need to shape and promote intercultural art instruction from pre-school to higher education level. If students are educated to understand the aesthetic values and philosophies of different cultures, they will understand and appreciate the pluralistic society they live in (Campbell, 1998). This in turn would help the students to be sensitive to the world as a community, to develop positive and productive interaction among different cultural groups. As Rachel (1988) stated, when students have the opportunities to more fully explore and comprehend approaches to diverse and unfamiliar arts, their appreciation and attitudes towards other cultures are enhanced. A reciprocal benefit ensues: art provides social and cultural knowledge about the range and variety of human experiences, and social and cultural awareness enriches knowledge of art. Similarly, according to Allison (1995), the differences in a multicultural society can be manipulated to increase students' awareness on the various cultures, and eventually they are taught to respect these differences.

Consequently, modernization of music and visual art curriculum in the direction of intercultural education can significantly improve students' knowledge and understanding of different cultures, thus developing intercultural attitudes, tolerance, and mutual respect.

One of the limitations of this research is relatively low reliability of the scale in *The Munroe Multicultural Attitude Scale Questionnaire,* i.e. of the subscale *action,* which can be explained by insufficient intercultural interactions of the research participants. Another limitation of the research is related to the gender structure of the sample, therefore in future researches the gender balance of the participants will be taken into account.

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Contact email: dobrota@ffst.hr

Material Design and Audio-Visual Narratives for Pedagogy: Theoretical Premises and Evaluation Tools for Experimenting Stop-Motion Animation as Teaching Method

Vincenzo Maselli, Sapienza University of Rome, Italy

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Abstract

Since the early 1900s the pedagogical research has matured a materialist perspective, recognizing the essential contribution of creative practice and material experience within learning paths. Starting from John Dewey's philosophy of experience (1938), passing through Maria Montessori and Bruno Munari's experimental teaching methods, Riccardo Massa's "educational materiality", to the most recent socio-material approaches, pedagogy has embraced the relationship between human beings, material art and experience design. These studies have explored and theorized how learning and knowledge are rooted in actions that encourage creativity, cooperation and reflective thinking. By starting from this theoretical framework and taking up the educational objectives formulated by the OECD for 2030, the proposed paper illustrates the methodological and theoretical coordinates of the research project "CCODE - Design, material experiences and stop-motion animation as didactic tools for developing creative thinking and cooperative learning", that suggests an experimental learning method based on storytelling and stop-motion animation tools, thus amplifying the educational value of this art form. The understanding and analysis of a narrative text, its transposition into a screenplay, the material manipulation and the stop-motion animation process are the phases described to structure an unprecedented and interdisciplinary method of acquiring theories, techniques and develop socio-emotional-cognitive skills. The paper therefore aims at disseminating the project's premises and ethical implications and describes both the experimental teaching module based on learning by doing (Bruner 1966, Dale 1969) and the evaluation tools carried out to validate the approach, the method and the educational objectives achieved.

Keywords: Design, Material Experience, Stop-Motion Animation, Teaching Method, Evaluation Tools

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Introduction

CCODE is a research project that aims at designing and testing a new and experimental educational method focused on stimulating cognitive, practical and social skills, by hybridizing different disciplines – pedagogy, narrative sciences, material design and animation design –, and structuring a workshop experience with 5th grade elementary school students. The designed learning approach aims at making students face some social themes of contemporaneity and their emotional and psychological effects by conducting an active and participatory experience: they are expected to analyze a narrative text, to translate it in a screenplay, to manipulate material and produce an artifact in stop-motion animation.

Experiential education, material manipulation and the design principles of the puppet making process and audiovisual production – specifically the stop-motion animation technique – are the tools suggested to structure the experimental learning path. The specific objectives of the new method are defined by integrating philosophies and pedagogical approaches based on the enhancement of sensuous and material dimensions, and the educational and didactic objectives formulated by the OECD (Organization for Economic Co-operation and Development) in terms of practical, theoretical and social skills. In the following sections the project's theoretical frameworks, its objectives, the addressed methodological approaches and hypothesis of structure will be described.

From "sensory education" to "educational materiality"

The materialist epistemological perspective in pedagogical research developed in the 20th century has recognized the necessary contribution of the material and experiential components in learning processes (Barone 1997). Among the main references in this field are John Dewey, Maria Montessori, Bruno Munari, David Kolb and the Italian pedagogist Riccardo Massa. In the 20th century, pedagogy has examined and linked the concepts of experience, collaboration, and the material dimension and the design process in the educational field, discussing the possibility of making the experience of material manipulation a learning tool to discuss topics about the contemporary (Dewey 2008, 2014; Massa 1975; Barone 1997; Fenwick et al. 2011, 2012).

John Dewey in the late 800s pointed out for the first time that the learning process in school should include a series of social, emotional, and practical events. It must occur in a social context in which students cooperate with their pairs and have a common learning objective. Dewey's view of learning process took into huge consideration the social, interactive, motivational, and cognitive aspects of the process of schooling (Dewey 2008). Dewey inaugurated a path of studies according to which students experience the relations between the thinking and the empirical world, between organism and environment, perception and objects, nature and culture, facts and values, instruments and objectives, individual and society, play and work, to build new spaces of freedom (Dewey 2008, 2014; Sharan and Sharan 1992).

Sensory education and the pedagogy of doing are other pedagogical approaches that place the value of action, movement and material dimension at the center of the learning experience (Valitutti 1964). Maria Montessori in the early 1900 reconfigured the role of the child and the importance of sensory stimulation in the learning process. The Montessori method, as it has been defined, depicts a child who, acting autonomously and independently in the environment, undergoes sensory experiences, which stimulate, without further mediation, the

development of his intelligence because "senses, by exploring the environment, open the way to knowledge" (Montessori 1999, p. 181). In the Montessori educational learning environment, materials are very important for activating knowledge. Materials, on the other hand, intrigue and attract attention, so that children get more focused.

In the 50s, the designer Bruno Munari continued experimentation on visual languages applied to pedagogy in order to develop creativity in children. The Munari Method aimed at stimulating children creativity through practical-based activities and he called this learning approach "gesture intelligence" (Munari 1958, 1992). In the "gesture intelligence" approach the hand is a tool endowed with an unlimited and incipient predisposition to learn and perform multiple activities. Tactile abilities, according to Munari, allow man to build an evolving relationship and to explore the external world and of its information (Munari, 1958).

In the 80s David Kolb addressed interaction and complementarity between theory and practice as the main means of knowledge (Kolb, 1984). He theorized the efficacy of the experiential learning model, and today this approach is widely recognized and validated to teach practical disciplines and make acquire technical skills. He described four stages of the experiential learning model that work in a cyclic way: concrete experience; reflective observation; abstract conceptualization; testing in new situations.

The Italian pedagogist and philosopher of education Riccardo Massa, in the 80s coined the expression "educational materiality" (Massa 1975, 1986), that defines a particular way of conceiving educational practices and of interpreting the learning process in a materialist sense. Educational materiality is established on two different levels. First, materiality is a key concept for decoding the educational reality and delineating a pedagogical object to be studied theoretically and empirically. On the other hand, materiality refers to educational methods based on concreteness, experience and relationships lived bodily and emotionally.

In recent years the so-called socio-material approaches have assumed a certain importance (Fenwick et al., 2011). These approaches have brought the material to the center of the debate and have shifted attention to the multiple relations between human and non-human (objects, tools, technologies, spaces, furnishings, natural elements) that occur within the educational processes. These studies aim at exploring how learning and knowledge are concretely rooted in action, and suggest exploring the materiality of educational processes in contexts of participation and collaboration.

Stop-motion and "tactile pedagogy"

Stop motion animation technique has its roots in late '800AD when the illusionist George Méliès randomly discovered the camera-trick according to which by stopping and restarting the camera during the shooting and in the meanwhile changing the position of the object in front of it, the object looks to move by itself (Harryhausen and Dalton 2008). As illustrated by Vincenzo Maselli and Eleni Mouri:

> "This movement is an illusion since it happens between the frames, and what the spectator really sees is what occurs [...] when everything is still and nothing happens. Stop-Motion embraces photography, computer graphics, performing arts, sculpture, knowledge of anatomy of moving bodies and video editing. To make a stop-motion video we need a camera and a material object to be photographed, following a logic of movement, direction and transformation." (2020, p. 648).

Stop motion is remarkably versatile in several ways as it can be used for many subjects, with every sort of materials and objects (plasticine, silicone, toys, legos, household objects), it can use figurative or abstract codes of representations and, as any other form of animated artefact, it can narrate in either linear or nonlinear ways. Stop-motion has been used for pedagogic purposes since the material qualities of the medium makes the production process easier to understand and to handle thanks to the direct manipulation of objects, puppets or flat figures. Stop-motion "tactile pedagogy" allows to learn tactilely how animation principles work by applying them to real objects, to interact with materials and manipulate them by hand, improving craft skills, and to work in group. Since stop motion requires many skills and inclinations, from artistic and craftsmanship talent to organizational skills, collaboration and teamwork are essential. As a material and tactile based learning method, Stop-motion "tactile pedagogy" has already been explored and used in different educational experiment based on the enhancing of the tactile experience and collaborative dimension of the technique.

By describing a stop-motion workshop experience conducted in 2014 Stephanie Hatten defines this animation technique capable of capturing students' imagination, investment and memory. By engaging elementary school students with this creative activity for over a decade she has tested that stop-motion animation allows to interact and learn how to use digital programs, how to work with the camera, how to work with abstracts codes of representation, how to select, manipulate or create the materials, and to work in groups (Hatten 2014). The English teacher Dan Grant in 2009 published an article describing his didactic approach with 5th grade elementary students to work with storytelling and animation by simulating a stop motion production work team in the classroom (Grant 2019). The principal investigator of the research project also conducted a stop-motion animation workshop experience in Alghero (Sardinia, Italy) in September 2019, that engaged design students in experimenting with this animation technique as a communication design tool by using different visual styles and narrative languages. Students produced four stop-motion short films using objects, paper, fabric, photographs and any other kind of flat element shot on a flat two-dimensional background. As a result of the students' experience, they thought that they could use the technique in their future work since it was revealed to be a very demanding but successful design tool quick to learn and practice and useful to experiment with materials, narrative, visual styles and codes or representation.

Among many others workshop activities involving the use of stop motion animation and digital storytelling, the author conducted a stop-motion animation workshop experience in Alghero (Sardinia, Italy) in September 2019, that engaged design students in experimenting with this animation technique as a communication design tool by using different visual styles and narrative languages. During the five days' workshop students worked in teams and had to follow the main phases of an audio-visual production process: pre-production (subject development, visual style definition, storyboard, puppets, objects, and backgrounds creation), production (camera setting, animation process), post-production (video editing, compositing, sound effects). They produced four stop-motion short films using objects, paper, fabric, photographs and other flat elements photographed on a flat two-dimensional background. As a result of the students' experience, they thought that they could use the technique in their future work since it was revealed to be a very demanding but successful design tool quick to learn and practice and useful to experiment with materials, narrative, visual styles and codes or representation (see Maselli and Mouri 2020).

Educational and didactic objectives

The goal of the Organization for Economic Co-operation and Development (OECD) for 2030 is the redesign of educational processes allowing students to improve skills, abilities and behaviors which have been classified into five socio-emotional competences. These skills range from collaboration to critical thinking, considered values necessary for each individual to effectively manage emotional, cognitive and social life (OECD 2019).

Stemming from the outlined theoretical framework and accepting the objectives formulated by the OECD, integrating them, the research project CCODE places itself as an occasion of convergence between the assumptions of "tactile pedagogy" and the need to redesign educational system according to new and necessary abilities. The aim of the research, therefore, is to provide an alternative learning method by formulating a new process that consider the object of learning, and the learning experience and provide new tools for dealing with it. Specific educational and didactic objectives of the research project are:

- Stimulate creative thinking. Creativity is strictly related to cognitive potential (Runco 2003) and "the thinking capability of children at all levels is significantly influenced by the opportunities they are given" (Cachia et al. 2010, p. 29). In pedagogic context creativity is used generally in a broad way. Sometimes creative thinking is associated to the idea of problem solving, on the other hand it is often used in association with art subject in the meaning of artistic creativity. In this research project the term creativity is considered as a design process attribute by applying Bruno Munari definition of the term. According to Bruno Munari "Creativity does not mean improvisation without method. The design method […] is linked to the creativity of the designer who, in applying the method, can discover something to improve it." (Munari 1992, p. 17). But creativity is not just an essential element of the technical process, being creative is a condition that requests to keep the importance of a subjective dimension of the design experience and to take out something personal and visceral but essential for embracing the design process creatively.

- Encourage collaboration in a social environment. According to the brothers David and Roger Johnson, in learning environment students need to show a positive interaction, an active participation and a visceral feeling of each other (1987,1989). Students feel that they cannot work without one or more group members. They need to work together in a specific direction and with a shared goal but participating with individual and defined skills. At the same time, interaction and cooperation mean that students of a group help each other on specific topics. Cooperative learning also requires developing a self-critical ability to judge the final outcome and to evaluate critical aspects that could have been better approached.

- Develop reflective thinking as a consequence of the exploration of the narrative text and the writing of the screenplay. John Dewey (2014) insisted on the value of the narrative mode of thinking as an opportunity to reflect on experience and, consequently, on social and emotional topic of the contemporary. Storytelling, according to Dewey, has several functions, and one of them is to enter a sphere of interiority and make possible to experience the narrative with a reflective consequence (reflective function).

- Learn new technical skills and knowledge on specific topic. Beside educational objectives, the research aims at verifying the stop-motion workshop experience power to

provide knowledge and improve skills. The workshop is structures into propaedeutic phases that students can face successfully just by developing technical and material abilities and improving the knowledge of topics and analytical methods, that will be explained and verified during the workshop experience.

Research's methodology and structure

CCODE is practical-based research aimed at structuring and verifying the use of an unprecedent learning method based on laboratory approach, and at using interdisciplinary tools coming from fields of pedagogy, animation design, material design, and storytelling. The research project shapes a new synergy between two discipline (animation and pedagogy), two educational approaches (the theoretical-based one, by studying a narrative text, and the practical-based one, by producing an audiovisual artefact), two contexts (educational environment and stop motion animation production dimension), and different objectives (above described), related to the learning of didactic contents and practical tools, the acquisition of cooperative attitudes and the development of creativity and reflective thinking. For testing this new method, an experimental workshop aimed at 5th grade elementary schools' children, supervised by the proponent of the research with the support of experts in the fields of narrative sciences and pedagogy, will be structured. The final outcome of the workshop will be the animated transposition in stop-motion of a "coming-of-age story" that addresses specific social and emotional contents.

In the following paragraphs, the hypothesis for the structure of the workshop will be schematized (Tab.1), and described in detail, including the explanation of carried out activities, material tools, and evaluation methods that will be used to test the method both in terms of the learning contents and acquisition of tools, and in terms of the reaching the mentioned educational objectives.

PHASES	ACTIONS	PARTICIPANTS
1. *CONTACT WITH SCHOOLS, TARGET DEFINITION AND PRELIMINARY EVALUATION*	• Select the primary schools to be involved in the experiment. • Preliminary evaluation. • Confirm target, number of classes involved, timing.	• School's Director • Teachers • Expert in evaluation methods
2. *DEFINITION OF SETTINGS AND PARTICIPANTS*	• Select classes to be involved in conducting the pilot experimentation. • Define topics, themes, narratives to be used	• Teachers • Experimental sample • Control sample
3. *FIRST EX ANTE EVALUATION*	• Formulate the evaluation grid. • Make teachers fill in the GRID to define students' skills and preliminary knowledge.	• Expert in evaluation methods • Teachers • Experimental sample • Control sample

4. *STOP-MOTION ANIMATION WORKSHOP*	• Sub-phase A. Students read and analyze the narrative text • Sub-phase B. Pre-production • Sub-phase C. production: Assets preparation, shooting	• Teachers • Experimental sample • Expert in storytelling • Expert in stop-motion animation
5. *IN ITINERE EVALUATION*	• Teachers are requested to weekly complete the evaluation grid	• Expert in evaluation methods • Teachers • Experimental sample • Control sample
6. *EX POST ANALYSIS*	• systematize the data collected and verify the level of acquisition of socio-cognitive skills during the laboratory experience.	• Expert in evaluation methods
7. *FINAL OUTUTP*	• - Editing and montage of the final video	• Expert in stop-motion animation

Tab. 1 CCODE_Phases, actions and participants

1. TARGET DEFINITION AND PRELIMINARY EVALUATION

The objective of the first phase of the research project is to select the primary schools to be involved in the experiment. After the selection is completed, a first preliminary evaluation of the project will be conducted. The workshop experience, indeed, is a pilot experimentation and requires to be scientifically validated in order to place itself as a new learning method. An expert in evaluation, the schools' directors and involved teachers will be asked to validate the tools, methodology and objectives formulated. In the same phase director and teachers of each school will be asked to confirm the suitability of the proposed target (second / third grade children) the number of classes involved and the timing (hours / number of weeks) for conducting the workshop.

2. DEFINITION OF SETTINGS AND PARTICIPANTS

In the second phase the classes to be involved in conducting the pilot experimentation of the project will be selected. The classes that will not participate in the workshop will constitute the control sample. The classes that will participate, on the other hand, will constitute the experimental sample. At the beginning of the workshop, indeed, the two samples need to possess the same knowledge about the topic and the selected narrative text, and the same ability in approaching creative and collaborative experiences. This starting parameter is necessary to evaluate, at the end of the experience, which one among the two groups of students has achieved better results in learning contents and addressed objectives.

Topic and contents will be also defined at this stage of the research as they will be formulated according to the didactic unit the workshop will relate to, and developed in agreement and complementarity with the school, the teacher and the class group that will experience the pilot experimentation. Those contents will be arguably based on what is reported by the National Guidelines for the primary school curriculum and the first cycle of education, drawn

up by the Italian Ministry of Education. These indicators identify four fundamental objectives to be inductively obtained during didactic units: "identity", "autonomy", "skills", "citizenship" (MIUR 2018).

According to the strategic program, cognitive, emotional and social skills cross all didactic units and disciplines aimed at structuring the relationship between "the self and the other" which prefigures the promotion of active and responsible citizenship. The workshop, therefore, will depict a didactic unit with structured contents and both didactic and educational objectives, but designing a different method and approach in dealing with them.

3. FIRST EX ANTE EVALUATION

The tool selected to evaluate the effectiveness of the experimental leaning unit is an "evaluation grid", intended to be used before, during and after the workshop experience. In the premilitary verification moment teachers will be asked to fill in the grid to define the students' level of knowledge of technical tools (teaching objectives) and relational and reflective skills on specific topics (educational objectives). This tool is inspired by the Mario Castoldi's "evaluation report" and – as Castoldi's evaluation reports – provides a score for the evaluation of learning, conceptualizes the levels of mastery of the expected skills and provides a useful framework for subsequent comparative evaluations (Castoldi 2016). "Evaluation reports" also investigate other dimensions consistent with the education objective of the project, such as: socialization; reflection; and change by applying a matrix made of specific indicators in order to quantitatively document the carried-out improvement. This kind of tool was proposed for the first time by Corrado Petrucco and Marina De Rossi in 2014 to evaluate digital storytelling products, and requires a top-down approach aiming at verify if intended results have been reached. The three set of parameters that teachers are supposed to investigate by completing the grid stem from the evaluation reports' structure, and slightly edited to better adhere to the content, process and objective of the workshop. Those questions concern:

- The evaluation of technical skills, i.e., abilities students learn during the production and postproduction steps, such as the shooting, the montage with the software, and the audio, photo and video editing (Tab. 2).

- The evaluation of contents, concerning the understanding of topics and meanings dealt with during the reading and analysis of the narrative text, such as narrative structure, style and contents (Tab. 3).

- The evaluation of the process, concerning the workshop experience and aimed at verifying the reaching of the educational objectives above defined: creative thinking, reflective thinking and cooperation (Tab. 4).

CATEGORIES	PARAMETERS TO BE EVALUATED (TECHNICAL SKILLS)
SCREENPLAY QUALITY	Effectiveness of the narrative text translation into a screenplay
ANIMATION SMOOTHNESS	effectiveness of puppets/objects movements and respect of the animation principles
PHOTOGRAPHS	Suitability of shot, composition, light and color
MONTAGE	Suitability of transitions, durations and animation for a clear reading of the image to create an engaging rhythm
AUDIO	Appropriateness of the soundtrack

Tab. 2 Evaluation grid parameters for verifying TECHNICAL SKILLS
Source: Petruccio, De Rossi (2014)

CATEGORIES	PARAMETERS TO BE EVALUATED (CONTENT SKILLS)
CONTENTS	Consistency of addressed contents and themes with the educational objectives chosen for the learning process
STYLE	Suitability of materials, text and technique for expressing specific emotional content
ORIGINALITY	Capacity of the output to express a personal point of view
ETHIC	Contents respect the human being and nature

Tab. 3 Evaluation grid parameters for verifying CONTENT SKILLS
Source: Petruccio, De Rossi (2014)

CATEGORIES	PARAMETERS TO BE EVALUATED (PROCESSUAL SKILLS)
MONITORING	Effectiveness of the monitoring process in the various phases of the experience
SOCIALIZATION	Capacity of the applied method of content analysis and production process to stimulate a continuous and constructive interaction and collaboration within the group
REFLECTION	Results of the experience in terms of generating reflective capacity and stimulating possible changes
CHANGE	Level of behaviors' changes stimulated by the didactic experience

Tab. 4 Evaluation grid parameters for verifying PROCESSUAL SKILLS
Source: Petruccio, De Rossi (2014)

4.   STOP-MOTION ANIMATION WORKSHOP

The stop-motion animation lab. is structured into three sub-phases, hereinafter referred to as sub-phases A, B and C. Activities planned for each sub-phase are:

- During sub-phase A, students will read and analyze the narrative text. The narrative, chosen in agreement with the teacher, will be the same studied and analyzed with classic learning approach and methods, by the control sample. This phase of reading, understanding, analysis of the themes and the subsequent writing of a screenplay will be conducted under the supervision of the teacher and an expert of narratology.

- During sub-phase B, the students of the experimental sample will face the pre-production phase, supervised by the teacher and the experts in stop-motion animation, and in the field of narratology. In this sub-phase the students will draw storyboards, characters, props and backgrounds, they will define the materials to be used to make characters, props and scenographies choosing between paper (cut-out animation), plasticine (Claymation), fabric or objects (animation of objects).

- Sub-phase C is production, divided into two moments:

1) Assets preparation (assets are all the elements necessary to start the animation phase). Much of the production phase of a stop-motion project is based on the preparation: 3D objects and/or puppets and backgrounds must be designed and modelled appropriately to allow effective animation. Puppets and background making phases are the most important experience the workshop will be based on, and involve all students in the experimental sample, who will fabricate puppets and objects designed in the pre-production phase by using defined materials.

2) Shooting. Students will experience the frame by frame shooting process under the supervision of the proponent of the research. By following the storyboard all the photos will be taken to arrive to the fully animated final artefact. Before the shooting students

will be briefly explained how this animation technique works: by taking one frame at a time and then moving the puppet/object with small increments before taking another shot. To complete the animation step, students will be also introduced to the use of a specific licensed software, DragonFrame. This software is professional but easy to use, and during the shooting they will be constantly supervised and guided by the expert in stop-motion animation.

5.   IN ITINERE EVALUATION

For the entire duration of the workshop, as mentioned, teachers will be required to observe the students' progresses, evaluated according to the specially designed "evaluation grid" and complete it according to the three main identified areas of interest: acquisition of technical skills, understanding of contents and experiencing of the production process.

6.   EX POST ANALYSIS

At the end of the workshop, the evaluation grids compiled weekly by the teachers will be collected and the methodology and evaluation expert will systematize the data to verify the level of acquisition of socio-cognitive skills during the laboratory experience.

7.   FINAL OUTUPUT

After the conclusion of the workshop experience, the expert in stop motion animation will edit the animated videos produced by the students and put all sequences together through a montage software in view of the production of the final output.

Conclusion

The described project has not yet been completed and it is not possible to evaluate the data. To date, the project is at Phase two and the professionals and researchers involved are working on the definition of the evaluation grids to be completed by teachers during the phase three of preliminary evaluation.

Stop motion experience as learning method, as mentioned, is not new and the process of film production has been already used to teach aspects such as animation principles, craft skills and team work. What is new in the described research is the focus on the process of material manipulation as if material, when used to shape something previously understood narratively, could be a successful vehicle of knowledge. Described pilot experimentation will reveal limits, advantages or critical points thanks to the evaluation tool applied to control learning objectives. The evaluation tool will then suggest what and how redesign, if necessary, methodological, approaches, steps and/or the addressed target.

By integrating stop-motion, material design, storytelling and pedagogy, the interdisciplinary workshop can be considered new in an international perspective and worthy of seeing its potential verified in the future. The formulated learning experience stems from methods theoretically and empirically validated, and approaches that pedagogy has used in the last century to enhance sensory experience, collaboration and action within the educational process, but goes beyond these premises by making an interdisciplinary leap that brings together analysis of the narrative text, creative writing and design. The method becomes an alternative didactic unit and could potentially prove to be applicable to any content, discipline

and educational context, not only the study of narrative texts, also mathematics, history and geography or foreign languages.

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Contact email: vincenzo.maselli@uniroma1.it

The Need for Socially Responsible Design in a Dynamic Society

Simon Dai, University of Canterbury, New Zealand
Heide Lukosch, University of Canterbury, New Zealand
Bahareh Shahri, University of Canterbury, New Zealand

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Abstract
In the light of social change diversification, the importance of shaping connections between people and products for more resilient ways of life is growing. The purpose of this paper is to uncover the importance of responsibility and self-cultivation of designers in social change diversification. For this aim, this paper reflects on a case study of the design of Chinese dockless bike-sharing systems, including Mobike and OFO. The case of the dockless bike-sharing systems represents fast-paced changes in the service design industry which necessitates quick, constant, and holistic design input. The paper reports on how the case study is described in literature, and what learnings can be drawn from this. The study highlights the important role of design for society and shows approaches of designers towards solving real-world problems. Self-cultivation of designers seems to be an important factor in reinventing proximity between social responsibilities, sustainable considerations, and market competition in design.

Keywords: Multiculturalism, Social Responsibility, Ethics

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Introduction

Designers are able to affect social change through service design. In this instance, social change refers to changes that alter the established societal institutions. For example, the increase of gender equality is one example of social change. Social changes are not always positive ones. Negative social changes such as the increase of women in criminal activities could also be attained which would be a great loss for society (Pattanaik & Mishra, 2001). Social change can be influenced and brought about by the population. As part of society, it stands to reason that designers can kickstart social change. This may apply most clearly to service design, which is where designers optimize an experience between users and service providers (Clack & Ellison, 2019). As the Interaction Design Foundation describes it, "When you have two coffee shops right next to each other, and each sells the exact same coffee at the exact same price, service design is what makes you walk into one and not the other ("Service Design")." Designers are agents of change who, through service design, influence the minds and alter the behavior of people (Dam & Siang, 2020). This aspect can also be brought to social change where it could be used to solve some of the problems society currently faces.

There is significant opportunity now for designers to have a positive impact on society for a few reasons. First, social media makes it easy for designers to follow social trends and take note of such opportunities, as well as learn what issues are current in the public's eye. Similarly, designers can easily share their work, and both involve users in earlier stages of design and work to make sure their designs are used in the intended manner. However, designers need to be mindful of the unintended consequences of their work. As this paper will show, a project can start with the best of intentions and still result in a net negative effect on society. The current study examines such case study, that of a public bike sharing program in Shanghai, China. This is a program that, on paper, would reduce people's dependence on vehicles, therefore reducing pollution and easing traffic. Combined with the city's public transportation network, these programs would enable most of the local population to easily travel around the city and reach their destination without need for a vehicle. In addition to the environmental benefit, users would be expected to get more exercise, increasing fitness. The benefits of such programs would seem to make them an excellent design and social program, but instead the unintended and unforeseen consequences of the programs provide a cautionary tale to designers looking to implement social change through service design.

Then, the current research will explore two research questions, those being:

Research Question 1:

Can designers positively influence social change?

Research Question 2:

Do designers need to consider unintended consequences related to their designs?

There has been other research into these questions. For example, Yeager et al conducted a social science experiment across multiple schools in the US and Canada from different ethnic backgrounds and of different genders (Yeager et al, 2016). The purpose of the experiment was to decipher how successful psychological interventions could be designed to help students who were going into high school. The results demonstrate that the use of intentional design, yielded better outcomes for students and improved their academic performance. One

important limitation of the study was that the results showed that long-term results were weaker compared to short-term results. Another limitation is that not all the factors that may contribute to the results were factored in, such as different teachers and learning styles.

In another case related to graphic design, specifically print design, chemicals are used in the design process. Graphic design has been identified as a major source of pollution which also includes visual pollution. In the book Visual Pollution, author Adriana Portella (2014) delves into how various components of graphic design affect the quality of the environment in which people live. The conclusion drawn from her research is that graphic design does indeed affect peoples' environment and thus affects their lives. Therefore, to avoid its negative effects, interventions need to be put in place.

These works demonstrate how design can impact the daily lives of people in society and illustrate the importance of considering the unintended consequences that may result from a designer's work. It is important that designers begin to consider these factors in their work, so they do not inadvertently make a situation worse. This is the basis for the concept of designer self-cultivation, which refers to the need for a designer to improve themselves and will be explored further in this paper.

Methods

This study aims to contribute to an answer on how designers can contribute to positive social change, referring to introducing a beneficial factor to a problem faced by society, such as climate change, inequality, or crime. This study analyses a design case that aims to contribute to social change related to climate change actions. For this research, both qualitative and quantitative data were examined. The criterion used to determine validity and reliability is peer-reviewed sources and the use of news articles. News articles can provide real-world information, while peer-reviewed sources provide credible data. Numerical data is used for the purpose of acquiring information about the resources present in the situation while qualitative data provides information concerning the perception of various members of society.

These methodological choices are justified by the fact that the research requires both numerical and interaction-based data. The information used in this research is both research conducted directly by the author and interpretation of works created by others. This was necessary as the information used in this paper is designed to analyze a current problem society faces and one example of a designed intervention, while at the same time using credible methods.

Research Data

It is imperative to review the data before attempting to answer the research questions. Figure 1 shows that bike-sharing systems have rapidly expanded in many regions of China as a result of their perceived benefits. Using the bike service, people would be able to bypass traffic, which should save a great deal of time. Additionally, people could save money that would otherwise be used to facilitate other modes of transportation. Technological advancements have also made it possible for people to access and operate bikes via their mobile phones. In addition, the rapid growth of the bike-sharing business in China has also been attributed to an increase in on-demand products such as transportation and food delivery.
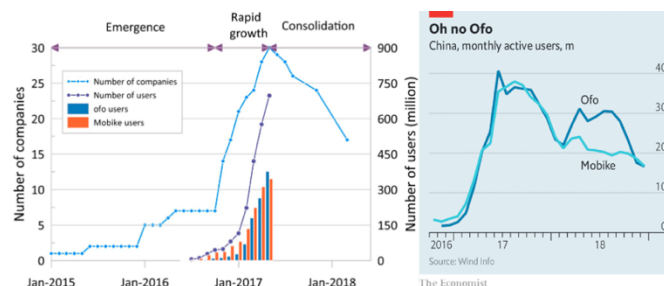
Figure 1: Bike Share Growth Users in Shanghai 2016 – 2019

Based on the data graph (Figure 1) above from "Rethinking the Utility of Public Bicycles: The Development and Challenges of Station-Less Bike Sharing in China (Wang et al, 2019)," after the rapid expansion between 2016 and 2017, there was a rapid decline in monthly users. Approximately 675 million people used the service in the first half of 2017, which is nearly 400 million people fewer than in the previous half of the year. As a result, there was a reduction in demand for bike-sharing services. The design of the system allowed users to park anywhere, leading to poor parking conditions, as well as a high rate of lost or damaged bikes. Due to a lack of early attention by the designers, there were no measures in place to address these difficulties.

According to this data chart (Figure 2) from "Mobile bicycle-sharing hits China, boom reinvigorates manufacturers (Yao, 2017)," user preference for modes of transportation changed before and after the introduction of the bike-sharing design system. It can be seen from the chart that the use of public transportation as well as walking decreased by 4% and 6%, respectively, after the introduction of the bike-sharing system. As opposed to this, the use of bicycles and cars increased by 26% and 2%, respectively. Considering that other modes of transportation have declined by 10%, the increase in bicycle usage is uncharacteristic. This indicates that people embraced shared bikes over other modes of transportation available to them (Lyu et al, 2021).
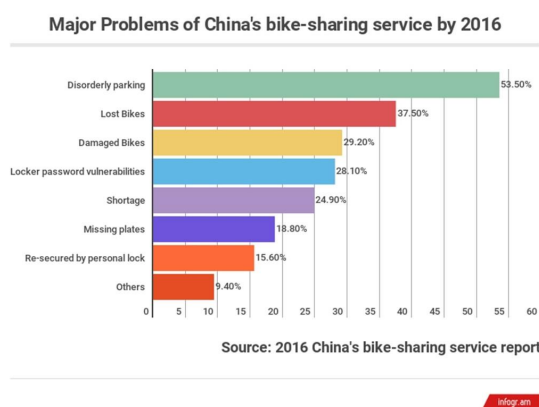
Figure 2: Problems identified with bike sharing programs

As shown in (Figure 3) below, public transportation and cars continue to be the preferred means of transportation for longer distances (Sun, 2018). Walking may have decreased as a result of the ease of access and low cost of using the system. There is a reduced likelihood of users walking when cycling would reduce their travel time.
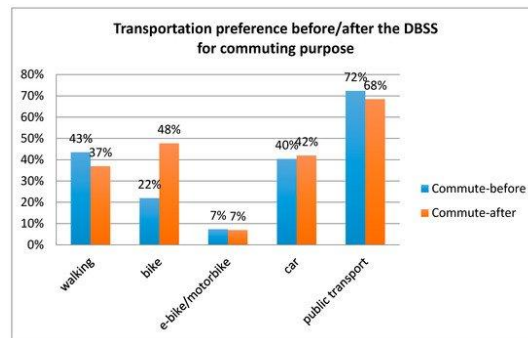
Figure 3: User preference in methods of transportation

Based on the data presented so far, these results indicate that bicycles are preferred over other modes of transportation by the public. The majority of individuals with adequate resources preferred to use their own means of transportation over the bike-sharing system. The use of bicycles initially increased rapidly, but then declined rapidly. The bike system was plagued by multiple design problems such as protection and parking. According to the data, designers are able to positively influence social change through service design, in response to the first research question. As demonstrated by the rapid growth in users of the bike system, the bike system was capable of bringing about social change.

In response to the second research question, the findings also support the conclusion that designers should consider unintended consequences when designing. Neither the creators nor the designers of the bike sharing system anticipated or prepared for the problems they would encounter. As a result, their design was unsuccessful, as demonstrated by the fact that many users stopped using the bike system. The size of the fleets of bike sharing companies is one of the unforeseeable problems. Unfortunately, the bike-sharing design system may have many more problems that have yet to be identified.

Resources, both material and financial, have been invested in the bike-sharing system, but rather than addressing the problems at hand, bike-sharing companies contribute to the proliferation of those products. Ofo and Mobike, two leading Chinese bike-sharing companies, have failed due to a lack of problem resolution (Zhang et al, 2015). There is a possibility that the bike-sharing sector can be saved if designers improve themselves and continuously research ways to solve the problems identified in their designs. By approaching projects critically, considering a bigger picture, and acknowledging their responsibilities to society, designers can solve the bike-sharing problem. As a result, they will have contributed to social change and improved the craft of design in a constructive manner.

Summary and Discussion of the Research

To summarize the research described above, designers influence society in a great way, such as in fashion and aesthetics. They exert a great influence on how people perceive things and how change comes about. This power comes with social responsibility. However, designers also face a lot of challenges, such as competition with each other, especially when they work in different companies, which dilute their social responsibility and instead direct them towards profits, novelties, and other vices that show their competitiveness. Companies are usually profit-oriented and frequently compete with similar companies in the production of products that will generate more returns than their competitors.

If designers knew the importance of the role they play and self-cultivation, there may be a chance that a better outcome could be achieved, which would improve the lives of a lot of people (Vallor, 2016). The focus of this research paper is to show the importance of the role of designers in promoting social change with the aim of boosting development of design as a discipline. In addition, we explore the unintended consequences of design to demonstrate the importance of considering the full impact a design will have on society and trying to build in mitigating features into the original design. Based on the concepts outlined above, specific subtopics were identified for discussion. These subtopics were selected with the goal of focusing the research and are as follows:

- Continuous Improvement of Designer Self-Cultivation

Self-cultivation refers to the process by which individuals improve and develop themselves through personal efforts. This is one method individuals may use to improve their morality (Peters, 2020). Improving oneself may refer not only to skill but to the products created or released by the designers. Interactive and graphic designers come up with multiple products which sometimes present unethical or immoral ideas. For example, marketing or technology that promotes male or racial superiority. These products may bring in a lot of profit and in themselves be extremely innovative and useful. However, they were designed to reinforce inequity and oppress groups in society. Designers have a responsibility to not continue with such designs.

A good example of designer self-cultivation is the design of the products generated through Value-Sensitive Design, which is design that considers societal values as part of the design process (Gerdes, 2022). This design method challenges designers to create products that factor in morals and values important to society (Manders-Huits, 2011). Through design methodology like Value-Sensitive Design, designers can self-cultivate into individuals who choose the welfare of society over material gain.

While self-cultivation of designers prioritizes the welfare of society over economic gains, it also attracts more individuals to particular products. This means that in the end, self-cultivation does not just improve the designer as an individual, but also attracts people to products that were made with the welfare of society in mind. As a result, it can also be seen as a method useful for promoting and marketing the products created by the designers.
For example, in China, designers came up with a project where bicycles could be shared by many people through technology, as discussed in this article. The designers in charge of the project concluded that the use of dockless bike-sharing would "…decrease the average trip time of passengers…increase the efficiency of an urban public transport network…[and] effectively improve the uneven level of traffic flow spatial distribution of an urban public transport (Sun, 2018)." In short, bike-sharing would reduce traffic congestion which would save a lot of money, time, and resources. The bike project was designed to alleviate problems faced by society as it proved to be a better, cheaper, and less time-consuming way of transportation, it attracted a lot of people i.e., customers and investors (Lipton, 2017). As a result, it became a profitable venture to earn money.

- Clarify the Responsibility of the Designer

The most well-known roles of designers include designing products and determining the interaction between the products and consumers. However, apart from their professional role in their respective capacities, designers also have another role, the social responsibility role.

This role is a result of the great influence designers have on the behavior of people. Moreover, their work requires them to relate and understand the context (i.e., cultural context) of their products and the repercussions of those products in society (Grant & Fox, 1992).

One social responsibility of designers is to guide and provide information. The only way for consumers to know if a product is beneficial or destructive is if they have adequate information about the product. Designers who created the product are responsible for it and therefore have a social responsibility to refine their work based on real-world performance and expectations compared to reality. Moreover, the designers also need to provide society with information that enables them to make the right choices when acquiring products. Through this method, people can ensure that the products they purchase are useful and of benefit to society and know how to distinguish between good and bad products.

Designers also have a responsibility to promote and ensure sustainability. This means that designers have the mandate to ensure that resources are utilized in a way that future generations would still utilize them (Pitt et al, 2009). This mainly comes into play through pollution where designers have a responsibility to ensure the sustainability of ecosystems. This responsibility mandates designers to create products that protect and reduce the harm caused to the planet by other products.

-        Ability to Learn Diversifying Social Change

There are many challenges that society has, had, or will face in sectors such as pollution of the environment and health (Stephan et al, 2016). To solve these challenges, social changes are employed. Social changes are the alterations or a specific order in society. These alterations bear with them repercussions that are either positive or negative to society. On the other hand, diversification refers to the process of availing a variety of routes/ways to handle various situations.

Diversification of social change in design is simply a framework for designers to bring about social change in multiple ways targeting multiple problems. It is an already established fact that there are many problems plaguing society. These are problems that may not be solvable in one way. Diversification of social change brings about many ways of relief which ultimately alleviates the effects of the problem while at the same time reducing the problem.

A good example of this is pollution. There are many ways that pollution can be solved. Designers have designed products such as bike-sharing which reduces pollution while improving public health. Other designers have designed vehicles that reduce pollution and so on. Therefore, diversification allows multiple paths to be taken to solve a problem.

-        Ability to Find a Balance

The effects of designer self-cultivation, responsibility, and diversity in social change greatly impact society. The impact on society can be positive but it may still have some negative effects on other parts of society. Moreover, if the solution generated is not handled appropriately, it may lead to the long-term failure of the project.

One of the benefits of solutions generated includes a reduction in pollution. Solutions also cater to the promotion of public health and solve other problems plaguing society such as

racism. While the benefits may not be complete solutions to the problems, they do influence society to positively change which becomes a solution to the problem. For example, cycling is a behavior that can be adopted by many which may reduce the pollution problem faced by society today through the reduction of vehicles that cause pollution (Zhao et al, 2018).

However, the solutions could also have a negative effect. Every action causes another one to occur. The reduction in using vehicles may mean that transportation companies lose a lot of revenue due to the reduced demand for their products. Moreover, it would also mean that employees of those companies may suffer economically. If the solutions are not organized in the right manner, they may fail. In their failure, more problems may arise from the expected solution.

It is therefore safe to say that the solutions generated may be good for society as a whole, but they may also have negative effects on different entities. For businesses, the reason why some stay away from such activities is that they may feel that the exploits may reduce their revenues and profitability. For most businesses, their sole purpose is simply making profits, and many will put their wants and needs before those of society. Designers should at least be aware of the relation between these factors, and ideally strive to achieve a healthy balance.

- Ability to Think Ahead

To successfully fulfill the objectives of this research, a particular occurrence was chosen, that being the Chinese bike-sharing design. The bike-sharing design was a revolutionary method designed by the Chinese people to address their traffic congestion and pollution problems. While the initiative had its advantages, it also had serious disadvantages which hampered its success.

The innovative bike-sharing design promoted convenience and promoted social values among its clients. It was a widely acclaimed model, and many international organizations gave numerous awards to bike-sharing companies such as Mobike to reward them for their role in reducing pollution which in turn helped alleviate climate change (Sun, 2018).
The companies responsible for the design received a lot of capital from multiple investors which ultimately resulted in problems for them. Rather than effectively managing their current bikes, these companies reacted to increased investments and demand by purchasing more bikes. This turned the bikes which were there to help society especially by reducing pollution into pollution. There emerged a situation where there were too many bikes on the streets and roads which were not originally meant to handle such high numbers of bikes (Ye, 2017).

This goes to show that problems are extremely complex, and design may not be the sole reason for the failure of solutions. However, it also begs the question, if all possible outcomes had been considered by designers, would the poor results be avoided? If the negative effects of the solution would have been identified earlier on and interventions for them created maybe the situation may have been different.

From the literature review and these pillars of research, it is expected that designers can influence positive social change through diversification, self-cultivation, and social responsibility. Based upon the China bike-sharing case study, design alone does not guarantee the success of the initiative taken. Therefore, another generated conclusion from

the literature review and the pillar of research is that design may not be able to solve the problem at hand.

The China-bike sharing design achieved the goal they had set out to do to some extent. However, the design had found new ways to fail that were unanticipated by the designers. This study contributes to designers and social change by showing their importance and not only solving the current problem, but also considering the potential consequences of any given design solution and how those new problems can be avoided or solved as part of the initial project.

Strengths and Limitations

This research was able to link poor design and lack of proper response to problems to failure of designs in China's bike-sharing system (Zhang et al, 2015). The limitation of the research is that it lacked depth. While the research was able to identify many factors that contribute to the importance of social responsibility in design, future researchers should add to the depth of this research. Specifically, primary research should be conducted with users of the bike-share systems to add the user perspective, and there may be a role for statistical analysis of the available data to further support or disprove the conclusions of this research.

Conclusion

A summary of the above designer methods and the analysis of the Chinese bike-sharing system may reveal the importance of socially responsible design solutions to society's problems at various levels, demonstrating designers' position in society as important contributors. Designers play a significant role in affecting social change, which explains their importance. Throughout a designer's career, self-cultivation is essential, as is accepting responsibility for helping to shape the society in which they live. By improving these processes, they ensure that they design products that benefit society and promote social change. Consequently, design improves, and society's welfare also has a chance to improve. The importance of self-cultivation and responsibility for designers cannot be overstated.

Finally, we have seen that designers can contribute to positive social change through diversification, self-cultivation, and social responsibility. An analysis of the China bike-sharing case study suggests that design alone does not guarantee the success of an initiative. To some extent, the China-bike-sharing design achieved the goal it was designed to accomplish. However, the designers did not anticipate several ways in which the design could fail. By demonstrating that it is important to consider not only the current problem, but the potential consequences of any given design solution as well as how these new problems can be avoided or addressed as part of the initial project, this study contributes to the fields of design and of social change.

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Human-Centered Design as a Qualitative Research Methodology in the Area of Public Health

Pierre Yohanes Lubis, University of Canterbury, New Zealand
Bahareh Shahri, University of Canterbury, New Zealand

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Abstract
This paper builds a deeper understanding of human-centered design (HCD) as a qualitative research approach in the pursuit of generating proper solutions in the area of public health. This study draws similarities and discrepancies between human-centered design methodology and the qualitative research approach. HCD largely emphasizes ethnography, which is inherently qualitative. HCD relies on the effort to perceive the problem from the point of view of the target user just as the qualitative approach frames an issue as they are understood by the people themselves. Both HCD and qualitative approaches are fundamentally 'bottom-up' by framing a problem as it is phenomenologically situated. However, qualitative research does present several discrepancies with the HCD approach when applied in the field of public health, especially regarding the methods of implementation of their respective solutions. Whereas solutions in the area of public health are typically enforced by 'hard power', in the field of design, solutions are commonly implemented by the use of 'soft power'. This is because public health is commonly perceived to be a 'public good' and therefore not commonly considered an area wherein the market can have a role. In the design discipline, however, solutions are normally crafted to compete freely in the market. By examining how several past solutions provided by the design discipline as well as observing how well received our solution was, it goes on to prove that HCD can truly be a boon when addressing public health issues.

Keywords: Human-Centered Design, Qualitative Research Methodology, Public Health

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Introduction

The human-centered design (HCD) approach makes use of participatory research methods and is eloquent in embracing ambiguity (IDEO.org, 2015; LUMA Institute, 2012). HCD as culminated by IDEO is geared towards the creation of market-based solutions and encourages the generation of social innovations. IDEO (2015) remarks how the international development community has designed solutions to the challenges of poverty without truly empathizing with and understanding the people it is looking to serve. Therefore, HCD is meant to tackle the issues of empathizing and lack of understanding. It is a process and the reason it is labelled as 'human-centered' is that it starts with the people it is designing for. Characteristics of HCD affirm the value of human dignity because it seeks to support and strengthen the dignity of human beings as they act out their lives in varied social-economic, political, and cultural circumstances (Buchanan, 2001).

Theoretical Framework

This paper aims to build a deeper understanding of HCD as a qualitative research methodology applied in the field of public health. We began by first establishing the proper positioning of the HCD approach within the constellation of the qualitative research methodology and common methods used in the HCD methodology before comparing HCD with other qualitative approaches often applied in the field of public health. Subsequently, the scope and the method of implementation between public health in general and the design field were compared. Finally, the HCD approach was utilized to craft a solution for the clean water issue in the slum community in Jakarta, Indonesia.

Human-Centered Design as a Qualitative Research Methodology

HCD as one of the contemporary design methodologies helps foster the transformation of the mainstream design discipline towards a participatory mindset and a co-creation activity with the target user. Changing the term 'user' to 'stakeholder' was employed to support this transformation since it elevates the status of the target demographics as they get increasingly involved in the design process out of their own volition (Krippendorff, 1998). Creative industries serve as a suitable habitat for this transformation because it is considered more open to the philosophy of co-creation than the more conservative manufacturing industries (Dorrington et al., 2016). HCD highlights the importance of synergy between all stakeholders and design experts in a design activity. The inclusion of the community or all stakeholders should generate the best solution that works for everyone in the community.

Having the element of applied ethnography, HCD is led by research rather than by design. HCD allows more user participation as it treats them more than just subjects of design. Ethnography can be defined as a kind of study that involves an in-depth, systematic study about groups of people by observing or participating in the lives of the people who are being studied (Madden, 2010). Its main aim is to provide rich, holistic insight into various cultures and sub-cultures: people's views and actions, and the environments that surround them: sounds, sights, spaces, locations, etc. Researching in an ethnographic context constitutes the immersion of the researcher to the target community even though objectivity and impartiality have to be maintained throughout the research (Muratovski, 2016). Ethnographers typically use a wide range of tools including notes, interviews, cultural probes, and other types of visual research (Muratovski, 2016; Reeves et al., 2008; Rose, 2012).

Design ethnography; ethnography in the field of design, can be distinguished from ethnography as it is practised by professional ethnographers and anthropologists. True ethnographers are most likely to immerse themselves into a different population for months if not years, while designers normally only collect information from time-sampled observation of behaviours. For instance, when leading immersive ethnographic research, designers can empathize with and taste the real experience of the participants through cultural probes (Martin & Hanington, 2019). The integration of ethnography in the design process helps reveal unaddressed needs that call for a design activity (Reese, 2004). The central mission of designers is to identify and meet the needs of the user, even the needs that the user themselves did not consciously know they had (Wasson, 2000). Ethnographic methods investigate not just what the user says they do, but what they do in actuality. For this reason, ethnography has been such an intuitive appeal to designers since it offers a new whole dimension to the "user". Looking at a particular problem from the lens of economics, ethnography is often applied by businesses when trying to identify what customers need without having to spend too much expenditure (Leonard & Rayport, 1997), given that ethnography possesses the capability to actively cultivate the creation of products and services that is in tune with the desires and needs of the user (Murphy, 2016). The use of ethnographic methods in the design methodology typically does not use a relatively large sample (Almon et al., 2014; Catalani et al., 2014; Hoof et al., 2015; McCreary, 2010; Reese, 2004; Simonsen & Kensing, 1997; Thoring et al., 2015; Wasson, 2000). Studies conducted with participatory methods do not use large samples (Amiri et al., 2012; Cheney, 2016; Moody, 2015; Morrison et al., 2015; Ramos et al., 2016; Robinson et al., 2009; Vechakul et al., 2015) which further solidifies the argument that the HCD approach is, by nature, qualitative.

Positioning Human-Centered Design in the Area of Public Health

The implementation of a typical design approach to offer solutions in the field of public health has been well-documented and the application of HCD has been proven to be quite beneficial to the field of health (Bazzano et al., 2017). Therefore, it is important to discuss the characteristics of the HCD methodology and its proper positioning as compared to other methodologies, especially in the area of public health. Qualitative health researchers typically put people first and focus on their feelings, emotions, and behaviours, a posteriori in health and sickness (Morse, 2012). Similarly, HCD's main angle is seeing the world from the eyes of the target user (Abras et al., 2004; Hanington, 2017). Rouse (1991) laid out the three primary objectives within the HCD approach: enhancing human abilities, overcoming human limitations, and fostering user acceptance. How a qualitative health approach explores health issues as they are understood by the people themselves perfectly aligns with the HCD approach which relies on the effort to perceive the problem from the point of view of the target user. Both approaches are bottom-up rather than top-down by focusing on the people first before trying to comprehend the whole system. Moreover, both HCD and qualitative health research perceive a problem as it is phenomenologically situated and utilize correlating approaches and procedures such as ethnography and narrative research to arrive at their solution (Creswell, 2007; Harrison et al., 2007; Holloway & Galvin, 2017).

Nevertheless, HCD and qualitative research, especially when applied in the field of public health, do present some discrepancies, most notably in the methods of implementation of their respective solutions. One can observe the different properties of the field of public health and the field of product design (including HCD) and their methods of implementation, as illustrated in Figure 1.
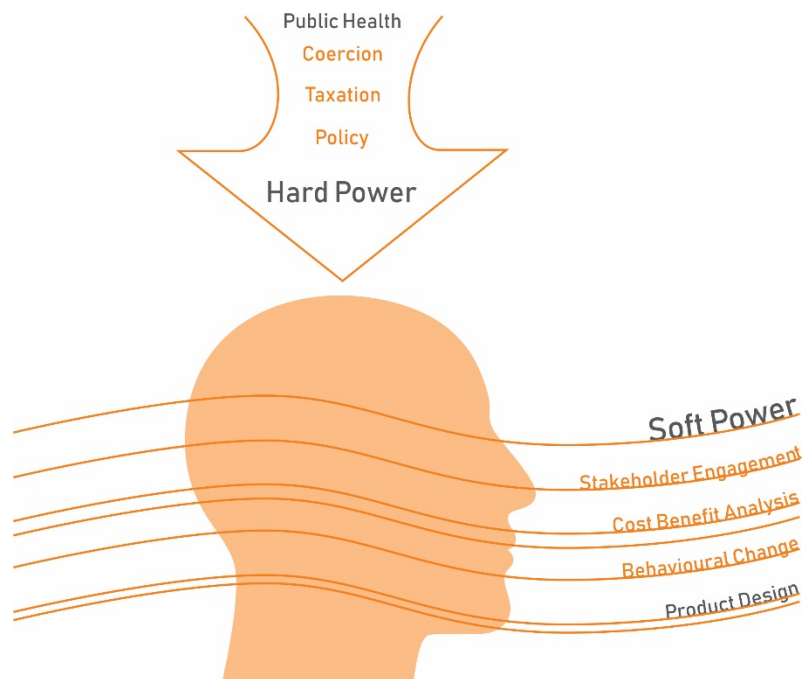
Figure 1: Methods of implementation in product design and public health

The level of implementation of solutions or interventions offered by the qualitative health research approach serves a larger scope and area when compared to HCD. According to Morse (2012), qualitative health researchers typically start by identifying interventions and examining those interventions, then move their findings back into professional care, into the political agenda, the educational realm, and back to the people themselves. There is certainly an authoritarian bent when it comes to the field of public health. Solutions are typically enforced through means of hard power that involve coercion, taxation, and policy-making. Hard power can be defined as a legitimized force that the state possesses to arrange and maintain a society that must be obeyed by all of its citizens. The dynamics of hard power leave people with little to no choice but to abide to avoid consequences that can are enforced by the state. However, this use of force can invalidate the individual's ability to think and choose which ultimately abolishes the capability of the individual to recognize the good (Peikoff, 1991; Rand, 1967). The main argument for the use of hard power is that public health is generally perceived as a 'public good' in terms of economics. Therefore, it is not something that is philosophically considered to be a role that the free market can fill.

In the field of product design, on the other hand, solutions are typically implemented by the use of soft power, a type of power that involves no force in its implementation. In the dynamics of soft power, the individual retains the ability to choose and there are no consequences at all for not choosing. There is no coercion in this dynamic because users or stakeholders are persuaded through the means of reason instead of through force. For instance, one may choose one brand of an automobile over the others due to its economical feature and other competing automobile manufacturers do not have the authority to force that person to buy their product. Instead, the implementation of soft power is typically supported by a series of persuasions such as stakeholder engagement, cost behavioural analysis, and behavioural change. A particular automobile manufacturer can increase customer engagement to produce a car that the users truly desire and thus sell more cars. The soft power dynamic can be traced back to Aristotle (1926), who developed the Three Means of Persuasion: *Ethos*, *Pathos*, and *Logos* (Figure 2). *Ethos* means an appeal to credibility and

trust, *pathos* to emotion and values, and *logos* to logic, reason, and proof. All three are applicable in the field of design.
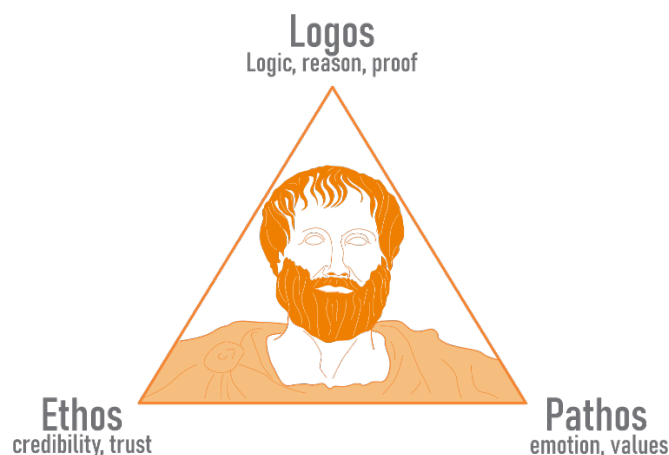
Figure 2: Aristotle's three means of persuasion

Stakeholder engagement is one of the hallmarks of the HCD approach where stakeholders are eased into the solutions by engaging, reasoning, and rationalizing together with them. The stakeholders are won by a discussion at the bottom end and not through top-down force.

Human-Centered Design for Public Health

Informed by the HCD methodology, we set out to conduct a comprehensive design process in pursuit of a solution for the clean water issue in a slum community in Jakarta, Indonesia during the span of six months. Figure 3 shows the progression of the design process, from start to finish. It is marginally divided into three stages of data collection: *Interview*, *Co-create* and *Bouncing Ideas Back*, and *Live Prototyping* and *Focus Group Discussion* as well as *Product Usability Interview*, with several occasions of iteration by the design/research team. While Session 1, 2A, 2B, 3A, and 3B were conducted together with the participants (i.e. slum inhabitants), topic groupings and theme identification, field observation, refinement and concept generation, and refinement and final design were conducted without any involvement from the participants.
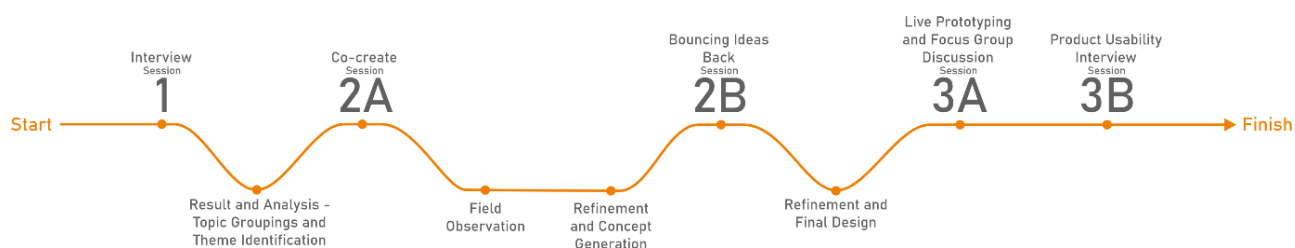
Figure 3: Stages of data collection

Session 1 involved interviews with slum inhabitants to investigate issues related to the topic WASH (water, sanitation, and hygiene) which are present in the community. Various HCD methods used in this session were fruitful in identifying those issues as well as revealing actual values held by the participants (Lubis et al., 2021). Obtained data from the interviews were then identified and grouped according to their relevant topic and theme before they were presented back to the participants in Session 2A, where participants were involved in a co-creation session together with the researchers in the pursuit of finding solutions to the

issues in the slum communities. After field observation and refinement and concept generation, ideas and possible solutions were then presented back to the participants in Session 2B. The ideas were visualized more tangibly so the participants could give feedback or iterate and improve upon them. In this session, a few ideas that had much support from the participants in the first session did not fare well while others gained more support with the help of visualization of those ideas. For instance, an idea for an electronic public toilet was deemed to be too complex for the community while an idea for a clean water delivery service that helps the community obtain clean water in the morning gained more support in Session 2B. Based on the feedback and iterations from participants, the design was then finalized, a prototype built and then tested directly in the slum community. The last two sessions (3A and 3B) were where the participants discussed the prototype of the solution as well as suggested improvements for it.

Ultimately, the solution was highly welcomed by the participants and encouraged the slum community to be more active in finding solutions to their problems. Through constant feedback and iterations from the participants, the solution has been proven to be beneficial to the improvement of the community and also highly desirable for the slum inhabitants.

Conclusion

This study has demonstrated how the human-centered design (HCD) methodology could be properly positioned within the larger nexus of qualitative research methods. Applied in the field of public health, we discovered how HCD and qualitative research present several discrepancies, especially in their different methods of implementation. Its participatory aspect imbued with co-creation activities distinguishes HCD from other qualitative methods. By examining how a solution that arose from engaging, reasoning, and rationalizing with stakeholders at the bottom end had been well received in the real-world setting as well as its high user acceptance, the HCD approach can truly be a beneficial and well-rounded methodology to tackle public health issues.

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Contact email: pierre.lubis@pg.canterbury.ac.nz

Generative Design: Co-Creation Process Between Designer and Computational Thinking

Camilo Ayala-Monje, Universidad de los Andes, Colombia
Camilo Ayala-García, Universidad de los Andes, Colombia

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Abstract

Generative design is a projective tool that allows designers and creators from other areas of knowledge to have applied innovation approaches. It is currently an emerging exploration process that integrates artificial intelligence and parametric design processes, consolidating itself as a milestone in the construction of alternative design proposals. This research analyzes the potential value of generative design in different fields; it presents and exemplifies the co-creation process between the designer and computational thinking, with six prototypes. It shows the product design process using this methodology and exposes the importance of these technologies. Generative design is recognized as a valuable opportunity for teaching and appropriation in academia because it allows to create products, evaluate, and optimize designs quickly, could generate more efficient processes and influences agile decision making to achieve higher performance throughout the design process. This research found that it is important for design students to know these tools, and to understand that, although they are very powerful, the human designer is and will be the one who makes the final decisions about the project, above the answers and algorithmic calculations that the parametric system gives. This research shows that this technology helps designers to face challenges in an era defined by the high degree of digitization, where it is increasingly necessary to create products that integrate with new technologies and human needs.

Keywords: Design Process, Generative Design, AI-Enabled Design, Genetic Algorithm, Evolutionary Algorithm

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Introduction

Generative design is a tool that allows designers and creatives from other areas of knowledge to approach applied innovation. It is considered an emerging project exploration process that integrates tools such as artificial intelligence and processes such as parametric design. It is being considered also a contemporary milestone in the construction of alternative design proposals. It is important for the designer who is trained not only to know these tools and master them but to understand that, although they enhance the development of the project, it is and will be the designer who makes the final decisions about the project, above the algorithmic answers and calculations that the parametric system provides. Generative design has had important historical antecedents that have allowed the development of the technology. The first has to do with what happened in 1962, at the Lincoln Laboratory of Massachusetts Institute of Technology (MIT); when Ivan Sutherland developed the Sketchpad system, based on his doctoral thesis "A Machines Graphics Communications System" (Sutherland, 1962). This development lays the foundation for computer-aided interactive graphics systems, Computer-Aided Design (CAD) and Computer-Aided Manufacturing (CAM) (Llach, 2013).

Subsequently, there is an important advance in the production of algorithms capable of promoting multiple solutions autonomously based on predefined parameters (Bernal et al., 2015). Although there is a wide variety of evolutionary algorithms, the four most prominent types are genetic algorithms (Holland, 1975), evolution strategies (Rechenberg, 1973), evolutionary programming (Fogel, 1963), and genetic programming (Koza, 1992). From the practical point of view, several designers have concentrated on the development of projects with a significant load of parametric design, taking advantage of these algorithmic capabilities that enhance the design. In the field of generative evolutionary design, is important to highlight advances such as: a system of generation and evolution of three-dimensional construction models (Janssen et al. 2005), which describes a comprehensive framework for generative evolutionary design that varies in a controlled way. The Supporting product innovation using 3D shape grammars in a generative design framework (XI Tang, 2014) which concentrates mainly on the integration of 3D shape grammars with conceptual design knowledge in a generative design system. this framework helps the development of an advanced system for the exploration of design alternatives. The key problem that is identified is generating alternative designs that vary in a controlled manner. Within the proposed framework, the design process is split into two phases: in the first phase, the design team develops and encodes the essential and identifiable character of the designs to be generated and evolved. In the second phase, the design team uses an evolutionary system to generate and evolve designs that incorporate this character. This approach allows design variability to be carefully controlled.

Finally, we highlight the work of Joris Laarman, the Bone chair, developed from Adam Opel GmbH software, and is one of the first applications of topology optimization and generative design to have an impact on the furniture industry (Laarman, 1998).

Throughout the history of design, and in the revised literature, it is recognized that the use of computer systems does not imply the absence or replacement of the Designer, who is undoubtedly the decider in the development, creation, and innovation of any result (Narvaez, 2022).

Generative design has multiple definitions that have varied over time, responding to development processes. The present research considered what was stated by Lazzeroni, Bohnacker, Groß & Laub (2009) who define this technology as a cyclic process based on a simple abstract idea. The idea is applied to an algorithm and then translated into a source code, which in turn, produces a serial output through a computer. The output return through a feedback loop, allowing the designer to reinforce the algorithm and source code. This operation becomes iterative based on the exchange and feedback of information between the designer and computational thinking, allowing the designer to make better design decisions.

Unexpected phenomena such as the arrival of COVID-19 represented a series of tragic and unfortunate events, still, in the case of the implementation of parameterization in the design project, it was a factor of acceleration and cultural acceptance. While the entire material universe of our culture and economy had to face immense unexpected challenges, our computational infrastructure allowed us to advance very quickly in the acceptance of digitalization in the processes of project development. Those factors became relevant in a socio-economic context characterized by technological advances and with a high degree of digitalization. In academic terms, which are the basis of the development of this project, it became a fundamental axis, given that it was during the pandemic, where the project was developed, despite the limitations and with the support of parametric design.

Specifically, the processes of co-creation between the designer and computational thinking were addressed from six prototypes, with particular emphasis on the role of the designers and the value they have in the decision-making process supported by algorithms. This factor became a tool to exploit in academia, in teaching, and the implementation and appropriation of emerging technologies in the classroom. The generative design allows to create product proposals, evaluate and optimize designs quickly, enabling more efficient processes that affect agile decision-making by the designer. It Also provided greater performance throughout the design process, encouraging a change in the role of the designer in the project and his relationship with the technological tools at hand.

Methodology

The methodology used in this research was collaborative, iterative, and incremental, and was developed in three stages. The authors consulted to support the methodology affirm that performance-oriented generative design methods can produce stimulating concepts and solutions based on solid and rigorous models of design conditions and performance criteria (Janssen, Frazer, Tang, 2005). With generative methods, computational thinking becomes a design generator, in addition to its more conventional functions of copywriter, visualizer, data verifier, and performance analyst (Shea, Aish, & Gourtovaia, 2005). The above, considering the changes in the design of the manufacturing process through generative design, and the large percentage of participation in the morphological proposal made by artificial intelligence (Hyunjin, 2020). The research considers the case studies analyzed by Buonamici, Carfagni, Furferi, Volpe, & Governi, (2021) which offer a practical description of the workflow and experiment with a specific software system, Autodesk Fusion 360 ®. The software implements a generative approach to the realization of alternative solutions for a static structural design problem set by the designer. It examines and analyze the structure, finding completely unexpected geometric solutions (Nebot, Peña & López, 2021).

For the development of this project, we wanted that the integration between the designer's intention in the project and the computational algorithmic potentiation was simple, so the

designer did not have to invest additional hours in software training. The software used in the study was Autodesk Fusion®, with the Generative Design module. At the time of execution of this research, the software had functionalities in development or beta state, such as experimental resolution algorithms, and geometrical displacement of limits (Autodesk, 2019). Such tools allowed us to enrich and explore the shape beyond the default possibilities presented by the software. The design process used the results of the CAD proposed models to delimit parameters and restrict objects with greater flexibility.

It was essential that the software had functions to allow the definition of criteria for its constant evaluation of the design processes. The tool has within its interface several visual evaluation possibilities that facilitated the co-creation experience. In the research, continuous evaluation was carried out, at all stages of the processes, generating the validation of alternatives to improve the design processes.

Methodological Model

The methodological model to which the present research is supported is the process evidenced by H. Bohnacker et al., (2009) in the book Generative Gestaltung. Modifications were made in the workflow making the process more dynamic, by adding five steps in the implementation of algorithmic rules. This allows the designer to gain control in the stage of definition and parametric modification. The methodology focuses on production, with a wide margin for academic reflection and naturalization of the design process in the classroom.
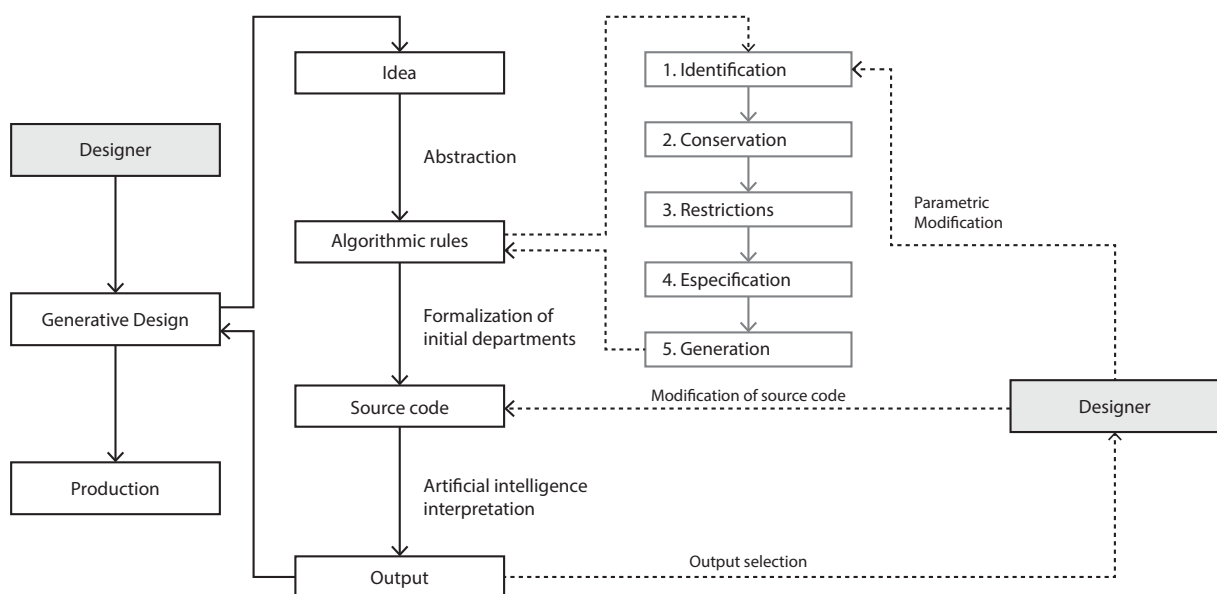
Diagram 1. Generative Design Methodology Based on Generative Gestaltung
(Bohnacker et al. , 2009)

The five steps in the implementation of algorithmic rules were proposed in conjunction with a series of questions to guide each of the steps and encourage the exchange and feedback of information between the designer and computational thinking.

Steps	Guiding questions for designers
1. **Identification:** it consists of recognizing the design problem that requires a parametric intervention.	- What is the goal of the design? - How do the pieces that make up the object interact? - What is the most relevant element to be intervened?
2. **Conservation:** Develop a basic CAD model that allows the software to understand the delimitations by conservation. What must be preserved from the geometries.	- What is the geometry that should be preserved? - How are the new elements generated and the geometry that was preserved related?
3. **Restrictions:** The software is delimited the space for generating constructive elements of the object.	- What are the constructive elements of the object? - What should be respected for these elements?
4. **Specifications:** Specifications, loads, details, manufacturing methods and materials are defined in the system so that the software can operate.	- What are the properties of the object components? - Do you have the technical tools to produce the object after the software calculates the specifications?
5. **Generation:** Execution and commissioning. On-cloud process of servers in hive to multiply the flow of processed data.	From the result the designer chooses the geometry - Should any parametric modifications be made? or would the element be ready for refinement?

Diagram 2. Five Stages in Implementation of Algorithmic Rules

Stages of the research

*First stage / **Sub-restricted Design***: the aim is to redesign an iconic modular object. For this purpose, the Eames Plastic Chairs DSW chair was chosen. At this stage, the constraint is flexible as only one part of the object is chosen to be redesigned. In this case, the most distinctive in the chair is the steel cross reinforcements. The restricted design allows the parametric software to feed the designer's decisions through the mathematical choices of possible alternatives, without a wide degree of freedom.

*Second stage / **Design Without Restriction***: In this stage, initial parameters based on a general morphology are used. Here the software can explore infinite results. Although it must respect elements defined by the designer, the number of calculations and results presented by the software increases in relation to the first stage.

*Third stage / **Restricted Dynamic Design**:* In this last stage, an iterative approach is used to generate similar project proposals in aesthetics and shape from similar initial parameters.

These stages help to evaluate the dialogue of co-creation between the designer and the parametric software to explore variations of a solution and thus, generate greater possibilities of transformation of the designed object. Although these possibilities could be obtained

analogously, it would be a long and inefficient process within the project. The support of this kind of software in the amplification of finite possibilities of algorithmic calculations in a short time enhances the creative development within the project and allows the designer, according to his aesthetic, cultural, and project preferences, to make better decisions for the development of the project.

Results

The results of this research project demonstrate advances in the process of exchange and feedback of information between the designer and a computational entity. The computer software translates the information into a portfolio of alternatives that the designer can analyze and choose, to improve its design project. It is crucial to implement such an approach in academic spaces that integrates product development through CAD, as it prepares designers not only to improve their projects but also to construct a critical approach by not letting the computer software the final decision of a particular design direction.

First stage / Sub-restricted Design

In the first stage of the research, **called sub-restricted design**, a series of viable transformation alternatives were generated and suitable for the manufacture of the steel yarn of the Eames DSW chair. 490 possible forms were obtained from the inputs (Figure 1). For the resolution of this case, predefined materials were used in the system that can be used in additive manufacturing methods, for example, AISi10mg aluminum, AISI 304 stainless steel, and polymers such as PLA (Polylactic acid) or ABS (Acrylonitrile butadiene styrene).
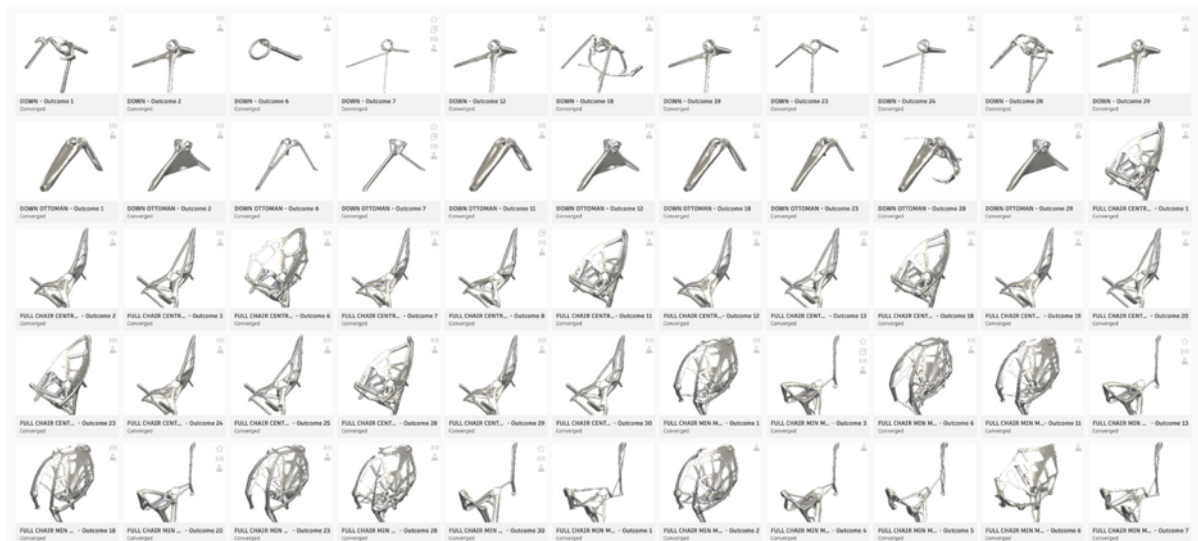
Figure 1. Generative design alternative interface, created with Autodesk Fusion®, Autodesk

For the first part, we generate two possible configurations under a non-restrictive additive manufacturing method, to be constructed with polylactic acid (PLA). This configuration showed potential in the autonomous topological creation with a lower volume structure as a replacement for the steel yarn of the original chair. A 3D visualization of the selected element is projected, together with the entire chair (figure 2).

Figure 2. Digital prototype of replacement of steel yarn for chair Eames DSW (Vitra, 2018)

In a second iteration, another configuration is generated with a stronger topological optimization process (Figure 3). A proposal that fits the parameters is co-created with the software and prototyped using additive manufacturing techniques of stainless steel AISI 304, considering high load capacities, resistance, and solidity.

Figure 3. Prototype replacement of steel yarn for chair Eames DSW (Drexler, 1973)

Although the software presents a significant number of options, it is the responsibility of the designer to make a curatorial process of them (Redshift, 2019). The final selection of the adequate piece for replacement lay exclusively on the designer´s criteria based on all

suggestions presented by the software. In this case, the selection was made considering which piece suits both the structural and aesthetic points of view.

Second stage / Design Without Restriction

In the second stage, called **design without restriction**, two elements of a furniture object with completely different formal characteristics were generated through the methodology set out above. The Acapulco chair (figure 4), which is a common chair created by artisanal techniques, was taken as a morphological starting point. Thanks to its aesthetical language and simplicity in the use of materials, it has been elaborated with many different variations, spreading in the material culture of Latin America. As it has no copyright, official manufacturer, or original design blueprints, is on the market by a large number of producers with a high number of variations.

Figure 3. The Acapulco Chair, 2020

For this exercise, the chair, divided into two formal entities was given to the software to propose alternatives of variation (Figure 3). The results of the generative design process showed a wide formal richness in the proposals for each case, and the derivations were selected considering the feasibility projection in the manufacturing process analyzed by the software. The fulfillment of the initial parameters, especially those of tension, strength, and resistance were suggested by the computer software. The selection based on aesthetic criteria

and cultural appropriation was the role of the designer. The results of the generation processes are closely related to the anatomy, and a large part of the shapes delivered by the software is highly organic (Figure 4 and 5). However, it was observed that some of the proposed solutions that technically achieve the desired requirements, maybe too unusual. Part of the co-creation process between the designer and computational thinking concludes with a classification and selection of the more attractive and feasible alternatives.
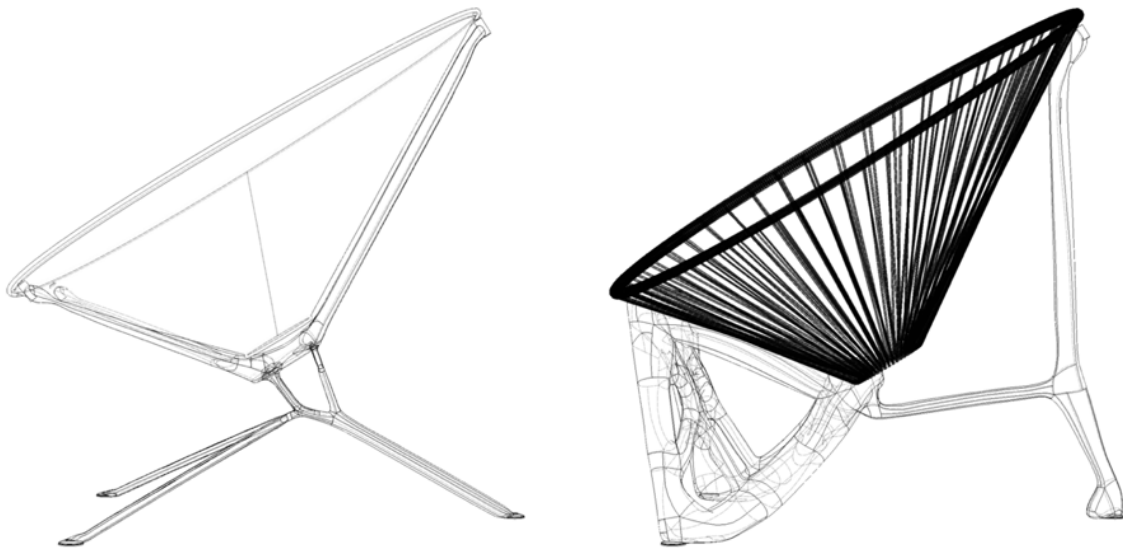
Figure 4 and 5. Traditional furniture re-purposed by the generative design methodology

Figure 6. Traditional furniture re-purposed by the generative design methodology

Third stage / Restricted Dynamic Design

In the third stage of the research called restricted dynamic design, two prototypes of furniture of the Ottoman chair type were generated. This element is born from the initial morphology of the chairs presented, designed as accompanying furniture. Is used to prove the same methodology, producing designs that can be part of the same object family and have

reasonable similarities with those proposed above. The methodological application of the five steps, together with the similarity in the input parameters generated 522 options in total. Following the process of co-creation between the designer and computational thinking, two outputs were selected which fits with a high degree of similarity to the furniture project. The shape of the Ottoman chair is composed by three or four points of support to the ground. They connect to a plane that serves as a footrest or bench of the seat. The Ottoman proposals made in the research have simulated resistance properties, like their peer and can withstand a similar load.
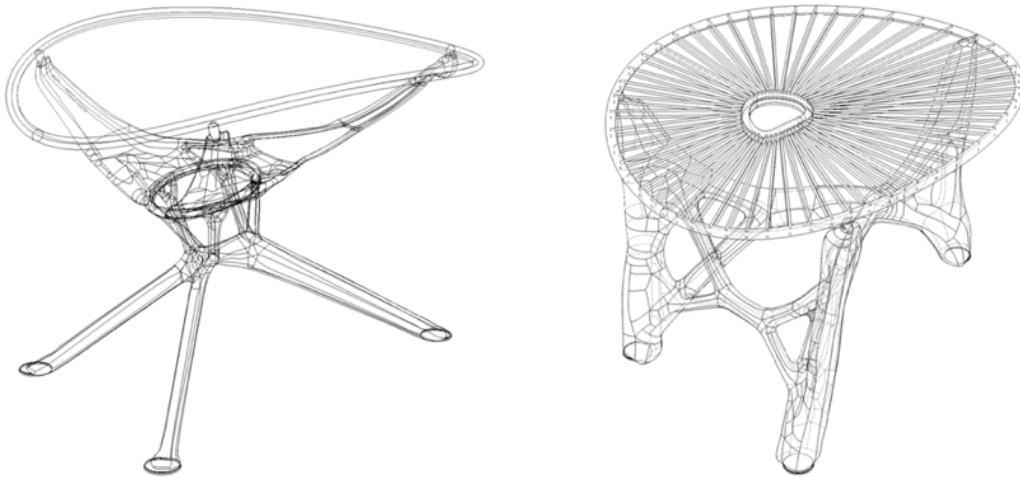
Figure 7 and 8. Ottoman furniture constructed by the generative design methodology

The previous process allowed us to verify the proposed methodology and infer that the software has the possibility of creating complex morphologies from a series of parameters given by the designer. The results obtained share formal, visual, and aesthetical elements of the whole project. The curatorial process to select the results produced by the software is the sole responsibility of the designer.

Figure 9 and 10. Ottoman furniture constructed by the generative design methodology

Figure 11. Rendered collection of furniture alternative 1

Figure 12. Rendered collection of furniture alternative 2

Discussion

In the methodology that is presented in this research, the active role of the designer in the conversation with computational thinking introduces a dynamic way to compose product development. We believe such a methodological approach must be taught in academic environments as it trains the designer not only in the use of state-of-the-art software but also in the decision-making process for the project. The advent of CAD software allowed in the past thirty years the development of new product language based on computational thinking. However, the decision of which shape, material, or finish is the best for the project cannot rely on the software. Instead, the designer should be responsible for the selection process based on suggestions presented by the computer.

It's important to know what these tools can do, as well as understand the limits of what they can't do in these early stages of implementation. The vision for the future of these systems,

and the integration of more forms of artificial intelligence are extraordinarily promising, but there is a risk that expectations will be excessive. It is difficult, even impossible, to create an algorithm that allows a generative design system to consider the aesthetic sensibilities of a designer. This technology faces a truly sophisticated problem when trying to devise beyond the automatically generated shape. Generative design is remarkable at calculating a finite number of variables and generating a virtually infinite number of outputs, or formal proposals. That's more than what a human designer can do; however, it is still too early for this technology to propose autonomously because only humans can understand the complex cultural dimensions that design can contain. There is no doubt that, over time, generative design systems will be able to address increasingly sensible, and more human, conditions and considerations. They will become an essential instrument in the product design and development toolkit but will never replace human sensibility in the development of a project.

Exposing designers in academic environments to these technologies is fundamental to promoting critical thinking. Software capabilities increase faster each year. Still, is important that the designer does not accept all design improvements proposed by the software without critical analysis, further refining of alternatives, and a conscious final decision before manufacturing.

Artificial intelligence will be programmed, and self-programmed, better and better to understand the needs of users, and these in turn will be more skilled in the use of these tools. we hope it can never replace the designer.

Conclusions

The project described in this article shows iteratively the co-creation relationship between a designer and a computational tool of algorithmic thinking. The main focus of this research is on supporting the formative development of designers through the use of these systems. The different experiments carried out show the combined creative capacity between the designer's thinking and algorithmic thinking. It is important to highlight the importance of maintaining both models of thinking and not pretending that one replaces the other. As long as this symbiosis between the designer's capabilities and the mathematical enhancement of the tool is maintained, better projects will emerge in the future. That is why the academic training of the designer must be complemented with this type of tool and not replaced as it tends to be thought with the arrival of technological advances of this nature. The generative design will require new ways of thinking, it will force designers and creators from other areas of knowledge to evolve their development and production models. It is not only about learning new software, or some new functions in existing software; in many cases, the way of approaching a project must be addressed from the genesis. This is an invaluable opportunity for the academy to integrate new ways of approaching the project into its curricular structures, and to train designers with better tools to establish non-linear dialogues with new actors in the design process.

The dialogues that the human being establishes with technology are collaborative, iterative, and evolutionary. They allow the generation of knowledge, to acquire a greater relevance when these collaborations have the potential to change the forms of production, democratize knowledge, and expand the frontiers of human production. Generative design, as a process of co-creation between the human being and computational thinking, has a great projection, while the technological apparatus has maintained a constant evolution as time progresses; the development of artificial intelligence and the progressive evolution of neural networks are

showing strong advances in the industry, promoting and naturalizing the adoption of these technologies in design processes.

Design projects can be formally enriched from topological generation systems using AI. However, one of the most important challenges facing this technology is cultural appropriation. Much of the forms delivered by the system are highly organic, however, incompatible with many of the morphologies that for decades have accumulated in the material culture of the different regions of our planet. Not all design languages can be solved in the same mathematical way, and this is a factor that parametric design does not yet take into consideration.

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Contact email: camiloayala@uniandes.edu.co
c.ayala954@uniandes.edu.co

A Collaborative Strategy for the Construction and Graphic Representation of a Cultural Ecosystem Involving Participatory Design in the Academic and Business Context

Diego Mergener, Porto University, Portugal
Pedro Cardoso, Aveiro University, Portugal
Bruno Giesteira, Porto University, Portugal

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Abstract

The main theme of this work is games as tools for promoting empathy, inclusion and teamwork in both academic and professional environments. Our objective is to present the entire process of elaboration of the Cultural Ecosystem derived from the realization of workshops that resorted to a participatory design approach that resulted in the identification of the main themes and subjects that constitute the Cultural Ecosystem derived from the concepts of Misha Titiev. In our methodology, tools and techniques employed during each workshop are described, as well as the results after completing the thematic analysis of the information generated with each partner. The doutoral project has a partnership with: 1) Association of Ludotecas do Porto, which contributed to the aggregation of information on the Social Dimension; 2) the University of Porto's Inclusion Support Nucleus, which contributed information regarding the Physical dimension; and 3) the company Mind Revolution, which has articulations with the University of Porto and contributed to the understanding of the Noological dimension of the Cultural Triangle. We end with a graphic representation of the synthesis of the results, presenting all the themes and their relationships with each dimension, we call Cultural Ecosystem. As for future work, we intend to identify the similar themes generated in each thematic analysis in order to identify the most recurrent problems and use them as a project requirement.

Keywords: Games, Inclusion, Cultural Triangle, Diversity, Participatory Design

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1 - Introduction

People of foreign nationalities end up facing challenges related to social inclusion when they arrive in a new country where they chose to continue their studies or start a new professional journey.

Among the challenges, in our society, insensitivity to the existence of other socioeconomic groups still prevails, what Cortesão (2012) calls 'cultural color blindness', the inability to see the other colors of the 'cultural rainbow'. This cultural rainbow concerns the inclusion of culturally different people, and according to Bleumers et al. (2012) explain that the concept of social inclusion has gradually replaced the concept of social exclusion. In short, social inclusion refers to a state of reintegration and participation in response to mechanisms of social exclusion, as social inclusion attempts to identify processes that cause deprivation and exclusion (Bleumers et al., 2012).

In order to understand the issues that are linked to social inclusion and cultural diversity, we developed a participatory methodological strategy that aims to obtain feedback and insights from partners through workshops and thus, subsequently, obtain a visual representation of the concepts that, in the opinion of the participants, make more make sense to integrate what Titiev calls the Cultural Triangle.

As partners we have the NAI is the Support Center for Inclusion (NAI) of the University of Porto, which has a vast repertoire of R&D projects related to accessibility and inclusion in the context of the university. ANILUPA is the Associação de Ludotecas do Porto (ALP) and this institution contributed to the aggregation of information on Social Dimension and validation of games and gamified activities in disadvantaged social contexts. And Mind Revolution, a company in conjunction with the University of Porto, in the training context for teachers and researchers, can benefit from its experience in business contexts.

Section 2 presents a general understanding of culture and the definition of the dimensions used as a basis according to Titiev (1992). Section 3 describes the methodological steps and tools used as strategies to jointly define the Cultural Triangle with the project partners. In section 4 we have the results obtained during the workshops and ending this article with the conclusions obtained after the test and the elaboration of the graphic representation of the Cultural Ecosystem.

2 - About culture

It seems strange to say that culture does not exist, but Hofstede (2002) states exactly that: culture does not exist. He explains that everything turns out to be elements to explain and predict human behavior, in this case, Lacerda (2011) states that culture only makes sense if there is the collective.

Souza (2008) says that to explain the concept of culture, the metaphor of the iceberg is usually used, because everything we see related to culture is nothing more than a visible surface, making it difficult to imagine and conceive what is below the water level. Trompenaars and Turner (1997) say that culture is like gravity, you don't fully experience it until you jump two meters into the air. They argue that our culture is like water to a fish, we only discover its need when we are no longer in it. In this metaphorical reasoning they say

that culture comes in layers like an onion, and to understand it we have to peel each layer until we reach its center.

Hofstede (1983) states that when we are in a country that is culturally different from ours, it is common for people to not to try to understand what both have in common but what we is different. In this case, Trompenaars and Turner (1997) explain that the first contact of an individual with a new culture corresponds to more concrete elements, consisting of the outer layer of the culture at a more explicit level. This level is about the observable reality of language, food, buildings, fashion and art. As one deepens his/her knowledge of the new culture, s/he moves onto what Trompenaars and Turner (1997) call the middle layer, where the norms and values of a culture are found, i.e. what society considers as right and wrong as well as what it considers good or bad. At the heart of these layers is what Trompenaars and Turner (1997) call the core, where the assumptions about the existence of culture and everything that composes it are found.

2.1 - The dimensions of the Cultural Triangle

Hofstede (1983) promoted research to develop a terminology to describe cultures. In his research, developed while working in a multinational company, he collected more than 116.000 questionnaires made with the employees of the company he worked for. As a result, Hofstede described what he called the four dimensions of national cultures, namely: (1) Individualism/Collectivism; (2) Power Distance; (3) Resistance to Uncertainty and (4) Male/Female. Hofstede (2002) states that the aim of his study of organizational culture was to identify values that differentiate organizations within the same country rather than similar organizations across nations.

Although Titiev (1992) has used a triangle as a way of visually representing culture, he explains that this representation, called the Biocultural Triangle, can have all the same sides in a phase and have different sides in certain circumstances, as not every form of life of a society is framed within a triangle, that is, various geometric shapes can be used as a visual representation. The (Figure 1) shows the graphic representation of Titiev's Biocultural Triangle (1992).
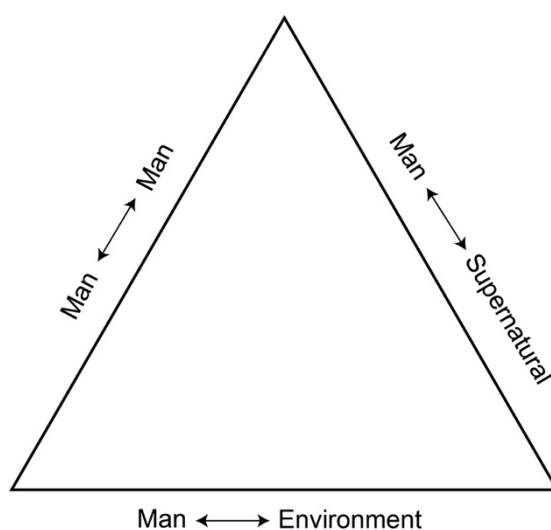
Figure 1: Biocultural Triangle adapted from Titiev (1992)

To better understand what are these three cultural relationships proposed in the Biocultural Triangle by Titiev (1992) and their relationship with the doctoral project, other words are used for each side of the triangle that are more related to the idea of the general proposal of the project.

For the man/man relationship, the term Social Dimension is used because this relationship, our interpretation, corresponds precisely to the contact between man and man, his relationship with other people, his affection and feelings.

The Physical Dimension refers to man's relationship with his physical environment, its rules, whether business, leisure or educational, it is the social inclusion of man in the environment. Examples of this relationship are the food we eat, the way we feed ourselves, our dwellings used by primitive man to house food and furniture being the clearest reflection of man's relationship with his environment (Titiev, 1992).

The Noological Dimension is the relationship between man and his spirit, his beliefs and ideologies, his cultural heritage, which corresponds to the supernatural concept used by Titiev (1992).

3 - Materials and methods

3.1 - Methods and tools used in workshops with partners

To accomplish our main objective, we devised a five-phase plan, following a participatory design methodology, as shown in (Figure 2).
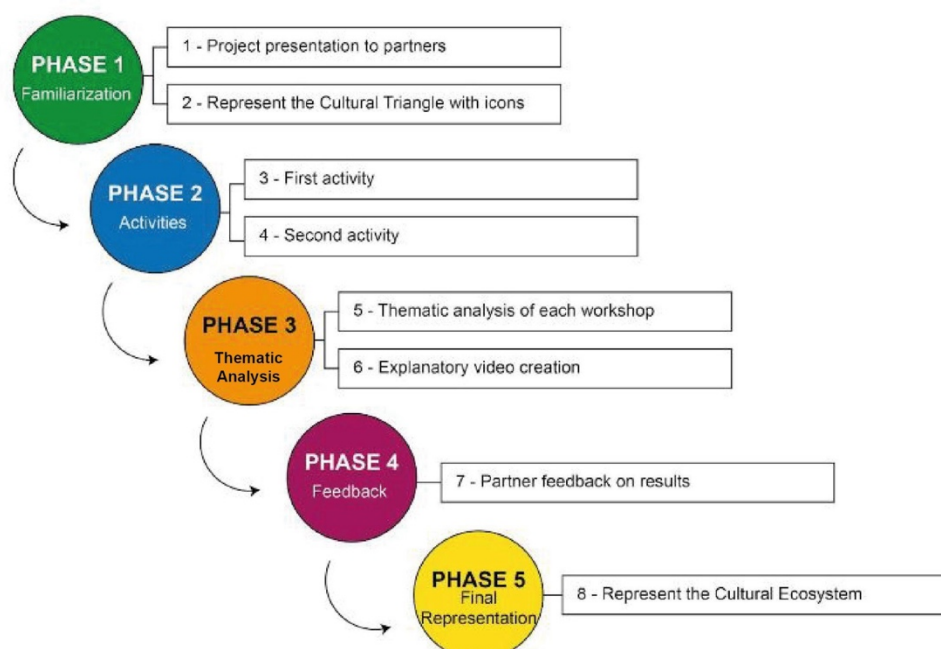
Figure 2: Methodology divided into five phases

In the first phase, familiarization, we present the objectives of the project and the context in which we operate so that partners understand what the work is and how they can contribute. The second phase corresponds to the activities carried out, in which we explain each activity

to the partners and what they should do in each one, being that in the first activity the partners must suggest words to compose the Cultural Triangle and in the second activity they must choose words already suggested. The third phase is focused on the thematic analysis of the results obtained in each of the proposed activities. We analyze the information obtained during the workshops and later share it with the partners. The fourth phase is focused on understanding the feedback from partners in relation to the results obtained in the activities, realizing if the information corresponds to the scenario in which they operate. Finally, phase 5 corresponds to the representation of the cultural triangle of the project that we have concluded, what we call its cultural ecosystem.

3.2 - Description of activities

For the activities proposed in the workshops, the collaborative platform Miro was used, which made it possible to work with participants remotely for security reasons due to COVID-19. As part of the methodological strategy, a short presentation on the context of the project was prepared so that each participant understood why they were at the workshop. This presentation lasted approximately 15 minutes and later, the participants were invited to access Miro.

For participants to better understand the concept of the Cultural Triangle, it was created within the platform using existing icons on the platform itself. The objective was to represent the meaning of each dimension of the Cultural Triangle through an icon that had the closest visual to the concept of the dimension. Thus, it would facilitate the understanding of the Cultural Triangle for the participants after the short presentation. The (Figure 3) displays this graphic representation of the project's Cultural Triangle using the icons.
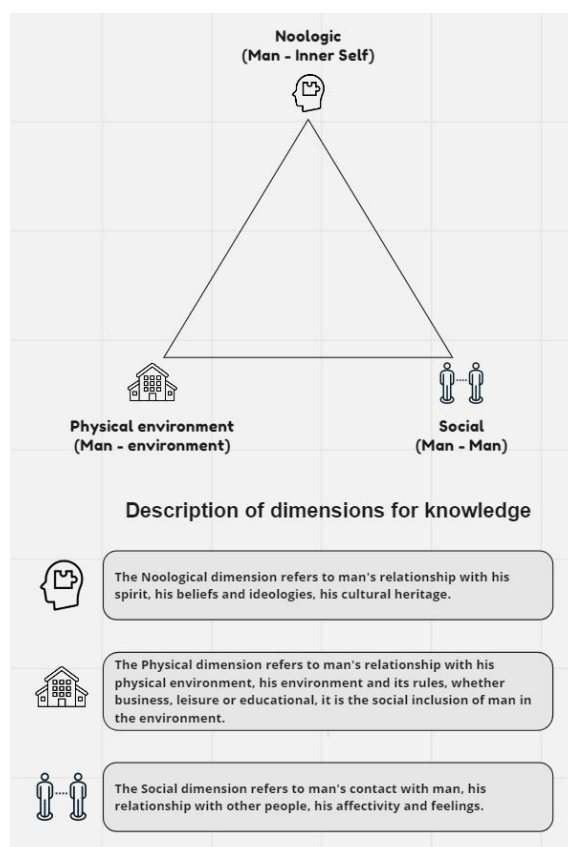
Figure 3: Cultural Triangle and its graphic representation

With the permission of the participants, the workshops were recorded to later serve as support for analyzing the results. The first proposed activity aimed to collect suggestions for new words (concepts) that made sense to the participants to compose the Cultural Triangle. For this, post-its were used and through the Insights sorting method by Kumar (2013), the participants should propose words that were associated with the activities and the scenario in which they worked professionally. According to Kumar, the Insights sorting method provides the identification of relationships between the generated insights, grouping them to discover patterns. Along with it, the Observations to insights method, also by Kumar (2013) was employed.

After suggesting words, participants were encouraged to choose at least three posts and place them at one end of the Cultural Triangle. Participants had 30 minutes to conclude the first activity. When time was up, they had to justify why they had suggested the words in the post-its and why they positioned them in a certain place in the Cultural Triangle.

The second activity aimed to understand which words previously suggested by the researcher of this work would be chosen to compose the Cultural Triangle. These words corresponded to the themes that were identified at the beginning of the doctoral project from the literature review carried out initially. For this activity, the card classification technique by Hanington and Martin (2012) was used, as it comprises exploring how participants relate words to each other. Participants had 20 minutes to complete this second activity. They were asked to justify why they chose a certain word and why they positioned it in a certain place in the Cultural Triangle.

The two activities are similar in terms of objectives, however, in the first, participants should suggest new words, as in the second, the words were previously written in the post-its. In order not to have any kind of influence on the participants related to word suggestion, we put as the first activity the participants should suggest new words, in this way any kind of influence by a word previously presented in the posts would be avoided.

After the completion of the two activities, a thematic analysis of the information placed in the triangles was carried out in order to identify and understand why each word was placed in certain places in the Cultural triangle. Then, with the words identified after the thematic analysis, an explanatory video was prepared and sent to the partners in order to justify the reason for the positioning of each word in the Cultural Triangle so that they could give feedback on what was created from your suggestions during the activities. With these concepts and themes, a representation of what would be the cultural triangle of the project was generated, taking into account the partners' suggestions.

4 – Results

4.1 - Workshop with NAI partner

In total, three workshops were held, one for each project partner. The (Figure 4) presents the final result of the first activity carried out with NAI.
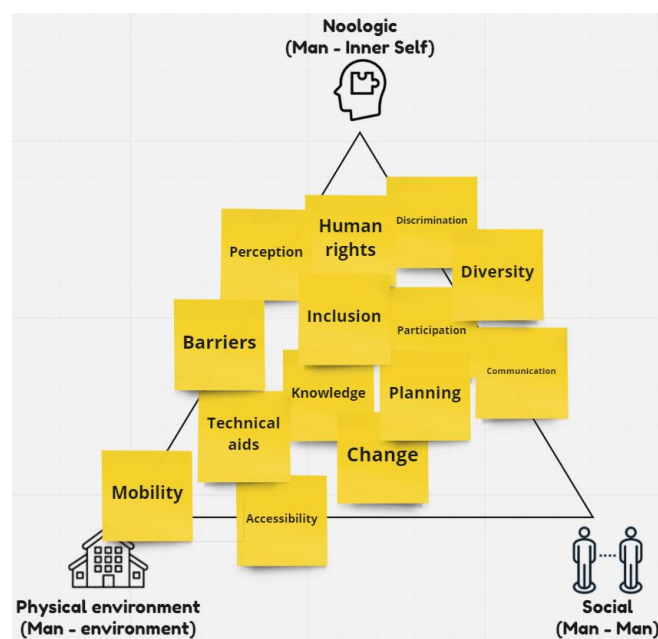
Figure 4: Final result of the first activity with NAI

Observing the representation of the triangle with the words chosen by NAI, we notice that there is a cluster of words positioned between the central part and the axis involving Physical Dimension and Noological Dimension. One may suppose that this outcome may be the result of the participant being used to work on a daily basis with accessibility in physical environments.

We can also observe that the words discrimination, diversity and human rights were positioned very close to Noological Dimension. According to the participant's explanation, discrimination can be experienced in several ways and is related with people's way of thinking, of seeing the world. Planning was placed at the center, along with inclusion, because for the participant, planning refers to something more operational that has influence from the three dimensions of the Cultural Triangle.

The (Figure 5) displays the Cultural Triangle with the words corresponding to the second activity, in which the participant should choose and place at least three words that make the best sense.
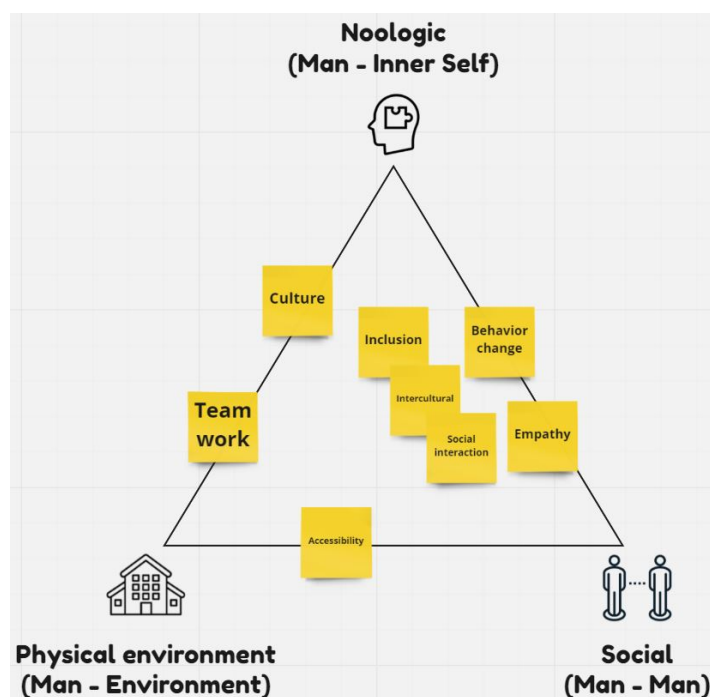
Figure 5: Cultural Triangle of the second activity with NAI

As in the first activity, the participant placed the word inclusion in the center of the triangle for the same previously reported reason. According to their explanation, social inclusion is related to Noological Dimension and Social Dimension, and although it can be influenced by Physical Dimension, it is essentially Social. The word empathy was placed closer to Social Dimension while the word behavior change is closer to Noological Dimension. As the participant explained, the change in behavior has more to do with inner enlightenment. When analyzing the positioning of the words in the triangle proposed by the participant, it is clear that there is now a cluster of words between the Social Dimension and Noological Dimension axis, as it is interpreted that many words according to the participant's understanding have more relationship between the two dimensions than with Physical Dimension.

After completing these two activities, a thematic analysis of the participant's discourse was carried out. Related to the first activity, five themes were found, namely: understanding, inclusion, obstacles, autonomy, and behavior change. In the second activity, four themes were found: existence of being, individualism, dissimilarity, and acceptance. With the themes identified, a new Cultural Triangle was generated, now with the themes found during the thematic analysis and participant feedback, as can be seen in (Figure 6).
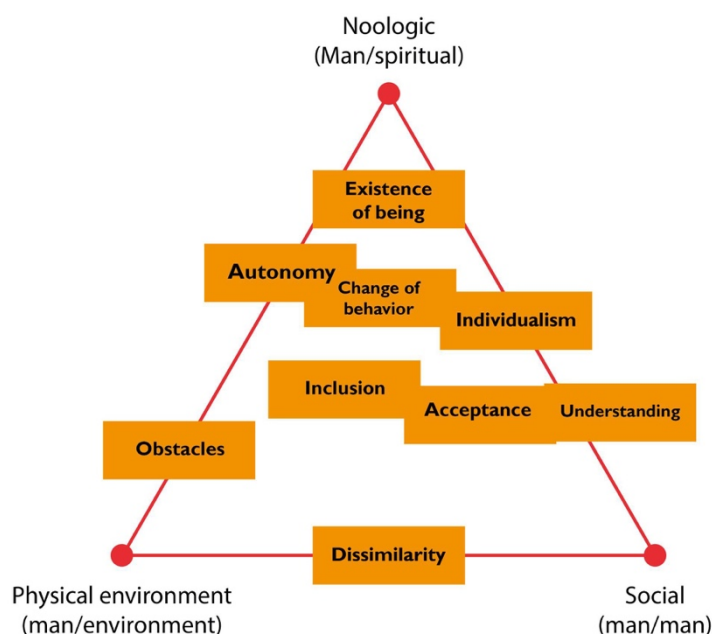
Figure 6: NAI Cultural Triangle after thematic analysis

The word obstacles was placed very close to Physical Dimension because it is understood that many problems mentioned by the participant are problems related to the physical environment. Autonomy was positioned close to Noological Dimension because it is understood that it is something connected to the human being and the person feels capable of doing anything without help. The word inclusion, as the participant had suggested during the activities, was placed in the center of the triangle because it has influence in all dimensions. Behavior change was positioned close to Noological Dimension on the axis with Social Dimension because it is concluded that if there is a change in the social scenario, there must first be a change in people's way of thinking. The word understanding was placed on the same axis as behavior change, however, closer to Social Dimension because it is perceived that it must occur not only in one person, but in several people.

Dissimilarity was placed at the center of the axis between Physical Dimension and Social Dimension because it is understood that there is both physical and social dissimilarity in society. The word acceptance is close to Social Dimension due to the logic that a person must be accepted by the group and not just by one person. Individualism, on the other hand, was placed at the center of the axis between Noological Dimension and Social Dimension because it is an obstacle that must first be fought internally so that collectivism can exist in the future. The existence of the being was placed close to Noological Dimension because it is a feeling of the person feeling present within a group, evoking the idea that I exist within a society.

4.2 - ANILUPA partner workshop

The second workshop was carried out with ANILUPA, featuring two participants. The (Figure 7) presents the final result of the first activity.
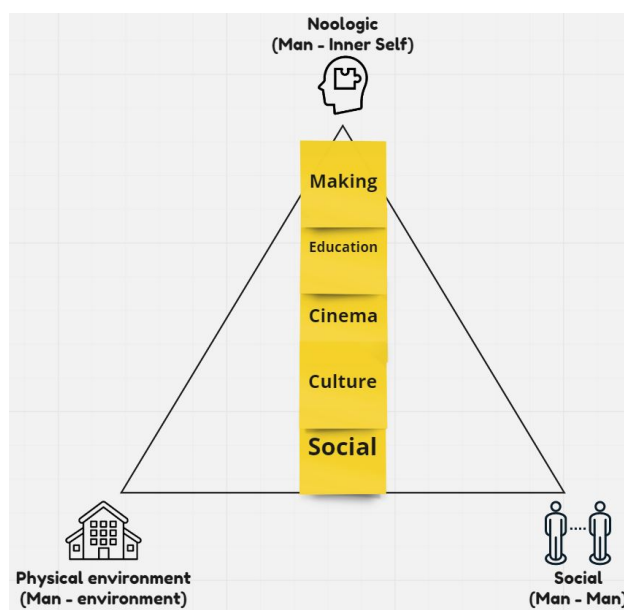
Figure 7: Cultural Triangle generated in the first activity with ANILUPA

Among the words proposed by the participants, the word cinema was placed at the center of the Cultural Triangle, because according to their explanation, cinema is the center of ANULUPA's activities and has a strong connection with all dimensions of the Cultural Triangle. The word creation was positioned very close to Noological Dimension because, according to the participants, creation has a strong connection with the diversity of content that can be produced, showing a strong connection with the person's inner self. The word social was placed just below the word culture, where in the triangle it represents the basis of all other words, where everything is interconnected and the social being the basis of everything. Note that the participants grouped the words in the center, placing them one on top of the other like a pillar. According to the participants, the social word ends up supporting all the others according to their context of action. After completing the first activity, as in the workshop held with NAI, the participants were invited to complete the second activity, as shown in (Figure 8).
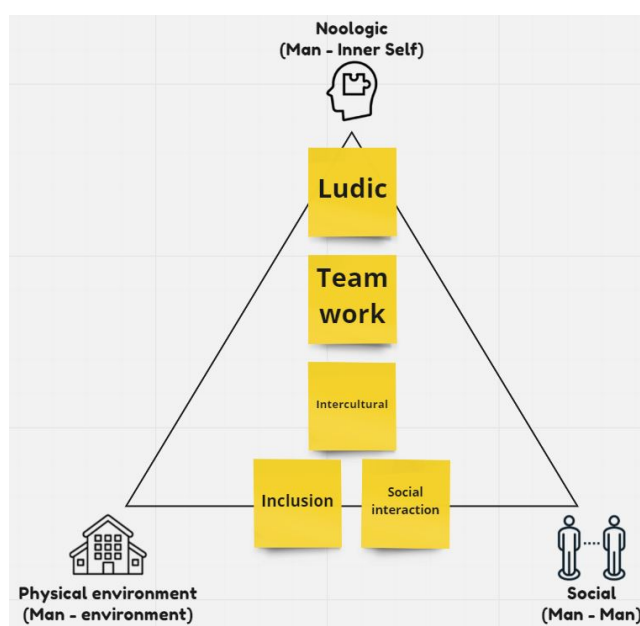
Figure 8: Cultural Triangle generated in the second activity with ANILUPA

In this new representation, the word teamwork was placed by the participants at the center of the triangle for the reason that it has a connection with all three dimensions and that the work that the participants carry out is exclusively in a team. The word inclusion was placed close to the axis between Physical Dimension and Social Dimension as it represents the appreciation of any public, fostering the relationship between people and including everyone in the same social group. Composing the base, the word social interaction was placed next to the word inclusion because it has a strong relationship between the two, because according to the participants' reports, social interaction in their work context has the sense of the person developing their projects and sharing them with others, sharing experiences and developing new cultural identities.

After completing the thematic analysis of the results of the two activities completed by the NAI partner, of the participant's speech related to the justifications of the first activity, 7 themes were found: Opportunity to learn; Different social contexts; Exhibition of ideas; Obstacles, Community; Ability, and Valorization of the human being. In the second activity, 7 themes were found, namely: Collective work; Idealization; Adversities; Flexibility; Satisfaction; Conviviality and Sharing. With the themes identified, a new Cultural Triangle, now featuring these themes can be seen in (Figure 9).
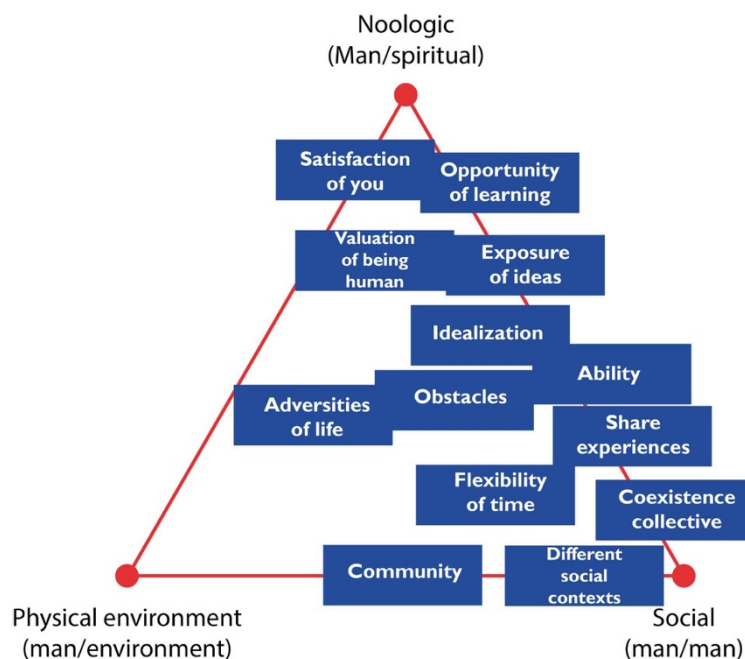
Figure 9: NAI Cultural Triangle after thematic analysis

The word opportunity to learn was placed very close to Noological Dimension along the axis with Social Dimension because seen from the author's point of view that it is a person's personal satisfaction in being able to acquire new knowledge. The word valorization of the human being was placed in the center next to Noological Dimension, as it is perceived from the author's that it has a connection with the way of being of the human being by people, where it has influence in all three dimensions. The word exposition of ideas was positioned on the axis between Noological Dimension and Social Dimension being closer to Social Dimension because from the author's, it is understood that exposing your ideas is also exposing your opinion within a society. The word skill was placed at the center of the Noological Dimension and Social Dimension axis because it is a human capacity that can be transmitted from one person to another. The word obstacles was placed more at the center of

the triangle to understand that there are not only physical obstacles but also social and psychological ones.

Next to Social Dimension the word different social contexts was placed as it is understood that this dimension has a greater influence, as it is not physical environments but social environments in which the physical environment is included. The word community was positioned in the center between the Physical Dimension and the Social Dimension as it is understood that this word represents society as a whole as well as the place where they live. Very close to Noological Dimension the word personal satisfaction was placed, understanding that it is an internal feeling for overcoming a challenge. The word idealization was placed almost at the center of the triangle, realizing that it is a thought or opinion of a person that is presented to others in a society. The word life adversities is next to obstacles because it represents the challenges that a person can face in all three dimensions.

Next to Social Dimension the word Share experiences was placed, as it is an action to be performed with other people. Also close to Social Dimension the word Flexibility of time was placed, as it is understood that it has an influence on people's lives in the relationship between one person and another. Finally, the word collective coexistence was positioned close to the Social Dimension, as the authors of this work understand that it is in the relationship between one person and another that human bonds develop.

4.3 - Mind Revolution partner workshop

The third workshop was done with Mind Revolution and had one participant. The (Figure 10) shows the final result of the first activity.
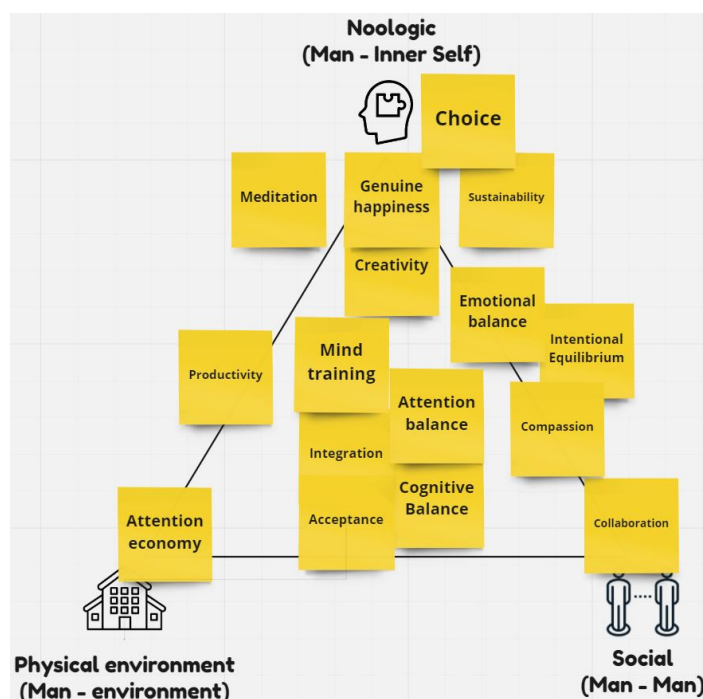
Figure 10: Cultural Triangle after finishing the first activity with Mind Revolution

According to the positioning of the words, it is noted that although there are some words close to Physical Dimension, the vast majority are in a cluster between the center of the triangle and Noological Dimension. As the partner works daily with activities involving a

good performance of the mind, it is understandable the existence and suggestions of words that are linked to Noological Dimension.

Cognitive balance was placed close to the balance of attention because, according to the participant, it is based on the way people understand the functioning of their minds and also on all the things that we perceive and our mind projects externally. Among the proposed words, the word emotional balance was positioned at the center of the axis between Noological Dimension and Social Dimension with the justification that our emotions, although experienced individually, are constantly influencing the relationships we have with other people. In this case, it is clear that the balance of emotions is important in the social relationship between people and that it has a strong influence on Noological Dimension. Another word that caught our attention was the word creativity, which was positioned next to Noological Dimension because it is a more individual expression of how a person expresses himself, how he sees himself and how he manifests it in the world. After completing the first activity, the participant was invited to build the Cultural Triangle referring to the second activity, as shown in (Figure 11).
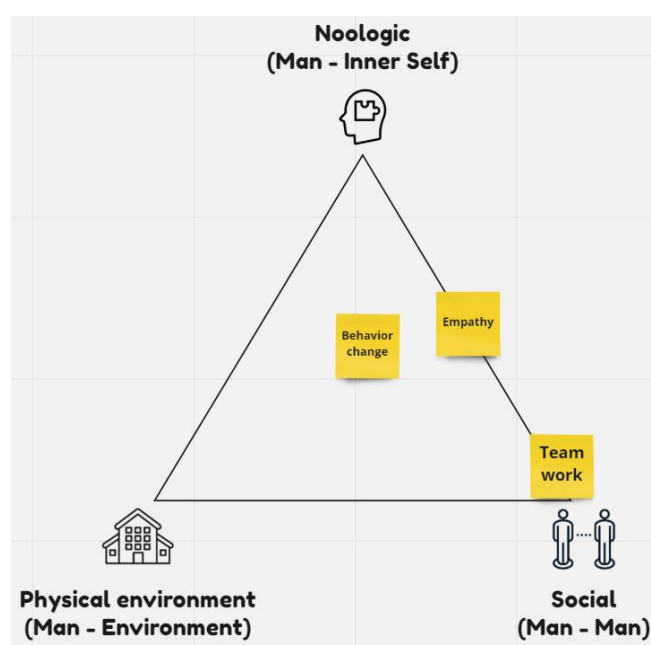
Figure 11: Cultural Triangle after finishing the second activity with Mind Revolution

Among the words chosen to compose the Cultural Triangle, the participant placed behavior change at the center of the triangle, stating that all the work he develops is more focused on an internal change of the person that can change relationships with other people. The word empathy was placed at the center of the axis between Noological Dimension and Social Dimension because according to the participant, empathy is one of the three elements of compassion and is basically what allows us to resonate. Finally, the word teamwork was positioned very close to Social Dimension with the justification that to build more humane, healthier, more compassionate and more altruistic relationships, they will directly influence teamwork, in the professional environment and in other areas. more personal in which people are involved.

After completing the thematic analysis of the results of the two proposed activities a total of 4 themes were found: Being assertive; Stability of mind; Interiority and interpersonal relationship. From the participant's speech referring to the second activity, 3 themes were

identified: Ideological change; Knowing Yourself and Human Connection. The new Cultural Triangle featuring the themes during the thematic analysis and subsequent feedback from the participant can be seen in (Figure 12).
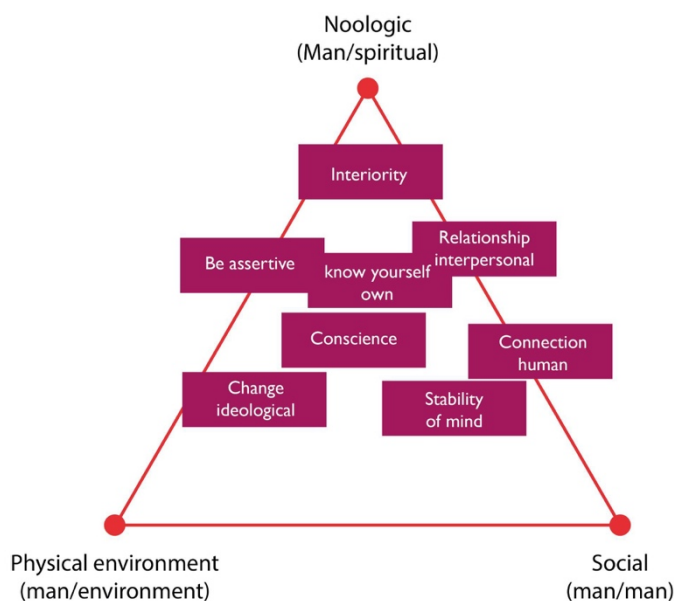
Figure 12: Mind Revolution Cultural Triangle after thematic analysis

The word interiority was positioned very close to Noological Dimension because it is an internal knowledge that is totally psychological. The word interpersonal relationship was placed on the axis between Noological Dimension and Social Dimension because it is understood that it is based on the relationship that a person has with another and is influenced by both dimensions, mainly Noological Dimension due to the way to consider. The word being assertive, on the other hand, was positioned very close to Noological Dimension because it is understood that properly choosing our attitudes in the face of challenges is a process that involves the person's way of thinking.

The word stability of mind was placed in the center of the triangle as it has influence from the three dimensions, and which is the foundation of all other words. The word ideological change was also positioned at the center of the triangle, as it is understood that a different way of thinking can influence the formation of a more balanced mind in all aspects. The word know oneself was placed closer to Noological Dimension due to the fact that internal knowledge is a process that everyone must do in order to later understand other people. Finally, the word human connection was positioned on the axis between Noological Dimension and Social Dimension because it is understood that this process has a social basis and group living, but also depends on people's way of thinking and their relationship with others. society and how connected people are.

4.4 - Final result of the thematic analysis of the workshops

With the final analysis of the discourse of the participants of the three workshops, a graphic representation was elaborated that could simplify which subjects are connected and involved with the doctoral project. For the associations of these connections, the following criteria were used: logic of the meaning of the word, influence of the word on the cultural dimension and proximity of the word to the dimension. With these criteria, we were able to position

each word in the Cultural Triangle according to our interpretation, giving rise to what we call the Cultural Ecosystem. At the end, all the words were joined in a single representation, thus forming the Cultural Ecosystem of the project (Figure 13).
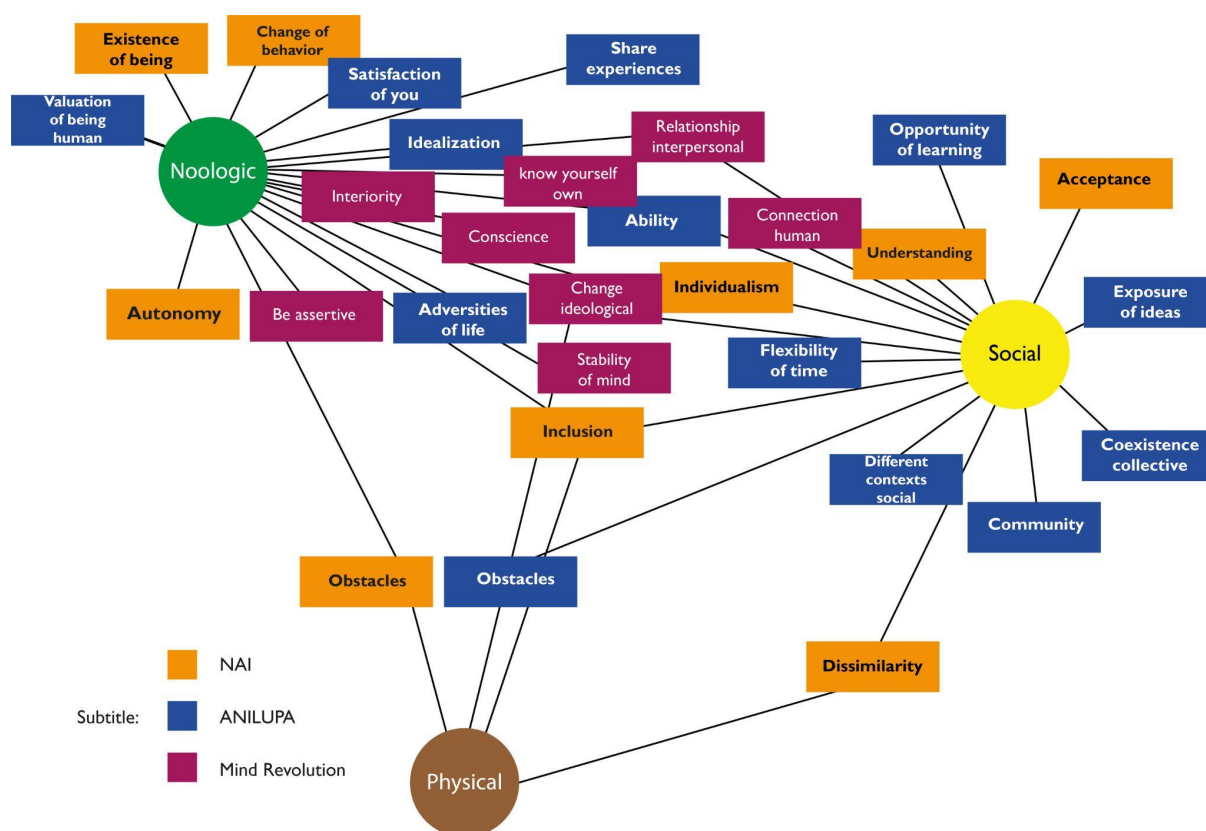
Figure 13: Cultural Ecosystem of the project

In this Ecosystem, we can observe the connections that each word has with each dimension of the triangle, some showing a connection with all dimensions. We also observed that there are larger clusters of words closer to some dimensions than to others, as we can see the lack of words closer to the Physical Dimension. With this graphic representation, we believe it is easier to, in addition to better understanding the words that involve the doctoral project, also facilitate other people to understand which areas are present in the project, such as psychology, well-being and self-knowledge.

5 - Conclusions and future work

The objectives of activity were achieved, obtaining the point of view of each partner in response to the questions of the activities. With each partner's feedback, it was possible to perceive themes and possible paths to be used as project requirements in the development of games or gamified activities, in addition to realizing that there were many other issues linked to the themes identified.

With the final representation of the Cultural Ecosystem, it was noted that there are many themes/words/codes clustered between the Noological Dimension and Social Dimension axis, however, there are few close to Physical Dimension. This raises the question of why there are not so many themes/words/codes next to Physical Dimension interconnecting the other dimensions. It is assumed that the answer to this question may help to better understand some

aspects still nebulous related to the project, such as the few games that work specifically with Physical Dimension.

With this representation, the next step is to elaborate an affinity diagram with the objective of grouping the existing words in the Cultural Ecosystem and then trying to extract possible project requirements that help in the elaboration of games and gamified activities — the next phase of the doctoral project. According to Hanington and Martin (2012) says that affinity diagramming is a process that assists in the organization of information in which data is grouped based on their affinity, forming themes found in the research. The authors complement by stating that affinity diagramming helps to capture perceptions, observations or requirements for the project. For this process, the variation called by Hanington and Martin (2012) of affinity diagramming was used for contextual investigation. The authors complement stating that this variation of affinity diagramming aims to promote a process of interpretation of information considering the meaning of each one.

Themes that share the same similar intent or have some affinity were grouped together resulting in four columns. The affinity diagram works with the logic that instead of grouping themes into predefined categories, a reverse path is made from bottom to top, first grouping specific themes that will give rise to general and more comprehensive themes (Hanington and Martin, 2012). As a nother future work, we intend to clarify these gaps and proceed with the understanding of the themes/words/codes identified and their importance in the following phases of the doctoral project, such as the generation of possible alternatives for games and recreational activities that can work with more emphasis the Physical Dimension.

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Contact email: diego.phoenix@hotmail.com

Digital Media and Sustainable Development Goals Breathe New Life Into the Artworks From the Soares Dos Reis National Museum

Rodrigo Carvalho, Universidade Lusófona do Porto,
ID+ / Unexpected Media Lab, Portugal
Cláudia Lima, Universidade Lusófona do Porto,
ID+ / Unexpected Media Lab, Portugal
Susana Barreto, Universidade do Porto,
ID+ / Unexpected Media Lab, Portugal
Eliana Penedos-Santiago, Universidade Porto,
ID+ / Unexpected Media Lab, Portugal

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Abstract

This paper describes a pedagogical exercise involving students from two Universities and the Soares dos Reis National Museum, all based in Porto, Portugal. The students - from Design, Multimedia, Video Games, and Visual Art fields - were challenged to recreate and animate, through digital technologies, artworks from the museum's collection. Besides exploring animation techniques, students had another inherent task: each work had to be focused on one, or more, of the 17 United Nations' Sustainable Development Goals. These goals, which cover different but interrelated topics such as clean energy, sustainable cities, climate, or education, were used as themes for each one of the projects. This way, students apart from the creation of digital media works, were also raising awareness for different social and environmental causes. This practice, therefore, has three different, but connected anchor points: shedding light on Portuguese art history and cultural heritage by means of recreating the past; the knowledge and awareness of social and environmental issues; and the exploration of digital animation techniques. In this study, all different stages of the pedagogical practice are covered, as well as analysis and discussion of the student's process and outcomes. The project is also put into context with similar methodologic approaches to recreating artwork from the past as a pedagogical tool. The outputs of the project will be later exhibited in the Museum alongside the original artworks in a long-term exhibition of the collection, mostly paintings from the 19th and 20th centuries.

Keywords: Digital Art, Animation, Pedagogical Practices, Art and Design Education, Recreating the Past

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Introduction: Recreating the past through digital technologies

The project presented in this paper follows up on a previous one, carried out in a similar pedagogical context and led by the same researchers, where the focus was on the artworks of Francis Bacon (Lima et al., 2021, 2022). In this project held in the framework of the exhibition *Graphic Works of Francis Bacon*, at the World of Wine Museum in Vila Nova de Gaia, Portugal (from April to September 2021), students were invited to create reinterpretations of Bacon's graphic artworks with modern digital tools. The students, who shared great enthusiasm for the opportunity of presenting their work in a public exhibition, explored different digital techniques and approaches in the creation of dynamic and animated alternative reinterpretations of Bacon's artwork. Their works were later presented at the exhibition on two display screens in a dedicated space at the end of the exhibition route. This way visitors started by exploring Francis Bacon's graphic work and ended the visit with the students' digital re-interpretations of his work (Lima et al., 2022).

Figure 1: Students' works displayed at the *Graphic Works of Francis Bacon* exhibition
(photo: Rodrigo Carvalho. V.N.Gaia, 2021)

Based on the same principles and methodologies, the current project had as one of the main references the advertisement campaign made by Prado Museum & World Wide Fund for Nature named *+1,5ºC Lo Cambia Todo* (which translates to *+1.5ºC changes everything*)[1]. This campaign, presented in 2019 in Madrid on the occasion of the COP25 - World Climate Summit, intended to create awareness of climate change and specifically on the impacts of an increase in global temperatures. Their goal was to communicate that a rise of just 1.5ºC could have catastrophic consequences on the planet. Their approach consisted in taking four well-known paintings from the museum's collection and recreating alternative versions with the impact of climate change. For example, they used Velásquez's painting *Felipe IV, a Caballo* (1635), and created an alternative version where the landscape is flooded, and Filipe and his horse are struggling to keep afloat. It aimed to stress that the increase of 1.5ºC in the global temperature could lead to the rise of the sea level.

The approach of recreating the past is a widely known practice in Arts and Design education. Recreating with new digital tools unleashes the discovery of new artistic possibilities from the visual work created decades ago (Afanador-Lhach, 2021). "Recreating the past" is the name of a course taught by the artist and educator Zach Lieberman at the School for Poetic

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[1] "+1,5ºC Lo Cambia Todo". Prado Museum & WWF (World Wide Fund for Nature). Accessed 15/07/2022. <https://www.wwf.es/nuestro_trabajo/clima_y_energia/cumbres_del_clima/cop_25_chile_madrid_/locambiatodo/>

Computation[2], at the MIT Media Art & Science program[3], and in workshops in diverse events. In these courses, Lieberman uses this method to teach art students to code. Students are invited to choose and study an artist from the past decades, usually a computer or generative artist, and then recreate their artworks from scratch using modern digital tools. This practice leads students to gain technical knowledge, exercise their observation, and analysis skills, as well as to learn and appreciate computer artists from a half-century ago (Levin, 2021). Lieberman stresses the idea that the "job of every generation of designers is to remake the past" (2015) as it is vital to know our field of work and who came before us. By recreating the past, apart from learning new tools and technical approaches, we also better understand the historical era, the politics, and the social and artistic movements where the artworks were created.

The idea of recreating the art from the past is also present in ReCode, a community-driven project that aims to archive artwork from computer art pioneers by translating early computer artworks into modern programming languages. Many of these artworks were made on now obsolete computers and software, and in many cases, the only record is a low-resolution picture in publications from the 1960s and 1970s. On their website[4], ReCode holds a list of many of these early computer artworks and invites anyone to recode them, giving them this way a new life and helping the preservation of the computer art heritage.

Many artists use the approach of recreating the past as practice. One example is Kajetan Obarski who created alternative animated versions of renaissance masterpieces such as *Judith Beheading Holofernes* by Caravaggio (c. 1599) or *The Nightmare* by Henry Fuseli (1781). We can see how by the use of new digital tools Obarski triggered new artistic possibilities from artwork from the past. This is also present in *Mechanical Masterpieces* by Neil Mendonza (2022), where he created alternative and interactive versions of famous paintings for an art installation at The Children's Museum of Pittsburgh. In this installation, visitors interact through custom-made electronic physical interfaces with iconic masterpieces such as the *Laughing Cavalier* by Frans Hals (1624), *Nighthawks* by Edward Hopper (1942), or *The Son of Man* by Réne Magritte (1964). Each interface is different and made specifically for each painting in a humoristic approach. As an example on *Laughing Cavalier* visitors can move a mechanical arm, which allows them to control a digital hand on the screen, which in turn tickles the Cavalier. This approach creates a close, emotional, and playful relationship with artworks created decades or centuries ago that would not be possible without the exploration of new digital tools.

The current project presented in this paper is informed by these works. It challenges students to create interpretations of Portuguese artworks from past centuries while raising awareness of the necessity of meeting the United Nations' Sustainable Development Goals. The artworks to be interpreted are part of an exhibition to be held in 2022 at the Soares dos Reis National Museum and it is intended to include the results by students in this same exhibition.

Workshop Methodology

These pedagogical practices involved undergraduate students from two universities - Escola Superior Artística do Porto (ESAP), and Universidade Lusófona do Porto (ULP) - and the Soares dos Reis National Museum (MNSR), all based in Porto.

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[2] School for Poetic Computation. Accessed 15/07/2022. <https://sfpc.io/recreatingthepast-spring2020/>
[3] Recreating the past. MIT Media. Accessed 15/07/2022. <https://rtp.media.mit.edu/>
[4] ReCode project. Accessed 15/07/2022. <http://recodeproject.com/>

As aforementioned, the methodology was informed by prior pedagogical practices carried out in the context of the project/exhibition *Graphic Works of Francis Bacon* (Lima et al., 2021, 2022), where we hypothesize that reinterpreting the artworks of artists from earlier generations using modern digital media would stimulate young people's interest and result in a deeper understanding of art (Lima et al., 2022). We also based the workshop methodology on strategies developed within the *Wisdom Transfer*[5] project, which aimed to enhance knowledge transfer between current art and design students and retired artists and designers who graduated from the School of Fine Arts in Porto (Barreto et al., 2021).

At ESAP the practice happened during the curricular semester, as a series of guided exercises as part of the course "Art and Multimedia Communication", which gathers students from the BAs in Communication Design, Fine Art, Visual Arts, and Cinema and Audiovisual. These exercises were carried out between October 2021 to February 2022 with a group of 17 students.

The proposals ranged from video animations, art memes, *tableau vivant* to avatars and were developed having the Museum collection as the backdrop for the exercises. The avatars were based on Portuguese artists represented at MNSR, namely Aurélia de Sousa, Henrique Pousão, Marques de Oliveira and Soares dos Reis. This encouraged a first contact of students with these artists and their artworks. In a second stage, avatar variants integrating the Sustainable Development Goals were produced.

At ULP this practice was carried out in the context of an extracurricular workshop involving students from BAs in Video Games and Multimedia, Communication Design, and Audiovisual and Multimédia Communication. It was composed of four two-hour sessions, that spanned three weeks. The goals of the workshop consisted of:
1) The recreation with digital tools of a painting from the museum collection to give it "life" through digital animation. The artists and paintings were previously selected by the curatorship of the exhibition to be held — it is intended to show in the exhibition the originals of the paintings and their respective animated interpretations.
2) Recreations should have as theme one (or more) of the 17 United Nations Sustainable Development Goals, in order to raise awareness of specific social and environmental issues.

The first session was dedicated to the project overview, an introduction to the museum's history and its collection, the presentation of the 17 United Nations Sustainable Development Goals, the viewing of the outcomes from the previous project *Graphic Works of Francis Bacon* (Lima et al., 2021, 2022), as well as references by other artists using the same approach of recreating the past with digital tools. At the end of the session, students were tasked to analyze and reflect on the selection of artists and paintings from the museum collection as well as on the Sustainable Development Goals that they were interested in working on.

In the second session, students presented their proposals to work on, the paintings that interested them the most, how they could be related to one of the Sustainable Development Goals, and how they were going to animate them in order to communicate the desired message. Each student proposal was discussed within the group, encouraging the sharing of knowledge and fostering more alternative solutions and ideas. Possible digital techniques and approaches were also discussed for each proposal.

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[5] Wisdom Transfer. Accessed 15/07/2022. <https://wisdomtransfer.fba.up.pt/>

The third session was dedicated to the presentation and discussion of the first drafts presented by the students. The concept and structure of the proposed narrative were analyzed, as well as technical issues of the digital animation. And the fourth and final session was dedicated to the presentation of the final animations and group discussion of the outcomes. In a few cases, further improvements were done after this session.

Results

We can observe a wide range of outcomes from the students' works, both in technical approaches as well as in the choice of UN Sustainable Development Goals to be worked on. Along with these goals, students explored sensitive topics within the works of art and have embedded them in the contemporary discourse, such as climate change, pay gap, racism, and cancel culture. Technically students explored different software and artistic languages borrowed from the works of art and responded to a cultural language put forward by the MNSR.

In the case of ESAP, apart from the digital animations, students developed other forms of fusion between art and digital media, namely *tableau vivant*, *memes*, and *avatars*. Figure 2 shows us two explorations of *tableau vivant*, where students recreated paintings' stagings by photographing themselves in the artworks, on the left is the recreation of Henrique Pousão's *Cecilia* (1882), and on the right Roquemont's *Cabeça da Velha* (1836). In Figure 3 we can see, on the left, an example of a *Meme* over the work *Menina a Ler* by Aurelia de Sousa where students overwrite the paintings with text with mundane jokes.

Figure 2: (left) Jorge Duarte's *tableau vivant*, interpretation of *Cecilia* (Pousão, 1882); (right) Cássia Pinto's *tableau vivant*, interpretation of *Cabeça da Velha* (Roquemont, 1836)

Figure 3: (left) Meme, *Menina a ler* (de Sousa, 1890/1950); (right) Sara Tacão's avatar based on Aurélia de Sousa

The *avatar*'s exercise was intended to get the students to explore a specific artist and create their online graphic representation. These graphics representations should visually communicate the artist's persona and characteristics and also address a chosen Sustainable

Development Goal. In Figure 3 (right) the student explored the avatars of Aurélia de Sousa addressing the goal of gender equality. In Figure 4 we can see a series of different avatars from the sculptor Soares dos Reis based on his portrait painted by João Marques de Oliveira (1881). In this case, the student chose to address goal number 3 - Good Health and Well-Being - so each one of the avatars holds a graphic element that symbolizes a specific target related to health. The first one (from the left) targets the improvement of risky patients' life chances; the second one aims to improve the quantity and quality of medical equipment; and the last one is focused on the improvement of access to a career in medicine.

Figure 4: (left) *Retrato de Soares dos Reis* (de Oliveira, 1881);
Jorge Duarte's avatar based on Soares dos Reis.

In Figure 5 we can see some of the outcomes from digital animations focused on goal thirteen "Climate Action". In one of the works the student chose the painting "Aspecto de Pompeia Vesuvio" by Henrique Pousão (1882), and created an alternative version where all the landscape is flooded with water by the rise of sea level, so the Pompeia Vulcano was turned into an island (first row). Also based on a painting by Henrique Pousão, "Girl Resting on a Tree" (1883), another student approached the climate change topic showing the effects of desertification by drying the painting's landscape to the point that the tree dies and breaks (second row). In the third row, we see the painting "Ilha dos Amores" by José Malhoa (1908) where a couple is sitting in nature, but gradually the landscape is being destroyed and the couple ends up surrounded by garbage.

Figure 5: Stills from students' animations.
First row: Sofia Silva, interpretation of *Aspecto de Pompeia Vesuvio* (Pousão, 1882);
Second row: Melissa Cébola, interpretation of *Girl Resting On A Tree* (Pousão, 1883);
Third row: Sara Tacão, interpretation of *Ilha dos Amores* (Malhoa, 1908)

Another Sustainable Development Goal highly addressed by the students was goal number five related to gender equality. In Figure 6 we have a still from a work focused on the pay gap

issue. The student chose two paintings, *Senhora Vestida de preto* by Henrique Pousão (1882) and *Retrato do Dr. Joaquim Madureira* by Artur Loureiro (1920), and each portrait is placed on one of the plates of a scale. Along the animation, we see gold coins being dropped on each one of the plates, at the beginning the division is clearly unfair as we see the man's plate with many more coins than the lady's. As the animation progresses, more coins begin to fall on the women's plate in a way that the pay gap becomes balanced between both.

Figure 6: Still from Joana Pinho's animation, interpretation of *Senhora Vestida de preto* (Pousão, 1882) and *Retrato do Dr. Joaquim Madureira* (Loureiro, 1920)

In Figure 7 we have a work also focusing on gender equality, this time addressing equal career opportunities, where the student chose a self-portrait by Aurelia de Sousa (1900), a painter known for feminist activism. Throughout the animation, we see Aurelia's original clothes being replaced by uniforms from professions normally associated with men, such as chefs or military commanders. The animated mouth in conjunction with a voice-over simulates the painter's speech which is declaiming the text by Paula Graça (1715) where she addresses the gender equality topic in the 18th century: she asks what kind of jobs are given to women since all the kingdom is given to male children.

Figure 7: Stills Gustavo Maldonado's animation. Interpretation of *Auto-retrato de Aurélia de Sousa* (de Sousa, 1900)

The exhibition on the MNSR putting together the students' works alongside the original paintings is yet to be realized. Further documentation of this practice will then emerge from the outcomes of the exhibition and the subsequent analysis and reflection by students, curator, lecturers, and the exhibition visitors to be surveyed for this purpose.

Conclusion

The clash of cultures between digital media and Portuguese old masters was not an easy one. Students at first reacted unsympathetically towards an artistic language that meant little to them. The memes exercise was crucial in defying this divergence. It bridged both languages and created a third meaning that made sense to students and helped them to tackle the coming exercises. "Old" works of art, from a bygone era that was far away from contemporaneity, suddenly through humor and satire, made sense and story, a visual story.

The practice of revisiting artworks from past generations by creating new versions with modern digital tools increased the interest of young students in learning about our art history. This practice led students to establish a very close relationship with the author and artwork, as they immerse themselves in the small details of the pieces and the author's techniques, color palettes, stroke style, and so on. It also gave them a better perception of the historical era in which they were created. At the same time, this process was used as a catalyst for learning new tools and technical approaches.

This bringing together of both distant worlds feeds directly into a field of research embraced by the museum (MNSR) that aims to create a link with local secondary schools too, through their works of art, teach the subject of history to students.

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Influence of Artefact, Activity and Design Value-Based Statements on Solution Outcomes

Mamata N. Rao, National Institute of Design, India
Deepak John Mathew, Indian Institute of Technology, India

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Abstract

A design brief is usually set by the client which includes various types of information such as the needs or requirements, target audience, technology aspects etc. A designer who receives this design brief brings one's own interpretation of what needs to be designed - a product, service, process or as a combination. Need or Design task Statement a key component of a design brief could be articulated as textual statements in several ways for a brief. We see a potential to look into the formulation of a need or design task statement in a brief at various levels of abstraction and see its influence on the generation of design ideas or solution outcomes. We framed three types of need statements based on - 'thing or artefact', 'activity' and 'aspired or desired design value' as part of design briefs that were given to participants who were then asked to generate design ideas. Design briefs with varied need statements were given to participants, in two formats - one group received the three statements in the sequence of artefact, activity and aspired value while the other received in the reverse order beginning with statement on aspired value first. The article would outline the findings of this study to understand the role of varied Design task statements and their influence on an individual thought and visualization process. The work would be relevant and help designers to redefine the briefs for both academic and professional settings.

Keywords: Need Statements and Types, Design Brief, Influence on Thinking

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Design brief, its relevance, variant terms and components

Most design projects begin with the formulation of a *design brief* and many times a brief is initiated by the client who hands it over to a design practitioner. A *design brief* captures information related to the needs & requirements, context, target audience, project objectives, scope/ limitations etc. for something to be conceived in future. The UK Design Council defines *design brief* as – "A Design brief is a clear definition of the fundamental challenge or problem to be addressed through a design-led product or service. It is a structured statement that outlines goals, constraints, budgets and timelines. It communicates project outcomes, identifies potential risks and highlights how these will be mitigated." (p.18). Talking about the domain of advertisement, Rothenberg (1999) regards *briefs* as a plan of action for the agency's creative team while MacRury (2009), refers to *creative briefs* as a document used by the creative team to translate clients' objectives into a creative application. Cross (2005) talking about the take of design briefs in the domain of engineering design regards *briefs* to be a statement of requirements to which a designer responds back with a design proposal. Lawson (2005) regards briefs as important ingredients for kick-starting any design activity referring to the context and domain of architectural design. Paton and Dorst (2011), consider the *brief* to serve as a starting point for initiating projects in the domain of industrial design and state the objective of a design brief is to, "….reframe both the client's and designer's preliminary appreciation of the situation in order to create an actionable view of the project for both parties."(p.575). In various domains such as architecture, engineering and industrial design, advertisement, design briefs are considered as kick-starters for beginning any project.

Phillips (2004), discusses the variant terms used for *design brief* such as *marketing brief*, *project brief*, *job ticket* or *innovation brief*. Hackley (2005), talking about the domain of advertisement proposes two types of briefs – 1. A *client brief* that contains information for undertaking the client's task such as the company, the brand, the product, information on the market segment, timeline, budget available etc 2. A *creative brief* that is written by the account planner of the agency for their creative team based on the client's brief. Design brief is referred to by variant terms based on the domains of practice. The term *mission statement* is used by Ulrich and Eppinger (2016) to refer to a document in the domain of engineering and product design that outlines the objectives, constraints and market opportunities for a future project. Blyth and Worthington (2010) writing about *briefs* in the domain of architecture refer to it as a statement *of need.* Design brief is referred to by variant terms such as *marketing brief*, *project brief*, *job ticket*, *innovation brief*, *client brief*, *creative brief*, *mission statement*, *statement of need* depending upon the domain of professional practice.

Design brief has an important role and relevance for initiating any new design activity across varied domains. It would be valuable and relevant to know the various components of a design brief. A design brief may be constituted of varied components. Silk et al (2014) regard *context* – information on the intent of the project and the target audience; *need statement* – brief and concise instruction on the functional requirement; *goal* – provides information on what needs to be achieved while *constraints* indicate any limitations or criteria for the expected design solution that would be considered worthy to be taken further. They regard *context*, *need statement*, *goal* and *constraints* as four important components to be considered while formulating a design brief.

Types of need statements

For our study we considered a *need statement* as one that captures the design requirement succinctly. Any given design brief can have innumerable and varied formulations of need statements. There are a number of authors who have used the terms 'design brief' and 'need statements' interchangeably (Cross, 2005; Sosa et al, 2018). Based on review of literature two broad orientations of need statements or briefs can be comprehended: 1. *Problem-oriented briefs* – that put forth only the situation or the undesired condition 2. *Solution-oriented briefs* – that express or indicate a target solution (Restrepo & Christiaans, 2003; Sosa et al, 2018).

March (1976), Roozenburg (1993) and Dorst (2010) discuss three different modes in thinking: 1. *Deductive thinking* 2. *Inductive thinking* 3. *Abductive thinking*. Each of these modes are shown to differ from one another in their usage of the three attributes: '*what*' – which is about the *artifact* or object, service, system to be designed; '*how*' – related to the *activity* or working principle, usage scenario or behavior of the design proposal ; and '*results or the design value*' – is what one aspires to bring in as the value of design proposal.

For our study three need statements were created based on the theoretical framework for thinking in design - 1. Artefact based 2. Activity based 3. Design value based

Similar studies undertaken earlier

Fricke (1996) conducted a study where a group of designers were presented with a precisely formulated design brief. While another group was presented with a design brief that had imprecise formulation of a brief. Those presented with precisely formulated briefs attended to it without additional queries, while those who received imprecisely formulated briefs regarded it to be incomplete. Liu et al (2018) studied the influence of open-ended, decision making and constrained statements on the cognitive behaviours of participant designers. This study found that open-ended statements promoted novel ideas and triggered divergent thinking, while constrained and decision making statements promoted convergent thinking and better performance. Zahner et al (2010) showed in their study that design problems with abstract formulations stimulated original solutions but with lower usefulness score. Gonçalves et al (2012) studied the influence of textual stimuli given as part of design brief on the quality of ideas. They found that distant stimuli promoted a higher number of flexible and original ideas from participants compared to near stimuli.

The various research studies carried out earlier have shown that formulation of design brief in terms of being precise, concrete or imprecise, abstract influenced the perception of a given problem and on a designer's cognition. Open-ended, abstract statements in design briefs triggered divergent thinking and novel ideas while constrained problems promoted convergent thinking and better performance with higher score on usefulness. Earlier work did not look at the influence of need statements created based on the theoretical framework for thinking in design - 1. Artefact based 2. Activity based 3. Design value based on the generation of design ideas

Our study

This research study looks at three types of need statements created based on design thinking attributes – *artefact*, *activity* and *design value*. The two statements generated based on

activity and *design value* do not state or hint on the kind of solution making them *problem-oriented need statements*. While the statement based on artefact suggests a solution and belongs to the category of *solution-oriented need statement*. For the study three types of need statements were framed, *two problem-oriented* and *one solution-oriented statement*. Table 1 shows the need statements considered for the study.

Types of Need statements	Need statements considered for the study
Solution-oriented need statements (artefact or object)	Design an *internet radio* keeping the elderly in mind.
Problem-oriented need statements (activity)	Design the *activity of listening to music* keeping the elderly in mind.
Problem-oriented need statements (design value)	Design an *intuitive, pleasurable music experience* keeping the elderly in mind.

Table 1: Artefact, activity and design value-based need statements for the study

Research approach for the study

A total of 29 students (13 females and 16 males) pursuing their Master's degree in design participated in the study. 15 students (6 females and 9 males) of 3rd semester in 2021 and 14 students (7 females and 7 males) of 1st semester in 2022 took part in this study. A total of three variants of the design brief were created with each variant containing only one type of need statement. Each design brief had textual content with - one of the three need statements; context in terms of intended users or target audience, company, instructions for generation and visualization of design ideas. The design brief and the three need statements considered for the study are outlined in Table 2 below.

Design brief	Need statement along with the no. of participants
A company wants to look at interesting product ideas for the elderly group to access internet music. This product may be used by the elderly for various usage scenarios - while they are walking or sitting in the park, when they are at home etc. **"Design an internet radio keeping the elderly in mind**." Generate your design ideas on blank sheets of paper in a time of 30 minutes. Use one page for one idea. At the end of 30 minutes take good photographs of each of your ideas and insert them in the same word document and email the document back to me.	Design an *internet radio* keeping the elderly in mind (artefact).
	Design the *activity of listening to music* keeping the elderly in mind (activity).
	Design an *intuitive, pleasurable music experience* keeping the elderly in mind (design value).

Table 2: Design brief and the three need statements

All the participants who took part in the study were asked to attend to all the three variants of the design brief. The participants were asked to generate ideas with the three statements one after the other in a sequence. The 29 participants were divided into two groups -
Group A: received the statement in the order beginning with - *internet radio*, followed by *activity of listening to music* and *intuitive, pleasurable music experience* in the end.

Group B: received these statements in the reverse order beginning with *intuitive, pleasurable music experience,* followed by *activity of listening to music* and *internet radio* in the end. Participants of both the groups were given a time of 30 minutes to generate design ideas for each design brief variant. The participants of both these groups were asked to generate design ideas with one idea represented on one page. All the design idea outcomes were collected from the participants for analysis. Table 3 shows the two groups and the order of need statements presented to the two groups - *Group A* and *Group B*.

Group A: order of need statements given to participants	Group B: order of need statements given to participants
1. Design an *internet radio* keeping the elderly in mind.	1. Design an *intuitive, pleasurable experience for music* keeping the elderly in mind.
2. Design the activity of *listening to music* keeping the elderly in mind.	2. Design the activity of *listening to music* keeping the elderly in mind.
3. Design an *intuitive, pleasurable experience for music* keeping the elderly in mind.	3. Design an *internet radio* keeping the elderly in mind.

Table 3 : The order of the need statements presented to Group A and Group B

The entire experiment was conducted in online mode only. Each participant was sent an email with the design brief outlined in a word document. The participants were given a time of 30 minutes to complete the task for a given design brief variant. Once the participants had completed the task they were told to take photographs of their design idea outcomes and embed them in the same word document shared by the researcher earlier. The participants were asked to email this word document back to the researcher. This procedure was the same for the three design brief variants shared with the participants sequentially. During the entire session the researcher was available to converse if needed with the participants on an online meeting platform. This online platform also helped the researcher to moderate the time given for each design brief variant.

Analysis and findings of the study

The design idea outcomes collected for the study were analyzed for the following parameters:

1.   *Average number of ideas* or *fluency* for each 'need statement.
2.   *The concreteness* in ideas analyzed at three levels - macro, abstract and concrete.
3.   *Novelty* of design idea outcomes.

The analysis and findings for each of the above parameters is presented below:

1. *Average number of ideas* or *fluency* for each 'need statement: The number of ideas generated by each participant for each given design brief variant containing one need statement was counted groupwise - Group A and Group B. The total number of ideas for each group was categorized based on the three need statements as shown in table 4.

Need statement	Group A (15 participants) no. of ideas	Group B (14 participants) no. of ideas
Design an *internet radio* keeping the elderly in mind.	total 42 ideas (2.8 ideas/ person)	total 22 ideas (1.57 ideas/ person)
Design the activity of *listening to music* keeping the elderly in mind.	total 27 ideas (1.8 ideas/ person)	total 24 ideas (1.71 ideas/ person)
Design an *intuitive, pleasurable experience for music* keeping the elderly in mind.	total 24 ideas (1.6 ideas/ person)	total 33 ideas (2.36 ideas/ person)
Total number of ideas for each group	93 ideas (6.2 ideas/ person)	79 ideas (5.64 ideas/ person)

Table 4: The number of ideas for need statements for Group A and Group B

For Group A the number of ideas/ person ranged from *2.8 ideas/ person* for need statement with the *artefact as internet radio*; *1.8 ideas/person* for need statement with the *activity of listening to music*; and *1.6 ideas/ person* for need statement with *design value as intuitive, pleasurable experience for music*.

For Group B the number of ideas/ person ranged from *1.57 ideas/ person* for need statement with the *artefact as internet radio*; *1.71 ideas/person* for need statement with the *activity of listening to music*; and *2.36 ideas/ person* for need statement with *design value as intuitive, pleasurable experience for music*.

Comparing the results for each statement for the two groups it can be seen that the number of ideas/ person are higher for the need statement that is given first and gradually drop for the need statements given 2nd and 3rd in the sequence. There was a decrease in the number of ideas/ person for both Group A and Group B. It was also observed that there was a minor decrease in the total number of ideas for Group B which had the sequence beginning with a design value based need statement. Group A had a total of 93 ideas for 15 participants with 6.2 ideas/ person while the number of ideas slightly dropped to 79 ideas for 14 participants in Group B with 5.64 ideas/person. *The number of ideas/ person or fluency was higher in the sequence: artefact-activity-design value than for the sequence: design value-activity-artefact.*

2. Concreteness in design ideas: All the design idea outcomes for the two groups were tagged based on three parameters –

a) *macro* when the idea represented does not show the product form, its use but shows one the overall context or the ecosystem.
b) *abstract* when the idea represented communicates product functionality but lacks a clear product form.
c) *concrete* when the idea represented communicates both a clear product functionality and form.

Figure 1a, 1b and 1c show selected design ideas tagged as *macro*, *abstract* and *concrete* respectively for the need statement 'Design and internet radio keeping the elderly in mind'.

| 1a. | 1b. | 1c. |
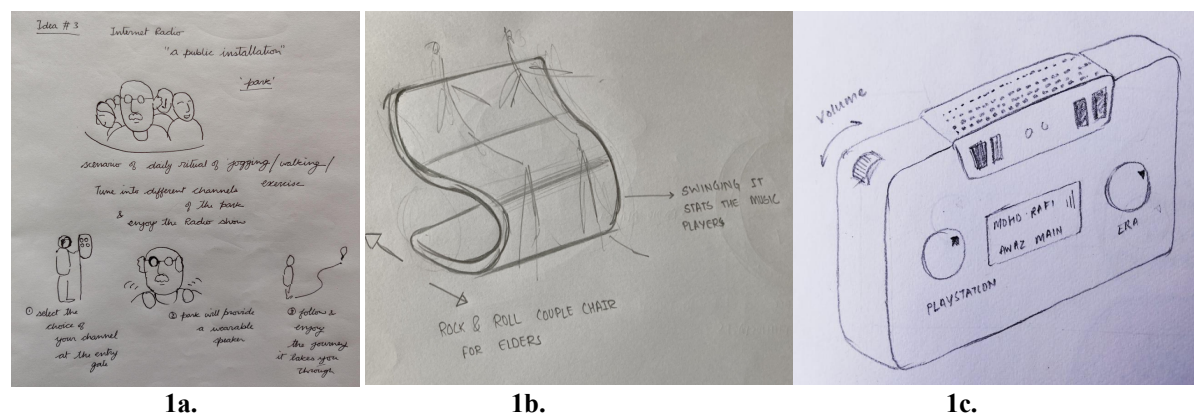
Figure 1a. Idea tagged as *macro*, 1b. *abstract* and 1c. *concrete*

The table 5 below shows the number of ideas for each need statement for the two groups - Group A and Group B that have been tagged or coded as being *concrete*. Only the ideas tagged as *concrete* are considered for discussion in this article, while the ideas tagged as abstract and macro have not been discussed.

Need statement	Group A (15 participants) no. of concrete ideas	Group B (14 participants) no. of concrete ideas
Design an *internet radio* keeping the elderly in mind.	27 ideas (1.80 ideas/ person)	15 ideas (1.07 ideas/ person)
Design the activity of *listening to music* keeping the elderly in mind.	16 ideas (1.06 ideas/ person)	13 ideas (0.93 ideas/ person)
Design an *intuitive, pleasurable experience for music* keeping the elderly in mind.	13 ideas (0.87 ideas/ person)	20 ideas (1.42 ideas/ person)
Total number of ideas tagged as concrete for each group	56 ideas (3.73 ideas/ person)	48 ideas (3.42 ideas/ person)

Table 5: The number of ideas for need statements for Group A and Group B tagged as *concrete*

For Group A the number of ideas/ person tagged as *concrete* ranged from *1.8 ideas/ person* for need statement with the *artefact as internet radio*; *1.06 ideas/person* for need statement with the *activity of listening to music*; and *0.87 ideas/ person* for need statement with *design value as intuitive, pleasurable experience for music*. The decrease in concrete ideas from artefact to design values can be observed to be halved.

For Group B the number of ideas/ person tagged as *concrete* ranged from *1.07 ideas/ person* for need statement with the *artefact as internet radio*; *0.93 ideas/person* for need statement with the *activity of listening to music*; and *1.42 ideas/ person* for need statement with *design value as intuitive, pleasurable experience for music*. There is a minor decrease in the number of concrete ideas.

Comparing the results for each statement for the two groups it can be seen that the number of ideas/ person tagged as concrete are higher for the need statement that is given first and gradually drop for the need statements given 2nd and 3rd in the sequence. There was a decrease in the number of ideas/ person tagged as concrete for both Group A and Group B. Group A had a total of 56 ideas tagged as concrete for 15 participants with 3.73 ideas/ person while the number of ideas tagged as concrete slightly dropped to 48 ideas for 14 participants

in Group B with 3.42 ideas/person. *The number of concrete ideas/ person was slightly higher in the sequence: artefact-activity-design value than for the sequence: design value-activity-artefact, but the difference is not significant. The number of concrete ideas was highest for the need statement presented first and decreased for the next two need statements.*

3. Novelty in design ideas: The design idea outcomes for each of the need statements were evaluated for quality of ideas for the novelty factor by the faculty. Figure 2 shows examples of design ideas tagged as novel by the faculty member for the three need statements - Design an *internet radio* keeping the elderly in mind; Design the *activity of listening to music* keeping the elderly in mind and Design an *intuitive, pleasurable experience for music* keeping the elderly in mind.
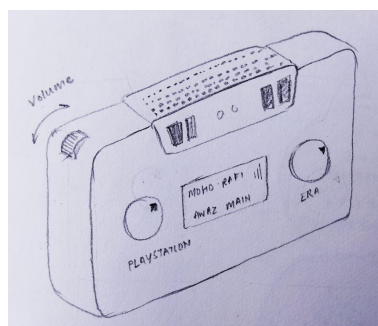
Design an **internet radio** keeping the elderly in mind
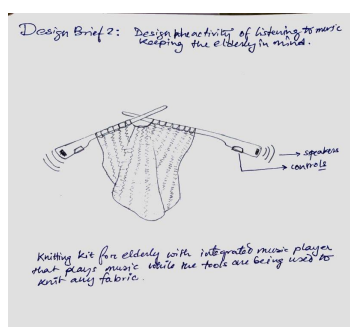
Design the **activity of listening to music** keeping the elderly in mind
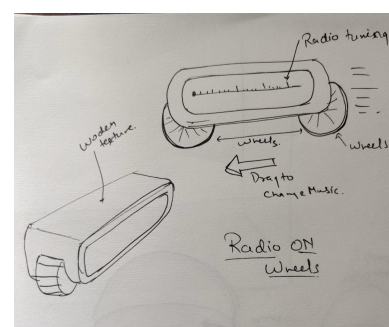
Design an **intuitive, pleasurable experience for music** keeping the elderly in mind

Figure 2. Design Ideas tagged as *novel* for the three need statements

Table 6 below shows the number of ideas that were marked as novel (including those with potential to be novel with better articulation) by the faculty member by evaluating all the design ideas that were generated by the participants. Those ideas that were tagged as novel were then mapped to the two groups under the three need statements. The number of novel ideas were compared to the total number of ideas generated for each category of need statement and for each group of participants.

Need statement	Group A (15 participants) no. of novel ideas	Group B (14 participants) no. of novel ideas
Design an *internet radio* keeping the elderly in mind.	06 out of 42 ideas (14.28% of ideas were novel)	02 out of 22 ideas (9.09% of ideas were novel)
Design the activity of *listening to music* keeping the elderly in mind.	02 out of 27 ideas (7.40% of ideas were novel)	04 ideas out of 24 (16.66% of ideas were novel)
Design an *intuitive, pleasurable experience for music* keeping the elderly in mind.	03 out of 24 ideas (12.50 % of ideas were novel)	02 out of 33 ideas (6.06% of ideas were novel)
Total number of ideas tagged as concrete for each group	11 out of 93 ideas (11.82% of ideas were novel)	08 out of 79 ideas (10.12% of ideas were novel)

Table 6: The number of ideas for need statements for Group A and Group B tagged as *novel* by faculty

In Group A percentage of ideas tagged as *novel* ranged from *14.28%* for need statement with the *artefact as internet radio* (the first need statement given); *7.40%* for need statement with the *activity of listening to music*; and *12.50 %* for need statement with *design value as intuitive, pleasurable experience for music* (the last need statement given). There is not much of a difference and only a minor decrease in the percentage of novel ideas for need statements with *artefact* and *design value.* The percentage of novel ideas was the least for the need statement with *activity* mentioned.

In Group B percentage of ideas tagged as *novel* ranged from *6.06%* for need statement with the *design value as intuitive, pleasurable experience for music* (the first need statement given); *16.66%* for need statement with the *activity of listening to music*; and *9.09 %* for need statement with *artefact as internet radio* (the last need statement given). There is not much of a difference but we see a minor increase in the percentage of novel ideas for need statements with *artefact* and *activity.* The percentage of novel ideas was the least for the need statement with *design value* mentioned.

Comparing the results for each statement for the two groups it can be seen that the *percentage of ideas tagged as novel are higher for the need statement that is given first and decrease for the need statements given later for the sequence*: artefact- activity- design value. For the sequence: *design value- activity -artefact the percentage of ideas tagged as novel gradually increase for need statements given later.* This observation shows that the sequence of need statements given has an influence on the percentage of ideas tagged as novel, but this needs to be established further with a larger sample size.

Conclusions and scope for future research

This study is relevant to both design teachers and students in the context of *setting the briefs* for design projects. It shows the formulation of *varied need statements* based on the deductive, inductive and abductive thinking framework in design. The general finding of the study showed that the sequence of need statements considered : artefact-activity-design value and vice versa influenced the ideational fluency, number of concrete ideas/ person and the *novelty percentage.* The followings are the specific findings:

1. *The number of ideas/ person or fluency was slightly higher for the group with the sequence : artefact-activity-design value based need statements than for the sequence: design value-activity-artefact based need statements.*
2. *The number of concrete ideas/ person was slightly higher in the sequence: artefact-activity-design value than for the sequence: design value-activity-artefact, but the difference is not significant. The number of concrete ideas was highest for the need statement presented first and decreased for the next two need statements.*
3. The *percentage of ideas tagged as novel are higher for the need statement that is given first and decrease for the need statements given later for the sequence*: artefact- activity-design value. For the sequence: *design value- activity -artefact the percentage of ideas tagged as novel gradually increase for need statements given later.*

All the participants for this study were students pursuing a higher degree in the discipline of interaction design. Further study with a larger sample size and participants from diverse disciplines would help establish the findings and shed light on the phenomenon of the influence of varied need statements on solution outcomes with more clarity.

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Contact email: mamatarao@nid.edu

Teaching the SDGs: Content-Based Research and Virtual International Exchange via Multimedia

Michael David Barr, Kyoto University of Foreign Studies, Japan

Abstract

Virtually everyone currently living in the modern world with access to the global media is familiar with the United Nations Sustainable Development Goals (a.k.a. the SDGs). The ubiquity of the symbol, the logo, and the colorful icon is such that these commitments made in 2015 are recognizable around the globe. This is particularly true in Kyoto, Japan, where one can see daily signage on buses or billboards, regular posts in the media, and support expressed on the local as well as national levels of government. Institutions are also on board, as these ideals are both simple to understand and, importantly, easy for students to agree with on principle. The SDGs have been called "the world's largest lesson", and as such, they constitute a tremendous educational opportunity. Throughout the unprecedented academic years of 2020 and 2021, a project was initiated, extended, and continued between cohorts of students at Kyoto University of Foreign Studies and Wenzao Ursuline University of Languages in Kaohsiung, Taiwan. The ongoing aim of these collaborations has been to connect larger issues to local communities. Due to the ubiquity and global reach of the Google Suite for Education - now Google Workspace for Education - groups can work together and interact in a way never before possible. Our research highlights the methodology, best practices, challenges, and advantages of structuring collaborative international projects in a virtual space with hyperlinks, sheets, multimedia, and shared documents embedded within a master sheet shared between up to a hundred participants.

Keywords: SDGs, Virtual Exchange, Project Design

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Introduction

Coming from the vantage point of project and curriculum design, the concept of collaborative online international learning (herein referred to as COIL) is about designing an educational experience around an educational philosophy of collaboration and teamwork. The author has participated in and led the Tandem Learning Research Group at Kyoto University of Foreign Studies, which has more recently become the COIL research group and has conducted more than ten international projects over the past five years. This group has been responsible for over twenty research projects and collaborative projects, from more traditional language exchanges within the English department, to projects involving English as a means of communication to perform other research-based tasks. As we move towards more Lingua Franca interactions, participants use English as a means of communication within the international academic community; speakers of different languages utilize a wide variety of content in their interactions. A primary component of our international projects was the use of SDGs as a key source of content. The design of the project and the central theme of the interaction is predicated on the fact that students create better content if it has a wider audience. When students create research, presentations, or writing that will be seen multiple times by a wider audience, they are likely to invest much more time and energy into the work.

COIL Project Content

We use the definition of the term 'artifact' to indicate "an object made with a view to subsequent use," and that can include anything from a class chat which is viewable later, to a shared 'wiki' page on the learning management system, to a collection of YouTube links curated and shared by students, for students. These are all examples of educational "artifacts" that can outlast the period of the individual class, term, or even school year. Our current projects are mediated by the Google Workspace for Education, and this platform was specifically selected for the simple reason that all members of partner universities have institutional access to those tools. Recent projects also utilized SDGs as project content for international collaborations for several key reasons. Firstly, these ideals fit well with the motto and mission statement of Kyoto University of Foreign Studies: "Pax Mundi Per Linguas", meaning "world peace through languages". The study of international themes, trends, and issues leads to a contributing and positive environment in the world moving forward.

The SDGs represent 17 broad categories of international action. They were established in 2015, ratified in 2020, and by 2030 many countries around the world have committed themselves to progress in these areas, including progressive ideas in the fields of education, equality, gender, and obviously environmental goals. The SDGs have been called the "world's largest lesson," and as a set of principles, they aim to encourage students to become changemakers in their communities. Becoming global citizens is a central aim, and especially applicable when the content we have chosen to study is easy to agree with in principle, in line with the goals of higher education, and supported by a wealth of online information. Davidson (2017) posits that the thrust of 21st century education should focus less on specifically technical skills, but skills such as critical thinking, collaboration, and creativity. By studying content with a tremendous amount of online information, students must think and process that information carefully to make sense of the underlying issues.

SDGs apply to local, regional, national, and global issues. Content is free and available to anyone with an Internet connection, so this facet of project design gives us an incredibly wide

reach. This reach and connectivity enable student groups to interact in a way that we could never fully achieve before, so the ubiquity of technology-based learning in the era of the COVID-19 pandemic proved to extend our ability to move forward with COIL projects. In 2020-2021 we participated in a trilateral classroom project and in 2022 we extended this to five professors and an even larger group of students working together between our institution and a Taiwanese partner university.

Project Design and Organization

The key to successful project design is the master spreadsheet (see figure one), which has several unique features. Firstly, it is colorful, and the evolution of our design and organization has really been a process of making online shared content more colorful, more collaborative, and more interesting to look at for all participants. Next, there are clear sections for each phase of the project, and these sections are color-coded by week. Such a clear method of organization allows all participants to see exactly where they are and what is expected of them at each phase. The next vial point is that the master spreadsheet is viewable to all members of the project who have been given the link. This puts control and information into the hands of the participants themselves. Finally, the master spreadsheet includes a wide array of clickable links to other pages and resources within the project. Some of these are editable by members while others are resources connected to the content that can only be viewed or read.

Figure 1. The Master Spreadsheet

A key component of our project design is the color-coded checklist with hyperlinks: everything is there, and in a remote learning framework or a live framework, all students have access to the "roadmap" at all times. Obviously, the smartphone has really taken this to the next level because anyone can access or interact with any aspect of our project from wherever they are. This is contingent on the permissions of participants: the organizing professors have control over who is in the project, and the privacy or ability to edit aspects of

the associated sheets and documents. It is obviously vital to ensure a safe learning environment, as well as to create backups of shared resources.

Collaborative Learning and Research

Students within all classes are initially divided into cohorts who will work together for the duration of the project. They then must make a connection and arrange get-to-know-you meetings with their group. Students record these meetings, and another central theme of project design is that it's not a micromanaged affair; we give the framework and the content over to the students, who then collaborate, meet, research, and create content. A popular education blog notes that teachers must "relinquish some of their control" in order to empower students to create and explore in the digital classroom (21 things 4 teachers, 2020). Members, as well as involved professors, have learned the value of making a personal connection at the beginning of a project. Developing rapport and becoming invested in a relationship with other human beings means that participants are much more inclined to devote their time and energy to communication and collaboration.

With the study of the SDGs, we focus on the goal of examining content in a way that allows students to understand big ideas and then how these affect their local situation. Then they have an opportunity to look at the regional, national, or international implications of their topic. Connecting with someone in another country using their second language as a means of communication, students in the English department can achieve one of their primary goals, which is to become better communicators. We enable this progress by way of a forum that is international in scope and accesses content that is based on real-world issues as opposed to language exercises in a textbook. This is one aspect of a broader trend in education; it no longer occurs in a vacuum. The National Standard Collaborative Board (2015) describes five goal areas that are commonly known as the five Cs: *Communication, Cultures, Connections, Comparison, and Communities.* These are not new and have been guiding language teachers since the 1990s. They provide an ideological framework for international communication and cooperation.

We are using Google Workspace for Education, but of course, there are analogous software platforms on Microsoft Teams or other learning management systems. Our choice of Google is primarily because it allows us to keep and share all content in one place, which all participants can access from anywhere, whether on a home computer, smartphone, or school computer. Another main concern with the design of international COIL projects is that they must fit into the term well, and the timing must work between universities in different countries with different schedules. Through trial and error, we found that a four-week project with introductory team-building activities and two main learning outcomes is the ideal length. Synchronous meetings are not necessary, but cohorts of students have a straightforward framework that they can easily begin with simple question and answer activities. Next, they research their chosen topic and share ideas on the issue in a spoken format followed by a reflective writing assignment. The project culminates in a narrated team Slides presentation.

Learner Autonomy and Agency

Students have agency: they are no longer viewed as individuals working on their own to construct target language sentences, for example, but they are social agents collaborating with other people (Kalaja et. al. 2011). Our education design here is based on real-world activity. Collaborators and professors create how-to guides and tutorials within a

multiplatform environment. Guides go step-by-step, for example, a roughly ten-minute guide showing students how to record audio on their smartphone, home computer, or school station computer, then convert that audio into the correct format, save it in a file hierarchy which we've structured for them, and then how to insert it into their Slides presentation. Agency is described by Reeve and Tseng (2011) as the process by which students proactively try to personalize and enrich both what is to be learned and the conditions and circumstances under which it is to be learned. Students take the framework provided by the class facilitators and personalize it. Another corollary benefit for student participants is having multiple professors produce tutorial content that can be added to the collection of available resources. Students are not only receiving contact from a singular professor with one accent or one style but benefitting from multiple perspectives, thus broadening their educational experience.

Benefits of International Collaborative Learning

A further benefit of content created outside of class time by cohorts of students is exemplified by the concept of the flipped classroom. The learning experience of international projects, again, is more reach – more content viewable by a wider audience, and asynchronously. Content is authentic and communicative, and there exists an aspect of positive peer pressure whereby students push each other to create better material. Cohorts of students with different skill or language levels help each other and mentor one another through the project, rather than relying on the professor. Content, questions, and answers are coming from members of the student's cohort and the Internet. Professor Ramesh Srinivasan described digital literacy as the doorway to other literacies (Srinivasan, 2020). That is to say that being able to use shared platforms is a *prerequisite* to other educational goals.

Furthermore, there is an aspect of what we call collateral learning: Even when not explicitly required to do so, students carefully watch other groups to see what they produce – comparing and benefiting from others' work. The vast majority of students have positive feedback about their international COIL project, saying that it helps them to better understand international issues, and improves their speaking skills. International community building also occurs, though it is not an explicitly specified goal.

International COIL projects are not without challenges. Technological hurdles such as email addresses, SNS accounts, formatting, tech training, connectivity, sharing documents, and others can be difficult to overcome, but all these challenges share a similar theme in their solutions: better project design, standardization, and clear communication result in fewer problems. The troubleshooting, communication, and experience of overcoming such issues over a period have resulted in a clear format and methodology which can be replicated. In the words of Yuval Noah Harari, "technology isn't bad. If you know what you want in life, technology can help you get it" (Harari, 2018). The technology that we use in the classroom should be a tool to serve the educational process, not the goal in and of itself. Therefore, technological challenges must be minimized as much as possible so as not to detract from the communicative tasks the are the real focus of COIL projects.

Conclusions

In short, the author believes in the benefits of real world and legitimate communication between international groups of peers. By widening the 'reach' of content created by students, for students, a higher caliber of academic achievement is reached. The ultimate goals of international COIL projects are not singular. As members of the English department at a

university with a rigorous language program, our students have a clear need and desire to communicate more effectively in English, increasing their spoken proficiency and, of course, test scores. Getting qualifications which will lead to future employment opportunities is key. However, there is another long-term and equally important goal that we can support as educators. As an institution or as individual professors, we aim to provide students with opportunities to become global citizens. In the process of actively and authentically communicating with peers at another institution, participants extend their horizons, learn about important issues, and embody a 'changemaker' mentality as they move forward in their lives and in their education.

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Mechanical 2021: Educational Game Concept to Promote Sustainable Thinking and Cooperation in Basic Education in Brazil

Diego Mergener, Porto University, Portugal
Emerson Ranieri Santos Kuhn, Feevale University, Brazil

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Abstract
This work aims to present the results of preliminary tests of the concept of a board game whose objective was to make people aware of the importance of their social/environmental responsibility related to the treatment and collection of plastic and electronic waste. The game is not characterized by competition between players, but cooperation, as it uses friendly social interaction to complete objectives. Based on aspects of the tabletop RPG, players must play as a team, evolve their characters and develop strategies together to overcome challenges. Two tests were carried out involving eight students aged between 12 and 13 years old, attending the 7th year of Brazilian elementary school. The purpose of these tests was to see if the idealized mechanics and rules were working as planned. As a result, some mechanics and rules were identified that were not operating correctly during the game. Another result obtained was the need to prepare an illustrative manual to facilitate the understanding of the rules. According to the tests, we concluded that the game not only addresses issues that work on cooperation and teamwork, but also involves logical-mathematical reasoning and creativity. It was found that sustainability should be better addressed in the game so that it has a greater reflective weight. As future work, we intend to adjust the identified deficiencies in the game in order to test again and see if the improvements resulted in better gameplay and cooperation between players.

Keywords: Board Game, Cooperation, Sustainability, Education, RPG

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1 - Introduction

Currently, making the right choices, from opting for sustainable consumption behaviors, whether health or well-being, is necessary for the maintenance of life on the planet (Nakajima and Lehdonvirta, 2013). Nakajima and Lehdonvirta (2013) argue that even people who develop awareness of the importance of the benefits of the right choices in their lives, have difficulty changing certain habits. And in this context, games can act as a driver of changing habits, because in this constantly changing world, gamification over time has been studied and used in several different scenarios, whether educational or business, aiming at changing situations and improvement of human sociability.

Gamification is gaining recognition not only in the sports sector, but also in other sectors such as road safety. In 2011, the Swedish National Road Safety Society and Volkswagen hosted the Speed Camera Lottery, a lottery system in which drivers participated when the speed limit was respected (Blohm and Leimeister, 2013). Another example in the metro sector is BahnSout4, which encourages Munich metro users to report damage to train stations. All examples do not represent or are games in the exact sense of the word, they only make use of possibilities that engage users in the use of products in a relationship of participation and "award" (Blohm and Leimeister, 2013).

In these attempts to use games for a specific purpose, Koster (2005) states that playing a game aimed at completing a goal is actually recognizing a specific type of pattern and playing make-believe is recognizing another pattern, that is, both although they are different in certain ways, they have the same logic, solving patterns.

It is in this context that the Mechanical 2021 project, presented in this article, aimed to raise awareness among the community and promote citizens' environmental education and responsibility in relation to the correct treatment and collection of plastic and electronic waste. This, in turn, was initially developed as a product concept for the participation in the second edition of the Electrão contest[1]. The game concept is characterized not by competition between players, but by cooperation in completing objectives, as it uses friendly social interaction to complete the project's purpose. Social interaction is the foundation of the construction of the person since it is in the context of these social relationships that language, cognitive development and knowledge of oneself and others arise (Heidrich, 2020).

From this perspective, the school is an environment where social interaction, sustainable thinking and actions must be encouraged and practiced daily. Kapp (2012) infers that gamification can and has been one of the tools used in education to create an effective connection between the need and the practice of these principles so essential to life. Gamification is part of the set of active methodologies that enhance the playfulness of learning, transforming it into more collaborative and participatory issues, contributing to the integral formation of students (Paiva et al. 2019).

Having defined the introductory scope, this article develops with section 2 with a reflection on the role of games in the teaching of sustainability and social responsibility having a joint influence of gamification. Section 3 seeks to describe the methodology used in each stage of the game's development. Section 4 describes the case study in which the game was structured. Section 5 presents the concept of the game, justifying the choices and those of each element

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[1] For more information about the contest visit: https://academiaelectrao.pt/vencedores/. Access at: 04/08/2022.

belonging to the game. Section 6 describes how the preliminary tests took place, ending this article with a reflection on the results obtained after the tests.

2 - Context and literature review

2.1 - Teaching through games

Currently, games are used as educational tools for adults in training and developing mental, emotional and even physical skills (Souza; Chagas; Silva, 2011). According to Pires; Hey; Teixeira (2012) the first games aimed at education and also at the development of strategic skills were war games that later evolved into business games, in which the first version of the game called Top Management Decision Simulation was developed by American Management Association in 1957.

This culture of using games for learning allows learning in an ever-emerging and ever-changing environment (Borges and Sproedt, 2012). In addition, games can influence the generation of a perfect playful environment for the development of social skills capable of helping the person to face uncertain social dynamics (Borges and Sproedt, 2012). Martin; Canada; Acedo (2017) comment that scientists from all over the world whose object of study is the brain agree on the fact that games, when having the challenge/conquest/reward cycle, promote the production of dopamine in the brain, which in a way reinforces the human desire to play. In this case, Martin; Canada; Acedo (2017) say that play is something already known and at the same time common with regard to social work.

Socially, Titiev (1992) says that games are considered biocultural, because people's bodies can perform any required action and each culture says how to use it based on the rules of each game. The author complements stating that many children's games end up training them for adult tasks, presenting educational functions. Koster (2005) adds that gamification involves the educational context, so games are good teachers of something, the question is what they end up teaching. At this point, it is necessary to develop good practices, linked to issues of social importance and maintenance of life, as it is essential that games should assist in a learning process aimed at the sustainable development of human relationships and societies.

2.2 - Games and gamification

Minina and Nikitina (2012) explain that games are attractive because the development and sharing of knowledge happen concomitantly with emotional exchanges that are natural factors in human interaction. Regarding gamification, Werbach (2014) writes that it should be understood as a process, that is, the process of making activities more similar to games, and in this way we create a clearer adjustment of their perspective of academic understanding. Both operate in synergy to most of the time achieve a specific goal, and nowadays, the appreciation for games and the potential for using gamification is growing.

An example of games for people instruction can be cited the use of serious games with virtual reality to train people in the moment of evacuation of buildings during an earthquake (Lovreglio et al., 2018). The authors also claim that serious games represent a new way of investigating people's behavior to deal with building evacuations in the wake of an earthquake. An online game named "Beat the Quake!" was developed by Earthquake Country Alliance in which the game prepares people to take precautions against earthquakes (Lovreglio et al., 2018).

In terms of solving problems as a team, Schrier (2018) says that by putting players to solve problems together, it makes them start to realize that people have different skills and have different ways of helping. This ends up making players more receptive to different types of skills and experiences, helping others to feel socially included (Schrier, 2018).

As for teamwork, we can have games whose objective does not involve competition itself, but rather cooperation between players. Competition and cooperation have concepts that distinguish one from the other, because while competition occurs when a player achieves a goal that others cannot. Cooperation, on the other hand, happens when a player achieves a certain goal when all other players achieve the same feat (Peng and Hsieh, 2012).

This context is closely related to educational principles exposed in the National Curricular Common Base (NCCB)[2], a document that guides education in Brazil. Gamification is one of the active methodologies that are current tools used in education to develop an integral learning of the subjects. Thus, according to the introductory text of the NCCB (2017), it is extremely important for Brazilian education to present and apply diversified didactic-pedagogical methodologies and strategies, including gamification, "using different rhythms and complementary content, if necessary, to work with the needs of different groups of students, their families and culture of origin, their communities, their socialization groups, etc." (BNCC, 2017, p. 16).

Using these differentiated methodologies from a "traditional" model is to be in line with contemporary demands for the formation of the subject, not only transmitting knowledge, but actually building it with students and effectively assisting in the process of integral formation of conscious individuals for society. Where these beings are capable of sustainable actions guided by real social responsibility.

2.3 - Sustainability and social responsibility

Involving games and environmental education, Queirós and Pinto (2022) argue that gamification applied with the aim of promoting social responsibility influences the generation of knowledge and sustainable practices with regard to recycling or reducing the consumption of non-renewable energy. Since this must be addressed in society and in schools, being more than just individual attitudes but serious public policies.

This situation, until 2020, could be found in the basic education network in the city of Rolante, Rio Grande do Sul, the municipality where the game tests were applied. The municipality, both in its public and private education network, defended the insertion of elements of sustainability and social responsibility, either through the creation of school cooperatives, or in the sharp reduction of plastic waste in the school routine. The school where the game was tested belongs to a private school system, the Notre Dame network, but because it was located in the city in question, it was also encouraged to rethink some of its practices, and it did so effectively. With the change in municipal management, some of these principles were out of focus in the public network, but they were rooted in the culture of the private school, which maintains the awareness of acting in the area with its students. For this reason, the game that we present in this work showed a sense of real importance in the children who tested it, this demonstrates a factor of relevance of the study, since the greater

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[2] The acronym of the document in Portuguese is BNCC (Base Nacional Comum Curricular).

the participation the greater the awareness of the subjects regarding the importance of sustainability and responsibility everyone's social.

3 - Methodology

For the development of the game, the seven steps of Design Thinking by Ambrosi and Harris (2010) were used to provide a quick idealization with simple steps of creation, from the first sketches, to prototyping. As for the preliminary tests, a non-participant observation was chosen, observing what worked or did not work in terms of mechanics and dynamics used in the game. For this, some observation criteria were used, which are: (1) As for the proposed objective for the game, was it completed?; (2) As for the mechanics developed for the game, were they easy for players to learn?; (3) As for the dynamics proposed for the game, does it offer fun and learning?; (4) What didn't work in the game? Our methodology as shown in Figure 1 was divided into three phases: Concept; Tests and Feedback from Participants.
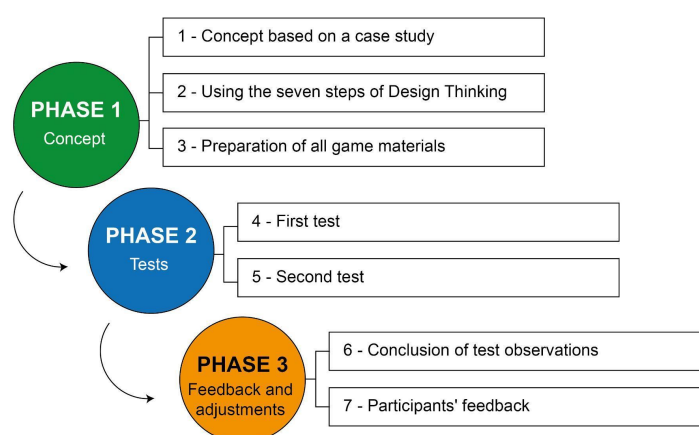
Figure 1: Development Stages

In Phase 1 we idealized the game based on a case study of an educational game, having the seven steps of Design Thinking as a development framework. After establishing the game's concept, we finished Phase 1 with the prototyping of all the materials that make up the game. Phase 2 involves effectively testing the game already with the physical materials of the game so that we can verify every detail involving mechanics, dynamics and the aesthetics used in the materials that are working as planned. Phase 3 is dedicated to reflecting the information acquired in the tests, taking into account the opinions of the participants who tested the game.

For the tests in advance, parents and the school administration were asked for permission to use the image of students in recorded video of the test, for exclusively academic purposes and further analysis. Two tests were proposed with eight students of the seventh year of elementary school aged between twelve and thirteen years. Each test lasted approximately ninety minutes and served to demonstrate the functionality of the game, its rules, dynamics, etc.

4 - Game concept based on a case study

As an educational game proposal, Mergener; casenote; Bez (2020) proposed a board game concept called Conquistadores das Areias. This game aimed to act as a support tool for the teacher in the classroom for teaching specific contents of history and geography for the sixth year of Brazilian elementary school. In developing the game's concept, Mergener; casenote; Bez (2020) elaborated some design requirements for the game, these being: Capacity for four players; use of tabletop RPG[3] mechanics and cooperative play.

By putting all these guidelines together, Mergener; casenote; Bez (2020) managed to design an educational game in which students (players) did not compete with each other, but played cooperatively in completing the objectives as a team. Figure 2 presents the concept of the game Conquistadores das Areias materialized for the initial tests.

Figure 2: Ultimate aesthetics of the Conquerors of the Sands game

After the tests, Mergener; casenote; Bez (2020) concluded that the design requirements used in the game concept were not only effective in completing the main objective, which was to provide the teaching of specific content in a playful way, but also can serve as guidelines for future work involving games, education and other application context. In addition, the author found that the use of tabletop RPG elements such as teamwork among players is a good alternative for working on social interaction among students.

5 - Concept used for Mechanical 2021 game

In 2020, Academia Electrão[4] proposed the second edition of a competition that aimed to award innovative projects in the area of management of electrical equipment, batteries, accumulators and used packaging. Academia Electrão is a project by Electrão, a Waste Management Association that aims to contribute to the circular economy objective, involving various types of waste that we manage, namely: packaging, electrical equipment and batteries.

As a way to participate in the contest, a game was created keeping in mind the existing rules and categories that accepted a game to compete for the prize. Based on the design

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[3] The acronym RPG stands for Role-playing game. For more general information about tabletop RPGs, visit: https://www.zoom.com.br/jogos/deumzoom/rpg-de-mesa. Access at: 04/08/2022.

[4] For more information about Academia Electrão visit: https://academiaelectrao.pt/. Access at: 04/08/2022.

requirements used by Mergener; casenote; Bez (2020), it was decided to design a game using some elements of the tabletop RPG. Likewise, it was also chosen to use cooperation between players and not competition like Mergener; casenote; Bez (2020) proposed in his game, however, designing it to be played not only in the educational context but also in the family, encouraging interaction between parents and children. Figure 3 shows the sketches for building the game board.
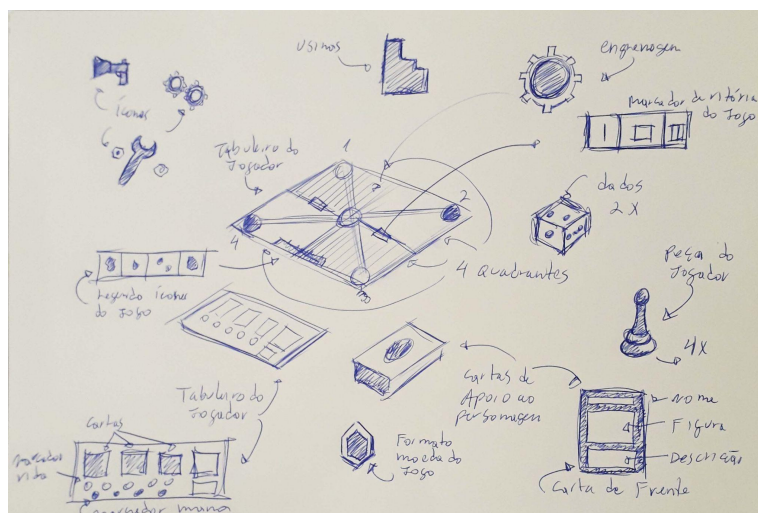
Figure 3: First studies and idealization of the game

The story of Mechanical 2021 takes place in a Steampunk-style apocalyptic future in which players must defeat the oppressors (zone bosses) and build recycling plants to be able to beat the game, as it is a cooperative game in which they are only players against the game. Figure 4 shows the final concept used for the game board using images only to exemplify what the aesthetics used on the board would be like in terms of design.

Figure 4: Final concept for the game board

The Mechanical 2021 game has simple and easy-to-learn rules, being a game featuring tabletop RPG features such as character creation and collaborative work between players. The game is for 4 players and each game is estimated to last approximately 45 minutes depending on the strategies that players will use during the game. It is estimated that children as young as 10 years old can play and it is a game designed to be used as an educational tool

within the classroom and as an entertainment game for the family. The objective of the game is to conquer the 4 territories and promote sustainability through the construction of recycling plants. The game ends when players have lost a territory 3 times due to death by an oppressor. Figure 5 presents the concept for the player board.

Figure 5: Final concept for the player board

We chose to use a rustic and aged aesthetic to visually provide what the game environment is like for the players, taking into account the elaborate story. Figure 6 presents the aesthetic concept of the cards that make up the support materials for players. The illustrations, as well as the images used in the aesthetics of the board, were only used to represent the closest aesthetic to the game. On the back of the cards, icons were used to make it easier for players to identify each type of card.

Figure 6: Final concept for the game cards, front and back.

The card represented by the letter (A) corresponds to the weapons or arsenal cards that players can add to their characters to facilitate gameplay when they face a challenge that requires attack or defense powers. The card with the letter (B) are cards that have defensive actions to help the player character to withstand damage caused by other cards. The card represented by the letter (C) are cards that have auxiliary or support effects, helping player characters to complete tasks more easily during the game. The card with the letter (D) corresponds to the oppressors (bosses) of certain areas of the board that players must win in battles. Finally, the letter with the letter (E) represents the treasure cards that players can find

during the game to earn extra bonuses. To help players understand what each icon designed for the game represents, a legend has been added to the board as shown in Figure 7.
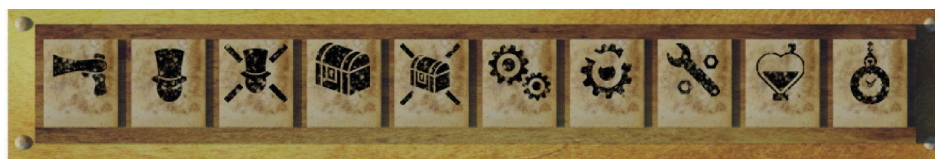
Figure 7: Concept for game icons legend.

As support materials, small tokens such as game victory tokens and treasure tokens were added to promote greater immersion in the game and also to facilitate resource management during the game. Figure 8 presents the markers developed.

Figure 8: Concept of the idealized markers for the game.

The marker represented by the number (1) marks the amount of energy that the player character has in order to activate the effects of support cards. The numbered marker (2) marks the amount of life the player character has. The number marker (3) is placed on the map to indicate the location of treasures. The marker with the number (4) indicates which treasures have already been found by players on the game board. The number marker (5) indicates the position on the map of the oppressor (boss) of an area of the board. The number marker (6) indicates the oppressor that the players have already eliminated. Figure 9 shows the final render of the game concept and its components used to participate in the contest.

Figure 9: Final representation of the game and all its components

After the final result of the contest released by Academia Electrão in July 2021, the game concept won first place in the category that was entered. With the positive result, the next step was to test the game to see what was working or not in terms of proposed mechanics and dynamics.

6 - Preliminary game tests

Test 1 – The first test was carried out with four boys aged 12 and 13, students in the seventh year of elementary school, with the presence of the teacher who helped throughout the test, as shown in Figure 10. After reading the rules, the operation and the game's objectives, they drew their characters and positioned themselves on the grid of the board.

Figure 10: First test of the game

From the first moment they tried to align themselves in cooperation to fulfill the proposed objectives, the participants initially did not pay much attention to the configuration of their characters, in terms of the weapons and armor available on the cards, this made them have greater difficulty in battles, but in all of them they acted together. This demonstrated that everyone could cooperate to overcome difficulties, they were very questioning about the rules, they wanted to understand everything and have fun playing. However, they presented difficulties in making decisions as a team, sometimes they differed in the group's choices and this proved to be an assertive point of the game's proposal, as they managed to work moments of cooperation linked to having time to talk and listen, even in the difficulty they had autonomy to negotiate and argue the best paths for the group.

Test 2 – The second test was now carried out with four girls aged 12 and 13, also students in the seventh year of elementary school and also with the presence of a teacher, which can be seen in Figure 11. It was observed that the participants acted differently from the boys since the beginning. After the explanation and reading of the rules, the group already tried to coordinate their actions for the common good, while in the first test, the participants cooperated in the combat, the participants of the second test moved around the board thinking about the group and the achievement of the objectives effectively.

Figure 11: Second game test

It was noticed that they had fun with the discoveries and constantly exchanged information, helping each other, they presented a synergy of action and approached several possibilities of path and problem solving, always listening and coherently deciding what they would do. They presented a little more difficulty in the initial combats, as they were not used to tabletop RPG games. However, they quickly learned from the tips their colleagues gave even outside of their shift. They progressed through the quadrants of the board faster due to their cooperation, they always discussed everything listening and speaking logical and focused arguments.

Both groups showed ease of acting as a team, but the participants of the second test showed a more refined and more accurate cooperation in the face of challenges. While the participants in the first test helped each other at critical moments, the participants in the second test acted to minimize the critical moments. The game showed a lot of potential for cooperation and exchange of information related to sustainability and the distribution of resources. The combats were complex at times due to some participants not having explored much the system of configuration and maintenance of the characters' resources, but the participants were challenged and had fun with the challenges and their solutions created together.

Conclusions and future work

Taking the observation criteria during the tests described in the methodology, it is concluded that the objective of the game was not achieved in its entirety, since critical thinking related to sustainable awareness must be better explored. However, the objective of influencing participants to play cooperatively instead of competing was successfully achieved. It was noted that some mechanics should be rethought to give more emphasis to the theme of sustainability during the game and some dynamics should be introduced to make the game more fluid.

In technical terms, it was noticed that some game elements such as the fragments used as a bargaining chip should have their size increased to facilitate their use. It was observed that the size of the board used during the tests, which corresponds to the area of an A3 sheet, although it allowed the students to play, proved to be small for the various actions that can be taken in the game. It is believed that a board with an area equivalent to the size of an A2 sheet may present better future results. Although at the time of testing there was still no concept of a manual for the rules and operation of each element of the game, the elaboration

of a simple and intuitive manual could help players to understand the rules and dynamics of the game faster, so that in the future they do not need constant help from the teacher.

Regarding the mechanics used in the game, the rules proved to be difficult to assimilate without the help of the teacher who already had a full understanding of how the game works. It is estimated that some rules should be simplified so as not to stagnate the game due to lack of clarity for players. Another detail observed during the tests was the comment of one of the students who asked "When will this end?" The student's question revealed points to improve in relation to the fluidity of the game, which may be influencing boredom due to the players' difficulty in overcoming some challenges. A positive point related to mechanics was the constant use of mathematics, mainly in the use of addition and subtraction of bonuses and other dynamics present in the game. Another detail observed was the possibility of adding small objectives in the game to provide small satisfactions to players before completing a larger objective.

Another fact identified was that the game can not only be used within schools but can also be played with the family, promoting the approximation of parents and children and acting as a tool for teaching sustainable awareness in the new generations. In addition, the game promotes the practice of other skills such as freehand drawing and the training of creativity and strategic management of resources, which indicates a potential way to explore new dynamics during the game.

For future work involving the game Mechanical 2021, it is proposed to continue its development and implementation in the academic field in order to identify other possible application scenarios, as well as the description of the results achieved during the applications for publication and dissemination in articles and conferences. Another possibility for future work is the idea of transforming the game that is currently configured for the analog platform, as it is a physical game, to be remodeled for the digital platform, thus increasing the rate and reach of dissemination. Another idea for future work is the possibility of new games being developed within Mechanical 2021's feature which is to put players in collaborative work working together to win the game. This idea should be complemented with the development of new games with the objective of promoting social interaction, awareness and empathy between people, as behavior change can be an excellent path as an idea for new playful projects.

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Contact email: diego.phoenix@hotmail.com

Myriorama: Obsolete Technologies for a Contemporary Scenographic Practice and Thought

Aurora dos Campos, Research Institute in Art, Design and Society (i2ADS),
University of Porto, Portugal
Helder Gomes, School of Fine Arts, University of Porto, Portugal
Sofia Ponte, IADE - Universidade Europeia and Research Institute for Design,
Media and Culture (ID+), Portugal

Abstract

This article reflects on some of the conceptual, spatial, and narrative possibilities of the use of the *Myriorama* game, and its pre-cinematic technology, in contemporary artistic and scenographic practices. To this end, it takes under consideration the language of *visual essays*, which has been increasingly explored by artists, photographers, and filmmakers who seem to share a desire to "show things as they are". More specifically, this analysis will consider the visual essay Myriorama nº1 (2021) by scenographer Aurora dos Campos and the historical contextualization of the first *Myriorama* decks. This "card game" was created by Jean-Pierre Brès, in 1824, in France. At the time the game was meant to inspire artists, create stories for children, and entertain a certain European elite. It became popular during the 19th century, with different versions in England, Italy, Austria, Germany, and Greece, for instance, but fell, as it began, quickly into oblivion. It is a game of portable dimensions, composed of hand-colored scenes, with human and animal figures, buildings, country landscapes, and everyday situations, which when combined and recombined create various visual narratives. The study relates the *Myriorama* game with the philosophical concepts of *perspectivism* and *pluralism* enunciated by Friedrich Nietzsche (1997), such as the ideas about the *limits of interpretation* proposed by Umberto Eco (2004), as well as the concept of *visual essay*. It is thus intended to contribute to unveiling tensions between the multiplicity of possible landscape representations and their interpretative limits in contemporary artistic practices.

Keywords: Myriorama, Perspectivism, Visual Essay, Landscape Representation, Scenography

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Introduction

Myriorama: obsolete technologies for a contemporary scenographic practice and thought deeps in on some of the artistic and conceptual possibilities of working with the system of the *Myriorama*, an illustrated card game that was famous in Europe in the 19th century, which is among the pre-cinematic technologies of the time. We have been working on the concept of this portable game, transforming it into a visual essay to reflect on the sense of stability, or rather an instability, of the gaze, how contemporary visuality has changed, and how that change unveils *perspectivism* and *pluralism* when considering the real.

This study is part of the Ph.D. research in Fine Arts at the University of Porto - "Scenography in recombination: a study on the limits between materiality and fiction"- by Aurora dos Campos and was developed together with her supervisors Helder Gomes and Sofia Ponte.[1] The research appears in a domain of practices that establish a dialogue between the artistic experience on stage and outside of the stage, thus exploring artistic and conceptual possibilities in the encounter between fiction and materiality. In this specific case, there is the exploration of the combination system of the *Myriorama* game for the creation of a visual essay about a specific landscape in Portugal.

Initially, we intended to develop the article focusing on a direct relationship between *Myriorama* and contemporary scenography, keeping into consideration that this artistic research starts from scenographic practice and expands to the urban territory while exploring the language of visual essays. During the research, we chose instead to change the focus and deepen the study of the conceptual and operative possibilities that *Myriorama* has to offer. Thus, we related *Myriorama* to the notion of *perspectivism* and analyzed the visual essay Myriorama nº1 (2021)[2] by Aurora dos Campos.

The text is divided into three parts: in the first part we do a brief contextualization of the Myriorama game; in the second part we propose some relations between the *Myriorama* game and Friedrich Nietzsche's concept of *perspectivism* (1997) and also the idea of *Limits of interpretation* from Umberto Eco (2004); in the third part, we think how the instability of the gaze still provides predictable interpretations of the real and comment the visual essay Myriorama nº1 (2021).

There are presently several artists creating visual essays that mix various realities in speculative exercises of fiction and fantasy. For instance, photographers and filmmakers such as Zoe Leonard (b. 1961, New York), Tacita Dean (b. 1965, Canterbury), Hito Stereyl (b. 1966, Munich) and Salomé Lamas (b. 1987, Lisbon) whose work communicates a desire to mix images conceived as an index of reality with some aspects of fiction. For Michel de Montaigne (Edelman, 2022), who introduced the concept of 'essay' back in the 16th century, this form of expression refers to an exploratory process that deals with a theme in a subjective way with no other purpose than to 'test' a theory or some ideas.

1. *Myriorama* contextualization

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[1] Aurora dos Campos has been granted the scholarship 2020.05918.BD by the Foundation for Science and Technology (FCT) /Portuguese Ministry for Education and Science to develop her Ph.D. research

[2] It was on display at the Casa-Museu Abel Salazar from December 2021 to February 2022 at the exhibition "When Activity becomes Art (2) - Dialogues", curated by Vera Carmo, as part of the Ph.D. program in Fine Arts at the Faculty of Fine Arts, University of Porto, Portugal.

Traditional *Myriorama*s, are portable deck-like games composed of paper cards illustrated with landscapes. The word *Myriorama* has its etymological origin in two Greek terms: myrias, which means multiple, and orama, which means scene, view, or landscape. Also called storytelling card games, the engraved and hand-painted scenes include human and animal figures, nature, and architectural elements. These illustrated cards when combined generate numerous variations of romantic theme landscapes. Another seductive aspect of the *Myriorama* is the scale of the game set. The miniaturization of space establishes an anachronous distance between reality and fiction. A wreck, a road, a plant, a sheep, all experiences become bi-dimensional images and relate to each other in narratives reflecting the values and culture of the players.

Although famous at the time, today, *Myrioramas* are obsolete and are less known than panoramas and dioramas. However, they continue to inspire illustrators and artists.

Figure 1: Jean-Pierre Brès, *Myriorama: Collection de Plusieur Milliers de Paisages,* 1824
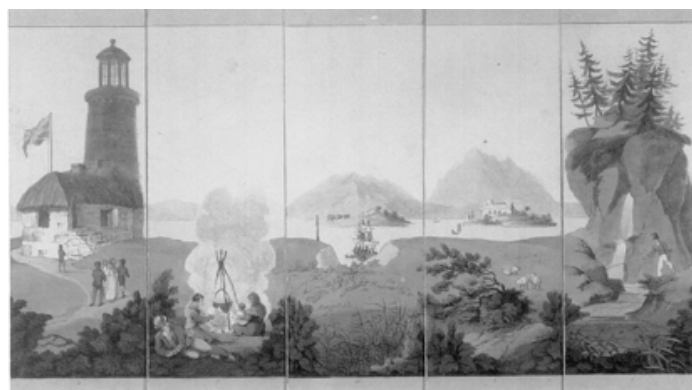
Figure 2: John H. Clark, *Myriorama: A Collection of Many Thousand Landscapes*, 1824
(Both figures are from the collection of Jacqueline and Jonathan Gestetner)

The first *Myriorama* game, according to Ralph Ryde (2004), an expert in the genre of panoramic painting, was created in 1824 by the French Jean-Pierre Brès (Figure 1). At the time the game was meant to inspire artists, create stories for children, and expand the culture of a certain European elite. This first version of the game has 32 cards enclosed in a frame, allowing four parallel pieces to be combined at a time. Brès` illustrations are close to the most common classical landscape painting at the time.

The *Myriorama* game quickly spread across Europe, and new versions appeared with local cultural and territorial specificities. For instance, John Heaviside Clark's version of the game draws a more panoramic view of the landscapes represented (Figure 2). This adjustment was due to the elimination of the lateral edges. Without these limits and with a common horizon the landscapes could be combined continuously allowing a greater number of variations. Considering that the early *Myriorama* game system works by combinatorial strategies, we can safely calculate the probability of combinations of its parts. Thus, by combining 16 cards, a player can create millions of landscapes. All similar, but all different.

When playing the *Myriorama* game, the player may form several different but equally valid landscapes. A player can create various relationships between scenes: peasants around a campfire; a caravel going on a trip; sheep grazing; a stream flowing down a cliff. The order of the cards creates different hierarchies and protagonists among these elements. The illustrations are made in a way that the game set does not force the player to read the narrative from left to right as if it were a book. In this game, all the events and elements of a landscape are previously available at the same time and the player decides how to order or interpret their relationships. There is no right or wrong representation of landscape. Nor a better or worst one.

2. *Myriorama* and *Perspectivism*

Analyzing one of Aurora dos Campos's recent visual essays, we realized that the *Myriorama* system brings Nietzsche`s idea of *perspectivism* to life (Nietzsche, 1997). *Perspectivism* and its notion of *pluralism* help to illuminate *Myriorama*`s visual potential to reflect on the possibilities of telling stories and interpreting them. Friedrich Nietzsche`s *perspectivism* starts from a questioning of the notion of truth and the notion of reality. He believed that theories - whether about religion, science or philosophy - are not capable of shaping a unifying thought of the real, since, in fact, "reality itself" is a construction of the subjects themselves. It is not a matter of saying that each subject has a different perspective of the real and, in a certain way, incompatible with that of the other subjects, but of sustaining that what is understood as "fact" or "real" is always the result of an interpretation.

Just as the *Myriorama* allows thousands of possible combinations without the notion of right or wrong, Nietzsche`s *perspectivism* affirms the plurality of points of view and interpretations that build multiple realities. The relationship proposed here between the *Myriorama* and Nietzsche`s *perspectivism* works as a visual metaphor, offering us images for a visual understanding of the philosopher`s concept. It is important to point out that Nietzsche`s *perspectivism* does not coincide with the painterly Perspectivism of the Renaissance. On the contrary, Nietzsche uses *perspectivism* as a relativizer and multiplier of points of view, while in the *linear perspective* of the Renaissance the point of view is unique.

The horizon line is usually a paradigm of orientation, its representation has contributed to situating subjects and objects in time and space. And yet, despite having a common horizon,

traditional *Myrioramas* do not necessarily have a single point of view. Unlike *linear perspective*, *Myriorama's* illusory model is not centered on just one vanishing point, on the contrary, its landscapes allow for multiple escapes.

The fact that *Myriorama* does not require a linear interpretation, but rather suggests attempts to speculate on the possibilities of creating relationships, brings another dimension of subjectivity and pluralism to the game. It provides different combinations between the order of the scenes, but also opportunities to create numerous narratives in each landscape.

However, there are two interesting conditioning aspects to be observed in the *Myriorama* game: the first aspect concerns the line of the horizon and the common foreground - this aspect, provides a sense of continuity between the parts but also creates a stable gaze that provides a certain conceptual and visual unification between each set of landscapes constructed; the second aspect concerns the illustrations per si, although they build thousands of landscapes, they are all within a specific aesthetic realm.

Figure 3: Campos, A. *Montage: Myriorama of Italian Scenery 1824+Pineapple*, 2022

Umberto Eco in his essay "The Limits of Interpretation" (Eco, 2004) reflects the multiplicity of interpretations a semiotic visual message carries. Eco argues that no matter how many possibilities there are for interpreting a visual message, these possibilities are finite. This limit, according to Eco, is found mainly in the "cultural framework" in which the visual message exists. For Eco, some meanings can be so deviant from a visual message communication process that their interpretation can be considered wrong or impossible. For instance, in a traditional *Myriorama*, a playing card with a color reproduction of a pineapple, such as this one, would be immediately considered "wrong".

This is a set of principles that are still part of the way any society works as a group. People relate to what they know and experience, and that comes from a social and cultural construct inherited. Reading Umberto Eco is also very helpful to understand why so many great contemporary artworks are still so misunderstood by the public.

3. Rethinking *Myriorama*

> "He dreamed that a road would cut through this field
> A river of asphalt would tear through the landscape
> The house would become an island
> Around him, a tide of cars".
> (Campos, 2021)

In the set of possibilities offered by *Myriorama`s* system of combinations, scenographer Aurora dos Campos has been working on the other hand, experimenting with these types of uncanniness and disruptions elements. She does that because the landscape concept changed, not only interfering of men in nature is more abrupt, and the cleft between rural and urban has extremely, but also because today the experience of space and its possibilities of representation also greatly changed. French philosopher Anne Cauquelain (Cauquelain, 2008) points out that for many decades, in the West, the landscape was linked to the Renaissance representation of nature, already with the illusion and artificiality of *linear perspective*, and that this perception of time and space must be "denaturalized". These pictorial representations model, argues Cauquelain, shaped our perception of the world and a common idea around the notion of landscape.

Artist Hito Steyerl (Steyerl, 2011) also points out that one's sense of spatial and temporal orientation has dramatically changed in recent years due to the technologies of surveillance and tracking for consumer purposes. One of the symptoms of this change is the growth of aerial views enabled by drones and satellites but also by the infinite vertical scroll movement that has been massively spread with smartphone technology. Steyerl highlights how a single, stable point of view is being replaced by multiple perspectives, overlapping windows on screens, distorted lines, and diverging vanishing points. In Steyerl`s reflection about the fragmentation of the Horizon and the seconding of the *linear perspective* paradigm, today, the sense of continuity, illusion, and stability provided by the traditional *Myriorama* card game is unrealistic.
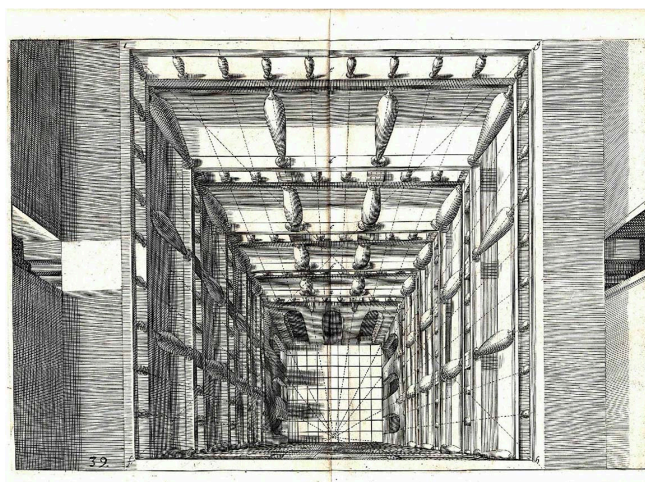
Figure 4: Hans Vredman de Vries, *Plate in Perspective* (God`s Eye View), 1604-1605

When bringing together the concept of visual essay, the *myriorama* card game, and her current experience of landscape, Aurora dos Campos's experiment represents space around her through a mixture between *myriorama*'s non-mechanical playing system and technical procedures enabled by digital capture and reproduction of the image. Just as Montaigne sets out to test ideas in essays, the artist has tried to test them on video. For instance, the first visual essay Aurora dos Campos produced in this way, Myriorama nº1 (2021)[3], arises from exploratory walks through the área around the House where scientist Abel Salazar (1889-1946) once lived. The House Museum was once located in a rural area and today has a hybrid

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[3] Myriorama nº1 (2021) can be seen at this link: https://vimeo.com/706072220

landscape with multiple temporalities and urban scales in superposition. Thus, the visual essay seeks to share a look, a point of view, on his experience in the place. A visual essay can approach Nietzsche's *perspectivism* insofar as it offers a subjective point of view on a subject.

Myriorama nº1 (2021), is inspired by the image combination system of the *Myriorama* game. The work consists of a video with 4 columns of rotating images, each column composed of photograph cards taken in urban-rural environments on the outskirts of the city of Porto. Some images depict details, other broad views of a road, a field, animals, or words on flat color background. The columns display fragments, that together, as well as in Hito Stereyl`s proposal, never form a stable horizon.

Figures 5 and 6: Aurora dos Campos, *Myriorama nº1* (7`57``) - Visual Essay, 2021

The *Myriorama* game allows viewing multiple images side by side and is capable of creating an opening for reflection on a series of questions. It is not a system of double or even triple, but a system of multiple relationships. The *Myriorama* inspires not only a connection between common threads but between consonant and dissonant ideas. Juxtaposing different images and temporalities; different social contexts; or even images found by chance; they can turn out to be landscapes, not always stable, that provide a series of possible semantic and aesthetic meanings.

The making dimension of the *Myriorama* game, not only of seeing and interpreting, brings with it temporality, action, and reflection in action. Looking at the world, registering it, making it matter, manipulating this matter in various combinations. Offering a look to another person. Offering to another person the opportunity to rearrange. Playing with the world. Playing with the material traces of the world. Playing with representations of the world.

Conclusions

To conclude, some provisional notes and considerations:
The traditional *Myriorama* card game allows simulating reality taking into consideration alike but different perspectives. Differences that a few years ago would appear insignificant or would be simply disregarded by most of us. The potential of visual combinations that this game tolerates and in consequence the narratives it generates, were linked to the philosophical propositions of *perspectivism* and *pluralism* anticipated by Friedrich Nietzsche in a very different cultural context in which we presently live.

The horizon line in the 19th-century *Myriorama* offered a stability of the gaze that encouraged a sense of continuity and order. Today, the possibilities of visual perception are different. However, although there is no clear frame for looking and however plural our subjective world may appear, representing it and communicating about it, has its interpretative limits.

A horse running in a landscape will mostly be linked to the idea of "freedom", and a pack of cigars on the grass as the concept of "trash". If bringing to life today some aspects of the *Myriorama* card game what material traces of the world would you link to play with, combine and speculate?

After the presentation of this paper at *The European Conference on Arts, Design & Education* (ECADE2022)[4], with the interest demonstrated by the colleagues present, we will take in consideration other potentialities through which this study can be developed. In particular, the possibility of using the visual system of *Myriorama* at universities as a methodology to reflect on some cultural contexts and interpretative differences.

Acknowledgments

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[4] Myriorama: obsolete technologies for a contemporary scenographic practice and thought nº 63351. In Culture & Heritage; Session Chair: Gota Hayashi; Room A _ Sunday, Live-Stream Presentation Session 3, July 10, 2022. The International Academic Forum (IAFOR).

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Contact email: auroradoscampos@gmail.com
          hgomes@fba.up.pt
          sofia.ponte@universidadeeuropeia.pt

The Competitive Transformation of Business Based on Agile Innovation Methods That Engage Visual Creatives as Business Process Leaders[1]

Viviana Alejandra Álvarez-Restrepo, Corporación Universitaria Taller Cinco, Colombia
Carlos Varela, Corporación Universitaria Taller Cinco, Colombia

The European Conference on Arts, Design & Education 2022
Official Conference Proceedings

Abstract
Humankind has been marked by profound transformations through the centuries. These transformations have led humanity to find answers and solutions to create new realities. During these transformations, a constant has been the ability to adapt to change. Although this may not necessarily be easily accepted, it has been recognized that the human mind is forced to innovate in these critical moments in history, resulting in a flourishing of the creative capacity. This creative capacity is reflected in the creation of methodologies that allow processes of innovation and resilience, which leads to competitiveness and innovation. The agile methodologies, are born to lead organizations to think and reinvent themselves in a more flexible way, responding to the needs of the current user who faces abrupt changes in the way they perceive brands and organizations. This perception is reflected in the needs for companies to be more competitive in a market that evolves and assimilates change. Business Design creates and captures value for organizations, transforming their value proposition as a real factor for the business. The role of the designer or visual creator in this ecosystem is done, among others, with these methodologies and concepts; establishing norms that allow the systemic and organized evolution of her creative work. In this research, we will expose the way in which visually creative minds contribute value from their knowledge as well as the way in which they have collaborated to impact their core.

Keywords: Agile Methodology, Design Thinking, Lean Start Up, Communication, Design Collaborative Work, Co Creation

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[1] This paper comes from the investigation project The Competitive Transformation of Business Based on Agile Innovation Methods That Engage Visual Creatives as Business Process Leaders by Alejandra Alvarez graphic designer and member of the board of directors of Taller Cinco and Carlos Varela graphic designer and Director of internalization and special projects.

Introduction

As professionals in the design industry, we have experienced that one of the most significant realities in today's world, which not only should concern business organizations but also visual creative professionals, is having to reflect on two key points: Competitiveness and Innovation, viewing both as a form of business sustainability.

This is a reality where we as creative professionals as same as the new business models should view the fundamentals of design as a generator of dynamic innovation that significantly impacts the business core and its society. Therefore, we should shift our thinking to no longer see "design" as a process conceived from a merely esthetic and operational point of view.

This misconception has left designers, unlike other professionals, with the need to "educate" their clients as to explain their role in the organizations. This model has been changing, creating a window of originality where design and its processes become more relevant, especially in the last decade, which, according to Nussbaum, "When people talked about innovation in the 90s, they really referred to technology, when people talk about innovation in this decade, they really refer to design" (Ceballos, Serrano Ortega and Blázquez, 2017).

For decades, agile methods have emerged as effective ways to create answers to a world where the only certainty is permanent change and constant acceleration. These are implemented with the objective of solving problems, developing effectiveness and productivity while at the same time generating a high degree of competitiveness and innovation.

From all this reflection our team based Our research in the need to analyze The Competitive Transformation of Business Based on Agile Innovation Methods That Engage Visual Creatives as Business Process Leaders. This formulation is based on the new business reality that we have been experiencing since the early nineties and more so today due to the pandemic, where the value of digital and technological revolution has increased the relevance and value of design and communication even more.

Based on these productive dynamics, we started seeing the need for creative professionals to strive to achieve an interdisciplinary thinking that contribute to all these orders while influencing different realities without losing sight of the essential: Putting the user experience at the center of the decision at the same time that achieving competitiveness and innovation. Tim Brown suggests that the design profession has a bigger role to play than just creating nifty, fashionable little objects. He calls for a shift to local, collaborative, participatory "design thinking" (Brown, 2009).

These facts made us understand that today's organizations in Colombia and in the world require creative leaders who take on these challenges. To achieve this, it is important to have the tools that shift their thinking from "The so call comfort zone" applying in the creative processes both unconventional and key solutions that lead to design as a key factor of innovation and transformation. As it is mention in New Jobs New Skills, social renewal, advancement and progress go through the reinvention of professionals, who leaving their "comfort zone" establish new relationships with their audiences, customers or suppliers (Pernías Peco, 2017).

Unlike other disciplines that focus on purely productive and commercial aspects, we've started viewing the design process as a way of articulating technology, the business model and the human as a way to promote innovation as a culture while building up the product without neglecting the representation of the business culture, actions that will result in achieving a strong brand loyalty that therefore will leads to the potential sustainability of the business model itself.

We all have experience in our day-to-day reality that business survival goes beyond visionary and missionary issues, we are fully entering a much more strategic and tactical future where the role of visual creative minds is called to lead innovative processes that contribute their value beyond the actual creative exercise taking design as a key factor of innovation.

In this scenario, where the conditions of sustainability are shifting it's essential to give creative leadership its place as an essential tool that drives organizations to transform and structure new business models, rethink products and services and patterns that lead to continuous improvement to create a competitive environment. It's for this reason that we have recognized that the professional set of minds should head towards the following factors:

1.   *Flexibility:* One of the factors that is most valued in these times is flexibility. Organizations are called to implement strategies that allow them to be and think more liquidly. The rigor of what is solid thinking causes business models to quickly disappear.

2.   *Velocity:* The speed and disposition in which challenges are assumed is very important, staying reasoning and not implementing timely solutions can mean imminent failure.

3.   *Adaptation to change:* but what is truly important and defines who survives and manages to achieve business targets is the adaptation to change. This historical moment has taught us that only if we assume the challenges with agility, resilience and with a strong purpose of getting ahead, will we be able to adjust to these new realities where the role of adaptation will be a relevant factor to achieve our goals of global competitiveness.

According to the World Economic Forum report (WEF) Colombia, stands out as making a valuable effort in its competitiveness, improving 88% of its variables. Although, it is an important achievement more work must be done as the country stands far from the standards of the first world.

Unlike developed countries, research done by the National University and SENA, shows that in Colombian companies the insertion of design is very low, showing indicators where only 5% of them invest more than 2% of their annual budget in design and 53% do not allocate any amount for these activities. This contrasts with what was indicated by 70% of these companies regarding the importance of innovation. Despite declaring this interest, reality shows that investment in innovation is poor and that perhaps businessmen are not clear about its connection with design. (Mancipe López, 2015). However, it is observed that there is some awareness of its value in the development of new products and services, the improvement of competitiveness and differentiation from the competition. This fact denotes that it is not necessary to "educate" Colombian entrepreneurs about the benefits of design and creativity, but they must be encouraged to note its importance in order to stimulate the industry.

From the study derived from the comprehensive care project in the design of the MinCIT (Mejía, Jiménez, Chavarria, 2014) that sought to generate transfer of knowledge in design through comprehensive interventions, a scale was generated to measure the insertion of this discipline in companies. Four categories were defined: 1) They know nothing about design; 2) They consider it to be styling; 3) Consider it as a process; 4) They understand it as innovation (Mejía, 2012; Mancipe López, 2015):
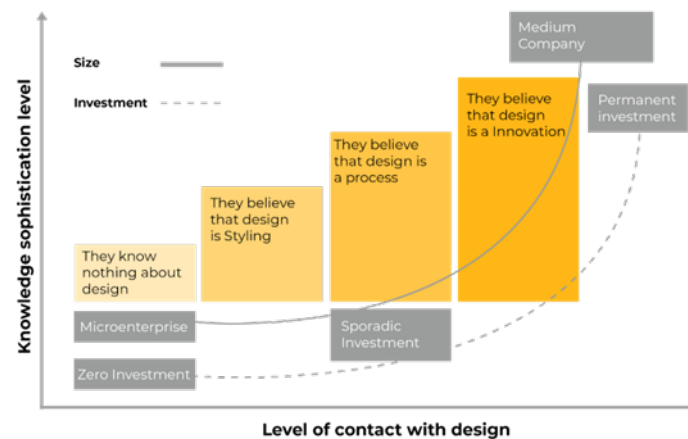
Figure 1: Scheme of design insertion levels according to PAD Taken from
Mancipe López (2015)

This graph represents the state of the art of design insertion levels according to the Colombian Ministry of commerce, industry and tourism where a scale was generated to measure the insertion of this discipline in companies. Four categories were defined:

1) They know nothing about design; 2) They consider it to be styling; 3) Consider it as a process; 4) They understand it as innovation (Mejía, 2012).

The insertion of design also depends on the size of the organizations. A 52% of Colombian's SMES have not hired design professionals and only 12% have made for more than 10 years. This contrasts with large companies, in which a 32% have not hired design professionals and 27% have hired them for more of 10 years. Therefore, this business structures have fewer possibilities for innovation due to their low investment in design (Mancipe López, 2015).

In order to be competitive leaders, both design professionals and entrepreneurs must develop leadership skills that inspire work teams to work collaboratively while substantially improving their life project, these factors will thrive commitment, discipline and creativity as key factors of both personal and business evolution. This means carefully designing a work culture that transforms processes and the way people work collaboratively.

It is here, where companies must apply tools to their leadership and business models that allow them to be agile in their processes and decision-making. In other words, to be more agile implies that companies must include experimentation as an important part of their process and to achieve this properly it is necessary to have collaborators who are trained to do so, that is, to have leaders ready to adapt to challenges that challenge them, taking them

with a high dose of motivation and transformation towards change while always be focused on the end user.

The adoption of agile methodologies has been an essential factor in organizations in recent years, giving companies a more dynamic and successful turn, allowing them to focus their results on meeting solutions based on the needs of their users; which have already experienced radical changes in their purchasing and consumption habits. Due to their flexibility and rapid adaptation, there are multiple benefits that organizations obtain in the implementation and use of said methodologies. These benefits are represented in cost reduction, speed in the delivery of projects, teamwork and commitment in all its members, higher quality in work and in the final product, whether product or service, among others. (Brum, 2017).

Based on these contexts, the target of this research was to define a framework of methodological principles that allow the leadership of the visual creative to shift its thinking towards competitiveness and innovation, based on agile methodologies supported by real application cases.

It is in this scenario, where the design discipline and its professionals should acquire an increasingly leading role, directing them to lead and harmonize the dynamics between supply and demand at the same time that contributes all their technical and conceptual knowledge to integrate it in a key way of providing and adding value in positive way to the organizations.

For these reasons the solution that we proposed was to include agile methodologies in the creative process, shifting the design professional to enhance their creative process to design products based on the real needs of their users while strategically understanding the profitability of the business and the viability of technology in order to project innovation.

It is pertinent definition stated in the Manual of Oslo (Organisation for Economic Cooperation and Development, 2005):

> Innovation is understood as conception and implementation of significant changes in the product, process, marketing or company organization with purpose of improving results. Innovative changes are made through the application of new knowledge and technology that can be developed internally, in collaboration external, or acquired through services advice or purchase of technology. It is possible to innovate in production processes, distribution, marketing and sales, new or better products, practical tools, processes, systems or business models, efficient use of resources and greater operational performance (p. 56).

By agile methodologies we understand those that, due to their flexibility and immediacy, allow us to adapt business projects, work teams and their management, to respond to the particular and specific needs of the environment. According to The Project Management Institute, companies that use these methodologies have 30% more profits than those that do not use them, and an increase of 37% in their income.

The Benefits

Greater customer satisfaction: It's strategies and objectives are focused on the end user.

Collaborative work: The union of the parts is stronger than each of its pieces, it is one of the strongest and most emblematic variables of these methodologies enhancing team building and co-creation as a way to build creative concepts and results.

Greater Control and predictability: Processes are iterative, allowing a bigger forecast to create better resolutions, anticipating errors and conceptualizing them as an opportunity for immediate and continuous improvement.

Cost reduction: Errors are identified as the project develops. This is a key factor to bring greater control or reduction of the costs.

Shifting the design professional mindset to see it the profession as Business Design, allowing to view it in a more strategic way, has given the Taller Cinco team the tools to bring an emerging concept which creates and captures value for organizations, transforming their value proposition as a real factor for the business. To achieve this goal, the implementation of agile methodologies has been a key factor to give the visual creators to establish norms that allow a more systematic and organized evolution of their creative work.

For the methodological approach for the case study presented in this research, we will be described how Taller Cinco and Corferias apply these processes over a period of one year, generating tactical and strategic solutions that solve and respond to the needs of the visitors, exhibitors and both organizations.

With this scenario, Taller Cinco's base team, comprised of 2 graduates, 5 professors, 5 students, 3 administrators and the Corferias Team comprised of 1 Director and 5 Sales Team members. The teams met and established parameters based on the development of agile methodologies such as Design Thinking and Lean Startup, resulting in brainstorming, planning and execution of the Ideal House as a relevant sample and success story being proclaimed according to the bureau veritas as an innovation product for Corferias in 2019. For the entire execution of this project, we extended the base team to 15 students, 20 speakers within others. The execution duration time was 110 days, 23 brands, 140 products installed.

Initially the team incorporated Design Thinking to allow us to systematize our processes, enhance collaborative work and expand opportunities, but in the process, we realized that we had to incorporate a methodology that would allow us to manage this creative process. It is here that the Lean Startup began to work with Design thinking, which has resulted in Taller Cinco's own method called Sinergy flow.

Results of the case study: The Sinergy flow T5

Sinergy Flow T5, this process method articulates agile and disruptive methodologies, empowering our team to adapt to collaborative and co-creation environments to achieve the necessary competitiveness, allowing us to create projects with a key business and technological model mentality that put the customer at the center. This is achieved by creating an iterative circuit of research, trial and error that helps us formulate and test these business models in advance, creating an environment of competitiveness and assertiveness

where user needs take precedence at the same time that pushes the creative teams to shift their comfort zone to apply in their creative processes both creative and strategic solutions that lead to design as a key factor of innovation and transformation to change.

This process map articulates the constructivist and constructionist fundamentals of Taller Cinco's base essence, adopting agile and disruptive methodologies that empower endogenous and exogenous teams to adapt to collaborative and co-creation environments that achieve the necessary competitiveness. Based on the humanistic environment that puts the end user at the center. This is achieved by creating an iterative circuit of research, trial and error that helps to formulate and test these business models and the visual and communication strategies in advance for their target markets, creating an environment of competitiveness and assertiveness where user needs take precedence.

The success of Sinergy Flow T5 is based on permanent feedback aimed at oriented learning that consolidates a culture based on results, continuous and systemic improvements that incorporate tactical and strategic exercises that result in productivity as a permanent policy propelling innovation.

Figure 2: Sinergy Flow Cycle T5 by Taller Cinco.
Taken form Alvarez Restrepo and Varela, 2020

Based on evidence and applied research, it is exposed how this connection between academia, organizations and technology, led to the development of special design and communication base projects where the improvement of learning results in our academic community and business models were evidenced. These processes projected the academic community of Taller Cinco to support its pedagogical model in currents such as constructivism and constructionism as well as in agile and active methodologies, adapting them within a pedagogical model in Colombian higher education.

As part of Taller Cinco praxis processes are applied in the classroom as a tactic to bring the academy closer to the productive sector with the aim of transferring knowledge that allows the understanding of the specific needs of these sectors in order to co-create joint responses that enable our professionals to meet real needs while conceiving solutions and strategies that support growth at the same time that strengthening competitiveness of these productive sectors while consolidating their own learning.

For this reflection, it is imperative to recognize the creative and complex problem-solving capacity that is developed in the tam members from the implementation of these

methodologies, resulting in the transformation in thinking and mindset that inspires innovation.

Strategic design transforms the concept of applied art from a useful and aesthetic vision to a driver of innovation, transformation and cultural change within the business environment. The intersection between analytical and intuitive thinking implies the formulation of proposals that dare to take risks, but whose execution and implementation are segmented to verify the results and introducing the necessary adjustments in the different phases, allowing iterations in the processes to let improvements and that see error as an essential part of learning and transformation. This approach became essential in our creative process.

As described in Design Thinking: Lead the present, create the future: "in the design company, prestige is given by its ability to solve problems: the more difficult the problem solved, the more creativity and prestige it transmits abroad." (Serrano Ortega and Blázquez Ceballos, 2017, p.33).

Those who have the following skills, which, according to Tim Brown, are essential for the development of any challenge and corporate culture, will be able to adapt more easily to change and thus project innovative solutions focused on the user, which allow greater competitiveness (Ceballos, 2017). These essential skills are outlined below:

They are Collaborative: It was demonstrated in the development of these projects that, creating a participatory, free and spontaneous atmosphere, an action and reaction are created, resulting in a trigger; where the team and its participants innately begin to work collaboratively, leaving aside individual resolution and moving on to the collective.

They are Observers: It was found that during development, a more global vision began to be generated, the approached from different points of view allow the process of solving the same challenge in different ways.

They are Empathetic: As Tim Brown says: "The first thing you need to innovate is to be inspired, and inspiration begins with empathy" (Serrano Ortega and Blázquez Ceballos, 2017, p.31). From this perspective, the work teams focused on the behavior and habits of the people, as well as on the work team itself in which they collaborated to identify the needs and possible solutions to the problems presented.

They are Integrators and have a global vision: In addition to being experimental, optimistic and patient, design thinkers know how to find patterns in an environment of chaos and they also have the ability to observe and interpret the global experience as a whole.
Conclusions:

The importance of liquid models: Companies and their cultural organization must enter more adaptive (liquid) models that allow them to explore and adopt disruptive methodologies to empower teams to adapt to collaborative environments that enhance co-creation to increase competitiveness and innovation. This scenario is ideal for the visual creative, as it allows these professionals to generate broader ideas to better impact the world.

Agility, as a stimulus in teamwork: This research showed that visual creatives can be management leaders, but for this they have to adopt and implement tools that allow them to systematize their processes. As we have seen in Colombian productive sectors there is a lack

of managers and executors in these methodologies. This opens up a new perspective in adapting new roles for the visual creative.

Resilience: In this new reality where change is constant, we have to overcome difficulties and see them as opportunities for transformation and improvement. There is no choice.

Mindset in Business Design: The visual communicator must transcend beyond the technical factor, since processes, strategies, and business planning are linked to their actions that must permeate the business culture.

Conclusions

Taller Cinco must be a leader in promoting these emerging models that seek to develop financial, operational and organizational models that, through Business Design, help leaders create products and services that are more focused on the user, creating more sustainable commercial models with greater competitiveness by promoting this thought in the training of new visual communicators.

Since the incorporation of viewing design as a strategy way of thinking, the academic community raised the incorporation of these fundamentals in the pedagogical model, promoting an entrepreneurial, proactive and innovative attitude in students, professors and graduates where the plurality of knowledge, teamwork, methods agile and effective, responsible empowerment and commitment to development ensure a positive impact on society.

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Contact email: alejandra.alvarez@taller5.edu.co

Sonic Kinesthetic Forest: Listening to and Dancing With Trees

Rennie Tang, California State Polytechnic University, United States
Eleni-Ira Panourgia, Université Gustave Eiffel/LISAA Research Lab, France
Lisa Sandlos, York University, Canada

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Abstract

Sonic Kinesthetic Forest is an interdisciplinary research project and pedagogical investigation that uses sensory-based, creative methods of drawing, sound, and movement for connecting humans more viscerally to trees and forest landscapes. Our work responds to David Abram's premise in *The Spell of the Sensuous* that sensory practices are vital for mitigating human disembodiment, desensitization and disconnectedness from nature in contemporary life. Resilience, as a means of adapting to and recovering from extremes, may offer a form of bodily reconnection that reinforces human and more-than-human relations, especially between humans and trees. We approach resilience as a relational state of being that can be achieved by stimulating sensory modes of expression. In this paper we draw from our respective disciplines as landscape designer, sound artist, and choreographer/movement analyst to explain and reflect on the sonic kinesthetic methodology we developed for exploring the sensory attributes of trees through the embodied acts of listening, moving and drawing. We describe how the methodology was applied in two pedagogical projects: Listening to Trees, a workshop for undergraduate landscape architecture students at California State Polytechnic University Pomona (USA) and Dancing with Trees, a choreographic piece created for adolescent dancers as part of the Guelph Youth Dancers project (Canada), and how the proposed sonic kinesthetic methodology was demonstrated as a case study during the ECADE conference. We also discuss how project participants cultivated a deeper understanding of the aliveness of trees, ultimately enhancing their own sense of resilience by forging a more reciprocal relationship with the sentient world.

Keywords: Landscape Architecture, Drawing, Dance, Movement, Sound Art, Embodiment, Ecology, Sensory-Based Methods, Pedagogy

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Introduction

Desensitization, disembodiment, and disconnection from nature are all widespread issues in today's world that can contribute to an anxiety-ladened sense of responsibility for 'saving the planet.' To counteract these paralyzing feelings, we assert that it is not enough for humans to be in nature but, rather, we must be together with nature to achieve a more productive sense of calm purposefulness that can then lay the foundation for individual and collective agency towards sustainable action. As such, it is particularly vital for human beings to establish symbiotic relationships with nature and critical to cultivate embodied ecological engagement through creative explorations.

Sonic Kinesthetic Forest is an interdisciplinary collaboration across landscape architecture, sound art and choreography/movement analysis. Through our ongoing collaborative project, we explore the question: How can ecological empathy and agency be fostered using integrative experiences of landscape design, sound art, and dance choreography? The deeper connection that we seek is a key step towards ecological empathy and embodied engagement with nature.

The Sonic Kinesthetic Forest project is motivated by ecologist and philosopher David Abram's claim in *The Spell of the Sensuous* (1996) that: "[n]onhuman nature seems to have withdrawn from both our speaking and our senses." and he asks, "[i]f perception, in its depths, is truly participatory, why do we not experience the rest of the world as animate and alive?" (p. 62). Our project serves as a platform for bringing these issues to the foreground, prompting conversations about how humans can better support and nurture resilient forest landscapes around the world. We are interested in how our three disciplines and their affiliated modes of expression can together connect humans more viscerally to trees and forest landscapes.

Shared Aliveness and Resilience

"There is no element of the landscapes that is definitively void of expressive resonance and power: any movement may be a gesture, any sound may be a voice, a meaningful utterance." (Abram, 1996, p. 117)

The interconnectedness of landscape, sound and movement expression as recognized in the words of David Abram above, is also a central theme in the work of acoustic ecology pioneer, R. Murray Schafer. He claims that for children under the age of five, life and art are entwined, but that once youth enter school the two separate (Schafer, 1986). Listening to natural soundscapes, he asserts, heightens human beings' appreciation for the unique and ephemeral qualities of human and non-human existence. Referring to listening practices of societies in the past for whom the recording of sound was not possible, Schafer claims that reducing the number of sounds one is listening to at one time is a way to achieve an experience of authentic fidelity that can only be possible in real time. In the short film *R. Murray Schafer: Listen* (New, 2009), Schafer states: "When you listen carefully to the soundscape it becomes quite miraculous," (0:35) and he encourages humans of all ages to focus on listening to their natural environments in order to enrich their lives (1:26).

For anthropologist Tim Ingold, being in the world "could be described as a condition of being alive to the world, characterised by a heightened sensitivity and responsiveness, in perception and action, to an environment that is always in flux, never the same from one moment to the

next" (Ingold, 2021, p. 84). In employing sensory expression to develop the shared aliveness that Ingold describes, our project proposes methods operating across landscape, sound and movement that have the potential to foster resilience of human and more-than-human bodies adapting to extreme conditions. The Sonic Kinesthetic Forest project draws from Ingold's notion that engaging in active sensory perception to tune in to the changing elements of landscapes and sounds can help us to grasp and better understand the constant flux and transformations of our world. This state of openness to the world through a heightened embodied engagement across senses can provide us, as Ingold discusses, with the "strength, resilience and wisdom […] to respond to the flux […] with care, judgement and sensitivity" (Ingold, 2021, p. 93).

Social anthropologist Doerte Weig also explores an ecosomatic aliveness between human and more-than-human stating that "[b]odily perception and awareness ground knowledge, wisdom, self-awareness and self-security as much as potentials for aliveness and co-presence" (Weig, 2021, p. 167). For Weig, listening and moving responsiveness beyond "the controlling human, individual, ego perspective, [...] is an attunement to aliveness, to the ecosystemic perspective" (Weig, 2021, p. 152).

Artist, educator, and filmmaker Sarah Abbott examines a collaborative mode of interaction between trees and humans, highlighting the potential to restore the environmental and climate balance of the Earth (Abbott, 2021a). On a related trajectory, dance scholar Maxine Sheets-Johnstone's writings on 'moving in concert' underscores the value of moving together with others in relation to a state of common aliveness:

> Moving harmoniously with others indeed has the possibility of ever heightening awareness and knowledge of the bodies one is not, of hearing others in a different medium. The experience of hearing ourselves kinesthetically and hearing others kinetically puts us in touch with our common aliveness. (Sheets-Johnstone, 2017, p. 8)

Choreographers Ann Cooper Albright and Anna Halprin describe the potential for dance and movement practices to foster resilience by mobilizing social, political, and personal change. Heather Houser reinforces the positions taken by both choreographers in this statement:

> They offer manuals for placing dance in contexts of exchange that produce *resilience*—another keyword of our times. What are the movement vocabularies that can cultivate resilience not as the act of bouncing back (yet another movement metaphor) but as the practice of being open, paying attention, shifting directions, and using touch and strength to create community?...Dance, for Albright, cultivates the flexible agency essential for resilience. (Houser, 2019)

Environmental change scholars Kaitlyn J. Rathwell and Derek Armitage (2016) argue that "artistic processes [can act] as mediators to bridge knowledge systems about social-ecological change". For Rathwell and Armitage (2016), artistic expression involved in collaborative and performance art "can help participants to better understand each others' values in the context of changing social and ecological conditions". These authors highlight the importance of art in the communication and exchange of shared stories through space and time in response to change. Art making and artworks have the capacity "to nurture local social-ecological resilience" and "move through social networks, from local to global levels" (Rathwell & Armitage, 2016). As Weig discusses,

Can we change the system, by changing the way we move and think-perceive with each other, by organising and relating sensitively? Such potentials and capacities are shaped by and shape the local and global systems we are nested with. These potentials are also shaped by rhythms of breathing and moving-sensing, which are both beautifully unique and at the same time intimately and inextricably embedded with qualities of, not fitness, but joy and aliveness of ecosystems. (Weig, 2021, p. 171)

Drawing on the above resources, the Sonic Kinesthetic Forest project conceptualizes resilience in terms of adaptation and recovering from extreme conditions through a bodily reconnection of humans and trees; as a relational and adaptable state of being that can be achieved by active engagement with sensory modes of expression in order to recognize and foster a shared aliveness between human and tree bodies. We seek to activate embodied processes of attunement to somatic sensation through moving, listening and drawing. We engage in these practices in response to and in a reciprocal relationship with trees so that mutual resilience can occur.

Sonic Kinesthetic Methodology

Since beginning our collaborative Sonic Kinesthetic Forest project in 2020, we have brought together a set of methodological tools for research and teaching purposes with the aim of generating novel or alternative understandings about trees and forests in sonic and kinesthetic ways. These methods are used in practice and in a reflective manner in order to create and make meaning from multi-sensory and transformative experiences.

Drawing

Landscape architecture research may be best positioned somewhere in between embodied and representational ways of knowing (Tang, 2021, p. 60). Inherent to representational drawing is the scalar gap between the drawing and the subject being drawn; the necessity to pictorially translate the live subject to a representation that fits on a piece of paper reduces the scale of the drawing and focuses on the art. This gap creates a distance between the designer and the actual place, situation or sensation they are trying to represent. In the work we have been doing with students we move away from representational drawing toward embodied drawing so students are always working at 1:1 scale.

The medium of charcoal has proven to be a highly effective tool for this type of drawing because of its versatility as an instrument - any side of the stick can be used to draw - and its powdery texture which responds well to the weight, speed and movement of the charcoal as it is applied to paper. Choreographer Trisha Brown used charcoal in her dance performances (Eleey, 2014), allowing the black stick to become an extension of her body while charcoal markings index the extent and quality of her movement. A digital version of Brown's work can be seen in William Forsythe's *Improvisational Technologies* (1999) where his movements are made visible through a computer-generated linework appearing as if the space around him were a canvas.

On the other hand, embodied drawing is not predicated upon the visual but rather the sensorial. It is a form of drawing that seeks to capture the sensory attributes of a subject through the act of drawing. The use of charcoal is particularly significant because of its association with trees i.e. charcoal is typically made from willow tree branches and its tactile qualities. For example, all sides of the charcoal can be used (side, edge and tip) to create

different line thicknesses, the amount of weight applied to the charcoal creates different gradients of blackness and the speed at which the charcoal is moved changes the line density and consistency; in other words, the relationship between the body and the charcoal plays a critical role in its effectiveness as an expressive medium.

Sounding

Sound is a medium that can provide us with alternative understandings about relationships between landscapes and bodies. Sound reveals information across human and more-than-human, ecological and geological, historical and geographical dimensions of landscapes. In listening and responding to, as well as transforming frequencies related to landscapes, we can reconsider our relationships with trees and organisms from an embodied and sensory perspective (Barclay, 2019).

Drawing from the fields and creative practices of acoustic ecology, environmental sound art and music inspired by or composed for landscapes and gardens, we use methods including: active, in situ listening and listening from the perspective of other organisms; field recording and sound-making activities with found objects; vocalization, metaphors and translational processes as well as verbal descriptions for articulating acoustic qualities of listening and sound-making experiences; and scoring processes across sound, landscape and movement. These methods are employed to promote an active and embodied engagement with trees and forest landscapes through listening and sound-making while moving. The objective of such experiences is to produce novel understandings of plants, organisms, materials, weather and ongoing transformations of the environment through their own frequencies and in response to these soundings.

Our approach to sound moves beyond solely observational towards sonic experience and action. With movement, sound-making actions, drawing-related sounds of gestures as reflected through charcoal on paper and their dynamic qualities, we explore sound as a "phenomenon of *experience* – that is, of our immersion in, and commingling with, the world in which we find ourselves" (Ingold, 2021, p. 170). Sonic Kinesthetic Forest encourages us to focus our listening on the interactions between trees and humans as a means of forming a symbiotic relationship. Such sonic engagements are not only concerned with sounds of the vegetal, but those aural traces that reveal the aliveness and ongoing transformation of forest landscapes and how these are shared with humans.

Moving/Dancing

The moving/dancing aspect of the Sonic Kinesthetic Forest project follows a lineage of embodied movement and somatic sensing approaches. We promote physical practices that are in accordance with Indigenous principles of attunement to nature as expressed by choreographer Santee Smith. Smith maintains that dancing helps human beings appreciate that "nature actually does call out and we need to listen, especially when we're dealing with a lot of climate change issues, disregard for Mother Earth, and a lack of connection" (TO Live, 2019, p. 1). The Sonic Kinesthetic Forest project relies on the idea that one significant way to improve our ability to listen to nature is to develop greater awareness of our own physical presence. We facilitate processes of listening to our own bodies through sensory attunement in order to recognize what movement pioneer, Irmgard Bartenieff called "our inner impulse to move" (Bartenieff and Lewis, 1980, p. 51). Thus, sensory attunement can "activate and

motivate" us to move expressively and to engage in dance improvisations that deeply connect our bodies to our environments (Bartenieff and Lewis, 1980, p. 1).

Taken together with embodied sound art and drawing practices, dance and movement within the Sonic Kinesthetic Forest methodology are approached under the premise that bodies are always moving. Whether our movements are so subtle that they are almost imperceptible to a single onlooker as is the case of shallow breathing, a heartbeat or the flow of blood through the body, or so expansive or specialized that they are considered to be virtuosic or spectacular by an audience in a dance performance or sporting event, we recognize that bodies are constantly in motion. This means that when we ask participants in our workshops to listen to their bodies and to move in response to their own sensations, we are confident that they may discover or rediscover their own sense of aliveness through dynamic movement.

Human beings move in response to their own inner sensory impulses but they also move to react to outer stimuli acting on their bodies. As theorized by Bartenieff and Lewis, movement always happens on a continuum of inner focus to outer connectivity, and humans move to adapt or cope with various elements in their environments (Bartenieff and Lewis, 1980, p. 51). Likewise, trees, forests and other elements of the natural world move in response to environmental stimuli. A tree may twist, turn or lean as a result of wind or sun and its roots may run deep or shallow, depending on the consistency of the soil and rocks beneath it. Forests respond and adapt through the gradual movements of growth and decay to environmental pressures coming from humans including irrigation, climate and urban sprawl.

Following this premise, the Sonic Kinesthetic Forest methodology involves moving together with trees. Participants of our workshops are asked to observe the particular dynamics, qualities, patterns, and shapes arising from the movements of individual trees or particular tree species, and respond to those movements through their own improvisational dancing. These movement/dance explorations often take place in forest environments where deeper connections can be facilitated, but they can also happen through creative visualization of trees when it is not practical to arrange an immersive forest experience.

Pedagogical Projects: Listening to Trees and Dancing with Trees

While our pedagogical projects took place in two different cities: Pomona, USA and Guelph, Canada, online technology allowed us to collaborate from the three locations where we teach: Toronto, Canada (Lisa Sandlos), Pomona, USA (Rennie Tang) and Paris, France (Eleni-Ira Panourgia). In particular, exchanges of ideas and facilitation of the sensory interactions necessary for our pedagogical methodologies were accomplished through video conferencing and shared media files (Figure 1).

Figure 1: The three collaborators in action

Listening to Trees

Listening to Trees was a workshop for undergraduate landscape architecture students at California State Polytechnic University (Pomona, California, USA). Workshop leaders, Lisa Sandlos and Eleni-Ira Panourgia, joined Rennie Tang and her students in Pomona via Zoom. They began the workshop by providing some insights about their respective practices and research as dancer/movement analyst and sound artist. They also shared several references for movement and sound projects that students could explore further. The primary aim of the workshop was to introduce landscape architecture students to topics and artistic works outside their own discipline to stimulate their thinking about alternative approaches to landscape design.

The presentations were followed by a series of small group activities involving the activation of word prompts. Lisa started by sharing some tree-related movement words (for example: leaning, spreading, twisting) and asked students to interpret these words through the movement of their body; they were encouraged to use all parts of their bodies as expressive instruments. Students were given some time to explore their movement interpretations in small groups and then present them in front of the camera on Zoom.

After the movement activity, Eleni-Ira gave the students another set of word prompts, this time focused on tree-related sounds (for example: rustling, crackling, absorbing) and asked students to interpret these words through sound-making. They were encouraged to use their voices, bodies, clothing or found objects to generate sounds. Eleni-Ira noted that vocalizations can be used in two ways 1) to imitate existing sounds and 2) to create more abstract sounds to interpret phenomena or a given state of an ecosystem through transforming sound qualities i.e., pitch, rhythm, density. Students were given some time to explore their sound interpretations and then present them in front of the camera on Zoom.

For the final activity students were asked to explore combinations of sound and movement. One team performed sound while another team performed movement and the playfulness of the unexpected juxtapositions and overall lively atmosphere of the room was palpable (Figure 2). It was clear that many students were taken out of their comfort zone and felt awkward using their bodies in ways they were not used to in a classroom setting. Many of them dealt with this by giggling or smiling as a way to release their nervous energy which had the effect

of creating a more uplifting energy in the room. Evident in this shift was a sense of shared resilience that encouraged students to adapt to their discomfort by doing the activity together with their peers. This activity clearly demonstrated the effectiveness of embodied pedagogy in deepening students' level of engagement, understanding and appreciation for the material they had learned through the opening presentations.

Figure 2: Cal Poly students exploring movement activity

The final project for the *Listening to Trees* seminar was the creation of a podcast episode that would feature a group of trees having a conversation with each other, with each student assigned to one tree and speaking from their own tree's point of view in first person. For example, an excerpt from one of the yet-to-be-published podcasts created by Cal Poly students features four trees talking about their 'emotions' as trees[1]. To accompany each 20-minute podcast episode students were asked to create a 1-minute video trailer for their podcast[2]. This was an opportunity for them to incorporate some of the visually-based explorations such as movement and drawing with their audio work. In the video trailer that accompanied the podcast episode above, students layered footage of tree leaves gently swaying in the wind with soft swirling hand movements followed by large arm gestures to create a clapping rhythm. This is one example of how students were able to artistically intertwine elements from each of the three disciplines to create a work that evokes emotion and reflects their deepened understanding of human-tree relations.

Working directly with sound and movement was a highly valuable experience for the landscape architecture students. Since they are more familiar with physical, rather than sensory/ephemeral, dimensions of space, these exercises open up new possibilities for non-verbal expression that can be incorporated into their future design projects.

Dancing with Trees

Dancing with Trees is the title of a choreographic piece and video project featuring youth and adolescent dancers in the Guelph Youth Dance Company (Guelph, Ontario, Canada). The dancers involved in the project were between the ages of 9 and 17. Lisa worked in the studio with the dancers while Eleni-Ira and Rennie were virtually present via a pre-recorded

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[1] Excerpt of the podcast created by Bryan Covarrubias, Brian Espinoza, Dudley Myer and Ramon Napoles: https://streaming.cpp.edu/media/Podcast+excerpt+Cal+Poly+camphora+tree/1_7c6719ya

[2] Video trailer created by Bryan Covarrubias, Brian Espinoza, Dudley Myer and Ramon Napoles: https://streaming.cpp.edu/media/Video_Trailer_Ray%2CBryan%2CBrian%2CDudley/1_k46epah4

instructional video that they had created prior to rehearsals. While Eleni-Ira and Rennie were not were not able to instruct the dancers live on Zoom due to the time differences, they demonstrated activities and appeared on the screen as if speaking to the dancers.

The structure of the instructional video was based on a forest landscape in Guelph that would be the site where the video was filmed. After learning about the forest through Lisa's descriptions, photographs, maps and online research, Eleni-Ira and Rennie developed video prompts that would help the dancers imagine themselves moving through four different parts of the landscape: field, pathway, forest and river. For each part, there was a sound-making exercise paired with a charcoal drawing exercise. Eleni-Ira invited the dancers to explore sound-making with tree branches, body percussion and vocalization activities (Figures 3 & 4). Rennie demonstrated four different expressive charcoal drawing techniques for the dancers to try on large pieces of paper laid out across the floor. The dancers were encouraged to treat the charcoal sticks as extensions of their body and to 'dance' with the charcoal.

Figures 3 & 4: Dancers performing sound-making and drawing activities

The entire sound-making and charcoal drawing session was filmed so that sections could be used for the video project. Eleni-Ira used sounds recorded during the rehearsal in the studio and in the forest as well as sounds from nearby forests, to create a sonic environment for the dance piece and the video project. The sound material was processed and arranged in response to the rhythms of the bodies and their interaction with the trees and other forest organisms.

Elements of the session were incorporated into the choreography that was created collaboratively by Lisa and the dancers. The dancers used sensory response and movement improvisation to express their relationships to individual trees. They moved to express the aliveness and interconnectedness of trees within forests and to integrate these characteristics into their own embodied experience of performing, both in the live dance production and the videotaped version of the final choreographic piece.

Working in small groups, movements emerging from improvisations were woven together to set the choreography. The older dancers developed a section using cooperative weight support combined with a series of tilts and reaches to explore the notion that forests provide a model of cooperation and mutual support - a model that human beings would benefit from emulating. They also created a section based on rising and falling to show patterns of growth, destruction and regeneration that happen in forests as the result of natural processes and human activity. The younger dancers worked with pine boughs as handheld props. They

interpreted the smells, textures and shapes of the boughs through their dancing while drawing movements of the forest and exaggerating them across the space.

The final section in the dance piece was the culmination of all of these movement motifs: all twenty-six dancers moved harmoniously together in a complex formation of rotating, concentric circles while also rising and falling, leaning and reaching, and drawing expansively in the space with the pine boughs. During the videotaping which took place in a forest environment, the participants of Guelph Youth Dance attempted to embody particular trees through movement which allowed them to imagine their role as caretakers of trees and vice versa, from a new perspective (Figure 5). The final video production, titled *Sonic Kinesthetic Forest*[3], documents the integration of drawing, sound and movement and it has been presented at multiple venues to showcase our research.

Figure 5: Dancers interacting and moving with trees

Case Study: Conference Activity

As part of our panel presentation at the European Conference of Art, Design and Education (ECADE) in Porto, Portugal in July 2022, we invited participants to experience our sonic kinesthetic methodology by moving, sounding and drawing with their body following the score below:

Movement: Close your eyes, notice the shape of your body, stand vertical like a tree, notice the exchange of oxygen and carbon dioxide through breathing, ground yourself through your feet like roots, allow swaying and free movement of upper body and arms like branches of tree, open your eyes and observe movement of the tree before you. Honor your own impulse to move and respond to the tree's movements. Touch the tree, express the sensation of touch through movement of your body, respond kinesthetically to smells and sounds of the tree.

Sound: Now imagine the sound of these textures. Try humming or whistling or mimicking sounds in other ways with your mouth or use your hands, body and objects around you to make sound to express the quality of those textures. The textures can be rough, bumpy, patchy, striated, peeling. And what about the leaves? Are they dry and crackling, are they

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[3] This video has been presented at several conferences in 2022: *Children, Youth, and Performance Conference (CYP), dance and the child: international (daCi)* and *The European Conference on Arts, Design & Education (ECADE)*: https://streaming.cpp.edu/media/SKF_FINAL_052022_1.mov/1_bf0fl2gq

rustling in the wind, are there other creatures sounding through them? Skittering, chirping, buzzing. Now imagine what it might sound like underground: what are the sounds of the roots as they reach, absorb, trickle.

Drawing with movement: Continuing your journey below the ground, trace the network of roots with your fingers, hands, wrists and arms as if you are drawing. Draw the entanglement and spreading of roots on the imaginary canvas in front of you. Gradually find your way above the ground, now using the palms of your hands side-by-side as a single thick paint brush. Move your brush upwards, pressing against the canvas in front of you so you can feel the weight of the tree trunk rising towards the sky. Once your brush reaches the canopy you can separate your hands so that you can encircle the canopy of the tree. Trace its outer shape- is it round, wide, jagged, pointy or twisted? Once your palm brushes meet at the top of the tree begin to explore the interior of the canopy, now using your fingers to create finer strokes to explore leaf margins and texture, branching patterns, and canopy density. When you are ready to bring your tree drawing to a close, bring your hands and arms into a neutral position next to your body. Feel the weight of your palm brushes dangling beside you.

The score allowed participants to imagine themselves as trees (i.e. embodiment) or to relate to the trees through their bodies (i.e. relational), while expressing their experience through movement, sound and drawing. Participants used their voices, found objects and surfaces in the room to improvise movements, create sounds and draw with hand gestures to explore dynamics of rhythm, density, texture, pressure, shape, pitch and volume. With their eyes closed, participants listened to a score that evoked sensory qualities of the experience and facilitated participant imagination. They sounded, drew and danced with their imagined trees or from the perspective of the trees. The drawing exercise added a visual component to their exploration of their imagined trees as if their hands left a residue on the surface of an imaginary canvas, making tangible the sound and movement sensations from the previous exercises.

Following the three parts of the score presented above, we invited participants to perform an improvised combination. This space of improvisation invited free experimentations with our sonic kinesthetic forest methodology whereby participants explored human-tree interactions with their bodies and imagined landscapes. Comments made by participants included the sharing of memories about trees that were familiar to them from their personal experiences. Participants also reported discovering new links between their experimentations within the sonic kinesthetic methodology and their own pedagogical and research processes in art and design.

Conclusions

We believe that new pedagogical methods for connecting humans and especially youth, more deeply to trees and forests are necessary and timely. Rather than learning about resilience through studying abstract concepts and theories, our work proposes that resilience is best embodied through interdisciplinary practices that have the potential to form multi-sensorial interactions between humans and the vegetal world. It is important for youth and all learners to experience embodied manifestations of resilience in order to further enhance their perception and appreciate the importance of human-vegetal symbiosis. As we continue this research we plan to investigate potential affinities between sonic kinesthetic experiences and Indigenous epistemologies and methodologies (Abbott, 2021b).

Our pedagogical experiments reveal the value of multi-sensorial, intergenerational and interdisciplinary approaches to environmental education. While different senses might be activated through conventional lessons in music, dance or art, it is the blending of all three sensory actions detached from a structured disciplinary framework - for example, sound rather than music, movement rather than dance and drawing rather than art - that allows for encounters and resilient juxtapositions to unfold unexpectedly. From an intergenerational standpoint, the intentional mixing of dancers of different age groups from the Guelph Youth Dance Company and the multi-year level seminar at Cal Poly created a non-hierarchical space that embraced difference and acknowledged our common aliveness as humans. Instead of dividing people up by year or competency level, a horizontal system of organization versus a vertical one evolved. Furthermore, the mixing of age groups was synergistic with the diversity of trees, in both age and species, in the forest landscape, thus reinforcing the sense of community and reciprocity that exists between all living beings. Lastly, the Sonic Kinesthetic Forest project supports interdisciplinary methods where students and collaborators are continually developing hybrid epistemologies and languages.

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Contact email: rktang@cpp.edu

Profiling the Instructional Designer: Towards a Systematization of the Profession

Carlos Rosa, IADE–Universidade Europeia, Portugal
António Gorgel, IADE–Universidade Europeia, Portugal
Rodrigo Hernández-Ramírez, IADE–Universidade Europeia, Portugal
João Ferreira, IADE–Universidade Europeia, Portugal

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Abstract
In recent years, particularly after the COVID-19 pandemic, the need to rethink learning experiences has become evident. Instructional design is a field that can contribute significantly to developing new ways of learning in digital environments; however, as a profession within the European context, it has not been regulated, nor the requirements for the practitioners of this field have been thoroughly systematized. This paper looks at instructional design and outlines the profile that a European Instructional Designer expert (EID) should meet. We contend that this person should be responsible for designing, developing, and delivering learning products and experiences and coordinating the Instructional Systems Design process. The learning products may include online courses, instructional manuals, video tutorials, learning simulations, among other digital learning experiences. We argue that Instructional Designers are poised to become key professionals in the educational domain and that, given their potential skills, they are in a critical position to contribute to the success of the 2021-2027 Digital Education Action Plan and the European Union's policy and strategy on digital and green transitions at large. The research is being developed in partnership with six European organizations (ISQe, IADE-UE, EFCoERT, EDEN, FIP, UT), focusing on developing competencies and a professional profile for the EID in line with the European Qualifications Framework Level 6. Namely, on articulating existing instructional design approaches with design methods. Ultimately, we intend to develop and empirically validate the profile and learning outputs for the EID, aiming to create a European level accredited training program.

Keywords: Instructional Design, Design Thinking, eLearning Experience, European Qualifications

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Introduction

The COVID-19 pandemic accelerated online learning at an extremely high pace. Remote teaching and learning models, which were heavily popularized by Massive Open Online Courses (MOOC) since the late 2000s and early 2010s, became a matter of absolute necessity for educational institutions across the world. The pandemic caught most of those institutions unprepared, even those who already had some form of blended model and infrastructure in place found themselves hastily reinventing their pedagogical models and training their staff to tackle the complexities of wholly remote learning. The unprecedented reliance on technologies for learning purposes forced all stakeholders, teachers, trainers, learners, and their families, onto a steep learning curve, which also showed how little digital technologies were in fact integrated into educational and training systems. Regarding the shortcomings exposed by the pandemic, the European Commission has alerted that within some Member States, "the vast majority of educators and learners had little if any experience of teaching and learning online and the different pedagogical approaches needed for this mode of instruction", and thus concluded "the crisis requires us to rethink how education and training, in all disciplines, are designed and provided to meet the demands of a rapidly changing and increasingly digital world (European Commission, n.d.a, p. 3). As countries around the world are seemingly overcoming the emergency, at least when it comes to educational responses to the pandemic, developing long-term strategies for robust digital education and training is an imperative. Instructional design thus emerges as a key field for the future of education. However, even though instructional design is not a new field, as a profession it is still struggling for recognition, needing more professional educational opportunities and recognizable experts. Due to its interdisciplinarity, the profession has been constantly subsumed under other designations, such as training course designer, designer of corporate training, instructional developer, instructional engineer, instructional systems designer, among others.

The approach used in instructional design depends on the context, the identified training needs, and the resources available (Brown & Green, 2016; Gibbons, 2014). The instructional design process involves systematic application of specific educational methods based on instructional theory and practice, to ensure the quality of instruction. Normally, the instructional design process begins with an analysis of the learning needs and objectives, followed by the development of all the instructional intervention's materials and activities, and evaluation of the different phases of instruction (University of Michigan, 2003). The systematization inherent to the development of any given instructional design project can follow several approaches. The most well know is the ADDIE (Analyse, Design, Develop, Implement, and Evaluate) framework, which is essentially a synthesis of several instructional design models, and which breaks down the instructional design process into five phases.

This paper looks at instructional design and outlines the profile that a European Instructional Designer expert (EID) should meet. We contend that this person should be responsible for designing, developing, and delivering learning products and experiences and coordinating the Instructional Systems Design process. The learning products may include online courses, instructional manuals, video tutorials, learning simulations, among other digital learning experiences. We argue that Instructional Designers are poised to become key professionals in the educational domain.

Background

Instructional design has its origins in (early twentieth century) educational psychology, and was subsequently influenced by general systems theory in the 1950s. Instructional design is an interdisciplinary area informed by cognitive psychology, communication science, design, and creative technologies, whose main goal is to develop innovative methods for education (Brown & Green, 2016). Consequently, it is common for instructional design teams to be composed of experts from different areas of knowledge, including designers, communication specialists, educators, programmers, project managers, assessment specialists, among others. The main goal of the instructional designer is the development of instructional experiences for diverse training courses, while making the acquisition of knowledge and skills more efficient, effective, and appealing (European Commission, n.d. b).

Instructional design now relies heavily on information technologies and—especially after the COVID-19 pandemic—on e-learning authoring tools. Which brings a particular set of challenges at the individual and professional levels, such as the need to maintain adequate levels of digital literacy for all stakeholders. Moreover, since current approaches to educational practices have become increasingly participatory, the specific needs and views of all stakeholders must be considered. Some learning solutions allow the beneficiaries of instructional design to actively participate in their learning process, for example by allowing them to control some of the variables involved. These learning solutions may include custom mobile and web-based software applications, augmented reality systems, online content, collaborative learning and communities of practice, games, interactive video, podcasts, research through social networks, among other technological possibilities (Cennamo & Kalk, 2019).

The QUEST Project

The QUEST (Qualifying for the Ultimate Engaging Smart Training) is a transnational project within the Erasmus+ Program. It is an Action Type focusing on Cooperation partnerships in vocational education and training. The Project began at the end of 2021 and will be developed until the end of 2023.

The QUEST project aims to contribute to the skilling of all educators in using digital technologies effectively in their teaching and training process by qualifying them for high-quality Instructional Design (ID) and contributing to the Digital Education Action Plan 2021-2027. The QUEST's specific objectives are to:

1. Contribute to the harmonisation, at the European level, of the skills of the Instructional Designer profession;
2. Facilitate the mobility of Instructional Designers at the European level;
3. Increase the capacity to develop attractive eLearning projects at the European level; and
4. Qualify professionals with previously acquired knowledge and skills in Instructional Design.

The consortium is composed of small and medium-sized organisations, such as the ISQ e-learning (Portugal), the Foundation EFCoCert (Switzerland), the Future in Perspective Limited (Ireland), EDEN Digital Learning Europe (Estonia), IADE-Universidade Europeia (Portugal), and the University of Turku (Finland).

Among the problems that the partners identified as priorities that could structure the Project are:

- the issues of (1) remote teaching and learning at a global scale;
- the need to promote (2) the green transition in education;
- the demand for enhancing (3) the quality and inclusiveness of education and training.

Concerning remote teaching and learning at a global scale, there is (a) the need to rethink the way education and training in every discipline are designed to meet the demands of the digital transformation; (b) issues related to the use of technologies for teaching and learning; the (c) lack of experience in teaching and learning online; the (d) need to improve alternative forms of education, which are flexible and promote lifelong learning; and (e) the COVID19 reality which enforced social restrictions. About the green transition in education, the consortium agrees with (f) the need to adapt existing curricula to include sustainable development goals; and (g) the urgency to promote teaching and learning experiences with lower–carbon emissions. Finally, focusing on the quality and inclusiveness of education and training, it highlighted (h) the need to systematise and implement learning experiences and digital skills for all citizens.

Our approach to Instructional Design

We adopt the view that *learning* and *experience* are closely interconnected. However, let us first consider these two terms in isolation. Learning is an ability that all humans possess; it is the process of acquiring new understanding, knowledge, behaviors, skills, values, attitudes, and preferences (Gross, 2020). The current view is that learning theories are founded on a constructivist theory of knowing. Notice that, in the introduction to The Cambridge Handbook of The Learning Sciences, Sawyer (2014, p.9) argues that "the learning sciences are based on a foundation of Constructivism (...) learning sciences research has resulted in particular findings about what support the learning environment must provide for learners to effectively construct their own knowledge.".

Constructivist learning theory proposes to explain how people know what they know. The key idea is that people construct knowledge using an active process in which experiences relate to what a person already knows. The current view of learning is that people construct knowledge based on what they already know and believe (Steffe & Gale, 1995). Thus, present-day educational theories view people as goal-directed individuals who seek information actively and build their knowledge. Furthermore, when people experience a formal education situation, they do it with prior knowledge that influences how they organize and interpret information. This collision between environment and prior knowledge impacts people's ability to memorize, reason, solve problems, and acquire new knowledge (Bransford, Brown, & Cocking, 2000).

Thus, experience is a crucial dimension of learning. Nevertheless, defining experience, on the other hand, is less clear-cut; Dewey (1980) offers a starting point, and his ideas have influenced design theory. For Dewey, actual knowledge is knowing how, rather than knowing that; in that sense, his perspective aligns with Polanyi's ideas of knowing (2005, 2009). Furthermore, Dewey understood perception not as something passive but as the participatory activity of a person interacting with the environment. Furthermore, Dewey distinguishes between an everyday experience (the mundane daily interaction with the environment) from experience, a singular event whose characteristics are linked with aesthetic quality.

So, experience refers to what can be perceived through the senses, whether information from external sources or through inner reflection. As such, experience is related to empirical observation. Given that experiences rely on sensory perception, experience relates closely to aesthetics (in a broad sense of the term), meaning what is perceived by the senses.

Given the above, we assume that people's knowledge and meaning are fundamentally generated by their experiences. As such, any pedagogical proposal has to be developed (designed) with a concern for the experience of the people involved. This is consistent with the contemporary concerns of design theory. Notice that, over the last century, the way designers think about the relationship between people and the artificial world shifted focus from the objects' form and function to a holistic concern with the overall experience the objects elicit from the people that use them (Buchanan, 2001).

How to design a *learning experience* is the heart of our focus. The overall meaning of experience design is in the name itself: it is a human-centred approach that focuses on people's experiences with the world of artefacts. Experience design is based on people's needs and feelings and also their specific contexts to design experiences that are meaningful to them. Designing a learning experience expands beyond making the interaction of the users with the designed artefacts easier, more functional, or accessible (the conventional user-centred goals mentioned in design theory); it means shaping the way people feel while experiencing an educational event. The most important consideration is that, when designing an educational service, regardless of how much the experience is prioritized, in the end, people will have an educational experience.

Furthermore, this experience is extended and multiplied across time: every web page, human interaction, and software or app will elicit a reaction from the people involved. Just recall how frustrating an experience it can be to interact with a learning management system that was poorly designed. This means that high-quality experience design requires every interaction to be well considered and solved as part of a system designed to offer a complete and coherent learning experience. As mentioned above, we are no longer focusing solely on a specific artefact but on the learning experience as a whole.

Also crucial for Instructional Design is the fact that it is not possible to separate the instructional process from the social and cultural circumstances in which the educational needs are embedded. Consequently, any instructional process is necessarily complex and cannot be approached from a linear, reductionist worldview. It follows that ID ought to be pluralist because knowledge and reality are experienced differently by every stakeholder. Therefore, a critical attitude towards the methods employed in the instructional process should be not an exception but a constant (Solomon, 2000).

It is also important to mention the advantages that rapid prototyping can bring to ID. Rapid prototyping is a recent method initially developed in the software industry that, as the name implies, focuses on short, iterative cycles of design, prototyping and testing with actual end users. Rapid prototyping brings a more empirical and constructive view to problem-solving and leverages the entire systematization process with a more democratic approach that incorporates more opportunities for everyone involved to participate throughout the design process (Brown & Green, 2016).

The European Instructional Designer professional profile

The EID professional profile in focus is based on the existing knowledge in ID, which originated in the early twentieth century in educational psychology and was later influenced by general systems theory in the middle of the same century. Subsequently, ID was informed by other areas of knowledge – psychology, communication, design, and information technology – becoming an interdisciplinary territory, welcoming specialists from different areas. It is essential to mention the ADDIE framework (Analyse, Design, Develop, Implement, and Evaluate) for developing a given ID project, which represents the basis from which the notion of the instructional designer was expanded, to create the EID professional profile.

In parallel, it is proposed to cross the principles that characterise the ADDIE systematization process with the Design Thinking methodology (Empathise, Define, Ideate, Prototype, and Test), whose primary focus is the cognitive approach used by designers in the human-centred design approach. The synergy between both processes allows for deepening the existing knowledge in ID, creating an innovative framework for the EID.

In this context, the ID initial phase is marked by the analysis of the problem and the associated lack of instruction. Understanding the socio-cultural and educational context through an empathetic approach is fundamental. The data collected in this phase must be processed to allow a straightforward reading of the identified instructional needs and all implied for good planning and systematization. This is followed by the phase of ideation and development of educational content that enables the best possible learning experience. The next step, dedicated to the instruction implementation, begins with an experimental approach: prototyping the instructional service to prepare the context where the learning experience takes place. Finally, in the testing and evaluation phase of the entire instructional process, its resources and methods, it is possible to understand the tested approach, which enables necessary corrections and improvements. This last phase occurs iteratively and is repeated until a quality instructional model can be implemented.

Based on the interdisciplinary sphere of ID, as well as the ADDIE and Design Thinking processes, the logic used for the creation of an EID professional profile is based on the inclusion and adaptation of a set of competency frameworks with proven relevance in the European Community, to emphasise the holistic nature of the professional profile in question. The primary reference is the document entitled (1) European Skills/Competences, qualifications, and Occupations (ESCO) for the Instructional Designer; followed by other relevant references: (2) Design perspectives: design skills strategy, elaborated by the Design Council, (3) OECD PISA global competence framework for students in an interconnected world, (4) EntreComp: The Entrepreneurship Competence Framework, by the European Commission, (5) DigComp 2.0: The Digital Competence Framework for Citizens, by the European Commission, (6) GreenComp: The European sustainability competence framework, by the European Commission.

In addition to scientific knowledge, the necessary competencies are defined, namely the specific personal and social skills that enable a quality performance. With a transversal nature, it is also essential to mention the innovative character, responsibility, and autonomy that the EID must demonstrate to implement and manage professional situations of great complexity, in particular, the creation of educational experiences of unparalleled quality and the mission of guiding the professional development of specific individuals and groups.

Considering the mentioned frameworks, the EID professional profile is defined through four essential Learning Outcomes: (1) scientific and empirical knowledge and skills, in the areas of Instructional Design, Cognitive Psychology and Psychology of Learning; (2) Design skills and mindsets for problem-solving and Human-centred design; (3) ICT knowledge and skills for developing digital learning experiences; and (4) multifaceted cognitive, socio-emotional and civic skills towards intercultural development and collective well-being.

These Learning Outcomes are transversal to a set of Competence Units (CU), described below, that define the EID professional profile, namely: (1) Foundations for ID 101; (2) Learning Methodologies; (3) Design Considerations; (4) ID Development; (5) ID Implementation; (6) ID Evaluation; and (7) Project Management.

Foundations for ID 101

In this CU, learners must understand ID as an iterative design process that produces instructional solutions to solve the audience's problems by interacting with the given environment (i.e., the existing faculties, tools, and resources) and interpreting the other CUs as an iterative ID process. Learners should also understand ID as a process of applying scientific learning principles to provide effective instructional solutions.

Another essential foundation is the development of the ID identity as a continuous-developed profession actively engaging in creative and holistic design, interdisciplinary collaboration, and intercultural communication. Finally, developing awareness of the different roles of technology in instructional design is also meaningful within this CU.

Learning Methodologies

In this CU, learners are expected to translate the customer needs and requirements to learning and pedagogical needs. They should also generate the instructional solution based on scientific learning principles through an iterative problem-solving process and convert the instructional solution into a learning path for detailing the ID. Also fundamental is developing the instructional designer identity to engage in the ID system with interdisciplinary and intercultural perspectives.

Design Considerations

In this CU, learners should translate the learning path idea to a storyboard that will be later used in the development stage. They should also align the storyboard with the Learning Methodologies CU, providing instructional functions in a product. Also critical is
learning to prepare the templates for collecting the content from clients, which will then be transformed into a learning product.

ID Development

In this CU, learners will create desirable, convenient and enjoyable learning scenarios that enhance the learning experience—followed by implementing content development processes that allow for flexible outcomes based on the users' needs. Finally, design learning products that deliver high-quality learner experiences through multimedia are expected.

ID Implementation

In this CU, learners should prepare the instructional process's learning environment and engagement approach. They should also organise the instruction materials and set the necessary conditions for both the teacher and the learners. Within this phase, the quality of the instructional materials review is also expected, and the learning setup involves the client.

ID Evaluation

In this CU, learners will define and apply quality criteria for all the ID stages. They should prepare evaluation tools that assess the quality of the learner experience of both teachers and learners. Also important is reviewing the evaluation outcomes to improve and modify the ID processes.

Project Management

In the last CU, learners will become aware of the importance of adopting a systematic approach to effective project management. They should know the different areas involved in project management (scope, time, budget and cost, HR, risk and communication) and the impacts of mismanagement of an ID project. Finally, learners are introduced to the main processes, techniques and tools to support their project management.

Conclusions

The EID professional profile results from a holistic learning experience, in which the qualified professional gather the necessary scientific and empirical knowledge, which will allow him/her to intuit, reflect, design, and implement specific instructional actions in the context of different socio-cultural dynamics, involving students and their contexts.

The European Instructional Designer (EID) professional profile presented in this document results from a set of determinant factors. First, it is essential to consider the existing knowledge in Instructional Design (ID), which originated in the early twentieth century in educational psychology and was later influenced by general systems theory in the middle of the same century. Subsequently, ID was informed by other areas of knowledge—psychology, communication, design, and information technology—becoming an interdisciplinary territory, welcoming specialists from different areas.

It is essential to mention the ADDIE framework (Analyse, Design, Develop, Implement, and Evaluate) for developing a given ID project, which represents the basis from which the notion of the instructional designer was expanded, to create the EID professional profile. In parallel, it is proposed to cross the principles that characterise the ADDIE systematization process with the Design Thinking methodology (Empathise, Define, Ideate, Prototype, and Test), whose primary focus is the cognitive process used by designers in the human-centred design approach. The synergy between both processes allows for deepening the existing knowledge in ID, creating an innovative framework for the EID.

Acknowledgements

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The Role of Advanced Typographic Taxonomy Systems *Vis-à-Vis* Modular, Variable and Parametric Typography

João Francisco Rodrigues Gomes, CIAUD, Research Centre for Architecture, Urbanism and Design, Lisbon School of Architecture, Universidade de Lisboa, Portugal
João Aranda Brandão, CIAUD, Research Centre for Architecture, Urbanism and Design, Lisbon School of Architecture, Universidade de Lisboa, Portugal
Teresa Olazabal Cabral, CIAUD, Research Centre for Architecture, Urbanism and Design, Lisbon School of Architecture, Universidade de Lisboa, Portugal
Elisabete Rolo, CIAUD, Research Centre for Architecture, Urbanism and Design, Lisbon School of Architecture, Universidade de Lisboa, Portugal

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Abstract
Typographic taxonomy systems categorise and describe the vast *corpus* of typefaces, created over centuries, and are used in teaching, commercial and professional settings. Mainstream taxonomy systems usually focus on separating neatly defined, text-bound typefaces into discrete classes, while grouping a huge diversity of display-bound typefaces and other outliers into loosely defined, generic classes. Modular and geometric typeface specimens are extremely varied and sometimes stylistically hybrid. Similarly, variable and/or parametric OpenType font specimens can cover a stylistic gamut potentially larger than those from simple typeface families or even multi-style, sans-serif+serif superfamilies (such as Rotis, Scala, etc.). The largely dominant mainstream taxonomy systems, with their typically simplistic and single-class categorisation processes, inadequately cover these complex typefaces. Moreover, the latter are used both academically and professionally, for expressive media and, particularly variable and/or parametric typefaces, also for running text (whose readability is, opposingly, paramount). The ever-increasing popularity and variety of these typefaces further exacerbates the inadequacy of mainstream taxonomy systems for academic and professional scenarios. Using advanced taxonomy systems would address these otherwise unavoidable issues and, thus, improve typography teaching, distribution of new typefaces, and typeface selection by professionals from within their already acquired/licenced collections. As a specific solution to these issues and their consequences, we present a theoretical approach, using a non-interventionist methodology of qualitative research, via literature review and observation, analysing potential advanced alternatives to mainstream taxonomy systems and proposing a further extension, in line with Brandão et al.'s 2020 proposal, to Dixon's own purposely extensible, multi-class-tagging, parametric/descriptive system from 2002.

Keywords: Typography, Typeface Classification, Typeface Taxonomy, Modularity, Modular Fonts, Variable Fonts, Parametric Fonts, OpenType Fonts, Font Distribution, Teaching

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Introduction

Taxonomy systems, such as the one pioneered by Linnaeus, aim to increase the understanding of complex universes, through the descriptive categorization and grouping of its members and the consistent teaching and usage of the literal and mental vocabulary derived from those processes. Typography, a field with more than five centuries of history, during which thousands upon thousands of typefaces were – and are still being – designed, is one such universe.

The origins of typographic taxonomy can be traced back to Sigismondo Fanti's compilations of different alphabetic styles in his calligraphy and lettering manuals (Fanti, 1514; Fanti et al., 1532), specifically to the naming scheme of the different specimens presented therein. Such styles would not necessarily be named as such by their original creators in their respective settings, instead simply being labelled as monumental, formal or running hands. However, the complexity which arose from their grouping in bespoke educational publications forced Fanti to categorize them according to their disparate historical and/or geographical provenance, as well as their structural characteristics.

The advent of modern typographic taxonomy as we know it is, it should be noted, a more recent phenomenon, and quickly evolved from its inception in the mid 19th century onwards, from the first attempts by De Vinne, Thibaudeau or Warde (Cabral, 2014, p. 68). The latter would, notably, be among the first scholars to recognize the limitations in her peers' work, namely the focus mainly on classic naming conventions instead of on structural details (Warde, 1935, pp. 121–122), and to attribute the creative explosion in the field of typography to advances in the means of production such as those by Benton (Warde, 1935, pp. 122–123; cf. Cost, 1994), anticipating the observations by Hoefler (1997) by more than half a century.

Challenges to Taxonomy Systems: Display Fonts, Font Families, Type Systems and Parametrization, and an Upcoming Paradigm Shift

Categorising modular and geometric typefaces, as defined by Gomes (2019b) and Brandão & Gomes (2020), has long been a fraught affair, on account of their structural deviations from the main Latin script archetypes, which make them display typefaces but not necessarily uncategorisable with those archetypes in hybrid, fringe cases. Likewise, the up-and-coming variable typefaces can span a gamut potentially larger than that heretofore reserved to outright separate typefaces from different epochs and/or styles or, at best, superfamilies including stylistic variants, such as *Scala* (Fig. 1), *Rotis* (Fig. 2), etc.

FF Scala Serif   Rotis Serif

Rotis Semi Serif

Rotis Semi Sans

FF Scala Sans   Rotis Sans

Figure 1: *Scala* (Majoor, 1991); Figure 2: *Rotis* (Aicher, 1988).

The heavy investment on both modular and variable typeface creation technology and on the promotion of the resulting specimens, and their ensuing apparent popularity, brought us to a typographic culture of fringe cases not unlike that from the Victorian era, and the inadequacy of the extant systems greatly hinders the tasks of teaching typography and type design theory alike, distributing typefaces and picking already owned ones. On a related note, our own students have indeed already presented us with such specimens in their creative assignments (Figs. 18 and 19), making the teaching of strategies to better contextualize, understand and make use of these typefaces an urgent matter.

We must also provide some historical context on the strictly technical side of the designing and implementation of variable and parametric type specimens, namely on type systems and earlier experimental examples. These specimens, namely those of the modular and geometric kind, extend as far back as the early 20th century, and became a staple of aesthetic vanguards and other speculative exercises (Figs. 3, 4 and 5).

Figure 3: *Kombinationsschrift „3"* (Albers, 1931, 2014).
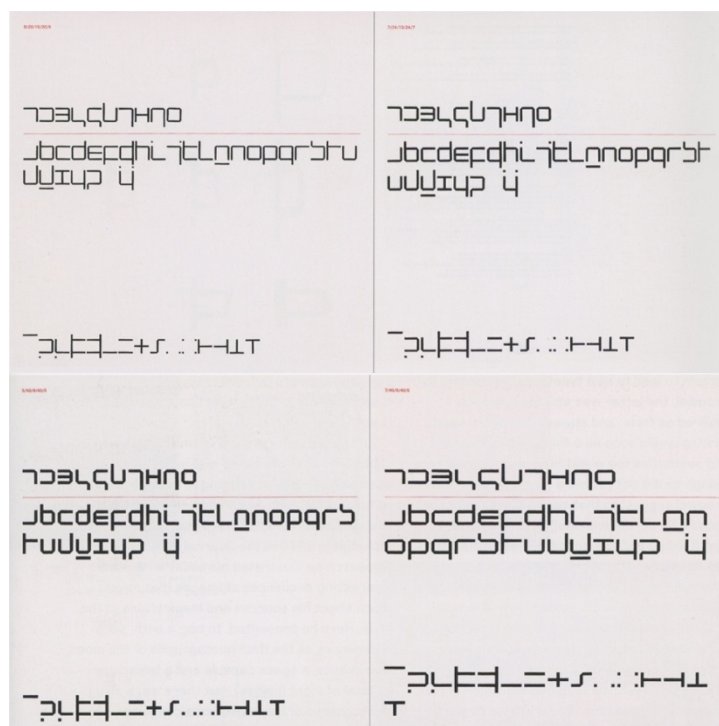
Figure 4: *New Alphabet* (Crouwel, 1967, apud Huygen, 2015, p. 321).
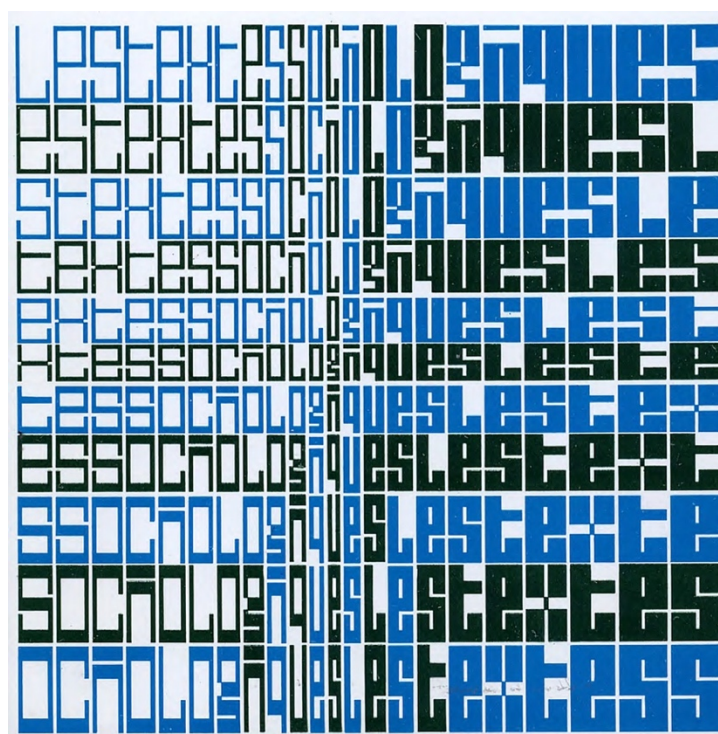
Figure 5: *Textes Sociologiques* (Schrofer, 1968, apud Huygen, 2014, p. 334).

Another important milestone towards true variability was the discrete and static parametrization of typefaces into type systems, or super-families, as defined by Frutiger (1989, p. 181) (Fig. 6), Aicher (2015, pp. 75, 175–178) (Figs. 2 and 11), Majoor (2004, 2010) (Figs. 1 and 10) or Bil'ak (2012) (Fig. 7). By virtue of being made up of separate fonts, first in physical form and later as digital files, their categorization was still an uncontroversial and simple affair.
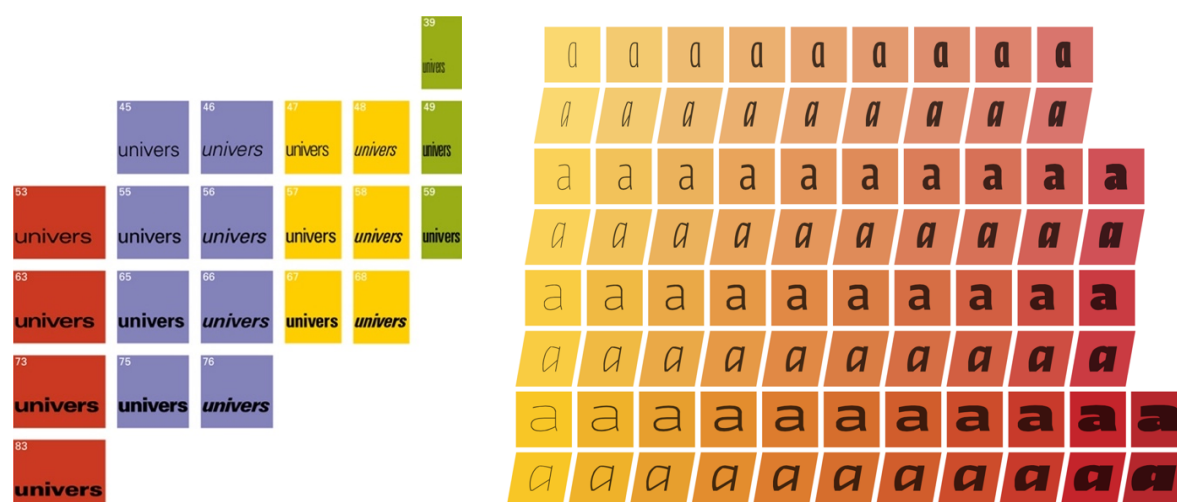
Figure 6: *Univers* (Frutiger, 1955, apud Donley, 2015); Figure 7: *Greta Sans* (Bil'ak, 2012).

Conversely, modular, variable and parametric typefaces are much more complex than type systems, as they fit all potential variants into a single font file or an extremely reduced number thereof.

By their very nature, complex creative activities such as typography will end up birthing novel ideas and approaches, to which scholars will often end up playing catch-up. One of the broad fields whose proper and well-deserved categorization coverage is long overdue is modular, variable and parametric type design. The niche status of both these sub-universes, modular/geometric, and variable/parametric type design, motivates said lack of coverage.

However, their diversity and popularity in both commercial and educational settings justifies a change to the status quo and motivated us to initiate that very process. Furthermore, with the momentous decision by the Association Typographique Internationale of recalling the endorsement of their own very popular and longstanding typeface classification system Vox–ATypI, based on the earlier work of Maximilien Vox (Association Typographique Internationale (ATypI), 2021), opened a privileged window of opportunity for other systems to gain momentum, and it is our hope that our proposals may be among them.

Our main goal is, thus, to be able to properly integrate these fringe typefaces into appropriate typographic taxonomy systems, in order to better teach their design and ensure their commercial distribution.

Two Different Approaches to Taxonomy Systems: Container-like and Database-like

Even in a field as complex as this, we can already make some sense of it, in a meta-taxonomy of sorts, and separate taxonomy systems into two large families. Both families obviously have their own strengths and weakness, but we shall put in evidence which one is more suitable to solving the issue at hand.

The most common, well-known and used systems, including the aforementioned Vox–ATypI (Fig. 8) or British Standard 2961:1967 (Fig. 9), are those which we call **Container-like**. They follow a traditional model, not unlike that seen in biological taxonomy, in a "'top down' approach" (Dixon, 2002) which neatly packs typefaces into separate boxes. These containers can vary in specificity and granularity but cannot even fit and describe the complexity of display typefaces from the Victorian, Modern, or Postmodern design eras, let alone the

ongoing creative explosion in contemporary type design without becoming infinitely complex and unsustainable themselves.
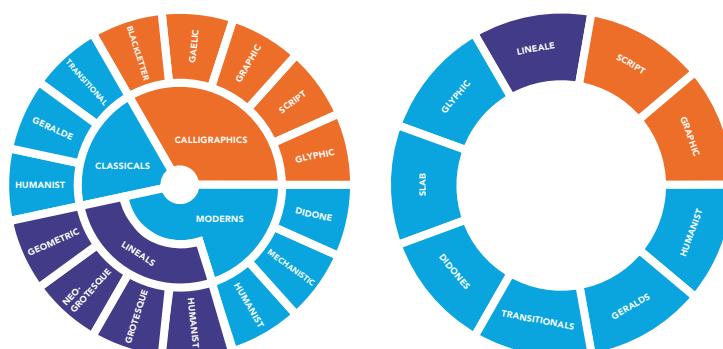
Figure 8: Vox–ATypI (1962); Figure 9: BS 2961:1967 (1967) (Childers et al., 2013, pp. 4, 6).

The other family of systems is that of the **Database-like**. These take a different approach, based on tagging, and the kind of frameworks they are made up of are much more flexible and future-proof by design, if apparently more complex at first sight. We should mention, however, that some conventional systems started out as hybrid or at least offer some added degree of complexity that transcends their containers. For instance, Dixon (2002) points out that Vox's initial system would actually be more akin to a database-like system, as it would allow for any font to belong in more than one category. This would still not be enough to tackle the current and future typographic corpus, however.

In a similar vein, Updike's system (Fig. 10), while fairly conventional and apparently Container-based, separates eras and geographic origins (Childers et al., 2013, p. 3), as if organizing its sub-variants on an "axis" of their own. This time and space principle makes it a **Hybrid** of sorts, and might indeed provide a workable blueprint for modular, variable and parametric typography as other separate "axes"[1]. But, besides the heavy criticism it drew from (1997, pp. 61–62), it would still not be enough to accurately describe those specimens in detail.
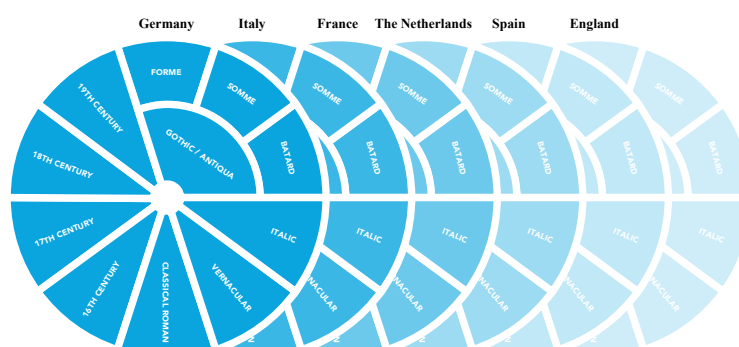
Figure 10: Daniel Berkley Updike's system (1922) (Childers et al., 2013, p. 3).

Kupferschmid's system, on the other hand, is completely **Database-like** and **Tag-based**, in a spirit of micro-classification which can even be user-generated, and follows a form model derived from Noordzij's letterform theories (Kupferschmid, 2012). These include Noordzij's

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[1] In the context of this paragraph, the term "axis" and "axes" refer to Updike's system itself as a concept and visual object, as a diagram (Fig. 10), and should not be confused with the modern concept of axes introduced with Variable typefaces (see note 2).

3-axis parametric cube (Noordzij, 2005, pp. 75–59) (Fig. 17), a trend-setter for the definition of "axes" in variable and parametric typography[2]. Accordingly, Kupferschmid separates tags into the bones level – that is, the skeletal shapes of the characters –, the flesh level – which include the presence or absence of contrast and finishings –, and the skin level – which pertains to the specific looks of said finishings (Fig. 11). For added context, skeletal shapes are the centrelines of strokes – a concept already put forth by Johnston and further solidified by Frutiger (1989, pp. 200–203) (Fig. 12), Majoor (2004, 2010) (Fig. 13) and Kunz (Fig. 14) –, contrast is the variation between thick and thin strokes, and finishings can be certain details such as serifs in general, hooks, or teardrop terminals in characters such as f, r, etc.

Figure 11: Bones, flesh and skin model (Kupferschmid, 2012).

Figure 12 (Frutiger, 1989, p. 202); Figure 13 (Majoor, 2010); Figure 14 (Kunz, 2003, p. 20).

Impressively, Johnston (1906, pp. 70–72, 114–115, 237) devised such a system at the beginning of the 20th century for his models of lettering, describing them in a hierarchic, numbered list with all their structural and decorative details (Fig. 15). In her much later and rather similar system, Dixon (2002) would also take the Database route, proposing a hierarchical model of analysis (Fig. 16). This new description framework is comprised of sources, that is, the historical influences behind a letterform, formal attributes, which are literally a very detailed of all the relevant shapes in a typeface, and patterns, which are common and recurring combinations, or archetypes, of the former two parameters in separate typefaces across history or even in the same time period. This system also stands out for its inherent expansibility, by design, in a very conscious and targeted effort by the author.

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[2] Noordzij's novel definition of "axes" pertains exclusively to the letterforms themselves (Fig. 17), and not necessarily to the visual representation of the categories in the systems based on it, or to other factors such as geographic or historical provenance of typographic specimens.

Figure 15: Analysis sheets from early Database-like system (Johnston, 1906, pp. 72, 115).
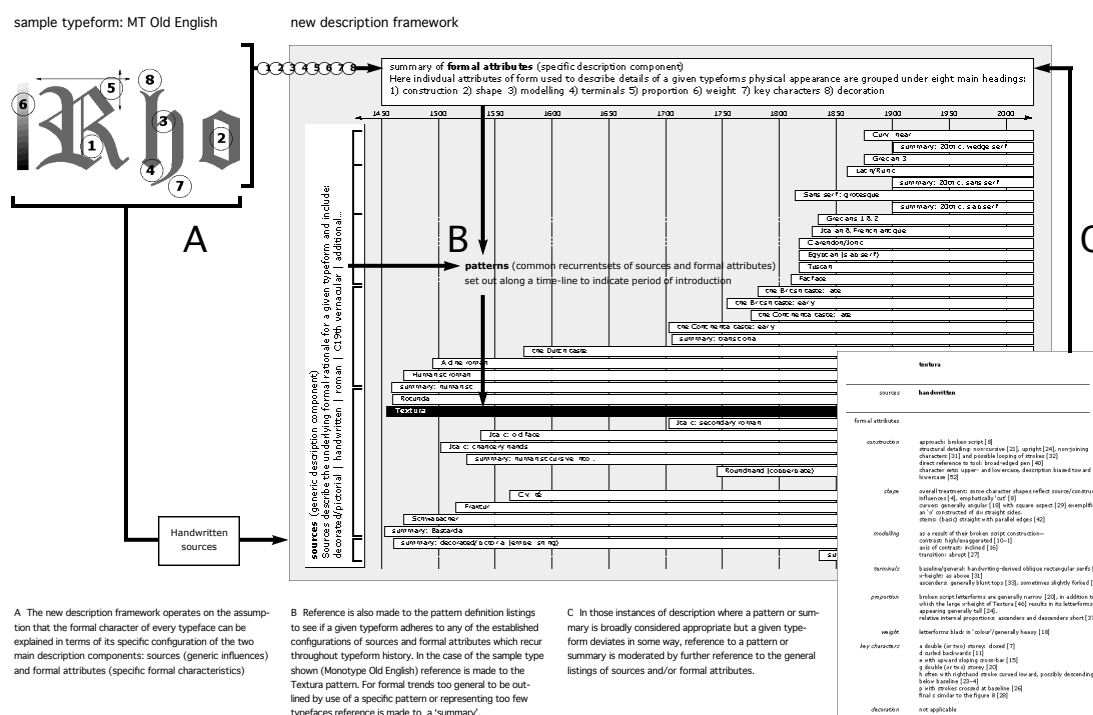
Figure 16: Database-like system and analysis sheet (Dixon, 2008).

Analysing Container-like and Database-like systems

We are currently confronted with technical deficiencies in the most popular typeface taxonomy systems used in commercial and educational settings, which devolve into matters of fairness and inclusiveness or, better yet, their lack thereof. Those systems are not inclusive of these fonts and cannot properly describe or represent them. The main trend is a complete

lack of dedicated Variable and Parametric categories, or tags, and, per Brandão et al. (2021), also of Modular and Geometric tags, which would then force us to put all of these typefaces in generic and, thus, unsuitable categories, even if nominally correct.

Regarding **Container-like** systems, these can already accommodate different members of a single, conventional type family in corresponding categories, by virtue of those typefaces' static quality. However, this separation is not ideal, and these seems have obvious limitations even when it comes to certain specimens with hybrid finishing configurations, such as Aicher's *Rotis Semi Sans* (Fig. 2). Variable and Parametric-related terms are, on the other hand, completely absent, which means that there is no ambiguity present, but also means that they are even less visible than Modular and Geometric typefaces if they are not strictly display, or decorative typefaces on their own. As for **Database-like** systems, especially the most recent ones, this omission feels more like an oversight. However, they also contain, by design, the mechanisms to accommodate these typefaces, on account of the lofty goal of accommodating any present and future innovations.

Considering the former, we are, thus, at a crossroads: we can either use **Container-like** systems or simpler **Tag-based** systems, and add to them the necessary categories for Modular, Variable and Parametric typography, while allowing for the original tags or categories geared for conventional type design, in a strategy comparable to Updike's, or go for a **Database-like** system and add to it all the necessary Variable and Parametric Type categories.

This will allow for an extremely fine degree of detail and, and while probably better suited for expert users' daily usage, it could still be simple enough for novice designers to understand as a primer, especially considering how interactive and immediate the experience of playing with Variable and Parametric typefaces in design applications, such as Adobe Illustrator™, or on on-line digital typeface stores and other distribution platforms can be.

We have decisively moved towards the second family, that of **Database-like** systems. And judging them on their technical merits, Dixon's seems to be more encompassing than Kupferschmid's, as it can indeed, if desired, include Noordzij's theories as well, but is not dependent on them by design. As we saw, Noordzij's system (Fig. 17) only encompasses three calligraphic axes, which is clearly not enough to describe the ever-expanding complexity of variable typefaces and their sometimes not so conventional axes.

Figure 17: 3-Axis parametric cube model (Noordzij, 2005, p. 79).

This system was and is used for interpolation purposes during the type design process, such as the one described earlier for typeface systems (Figs. 6 and 7), with which type designers generated static, finished instances, or separate font files, from discrete points on those axes.

The ongoing variable typeface revolution comes down to these type designers handing over some degree of control to end-users, thus allowing them to pick any intermediate value in those axes' continuums and create, on the fly, extremely fine-tuned, bespoke combinations which would otherwise be unfeasible or uneconomical to set in stone beforehand.

Regarding this combination of flexibility and complexity and for reference, we present examples of exercises by students of ours, respectively making use of *Arizona* (Hanzer, 2021) (Fig. 18), a typeface which can smoothly transition from Sans-Serif to Serif – making the process of categorizing Rotis appear outright simple by comparison –, and making use of *Fit* (Ross, 2017) (Fig. 19), a variable geometric typeface, which bears no relation whatsoever to calligraphy. We also call into attention *Cheee* (Edmonson, 2020) (Fig. 20), a typeface whose axes its author mused on naming after marijuana-related themes.
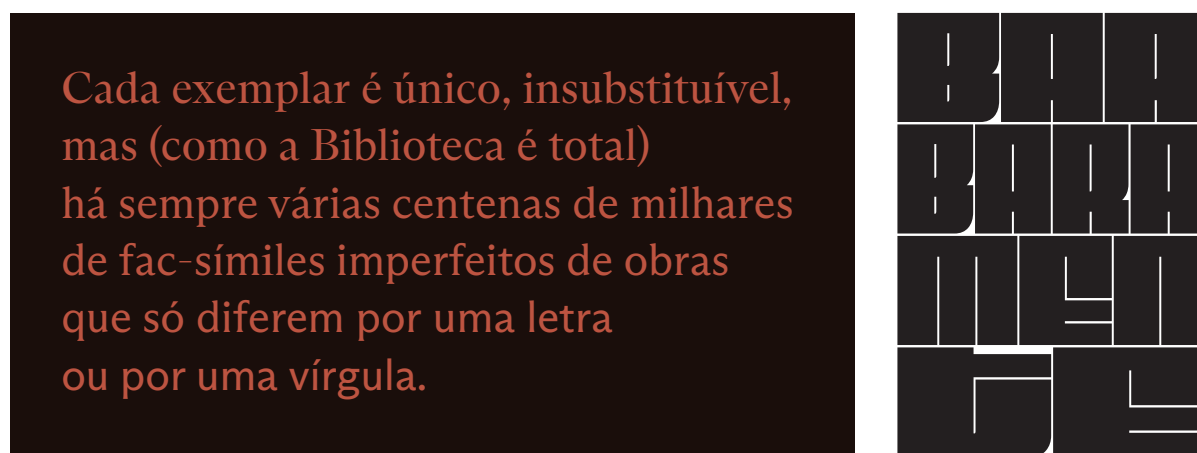
Figure 18: *Arizona* (poster by A. Carmo, 2021); Figure 19: *Fit* (poster by M. Matias, 2021).

Figure 20: *Cheee* (Edmonson, 2020).

After careful consideration, **Dixon's system**, which was already the previous target for expansion by at least two of the present authors when it came to adding Modular and Geometric Type-related categories to an existing system (Brandão et al., 2021), is similarly our prime pick for the analogous process pertaining to Variable and Parametric typefaces.

On Expanding an Existing Taxonomy System with Variable and Parametric Type Categories and Axes

We propose, thus, the addition to Dixon's system of the following headings and submenus to the formal attributes framework, including the definition of the absolute limits of its axes and any relevant intermediate points or ranges: **Variable**, as a construction approach; **Shape Axes** pertaining to the general formal and positional aspects of letterform components, such as **Curve**, **Stem**, etc., as well as **Ink Trap Width** and **Depth**, **Formal/Casual** and **Regular/Distorted**; **Modelling Axes** dedicated to **Angle of Contrast**, **Angle of Slant**, and separately to conventionally **Thick** and **Thin Strokes**, which allow a current trend of emulating Victorian-like, reverse-contrast typefaces; **Terminals**, or **Finishings Axes**, such as **Serif Length**, **Thickness** and **Shape**, and **Swash Length**; **Proportion Axes**, such as

Character Width and **Height**, which look to be increasingly popular and setting another aesthetic trend; **Weight Axes**, such as **Weight** and **Optical Size**; and Axes dedicated to **Key Characters** and **Decoration**, such as **Shading**, **Bevel**, etc., if applicable.

We can also identify trends in specialized applications and, accordingly, suggest entirely new headings such as **Animation** (as the existence of a format which allows for several different instances in a single file lends itself to those), or **Legibility**, for readers with special needs, or any other new Headings and Axes which are deemed relevant, which will be actively encouraged as an ongoing debate in academia and in the industry.

Furthermore, all these Headings and Axes are fully compatible with our earlier extension to Dixon's proposal, focused on Modular and Geometric Type design, and even with grid-based fonts, provided that the intermediate values which allow the resulting proportions to fit on grid units and subdivisions are patently stated.

Also of note, from the combination of these formal attributes and recurrent references we can already identify a few already existent Variable- and Parametric-specific/enabled patterns or, more exactly, real-world application patterns, such as the *'randomly extended characters on the width axis'* seen on the following examples (Figs. 21, 22 and 23).
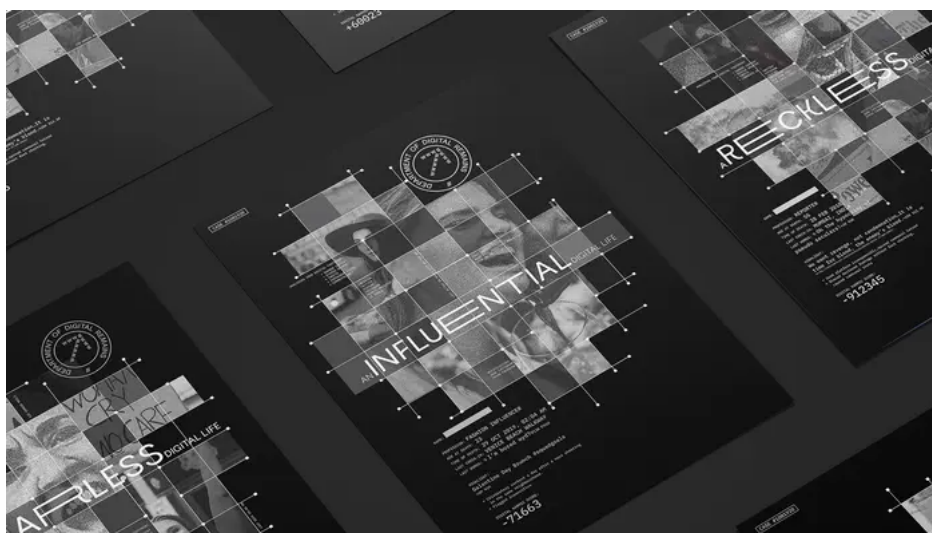
Figure 21: *Bandeins Strange* (Müsgens, 2019; Nair, 2021).

Figure 22: *MEO Text* (Alves, 2015; Altice Portugal, 2020).

Figure 23: *Lusofonia Record Club* (Folchini & Silva, 2021; the Authors, 2022).

Another such variable- and parametric-facilitated pattern is the ***'reverse contrast'*** (Figs. 24, 25 and 26), which can be very broad and unconventional (Fig. 26) and depend on just Axes being pushed to their limits. Furthermore, these formal attributes do not preclude variable fonts from adhering to conventional references and, thus, from belonging to conventional patterns as well, as the Variable and Modern/Uncial hybrid *Escura* (Fig. 27) attests.
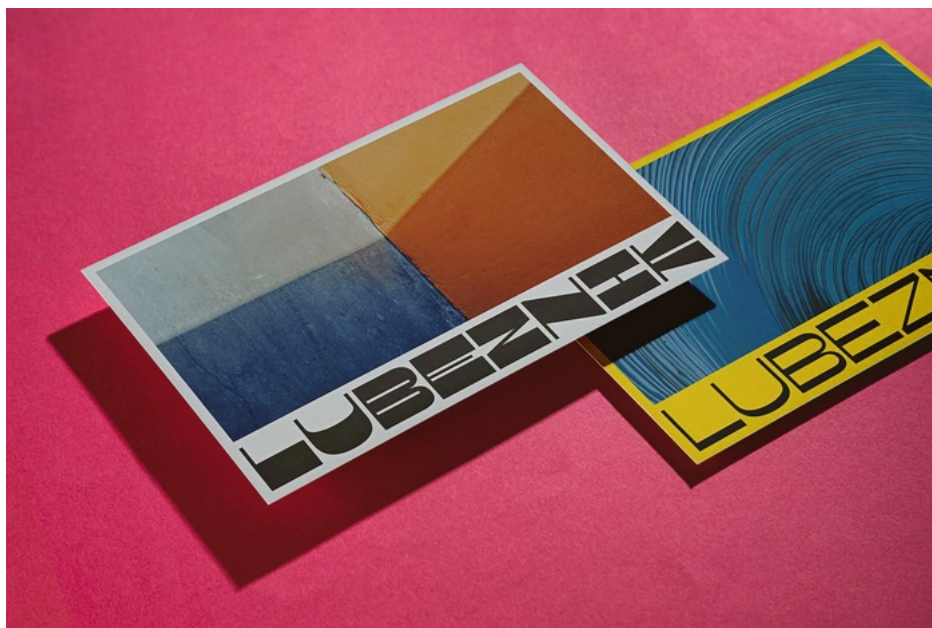
Figure 24: *Lubeznik Display* (Miller, 2021).

Figure 25: *Shrill* (Midzic, 2019).

REVERSE CONTRAST

Figure 26: *Cheee* with reverse contrast (Edmonson, 2020).

OST ESCURA, A FONT WITH SWASH EXTENSION AXIS

Figure 27: *DSType Escura* (Leal & Santos, 2022).

Testing the Proposed Extensions

We present the proposed extensions to Dixon's system (Fig. 16), including those earlier set forth by Brandão et al. (2021), in Appendix A, and a preliminary test of them aiming to cover the maximum variety thereof, having chosen, for reasons of economy, *Fit* (Fig. 19), a specimen which would elicit the need for those related both to modular and geometric typefaces, and to variable and parametric ones, also presenting it in Appendix B.

The system in its current did not reveal itself to be much more complicated to use than the earlier extension, having only required, in *Fit*'s case, the installation of the variable font file, generously provided by DJR type foundry, and its testing in Adobe Illustrator™, in order to check the width axis values against the corresponding family member/weight names.

Conclusion

More than just serving as an end into itself, categorizing modular and geometric, variable and hybrid typefaces also serve important practical goals, especially if this process is done in a streamlined, systematic and potentially even standardized fashion – as much as the diversity of the corpus under scrutiny allows.

The benefits of the usage of advanced systems such as these can be twofold: on one hand, being able to properly analyze novel or otherwise unconventional typefaces allows researchers, educators, students and professionals alike to better understand and make use of them. This factor is especially important considering how the freedom and flexibility afforded by variable typefaces has the potential, in the not-too-distant future, to break established conventions on a wider scale. These conventions, along with classic typographic taxonomy systems, however, do not necessarily have to be abandoned; quite the contrary, as they predictably will still inform all researchers, educators and practitioners even in a future where they might be rendered obsolete.

On the other hand, on the commercial side of things, the ability to understand, appreciate and make use of the existing typographic corpus more critically may trigger an increase of both

supply and demand of good quality modular, geometric, variable and parametric typefaces, which, in turn, may also justify the need of advanced typographic taxonomy systems as discovery devices on digital typographic foundries and distribution services.

There is, more than ever, an ongoing, lively debate on this topic, including during the presentation of this very research with Amado, who suggested CEDARS+ (Chahine, 2021) as a more appropriate system both for academic and commercial settings, and as a vital component in future editions of SLOType (cf. Amado et al., 2021).

As such, we intend, on future Advanced Typography classes and editions of the Calligraphy and Modular Typography workshops at Universidade de Lisboa, to test both our system and the suggested alternative (and, time allowing, others which may arise as viable), along said classic systems, and present our findings at a subsequent edition of ECADE or at a similar venue, and/or as part of the corresponding author's PhD research project.

As an added vector of testing and dissemination, the corresponding author and dos Reis Duarte, one of the members of the former's PhD supervising team, intend to take their combined typographic corpus (Rangel et al., 2016; J. F. R. Gomes, 2016, 2017a, 2017b, 2018, 2019a, 2021) and invite other up-and-coming type designers in order to create a digital type foundry of their own, in which this system, a variant thereof or some of its elements may be part of the tools provided to prospective customers.

Acknowledgments

Appendix A: Model of Advanced Taxonomic Analysis Sheet

construction
> approach: variable
> axis [n]'s limits:
> axis [n]'s relevant steps:
> structural detailing:
> direct reference to tool:
> character sets:

grid (if applicable)
> kind:
> module snapping:
> character snapping:

shape
> overall treatment:
> curves:
> stems:
> shape axis [n]'s limits:
> shape axis [n]'s relevant steps:

modelling
> as a result of its […*] construction– contrast:
> contrast axis's limits:
> slant axis's limits:
> thick stroke axis' limits:
> thin stroke axis' limits:
> transition:

[*fixed, short description/*variable, described by the following axes]

terminals
> baseline/general axis [n**]' limits:
> x-height axis [n**]' limits:
> baseline/general axis [n**]' relevant steps:
> x-height axis [n**]' relevant steps:

[**serif length, thickness, shape, etc.]

proportion
> character width axis' limits:
> character height axis' limits:
> ascenders axis' limits:
> descenders axis' limits:

weight
> weight axis' limits: …
> weight axis' relevant steps: …
> optical size axis' limits: …
> optical size axis' relevant steps: …

key characters
 …

decoration
 shading axis' limits:
 shading axis' relevant steps:
 bevel size axis' limits:
 bevel size axis' relevant steps:
 decoration axis [n]'s limits:
 decoration axis [n]'s relevant steps:

animation
 loop duration: [n] frames

legibility
 reading distance axis' limits: …
 symmetry/asymmetry axis' limits:

Appendix B: Advanced Taxonomic Analysis Sheet for *Fit*

construction
　　approach: variable, modular and geometric
　　structural detailing: non-cursive, straight, unconnected characters, most horizontal stems are close to baseline in neo-Art Déco style
　　direct reference to tool: n/a
　　character sets: monocase, with mixed-case characters

grid
　　kind: orthogonal, irregular with fixed-width/height gutters equal to horizontal countershapes, linearly variable fields on the x-axis and dependent, non-linearly variable fields on the y axis, without field subdivision in either case
　　module snapping: module edges line to the grid and skeletal forms line to fields
　　character snapping: staggered (non-monospaced) and fixed (to the fields) except for M, W, I, and 1 (one)

shape
　　overall treatment: most characters present a squared, blocky look.
　　curves: some characters feature perfect-arc rounded corners with constant radius, on the upper-left and lower-right corners of applicable strokes, for disambiguation purposes
　　stems: (basic) straight with parallel edges
　　width axis's limits: 1 to 1000 (1:1 ratio to 77,5:1 ratio in relation to gutter width)
　　width axis's relevant steps: 1 (Skyline), 10 (Compressed), 27 (Extra Condensed), 56 (Condensed), 110 (Regular), 191 (Wide), 335 (Extra Wide), 580 (Extended), 825 (Extra Extended), 1000 (Ultra Extended)

modelling
　　as a result of its variable, modular and geometric construction, and closed negative space, contrast: variable, affected by width axis, and hard to perceive
　　width axis's limits: from 1–110 – no contrast; from 111–1000 – negligible to high
　　transition: abrupt

terminals
　　baseline/general: horizontal, straight cuts
　　x-height: same as the baseline
　　ascenders and descenders: n/a

proportion
　　character width axis' limits: I at width axis 1 – 1:47 w/h ratio, to M at width axis 1000 – 3,7:1 w/h ratio

weight
　　weight: variable, from Regular (1 – Skyline) to Ultra-Black (1000 – Ultra Extended)

key characters
　　T with bar near to x-height; L with spur cut near to x-height; squared A, M, N and W

decoration
　　n/a.

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Contact email: joaogomes@campus.ul.pt

ICO-Cymatic Backstage Design Process: Applying Vernacular Techniques and New Media Into Ephemeral Spaces for Art Installation in South America

Elvert Durán Vivanco, University of Bío-Bío-Chile, Chile
Carlota Durán Vivanco, Teja Verde Ecodiseño, Chile
Jimena Alarcón Castro, University of Bío-Bío-Chile, Chile

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Abstract

Cymatic is a study area of vibrational nodal phenomena. The term is coined in the field of physics. It refers to the analysis of nodal movements in non-conformal media, such as fluids and grains, generating temporary geometric patterns determined by three significant factors: water volume, light and sound. This research will show some design practices in the form-finding design process in temporal spaces, using geometric concentric patterns obtained from sound stimulation known as cymatic. Stages of recording, analysis and digitization of sound stimulation in volumes of water into small containers with different materials and shapes. The sound registers and its correlation of cymatic phenomena includes traditional building techniques and technological aspects, such as parametric design and 3D printing. Preliminary results illustrate the innovation process on ephemeral space and design objects, considering areas related to art, science and technology. Methodology approaches are mainly based on Research Through Design and it will show some preliminary results about cases of study: Ico-cymatic backstage ; multipurpose ephemeral spaces for art installation. It describes an ephemeral icosahedron shelter built with hybrid vernacular reciprocal structures made with Chilean bamboo and covered by membranes. The following experiments established the causal relationships between sound stimulation and processes of self-organisation of states of matter reflected on surface tension of bodies waters, and it will show this nodal phenomenon as an alternative source of inspiration for design process.

Keywords: Cymatic Patterns, Vernacular Design, New Media, Research Through Design, Temporal Space

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Introduction

Geometries and morphology, growth patterns, protection systems, among others geometric factors from nature, have been a fertile source of inspiration for different areas of knowledge. The cymatic movements in their different configurations and media are a fascinating theme, not only for the resulting geometric complexity, but also for making evident a less frequent aspect between the sound and its shape, making visible the invisible. From a physics point of view, a wave is a disruption that moves from the point of origin to the medium surrounding that point. It refers to the effects caused by the periodic movements produced by sound waves, which are reflected in this state of matter. According to Chladni (1787), this phenomenon at the molecular level, electrons generate a compass or cadence creating a variable wave, in which is possible to observe by the human eye be replicated in its organisation characterised by its cyclic geometric movement. In this concern, observation of this sound choreography on liquid state of matter was already part of the studies in the Renaissance, first by Da Vinci and later by Galileo, just to mention a few scholars in the studies of nature that dabbled in this subject. In this regard, cymatic patterns , also known as *standing waves*[11] consists in the interaction of wave parameters of amplitude, frequency and length, which travel by the same medium in opposite directions (nodes and antinodes). CHLADNI, E(1787).

Figure 1: Cymatic pattern obtained from sound stimulation.
Range of frequency from 10 to 200 hertz.
Source: author

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[1] Standing wave, also called stationary wave, combination of two waves moving in opposite directions, each having the same amplitude and frequency

Frei Otto coined the term *"Selbstbung"*, which in German describes the process of self-forming. This refers to the generation of the shape of a given structural system under conditions of a "self-encountered" state of equilibrium, defined by the forces acting on it and the internal resistance determined by the material properties. For Otto, just like a soap film possessing the property of self-organisation and thus finding its own shape, a tensioned membrane can be conceived under this same logic, trying to minimise its (material) energy. In other words, Frei Otto determines, by means of the empirical method, what would become a process of self-regulation determined by the physical laws prevailing at that time.
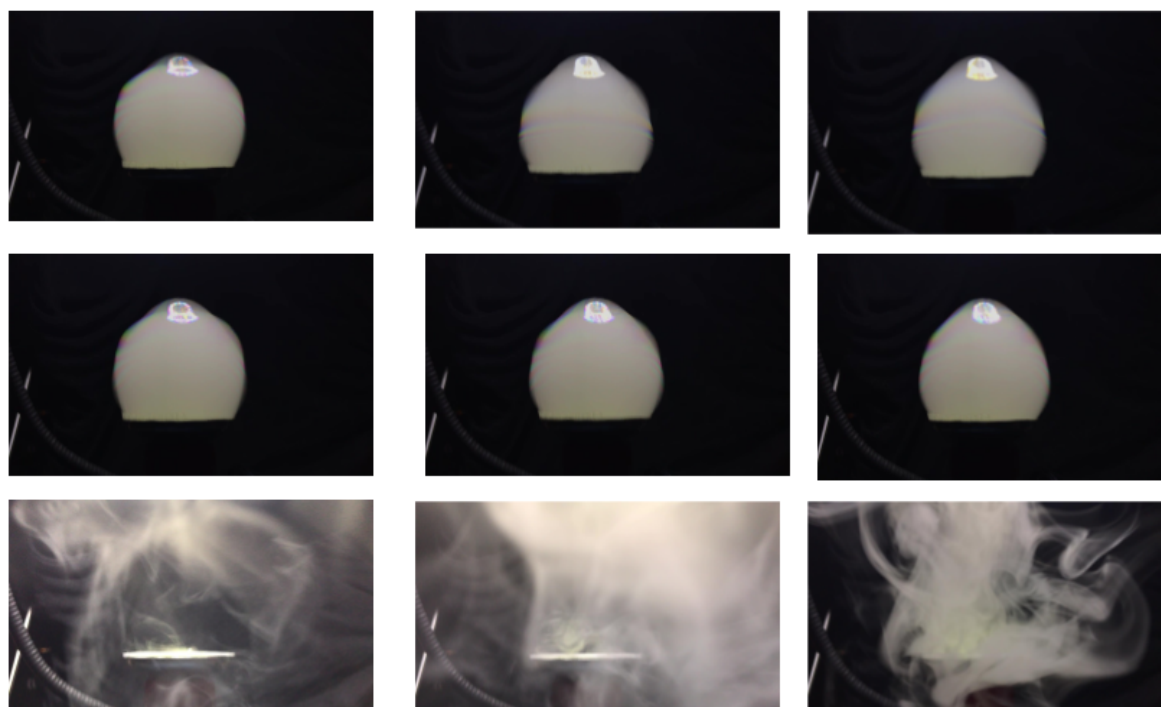
Figure 2: Bubbles soap filled with smoke responding to sound stimulation.
Range of frequency from 5 to 100 hertz.
Source: author

According to GOLDSMITH & FAIA (2014), two main currents can be distinguished in this sense: form finding (FF) and shape finding (SF). An interpretation of these two terms is formed finding and shape finding. In FF, the designer observes processes in nature to discover forms of organisation and methods of construction. The study here is about the ability to discover an optimal form in a context of dynamic adaptability. The beauty of form does not have to be designed; rather it becomes a property that emerges or is discovered. The condition of temporal organisation of the liquid (cymatic patterns) is presented as a new way of interpreting a dynamic surface, which is a potential case study for the observation of surfaces of a certain complexity. Experimentation through artefacts in a controlled environment creates the ad hoc conditions for a case of form finding, in other words a form finding cymatic.

Over time, a large number of experts from the scientific, artistic and therapeutic world have been able to demonstrate the advances in the recording of these patterns and their application in different contexts, making it possible to demonstrate the behaviour of the states of matter and its capacity for self-organisation by means of sound energy, making the invisible visible. The state of the art of this phenomenon is varied, being a reference in some artistic

installations, mapping, print design, object and jewellery design, temporary architecture, or pavilions.
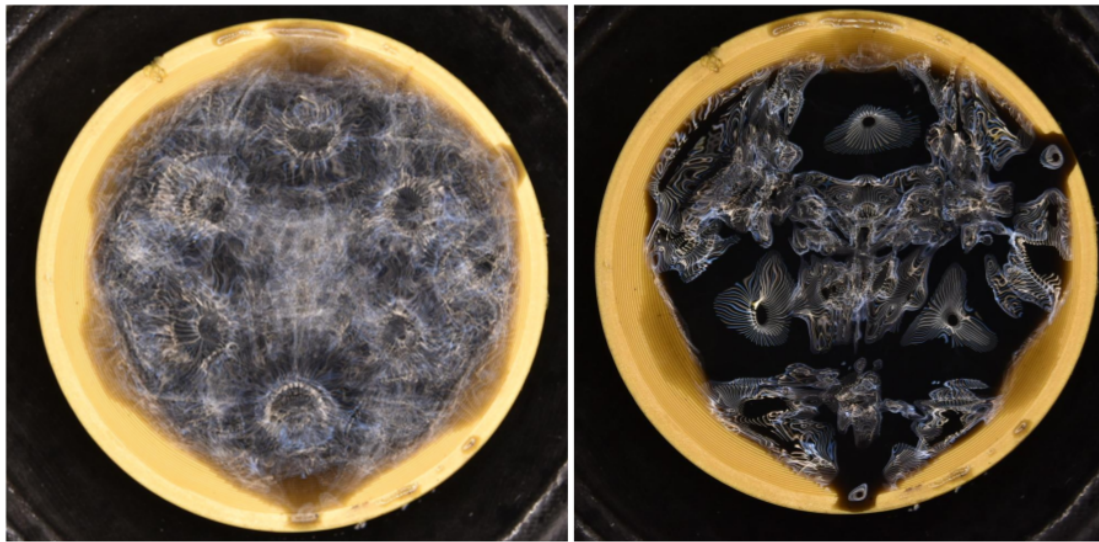
Figure 3 : Cymatic nodal pattern (38 Hetz) . Inked water responding to sound stimulation in circular container Frequency 100 hertz.
Source: author

Material and methodology

The impact of technical procedures has generated changes in how information is processed, generating new behaviours in how information is distributed and shared. Three-Dimensional Scanning, 3D printing systems, laser cutting and engraving, and numerical control centre machines are some of the most accepted technologies in a productive reality on a limited scale and focused on the particular needs of users, who are gradually opting for this type of form to materialise ideas. Open source projects, for instance, are clear evidence about how virtual models and procedures can now be spread throughout the world, which with the help of materialisation technologies, can become a concrete reality.

Technology and parameters

The word parametric derives from the noun parameter, which is a variable in an equation or system. In the field of digital modelling, the term parametric model refers to a digital model based on sets of variables, where the resulting three-dimensional digital shapes or patterns can vary. Changing the numerical value of a single parameter can alter the product of the equation. This means that the final digital result is not completely developed by the designer, but rather the result of an equation, relationship parameters, that the designer-programmer establishes (FERNANDO et al, 2012).

According to CHIARELLA & PASTOR (2015), this renaissance in the conception of complex forms, belonging to the field of Descriptive Geometry, aided by software such as Rhinoceros® and Grasshopper®, provides not only mathematical reasoning in the established parameters, but also a concatenation of ideas and sequence of logical steps described on a virtual canvas. According to the authors, parametric programming offers not only one

solution but a family of solutions to the same problem. Finally, the guiding idea that lies in the incorporation of parameters into design process is fundamentally based on being able to include new instrumental resources that expand the range of possibilities or results in the work of design disciplines CHIARELLA & PASTOR (2015).

On the other hand, CASTRO & PÁSSARO (2017) point out the importance of a reciprocal process between digital and physical models, arguing that it is a constant back-and-forth dialogue between analogous and digital. According to the expert in parametric digital design, the algorithmic relationships created by specialised software for the materialisation of a tangible model are subject to constant improvement processes, thanks to the important feedback generated by observing the behaviour of analogous models devised by computer. Both the virtual and the tangible version are parallel and complementary paths, the differences attend to the aspects of objectivity and subjectivity in the communication process. Digital manufacturing has become an opportunity that this research aims to address, through the use of globalised technologies, material and local techniques, (FRAMPTON, 1981).It is important to mention that at this point the research aims to find parameters that combine the versatility that virtuality brings with it together with the concreteness of the physical world.The following case study presents a method for studying cymatic patterns in its capture, experimentation, synthesis, and interpretation of this natural phenomenon, under certain conditions of light, sound, temperature and density, among other essential factors. The method used by Michael Faraday in 1831 is used as a reference in the first instance, the method used by the scientist to analyse the continuous movement of water using cylindrical containers (SHELDRAKE,M , SHELDRAKE, R.2017).

The first part of the experiment is the design and construction of a sound artefact (Cinemascope, figure 4) to facilitate the observation of cymatic phenomena. In this aspect, even though this cymatic artefact can be built with relatively simple to obtain elements. The main elements of this measuring system are composed of six parts.
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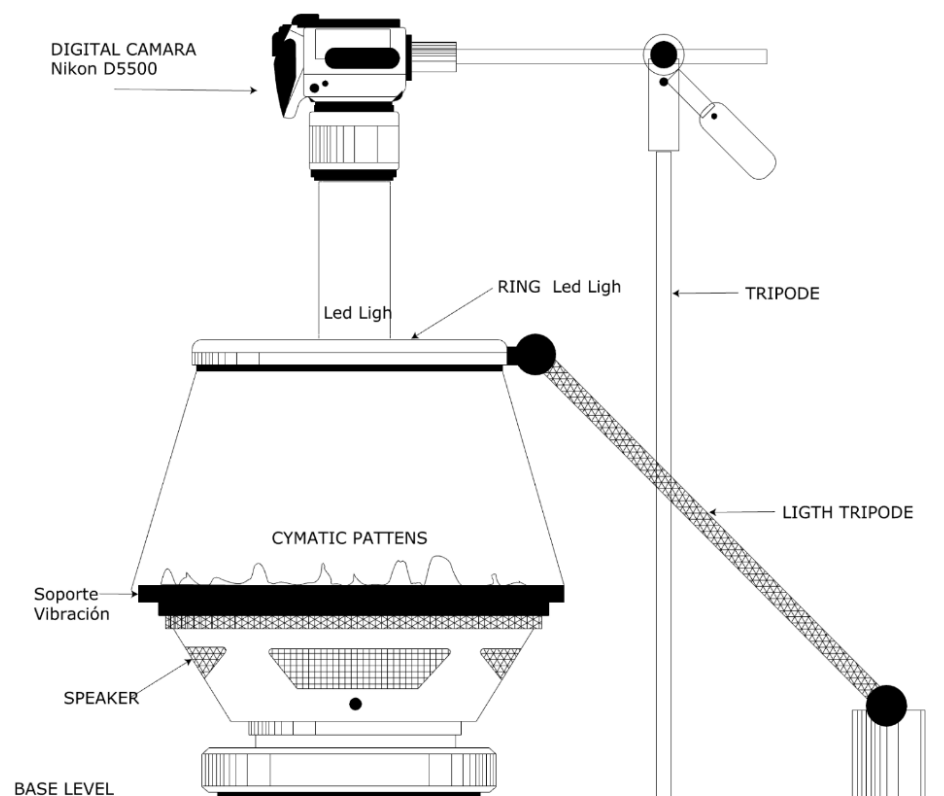
Figure 4: Oscilloscope. Cymatic recording scheme.
Source: author

Components of the system:

-Liquid body: The volume is variable, for this occasion we use a range of 60 to 80 ml of distilled H2O. The liquid is darkened by means of black dye to generate better light contrast on the surface of the volume to be examined.

- Light source: LED light ring inner diameter 80 mm. Total power: 9 W. Colour temperature: 3200 K-5500 K. This type of light source was chosen to allow free adjustment of the recording device, allowing vertical adjustment.

-Recording device: Photographic camera or any media device that allows video and photographic recording. For this experiment, a Nikon D5500 camera was chosen, configured with Iso 2000. The ratio of the ring size is in proportion to the size of the camera lens.

- Support system: Support table for the sound source and liquid container. Independently of this, an adjustable tripod is required to adjust the recording device and the light source. For this experiment, two independent supports were used, so that the distances could be adjusted independently, in order to isolate any variable in the process that could alter the observation of the cymatic phenomenon.

- Sound emulator:
Generator of sound frequencies measured in Hertz. This type of device can be obtained from online digital platforms. In this case, an online sound wave emulator was used in sinusoid or

sine wave mode. Also, there is a MPK *mini* Play mk3 used to generate mainly in ranges between 7 to 100 hertz.
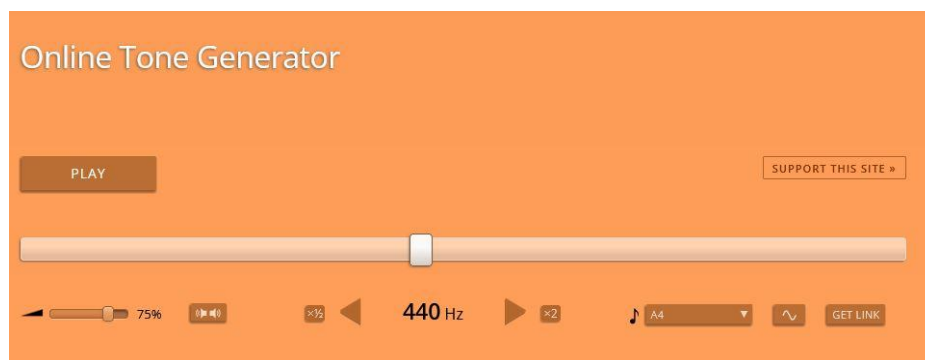
Figure 5: Generator of sound frequencies measured in Hertz.
Source: https://www.szynalski.com/tone-generator/

The methodology used describes research through the design of RtD (Fraylin, 1993) reviewing geometrical aspects of the cymatics and its potential use as an input for the creation of geometric textures based on sound morphology. Our proposal also emphasises on the importance of new media (Manovich, 1993),(CNCA, 2020) for creative processes and morphological studies of three-dimensional patterns generated.

The following case of studies (YIN, R., 2014) will show us the design process based on analogous and digital models inspired by cymatic patterns. its design prospect by using local and global resources in different scales of intervention.

Case of study

ICO-Cymatic Backstage; temporal shelter design space

As FRAMPTON points out in his concept of critical regionalism, local characteristics must coexist with other influences in a symbiotic relationship within the socio-economic and productive sphere. This relationship is enhanced by the contribution of new media and technologies that society has incorporated over time due to globalisation. The different stages of the process of creation, production and dissemination of design are not exempt from these influences. Designers, architects, artists, and artisans, among other creative disciplines, have been retaking forgotten ground, finding an opportunity for local development in cultural dissemination as an essential part of the productive scene, which today is known under the name of the local creative industry. (UNESCO; LOCAL CREATIVE ECONOMY REPORT, 2013).

It seems that this theme of spaces for temporary use is determined by a basic condition of survival in people. The designated attributes in the design of spaces for these situations is a mixed area of knowledge and techniques, where temporary architecture interacts, as well as industrial design, military tactical knowledge, medical assistance, logistics, to name just a few of the professions that work in this area of mitigation of extreme situations.

In the case of tensile structures, we can see an emerging market niche in the implementation of temporary spaces for social and cultural purposes. Regulations for use in urban contexts, structural resistance, quick assembly techniques, forms of high aesthetic value and mainly a

minimum impact on the environment, are some of the considerations that were considered when designing this proposal.

For CORREIA DE MELO (2017), the conjugation among geographical space, people and their respective object-action interrelation, is what finally contributes to the definition of its space, what the author calls as a stage, in this case a stage for temporary or ephemeral use. To go even deeper into this time-use relationship of the time spaces of bounded use, the word refuge refers to a space built to provide temporary shelter or protection. It is in this relationship object - action, that the transitory stay of the traveller who inhabits, spends the night, and recomposes himself physically and psychologically to continue the journey.

Throughout the world, the concept of the vernacular, as a cultural and technical state of popular knowledge, where tangible aspects of ways of living are reflected through objects and built spaces, as well as through the intangible or immaterial, where, for example, the know-how with a certain material on the one hand, or the cadence or intonation of how people speak on the street, further enrich this type of geographic space with vernacular characteristics (SANTOS, M., 2014). To a large extent, this relationship is determined by the place, where its inhabitants, with a resilient posture in the face of the environment and the adversities of nature, have wanted to adapt to the conditions defined by climatic factors and natural resources. In these concerns, another case worthy of analysis is the situation described by the bamboo species, which are scattered in the tropical and subtropical geographical area of the planet, with a range of native and introduced species, forming an important part of the local construction heritage based on bamboo and its properties. . With a fairly wide botanical taxonomy, its natural distribution ranges from 46°N latitude to approximately 47°S latitude, also reaching 4,300 m above sea level. In addition to having a great capacity to absorb carbon dioxide and having a structural resilience comparable to steel, bamboo has a constructive versatility to be complemented with other types of materials, which has been the subject of study and development in the manufacture of structures. resistant and light. . In South America, more specifically in Chilean-Argentine territory, there are other versions of bamboo, the chusquea quila (from the Mapudungun kü_la; three) and the chusquea culeou, colloquially known as coligüe (from the *Mapudungun*; place of reeds), materials used in the construction of houses, decorative handicrafts, musical instruments, utensils and war weapons of Mapuche origin, as well as objects of daily use in domesticity of Chilean cities. This endogenous South American cane, with few branches, green foliage and daughters with a serrated edge, can reach up to 8 metres in length, and is found from the central zone of Chile, to the extreme Chilean-Argentine Patagonia. The fundamental difference of this raw material in relation to the rest of the bamboo types is that the coligüe has a continuous wall, it is a full cane.

Figure 6: Bambusa vulgaris (common bamboo, Brazil) *chusquea culeou (colihue, Chile).*

Design proposal

Icosahedron cymatic : Multipurpose ephemeral spaces for art installation : It describes an ephemeral icosahedron shelter built with hybrid vernacular reciprocal structures made with chilean bamboo and covered by membranes. Two main uses in terms of arts spaces were part of this design considerations; firly an urban shelter installation developing the concept of cymatic phenomenon. Secondly its capability to transform it into a sustainable art installation that promotes saving water.

It is important to mention that for a reciprocal structure to exist, it needs a minimum of components, being three elements that make possible a three-dimensional version of space, being able to circumscribe regular and irregular polygons at its base, being the reiteration of this pattern of overlapping relationship, as a systemic tessellation, which allows its growth. Finally, each component unit of this system may have different dimensions, but interdependence is a sine qua non-characteristic of this structural support
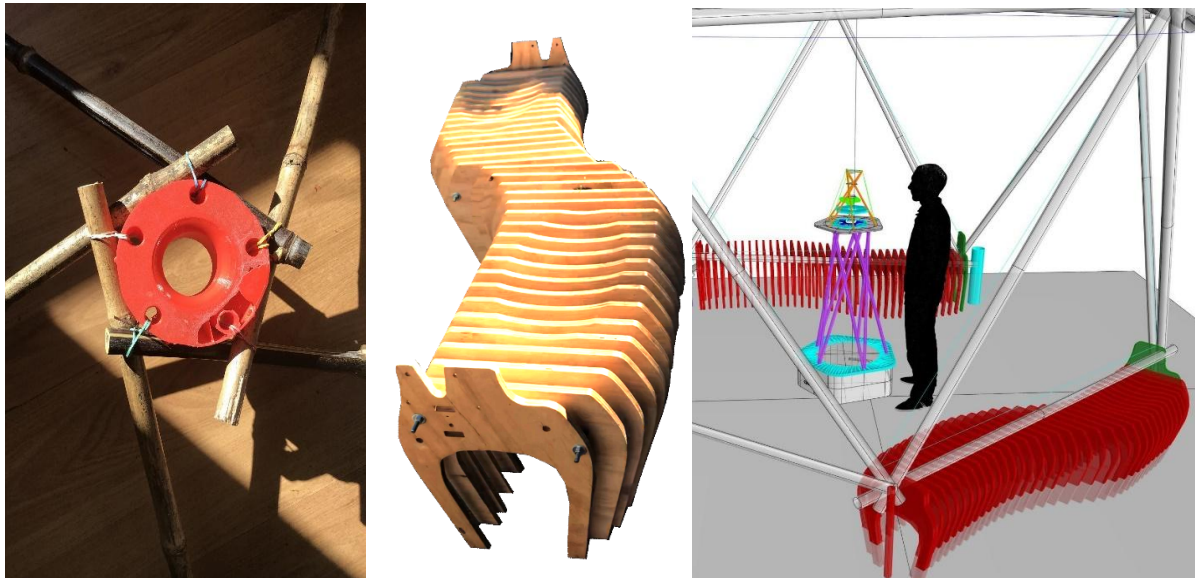
Figure 7, 8 and 9: Design process; icosahedron bamboo connector (PLA printed),
Parametric bench and general structure proposal.
Source: author
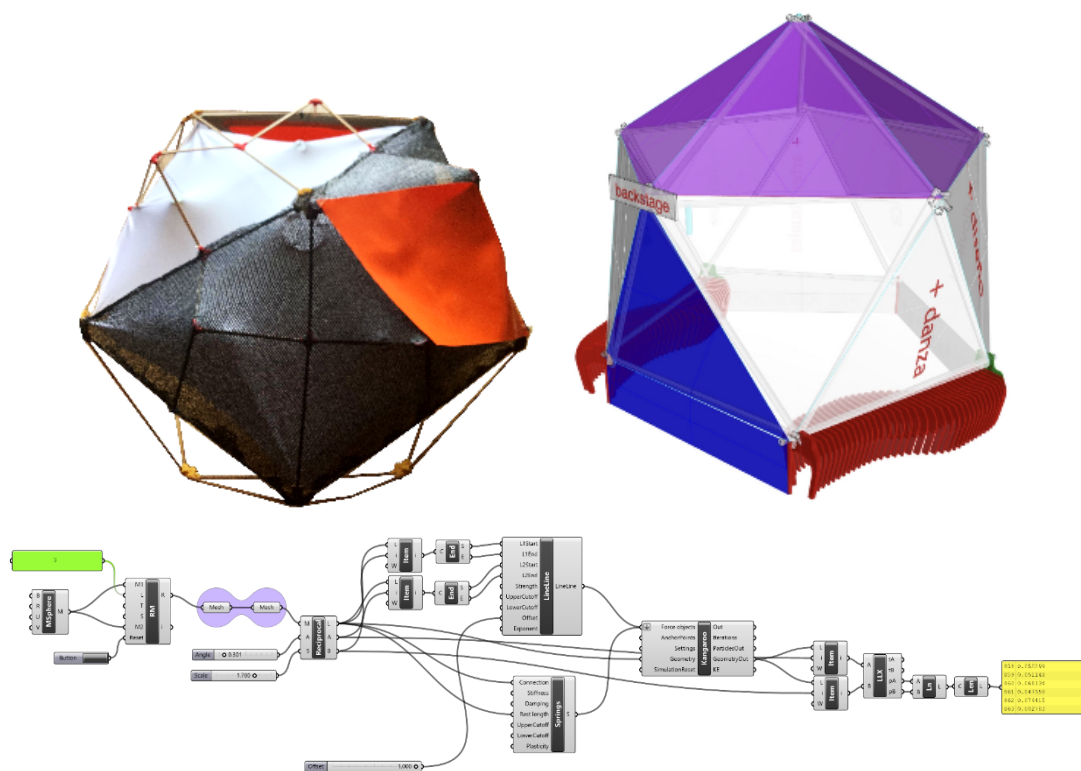
Figure 10, 11 and 12: Physical scale model proposal (1:5); virtual shelter ; workflow for
reciprocal structure Grasshopper and Rhinocero.
Source: author
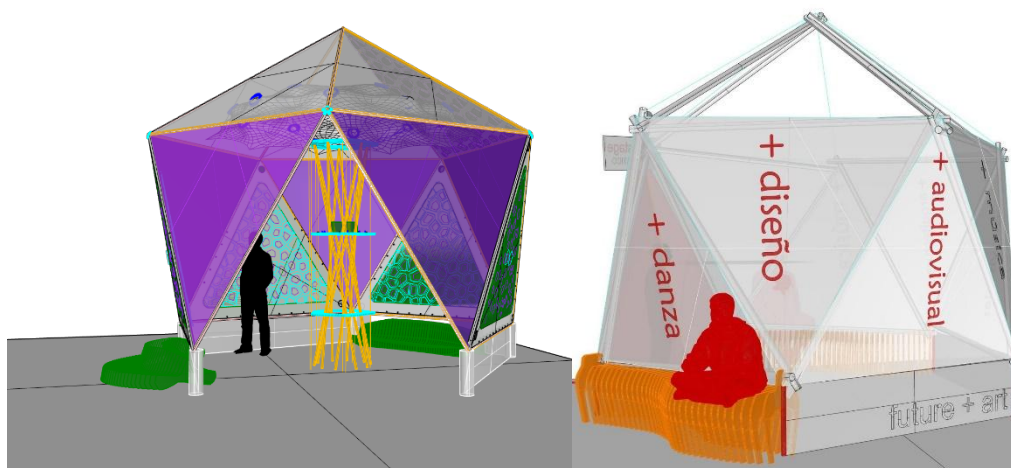
Figure 13 and 14: Virtual design shelter, developing ideas
related with a interior mapping projection

This project was part of an art installation, used as a backstage concert nearby BioBio river. Important aspects such as installation process, structure for wind performance and usability will be some of the issues described as part of the result of this interdisciplinary research. This design project was held during the "Music Rivera Festival" in Concepcion Chile in 2020, and it was sponsored by FIC Future Mas/Art: Creative Industry project.

Figure 15 and 16: Oscilloscope and cymatic mapping on roof space.

Conclusion

We believe that the themes underlying this research go beyond the object itself. Iit is also known in the design discipline as discursive design, which is mainly based in the narrative or story that the artefact or object tells, using the design space in order to carry on an important message. The ability to bring something of temporary character or even non-existent to the real world, as part of the ability to relate phenomena and to project new configurations in an advantage that goes beyond the capacity of imagination. On the other hand, The integrated use of tools, techniques and methods is characteristic of a transdisciplinary approach, where knowledge from different areas is integrated into an overall vision, and their relationships and projections can be studied. The result of this methodological approach is characterised by being a state where the contributions of each participant are not identified in isolation; on the contrary, they are merged, achieving another new state. The characteristics of this last method are part of the mode proposed by Jean Piaget in the 1970s, where the type of result or conclusion is a state that does not belong to any of the participating disciplines; it is a new condition, a sort of hybrid state, as a result of the transdisciplinary research crossroads.

We can see that this freedom of choice or free will of digital or analogue methods will bring a series of variables that directly affect the qualitative and quantitative aspects of the research processes. This makes us think of a fruitful field for a conversation between both ways. In the case of the FFC, employing a non-linear thinking process, we have been able to implement different techniques for the capture, processing and materialisation of a complex surface, both for its level of detail and its ephemeral condition. The abovementioned stages make us think of different ways to *"solidify the liquid"*. Either by technological means for its construction or digital visualisation and analogue construction.
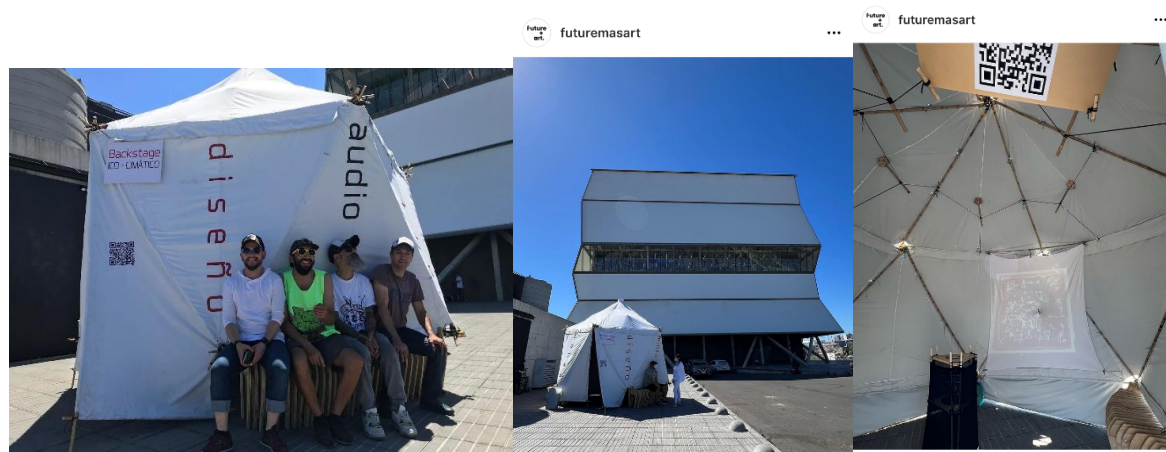
Figure 17 and 18: Social media FIC Future + Art, Inauguration festival day.

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Multisensory Approaches From Interactive Art to Inclusive Design

Federica Delprino, University of Genova, Italy

Abstract

In interactive art and multimedia installations, the public plays a fundamental part. Visitors change the meaning and the appearance of artwork according to their sensitivity and preferred way of interaction. For designers, this audience is the set of users on which they should focus their projects. Among the most pervasive technologies are a variety of solutions for interacting with the environment, activated by gesture and movement sensors, voice interfaces,.. and a range of ways of enabling people with different abilities. Many of these technologies were born to be integrated into disability devices or are often used to allow access to the usage of an artifact by people with different kinds of impairments. There are many examples of how solutions designed for specific niches have over time been integrated into common use in private and public areas, recreational and cultural spaces. Through an analysis of the process that has given rise to this, it is possible to understand when and how designers should intervene in the creation of their projects to ensure the accessibility and usability of the resulting artifacts. In the empathizing and ideating design phases, it seems necessary to consider the various multisensory modes of interaction to guarantee the usability and scalability of the project. In this way, the outcome may become truly inclusive and accessible, but also a benchmark for human-centered design, starting from specific needs and incorporating them into everyday use to integrate small groups and minorities, not creating projects and devices that separate and divide them.

Keywords: Design for All, Multimedia Arts, Interaction Design, People-Cantered Design

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Introduction

The contribution, as shown in the poster (Figure 1), shows the connection between technologies used for assistive use and the ones applied in interactive art installations. In particular, there's a focus on how touchless technologies may be inclusive.

The contact point between the different fields of application lies in the ways of interaction and activation needed from the users to enjoy the environment or the artifact. The scheme shows which kinds of assistive technologies have been integrated into everyday use and in other fields; most of them are based on voice commands and sensors: they're touchless interactions. Taking into account the multimedia arts field, it's been highlighted how people can engage with the space and its artifacts, enjoying the exhibition through one or more specific gestures. This action may be touchless or touch-based.

When it doesn't require physical interaction, the environment results more inclusive, since the integration of voice and gesture generates an accessible scenario in which coexist the fulfilment of different kinds of user needs - going beyond the mere demand for access but for the satisfaction of standards up to the tip of the 'pyramid of needs' (A. Maslow, 1954)

In the universal design approach, indeed, the aim should not only be to enable, but also to ensure a pleasant, enjoyable, suitable, and above all uniting and not separating experience. This can be done by considering users' abilities from a broader point of view, designing according to modes of interaction that bring together: possibility of choice; engagement and involvement; ease, and speed of interaction.

To emphasise this connection, it's been addressed a variety of case studies of projects in multimedia arts that have been designed using a technology born for a specific need. This shows how antifragile projects can be born out of limitations (N.N. Taleb, 2010), which adapt to the difficulty and feed off it, giving rise to an inclusive and enabling solution, in which the user is at the centre.

To do so, it's been re-defined the concept of 'disability' itself, accepting definitions of inclusive design (The British Standard Institute, 2005) and universal design (N. Steenhout, 2010), assistive technology (L.Lischetti, 2010), and prototype (T.Maiorana, 2020) that are geared towards creating empathy on the part of the designer and designing without the need to produce different solutions that would effectively separate users.

For the contribution it's been crucial to source from various research fields and areas, finding a 'centre of gravity' for research (G. Anceschi, M. Botta, 2009) resulting in an intersection that takes into account an area in which data are at the service of the well-being of the individuals; so a people-centered vision in a human environment and 'systemic eco-efficiency'(E. Manzini, 2004) which takes into consideration the needs of communities in a broader and interchangeable mindset.

Figure 1: Poster presented to the conference

From assistive design solutions to interactive art installations

Solutions and tools may be identified and classified according to the specific need they assist or compensate. The process of analysing which technologies have remained used just by certain users and which ones, on the other hand, spread to be put in mainstream devices and used by the majority of populations, it's needed a classification according to the disability or disorder they have been designed for.

For vision disabilities there are I) vocal syntheses II) screen reader III) braille display IV) peripheral customization (open source); for hearing disabilities I) voice meeting II) dragon naturally III) speaking cochlear implants; for intellectual disabilities, I) special keyboards II) mouse emulators and touch screens III) customized interfaces IV) alternative augmented communication V) verbally premium apps and video modelling; for motor disabilities, I) sensors and switches II) communicators (basic aids) III) PC with adapted configuration; for (specific) learning disorder/disability I) map-building software, speech synthesis, reading apps, study organisations, smart pen, spell-checker II) pedological devices. (Figure 2)

Figure 2: Solutions and tools by specific needs, an analysis of the ones which become widespread and the ways of interaction that have in common

For disabilities, deficits, particular problems, there were often designed specific solutions (analogue or digital) that in some cases remained stigmatising, in others became widespread.

A case study analysis of projects created using a technology for a specific need or disability was implemented; examples where the same technology is used in multimedia arts were then examined. e.g. Touchless sensors to open automatic doors and smart faucets: conscious or unconscious gestural interaction. The same principle is used in works such as Dominique Gonzalez-Foerster 'Séance de Shadow II (bleu)', 1998[1]; Adrien M/ Claire B Company's 'Hakanai', 2013[2]. Voice assistants are used for digital with voice by visually impaired people, but this technology is very useful for avoiding looking at the screen and performing other tasks.

Referring therefore to classification in the beginning of the paragraph, one can identify several technologies that are indeed used and originated to respond to needs related to specific disabilities, but that can also be found within everyday devices and are used for multimedia and interactive art. These, in particular, are vocal syntheses and assistants, screen readers and peripheral customization (open source) that respond to visual deficits; voice meetings and software or technologies such as dragon naturally speaking for hearing disabilities; voice syntheses, reading apps, study organizers and more generally pedagogical devices that were born to aid learning problems.

This thereby highlights how the same design solution can be spent with an assistive purpose and for a cultural, entertaining, engagement-creating purpose.

Products, services, and artifacts in general that are created for the disabled do not necessarily have to be relegated to this use but can be instruments of involvement and union, creating unique solutions for users with different physical, cognitive, and motor skills.

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[2] retrieved on https://www.am-cb.net/projets/http-www-am-cb-net-projets-hkn, last visited 10/08/2022

Enablement and engagement: multimodal activation actions

Looking at the diversity of environments and contexts between assistive technology per se and the same technology used in the arts, we will see that at the center is precisely the interaction the user can make with space. The gesture in itself, or in any case the multitude of senses brought into play to activate the space and the objects within it, is a fundamental element. Hence the point is the characteristic that these technologies have in common, which have made their way from a specific need to mainstream use, and the possibility of choice that gives rise to a concept of 'inclusive multitasking' that is not the child of bad design, but which gives the possibility of performing several actions at the same time or even doing just one, but in such a way that this can be for those who have several possibilities of interaction a choice and for those who have only one an important activating element that makes it possible for people with different needs and abilities to enjoy the same space. This does not interfere with the speed of interaction, on the contrary, it creates a variety that gives rise to a level of engagement and involvement that is inherent to the technologies themselves and that has the possibility of being developed in a design manner. The multi-modality of interaction and including touchless also gives rise to a hands-free perspective (Figure 3).
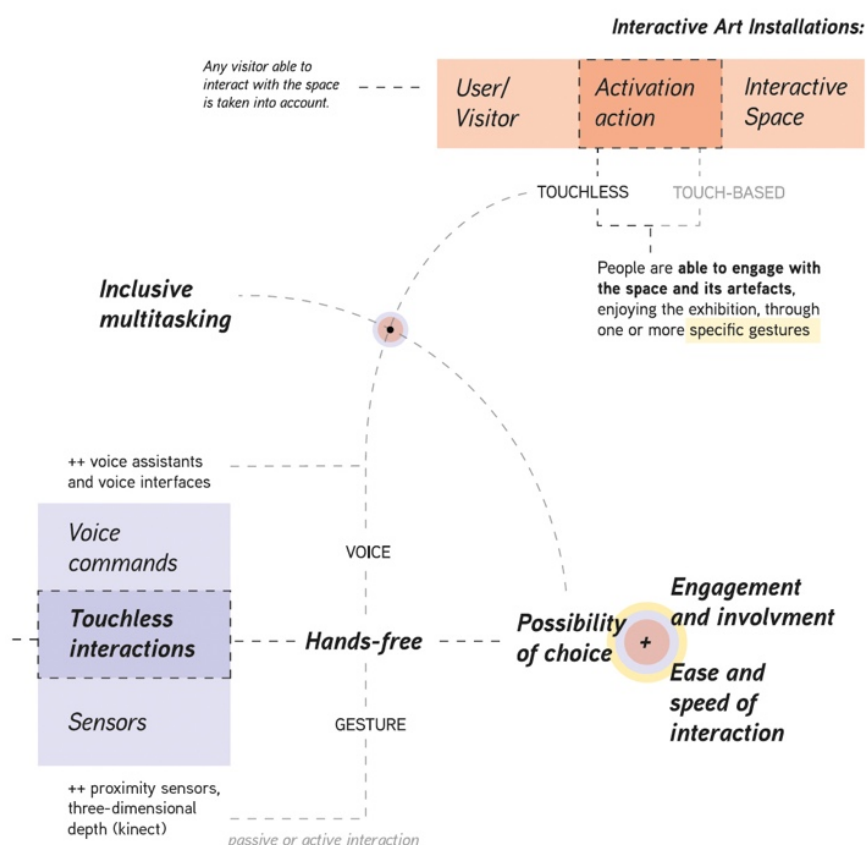
Figure 3: Interactive art installations and inclusive ways of interaction: features of touchless interactions based of possibility of engagement and access of visitors/users.

In the case of the artistic field or in any situation where assistive technology goes beyond the use for which it was intended, the concept of disability is not brought into play or questioned as central.

There is thus a key additional parameter within the operation of comparing these technologies concerning the case studies analysed: at the centre, indeed, is not only the technological element in itself but the mode of interaction it generates. The latter stands to be the real discriminating factor for the inclusive nature of the project. In fact, at the centre is the user and the possibilities he or she has to take advantage of what is around him or her. The stigma is based on a prejudice that results in isolation; what causes stigmatisation in the first place is precisely the fact that some devices are a source of separation and are often designed only to accomplish a function, without any thought for the aesthetic or social implications, which are important for maintaining a user's point of view of identity aside from their disability. To adopt a transversal point of view on certain types of technologies, one can take into consideration the definition of the Assistive Technology Industry Association (ATIA), according to which an assistive technology is 'any instrument, object, equipment, programme, software or system used to increase, maintain or improve the functional capabilities of persons with disabilities' merged with the fact that 'any technology that enables someone to accomplish something that normally could not do' (L. Lischetti, 2010-12).

Broadening perspective and definitions on assistive technologies for a common benefit

By shifting the definition of technologies created for disability towards the idea that compensatory solutions are enabling in a broader sense, it will be perceived that every user makes use of objects to help them achieve something they would not normally be able to do themselves.

The idea of inclusive and accessibility-focused design thus does not become the aim of a specific branch of research or design that is intent on finding solutions for specific deficits, but becomes an attitude that is the prerogative of all users, as they can be related according to different abilities. Inclusive design may be seen, so, as "the design of mainstream products and/or services that are accessible to, and usable by, as many people as reasonably possible [...] without the need for special adaptation or specialised design" (The British Standards Institute, 2005).

In terms of necessity, therefore, from a design point of view, one does not necessarily have to focus on a lack, but also on the will of the user. The fact that technologies created for disabilities are inserted in cultural contexts, entertaining, created to create engagement or to make spectators ponder makes one realise how much potential there is in design methodologies that move towards universal design. We can define this concept by identifying it as the "process of finding solutions usable and effective for everyone, not only for people with disabilities" (N. Steenhout, 2010).

The art world, with its installations and the desire to bring to life through interactive art a different and involved role for the spectator who thereby becomes a user, is a prime example of the possibility of union and inclusion provided by the integration of touchless solutions involving the use of voice and gestures to activate the surrounding space. This creates, on the one hand, a certain unity between visitors, but also enhances the singularity of the experiences, emphasising the importance of the use of one's own body and normalising viewers towards modes of interaction that are often not perceived as primary.

The latter, nonetheless, found a strong diffusion with the advent of the covid-19 pandemic, which challenged all those interactions based on comma touch as a possible carrier of comma

viruses and paved the way for the use of other modes of activation and relationship with the surrounding environment.

Possibilities of choice and limits: new skills for new touchless interaction relationships with space and artifacfts

The pandemic period itself challenged exactly the possibility of choice and the resulting limitations gave rise to designs conceived for a time when touch interaction was not considered predominant. This at global level has also broadened the range of people's skills, developing not only awareness but also the everyday habit of using touchless technologies, leading them to mainstream. There is a before, during and after era that defined certain experiences and modes of interaction as not replaceable, but opened up a range of possibilities between the physical, digital and phygital (Morozzo M.C., Bertirotti A., Delprino F., 2021). Thus, proposals and situations that were only experienced in particular situations or within an artistic context often become part of a city itself, on a community and personal level. There are touchless scenarios (Figure 4) which involve touchless gesture, relying on space and/or sound; voice assistants; virtual reality; augmented reality. Other solutions include a tactile part such as braille or multi-sensory solutions such as some panels that provide several types of sensory exploration, which can be combined or integrated with touchless ones.
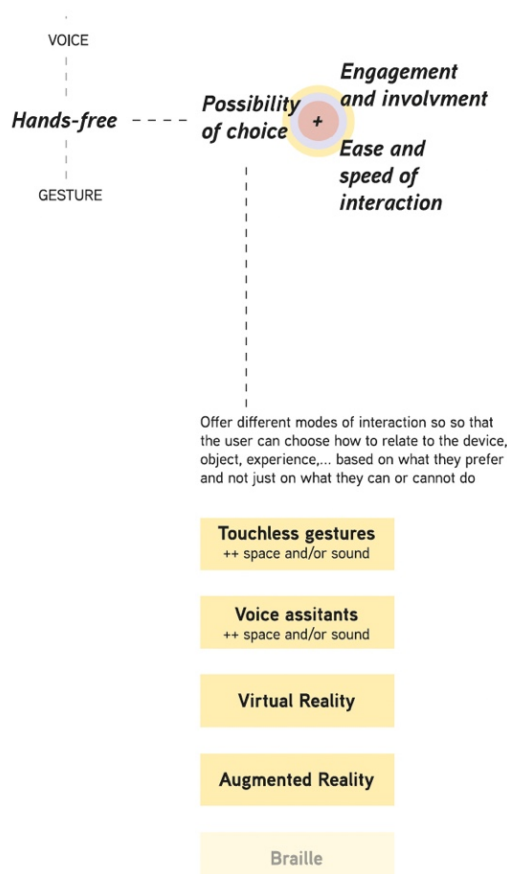
Figure 4: Touchless scenarios

The former includes the interactive work 'EGO' (2015) by Klaus Obermaier with Stefano D'Alessio, Martina Menegon[3]; 'The Treachery of Sanctuary' by Chris Milk (2012-2014)[4]; 'IRIS' by HYBE Studio (2012); which use motion sensors and/or kinect to make the viewers' movement create a change for the environment and installation that depends on the user's own body and movement. On the level of sound interaction, there is 'The Forty Part Motet' (2001) by Janet Cardiff[5], a reworking of 'Spem in Alium Nunquam habui' (1575) by Thomas Tallis attraversp 40-track sound recording and 40 speakers activated and experienced by the audience by approaching or not approaching them. Speaking instead of sensors in everyday life, with our bodies we can open the automatic doors of a building or activate a tap with a special sensor. Although less performative and entertaining, the underlying concept is the same sensor technology, then linked by other elements and strong concepts and set-ups.

Art installations that make use of voice assistants include Neil Mendoza's 'Robotic Voice Activated Word Kicking Machine' (2017)[6], in which users can approach a speaker, pronounce a word and it will be visually generated on a screen along with those of the other visitors, repositioned by a King machine that literally but virtually launches them with those pronounced by others. Then there are software and applications such as VoiceDraw that allow you to draw with your voice. The latter is a hands-free voice-driven drawing application for people with motor impairments (Harada et al., 2007). In this case it may be compared to Paint, with the difference that can be used with voice, but voice assistants have since spread to personal devices, for education and work.

For virtual and augmented reality, one can relive and explore the ruins of Brescia thanks to CarraroLab's 'Brixia Time Machine'[7]; see graffiti and murals in motion thanks to the AR project 'MAUA'[8] in Palermo, Milan, and Turin.

These are some valuable case studies to be taken into account in order to broaden the consideration of interaction and reference for the use of inclusive, compensatory, assistive technologies in stimulating ways and towards a common benefit.

Conclusion

Regardless of the ambit and the design tools, therefore, an awareness of the inclusive potential of integrating different forms of interaction which are not only based on tactile integration but also on the vocal and gesture aspect, is important to build the empathisation phase of the research and design itself. In the design process often a part of prototype realisation concerning the empathisation towards users with special needs, that do not correspond to those of the work team and that they do not know from direct experience, tools are used to better understand the circumstances. These can be interviews, shadowing, simulation methods that are often costly in terms of money and time. Prototyping can also be more generally any "intervention which enhances our ability to learn about an element of a design challenge with minimal risk, investment, and time" (T.Maiorana, 2020).

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[3] retrieved on http://www.exile.at/ego/, last visited 10/08/2022

[4] retrieved on http://milk.co/treachery, last visited 10/08/2022

[5] retrieved on https://cardiffmiller.com/installations/the-forty-part-motet/, last visited 10/08/2022

[6] retrieved on https://www.neilmendoza.com/portfolio/robotic-voice-activated-word-kicking-machine/, last visited 10/08/2022

[7] retrieved on https://www.carraro-lab.com/portfolio-item/brixia-time-machine-ar-glass-e-augmented-catalog/, last visited 10/08/2022

[8] retrieved on https://mauamuseum.com/, last visited 18/07/2022

The same consciousness-building about ways of interacting that can be more inclusive, helps to expedite this process and make it more effective even when one is not in a position to have a direct relationship with certain users and to address specific needs, but at the same time still wants to build an environment, an object, a set of inclusive artefacts.

The idea that an inclusive project and an antifragile structure can be born out of limitation is fundamental. This perspective, rather than resilience, is underpinned by an economic model and a philosophy that seeks to feed on contingency, being willing to change and integrate the limitation itself. At the centre is therefore the user seen in terms of their needs as an individual and as part of the community, a relational entity. By taking into account the ways of interaction accessible to the user, it is possible to create inclusive solutions. These multisensory modes of interaction become 'enabling' in many respects.

The next step is to develop design tools and strategies for empathy in order to take these ways of interaction into account as an integral and structural part of profiling users and generating inclusive projects, both auxiliary and engaging.

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Contact email: federica.delprino@edu.unige.it

Doctoral Side Effects: Damage Limitation Versus Unexpected Benefits to PhD Research in a Pandemic

Adriana Fernandes, University of Porto, Portugal
Aleksandra Kosztyła, University of Porto, Portugal
André Casteião, University of Porto, Portugal
Diego Mergener, University of Porto, Portugal
Eduardo Morais, University of Porto, Portugal
Heitor Alvelos, University of Porto, Portugal
Hugo Palmares, University of Porto, Portugal
Ivy Francielle Higino Martins, Federal University of Cariri, Brasil
Luciana Lopes, University of Porto, Portugal
Marcela Rosa, University of Porto, Portugal
Ana Miriam Rebelo, University of Porto, Portugal
Miriam Regina Zanini, University of Porto, Portugal
Pedro Fragoso Lopes, University of Porto, Portugal
Santiago Luiz Gonçalves Mourão, University of Porto, Portugal

Abstract
In May 2021, following up on a publication by PhD Design students of the University of Porto on the topic of the various kinds of impact of the current SARS-CoV-2 pandemic in doctoral research, the authors organised an informal online meeting for Arts and Humanities PhD students and recent graduates. The goal was to share insights, strategies, methodologies and other concerns that have been emerging empirically and intuitively in individual contexts. The present article therefore reports on these shared concerns, and subsequently analyses them. The session was held informally via Zoom, with an international presence; two virtual rooms were created for the purpose of accommodating linguistic diversity; conversation was spontaneous while moderated. Moderators provided a synthesis of discussed topics at a final joint segment of the session. Various students and graduates recognised the potential for the session to become a template for an extended support network; this is an additional motivation for the present article. Furthermore, the session provided a recurrence of experiences and adaptive measures, and the possibility of incorporating certain adaptations as permanent. Lastly, the present article ends with an inventory of identified adaptations, and their critical analysis as potentially permanent, positive changes in doctoral research procedures.

Keywords: Phd During Pandemic, Online Research, Emerging Methodologies, Online Forum, Support Networks

Introduction

Held on the 21st of May, 2021, the one-hour, online meeting "Doctoral Side Effects: Let's talk about doing a PhD during a pandemic" (DSE) promoted a discussion on the impact of the Covid pandemic on doctoral research.

The present article identifies and analyses methodological strategies employed in the Doctoral Program in Design of the Fine Art Faculty of the University of Porto, in the period between March 2020, when a State of Emergency was ordered in Portugal, and May 2021, when DSE was held. The pandemic imposed a lockdown at an almost global level, forcing students in different contexts and at different stages of research to revise their research plans.

The successive lockdowns that occurred in this period altered the class dynamics of the Design Doctoral Program at U.Porto (Figure 1), with classes being held remotely through audiovisual interfaces. Students have had the opportunity to experience and reflect on the advantages and disadvantages of these restrictions on their doctoral research projects. The search for alternative solutions and adaptations, as well as new methodological approaches, has in itself become an object of research to some, given the absence of prior guidelines on how to act in face of such an unforeseen scenario. Research procedures thus tended to unfold mostly intuitively and empirically.
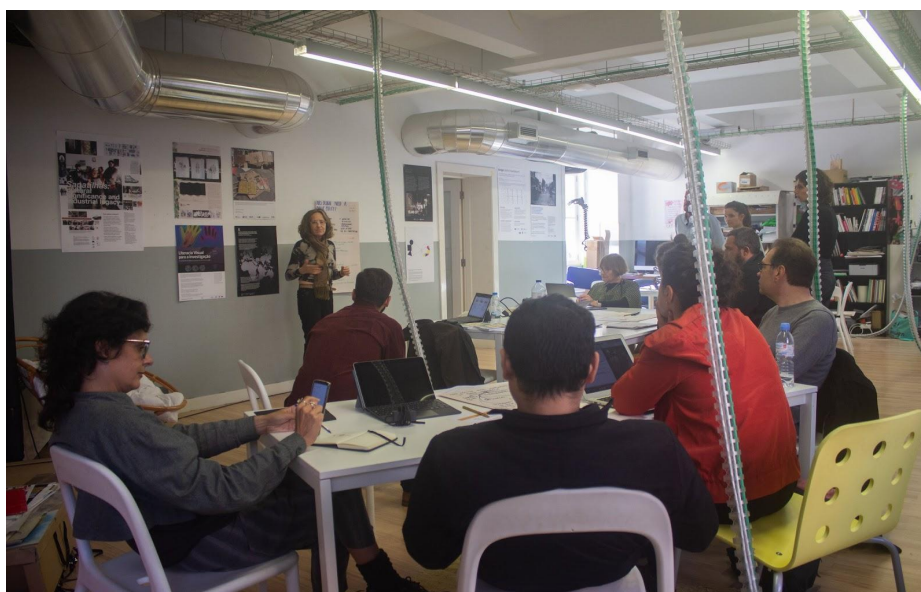
Figure 1: Dynamics of classes of the aforementioned doctoral program before COVID-19

The ineditude of the experience was felt by the PhD students at U.Porto as an opportunity to assess and share a range of experiences with the scientific community. The first output of this assessment was the publication *Tigers in Zoom Cages: tips and testimonies on advancing doctoral research in a pandemic* (Figure 2)*. A fourth volume of an ongoing series (https://doctortiger.wordpress.com), it brings together contributions from ID+, the doctoral program's host research center (http://idmais.org).

Figure 2: Cover of the publication Doctor Tiger vol 4: *Tigers in Zoom Cages*
tips and testimonies on advancing doctoral research in a pandemic

Throughout this period, a diversity of communication and discussion channels emerged: many of them have approached the difficulties and the unexpected perks generated by the migration of research methodologies, traditionally employed in a face-to-face context, towards remote situations - particularly the methodologies employed in the Arts and Humanities. These communications and discussions took the form of conferences, meetings, forums and readers, organized by academic communities, reported experiences and pedagogical solutions; however, first-hand testimonies by doctoral students on the challenges of the pandemic proved to be practically non-existent.

For the above reasons and considering the uniqueness of this period in regards to research activity, this article concerns the testimonies of the doctoral students that participated in DSE. The main objective was to converge on ways of overcoming the pandemic/confinement circumstances within research, but conversation ended up including a range of further considerations. The article concludes with an analysis of the replicability and longevity of the identified methodological approaches.

Doctoral Side Effects: decisions and planning

Following the *Tigers in Zoom Cages* publication, an event was organized in order to broaden the scope of the debate to doctoral students from other national and foreign universities. Different formats were considered for the event: a conference, a forum, a round table, a workshop, a hackathon, or an informal meeting. The advantages and disadvantages of a formal event, which would imply inviting reviewers or evaluators, were analyzed: we concluded that this process would hinder logistics and introduce an excessively formal narrative. Given the circumstances, an informal event between doctoral students was therefore the chosen format. Although initially a rather more ambitious event with specific objectives was considered, the final proposal was to hold an informal meeting for doctoral students without predetermined expectations, while keeping an eye on potential conclusions.

The possibility of holding a hybrid event was discussed, but an entirely remote format was chosen in the end: this would enable increased participation from students in confinement and/or remote locations. Because of the aforementioned methodological specificities, it was decided that the event would welcome Arts and Humanities students.

Doctoral Side Effects: Let's talk about doing a PhD during a pandemic was thus held. The event took advantage of a flexible, largely spontaneous, and informal structure. The underlying mottos for debate were: what methodological adaptations were made in your research as a consequence of the pandemic? Are these methodological adaptations emerging models, or temporary remediations? What have been the unexpected advantages of the pandemic context in your situation?

To communicate this event, an e-flyer was created with access information (Figure 3). As for its dissemination, emails were sent to national and international research centers, and each organizer reinforced the dissemination on social networks.
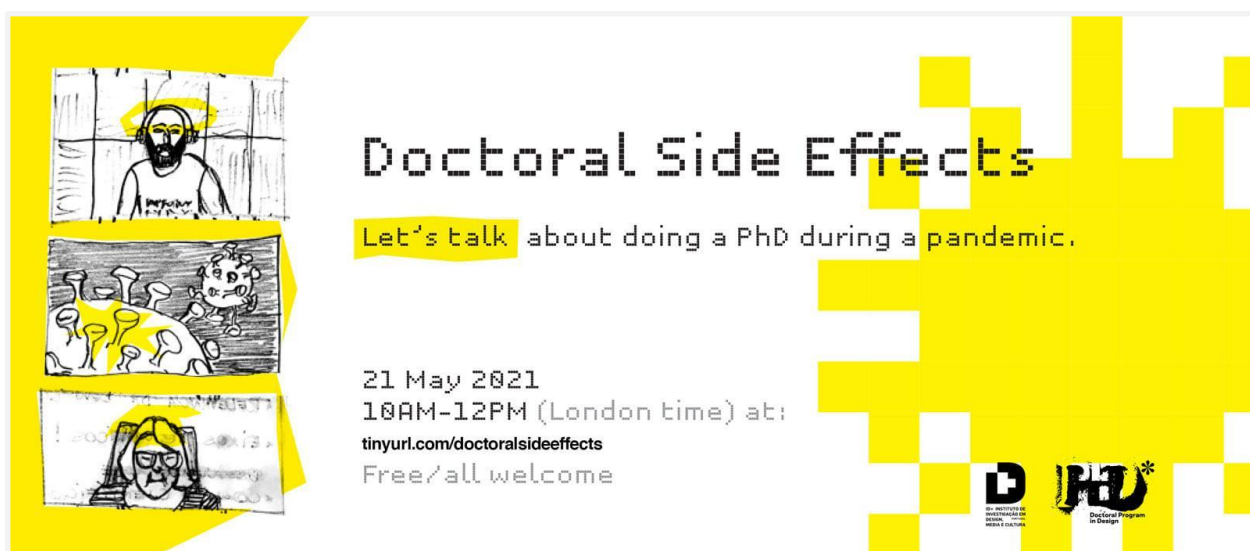
Figure 3: Doctoral Side Effects advertisement banner

The meeting

The Doctoral Side Effects meeting took place in videoconference format (Zoom), with the participation of 22 doctoral students and researchers from national and foreign universities (Figure 4). Two simultaneous rooms were organized, in order to accommodate Portuguese and English speakers (Figure 5). The sessions occurred informally, with testimonies according to the flow of the conversation. The Portuguese room was moderated by a student from the organizing team and the English room by the course director. Additionally, the organisers took written notes for subsequent summary and analysis.
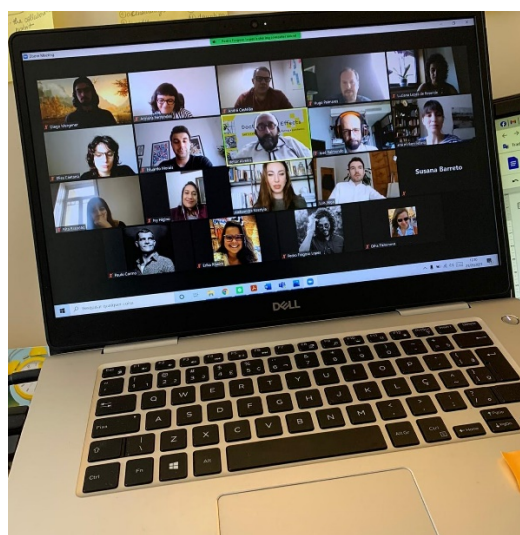
Figure 4: Doctoral Side Effects online meeting
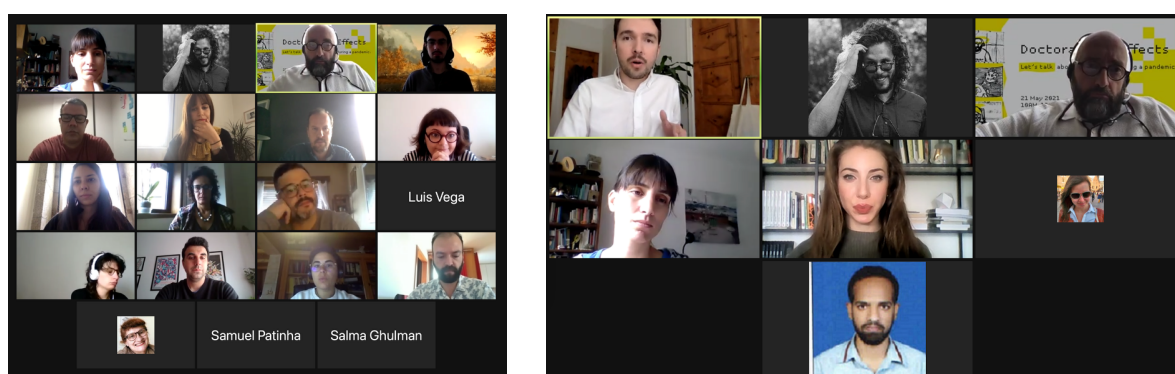
Figure 5: Portuguese-speaking room and English-speaking room

The addressed topics included:

I) Research/Researcher adaptability to the ubiquity of the digital

The following changes were reported: the need to migrate to new platforms and systems not specific to Arts and Humanities, over which researchers had little mastery; changes in work schedules in the interest of productivity; avoiding excessive access to disturbing social media and news reports; an adaptation of workstations to other environments; audio recording for later transcription and referencing; changes to methodologies - various of them later perceived as unexpected advantages; pragmatism; reconsidering the scale and scope of the research; accepting what was *possible* under the circumstances; approaching remote work without bias: empathy, bonding and mutual support emerged somewhat unexpectedly. Additionally, various participants reported that they came to casually accept and embrace the use of digital tools and environments, as online work facilitated and advanced theoretical components of their research.

II) Access, exclusion, or refusal to respond through digital media by participants in case studies

Adaptations were reported which hindered the development of the research, having intensified and even become permanent in the pandemic period. One researcher witnessed a

lack of dialogue due to the harshness of the area of her investigation; others reported discontinued collaborations due to the impossibility to establish remote communication with important partners, who either did not have access to the digital environment or avoid the use of online platforms, or do not feel comfortable in carrying out remote conversations.

III) An absence of conviviality

The impact of the lack of in-person interaction was addressed. There were cases in which the pandemic intrinsically altered the universe of study itself, where the conviviality between people ceased, and the premises of the research environment were drastically transformed. In several cases people sought new ways of interacting, and conviviality has moved from physical to digital environment: new digital contacts and permanent digital environments have emerged, forming hybrid environments in various instances.

Further issues discussed included difficulties in engaging people in online environments, and the use of gamification strategies; the need to verify data in future developments; concerns and hopes about being able to hold face-to-face events; questions about how to test and validate models to be replicated in a face-to-face format, when the tests were carried out strictly via virtual and digital models; and a debate about the loss of unexpected instances related to in-person dynamics: some participants argued that this was not lost, but rather migrated towards online environments.

IV) Expectations

The importance of managing expectations was a highlight: one researcher shared their mantra, after a remark they had once heard during an academic presentation, that "everything that happens [during research] is a finding. In addition, various participants argued for the inevitability, even the advantage, of incorporating the pandemic/confinement experiences as legitimised factors in the research, rather than regarding them strictly as antagonistic occurrences.

V) Minimising the constraints of virtual environments

Virtual environment constraints perceived as counter-productive were registered: excessive use of online platforms as a replacement for in-person classes, with equivalent structure and length; the fact that a constant image of the self via webcam can become tiresome; fatigue and memory issues due to the overflow of information and unfolding circumstances; a mandatory use of digital devices without prior check on accessibility conditions by students; a lack of adequate digital infrastructure at home in some cases; a loss of spontaneity in the research process; Lastly, there was a reflection on the need to consider insecurities, lack of skills and motivation, and a difficulty in evaluating methods and outcomes.

VI) Opportunities and benefits paradoxically arising from the pandemic

For various investigations, the pandemic brought specific and unexpected benefits to their research. The impossibility of in-person field work contributed to the discovery of new means to carry it out in digital environments. An internationalization of research became easier, as direct access to researchers in distant locations was made substantially easier. Similarly, the migration of international scientific initiatives such as conferences to online platforms benefited the progress of several investigations.

One researcher was confined together with her object of study: this facilitated and accelerated participant observation and interviews with other collaborators. The lack of human contact during confinement fostered voluntary participation in interviews: a clear expression for the desire for human contact during this period. It was acknowledged that online events, live broadcasts and meetings facilitated access to people; however, while attending online events was seen as an advantage, oversupply became an occasional problem.

A group of researchers reported that personal interconnection was surprisingly increased by the pandemic, when group work took place on a weekly basis in benefit of each researcher's individual project: empirical proof that it is possible to maintain, and even enhance, collaboration, sympathy and empathy in online work environments.

Tacit information obtained via videoconference, such as access to the personal environment of others, could itself become a subject of investigation.

VII) Research difficulties arising from the pandemic

When most academic activities were disrupted by the pandemic, various students had the sudden impression of having more free time, and consequently created expectations that this would speed up investigative work. However, much-mentioned issues during the meeting were a difficulty in maintaining focus, concentration and discipline without a structured schedule and defined commitments. A difficulty in writing the thesis amid a high degree of uncertainty about the future, being stuck at home, added up to the need to ensure daily housework and concerns with family members who needed support. A significant increase in anxiety about not reaching goals was reported, as well as insecurities and uncertainties emotionally affecting the researchers and their writing.

Participants addressed self-discipline tools such as to-do lists with daily goals, the importance of balancing work and rest, taking regular breaks between online meetings, and paying special attention to health, nutrition, and exercise.

Difficulties in adapting field work methods to online contexts, especially in collaborative contexts, were mentioned; however, a firm belief emerged in an imperative to avoid letting the investigation (and the researcher) become hostage to the situation, as well as the pertinence of being transparent in reporting changes and shortcomings due to the pandemic situation. Additionally, the fear of research becoming dated or invalidated was overcome by the realisation that research during a pandemic is in fact a unique opportunity to report on extraordinary circumstances.

In the English-speaking group, the most mentioned challenge by participants studying outside their country of origin arose from the fact that they were mostly alone in a host country they did not have the time to familiarise themselves with. This greatly impacted the search for a circle of contacts and connections and hindered a long-awaited exchange of ideas and inspirations, giving rise to feelings of alienation and self-doubt regarding the purpose of doing a PhD abroad. All of this implied inevitable adaptations and demanded the search for different forms of contact. One of these adaptations was to attend classes in other disciplines, as well as events from other research groups, thus broadening the circle of potential acquaintances/contributors, and creating opportunities to identify and pursue contributing research topics.

The use of social media platforms was also taken into account. According to researchers, online communication made it a lot easier to gain insights into their field research with peers from around the world.

Financial difficulties resulting from the pandemic were also mentioned, particularly in regards to job closures, - although for various participants the migration to online environments has presented advantages, with the reduction of transportation expenses.

Conclusions and future perspectives

According to DSE participants, during the pandemic, doctoral research experiences were similar regarding the need to adapt ongoing research methods. These adaptations may become innovative templates if replicable to an advantage and new confinements are necessary in the future.

While not all projects benefited from the lockdown and confinement, there were those which presented considerable added value; for example, those in the data collection phase, which in view of the requirements of confinement, were able to acquire information remotely - and in various cases, with a greater scope due to increased access and reduced expenses. On this subject, the shortening of distances and the ease of communication with research subjects/participants has become something tangible and feasible. This is an example of a practice that will probably become more frequent in the future; it is expected that, if this is the case, the quality of the information obtained, as well as the asymmetries of online access, will be largely safeguarded: what will happen to investigations that depend on data collection from populations with less access to digital media?

The various scenarios reported above indicate a distinction to be kept in mind: common forms of impact of the confinement on doctoral research, versus forms of impact specifically derived from the research context and discipline, as well as physical, material and psychological conditions of the researcher.

It is important to note that even though communication was made easier between respondents, the absence of physical and visual contact caused a considerable amount of subjective, non-verbal communication to be lost.

Many participants reported feelings of loneliness during the investigation; the contact and the exchange of experiences with other researchers enabled some form of relief from these feelings. We therefore propose that holding regular online events similar to DSE could be highly beneficial for the motivation, work capacity and well-being of PhD students, even beyond the constraints of confinement.

The fact that digital tools highly flexible enable work and socialization dynamics both structurally and geographically, allows us to foresee the possibility of creating self-regulated collaboration, support and mobilization networks that transcend circumstances, disciplines and doctoral work stages.

Strictly speaking, this possibility already existed as a technological resource before the pandemic and the successive confinements. Nevertheless, it was this global crisis that, perversely, transformed the availability of a technological resource into a model of global network communication among doctoral students. This networked communication,

paradoxically revealed in adverse circumstances, would not only be an opportunity for emotional support, but equally an opportunity for expansion and consolidation of contacts and complementarities at the level of the doctoral work itself.

The discussed topics ended up raising a new set of questions that are registered here as possible themes for future meetings and phenomenological analyses:

- In the transition from face-to-face to digital context, how is research validated? Do the approaches employed online as a result of the pandemic serve as validation for proposed methodologies for face-to-face contexts?

- How to overcome the undesired potential for exclusion that exists in particular forms of field work and among peers?

- What is the impact of a relative lack of synergy with colleagues and peers in an exclusively online context of communication? Did these synergies decrease with the employment of remote communication, or did it remain in new forms and possibilities?

- How to maintain healthy routines of engagement with digital devices in times of necessary overuse?

- Can researchers' motivation, as well as their work discipline, be improved through the formation of mutual support networks?

- In what future scientific contexts might these theses, developed in pre/during/post-pandemic times (and addressing them), become particularly relevant?

- What adaptations made during confinement appear to be permanent? Which of these transformations could have an advantage for doctoral research on an ongoing basis?

Acknowledgments

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Contact email: up201700317@fba.up.pt

Design as a Facilitator to Changing Mindsets for Craftmanship Enterprises' Resilience

Adriana Patricia Fernandes, University of Porto, Portugal
Claudia Albino, University of Aveiro, Portugal
Júlio Dolbeth, University of Porto, Portugal
Fabiano Virgínio Pereira, Istituto Europeu di Design, Brazil

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Abstract

Craftmanship is currently promoted as a foremost cultural manifestation, as they represent the heritage, diversity, and creative potential of a society. It also favors the generation of jobs, being characterized as an economic activity and not static, which must adapt to contemporary times and respond to the market and consumer needs. There are glaring gaps in awareness and information among artisans in this field, and design can contribute to mediating these two discontinuous realities. This article presents a case study that analyzes the possibilities of an approximation between design and craftsmanship that promotes collaborative processes in a knowledge-sharing scenario to create sustainable products and services. The design thinking approach was used in three workshops involving a group of thirty-nine artisans and three designers, where reflection exercises about artisanal product values, brand building, and business management were carried out. Each participant was encouraged to reflect and collaborate with their peers. The designers took on the role of facilitators for change and innovation, working with artisans to build a new mindset about their craft practice as a business. The focus on changing the mindset of those involved intends to favor the autonomy and resilience of the enterprises by proposing lasting and not ephemeral positive changes, as seen in the current state of the art. This study allowed us to infer that innovation through design happens when the results achieved present new models of individual and collective behavior, influence business models, and establish financial results for those involved.

Keywords: Craftmanship, Strategic Design, Design Thinking, Resilience

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1. Introduction

Handicraft is a manual, authorial production with symbolic values and cultural identity. Despite maintaining the use of traditional techniques, it is reconfigured over time. According to Canclini, handicraft is not a static activity, a set of fixed and immutable repertoires. Instead, it results from a collective experience of how people connect with each other, with artifacts and the social and cultural context to which they belong. Craft products are currently being restructured as contemporary social, cultural, and economic processes (Canclini, 2013, pp. 215-238).

In addition to its importance as a cultural heritage, handicrafts provide financial returns and generate jobs with a small investment (Cuéllar, 1997). At the same time, it is a means of subsistence and a factor in the balance of the labor market; it is traditionally an essential complement to the rural economy and works as an informal system for training the workforce and promoting tourism (Pereira, 1979).

According to the World Commission on Culture and Development Report of UNESCO (Cuéllar, 1997), crafts represent about a quarter of micro-enterprises in the developing world. In Brazil, manual work is an income option growing gradually and accounts for 2.8% of the national Gross Domestic Product (GDP). It is an activity that employs around 8.5 million people and earns R$ 28 billion per year (MINC/IBGE, 2006).

Artisanal practices are an asset of great importance for nations. Cultural, social and economic values are related in their materiality. However, with the advent of industrialization and the growth of mass production, handicrafts lose their value as consumer goods. The demand for handcrafted products on the market over time has drastically reduced, and handicrafts are no longer a profitable activity, discouraging current and future workers.

However, the escalation of industrialized products' consumption and the current lifestyle of most social groups brought the planet to a difficult moment of crisis. Actual models are no longer compatible with the available natural resources, which are no longer sufficient to guarantee the sustainability of life on the planet. Fundamental issues concerning the balance of natural and cultural systems and the quality of life are highlighted. New forms of organization and lifestyle will be increasingly necessary (Manzini, 2008).

The events of recent history show that change is already underway. We are transitioning from a system based on manufacturing material goods to another directly related to information and knowledge. In this scenario, Manzini (Manzini, 2015) observes a new path in the awakening of a culture that unites the local with the global and the emergence of resilient infrastructures capable of transforming the work organization as they bring production closer to consumption, the 'distributed systems', which appeared and spread in different innovation waves.

In this new scenario, the valuation of local production, resilient systems, creative communities, and small-scale production stand out as alternatives for a viable future, bringing a new opportunity for crafts' protagonism.

2.   Approaches between Design and Craftsmanship

The UNESCO strategy for crafts aims to preserve and strengthen handicrafts in promoting approximation and dialogue between crafts and design. It presents the designer as an interface between tradition and modernity, helping to adapt artisanal production to the needs of life, and bringing handicrafts as a predominantly rural activity to the increasingly urban, if not global, market (Trust, S.A., & UNESCO, 2005).

In Brazil, measures of approximation between design and craftsmanship have increased since the 1980s, consistently generating income or bringing visibility to craft products, generating more or less lasting results without changing the sector's status quo significantly. The agents are usually governmental or educational institutions, and the predominant focus is developing products and transmitting knowledge. Despite the highly positive results, they are usually ephemeral and often disappear at the end of the action (Borges, 2012).

3.   Strategic Design

From the beginning of its existence, when it was conceived as the art of shaping products for mass production, the design was firmly embedded in consumer culture (Margolin, 2002). Up to the present, it is still cited by many authors as part of the problem faced with the environmental crisis (Manzini, 2008; Papanek, 2005).

Over time, it is possible to identify significant changes in how design relates to the market and society. Progress has been made that ranges from industrial design to communication design and which today makes room for service design and the strategic approach.

Several authors discuss the new possible paths. Manzini (2015) highlights designers as drivers for social innovation and sustainability. Krucken (2008) highlights the design challenges and opportunities, reinforcing the need to rethink project culture and practice and its intervention in society. Cardoso (2012) recognizes design as a field of knowledge in evolution, which focuses its importance precisely on its "capacity to build bridges and forge relationships in a world increasingly torn apart by the specialization and fragmentation of knowledge".

The design came to be perceived for its ability to create, in addition to products, new meanings, services, business models, or experiences that meet people's needs (Brown, 2009; Meroni, 2008). This systemic approach, related to the product system and not just the industrial product, is known as strategic design.

The strategic design process is also characterized by being intensely participatory, requiring stakeholders' systematic involvement, and allowing the interference of various specialties, techniques, technologies, and knowledge. The strategic approach to design is to take advantage of these activated relationships (Meroni 2008).

The set of key design capabilities for strategic actions are: (1) the ability to see, understood as the ability to read contexts and systems-oriented; (2) the ability to predict, understood as the ability to anticipate future criticism and (3) the ability to show, understood as the ability to visualize future scenarios (Zurlo, 2010). Besides helping visualize possible future scenarios, the strategic design uses this ability to organize and make context data compatible with understandable options, giving meaning to new forms of organization.

Based on this context, the following case study presents a methodological proposal for bringing design and crafts together based on the strategic approach of design, which uses the principles of collaboration and design thinking. This proposal was designed to aim to reach permanent and not ephemeral changes, focusing on empowering artisans to manage their businesses in a resilient way.

4.   Case Study – Craft Design Rio Project

The case study presented here describes the context of the Craft Design Rio project, an initiative of the SEBRAE Reference Center for Brazilian Crafts – CRAB (https://crab.sebrae.com.br/), developed in partnership with the Centro of Innovation, Design, and Research of the Istituto Europeo di Design in Brazil - CRIED (https://cried.com.br/). The project was carried out between January and June 2017, in Rio de Janeiro, Brazil, with the participation of 59 artisans, artists, and designers from Rio de Janeiro, pre-selected by SEBRAE - Brazilian Service of Support to Micro and Small Companies. Companies.

CRAB is a Brazilian institution created to work on the repositioning and qualification of national handicrafts. Its mission is to expand the commercialization of pieces produced by Brazilian artisans. It works, among other fronts, in developing business training actions for artisans and improving the production chain and qualification of artisanal activity.

In 2017, CRAB approached CRIED, intending to develop a project to strengthen local handicrafts. Based on demand, a customized proposal was developed, based on processes of co-creation of values, committed to results focused on the local context.

The Craft Design Rio project was an initiative that brought together a set of Strategic Design concepts, methods, and tools aimed at recognizing, encouraging, and identifying new value opportunities for contemporary craft production in the state of Rio de Janeiro. Its general objective was to reinforce the exclusive combination of creative knowledge, techniques, and technologies already practiced in the state.

It consisted of training and consultancy workshops in design-oriented innovation processes, translated exclusively into the context of regional artisanal production. The workshop aims to strengthen the collective knowledge bases and favor constructing a new way of thinking about artisanal practice, focusing on the intrinsic values of the product, the territory, and the authors.

The expected results at the end of the program were:

- Provide the participants with Strategic Design and Innovation training, aiming for the collaborative construction of a new mindset;
- Improved competitiveness of the regional products against national and international competitors;
- Improvement in the development processes of new products and new market opportunities using design thinking in its strategic approach;
- Systemic improvement of handcrafted products' design processes, production arrangement, brand management, and marketing of micro and small crafted based business in Rio de Janeiro;

The process was organized into three phases: (1) Diagnosis and Planning, (2) Workshops, and (3) Results (Figure 1).
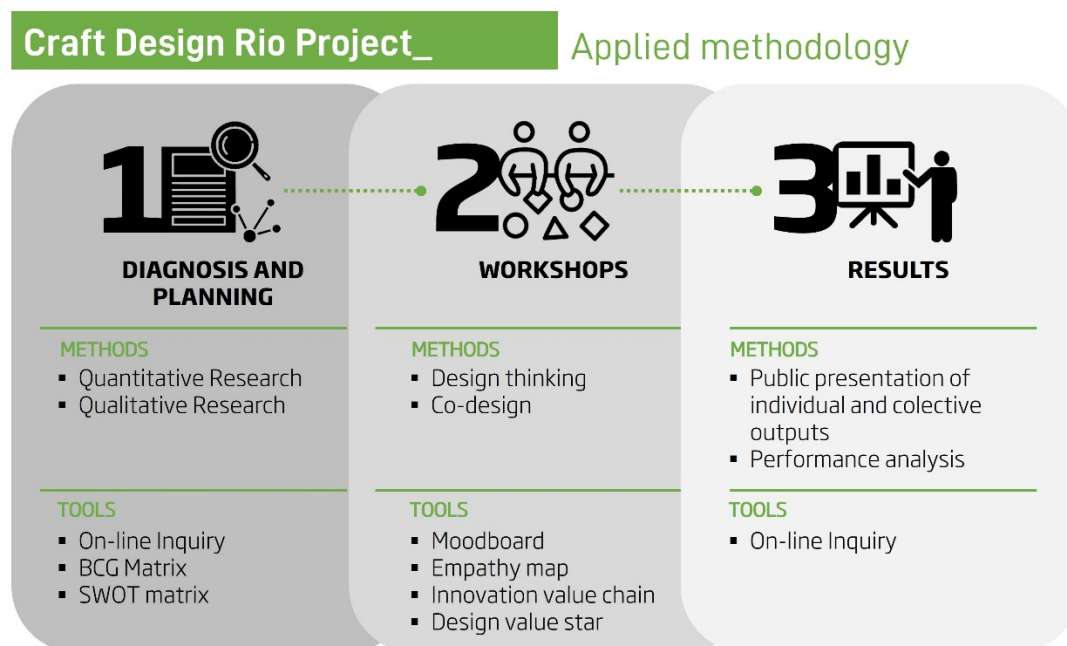
Figure 1 – Craft Design Rio Project's phases (Source: the author)

4.1.   Phase 01 – Diagnosis and planning

The first phase of the activities involved carrying out a diagnosis of the productive and creative potential of artisans in the state of Rio de Janeiro. This initial research aimed to outline the state of the art of local artisanal production, covering the following aspects: Issues related to organizational structure, Product and manufacturing process, Raw material, Management, Market positioning, and issues related to the perception of the business itself.

The following results were expected from this research:

- Identification of territorial competencies and contextualization of artisanal knowledge;
- Analysis of the handcrafted production systems know-how;
- Identification of cultural bases for competitive growth in local, regional, national, or international markets suited to each producer profile;
- SWOT analysis on the productive and creative design potential of artisans and micro-entrepreneurs in Rio de Janeiro;
- Strategic mapping of opportunities: market scenarios, innovation, and sustainability

The methods to collect information were quantitative and qualitative research, applied through an online survey from 09/Feb/2017 to 15/Mar/2017. The participating target audience was defined by the partner institution SEBRAE, consisting of 59 professionals registered in its database as craft professionals. Professionals were invited and expressed interest in participating in the initiative.

After collecting information, an analysis of the results followed. As it is a large and diverse sample – in terms of demographic profile and professional performance – it was decided to organize three smaller groups to enable collaborative activities to be carried out with greater

individual use. Two classification criteria from the Term of Reference –SEBRAE System's Performance in handicrafts (Mascêne & Tedeschi, 2010) were used to define the groups and order particular demands.

The first, 'Handicrafts categories', refers to the production process, its origin, use, and destination, and suggests the organization of handicraft production in the following categories: Handwork, Indigenous handicrafts, Traditional handicrafts, Cultural reference handicrafts, and Conceptual handicrafts. The second criterion, 'Product types', refers to the type of use and proposes classification into six areas: Adornments and accessories, Decorative, Educational, Playful, Religious, and Utilitarian.

These two criteria were used to identify similarities that enabled the organization of three working groups with similar interests, furthering a synergic and creative environment for the workshops.

4.1.1. Inquire

Fifty-nine artisans responded to the survey. From this sample, the majority (62.7%) are legally qualified as 'MEI' (individual micro-entrepreneur) and have only one person working (59.3%). The predominant gender is female (86%), and most companies are located in the Metropolitan region (46%). The craft practice is the only income source for 58% of respondents. The other 42% have another source of income.
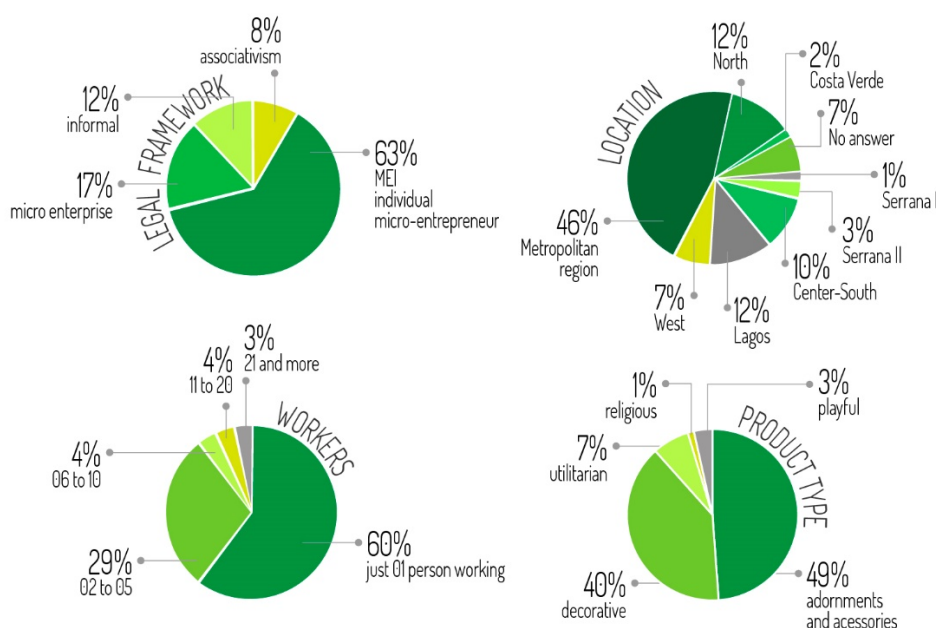
Figure 2 - Inquire results (Source: the Author)

As for the type of product produced, the majority (49%) produces Adornments and accessories, and 40% decorative products. The other categories appear less represented: Utilitarians 7%, Religious 1%, and Playful 3%.

4.1.2. New category – Crafted design

Different characteristics were found in some organizations during the analysis of products to categorize them according to the SEBRAE criteria previously presented. It became challenging to consider the five suggested categories, especially regarding the motivation of the creative process.

In most craft organizations, the creative process starts with a manual skill, where the creator explores their capabilities and materials and arrives at a range of products from this technique. The products maintain the predominance of manual processes (as these are the central basis of their creation) and aesthetically communicate the 'handmade' appearance.

In other cases, it can be seen that the creative process starts from a concept or a target audience's need. Then concerns arise with the material, technique, and manufacturing processes to design a range of products that meets the initial concepts. This second way of developing products is very close to the design's creative process, sometimes involving manufacturing processes, molds, and tools. The product often departs from the 'handmade aesthetics', despite being predominantly handmade.

Therefore, a new classification was created to identify these differences and organize these groups in a particular category:

Crafted Design – Objects produced from a deliberate project to affirm a lifestyle or cultural affinity. The creative process starts from a concept and explores techniques, materials, and typologies to express it. It has originality, often demonstrating the predominance of a specific artisanal technique or material. It demands to manufacture using molds or tools or involving people who know only part of the process. Usually, the person in charge has creative professional training, and the products may not express the aesthetics of the 'handmade' product.

The groups were organized considering this new category (Figure 3):

Figure 3 - Classification of productive artisanal organizations according to "Handicraft categories" (Source: the Author)

4.1.3. SWOT Matrix

SWOT Analysis is a tool to assess an organization's Strengths, Weaknesses, Opportunities, and Threats. It seeks to understand how the organization behaves concerning competitors, analyzing factors inside and outside the organization to determine whether the defined business objectives are achievable or not (Kumar, 2012).

This tool was applied to identify how artisans understand their business and the existence or not of a strategic vision. In preparing the matrix (Figure 4), respondents were asked to cite at least three items for each question about their business: Strengths (that you already have), Improvements (that need to be done), Opportunities (that you have not yet explored), Threats (which can hamper your performance).

- *Strengths:* Responses focused on product qualities (quality, finishing, exclusivity, originality, design) were cited 99 times. Then business qualities with 37 citations (service, machinery, marketing, organization, punctuality) and many cite personal qualities as strengths, cited 36 times (creativity, skills, good taste, 'belief in my work', 'love for what I do').

- *Improvements:* It was possible to identify four predominant subjects in 155 responses: 'Business' – 67 citations (regarding infrastructure, branding, equipment, planning, increase in production), 'Sales' - 50 (sales increase, marketing, online sales, fairs and events, export), 'Product' - 30 (new materials and processes, design, packaging, finishing, innovation), and 'Personnel' - 08 (qualification, professionalization, time management).

- *Opportunities:* 111 responses were collected, and the predominant subjects were: 'Sales' (cited 68 times), 'Products and production' (17), 'Strategy' (12), and 'Marketing' (8).

- *Threats:* The subjects were diverse. In general, artisans cite weaknesses in their own business as threats, indicating a lack of vision about the external factors influence as a determinant for the good performance of the business. Some patterns can be highlighted: Raw material (cited 10 times), Competition (08), crisis (07), Logistics (04), and Outsourced suppliers (04). Subjects related to weaknesses of the business itself: Management problems (05), Low productivity of artisanal work (04), lack of capital for investment (07), lack of dedication (02), and health problems, since usually the artisan is solely responsible for administration and production (03).

Figure 4 - SWOT Matrix (Source: the Author)

As a diagnosis conclusion, it is possible to outline the group's profile as highly diverse. Different business structures were identified, always determined by the profile and repertoire of the craftsman responsible and the type of artisanal practice on which they are supported.

In general, it is possible to notice that artisans feel comfortable in matters related to their product and work, citing as strengths internal factors related to their craftsmanship and the product, and as weaknesses external factors related to business management and the marketplace. The idea of artisanal practice as a business is still tenuous for the interviewees, and the most significant challenges faced are related to business management and sales.

4.1.4. Competitiveness Matrix

The competitiveness matrix (Best, 2010) was used to evaluate two criteria for building a brand positioning. The horizontal axis evaluates how the creative process is built, whether based on the mastery of a technique or if it starts from a conceptual intention of transmitting a symbolic, historical or cultural meaning. On the vertical axis is the identification of the manufacturing process, evaluating the predominance of manual and industrial processes (Figure 5).
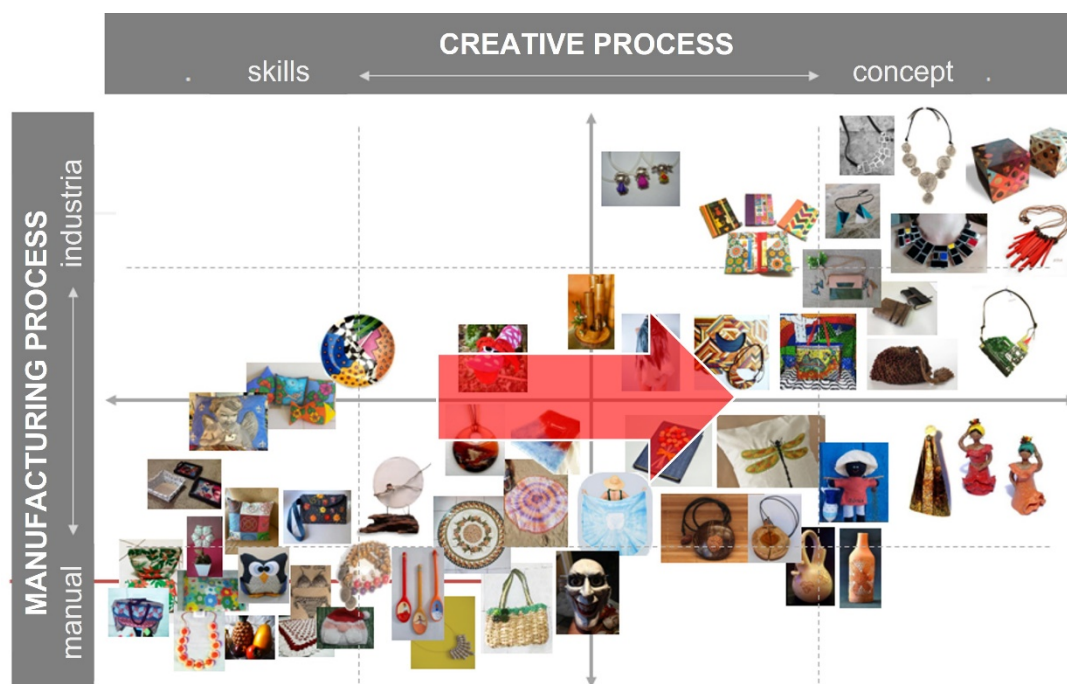
Figure 5 - The competitiveness matrix. The red arrow represents the project goals: leading participants to a more conceptual creative process (Source: the Author)

By analyzing the visual result of the matrix, it is possible to understand the brand positioning of the organizations and how and with whom it dialogues in the market.

On the horizontal axis, the more to the right the brand indicates that the creative process is based on concepts. The organization shows a coherent narrative through its product line, which reinforces its identity, leading it to precise positioning in the market. On the other hand, when the creative process is anchored in the aspects of reproduction of a craft technique, and there is no straightforward conceptual narrative, the more weakened the identity (sometimes non-existent), leading to a handicap in market positioning.

After the diagnosis, it was possible to identify a complex scenario resulting from the diversity of the sample. There were different products, artisanal technics, and markets. The workshop's strategy would be to bring this diversity closer and create a friendly sharing environment so that participants could learn from each other.

The participants were organized into three groups to establish a common ground. The setting up of the working groups took into account affinities in their practices: affinity for product typology (accessories, jewelry, and bio-jewelry), technique, and raw materials (Fabric, Patchwork, and creative sewing), and product's type of use and application (Decorative and utilitarian objects).

4.2.   Phase 02 - Workshops

After carrying out the diagnosis that allowed the initial understanding of local production, and the organization of groups gathered by the affinity of techniques, products, and materials, phase two followed the realization of the training, integration, and inspiring workshops.

Specific approaches and content were developed, alternating moments of reflection on subjects such as Craftsmanship, Creativity, Innovation, Design, and Branding, and moments of practical exercises, exchanging ideas and ideation. The themes have been selected due to their potential collaboration for developing a new mindset about the craft practice, leading the participants in moments of intense reflection about their challenges.

The ideation phase was challenging since each artisan had his business as an object of reflection. In this diverse scenario, where there is no single answer, the way out was to apply a non-linear method that would enable participants to deal with the complexity and understand the potential for transforming contexts.

In project environments with no linear or pre-defined methodological steps and scenarios that cannot be predicted, design thinking tools are a powerful resource that helps identify the most appropriate solutions for each process step. It is a fast-paced, iterative process that can be applied to even the most confusing business challenges, and it is a strategic activity that identifies clear opportunities for action (Brown, 2009; Ingle, 2013)

Figure 6 presents some strategic design tools to lead the participatory analyses and discussions.

- *Moodboard:* collages used in design to graphically portray a concept, allowing the elaboration of a consistent visual horizon that works as a frame for the project (Bürdek, 2010).
- *Analysis of the innovation value chain:* Identify stakeholders, weaknesses, and strengths of the value chain at all stages of the artisanal product's development, production, and commercialization.
- *Design Value Star:* Analysis of the value attributes of the artisanal product (Krucken, 2009).
- *Empathy Map:* Deepen knowledge about the target audience, developing a better understanding of the environment, behaviors, concerns, and aspirations (Osterwalder & Pigneur, 2011).
- *Personas:* Outline the target audience's profile, in addition to sociodemographic characteristics (Miaskiewicz & Kozar, 2011).
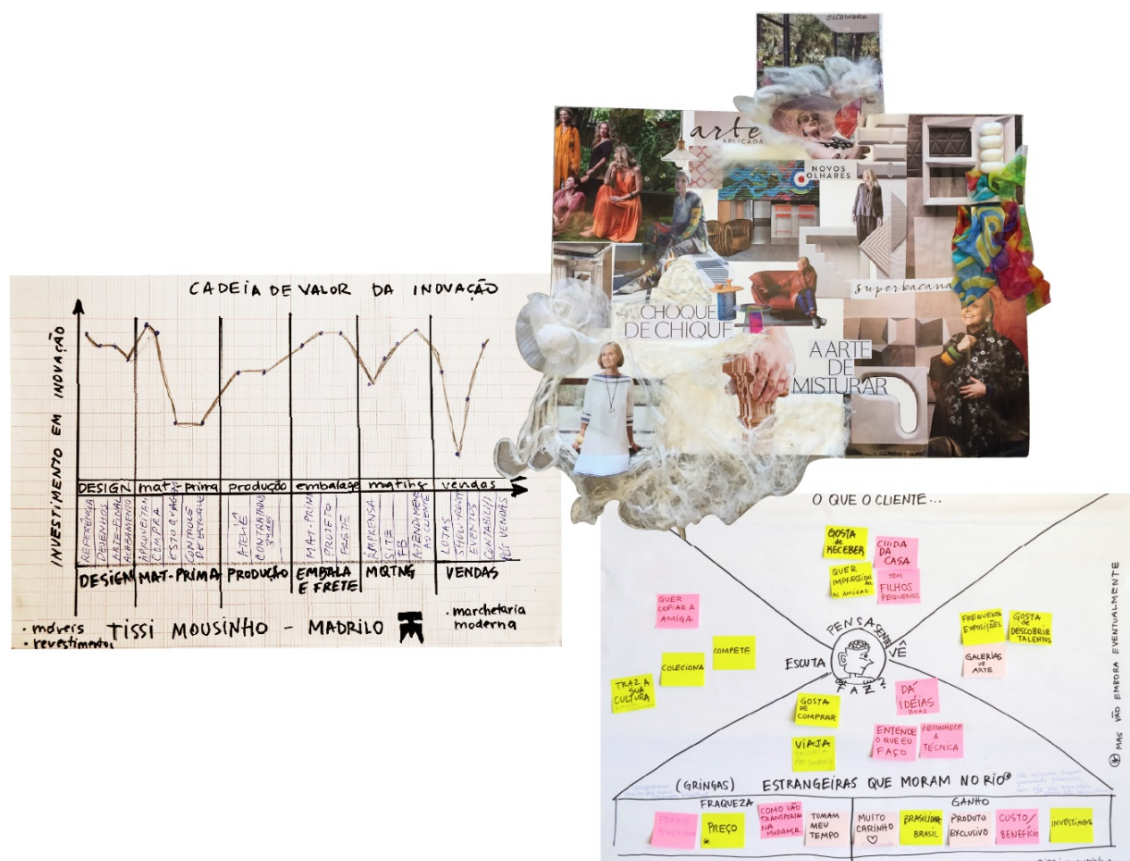
Figure 6 - Some of the strategic design tools applied in the workshop
(Source: provided by the authors)

All activities were carried out collaboratively, with participants divided into small groups as they performed each exercise and shared the results with the whole group (***Error! Reference source not found.***). At the same time, facilitators pointed out relevant topics and sparked discussion. The group proved extremely participatory, transforming the moments of sharing results into a rich knowledge exchange. The artisans were able to learn from each other by identifying common problems and contributing to their strengths.

The role of the facilitators in this context was to conduct the discussion topics systematically and objectively, contribute to the formation of strategic thinking and promote an environment of synergy.
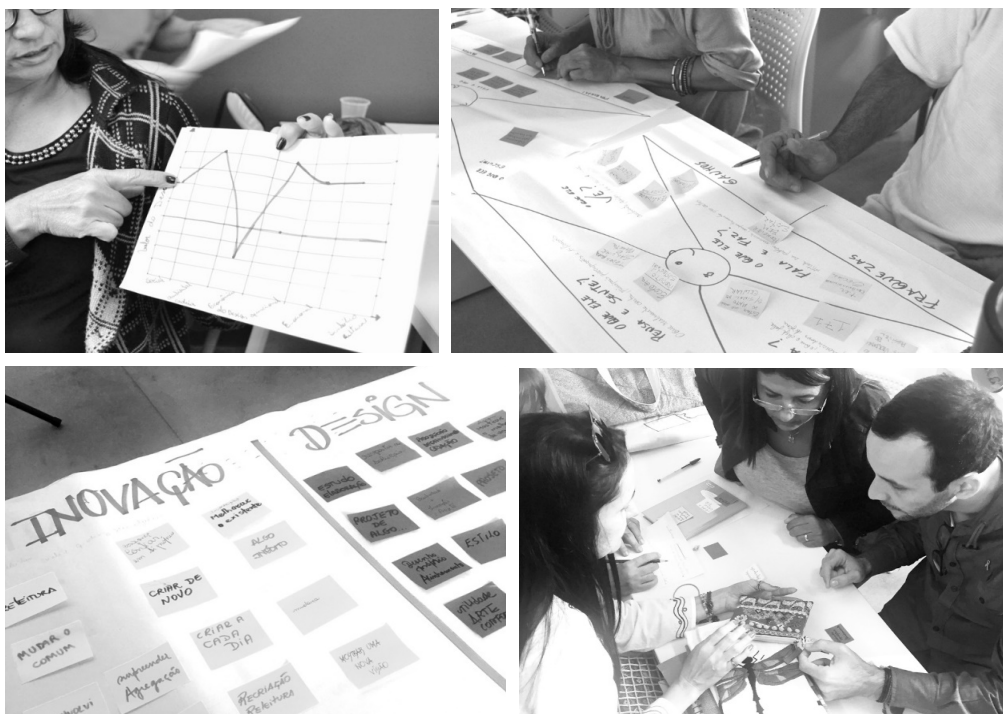
Figure 7 - Images of the collaborative activities carried out in the workshops
(Source: the Author).

4.3.   Phase 03 – Results

After the workshops, the final challenge was launched: each participant had to present, within a month, a transforming proposal for their craft-based business. The proposal should directly result from the reflections carried out during the work week. No formats or defined tasks were stipulated since the impact of the content discussed could affect each business in different ways.

Participants were asked to identify, among the exercises performed, subjects that stood out as great opportunities for innovation in their business and to present a proposal based on a new way of thinking. The objective of this final exercise with a broad scope was for each professional to look for possible qualitative leaps in different areas of their work based on the reflections carried out in the workshop.

The final meeting took place within a month as a temporary exhibition open to the public. Each participant received $1m^2$ to expose their proposal, and the guests walked around the space enjoying the explanations. Thirty-six participants were present, and the exhibition lasted six hours.

The results were diverse and in different business contexts: product mix diversification to reach a new audience or market niche, new social media strategy to reinforce branding, quality improvements on product components and finishing, brand redesign, new packaging, new raw materials, partnerships between artisans for new products, designing new products with symbolic and cultural values, implementation of collaborative work in the artisanal organization and finally, what most represents the strong assimilation of the value of collaboration by the participants was the proposal to create a collective of artisans.

The 'Qoletivo Qraft – Qoletivo Regional de Artesanato e Formação de Talentos' was proposed by one of the participants and had the initial engagement of 20 participants, who committed to participate in the enterprise on the day of the closing event.

The collective work allowed the artisans to organize a collaborative store in 'Fabrica Behring', a well-known open space for creatives in Rio de Janeiro where artists, artisans, and designers have their ateliers open to visitation and product sales. The group also participated in the IED Fashion Sunsets exhibition, held at the IED São Paulo headquarters in July/2017. Since then, the group has remained united, despite changes in members and location. Some artisans left the group, others started to join, and up to the date of writing of this paper (July/2022), it remains functional under the new name of 'Espaço Colabora Nobrega' (https://www.instagram.com/colaboranobrega/).

5. Impact evaluation

Regarding the impact assessment, despite the diverse nature of the results and the difficulty of a quantitative assessment, it is possible to identify three predominant movements in the final proposals:

The *collaborative movement* is reflected in several of the results presented, such as new products developed through partnerships between artisans, implementation of collaborative work in organizations, and the foundation of an artisans' collective. For this movement, the importance of the initial careful group organization to provide a collaborative environment where members could find affinities and develop empathy was fundamental.

The *empowering movement* can be highlighted in the artisan's change of mindset about what design is and how the application of its concepts can benefit their work, not just in designing products but in managing their business. Through the results, we can notice the artisans identifying their weaknesses and creating new strategies, such as redesigning a brand or branding, creating new packaging, and designing new products with local values inspiration or specific customer needs. This shift in perception indicates that they can probably do it autonomously in the future.

Furthermore, the *innovation movement* is identified in all the proposals. The combination of innovation processes with tacit knowledge and the focus on meeting user expectations made it possible to generate tangible and intangible values, which translated into different strategic results for each participant.

6. Conclusion

In general, it is possible to perceive in all participants a great passion for their work, a tendency towards individual work, a great disposition for the creative process and manual work, and great difficulties in business management, strategic positioning, and sales.

According to the diagnosis carried out for the project, the handicraft in Rio de Janeiro is diverse in terms of technique, cultural repertoire, and stages of development. A new form of craft practice was identified in the group of participants, not foreseen in the SEBRAE Terms of Reference, which indicates the emergence of a craft practice based on a creative process very similar to the design process, which starts from a concept or the need to a target audience.

The complexity in this diversity, added to the marginal positioning reserved for craft work in today's society, configures the demand for differentiating methodologies and innovation and design tools, stimulating the search for a new positioning and new social, environmental, and economic results for craftsmanship practices.

In this way, the "Craft Design Rio" project, organized by SEBRAE and IED – Istituto Europeo di Design, presents itself as an initiative aligned with current demands. It seeks to promote the culture of innovation to improve the process of adding value to the artisanal business, boosting quality and competitiveness facing new market parameters, using strategic design tools and methodologies.

The high productivity and high degree of tangible innovation manifested in the final results and the intangible gains identified in increasing the understanding of the business and identifying existing challenges prove the great potential of actions that brings together strategic design and craftsmanship.

The methodology designed for the Craft Design Rio Project can be characterized as a "Transforming Mapping" as it allows to collect of information about the local artisanal production and the creative potential in the region, provide contact between professionals and networks articulation, and create a new way of thinking.
At the same time, it works as a training program and research tool that can be the basis for developing new development actions, featuring a vital pillar to be considered in a sectoral development program for Brazilian handicrafts.

For future actions, it is possible to outline actions based on three pillars with a focus on *Preserving, Developing,* and *Displaying* Brazilian handicrafts, seeking to contribute to the expansion of work opportunities, strengthening and autonomy of groups and organizations, and implementing innovative models and processes in the sector.

This set of developments could consolidate results and generate a continuous cycle of sectoral innovation. It could be applied and reapplied according to the identification of local demands, thus fostering the development of the sector as a whole, guaranteeing actions for the preservation, development, and dissemination of handicrafts as an alternative for economic development and cultural valorization.

Acknowledgments

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Contact email: adri.patricia.fernandes@gmail.com

Using Design to Connect Children Through Playful Discovery

Lee Brewster, Lancaster University, United Kingdom
Leon Cruickshank, Lancaster University, United Kingdom
Diane Potts, Lancaster University, United Kingdom
Nik Marsdin, Lancaster University, United Kingdom

Abstract

This paper presents the first stage of FUSE, a project presented here as an example of how interdisciplinary researchers, university outreach staff and schools can come together to address the systemic inequalities in education exacerbated by the Covid-19 pandemic. Children's connections with their school, their families and with each other was central to this collaboration. Children were encouraged to explore their domestic situations and the materials and objects they found available to them through playful discovery, utilising a series of prompt posters and a box of carefully chosen materials. The results of their playful and creative activities were shared using a number of return pathways including mobile phones, photos and physical artefacts. Using collaborative design methods, semi-structured interviews and visual documentation of artefacts we have identified a number of tools and techniques that have helped to engage and make connections with children, school teachers and peers. Unexpectedly the project has also strengthened the connections that children have with their siblings, parents and grandparents through imaginative, experimental and playful activities. This paper shares the elements from this project that helped to create the mindset for a playful approach to discovery. Through an analysis of the multiple return channels that tell us about the way the FUSE boxes were used we map how this has had an impact on the children's approach to discovery-led activity, to schools changing approach to non-punitive interventions with challenging children and how this is informing policy development within these schools.

Keywords: Education, Co-design, Children, Language, Equality, Playful, Discovery

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Introduction

In the U.K. parents had to suddenly home school due to the Covid 19 pandemic. Children became disconnected from their schools, teachers and peers and many parents struggled to support their children's learning. Some families had the resources to facilitate online learning and connect with teachers in virtual learning environments, children looked after and children of key workers were allowed to continue attending school. This left many children, not visible; these children were part of families who either lacked resources or lacked knowledge to use resources. These families often did not have a strong educational base on which to draw in order to support learning for their children. In some cases, these families were provided with laptop computers and means of internet access but these were never activated or used by the children. These families were already often struggling with precarious incomes, insecure food supplies and poor access to green areas and gardens, under resourced in every way. The combination of these factors led to a considerable number of families in Lancaster and Morecambe being significantly more impacted by Covid 19 than others with more resource and more contingency that they could draw on.

The 'Box' project responded to this situation, not by parachuting in technology but rather developing a high-quality set of physical resources in a cantilever toolbox, scissors, bulldog clips, fixings, string, elastic, chops sticks and drawing and writing equipment. Accompanying the 'Box' was a range of research led provocations, not prescriptive worksheets but non prescriptive prompts.

This paper explores how the box and prompt poster resources led to imaginative, self-directed and playful discovery, that re-connected children with their teachers and strengthened the bonds that they already had with their parents, siblings and grandparents and how a multidisciplinary response led to policy changes in primary schools.

Approach

The schools that took part in this project were all based in Morecambe and Lancaster in the north west of the U.K. there is a high percentage of children who receive free school meals and the communities there could be described as under resourced and under heard.

The response to this situation, might be interpreted as the pre-co-design stage of the larger FUSE project. Under pre-Covid 19 condition this 'Box' resource would have been a co-design project, gathering diverse groups of adults and children together to address systemic issues in education (Paracha et al. 2019; Sanders and Stappers 2008; Vaajakallio, Mattelmäki, and Lee 2010). However social distancing laws prevented this and the very people who might have been part of the multiple design teams were unable to access the internet or meet face to face. Although this response was co-ordinated by a multidisciplinary team and the projects were generated by a call out across multiple disciplines in the university, it would not be described as co-design as the users did not directly contribute to the process (Cruickshank, Coupe, and Hennessy 2016; Simonsen and Robertson 2013; Steen 2013). It might however be seen as a pre-co-design stage which laid the pathway for collaborative design to really happen when the Covid 19 restrictions were lifted. The approach adopted in this case or more accurately imposed upon it was one of collaboration between the multidisciplinary stakeholders who had access to, and the knowledge to use, digital communications. Encouragement and opportunity were provided to those children who received a 'Box', asking for feedback and suggestions for further materials and contents when their resources

needed to be replenished. The design team were able to respond to the children's feedback, making changes and in time those children would be invited to participate in the workshops discussed in the conclusion of this paper.

Methodology

The research methods used in this project were a response to an unprecedented situation.

A core group of researchers from design, linguistics and outreach workers provided support and momentum for a wider group involved in the project. Emphasis was given to methods of communication to ensure timely and appropriate responses for researchers and teachers, researchers were mindful that teachers workloads and demands on time had increased.

There were also a number of return channels set up for children and parents to share their artefacts and thoughts with researchers and teachers. Firstly; children had the option to take the physical artifacts into school to have them displayed in the windows of school so that their peers would be able to see them. Secondly; children or parents could send photographs via their mobile phones directly to school and the teachers would respond to the child and then post the photographs on the school website. Thirdly; children were given postcards and stamps and were invited to write and draw on a postcard and send it in to school, this method was not a preferred means of sharing stories and artefacts.

Although many families lacked resources, sending photographs of artefacts via mobile phone did not seem to be an issue and was the preferred method, these images were often accompanied with comments from parents on how much their child was enjoying using the prompts and box and they also shared who had been involved in the creation of the artefacts. Teachers who normally taught the classes issued with the 'Box' fed back to head teachers, there were expected and also unexpected responses. The head teachers participated in semi structured interviews with the researchers in the depths of the first and second lock down situations and also as restrictions began to ease, their insights helped researchers to understand the changes in children's, parents, siblings and teacher's behaviour in domestic environments and in the classrooms.

Creating Project Resources

The 'Box' resource emerged in two distinct ways firstly the actual box of materials, which was carefully chosen to provide components and fixings that challenged children to make, build and explore things. The contents were not gathered by chance, there was no glue or easy fix solutions in the box, there was no glitter or decorative elements. The intension was always to challenge the children to experiment, try, test and fail with no right way or instruction to follow or images as comparison. What if? and how can? Were the questions we intended to provoke. The 'Box' emerged through an iterative process over a period of weeks. The cantilever style was intended not just as a home for the materials supplied but also as storage for found and collected objects curated by the children. It has the potential to evolve into very a individualised resource.

The core, cross disciplinary team discussed on multiple occasions what resources the children would have access to in their homes. Assumptions that perceived everyday objects like sticky tape, scissors and string were put aside. The researchers understood that most household would have some furniture, bedding, kitchen equipment and food packaging also structural

elements like doors, handles on cupboards and so on. These were all considered as potential places that could be incorporated into built structures. Figure 1. Shows the 'Box' and teachers from a participating school.

Figure 1. 'Box' and teachers from a participating school

The second element that accompanied the 'Box' were the prompt posters. A call was put out across the university for ideas for projects, for primary school children to do at home. Projects were returned from science, computing, engineering and design. These projects varied in complexity and specification and so it was decided that they would be used to inspire and influence far less prescriptive provocations (prompts), the intention was to deliver much more than a worksheet for children to follow or fill in.

An example of this was a potential project idea that explored a section of coastline, a map would be included of the coast and a collecting jar and sieve would also be included in the proposed activity pack accompanied by instructions. The core interdisciplinary team reflected on the resources and support that the children receiving the pack, would have available to them. Gaining access to the coast even though it was in close proximity was not realistically achievable for primary school children on their own and given even simple tasks to read and follow would be problematic. This project was distilled to 'Follow a bug", which would be achievable anywhere, resources were provided to draw or write or make, in response to the activity but no instruction was given. This was not about doing experiments sitting at a desk or reproducing a school environment in the home. This project promoted physical, experimental, playful activities. This was done by distilling the language in the original projects down to two or three words, thus leaving only the essence of the activity. In order to see if others outside the design team were able to do this, we asked participants of a university-led science festival (funded by the Economic and Social Science Research Council (ESRC) to attend an interactive workshop called 'looking through the lens of a 6yr old' to test our ideas on distilling prescriptive activities into fundamental language. The workshop explained the process of taking an idea and distilling it until only 3 words were left to describe a non-prescriptive, playful activity that had an outcome. Firstly, discussions at the end of the workshop, revealed that this activity was more difficult than it first seemed, the distillation took three or four iterations, each time removing any prescriptive words. Secondly, post workshop discussions explored why more of children's education should be non-prescriptive allowing them to use imaginative learning techniques, removing criteria, assessment and comparison of peers. The benefits being that the children would take ownership of their learning and that it would be self-directed, and they would enjoy it. Figure 2. Shows a selection of prompts that were given out to children.
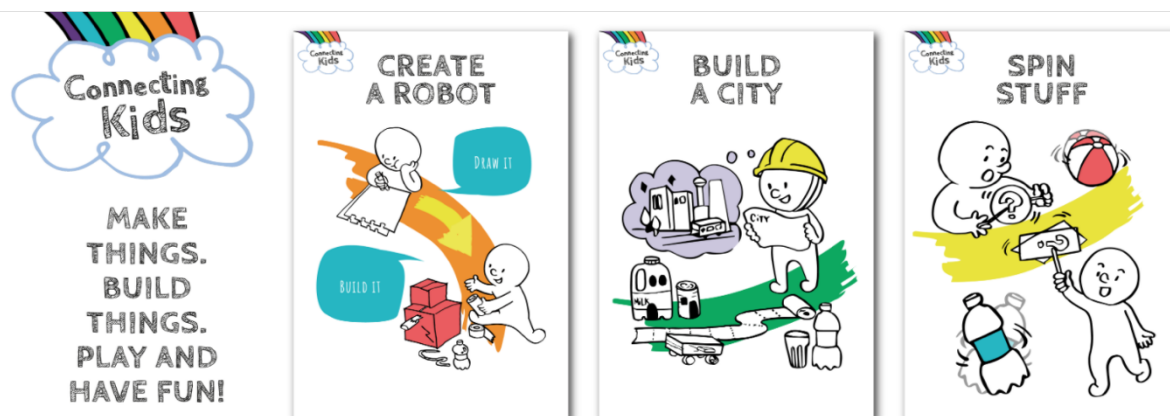
Figure 2. prompt posters (Graphics by Nuri Kwon)

Figure 3. is an example of how the interactive workshop helped the distillation of projects that lead to a provocation or prompt that is non prescriptive. Each iterative stage removes prescriptive words until only the fundamental essence of a project is left, that still has an outcome.
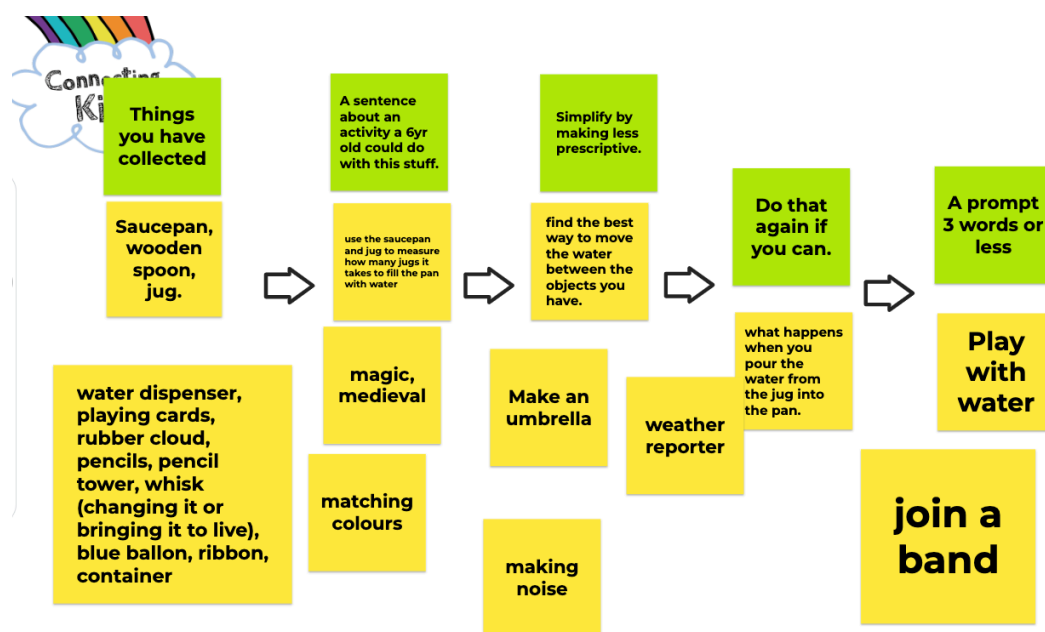
Figure 3. Distilling projects to fundamental language

Getting Resources to Those Who Needed Them

There were a number of issues that needed to be addressed before the realisation and distribution of these resources.

Beyond Imagination, Lancaster University's design research laboratory agreed to fund the initial round of 500 box resources. The budget for each child's resources was set at between ten and twelve pounds sterling.

The unprecedented situation that the Covid 19 pandemic created was challenging, the multidisciplinary team including university staff and teachers, did not meet face to face until after social distancing legislation was lifted. All meetings for the development of the resources were carried out online or on the telephone. The unfamiliarity with online meetings and software were problematic for the academic team at times but those members of the team who were not affiliated to the university were not privileged to the same digital communications channels, this highlighted another level of inequality and access to adequate resources.

The teachers in school at this time were under significant pressure to continue to deliver learning in the classroom, online and via the postal service, often visiting children's houses before and after school hours to continue contact and care for their wellbeing as well as their learning. To ensure that demands on teacher's time was minimal by the researchers and outreach staff there would be only one point of contact and that person would be responsible for arranging appropriate meetings and discussions.

The box, resources and prompt posters, were developed and prototyped by individuals within the team and all the materials were ordered online and delivered to the university. Outreach staff and volunteer students who were already living on site in the university packed the boxes and they were then delivered in batches to schools by the university outreach staff, in their cars to begin with and then by van.

Schools distributed the boxes in a number of ways, children who were already in schools were given boxes, those children who were at home were invited into school to collect their box or it was delivered to them at home by teaching staff. The box was distributed with three prompt posters initially but more posters were released in batches of three each week, teachers reported that children were asking for the next set of posters before they had been sent and were completing the activities as soon as they received them. Children who were not supposed to be in school during the social distancing lockdown periods were asking if they could attend after school computer classes in one school, this allowed them to pick up a poster before it was sent via the postal service, enabling the children to receive them a whole day in advance.

Responses to the Resources

Parents of the children who used the 'Box' resource fed back that they had observed their children working with siblings on projects and that this was unusual, they reported that existing bonds between parents and grandparents had been strengthened, in part because parents and grandparents were not intimidated by the prompts, often they did not do homework with children as they thought they would not be able to do it. The prompts were not recognised as school work.

As restrictions began to ease children were encouraged to take their 'Box' into school and use it to help them visualise abstract concepts, not just in design and technology and art but across the curriculum of subjects. Teachers began to notice some of the materials from the 'Box' creeping into homework projects in other areas of the curriculum, suggesting that the mindset for playful discovery was travelling from the informality of home and children were seeing the potential applications of this mindset.

Teachers encouraged children to use the 'Box' when they got stuck on a project or when they began to misbehave after losing concentration. The resource was given to children instead of punitive measures in some cases, allowing them to be playful but still focussed on the work in hand.

Teachers from a special school reported that using the 'Box' as a mediation tool had helped one child to be reintegrated into mainstream education. Figure 4. Shows some of the responses from isolated children followed by accompanying messages from parents.

Figure 4. Some of the responses from isolated children

- "She has really enjoyed the box! Thank you so much, I will get a pic of 'C' with her makes as well send in."
- " 'A' has really enjoyed making things out of his craft box. Thank you, here are some of the bits he's been busy making."
- "The girls have finished the robot they made together"

Potentially the boxes of each child might change and evolve individually, each child adding their own resources or collections of materials and artefacts.

Conclusion

In this paper we have shown that using designerly thinking (Cross 1982) and fundamental language supports children and teachers to reignite imaginative, experimental ways to connect and learn. Approximately 3000 'Box' resource packs have been distributed to children up to this point.

The project has had impact at multiple levels, it has helped to reignite the imagination of primary school children and reconnect them with their teachers during the unprecedented situation that resulted from the Covid 19 pandemic. It has helped to strengthen the relationships that already existed between children and their parents, grandparents and siblings. Furthermore, the 'Box has given teachers a mediation tool that helps children to be imaginative, supporting playful discovery in the classroom. Teachers are responding to the changes seen in the children and researchers are seeing changes in practices in schools. Head teachers reported that children were to be given access to the 'box' on their desks, to add richness to their learning and children would not need to ask to use this resource.

The teachers who have been interviewed so far in this project have highlighted elements that they said helped to create the mindset for playful discovery, as follows;

- Embracing and valuing failure
- Being comfortable with uncertainty
- Being experimental
- Being playful
- Informality
- Non prescriptive
- No assessment
- No comparison to others
- Self-directed
- Joyful

The Box project was a product of the Covid 19 emergency, we have distributed over 3000 boxes and the replenishment of these boxes is an ongoing activity and part of a long-term commitment to the schools and children. Our learning from the Box project also informed the development of a new project with longer term aims, exploiting the possibilities to work more directly with children and staff in schools. Fuse: codesigning discovery, is a project engaging 60 children and their teachers and support staff. A series of workshops for teachers and children have taken place to establish how to share fundamental language and new ways of using designerly thinking in learning. Researchers will be scaling the Fuse project to support more children and teachers to uncover playful approaches to discovery. There remain fundamental issues with the language used in design practices. They centre on providing explicit, shared language that can be used by anyone who wants to be a confident agent of change.

Acknowledgements

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Contact email: l.brewster@lancaster.ac.uk
l.cruickshank@lancaster.ac.uk
d.potts@lancaster.ac.uk
n.marsdin@lancaster.ac.uk

The Design Studio as a Place of Study: Critique as Hermeneutic Conversation

Naoko Masuda, Alberta University of the Arts, Canada

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Abstract

As postsecondary design educators, are we providing students a place of study or are we just instructing? Educational theorist and historian Robert McClintock's "Toward a place of study in a world of instruction" (1971) was published as a critique of the instructional culture in education in which he observed an overemphasis on pedagogy and the role of the teacher in student learning. In McClintock's conception of study the student is not a passive being reliant on a teacher to provide learning opportunities, but rather an active agent in their own self-cultivation. With the ongoing academization of design education and the outsized impact of communication design on society, there is an urgent need to consider how our own understandings of communication design, its history, and design education impact the future of our discipline and larger society. As part of a Master's thesis conducted using a hermeneutic approach and interpretive analysis to gain a deeper understanding of the lived experience of design educators, two communication design educators in a Canadian university were interviewed. Amongst the revelations was the value and significance of conversation, including within the design critique, as a necessary foundation for a student-teacher relationship that supports learning for both parties. This presentation explores Gadamer's concept of the hermeneutic conversation (1960/2013) as one approach that may help teachers and students transform the design studio into something closer to McClintock's "place of study" and open possibilities of self-formation for students and educators.

Keywords: Design Education, Design Critique, Design Pedagogy, Study, Hermeneutics, Conversation

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Introduction

Teaching and learning might impart knowledge, whereas study led to understanding, whereby things known were made one's own and became a part of one's judgment… (McClintock, 1971, p. 162).

To instruct relates to training. To educate is to foster the development of judgment, personal initiative, and the conscious adoption of values. This distinction is essential. To be a good designer in the broadest professional sense, in addition to the technical knowledge, one has to be a good citizen, that is, a socially responsible person. For this, technical instruction, however good, is insufficient, let alone faith in intuition (Frascara, 2007, p. 68).

Despite the increasing complexity of the work of designers and of the impact of design on society, and as graphic design education is increasingly academized, it is, as Harland (2017) states in his introduction to a special issue on graphic design education, "bemusing" that there is a relatively small pool of research on design pedagogy. Of the research available on design curriculum and pedagogy, many touch on topics that focus on what is taught (Goldschmidt et al, 2010) and how that is taught, and what research exists is mainly from American and British perspectives (Souleles, 2013; Harland, 2017). This may be in part due to the history of design education (McLean-Knapp, 2015); its close association with commerce and industry and the privileging of practice (Masuda, 2022); and in the relative newness of design education to the academy. Perhaps for these and other reasons, there is limited scholarship reflecting upon what it means to be educated and to educate in graphic design. With growing academization and the growing number of specialties (such as user experience design, service design, and information design) within and related to the graphic design discipline, it is now more important than ever to critically consider whether we are, in Frascara's (2007) words, only "training" (p. 68) designers rather than educating them.

If design education is to move beyond just building skills and gaining knowledge, to encourage and contribute to the self-cultivation of students as designers and as individual human beings, training will not be enough. In order to gain a deeper insight into why design education is the way it is currently, it is important to critically reflect upon how who we are—as practitioners and educators and as individual human beings with a past—affects the design classroom and curriculum. As part of a Master's thesis, I conducted a hermeneutic inquiry into the lived experience of design practitioner-educators, which included two hermeneutic interviews with design educators. One important revelation of these interviews was the importance of conversations in the classroom, both between teacher and student, amongst students, and also between students and both their own work and the work of others (Masuda, 2022). In the process, one conversation in particular that impacted me was the one I had with the seminal 1971 essay "Toward a Place for Study in a World of Instruction" by American educational theorist Robert McClintock. In it McClintock argues against a myopic conceptualization of education represented by training and instruction and instead champions study as the conceptual heart of education. I propose that the design critique as hermeneutic conversation based on the work of Hans-Georg Gadamer could help design educators to see the design critique as an opportunity for such study for both students and themselves.

Study and self-cultivation

In "Toward a Place for Study in a World of Instruction'" (1971), McClintock provides a historical overview of the concept of *study* and argues for it as an alternative to teaching and

learning. Referencing the writings of philosophers such as Michel de Montaigne, Erasmus, and Seneca, McClintock critiques the educational culture of instruction and makes a case for study as the path to achieve greater understanding, both of the world and of the self. Citing Montaigne, McClintock states that in teaching and learning, the student is made over reliant on a teacher to impart knowledge, rather than doing the "work of finding out" (p. 162) for the self. It is this work of finding out that leads to understanding and self-understanding, things that cannot be imparted from teacher to learner. Understanding must arise from within the individual student. This is echoed by Erasmus, for whom study was an art of "both discipline and delight" (McClintock, 1971, p. 164) and as such, a phenomenon that must manifest differently for and from within each student. For both philosophers, teachers were there to guide and encourage, rather than to instruct. Study acknowledges the individual's motivations and interests, unlike instruction which seeks an outcome to which students are required to conform (McClintock, 1971).

Although self-cultivation is often emphasized at the beginning of any educational movement, there is evidence throughout history that over time, a culture of instruction creeps in and overshadows a culture of study. In ancient Greece and Rome, with the growth of empire, so too did the need for well-trained bureaucrats and military officials and with it, a greater reliance on instruction (McClintock, 1971). Jesuit Christian education too began with a focus on study with the teacher's role mainly to encourage and facilitate self-discovery, yet with time, external pressures and accountability "for the people they produced" (McClintock, 1971, p.177) forced teachers toward greater emphasis on instruction. In more recent history, population growth, industrialization and its fixation with measurement, along with accompanying changes in societal views and values have all contributed to the growing culture of measurement and instruction (McClintock, 1971; Pinar, 2004). In my own context, the provincial government in Alberta, Canada, requires students in elementary and junior high school to take provincial aptitude tests, the results which are used by private organizations such as the Fraser Institute to "rank" schools (Fraser Institute, n.d) ostensibly to inform parents. At the higher education level, publicly funded universities are required to meet curriculum-affecting key performance indicators that have little to do with subject matter understanding or self-cultivation beyond workforce readiness. A focus on instruction can be thus seen as a homogenizing and conforming force that supports those in power, rather than one that respects the autonomy and creativity of diverse individuals.

It is important to mention here that instruction has its place and will always do so in some proportion to study (McClintock, 1971). In design education for example, students will need instruction in specific skills and knowledge (such as those taught in many foundational courses) to be able to solve more complex design problems later in their studies. However, while instruction focuses on atomic particulars—a skill, a unit, a course, or even a degree— study is a lifelong endeavor of understanding. Study also recognizes the autonomous creative student as a human individual and the initiator of understanding, rather than the teacher (McClintock, 1971). As a process of self-cultivation, study goes beyond curricular outcomes or the acquisition and assessment of skills and knowledge to understanding and self-understanding. McClintock's conception of study as a site for understanding also recalls the curriculum theorist William Pinar's words. Pinar eloquently states that "understanding is the raison d'être of the curriculum" (2015, p. 112) and that such understanding, is at once "intellectual and emotional", "individual and social, directed to the present as it is informed by the past" (p. 112). If study is truly the "site of education" (Pinar, 2015, p. 14), we would do well to try and understand what this could mean for design education.

As higher education everywhere faces challenges such as relevance, corporatization, and funding cuts, and even the pandemic, McClintock's critique feels more relevant than ever over fifty years after its writing. For my part, McClintock's essay has forced me to contemplate whether I as a design educator too often depend on instruction instead of supporting students in study, thereby stifling their autonomy and creativity. What does instruction look like? What can study be? How can we help students to find their own motivation in the art of discipline and delight? As one who teaches undergraduate students, however, I cannot just contemplate. I want to do what I can to support study, not only for students and colleagues, but also for my own self-cultivation. As Frascara (2007) urged:

> We have to set the bar high enough that we abandon the idea of training designers, and get on with the practice of educating them, even if, in the end, they begin to think differently than us. At least they will think, and will not just copy, like trained monkeys, the miserably superficial look of things. (p. 68)

In understanding our practice of educating students, reflecting upon whether we truly are educating them or only training and instructing them, we may be better able to respond to Frascara's call. Afterall, the word studio shares the same Latin root as study, which has meant such things as "eagerness", "to strive toward, devote oneself to cultivate" and "apply oneself" (Etymology Online, n.d.). The studio should therefore be the perfect site for study as envisioned by McClintock, Pinar, Montaigne, and its other advocates. Further, in the design studio, I believe that the design critique in the form of a hermeneutic conversation may be one way to engage in and encourage study.

Hermeneutics and the Critique as conversation

Hermeneutics is the study of interpretation and is closely associated with German philosopher Hans-Georg Gadamer. Moules (2002) states that hermeneutics is at once "the tradition, philosophy, and practice of interpretation" (p.2). The main concerns of hermeneutics are meanings and understandings of taken-for-granted phenomena within a specific context, and how these are affected by our own history as interpreting beings (Gadamer, 1960/2013). In the context of research, hermeneutics is not so much a research methodology, but rather an approach to inquiry (Moules et al., 2015). As hermeneutic inquiry aims solely to better understand a phenomenon more deeply, the goal is not to find a universal theory, but rather to deepen our understanding of the particular. As such, it does not seek to remove the researcher from the research but acknowledges the researcher as an important part of understanding the phenomenon. It is the research topic that leads the researcher, rather than a hypothesis. To this end, inquiry is always in conversation—with texts of all kinds, with interviewees, with images, and with the self as an active participant in the inquiry. This conversation is at the heart of hermeneutics.

A hermeneutic conversation, however, is not just any conversation. It is not idle talk. It is not a debate where one wins or loses an argument, nor is it about coming to an agreement. A hermeneutic conversation is one that holds the participants to the particular topic being discussed, and one that is entered into with an ethical orientation to the other (Dostal, 2021; George, 2020; Moules et al., 2015), humility, and openness to the possibility that one might learn something new, and even if they are shown to be wrong. In this way, a hermeneutic conversation is not easy for those who have fragile egos, insecurities, ambitions, and the like—which sums up most human beings. Further, although it may be the case, a hermeneutic conversation does not need to be between two people, nor does it have to be strictly verbal. It

can be a conversation between text and reader, such as a researcher trying to understand a journal article. It can also be art and viewer, or perhaps a concert poster and someone trying to decide whether to attend. As long as there is room for interpretation and the desire for understanding, there is the possibility of a hermeneutic conversation.

In the case of a design critique, there is the possibility of a hermeneutic conversation, insofar that it is a conversation about a specific topic—the work, be it work in progress or a finished product that the student brings to the studio. A critique is meant to guide students in making sense of their own work and their relationship to it (Scagnetti, 2017), and by extension help students to connect to the world at large. It helps participants to make explicit and explore values, both as individuals and as a community (Orr & Shreeve, 2018). It is meant to cultivate not only the intellect but also the emotions, connecting the individual to the past and present world, (Pinar, 2015). In doing so, understandings arrived at can also become a launching point for further inquiry, new understandings, and more self-directed study beyond our time with them. Approaching the critique in this way with a view of the student as a whole individual with a life beyond the classroom and beyond "design student" may better cultivate the desire to study. The design critique as hermeneutic conversation therefore has the potential to be a site of study.

Conversational critique as site of study

As part of my own inquiry, I interviewed two design educators about their experiences of being practitioner-educators. One important finding was regarding the value they placed on building relationships with students, and the value of conversation both as a way to teach and learn, as well as to establish trust. The design critique was among such conversations (Masuda, 2022).

One interviewee, Frank (pseudonym), speaking about both first year and senior level courses, referred repeatedly to having conversations with students to understand the student's "intention" (Masuda, 2022, p. 48)—both for the task at hand and beyond the class activities—while also trying to guide them in the formal aspects of the subject matter. He speaks not only of observing the work, asking questions of the student, and listening carefully to their responses, but also of observing the student—their body language, for instance—for signs of how they can provide the academic and other support the student needs at that particular time.

From a hermeneutic perspective, both the verbal exchange and Frank's non-verbal reading of the student as text can be considered conversation (Gadamer, 1960/2013). Through these conversations, Frank comes to better understand the student's motivations and interests, allowing him to "contextualize the content for the individual" (Masuda, 2022, p. 49). In this way, the critique is always a conversation for Frank and rooted in a deep respect and care for the individual human beyond the label of student.

George (pseudonym), who teaches mostly at the senior level also speaks passionately about the students—their intelligence, capabilities, and potential. For him, a critique is a conversation in which he and students can ask questions of each other and themselves. It is an opportunity to draw on the diverse experiences of the participants and explore one another's assumptions, so that perhaps they may arrive at new understandings (Masuda, 2022).

For him, the technical aspects of design, though not unimportant, are always in service to the larger questions of life—both as a designer and as a human being in the world. George talks of trying to guide students to a "magical weird hard-to-access intangible space" (p. 52) beyond the concerns of knowledge and skill acquisition. In this place he feels the students begin to gain a deeper understanding of themselves as designers and their relationship to the world through the subject matter. Much like in McClintock's conception of study, the heart of Frank's curriculum seems not to lie in technical mastery, but instead in the goal of student self-cultivation.

Like any critique, the ultimate topics of the teachers and the student's discussion is the work itself, both in its conceptual and formal qualities. For both interviewees, however, the conversation around the artifact is simultaneously an opportunity to guide the student in their understanding of design as a subject matter and what it means to be a designer, as well as a space for the student's—and often even the teacher's—self-understanding. While both are careful to make sure that students have the opportunity to learn the knowledge and skills needed to continue their studies, how they approach the critique is not only as instruction but rather as a conversation. Despite their different styles, both approach the student and their work with curiosity, humility, and openness that they too may learn something about and from the student who they regard as whole individuals beyond being a student in their class. This new understanding can further help them to engage and encourage the student in their studies. Their approaches to the design critique—a hermeneutic critique—can be seen as good examples of the role of the teacher in study as one whose "purpose [is] hortatory and heuristic, rather than didactic" (McClintock, p. 176).

Barriers to conducting a Hermeneutic Critique

Despite the possibilities, and despite the humility and openness of the teacher, there may be many factors that could make having such generative and genuine conversational critiques difficult in the design studio classroom.

First, for a hermeneutic critique to lead to new understandings, the student too must be an active participant who arrives at the conversation with curiosity, openness, and humility, and already possess some desire for study. After all, in higher education, the assumption (and hope) is that students have chosen their path of study. However, there are many reasons why a student will not or cannot participate as we would desire. They may feel that a particular project or course is irrelevant to their long-term objectives. Expectations about what it means to be a design student and subsequently a designer may be far removed from the reality of being one. There may be a language barrier. Or perhaps their life outside the classroom, such as work, family, and health issues might be hindering them from participating fully. Regardless of the multitude of reasons, the result may be that a student may not be intellectually or emotionally available for the sometimes-difficult conversations that arise in a hermeneutic design critique.

The current culture of education itself may also be a barrier to such a design critique. Growing up in schools with an emphasis on instruction itself may mean that students have had little opportunity to exercise their autonomy before coming to higher education. I often see students who have come directly from high school struggle with the ambiguous nature of design, where there is often no one correct answer. On the other hand, the culture and inherent values of the design discipline and design education may also hinder genuine conversation. As an example, Frascara (2007) suggests that the design educators' inability to

"articulate empirical knowledge verbally" (p. 62) continues to uphold the myth of the intuitive designer as "magician". Simply, without being able to articulate why one design solution is better than another, we cannot have meaningful conversations about design. Finally, the responsibilities of an educator in an academic setting may themselves hinder a design critique from becoming a hermeneutic conversation. After all, part of our work as teachers is to assess and evaluate student work. We must therefore keep in mind that although ideal, we can never be truly equal partners with students in this conversation—a reality about which students are keenly aware.

Another major barrier to a hermeneutic critique is time. Time and the lack of it is something that the two interviewees mentioned on numerous occasions, and a common topic of conversation amongst design educators (Masuda, 2022). Not only does the work of designing take time, but so does critically engaging with it. Furthermore, student-teacher and student-student relationships take time to develop. George, in particular, comments on the importance of rapport, and how over "two or three classes" (Masuda, 2022, p. 78) there is a greater possibility of establishing a trusting relationship that allows for more genuine conversations. But for many of us, this may not be a possibility. In addition, cuts to educational funding, competition, and corporatization have led to reduced studio time and programming, and even school closures (Seltzer, 2019). In Alberta, recent funding cuts combined with reduced contact hours has meant that we have less time with our students than we had a decade ago. Without the time to come to understand one another beyond the roles of instructor and learner, it becomes more and more difficult to engage in hermeneutic conversation.

Finally, our own very being can also stand in the way of a hermeneutic design critique. Our experiences, self-understandings, and even our outward appearance could hinder genuine conversation. In the day-to-day, even the traffic encountered on the way to work may put us in a bad mood, closing us off from genuine conversation. The narratives we create for ourselves may also affect our ability to be open and curious. An example I often come across is the student who is convinced that they are not good at something (e.g. writing) because of past experiences, making it difficult for them to be open to new understandings. Further, one interviewee expressed that at times they have felt stereotyped by students because of their age, gender, and their professional background—none of which can be changed. With so many possible barriers to a critique as hermeneutic conversation, the road to self-cultivation through study is not an easy one.

Conclusion

Despite the many challenges, a design critique based in hermeneutic conversation is an ideal worth striving for as we support students in not only their design education, but also their self-cultivation. If we do not, as Frascara says, "set the bar high enough that we abandon the idea of training designers" (2007, p. 68), design education will not be able to support students over the long run as they are tasked with increasingly difficult design problems under increasingly complex circumstances. For them and for society at large, we must strive to understand anew the education of future designers. In doing so, I continue to reflect upon how I and other design educators can facilitate a studio environment in which students can find and grow within themselves the desire and discipline for study and self-education beyond just the acquiring of skills and knowledge they no doubt need if they are going to become designers. The design critique, so central to design pedagogy (Orr & Shreeve, 2018), and one often taken for granted, is a phenomenon worthy of new considerations and further conversation.

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Contact email: naoko.masuda@auarts.ca

Tragedy to Triumph: Utilizing a Graphic Novel and Instructional Design to Sustain the Culture, Heritage and Resilience of a Community

Patsy Iwasaki, University of Hawaii at Hilo, United States

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Abstract

Arts, design and education can powerfully combine to create relevant and impactful place- and community-based educational resources that engage interdisciplinary approaches and perspectives. This study will discuss the multiple setbacks, including COVID-19 upon a community, and explores how an original graphic novel about a 19th century labor advocate is utilized to educate and promulgate the heritage, culture and resilience of the area. The Hāmākua Coast of Hawaiʻi island has a long history of migration from Asia and Europe since the 18th century. Workers from China, Japan, Korea, the Philippines, and Portugal were recruited for the numerous sugarcane plantations. However, the once thriving region has been impacted economically and emotionally with the demise of the sugar industry, highway infrastructure, and the COVID-19 pandemic. Community organizations pivoted and addressed food security. The community also came together in resiliency when it honored the legacy of Katsu Goto in 1994, building a memorial, and annually commemorating him as an early champion of labor, not a victim of racism and oppression when he was lynched and hung in 1889 for his advocacy of plantation laborers. This qualitative study reveals the instructional design of utilizing a graphic novel about Goto to create an educational module with the aim of creating important connections and a sense of place, pride, and healing for a community experiencing adversity. An instructional design model guided five instructors with the module design and a motivational model provides the framework to analyze the data collected. This study is intended to contribute to sustaining the heritage, culture and resilience of the region and give insight to others.

Keywords: Graphic Novel, Heritage Culture and Resilience of a Community, Instructional and Motivational Design

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Introduction

The last sugar plantation in Hawaii, which was Alexander & Baldwin's Hawaiian Commercial & Sugar (HC&S) company, closed down in 2016 in Pu'unene Maui (Keany, 2016). As labor costs increased and less costly sources of sugar increased, most of the sugar plantation companies in Hawai'i had already closed down in the 1990s or earlier. On Hawai'i island, Hilo Coast Processing and Hāmākua Sugar both closed in 1994, and Ka'u Sugar, the last sugar company on the island, subsequently closed in 1996 (Associated Press, 1996). Their closures ended over 160 years of sugar's reign upon the islands.

But back in the 1800s, about 185 years ago, during the mid to late 19th and early 20th centuries, the production of the lucrative and successful sugarcane was "king sugar" throughout the major islands of Hawai'i that began as a labor-intensive sugar plantation system of repression that dominated agriculture and Hawai'i's economy (Keany, 2016).

Most of the laborers during this time period were from Asia - China, Japan, Korea, and the Philippines - and they were committed to a three-year contract. A majority were from Japan; by 1924, over 200,000 Japanese nationals were living in Hawai'i from many prefectures in Japan (Odo & Sinoto, 1985).

However, Europeans also migrated to Hawai'i. Over 25,000 Portuguese nationals, mostly from Madeira and the Azores, but some from mainland Portugal, were recruited for the sugar plantations starting in 1878 (Felix, 1978). There were also 8,000 migrants from Southern Spain who worked on the sugar plantations from 1907 to 1913; Hawai'i was a gateway for them and they eventually ended up settling in California (Albertos, 2019).

A Brief Summary of early Japanese Migrant Katsu Goto

The researcher wrote a graphic novel *Hāmākua Hero: A True Plantation Story* (Iwasaki & Berido, 2010, 2011, 2022) about Katsu Kobayakawa Goto, a Japanese national who was a labor recruit aboard the ship *City of Tokio* and arrived in Hawai'i in 1885. He was part of the first group of *Kanyaku Imin* (First Ship Immigrants), Japanese laborers under a government agreement between Japan and Hawai'i to work on the prosperous sugar cane plantations in the Kingdom of Hawai'i (Odo & Sinoto, 1985).

He was educated and as the oldest son in his family, it was necessary for him to be adopted in name only by the Goto family in order to leave Japan and emigrate to Hawai'i. After being processed at the Hawaiian Board of Immigration on O'ahu, Goto was assigned to the Soper, Wright & Co. sugar plantation near Honoka'a on Hawai'i island. The work was extremely demanding and living conditions were poor. After his three-year contract was completed, he opened up a general store in Honoka'a and became the first Japanese store owner. Prices were competitive and he stocked Japanese groceries and merchandise from O'ahu that helped ease the settling of the Japanese immigrants (Beekman, 1984, 1989; Iwasaki & Berido, 2010, 2011, 2022; Kaya, 1988; Kubota, 1985).

The store quickly became a gathering place for the fledgling migrant Japanese community. Due to his English proficiency and leadership skills, Goto became a community leader and mediator between Japanese plantation workers and management at Honoka'a (Overend) Plantation. He advocated for improved working conditions and wages by serving as the liaison and interpreter. Just as quickly, Goto's business success and labor facilitation made

him a target as an instigator of worker unrest (Beekman, 1984, 1989; Iwasaki, 1994; Iwasaki & Berido, 2010, 2011, 2022; Kubota, 1985).

Goto, 27, was unfortunately lynched, killed and hung on a telephone pole on October 28, 1889, a short four years after his arrival for being a champion for sugar plantation worker rights and dignity (Beekman, 1984, 1989; Kubota, 1985). While Goto's story highlights the racial, economic and social injustice in Hawai'i's plantation society over 130 years ago, it also features the significant narrative of the Japanese American experience and Hawai'i's labor and social evolution within American history. Goto is represented in anime form on the cover and throughout the graphic novel in Figure 1 below.
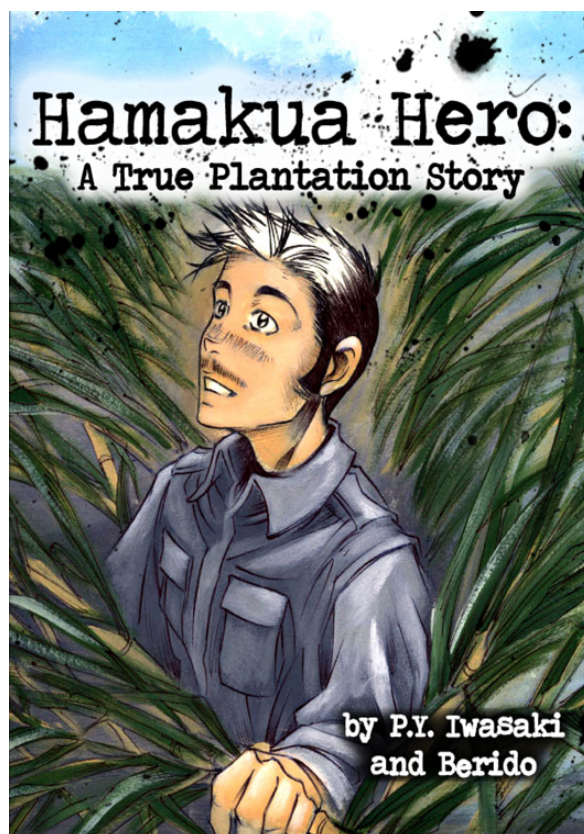
Figure 1: Katsu Goto is represented in anime form on the cover of the graphic novel.

Now he is being honored and remembered for his courage and action and the researcher is utilizing his story as a Hawai'i place based, educational resource that can sustain culture and encourage resilience. With a focus on the area's diverse immigrant history, the researcher sought to encourage academic success, growth and resilience among students through this culturally-relevant, community-based resource.

Literature Review

The University of Hawai'i system seeks to be a leader in indigenous education and each of its 10 campus sites are located in communities with a unique, historically-rich and culturally-diverse environment. The 2021-2031 UH Hilo Strategic Plan Mission and Vision states: "The UH Hilo *'ohana* (family)inspires learning, discovery, and innovation in unique environments that challenge each student to reach their academic, personal and professional goals. Our *kuleana* (responsibility) is to improve the quality of life of our diverse campus community, the people of Hawai'i Island, the state, the Pacific region and the world."

The campus also supports cultivating and sustaining teaching practices that reflect a diverse, multicultural university that is rooted in the rich mix of Native Hawaiian, Asia-Pacific, local, national and international cultures that represent Hawai'i and its faculty are encouraged to add Hawai'i-based resources to their curriculum as outlined in Goal 2: Strengthen Our Commitment Goal 2: Strengthen Our Commitment to 'Āina (land) - and Community-based Education. The goal and vision states: "Through partnership and discovery our students succeed and our academic programs flourish within the context of a vibrant Hawaiian place of learning. Partnership translates into ideas, collaborative learning and research, reciprocal relationships that make a difference in the local, regional, and global lives of people, and contributes to a resilient and sustainable future for Hawai'i."

The researcher's graphic novel *Hāmākua Hero: A True Plantation Story* about Goto as discussed above is a creative and academic endeavor that adds an educational, sustainable, culturally relevant, place-based instructional resource about Hawai'i history.

Culturally relevant, place-based education has been a growing pedagogical movement for many years. Gloria Ladson-Billings introduced a Culturally Relevant Pedagogy theoretical framework back in 1995 which has been adapted and extended by many researchers, including Shelly Brown-Jeffy and Jewel Cooper in 2011. *Place- and community-based education in schools* by Smith and Sobel (2010) proposed engaging students in communities to better confront and seek solutions for social and environmental problems, and Hawai'i authors and researchers have also explored this approach (Chappel, 2018; Goodyear-Ka'opua, 2013; Ledward & Takayama, 2009).

Moll et al. (1992) discussed how storytelling can encourage students to voice their own history, culture and personal knowledge to become experts of their own experiences and knowledge. Paris and Alim in 2014 discussed culturally sustaining pedagogy as the foundation for tolerance and respect by incorporating identity and culture, which can also address systemic inequalities.

San Pedro and Kinloch in 2014 and 2017 claimed that exchanging stories is central to educational research and that stories can establish more inclusive, interconnected and decolonizing methodologies. Also in three articles Campano, Stornaiuolo and Thomas (Campano & Stornaiuolo, 2018; Stornaiuolo & Thomas, 2018; Thomas & Stornaiuolo, 2018) discuss how collective knowledge and storytelling are able to address long standing systemic violence and oppression and help students become agents of change.

Current Study

This current study addresses how the once thriving region of the Hāmākua Coast of Hawai'i island has been impacted economically and emotionally by the following 3 elements:

1. Closure of the sugar plantations. As labor costs increased and less costly sources of sugar increased, all of the sugar plantations in Hawaii shut down. The last two sugar plantations along the Hāmākua Coast shut down in 1994 (Associated Press, 1996).

2. Highway infrastructure. The building of the Daniel K. Inouye Highway, completed in 2013 and 2017 significantly impacted the community. Local residents and visitors can now bypass the entire region to and from the east and west sides of the island, severely decreasing economic opportunities.

3. COVID-19 pandemic. After the closure of the sugar plantations, the majority of residents began to commute to the west side of the island, to the visitor locations of Waikoloa and Kailua Kona, to work in the visitor industry. These residents were furloughed or let go when the hotels, restaurants and activities were shut down due to the pandemic. Community organizations pivoted and then addressed food security, demonstrating resilience.

The community also came together in resiliency in 1994, the same year the Hāmākua Coast sugar plantations closed down, when it honored the legacy of Katsu Goto. They built a memorial, and annually commemorate him as an early champion of labor, not a victim of racism and oppression when he was lynched and hung in 1889 for his advocacy of plantation laborers (Iwasaki, 1995). Since 1994, for 27 years, a memorial service has been held with activities to honor his legacy and bring attention to other current issues of social justice today. Even during the COVID-19 pandemic, virtual commemorations were held (Honoka'a Hongwanji Mission).

The organizers put a lot of thought into the building of the memorial with elements honoring both Japan and Hawaii, two cultures brought together through migration. As shown in Figure 2 below, the column to the left of the memorial is made of hinoki, Japanese cypress wood, and stones from Japan; and the blue tiles are done using a traditional Japanese style. Elements from Hawaii are on the right: the column is made of 'ōhi'a wood and a large lava rock from nearby Waipi'o Valley secures the base. The tiles have a sugarcane motif design at the ends and the plaque honors Katsu Goto's legacy.

Figure 2: The memorial built in Honoka'a in 1994 commemorating Goto's legacy features elements from both Hawai'i and Japan.

Research Design

In this qualitative study, the ADDIE model of instructional design helped guide the participants, five instructors utilizing the graphic novel *Hāmākua Hero: A True Plantation Story* in their classes, with the design of educational lesson plans and modules to encourage academic success and understand Hawai'i history and culture. Two of the instructors were appropriately from the Hāmākua area, an important factor for the study, as the purpose of the study was to help sustain the culture, heritage and resilience of this community through the graphic novel. The analysis, design, development, implementation and evaluation process of ADDIE aimed to create important connections and a sense of place, pride, healing and resilience for a community experiencing adversity.

ADDIE Model of Instructional Design

While applying educational best practices, the ADDIE model of instructional design (Allen, 2006; Dick et al., 2001; McGriff, 2000; Molenda, 2015; Molenda et al., 1996; Serhat, 2017) systematically guided and organized the study's learning design process of the instructional modules and lesson plans. During the development phase, formative assessments were conducted with the five experienced educators.

This process was selected because it systematically organized the study's instructional and learning design approach and procedures extremely well. The ADDIE phases of analysis, design, development, implementation and evaluation were appropriately applied to the study's process.

With its origins as an instructional tool for the military, the ADDIE model has expanded to become a successful and popular systematic instructional design process for performance, job training and educational settings because it provides a "dynamic, flexible guideline for developing effective and efficient instruction," (McGriff, 2000, p. 1).

Many studies have successfully applied the ADDIE model in both qualitative studies, with smaller samplings, and quantitative studies, with larger samplings, in the United States and the world in a wide variety of educational settings including K-12, undergraduate students, graduate students, library instruction, technological and vocational students, and with workforce training (Allen, 2006). Figure 3 below features a representation of the ADDIE model instructional design process used in this study.

ADDIE Model of Instructional Design

EVALUATION
Evaluate the results of the implementation of the instructional module with the target audience.

Evaluate the data collected from the participants.

Summative assessment; results of the evaluation surveys.

ANALYSIS
Analyze and determine what is needed:

Problem identification.

Needs assessment of the target audience.

DESIGN
Design the instructional content. Use the ARCS model to inform and guide the design of the data collection instruments and the analysis and interpretation of the collected data.

IMPLEMENTATION
Implement the instructional module with the target audience.

Collect data from the participants.

DEVELOPMENT
Develop prototypes of the instructional module: Conduct formative assessments with participants.
Each assessment informs and guides the design decisions for the next iteration.

Figure 3: Representation of the ADDIE model design process used in this study.

During the ADDIE process of this study, the researcher learned that teachers are admirably committed to applying educational best practices to meet the instructional guidelines and goals while meeting the challenging needs of their students. They have to work together with their grade levels, but are also quite autonomous and independent. The researcher's initial plan was to work together through the iterative ADDIE design process to create a uniform lesson plan or module. However, the researcher strategically shifted to work with the educators who understandably wanted the freedom to adapt and adjust modules and lesson plans to fit their own class and student needs. For example, one teacher taught classes with Advanced Placement students who disliked group work because they usually ended up doing all of the work; another enjoyed assigning group work; and another instructor dealt with alternative learning students with whom the typical academic research paper or essay would not result in successful outcomes.

ARCS Model of Instructional Design

To increase the likelihood that the lesson plans and modules would resonate with the target audience - students at the intermediate, high school and college levels - the study's design was based on a well-established model in motivation and instructional design: the ARCS model (Keller, 1983, 2010, 2017; Peterson, 2003; Pappas, 2015). The ARCS acronym stands for the instructional motivational factors of: attention, relevance, confidence and satisfaction. Table 1 below features Keller's ARCS model concepts and definitions.

The ARCS model guided the design and development of the study's instruments, the interview questions for the participants, to ensure they addressed the topic from the four ARCS perspectives: attention, relevance, confidence and satisfaction (Gagne, et al., 2005). To ensure the interview questions obtained useful data, including drawing out the rich and thick descriptions of qualitative data (Creswell, 2018; Maykut & Morehouse, 1994; Yin, 2016), another instructor familiar with the topic reviewed the questions and they were revised before implementation. This provided an inter-rater reliability check.

The ARCS model informed the process of the design and development of:
1) the data collection instruments in the study,
2) the educational lesson plans and modules, and
3) the interpretation and analysis of the data collected.

Besides the helpful data collected through field notes and observations during the ADDIE instructional design process, the researcher felt the best way to collect data for this study was to conduct in-depth interviews with the five participants, teachers at the high school and university levels. This applied the triangulation method of data collection to increase credibility and validity (Bryman, 2012; Glesne & Peshkin, 1992; Yin, 2016). The ARCS model framework helped the researcher align the interview questions with the ARCS motivational factors (Gagne, et al., 2005; Keller & Suzuki, 2014), and also categorize the data to enable important and meaningful findings and outcomes during analysis and interpretation.

Keller's ARCS Model Concepts and Definitions
Attention
- Capturing interest and curiosity   - Perception and by inquiry   - Connection and participation   - Specific, relatable examples; conflict and variety
Relevance
- Immediate application   - Set example through experience   - Set example through role models   - Future usefulness
Confidence
- Enable self-confidence   - Facilitate self-growth   - Give learners control   - Ability to provide feedback
Satisfaction
- Immediate application of information   - Useful application in the future   - Acquire real world knowledge and skills   - Enable positive outcomes

Table 1: Keller's ARCS model concepts and definitions.

Results

During the ADDIE process, the researcher learned the participants are admirably committed to applying educational best practices to meet the instructional guidelines and goals while meeting the challenging needs of their students. They work together with their grade levels, but also work independently to develop their lesson plans and modules to accomplish this. The researcher's initial plan was to work together through the iterative ADDIE design process to create uniform lesson plans or modules. However, the researcher strategically shifted to work with the educators who understandably wanted the freedom to adapt and adjust modules and lesson plans to fit their own classes and meet the needs of their wide and varied students' needs. For example, on one end of the spectrum was a teacher who taught classes with Advanced Placement students; and at the other end was a teacher who only worked with alternative learning students.

After completing the ADDIE instructional design process, analysis and interpretation of the data collected provided significant results. The five teachers at the high school and university levels wanted to utilize the graphic novel fundamentally in two ways:

1) As a major assignment: research projects about current, relevant topics such as immigration, diversity, culture and social justice that encouraged students to explore place-based, culturally-relevant resources. One of the resources students were encouraged to use was *Hāmākua Hero: A True Plantation Story* (Iwasaki & Berido, 2010, 2011, 2022).

The teachers said the assignment was very well received and the graphic novel served as a catalyst, a launching point for students to conduct research in a number of areas they were interested in. High school and college students appreciated that the graphic novel was visually appealing, historical, and the images, panels and short text moved the story and plot like a film. Some teachers wanted to give students the freedom to create their own final project platforms: a traditional paper, a script for a play, a video, or an original comic book, or other forms.

2) As a minor assignment: exercises or worksheets with multiple choice, fill in the blanks or deeper, open-ended questions.

One teacher used *Hāmākua Hero* in a module of a required "Modern History of Hawai'i" class with his alternative learning high school students. He said the content of the graphic novel really resonated with his vulnerable students. They were willing and wanting to engage with the curriculum relating to *Hāmākua Hero.* The instructor said the resource is about Hawa'i'i's history and his students learned about immigration to Hawai'i. After reading it, they understood how Hawai'i became a multicultural society because of labor recruitment for the sugar plantations.

He said that his students won't touch a textbook filled with words, but they opened up *Hāmākua Hero* and read it in 20 to 30 minutes. Similar to the college students, the high school students were drawn to the visuals, the images, and how the panels and short text move the story and plot like a film. Here are a few of the themes in the graphic novel that resonated with his alternative learning high school students:

Sibling Relationships

In *Hāmākua Hero*, the researcher tried to establish a relationship with Katsu Goto and his younger brother Sekijiro, since Sekijiro is the narrator for the story. Elements of Japanese culture and tradition were added; thus, in Figure 4 below the brothers are pounding steamed rice into mochi rice cakes for the New Year's holiday and Katsu surprises his brother with his news about leaving Japan to go to Hawaiʻi. It also adds an opportunity for some action and humor, with Sekijiro almost pounding Katsu's hand off.

Figure 4: Depicts the importance of sibling relationships and
introduces Japanese culture and heritage.

The alternative learning students relate to this relationship since the sibling relationship is often so important and foundational to them. They have moved from schools, from communities and from neighborhoods; and for those in foster care, they've been removed from their parents, and from their families. Often, it's the siblings against the parent or parents, against the family, against the world. Siblings have to be able to rely on each other, especially if there's any type of abuse involved.

Control over their own Lives

This page (see Figure 5 below) when Katsu Goto opens his general store resonates with the students. They long for control, they long to be the "boss" of their own lives. They have often had to be at the mercy of an unstable family life - they sometimes don't know where they're

going to sleep at night, or where their next meal is coming, or if they'll have clean clothes to go to school. They're often handed off to this friend, that friend, this aunty, that uncle; they have no control in their lives. The instructor said it's rewarding for them to see Goto finally be successful and open up his store.

Figure 5: Depiction of Goto and his general store in 1888 in Honoka'a, Hawai'i island.

When the researcher asked the teacher about the unfairness and violence in the story - how Goto is ambushed and lynched after meeting with Japanese workers he is trying to assist, he said the students can wholeheartedly relate to it. It encourages them to practice resilience. See Figure 6 and 7 below. He said they are faced with unfairness and violence every day. Inequity. They have often lost family members to violence or health issues. They feel that life has been unfair to them.

The teacher knows exactly when the students get to this part in the graphic novel when they are reading it in class. When they get to this part, the students' yell, put the book down, or shout out "What!" because the story takes such an unexpected turn. The instructor said that the story starts off as a typical "guy overcoming hardships," rags to riches kind of story: man comes to Hawai'i, he works hard, he opens a store, he's successful.

Then he is attacked, pulled from his horse, lynched and hung on a telephone pole. The teacher tells me that the students are literally and emotionally thrown off a cliff by the story.

They can't believe it. However, at the same time, they also do believe it. He tells them it's a true story.

Figure 6 and 7: Depiction of the violence in this true story that encourages resilience.

Although this tragic lynching happens, the teacher emphasized that *Hāmākua Hero's* impact on the students is so very positive and impactful. Yes, what happens to Goto is horrific, unfair and unjust, but that is just what catches their attention, he said. The teacher emphasizes that the takeaway for the students is that he was a good person. He lived a good life. He worked hard. He helped others. They realize that because of what happened to him, they can actually read about him now. If the lynching didn't happen, he would just be another interesting migrant story; one of many.

There's a memorial in Honokaʻa and people can learn about him. They also learn about resilience from Goto's story. The teacher shared that students make that connection and conclusion. That good has come out of this story. Perhaps if they try hard, complete high school, graduate, practice resilience, and do good, good can come into their lives.

The outcome of this study was very positive and significant. *Hāmākua Hero* was used in high school and university research papers as a resource that helped students explore current, relevant topics such as immigration, diversity, culture and social justice. The feedback from the high school teacher who taught alternative learning students was surprising and inspiring for the researcher who learned that the story really resonated with and had a positive impact upon his students. It was so very helpful to know that *Hāmākua Hero: A True Plantation Story* can indeed be used in place-based, cultural curriculum in Hawaiʻi, and possibly elsewhere in this way.

Conclusion and Further Research

This study successfully and innovatively applied and integrated social and learning sciences theory to humanities, arts, design and education research. The overall goal of this study was to engage interdisciplinary approaches and perspectives to combine arts, design and education to explore how a relevant place-and community-based educational resource could impact students, encourage academic success, and contribute to sustaining the heritage, culture and resilience of a region and give insight to others.

The Hāmākua Coast of Hawaiʻi island has a long history of migration from Asia and Europe since the 18th century. Workers from China, Japan, Korea, the Philippines, and Portugal were recruited for the numerous sugarcane plantations. However, the once thriving region of the Hāmākua Coast of Hawaiʻi island has been impacted economically and emotionally with the demise of the sugar industry, highway infrastructure, and the COVID-19 pandemic. Community organizations pivoted and addressed food security. The community also came together in resiliency when it honored the legacy of Katsu Goto in 1994 by building a memorial, and annually commemorating him as an early champion of labor, not a victim of racism and oppression when he was lynched and hung in 1889 for his advocacy of plantation laborers.

This qualitative study revealed the ADDIE instructional design process (Allen, 2006; Dick et al., 2001; McGriff, 2000; Molenda et al., 2017) that guided five teachers utilizing the original graphic novel about Goto, *Hāmākua Hero: A True Plantation Story* (Iwasaki & Berido, 2010, 2011, 2022), in their classes. The purpose was to create lesson plans and modules that would not only fulfill educational policies and guidelines, but also create important connections and a sense of place, pride, and healing for a community experiencing adversity. A motivational model, the ARCS model (Keller, 1983, 2010, 2017; Peterson, 2003; Pappas, 2015), provided the framework to analyze and interpret the data collected.

Participants said the assignment was very well received and *Hāmākua Hero* served as a catalyst, a launching point for students to conduct research in a number of areas they are interested in. Students appreciate that the graphic novel is visually appealing, historical, and the images, panels and short text move the story and plot like a film.

After completing the ADDIE instructional design process, and analysis and interpretation were completed, the teachers wanted to utilize the graphic novel fundamentally in two ways: 1) As a major assignment: research projects about current, relevant topics such as immigration, diversity, culture and social justice that encouraged students to explore place-based, culturally-relevant resources with *Hāmākua Hero* as one of the sources; and 2) As a minor assignment: exercises or worksheets with multiple choice, fill in the blanks or deeper, open-ended questions. The results were significant in confirming that *Hāmākua Hero: A True Plantation Story* can indeed be used in place-based, cultural curriculum in Hawai'i and possibly elsewhere.

However, the results discussed in this article are not yet complete since data collection for this study will continue for another semester. In the Fall 2022 semester, the five educators will continue to use *Hāmākua Hero* in their classes and six more teachers will be utilizing the graphic novel in curriculum and instruction. Four of the additional teachers who will be participating in the study are from Honoka'a Intermediate and High School. This is a welcome development as the purpose of the study is to encourage academic success, understand Hawai'i history and sustain the culture, heritage and resilience of this region and community. The researcher looks forward to collecting more data that may contribute to the sustainability of the cultural legacy of the community to the next generation, which is an energizing and motivating goal.

Looking forward, this effective and dynamic interdisciplinary approach of combining arts, design and education to create relevant and impactful place-and community-based instructional resources is an important and significant contribution to the fields of the learning sciences and the humanities. This may influence and impact the broad possibilities of interdisciplinary and intersectional research design and collaboration, an integral part of living and learning in a thriving, multicultural global society.

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Contact email: piwasaki@hawaii.edu

The Study of the Visual Effects of Depth Creations and Perspectives in New Egyptian Archeological Discoveries

Heba El Kamshoushy, Alexandria University, Egypt

Abstract

Many researchers have worked on the analytical study of the ancient Egyptian art executed in two dimensions as paintings or reliefs depending on the famous squared grid, which was the main guide for the artist to maintain standard proportions in drawing. But in this research I have attempted to base my own analysis and theories that may be put forward to study how the ancient Egyptian artist creates techniques to influence a sense of perspective using the decrease in size to the visual plane. There have been several recognizable elements used by the artist to give depth to their compositions. Although he accepted the drawing surface as flat and created the visuals through a series of symbols arranged over the flat surface, but the detailed analytical study of some objects revealed his attempts to copy the objects as they are seen in nature showing a beginning of a perspective study and depth. The importance of the study lies in it's application on the recent Egyptian archeological discoveries announced by the Egypt's Ministry of Tourism and Antiquities - aiming to understand more about the ancient Egyptian arts and exploration of the Egyptian civilization - based on the work of the Egyptian archaeological missions in various sites in Saqqara. Which comes within the framework of the state's support to conduct archaeological excavations and preserve the ancient Egyptian civilization.

Keywords: Egyptian Art, Monocular Depth Cues, Archeological Discoveries

Introduction

Most of the remains from ancient Egypt came from tombs and temples, as the Egyptians believed in afterlife eternity. In ancient Egypt, this was the primary source of inspiration for the development of art. They erected magnificent statues for their gods, and the decorations on their tombs and temples were the primary source of information about ancient Egypt.

"Natured by the unique civilization of the river Nile, the art of ancient Egypt gave expression to the thoughts and aspirations of an extraordinary people. Chronicling their views of the world, gods, society, life and afterlife for over three thousand years." (Gay Robins, p2, 1994).

The researches divide the history of ancient Egypt into the following periods: prehistory (up to ca. 3100 B.c) , The Archaic Period (ca. 3100-2650 B.C.) , the old kingdom (ca. 2650-2150 B.C.), the middle kingdom (ca.2040-1640 B.C.) the new kingdom (ca. 1550-1070 B.C.). At these times of prosperity the Egyptians created a huge civilization leaving us thousands of visual arts.

Many people believe that ancient Egyptian art hasn't changed much over thousands of years as a result of Egypt's secure location surrounded by deserts and enriched by the Nile River. The Egyptian way of life, philosophy, language, and religion remained stable over thousands of years, maintaining its identity and character remarkable throughout its history (Edith Whitney Watts, Barry Girsh. p.7). But this is not totally true, as studies have revealed a significant evolution in the visual presentation of figures and elements in tomb walls, temples, and sculptures across the kingdoms.

Egyptian archeological discoveries

The Egyptian archaeological mission had announced a number of significant discoveries in the Saqqara archaeological area in recent years, including the discovery of hundreds of colorful human coffins containing mummies in good condition for senior statesmen and priests of the 26th Dynasty, which was listed among the top 10 archaeological discoveries in the world for 2020. (M. Marie. 2022) Which comes within the framework of the state's support to conduct archaeological excavations and preserve the ancient Egyptian civilization.

On the 13th of April 2019 the Egyptian archeological mission working in Saqqara has announced the discovery of a burial tomb, it was announced to be for a man named Khuwy, a dignitary from the Fifth Dynasty (figure 1). "The mission uncovered this tomb while documenting the collection of pyramids that belong to King Djedkarea who was the eighth and penultimate ruler of the Fifth Dynasty of Egypt in the late 25th century to mid-24th century BC, during the Old Kingdom" (Essam, 2019).

On March 19, 2022, Egyptian archeological mission working northwest of the pyramid in Saqqara, has announced the discovery of five remarkably well-preserved tombs containing burials and covered with ancient Egyptian artistic drawings, the tombs re also from the old Egyptian kingdom (figure 2). Where it was announced in a press conference with publishing detailed pictures of their unique artistic content. The artistic scenes on the walls of the tombs were covered with remains of most of the colors.

Announced by M.Waziri. - Secretary-General of the Egyptian Supreme Council of Antiquities - The first tomb discovered belonged to a high-ranking statesman, according to

legend. The walls of the burial chambers are carved with scenes from various funerary rituals, such as offering tables, the palace facade, and the seven oil pots. Because of its proximity to the tomb of a man named "Yart," the second tomb is most likely that of his wife. The third tomb is a rectangular well located at a depth of about 6 meters below the surface of the ground for a woman who bore the titles of decorator of the kings and queens, and priestess of the goddess, while the fourth tomb is a rectangular well located at a depth of about 6 meters below the surface of the ground for a woman who bore the titles of decorator of the kings and queens, and priestess of the goddess (M. Marie. 2022).

A

B
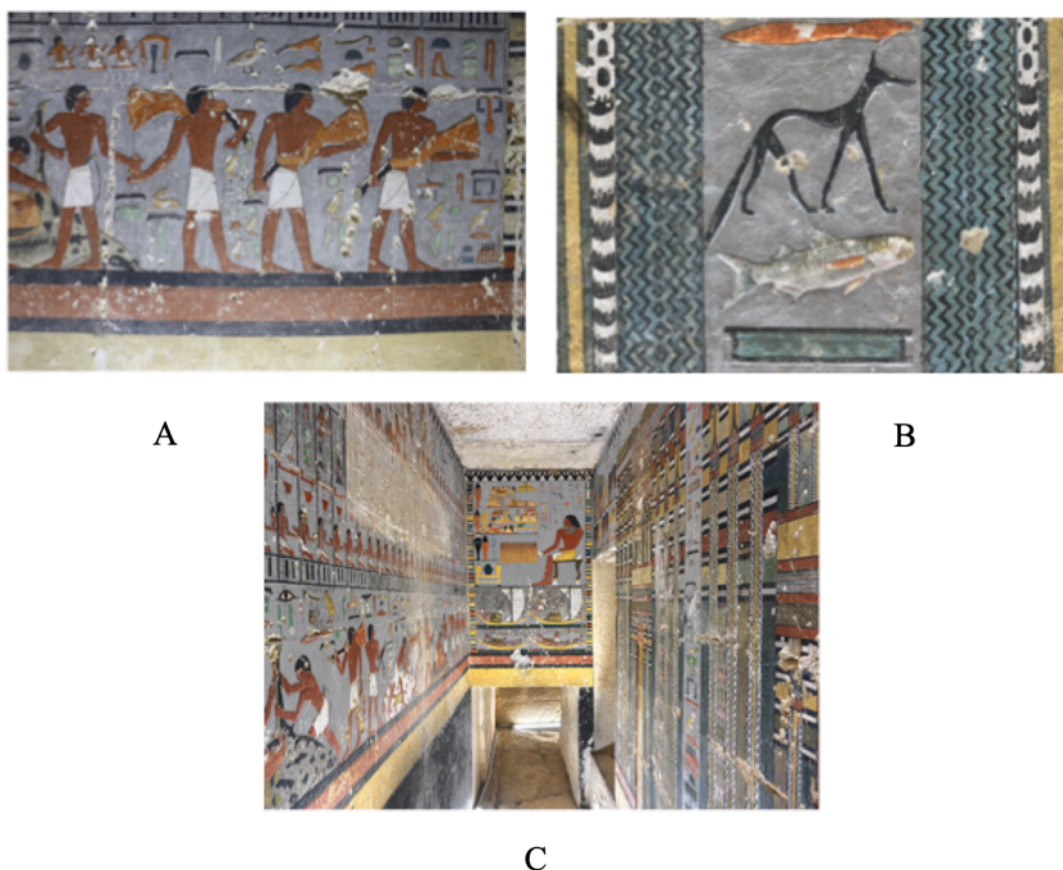
C

Figure (1): Walls of Khuwy's tomb in Saqqara.
Photo adapted from Megahed, M & Vymazalová, H. 2019.

Figure (2): Walls of a discovered tomb in Saqqara.
Photo adapted from M. Marie. 2022.

Grid systems in ancient Egyptian art

It is well known that the Egyptians raised great monuments to their deities and their dead that serve as testaments to their eternal beliefs. The decoration of temples and tombs is a major source for our knowledge of Egyptian art.

"Ancient Egyptian art is characterized by the idea of order. Clear and simple lines combined with simple shapes and flat areas of color helped to create a sense of order and balance in the art of ancient Egypt". (Royal society of chemistry. 2022)

The ancient Egyptian artist's arrangement of the elements on the walls was not random; but he used mathematics to construct his compositions, based on axiality, proportion, and hieratic scaling, In order to maintain the correct proportions in their work (Royal society of chemistry, 2022). The artistic arrangement followed precise squared grid systems and guide lines to align and size the elements within the given format with great proficiency resulting in accurate uniformity of Egyptian art as a result of the standard common proportional system (Teeter, E., 2022). This rule was first applied in the old Egyptian kingdom, with minor variations in proportions in the middle and new kingdoms (Madsen, R.S, 2019).But these variations did not change the style of Egyptian art during the 3000 years that pharaohs ruled Egypt, as objects from any period during this time are instantly recognized as being Egyptian art (Teeter, E., 2022).

Figure proportions were based on the width of the palm of the hand, so there were rules about head-to-body proportions. The faces should not show any emotions (Royal society of chemistry, 2022) .The standing human figure was proportional from the hairline to the soles of the feet by an eighteen-square grid, and the length of the foot was allotted three squares, while the torso from the neck to the waist was allotted four squares. This system was used until the twenty- fifth dynasty (700 b.c.), when the grid was changed to twenty-one squares, resulting in the elongation of the figures prominent in the Ptolemaic and Roman eras (332 b.c. –A.D. 395) (Teeter, E., 2022). Ancient Egyptian artists used vertical and horizontal reference lines. Many tombs still have these grids on the walls, which were used to ensure that the lower and apprentice artists working for the master artist followed the conventions. (Royal society of chemistry, 2022)

Figure (3): Outline study of Khuwy's main figure.

Monocular depth cues in the Egyptian art

Many viewers find much of Egyptian art familiar and easily understandable, so that they can appreciate it without knowledge. In the two-dimensional Egyptian art, the artist has accepted

the drawing surface as flat (Gay Robins, p2, 1994). Although the artist has presented the elements to be invariably voluminous and located at various distances, their presentation on the tomb walls is necessarily two dimensional. "The Egyptians conceptualized a system of pictorial conventions that was tailored to their particular cultural needs. Based on frontal images, where "frontal" means unaffected by foreshortening, and the images are mental or memory images, a concept created to explain Egyptian representations by mental storage mechanisms ". (M. k. Hartwig., 2015. P.146).

To create the illusion of perspective on a flat surface, drawing any object in three dimensions requires a specific viewpoint. Drawing an object in two dimensions necessitates depicting only one surface of that object. And it turns out that emphasizing just one surface has advantages. The outline conveys the most information in pictorial representation. When something is defined by an outline, it is easier to understand. Even though many Egyptian drawings and paintings include details from multiple sides of the object, the outline becomes the most important feature when drawing on a flat surface. There is also a strong emphasis on clarity and readability. The majority of Egyptian art was displayed in an architectural context. Relief modeling, also known as bas-relief, which involves mounting or carving a mostly flat sculpture into a wall, this technique was used in some tomb compositions. You can't say that a relief's outline is flat because the relief also models the body's surface and has texturing and surface detail in addition to its outline. (Martin M., 2022.)

Despite the two dimensional identity in the Egyptian art, the analysis of the research case studies shows various basic attempts from the Egyptian artist to imply depth, whether it was intended or as a result of copying the nature infront of him in his drawings -in a very basic form using techniques that exploit the well-known monocular cues of depth-. (Brooks K. R. (2017).

"Human operators perceive depth by interpreting a variety of cues collected by the visual system" (R. Bogdanova, P. Boulanger, and B. Zheng, 2016. p2). Both physiological and psychological cues are used by the human visual system to interpret depth in sensed images drawn on a flat surface. When viewing drawings with only one open eye, the viewer can access some physiological cues that require both eyes to be open (binocular) (monocular), the human visual system senses the object distances based on all available depth cues. (Okoshi, T., 1976). Monocular cues -in their basic form- used by the Egyptian artist, influencing a sense of perspective to the viewer to be judged (Brooks K. R. (2017) were eventually harmonized in the geometrical system of the Egyptian art. The most interesting - from a theoretical point of view- are overlapping and occlusion, relative size, gradient and simple shading (J. Hayman, 2006.p13).
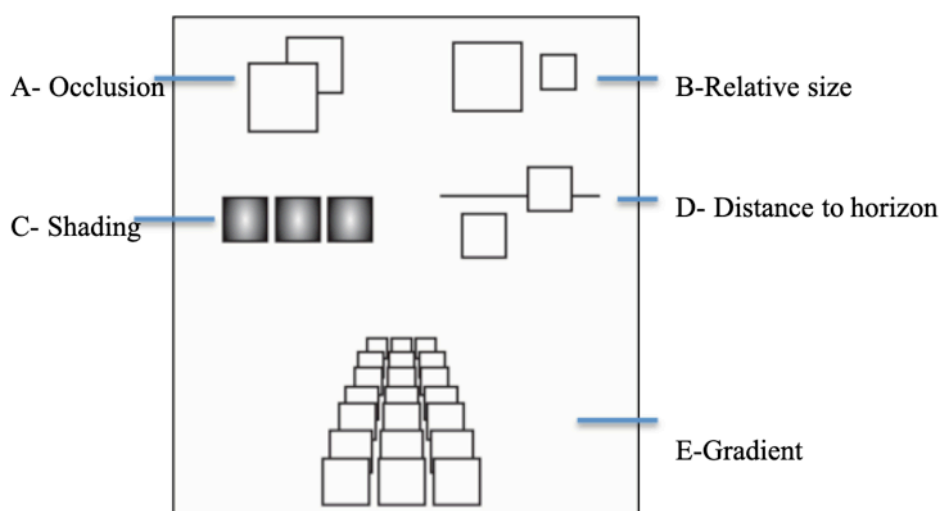
Figure (4): Monocular depth cues.
Photo adapted from R. Bogdanova, P. Boulanger, and B. Zheng, 2016.

Relative size

Through out different historical periods artists adopted different techniques to show the decrease in size of objects at a distance to apply a perspective presentation; the foreshortening of objects lying at an angle to the picture plan, and the convergence of parallel lines as they move away from the viewer (Gay Robins, p2, 1994). But relative size in the Egyptian art is a very critical matter. The relative proportions are not haphazard or unintelligible, but convey a consistent ideological message (B. A. Power, P.38, 1999). The sizes of the figures in ancient Egypt were determined by their importance, power and strength. In order to clearly define the social hierarchy of a situation, figures were not drawn to sizes based on their distance from the painter's point of view to show depth or perspective, but on relative importance (Gay Robins, 1994). "Ancient Egyptian art aimed at producing a readable meaningful picture, which represents the meaning not the perception of the world". (K., Aldenhoven, 2019). Therefore the proper understanding of the "meaning" of the illustrations in the Egyptian art helps in understanding the use of relative scale (B. A. Power, P.37, 1999).

This is very clear in the case studies of this research. In (Figure 1-C), the tomb owner drawn as the largest figure in the scene (Royal society of chemistry, 2022) and dominates the rest of the composition, "where conventions for drawing the human figure are reaching their standardized form" (B. A. Power., P.38, 1999). The left wall in figure 1-A contains a secondary scene divided into three main horizontal registers, the first two divided into vertical columns containing figures carrying offerings. The figure's sizes are relatively much smaller than the tomb owner on the front wall in figure 1-C (H. ElKamshoushy., 2019). "The larger the scale of the figure, the more important they were" (A. Calvert, 2022).

Gradient patterns

Although the relative size is related to the figure importance, gradient patterns - not related to image importance -have been used by the Egyptian artist. A very clear example of the gradient decrease in size is the circular details on the fish, Figure (6). The analytical study of

the fish pattern shows geometrical accurate decrease in size in each row of the pattern, creating a unique gradient effect making the fish look more voluminous, and creating an impression of spatial depth. The gradient pattern represented in accordance with the artist's viewing and not with his imagination, as a result of copying the nature infront of him (M. k. Hartwig., 2015. P 146).

Another clear example of the use of gradient sizing, the offerings in figure (5), The image shows a sample of the offerings presented to the tomb's owner drawn on the horizontal registers on the front wall facing the main figure. The objects of known distance subtend a smaller and smaller angle, it is interpreted as being further away (M. Kalloniatis, C. Luu., 2007) . Although the decrease in size is very close, and the depth impression is not very clear to the viewer, but it is considered a very basic form of monocular depth cues.

Figure (5): Detailed study of the offerings gradient patterns in Khuwy's tomb.

Figure (6): Detailed study of the fish circular gradient pattern in Khuwy's tomb.

Interposition

Interposition cues occur when there is overlapping of objects. The overlapped object is considered further away (M. Kalloniatis, C. Luu., 2007) When objects block each other out of our sight, we know that the object that blocks the other one is closer to us. The object whose outline pattern looks more continuous is felt to lie closer. Figure (7) shows depth perception based on overlapping techniques. An image with continuous outline is felt closer to the viewer .In image A the larger square is infront of the smaller one, in image B and C no clear depth information can be understood. In image D the smaller square is closer to the viewer than the bigger square (Okoshi, T., 1976.)

Overlapping -which is the oldest technique for depicting non-planer spatial relationships- was already used by the Egyptian artist in the old kingdom, to depict one object partly occluding

another. In Egyptian art, meticulous overlapping is often used to depict a row of objects (Figure 1-2) (J. Hayman, 2006. p 13).

The Egyptian artist tried to employ some depth cues to show overlapping, that was clear in the relationship of figures and objects they are carrying, figure of Khuwy's arm passing in front of his body carrying an item shows that it lies between the figure and the viewer (figure 3), and also the standing figures carrying offerings passing in front of their bodies giving an illusion of depth (figure 1-A) (Robins, 1994).

Symbolism plays an important role in establishing a sense of order in Egyptian art. Important figures were not usually depicted overlapping, but figures of servants were. Each object or element in a scene was designed and drawn from its most recognizable angle. The objects in a scene were then grouped together to create the whole. This is why images of people show their face, waist, and limbs in profile, but the eye and shoulders are shown facing frontally. These scenes are composite images designed to provide complete information about the relationship of the objects to each other, rather than from a single viewpoint. Rules were also applied to the poses and gestures of the figures to reflect the meaning of what the person was doing. An ancient Egyptian artist would depict a figure in an act of worship with both arms extended forward with hands upraised. The Egyptian artist did not attempt to replicate the real world but did achieve a realistic dialogue between the three dimensions world and their paintings by the use of position and grouping to represent depth so the background is shown above the figure, the foreground below or to one side.
 (Royal society of chemistry, 2022)
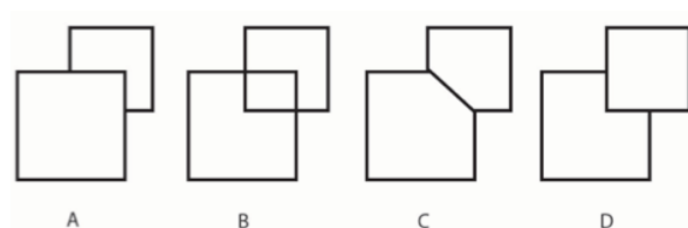
Figure (7): Depth perception based on overlapping techniques. (Okoshi, T., 1976.)
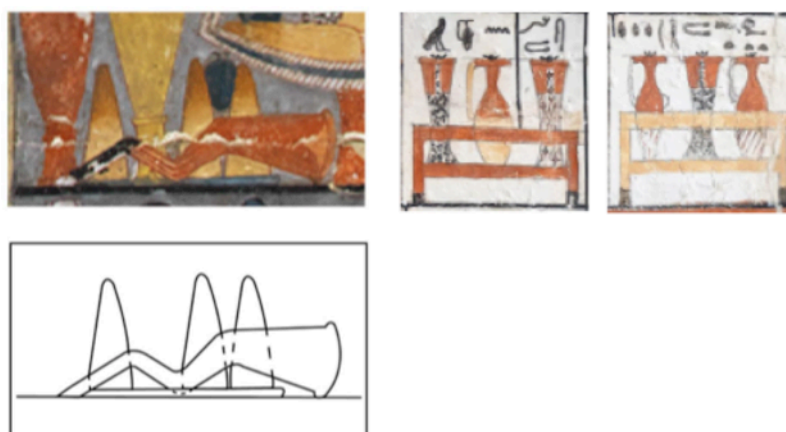
Figure (8): Overlapping and occlusion in the Egyptian art.

Gradient colors and shades

"The Egyptian colors were not chosen randomly but each had a very specific symbolism for the Egyptians and was used to convey that significance. In the Egyptian art color was regarded as an integral element of all art representations" (Joshua. J., 2017).

Gradient colors or shades can provide information about an object's dimensions and depth (figure 9). Although the Egyptian artist depended on flat coloring with no shading in most of his illustrations, slight shading is recognized in some offering drawings on the tomb walls. It is not clear whether it was intended by the artist to show a sense of depth using gradient colors and shading or it was a result of the precise copying of the objects infront of him in his drawings.

Figure (9): Evidence of shading used by the Egyptian artist.

Conclusion

The importance of this research lies in it's application on the recent Egyptian archeological discoveries announced by the Egypt's Ministry of Tourism and Antiquities - based on the work of the Egyptian archaeological missions in various sites in Saqqara. Aiming to understand more about the ancient Egyptian arts and exploring the Egyptian civilization. Revealing more information about the artist's dialogue between the three dimension world and their paintings.

The ancient Egyptian artist's arrangement of the elements followed a precise squared grid system and guide lines to align and size the elements within the given format with great proficiency. Despite the two dimensional identity in the Egyptian art, the research analysis of the case studies shows various basic attempts from the Egyptian artist to imply depth. It is not clear if they are basic attempts from the artist to show depth and volume to his elements or it's a result of the precise copying of the nature infront of him in his drawings.

In a very basic form, some of the illustrations show the use of techniques that exploit the well-known monocular cues of depth-. The most interesting - from a theoretical point of view- are; overlapping, occlusion, relative size, gradient and simple shading. The dominant feature used in the artist's drawings was overlapping and occlusion while shading and gradient patterns were used in very limited drawings. Relative size was used to convey a consistent ideological message, that the larger the scale of the figure, the more important they were, and it wasn't meant to convey depth or perspective in his drawings.

Gradient sizing of patterns were recognized in only two visual elements; The offerings placed on each other and the fish pattern, which both shows geometrical accurate decrease in size in each row of the pattern, creating a unique gradient effect making the element look more voluminous, and creating an impression of spatial depth.

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Photographic Mnemotopes:
Phototextual Reports as a Research Tool for the Communication of the Memory of Places

Clorinda Sissi Galasso, Politecnico di Milano, Italy

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Abstract

The proposed study refers to Communication Design for the Territory, a discipline that has taken up the territorial theme as its own specific dimension, in conjunction with memory studies, an academic field that investigates memory as an integrated interdisciplinary system that combines the physiological dimension with the socio-cultural one. The focus is the concept of *mnemotope*. The term combines two Greek words, *mnéme*, memory and *tópos*, place, becoming a plural object of territorial interpretation of various forms and scales, that can be categorized in mnemotopes with trauma (e.g., war mnemotopes) and mnemotopes without trauma (e.g., birthplaces of illustrious people, literary mnemotopes). The communication and representation of mnemotopes is essential to manifest their territorial network and to make their cultural value emerge. Photography, given its historical link with the memory of places and its visualization, is one of the most suitable systems for mnemotopic communication, especially in its relationship with the textual narratives. For this reason, it has been developed a specific design tool, the *mnemotopic phototextual report*, which can enhance the recognition of mnemotopes, express their different typologies, and evoke their immaterial qualities. The report not only merges textual apparatus and visual apparatus in a unique environment but cross the traditional models used in the academic context for case study research with diaristic narratives and literary travelogues. The paper will show in detail the features of the *mnemotopic phototextual report* as valuable tool for the description of territories, places, and their memories, on the edge between photography and design.

Keywords: Mnemotope, Communication Design, Memory of Places, Phototextual Report, Photography

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Introduction

There is a strong connection between memory and places. Their relationship proves to be a central theme of interdisciplinary research and Communication Design can offer an original perspective on this topic by favoring the reactivation of the territorial past.

In particular, Communication Design for the Territory, a recent discipline that has taken up the territory as its own specific dimension considering places as stratified entities, gathers and analyzes contents (archival documents, testimonies, historical photographs, etc.) and reconnects them to places using specific tools and devices. It can provide new answers to the search for a theoretical solution between the ideas of "places of memory" and "memory of places" by focusing on the concept of the *mnemotope*. The term is composed of the two Greek words *mnéme*, memory, and *tópos*, place, condensing in a singular term the bond between these two fundamental aspects of humanity. The origin of this *portmanteau* is intrinsic to the studies regarding the spatialization of memory. This topic is historically multidisciplinary and has led to a variety of considerations and debates in fields of knowledge such as cultural anthropology, history, photography, and sociology. Until the XVIII century, the link between places and memory was recognized only as "a way to remember", a mnemotechnic (Yates, 1993) configured in the classical *loci memoriae*, ancient associations of concepts, images, and places generated in the mind to reactivate large amounts of information that could thereby be transmitted. At the beginning of the XX century, this broad and interdisciplinary discussion includes the innovative work of French sociologist Maurice Halbwachs, who in *Les Cadres sociaux de la mémoire* (1925) states that memory can only exist if it is contextualized by the social group to which the individual belongs. His thesis clearly breaks away from the physiological and technical view of memory and starts from the radical assumption that no one can remember alone, and that memory is created since childhood by being integrated in a specific and recognizable social framework. He is also considered the father of the idea of the collective memory. For the sociologist, memory is never a purely individual matter, and communities need shared mnestic support to recognize themselves as such and to survive events. Even the most intimate and personal memories exist «in relationship with a whole ensemble of notions which many others possess» (Connerton, 1989, p. 36). Collective memory does not only refer to the past but also inhabits the contemporaneity and «unfolds within a spatial framework […] we can understand how we recapture the past only by understanding how it is, in effect, preserved by our physical surroundings. It is to space - the space we occupy, traverse, have continual access to, or can at any time reconstruct in thought and imagination - that we must turn our attention» (Halbawchs, 1980, p. 139-140).

Forty years later, Pierre Nora, inspired by the theories of Halbwachs, publishes a monumental work, divided in seven volumes, entitled *Les Lieux de Mémoire* (1984). The author considers the *lieu de mémoire*, the place of memory, as mental or physical, abstract or concrete, territorial or objective entity «where memory crystallizes and conceals itself» (Nora, 1989, p. 7). He does not only focus on the physical and territorial dimension of mnestic sites, but he also dwells on other external and mediated marks as objects (e.g., vocabulary, encyclopedia, calendar), famous characters in the history of a country (e.g., Jeanne d'Arc) and traditional celebrations.

The success of Nora's study is so vast that produces a turn in the mnestic context materialized in a historical period of unexpected and excessive interest in memory, not only in academia, but also in other cultural fields such as art, psychology, neuroscience,

cinematography, and literature: the *memory boom* (Winter, 2007). During this time, the concept of the *lieu de mémoire* goes through considerable issues. Under a theoretical perspective, it loses the interpretative nuances highlighted by Nora, becoming a concept associated only to the celebratory side of the past. The aspiration to give voice to places where history and memory are integrated on an immaterial level, places where symbolic value stands for the permanence of time, is equated with the theme of commemoration, eliminating the mnestic variations.

The idea of *lieu de mémoire* also raises translation problems: after Nora, many countries try to find their own version of the concept. In Germany, the term *Erinnerungsorte* (François & Schulze, 2001) is the most commonly used, where the word *erinnern*, "to internalize", has come to refer to memory and also has a didactic connotation, meaning "to learn", "to teach" (Erll & Nuenning, 2010, p. 22). In Italy particularly relevant are Mario Isnenghi (1996) reflections: in his work, echoing Nora's title, *I luoghi della memoria*, the author focuses on the symbols, characters, and structures of Italy from 1861 to the second post-war period. In the US there are the studies of Jay Winter that in the essay *Sites of memory* (2010) stay in the field of commemoration, affirming that the sites «have an initial, creative phase, when they are con- structed or adapted to particular commemorative purposes. Then follows a period of institutionalization and routinization of their use» (p. 312).

In this specific historical and conceptual framework, the *mnemotope* finally appears. At the beginning it is only a synonym, another terminological alternative replacing the *lieu de mémoire*. In 1992, Jan Assmann, a German anthropologist, decided to use the compound word indicating a territorial object of territorial interpretation, a topographical text of cultural memory (Assmann, 2011). Today the mnemotope can be considered as a complex entity where are condensed the physical and the symbolic sides of memory, connected to a specific place. A reality that can be identified and recognized on the territory, geolocalized even if inaccessible. The term has been sporadically used in fields of knowledge like anthropology or sociology and is currently part of the *Memory Studies*, an international and interdisciplinary network of researchers that consider memory as an integrated system combining the physiological dimension with the socio-cultural one, particularly interested in all those apparatuses in which memory is stratified and which may favor its transmission (e.g., places). Prominent scholars in this field include the aforementioned Jan Assmann, Paul Connerton, and Jay Winter.

Mnemotopic Phototextual Report

To investigate the concept mnemotope under a communicative perspective, the present study was divided into different stages: mnemotopic categorization; mnemotopic exploration; mnemotopic analysis.

1.   Mnemotopic categorization

At the beginning of the research, I preferred not to focus on a standard, formal definition of mnemotope, that would have affected its intrinsic complexity. Instead, I moved toward organizing a mnemotopic taxonomy that would allow me to highlight the variety of these territorial realities. Mnemotopes can be very different from each other, in terms of scale, type, and accessibility. They can be man-made structures or natural landmarks, minuscule dots on the map or entire regions, and even empty spaces (Van Rookhuijzen, 2020). We can therefore rely on a preliminary categorization that divides mnemotopes into individual and

collectives. Individual mnemotopes are places related to personal, private memories, a bridge between autobiography and topography. They are rich in sensory elements and emotional shades, but they are also very fragile and overexposed to the passage of time; if they are not communicated and shared, they can last as short as a generation. On the other hand, collective mnemotopes are public places, more stable and recognizable than the individuals as they have already passed through processes of institutionalization.

We can also distinguish between two other mnemotopic macro categories: mnemotopes *with trauma* and mnemotopes *without trauma* (Fig. 1). The first are realities connected to the traditional idea of places of memory, commemorative sites that provide public mnestic recognition. Their surface is characterized by forms of externalization of memory such as monuments, memorials, and memorial museums. Without trauma mnemotopes offer a very different perspective. They are mnestic entities that are not imbued with contested memories but are equally marked by strong emotional experiences, multilayered microcosms, cultural intersections where territory, past and curiosity coexist, often linked to the creative side of the past. We can identify for example: cinematographic locations; literary mnemotopes, birthplaces of illustrious people such as artists, writers or poets; historical cafes; industrial menmotopes. In the area between mnemotopes with trauma and without trauma, we can then classify liminal realities such as: ruins; mnemotopes, marked only by commemorative plaques; naked places, places that have no traces of the event whose memories they preserve (Pirazzoli, 2010); cemeteries as places of collective burial that can collect famous graves.

These two macro categories are not to be understood as exclusive but are in dialogue with each other. In fact, mnemotopes are dynamic and active realities that inhabit the territory and for this reason are constantly taxonomically evolving.
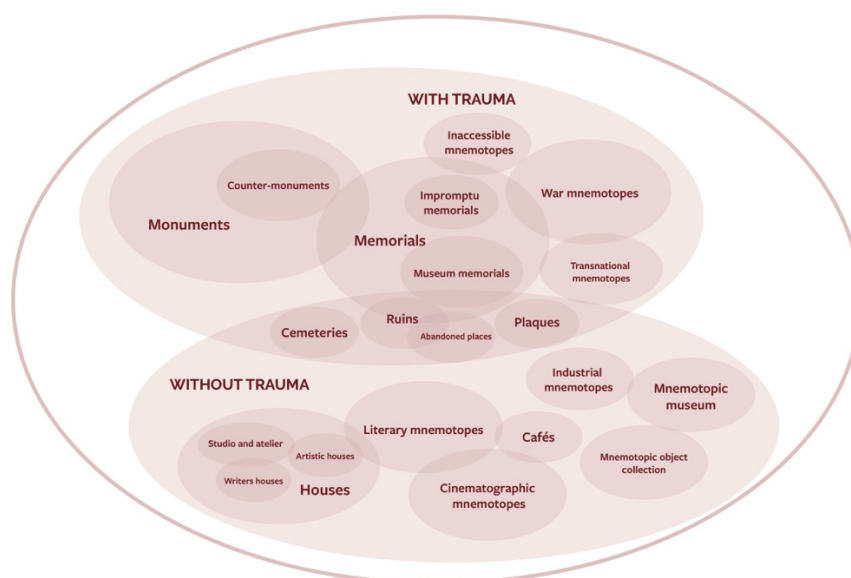
Figure 1: Mnemotopic categorization, 2021.

2.   Mnemotopic exploration

In order to understand the mnemotopic features I decided to physically explore these territorial realities to directly experience the memories that they still contain and preserve. From January 2018 till May 2022, I explored 92 international mnemotopes. Wherever

possible, I gathered communication devices (e.g., brochures, pamphlets, maps), used audio guides, participated in guided tours, and contacted those responsible for the sites to get a complete picture of the mnemotopes' history and current presence. Throughout the exploration phase, I took travel notes, and each mnemotope was documented by a series of photographs to detail the site and the surrounding landscape. These images were accompanied by original photographic production to evocatively represent the connection between place and memory. Parallel to the spatial exploration, I also conducted research in relation to languages: I investigated many possible communicative apparatuses to translate the mnemotope and I decided to use the phototext, which focuses on the fusion of the narrative and visual planes into a *unicum*. In the phototextual environment (e.g., the page), the verbal and the eidetic levels are assembled and combined to generate a *third object* in the mind of the viewer/reader, «that develops and lives only in the constant 'ping-pong' of the eyes when they move horizontally back and forth from image to text» (Chiocchetti, 2018, p. 742).

3.   Mnemotopic analysis

After setting the mnemotopic taxonomy and opting for the phototext as the elective language of the research, I moved on toward the analytical phase. Therefore, I decided to create a specific design tool for mnemotopic communication so that I could examine their characteristics in detail, and I could emphasize their presence in the territory. From a methodological point of view, the elaboration of the tool refers to the blend of different apparatuses.

First, the *case study report*, configured as mode of inquiry that investigates a contemporary phenomenon – the case – in depth and within its real-world context (Yin, 2018). To this research framework I added the phototextual model, and more specifically the auto-photobiotext: based on the idea of photography as a place of preservation of the past, the autobiographical phototextual apparatus offers the union of the photograph as a subjective vision of oneself and the surrounding reality (Ferraro & Sperti, 2021) with the personal textual account of one's experience in the world, often taking the form of diary notes, introspective and extemporaneous reflections, correspondence, and poetic excerpts. Then, I included the *travelogue*, a narrative genre that is part of the broader field of travel literature, which became popular at the beginning of the seventeenth century, collecting narrations describing journeys and explorations.

Combining these three devices, I generated the *mnemotopic phototextual report* (Fig. 2): an analytical interpretative report, core of the entire research, describing the main mnemotopic sub-typologies, facing the mnemotopic complexity and variety, able to valorize and recognize the fundamental presence of these territorial entities. Echoing the studies of one of the most important scholars in phototextual practices, Michele Cometa (2016), each report is divided in three complementary parts: *inscriptio*, *subcriptio*, *pictura*.

The *inscriptio* is the informative apparatus of the report including: the title, in this case the name of the place; the location; the coordinates, as each mnemotope can be identified on a map; the mnemotopic category; the mnemotopic typology; the state of preservation; the website, when present. The *subcriptio* is the commentary part of the report, consisting of two complementary sections: Description, analytical report of the mnemotope, with basic information about the place; Mnemotopic relevance, autobiographic mnemotopic storytelling, acting as a travelogue. I decided to leave this part in Italian, my native language, because it

constitutes the most subjective and emotional part of the whole phototext. It is the personal account of my mnemotopic experience on each place.

The *pictura* is the visual level of the phototext consisting of two pictures for each mnemotope taken from the photographic reportage, with occasionally the insertion of not-self-produced materials (e.g., links to music tracks to expand the phototext experience at the synesthetic level). The visual apparatus mixes descriptive and informative photographs with detailed pictures that do not refer directly to the appearance of the place but to the memories it contains and preserves; on each page, images constantly dialogue with the text. Verbal and visual parts continuously interface and mutually export their meanings.

Figure 2: Example of mnemotopic phototextual report, 2022.

Mnemo Photo project

During my research I decided also to involve the mnemotopic phototextual report in other design projects to test its functions, objectives, and results. *Mnemo Photo*, for example, is a photographic project focused on individual mnemotopes. After having explored so many public and collective mnestic realities, I decided to concentrate on personal memories and places.

I asked to the participants of the project to compile an online form indicating one of their personal mnemotopes with: name and age; title related to the place or the memory; coordinates or precise address of the place; physical description of the place as accurate as possible to be identified; relevance, or the importance of the memory associated to that place. After having collected the data, I proceeded to map the locations (Fig. 3) indicated by the participants and to establish the routes for the photographs.
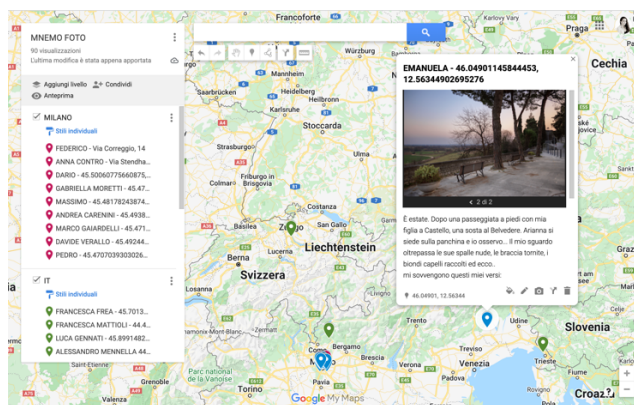
Figure 3: Mnemo Photo, map of the geolocalized photo places, 2022.

For the pictures, I tried to choose the time of day with the least human presence, if possible, and to reflect the moods and color suggestions given by the participants. I printed the photographs on a 30x45 cm rigid support and returned them to the mnemotopic owners.

Then I made a staged portrait (Fig. 4) with the persons holding the printed photo in their hands; they had the possibility to choose in which part of the house to take the picture and with whom. I decided to take the portraits in their homes rather than in front of a neutral background to create a meta-photo in the encounter between the inner individual mnemotope – the place of residence – and the outer individual mnemotope – the place of memory that is externalized and spatialized. Even though the photograph of the place can appear mixed with the place, the domestic environment represents an essential part of the research: the house is one of the most meaningful mnemotopes, guardian of personal memories.

Figure 4: Mnemo Photo, example of meta portrait, 2022.

Being invited and entering private homes was a very challenging part of the project, but it was also the most sensitive part of the whole research, because it allowed me to share with the participants different mnemotopes, the memories associated with them and the unique moment of recording reminiscences in an intimate and safe environment.

In addition, the project wants to investigate people's reaction when they look at their own place, their mnemotope, photographed by external eyes, to see if they can still recognize it despite the passage of time. Mnemo Photo also intends to study whether there are recurring

aspects that can unify and characterize the representation of individual mnemotopes, adding new ty- pologies and patterns (e.g., square, bench, door, street, bar, park) to those already highlighted in the research, during the categorization phase. The project is still in progress[1] and will take a serial form, almost as if it were a mnestic topographical mosaic. The individual mnemotopes, communicated through the three-part report (Fig. 5), photographed and returned to the owner, enter, thanks to the final portrait, a new path of public fruition and shared recognition that brings them closer to the collective mnemotopic realities.

Figure 5: Mnemo Photo, example of phototextual report, 2022.

Conclusion

The research was conducted from a design perspective to highlight the role of communication design in connecting memory and places through phototextual mnemotopic practices and tools (i.e., mnemotopic phototextual report). Based on this process, the main research contributions should be considered from three different perspectives: theoretical, methodological and disciplinary. The main theoretical achievement relates to the definition and categorization of mnemotopes. By combining the main references to the mnemotope, highlighting points of contact, overlaps and conceptual distances, I was able to provide a possible definition of the concept mnemotope that emerged in the design context. In this context, it was also of great importance to propose a mnemotopic taxonomy based on the main macro-categories (individual mnemotopes; collective mnemotopes; mnemotopes with trauma; mnemotopes without trauma) and then divided into clusters analyzed through the phototextual practices.

From a methodological point of view, the most important contribution consists in the typological analysis tool identified in the encounter between case study report, auto-photobiotext and travelogue: the mnemotopic phototextual report. In particular, the phototextual practises normally treated in the literature and in the photographic field were repurposed for project use, taking the operation beyond the realm of method and giving it a project dimension. Reports conceived as formats are an act of communication design whose contribution can be understood not only at the methodological level as useful tools for case study research, but also at the project level as effective hybrid apparatuses for mnemotopic

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[1] For further information on the project and to participate visit the link: https://forms.gle/2nB2doznphVCEqiY8

recognition, remediation, and communication. Staying within the discipline context, I believe that the mnemotopic phototextual can be used in other design projects, such as in the case of Mnemo Photo, but also in other disciplinary contexts as an analytical tool suitable for increasing knowledge of hybrid topics like mnemotope, and for expanding categorization processes and studies through case studies with an approach that mixes the visual and the verbal generating new formations of meaning.

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Contact email: clorindasissi.galasso@polimi.it

Lettering Design in Raul Lino's Work: Humanism, Nature and Tradition in Architecture, Graphic Arts and Design

Regina Delfino, Techn&Art – Technology, Restoration and Arts Enhancement Center, Polytechnic Institute of Tomar, Portugal

Pedro Matos, Techn&Art – Technology, Restoration and Arts Enhancement Center, Polytechnic Institute of Tomar, Portugal

Inês Serrano, Techn&Art – Technology, Restoration and Arts Enhancement Center, Polytechnic Institute of Tomar, Portugal

Anabela Moreira, Techn&Art – Technology, Restoration and Arts Enhancement Center, Polytechnic Institute of Tomar, Portugal

Abstract

Raul Lino's work is often connoted with the image of *Estado Novo* and with *Português Suave*, an architectural style with a partly degenerate and retrograde taste. However, this view does not consider that a part of his most important work, which in addition to architecture covers various decorative arts, was developed before that Portuguese dictatorial period; just as it tends to forget the centrality of its humanist and naturalist character. This study analyses the graphic work of this architect, in particular the lettering, which covers periodicals and book publishing, architecture or graphic brands. Much of this work is linked to education, due to the relationship that Lino established with the writer Afonso Lopes Vieira and his children's literature, or with the João de Deus Kindergartens. This less studied part of Lino's work not only reflects the idea of a total work of art, of integrity and application of values and beauty to everyday life and its artefacts; as it underlines the importance given to calligraphy; or to the mixture between erudite and popular tastes, of national or regional nature. Recovering these values is urgent today, insofar as the digitization of reality and our day-to-day life, even if inevitable and partly necessary, has tended to relegate the importance of craftsmanship, of Man's relationship with nature and a way of thinking linked to the body and to doing. And as has been proven, these values are decisive in the construction of straight, creative citizens with respect for Others, Nature and the Earth.

Keywords: Raul Lino, Lettering Design, Graphic Design, Illustration, Editorial Design, Graphics in Architecture

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Introduction

The work of the architect Raul Lino (1879-1974) has been subject of research for some time, especially focusing his architectural projects. His work had special importance and influence on Portuguese architecture, especially during the first half of the 20th century, and in the creation of a national identity in architecture and in other fields of Portuguese culture. Both his work and influence he had have not always been seen positively due to some connections attributed to fascism and to a style and taste known as *Português Suave*. However, much of his work and mindset has a truly humanistic nature, reflected in his varied work that goes far beyond architecture and covers various decorative arts, some of which predates the Portuguese dictatorial period.

The search for beauty, a certain naturalness and truth, and its application to different dimensions of everyday life are part of Lino's search, similarly to what happened in several contemporary European movements. These comprised a global project that went beyond traditional arts, extending to many artistic applications. Lino had special contact with British and German realities when he studied there in his youth, between 1890-3, at a Catholic college in Windsor, and 1893-7, in Hanover, studying furniture design, woodwork and architecture. In 1911-2 he returned to Germany to study decorative arts, graphic arts and human figure drawing, in Berlin.

At this time, various movements such as the *Arts and Crafts*, in the UK, or the *Jugendstill*, in Germany, valued humanist values, nature or manual craftsmanship, as opposed to industrial development that tended to dehumanization and often indifferent to aesthetics; or in opposition to neoclassicist and elitist aesthetics. In particular, Lino's relationship with German architect Albrecht Haupt, in whose studio he was an intern, developed in him a particular taste for nature, history and national characteristics, which would be shaped more or less evidently in all areas in which he acted.

In fact, Lino's projects were quite embracing, covering architecture and all of the interiors, including furniture and wall decoration, paint or tiles, tableware, textiles or metalwork design. In Portugal, at this stage, Lino was one of the most important representatives of a total vision of the work of art. The application of beauty to the most varied ways of living, on a day-to-day basis; thinking the house and inhabitation as a whole, in a dignified way, and adapting all responses to the particularity of his client, are some fundamental aspects of his work.

This paper is part of the project "Raul Lino – An itinerary through heritage", which studies his architectural work in the region of Abrantes. This project is part of Techn&Art research center, of the Polytechnic of Tomar. According to Serrano & Moreira (2021) heads of the project, the work by Raul Lino in big cities is relatively studied and documented, but in Abrantes, which has one of the largest concentrations of buildings designed by him, this research is still missing. However, during the course of the project we were awakening to the need of also study his graphic work, as we found great care in details like door numbers, tiles and other graphic applications in architecture, with a dimension and identity of its own that we sought to check in other Lino's works.

Regarding to graphic design, fewer studies have been focusing Lino's work. In this area, we found lettering design of special interest, which Lino practically always hand drew. It is noteworthy the importance he attributed to hand lettering, whether applied to buildings,

books, marks or even architectural projects. Thus, here we focus on the importance of lettering, its design and composition, and its combination with graphic or architectural elements.

The methodology includes a review of the literature about Raul Lino. In addition, a field survey was carried out, a research and documentary analysis of the editions and some architectural projects. These documents are in the archives of the Municipality of Abrantes, in the collection of the National Library of Portugal and in the collection of projects deposited at the Calouste Gulbenkian Foundation. In the field, several buildings were visited and a photographic collection of their graphic elements was made.

Editorial Work

Raul Lino's editorial work mainly took place throughout the 1910s, part of the initial phase of his career. In Portugal, in the pre-modernist phase, the art of books from previous centuries had faded with a certain industrialization of graphic production, with the country's scarce resources and a small audience for Portuguese-language editions. All this contributed to the fact that editions at the turn of the 20th century did not have the splendor nor the debates that took place in much of the rest of Europe. Thus, we agree with Rio-Carvalho (1970, p. 216) when he mentions that part of Lino's activity in this area renewed illustration and book design "for its discreet dignity" and threw "a stone in the doldrums of publications destined to children for its lively, simple and refined appearance". Added to this is creativity, although more restrained than in other areas of Lino's activity, mainly aiming to raise awareness for beauty and simplicity.

Rio-Carvalho (1970, 1990), in the exhibition catalogs dedicated to Lino, provided a complete overview of his activity in this area, complemented by Lino (2014) and Godinho (1972). Although Raul Lino does not have an extensive graphic work, it is relatively varied, covering book and periodical illustrations; book and magazine covers; promotional material, such as postcards, programs and prospectuses; graphic marks, letterheads and ex-libris; and the application of graphics to architecture. These last two areas will be deepened in separate parts of this paper.

Animais Nossos Amigos (1911), Poesias sobre as Scenas Infantis de Schumann (1915), Ilhas de Bruma (1917), Afonso Lopes Vieira

The poet and writer Lopes Vieira was one of Lino's greatest friends. For many of his books Lino designed covers and illustrations. *Animais Nossos Amigos* is probably Lino's first work for Lopes Viera and is by far the most complex (Fig. 1), partly because of the use of colors in illustrations. The book is printed with five colors, four of which are what we call today four-color printing, to which beige was sometimes added. Today CMYK printing is commonplace but was being introduced at that time. In this type of work, along with creativity, illustrators had to think about how to print it. In jobs with two or more printing colors, they could think of mixing them in order to obtain a greater chromatic palette and, as a general rule, they would still make the colors separation in order to print them individually and sequentially. It is worth noting that this process was relatively difficult to perform at the time, since each of the printing colors had to be manually separated, thus generating as many drawings as colors to print. So, in addition to the expressive value of Lino's illustrations, they are also rich from a technical point of view, when varied chromatic results are obtained through this mixture of printing colors.

It is also interesting to see the way Lino combines titles with illustrations, as well as the creative drop caps; or, at the beginning of stories, with decorated frames, offering beauty, elegance and sensitivity appropriate to a work aimed at children, in a suggestive interaction between text and image (Fig. 2).
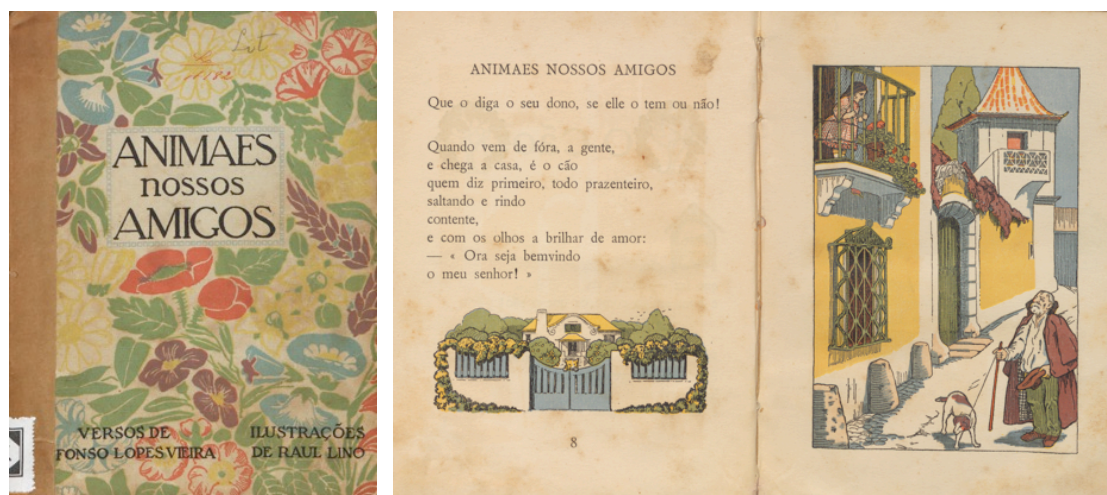
Figure 1: *Animals Our Friends*, front cover and inside pages.
(SOURCE: Portuguese National Library.)

Figure 2: *Animals Our Friends*, chapter openings in odd pages.
(SOURCE: Portuguese National Library.)

The hand-drawn lettering and composition cannot be considered innovative, but they must be framed in the international movement that valued Roman fonts, as opposed to many others that appeared in the context of advertising and in other forms of mass communication. The British William Morris, the Americans Morris Fuller Benton and Frederic Goudy (Pevsner, 1980 and Blackwell, 1993), or the German Peter Berhens (Burke, 1992) are some examples of this movement that rescued tradition, valued manual work, a beauty and a delicacy that contrasted with the mechanistic values of the industrial revolution. In text composition there is also a personalization of letter spacing, as well as variations in their width, which letterpress with movable characters did not allow.

On *Poesias sobre as Scenas Infantis de Schumann* cover the typeface is a classic, humanist Roman, recurrent in works for Lopes Vieira (Fig. 3). However, Lino now uses hollow letters, which accentuate the candid and youthful aspect of the illustration and the graphic elements that frame the cover and the title. This variation was used by Lino on other occasions when he intended to highlight the poetic character of words.

Figure 3: *Poetry about Schumann's Childhood Scenes*, front and back covers.
(SOURCE: Portuguese National Library.)

On the other hand, in *Ilhas de Bruma*, also a work of poetry but aimed at an adult audience, now in a contained register, the letters gain a strong character, revealing tragic feelings, such as nostalgia or pain (Fig. 4). The replacement of the U by the V, as in Old Portuguese, underlines the historical character of the work. The rockroses and spike frame, in the Arts & Crafts style, was a kind of hallmark of this neo-romantic author, repeated on many of his book covers or title pages.

Alba Plena, Augusto Gil (1916)

For this poetry book, Lino designed the cover, illustrations and title letters and drop caps (Fig. 5), as in *Animais Nossos Amigos*. However, the illustrations and the use of color are less expressive and suggestive, but of greater symbolic value. The letters are designed in the same classic type – then called Old Style – offering a personal touch in certain details, such as the lowercase a or the capital S. The symbol in form of a four-pointed star, separating words, further accentuates the spiritual, lyrical and symbolic character of the work. As in other

works, the traditional but standardized typographic vignettes, separating chapters or closing the book, are replaced by hand-drawings, strengthening its personality and uniqueness.
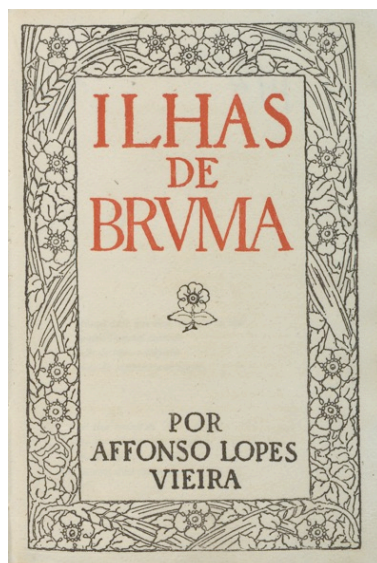
Figure 4: *Bruma Islands*, title page (similar to the front cover).
(SOURCE: Portuguese National Library.)

Atlântida magazine (1915)

This is probably one of the most interesting examples of Lino's letterings. The cover was repeated throughout many issues, changing only the color, with the exception of the last issues, when Raul Lino designed another one of his floral patterns (Fig. 6). The letters have a well-marked character, with straight serifs and some very characteristic stems, such as the crossbar of the A, the upper ends of T, N and A, and the diagonal of the N. The title verticality accentuates the lightness and elegance of the design.

Along with the title, the description dominates the cover. Lettering design has mixed characteristics, between a certain objectivity and some gesture, which we find once again in the exaggeratedly narrow S.
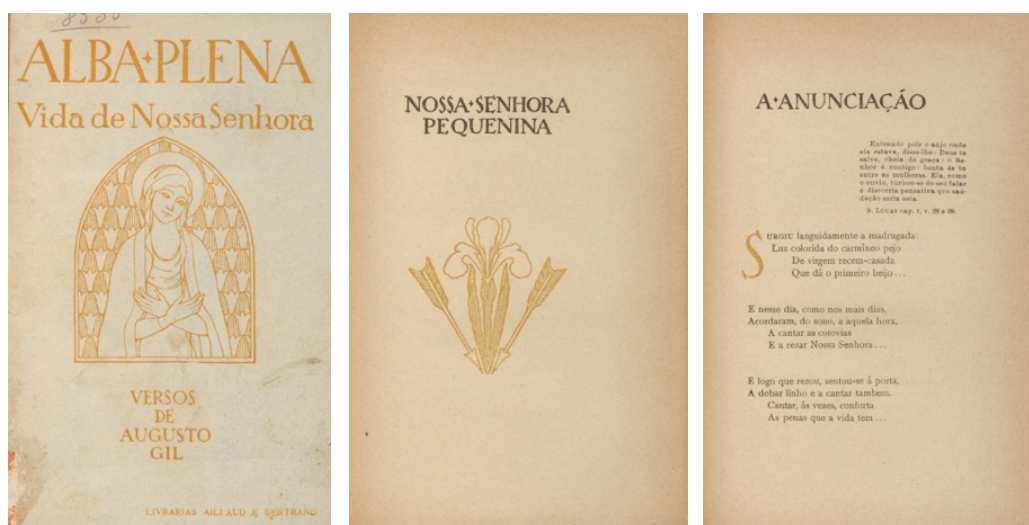
Figure 5: *Alba Plena*, 3rd. edition, front cover and opening pages (odds).
(SOURCE: Portuguese National Library.)
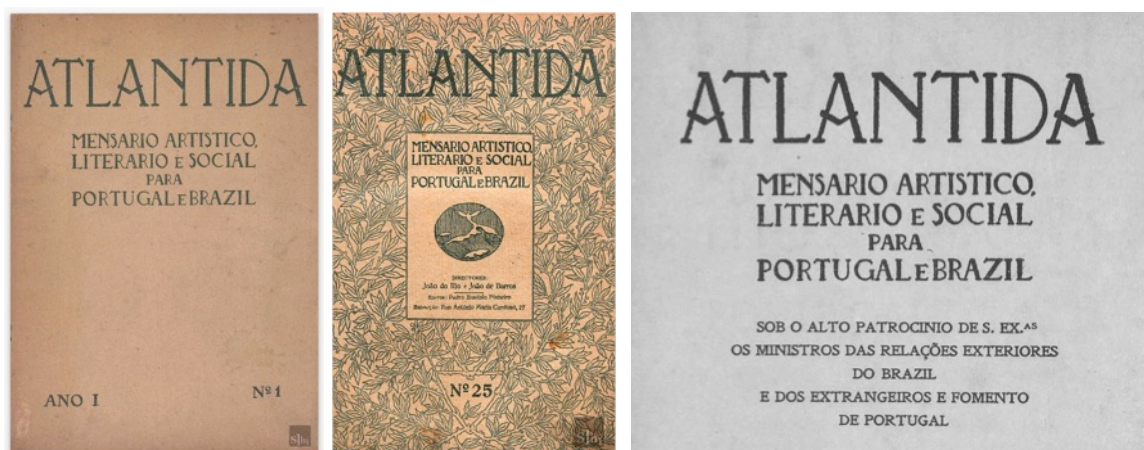
Figure 6: *Atlântida* front covers (n.1, 1915 and n. 25, 1917), detail of the title page.
(SOURCE: Portal de Revistas de Ideias e Cultura.)

Cartilha Maternal, by João de Deus (1912)

This front cover is not attributed to Raul Lino by any of the aforementioned authors. But Silva (2008) has no doubts in attributing its authorship to Lino, despite not mentioning the sources. We agree with him, as both the illustration and the hand-drawn lettering have characteristics attributable to Lino (Fig. 7). On the other hand, Lino's very close relationship with João de Deus Ramos and his intense collaboration in the foundation of João de Deus Kindergartens are well known, as we will recall later.

This work stands out from others, as it is an important book in the history of education in Portugal. It has been edited numerous times since 1876 – this is the 24th edition and many others have followed. Lino executed an illustration of symbolic and poetic character, establishing a parallel between the flower – student – and the butterfly – educator –, which will help to blossom one and the other (Silva, 2008). Lettering design, again classic, reinforce the personal and humanist character, not only because it is hand-drawn, but also by certain particularities: the very low crossbar of the A; the diagonal of the N; the larger bowl of the R; or the quite open upper beaks of the T. Also the word *maternal* with letters touching each other, reinforce the idea of union, so interesting and pedagogical.

Figure 7: *Maternal Speeling Book*, front covers of parts 1 and 2.
(SOURCE: Portuguese National Library.)

Graphic Brands, Letterheads and Ex-Libris

The work produced by Raul Lino in this area also lays on an early stage of his career, mostly in the 1910s and 1920s. Unlike the lettering for editorial artifacts, designed mostly with classical roman faces, regardless of the type of literary work, Lino's work for marks is much more varied. Along with classics, we find straight types, some more fanciful, others more or less formal or informal. Here Lino distanced himself from a more serious or dignified character that he regularly wanted to offer to editions, approaching more the personalities to whom the marks were intended. It seems that there was a certain interpretation of the psychological character of the commissioners and their tastes, which is shaped in quite different solutions, both in the drawings and their symbolism, as in lettering design. In this sense, we see here an attitude closer to Lino's architectural designs, and even to a somewhat modern sense of design, in which form follows function.

Lisbon University (1914)

It was designed as an ex-libris and used with some adjustments as a symbol in the University's graphic brand, by the end of the 20th century (Fig. 8). Lino's observation regarding the columns chapiters seems to us also appropriate for the letters: "I purposely adopted for the chapiters design, not a pure Hellenic model, which I feared could have an exclusive humanist meaning, but the mixed effect of Visigothic chapiters as the broadest symbol of Aryan civilization" (apud Godinho, 1972, p. 29). Lettering design also refers to Indo-European culture, both in its design as in the outline. In fact, the letters have a hybrid design, combining linear characteristics, in their homogeneous thickness, with Roman letters, and triangular serifs that sometimes go unnoticed.

Figure 8: *Lisbon University* ex-libris and symbol.
(SOURCE: Godinho, 1972, Portuguese National Library.)

Câmara Pestana Institute (before 1920)

This brand, also used as an ex-libris, has the same symbols as the University mark, of which the Institute was a part, but with very different characteristics (Fig. 9). Among the differences, the columns and the ship stand out: both are closer to us in time, especially the ship, which is now a carrack. Also the lettering design has some similarities with the previous one (thickness of stems and, in a certain way, the serifs). However, their nature is quite different. We no longer have a somewhat majestic character, but more informal and reflecting values closer to the time in which they were designed: a finer letter; rounded serifs; different proportions, such as the height on the crossbar of the A, or its width; the beaks of T, E and M; the inverted B; or the typical Lino's narrow S.

Figure 9: *Câmara Pestana Institute* ex-libris and mark.
(SOURCE: Godinho, 1972, Portuguese National Library.)

Benno Weinstein (circa 1912)

Godinho (1972, p. 28) refers that the ex-libris of this German banker (Fig. 10), probably the first one that Raul Lino drew, "... must have been made shortly after his stay in Germany in 1911 (...). In fact, it reflects an entirely new concept of graphics compared to what we are used to find in works from this period." Despite this, the theme and the line expression seems characteristic of other Lino´s drawings, even if the outline separating the letters and the white spaces is unusual. The text is composed in different types: one, organic, with some Art Nouveau reminiscences; the second, straight, strong, less usual in Lino's designs, but which we find in other works.

Figure 10: *Benno Weinstein* ex-libris.
(SOURCE: Godinho, 1972, Portuguese National Library.)

António Menezes (1916)

Concluding this selection another ex-libris, for doctor António Menezes (Fig. 11). This is an abstracting solution, unusual in Lino's work. It accentuates the symbolic value of the image, even though it maintains a certain decorative character, much to Lino's taste, evident in the subtle combination of curves. Text, composed with a linear font, combined and integrated into the frame, gives and accentuates the strength and simplicity of the message. We agree

with Godinho (1972, p. 30) when he considers that "as a synthesis, this design is (...) the most achieved among all marks that Raul Lino worked on, and the one that will continue to be updated for many years to come".

Figure 11: *António Menezes* Ex-Libris.
(SOURCE: Godinho, 1972, Portuguese National Library.)

Graphics in Architecture

Raul Lino's graphics in architecture is not addressed in its bibliography and is poorly documented. However, it can be considered the most interesting and, in certain cases, by far the most viewed. The examples that we select cover most of the architectural types that Lino worked on – private housing, school and commercial architectures, and interventions in leisure spaces. They are necessarily examples of a small part of his vast and long career (more than 700 projects), whose starting point is practically restricted to his most significant works. However, here we find rich examples of Lino's creativity and sensitivity, with always balanced lettering designs and harmonious integrations.

Roque Gameiro House (1898, 1900)

The project for Roque Gameiro House is a joint work, both in architecture and decoration, built in two main phases. The first in 1898, attributed to Alfredo Roque Gameiro himself (Cravo and Meco, 1997) and, adds Barata (2020) and Manoel & CMA (2015), with a very likely collaboration of Lino – as they became great friends since they met in Leipzig, and as they traveled together through different regions of Portugal, in 1897, in a collection of a naturalistic and ethnographic nature, which significantly influenced their later works. Raul Lino authored the second phase of construction, in 1900.

According to Cravo and Meco (1997), most of the tiles are of uncertain authorship. The exceptions are those designed by the ceramist and caricaturist Rafael Bordalo Pinheiro and manufactured in his Fábrica de Faianças Artísticas das Caldas da Rainha, in 1898. In this set are the dining room tiles, which include an upper frieze all around the room, with popular proverbs, in a Gothic-inspired typeface.

The author is unknown in the remaining tiles with text. However, there are two of these pieces that are worth highlighting: the ashlar finish in the lower bedroom of the tower, with popular sayings; and the emblem, with a motto, on the north wall of the building – the last one surely from 1900, from Lino's intervention phase. Cravo and Meco (1997) consider that these tiles may have been produced at Fábrica de Cerâmica Constância and by one of its regular collaborators in this period, the painter José António Jorge Pinto – the first one, to

which Lino always resorted to carry out his tile drawings; the second, who collaborated with him on other projects.

The emblem graphics (Fig. 12) is not very elaborate, suggesting small finishes (H, M, T and one of the I), but fundamentally straight, without serifs. The curves of the diagonal stems of two of the N, the junction of the letters PANE, as well as the letter P, drawn as a D, are the only details of greater freedom, which the technique of plied tiles also helps to contain.

The graphics used in the aphorisms (Fig. 13) denotes a certain old, medieval style, using some capitals with influence on uncial letters, such as the very characteristic rounded E and M, but with a very free interpretation and a decoration in the Art Nouveau style, with flowery endings, many letters linked or intertwined. Most of the remaining capitals are in a more current Roman style, without the typical uncial ascenders and descenders, with a design and difference in width between the stems, common at the time (A, D, R, e.g.).

Figure 12: Emblem in Roque Gameiro House north facade.
(SOURCE: Photography by the authors.)

Figure 13: Tiles in the lower bedroom of the Roque Gameiro House tower.
(SOURCE: Photography by the authors.)

Patudos House (1904)

The graphics composing Lino's signature, on the exterior of the building (Fig. 14), is another one of the rare examples of lettering design with some Art Nouveau influences in his works, also probably by Jorge Pinto, who painted the remaining tile panels in the house. Here we

have a clearly ancient Roman design, but with endings and serifs that are often exaggerated, sinuous and with several other decorative variations. Although Lino did not the final design, he certainly has sketched it, even if its later execution, by other author, was more or less free. In any case, they reflect the influence that Art Nouveau had in early stages of his career, which can be found in several works from this period.

Figure 14: Patudos House outside signature.
(SOURCE: Photography by the authors.)

We agree with Barata (2020, p. 25) when he says that "a certain cosmopolitan and urban character that in concrete practice marked those movements [Art Nouveau, Arts and Crafts, Jungend Stil, Sezession...], would make that its attraction was lost in the face of the discovery of the southern, Atlantic, Iberian and rural world in which the two artists [Lino and Gameiro]

still in training were beginning to find the possibilities of a more vivid realization of the aesthetic ideals proposed by Ruskin, but now in its reading in terms of the "Herderian" view of the geographic and nationalist roots of the cultures of the peoples".

Cypress House (1912)

In the first house designed to himself, we find one of the most interesting examples of Lino's application of graphics to architecture. Again, the execution was carried out by another artist, in this case Nolasco, who painted the murals in the dining room (Rio-Carvalho, 1990) and probably also the stained glass window with the inscription Lino choose as his motto (Fig. 15). The phrase by Sadi of Shiraz, was found by Lino in Thoreau's Walden (1854). Again with classical Roman letters as starting point, the design and the way text is composed and distributed in the rectangles reveals an interpretation of great freedom, in accordance with the message it conveys. With some variations, we find several details that have become Lino's brand image, such as the short S, the open serifs of the E or its less noticeable intermediate horizontal bar. The R large bowl or the rather tall crossbars of A and H and, in this case, also the E are details that we find in other Lino's designs.
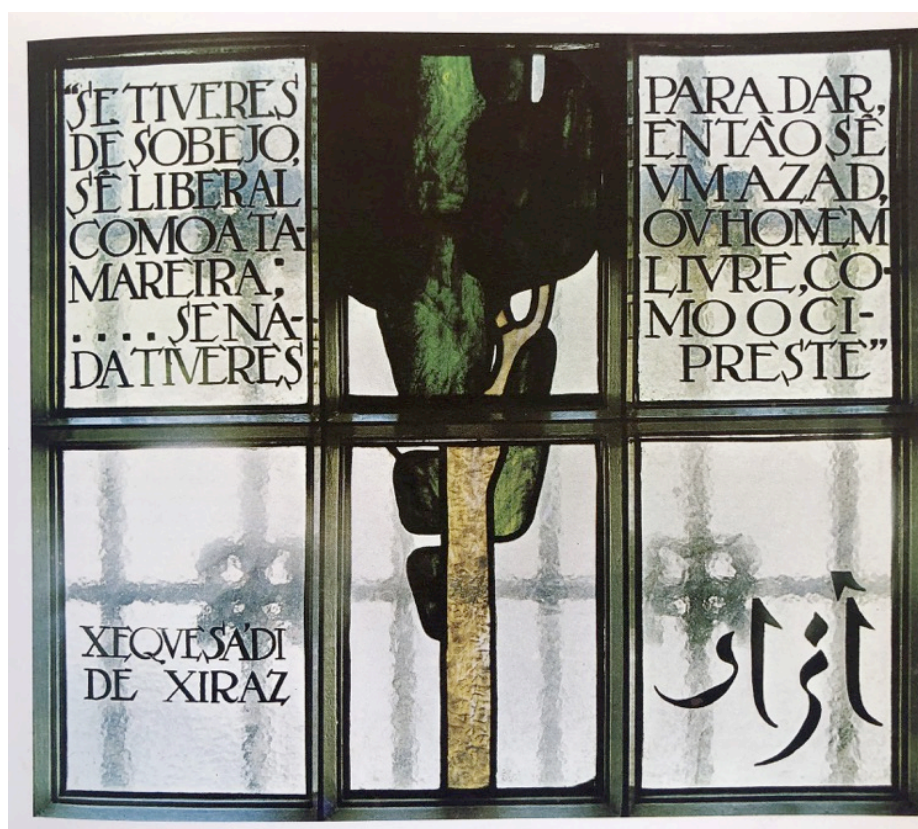
Figure 15: Cypress House dining room stained glass.
(SOURCE: FCG, 1970, Portuguese National Library.)

João de Deus Kindergarten (1911, 1956-64) and João de Deus Museum (1917)

As noted, Lino's collaboration in the area of education with João de Deus Ramos was fruitful and varied. Lino designed the first eleven kindergartens for this association, between 1911 and 1956. We highlight the first, along with the Museum (Fig. 16), and the changing project of the last, in Alvalade neighborhood, Lisbon (Fig. 17).

The graphics used by Lino in these buildings excels in restraint and seriousness, a common trait in his works aimed at children, as seen before. Our interpretation is that there was an intention to give value and dignity to education and literacy, which at that time were still lacking. Thus, Lino chooses again the classical Roman type to compose texts, typically centered on the top of the entrance and/or on the symmetrical facade.

The Alvalade project, from the set of his later works, follows a lettering design similar to the others, but loses some typical characteristics of Lino's early career, such as the narrow S or the R large bowl. In this case, we find interesting to note two more things. Firstly, the architectural project includes the design of some letters in full size. This was never Lino's practice, usually only sketching the letters or, in some cases, not even including them in the projects. In initial projects, perhaps when Lino worked with artists or artisans who would put his projects into practice and whom he trusted, these details were intentionally left to the discretion of performers, in Lino's respect for their work. Including these details in the project should consider that the idea of the craftsman creator was lost throughout the 20th century. The current practice became that of detailing right at the project stage, avoiding any unexpected deviation.

Arising from the previous remark is the detail we find in the project. The rigor of the design allows us to closer analyze Lino's options in terms of details, such as serifs and other endings, short and chamfered, suitable for the scale and materials used; or the subtle variations in letter thickness. This lettering does not have the manual, artisanal character, nor the gesture Lino used in previous drawings, but we still find it original with reminiscences of a certain tradition that, combined with the figures below (based on a drawing by painter António Carneiro), give the openness and stability so necessary to the teaching and learning process.

Figure 16: João de Deus Kindergarten, in Coimbra and João de Deus Museum, in Lisboa. (SOURCE: Photography by the authors.)

Figure 17: João de Deus Kindergarten, in Alvalade, and detail of the lettering design.
(SOURCE: Photography by the authors; Calouste Gulbenkian Foundation Archive.)

Commercial projects: Gardénia (1917), Tivoli Theater (1925), Loja das Meias (1933)

Raul Lino did far fewer commercial projects than individual housing. These three examples are significant both because they still exist in Lisbon, maintaining their functions, and because of the importance they all had as commercial and cultural spaces.

Also in these cases Lino rarely ran away from his chosen typographic family. We imagine that here it would also be intended to offer dignity to this activity, at a time when consumption and the characteristics of modern life were on the rise.

Figure 18: Detail of the Gardenia and Loja das Meias stores. (SOURCE: Photography by the authors; photography by Mário Novais, Calouste Gulbenkian Foundation Archive.)
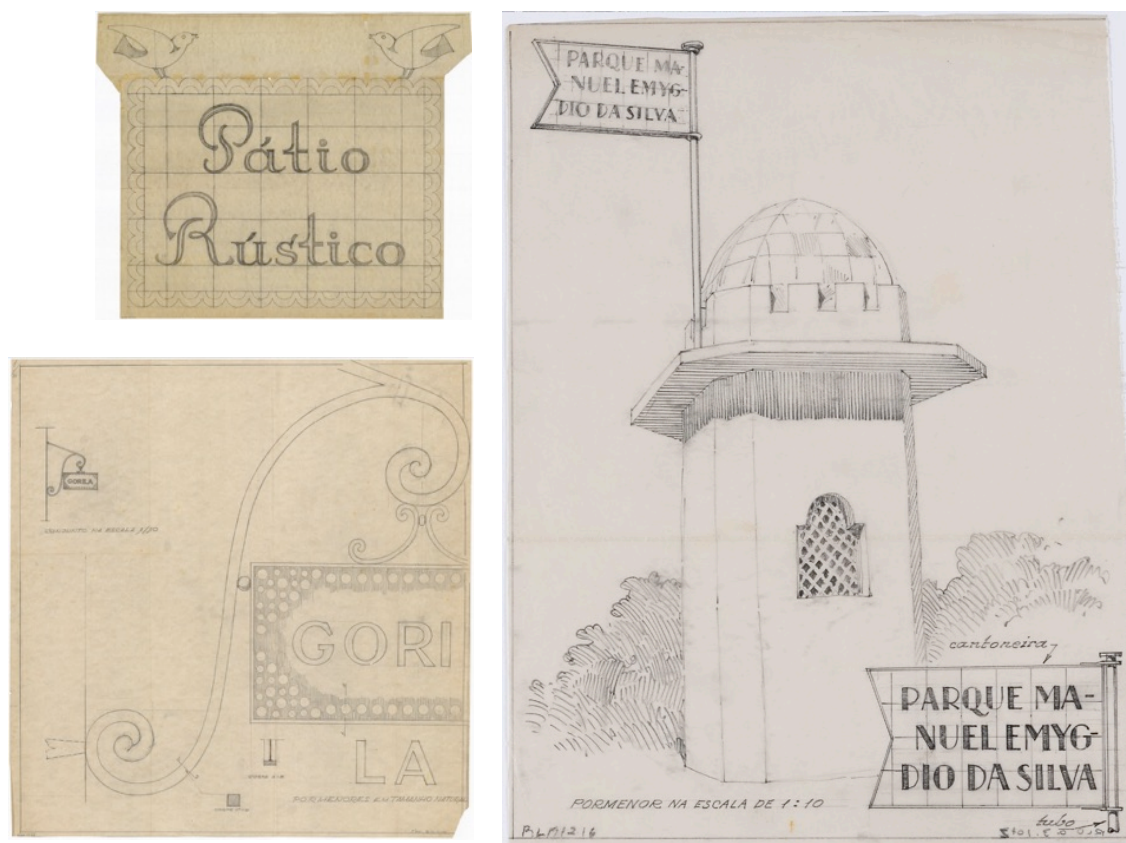
Figure 19: Several details of architectural projects for the Lisbon Zoo.
Dated, clockwise, starting at the top left: 1942, 1953 and 1967.
(SOURCE: Calouste Gulbenkian Foundation Archive.)

Lisbon Zoo (1935-72)

Concluding this selection are some of the several projects Lino designed for the Lisbon Zoo. Fountain projects and urban furniture design; a monkey village; the dog hotel, maternity or hospital; the houses of camels, hippos, elephants, giraffes or gorillas are some examples, many of them with identifying or informative graphics.

We consider interesting the variety of typefaces that Lino proposes. Even though many can be considered restrained in today's eyes, we understand that the playful side of the work gave rise to some informality and adaptation of the faces to different situations. There may still be some lack of coherence between the different graphics, but the sometimes-relaxed character seems to us appropriate.

Conclusion

The graphic work of Raul Lino, the most important part of which was developed in the 1910s, while not vast, is interesting and varied. In Portugal, this was the decade that preceded the emergence of modernism in national design. Not having been much studied yet, this period should not have been very relevant in terms of quantity and quality. At this stage, Raul Lino stands out not only for his commitment and love, but also for the novelty of his perspective and expressiveness applied to visual communication. Lino's thinking seems to us new at the time, diverging both from the lines and elites linked to the Fine Arts of the

national metropolises, and from the growing banalities resulting from an initial phase of industrialization in the country's graphic arts.

Lino's sensibility came to distinguish him in three areas of activity: edition, graphic marks and graphics in architecture. While in edition he followed a more traditional path, focused on the dignity of communication, in part resulting from the type of works and authors he worked with; in the other two he was more daring, producing more free and expressive results, reflecting more of his personality and culture. Especially in the graphics for architecture, his production was fruitful and had a little more repercussion.

However, in general, and in graphic design in particular, his work has not been given the importance we think it deserves. The fact that he never identified with contemporary movements, especially modernism, contributed to his forgetfulness and that of his work. Rio-Carvalho (1970, p. 222-4) sums up well the reasons for this mismatch: due to "... excess personality, Raul Lino is a bastard, in the Sartrean sense of the term, an outsider, (...) in Portuguese society who never understood him, as a creative artist. (...) Many of the fruitful searches of this time did not interest him. He is at the antipodes, for example, of the futurist movement. A life of steel, fever, pride and mad speed, Raul Lino doesn't care at all. More, he is opposed to being integrated into this kind of life. Given that futurism, at least theoretically, was the movement that launched Portugal towards modernism, perhaps this explains the mismatch between Raul Lino and his time."

It will be precisely some of these values – the criticism of the machine as a tool of facilitation and dehumanization, human freedom and dignity combined with love and respect for nature and the creativity of human beings – that it is important not to lose sight of and, moreover, to foster them in us and in future generations, as guarantee of a dignified and harmonious life on our planet.

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Contact email: re.delfino@ipt.pt
              pmatos@ipportalegre.pt

Exploring the Hybridization of Traditional Printing and Digital Fabrication Processes to Expand Design Innovation in the Classroom

Pedro Amado, University of Porto, Portugal
Cristina Ferreira, University of Porto, Portugal
Maíra Woloszyn, Federal University of Santa Catarina, Brazil

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Abstract

Design education has been institutionalized for several decades, but digital competencies have shifted the role of the "designer-author" to a "digital black-box operator". Computational Design and Media Literacy are directly related to the development of critical thinking. Promoting these literacies is a priority as they allow us to understand and operate a range or set of tools and processes of the wider media ecosystem today, and leverage these into future uses or developments. This paper aims to promote hybrid media literacies through the reporting of a design-led research and development process of an innovative DIY flatbed proof press – the XT-Press– a powerful tool for designers and students to learn more about history, purpose, graphic and algorithmic possibilities of combining computational and traditional processes and materials. Building upon previous digital fabrication and traditional printing experiences, we designed and conducted three custom experiences: one in refining the design and building the press. And two additional ones using the press with a small group of participants in a Graphic Design higher education informal context. Through these, we have learned that by being able to iterate back and forth between design and fabrication of the tools and processes, as well as design and printing of the "designer-author" compositions, we are successfully promoting the acquisition of these set of skills and the expansion of critical thinking. At the same time, providing insight into historical and technical production processes by achieving control and intervention in all stages of the design and production.

Keywords: Letterpress, Computational Letterpress, Post-Digital Design, Post-Digital Letterpress Printing, Computational Design, Computational Design Thinking, Design Literacy, Editorial Design, Design Education, Digital Fabrication, STEAM

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Introduction

The universe of activity of Communication Design today is more diverse and complex than in its genesis in the 70s in Portugal. Digital media have propelled design into new territories of dynamic, interactive, application of new ways of thinking creatively. Traditional design elements such as branding, visualization, and editorial design are applied in new contexts such as the Web, Applications, and Games. This is a change seen in the professional market (e.g. North America) in recent years. Traditional areas such as identity or illustration have not experienced a significant decrease in demand (AIGA, 2020). But a growth in demand in digital areas such as UI and UX design, data visualization, programming, as well as their application in education.

Design in Portugal took a long time to become institutionalized. Until the 1950s, communication works were done by visual artists, architects, graphic artists, or typographers whose formal training was done in the workshop context of the printing houses or in the main artistic schools, such as the António Arroio Decorative Arts School (Durão, 2003; Almeida, 2009). From 1959, with the professional influence of the first designers like Sebastião Rodrigues, Daciano da Costa and Victor Palla, a change in education began to take place, and until 1971, Design education shifted to professional studios or schools. Between 1971 and 1974, the IADE, Ar.Co., the Fine Arts Schools of Lisbon (FBAUL), and Porto (FBAUP) began formal Design education programs. The practice-based learning model –still strongly linked to drawing– changed very little until the beginning of the 21st century, which accentuated the gap between academic activity and professional needs (Almeida, 2009).

The introduction of digital tools in the mid-1980s changed the professional practice of design. Lithographic and letterpress practices were in decline, to the detriment of photo composition. The introduction of the digital Desktop Publishing (DTP) workflow changed working methods profoundly and rapidly. A change that was quickly felt in the professional activity Portugal, radically changing processes within the industry in less than 10 years. In education, the change was slow to be felt, despite occasional changes in curricula. Having been institutionalized as an independent research and development practice for several decades, Graphic Design is still understood as a functional problem-solving activity that incorporates aesthetics within craft-based activities, mainly geared toward print media and artifacts. The digital transformation of the past three decades challenges this *status quo*, but institutions are still struggling to adapt their methods and curricula (Pettersson, 2015, pp. 8–13).

The first Portuguese Design programs that offered digital skills date back to the early 1990s, but it was not until the end of the decade that these changes became more evident at a national level (Morais, 2021, p. 86). In the first decade of 2000, programs were still very much focused on the classic project-based nature of Design. The Bologna curricular reform forced the introduction of new curricular units aimed at developing multimedia or computational design skills (Amado, Oliveira, & Morais, 2021).

As digital competencies have shifted the role of the "designer-author" to a "digital black-box [software] operator" (Maedche et al., 2019; Menges & Ahlquist, 2011), a paradigm shift long identified by John Maeda (2019; Ghoshal, B., & Erondu, J., 2017), life-long learning and professional skills update becomes a challenge for designers and students alike. They must master two out of the three current forms or design competencies: (a) Classical Design (or

project-based design, such as product, or graphic); (b) Systems Design (or Design Thinking); (c) Computational Design (or Digital Design).

The first two are well established today and recognized as autonomous fields of study and practice. The third and most recent one –Computational Design– has emerged in the last decades within a border and more complex ecosystem of Design thinking and doing, supported by digital computational tools and processes (figure 1). As such, it is usually identified as computational or digital design. It builds upon the first two types of design – classical and systems– and, as a result, it requires the development of a unique skill set.
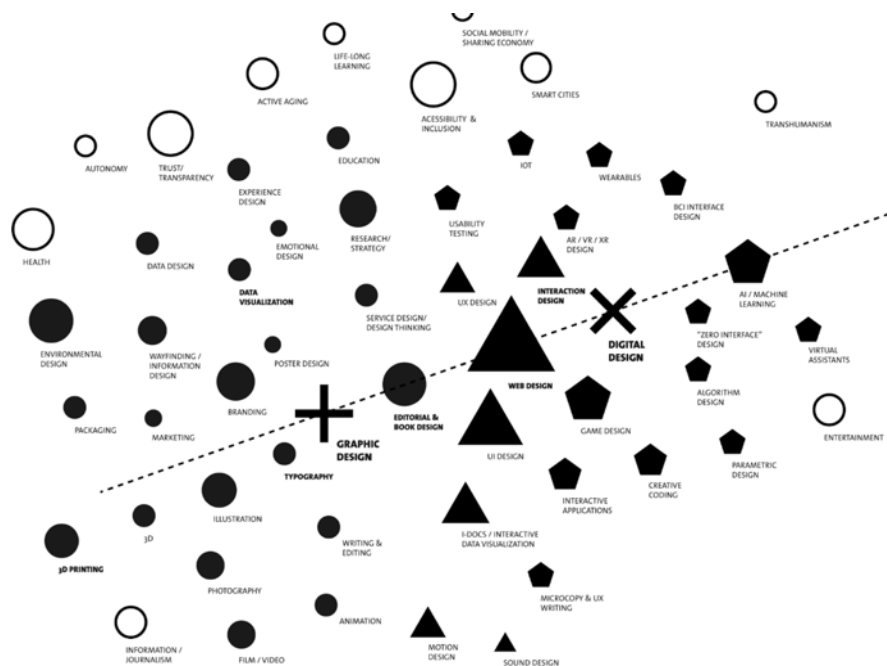
Figure 1: Diagram of the areas of Graphic and Digital [Computational] Design.
Source: Amado, Oliveira & Morais, 2021.

In Portugal, we still lack this specialization or update within Computation or Digital Design. Bachelors are mainly geared towards classical design. And Computational Design is still seen as a specific course(s), or group of skills to be acquired in the "Classical Design" context of academic programs.

According to Marco Neves (2022), currently, Portugal's Design Higher education system consists of 160 Programs at 55 Higher Education Institutions. We can further break down these numbers in:
- 55 3 to 4-year bachelor's degree programs, in a narrow scope of professional areas, and a broad scope of competencies, still very attached to the classical "artifact" project-based design;
- 70 2-year graduate master's programs, in a broad range of professional areas, mainly geared toward the specialization of the original fields of study and further consolidation of bases;
- 11 3-year post-graduate Ph.D. programs. Despite the opportunity for Ph.D. candidates to further specialize, current programs are supported by very broad and open-ended research units scattered throughout the national territory. The volume of post-graduate Design candidates is still very low, which generates a political and logistic conflict in opening narrow and specifically geared or niche Ph.D. programs that tailor to highly

specialized fields. Nevertheless, due to the increasing demand in Computational Design –and the increasing offer in other areas such as Sciences and Technologies of Communication– this is an underexplored field of opportunity.

And yet, as Neves mentions, Design Education is mainly geared toward an artifact creation base, instead of being aimed at problem-solving or experience-based education – these are the upcoming societal challenges. Systems and experiences. Not "things" (Neves, 2022).

This may be because computing, despite being seen as a tool that can aid creativity, is not usually seen as a creative or artistic discipline (McCormack & d'Inverno, 2012). In line with a hostile tradition towards emerging digital media or technologies, we see that if Computational Design and Thinking literacies are seen as different or competing ways to perform traditional processes, it is unlikely that university curricula will absorb computing subjects from a lifelong learning perspective, independent of the mere training in current commercial tools (Morais, 2021). Students and professionals need to be prepared for a constantly changing economic social and technological landscape, as they are constantly shaped by computing. As such, they need to learn to think algorithmically and computationally, to solve problems with varying levels of abstraction (Jacob & Warschauer, 2018). These computational thinking skills will not only allow them to adapt to these new and more complex systems and problems and will also leverage their previous classic design skills. Furthermore, it will facilitate additional literacy development. As Jacob & Warschauer mention, Computational [Design] Thinking is in itself a new form of literacy. A new and specific one that integrates traditional literacy, computational, and new media literacies. But, due to the social, interactive, and ubiquitous nature of computing, it also requires "[s]pecific social, cognitive, and material features"(Jacob & Warschauer, 2018).

There is still some resistance to developing a heutagogical approach in implementing a STEAM teaching-learning model oriented to the production of artifacts within Graphic and Computational Design, promoting a mismatch between training and professional needs in the short and medium term. As such, this paper argues that developing and promoting the use of experience-based projects such as the development and operation of computational-designed traditional presses in education promote systematic design and holistic experiences. More than oriented to the design and development of "things", these projects promote the experience in itself. Experiences that, when applied to specific social challenges such as cultural heritage preservation, or local human value promotion, enhance and promote the classical design skill set and prepare students and professionals for current societal challenges.

To present the argument for the promotion of hybrid computational and traditional design experiences in the classroom, this paper is structured in two sections. First, a review of the state-of-the-art initiatives ranging from traditional and provisional [digital fabricated] presses and workshops. These provide the current landscape in institutionalized and informal teaching of the traditional and the new design literacies while fostering the cultural and technological heritage promotion while using letterpress as a process and technology related to graphic and editorial design to develop these skills and competencies. Second, we present the process and results of designing, developing, and using our custom provisional press. Grounded on previous experiences and the state-of-the-art review, we designed and developed a provisional flatbed "Vandercook-style" self-inking cylinder press. The process of designing and building it in a DIY academic environment leveraged the classical design skill set of the students and teachers involved, as well as –in the last case we are reporting–

the promotion and development of algorithmic and computational design skills within the graphic and editorial design.

State-of-the-art review of current traditional and Post-Digital Letterpress Printing initiatives within Art & Design

Letterpress can be defined by the use of movable characters, to set compositions and print them with presses on assorted media such as posters or books (Amado, Silva & Quelhas, 2021). It has slowly been fading in the last 40 years, as the active population of traditional letterpress composers and printers decreases (a general international trend), and with scarcer materials to print with. However, this interest is resurgent – an analog design and production process revival.

As a technological process and craft-based activity, letterpress printing is an empowering and pedagogical process with multiple benefits not only for Art & Design education but also for authors and the general community. Today, it encompasses much more: as a process, it is useful to understand and expand the notion of physical and digital compositions as modular systems of rules. No longer a revolutionary phenomenon, Digital technology is a normal part of everyday life, where transitions from digital to analog are common in both directions, giving rise to new hybrid and valuable artifacts and processes (Ludovico, 2012). Currently, the development and use of traditional composition and printing techniques along with digital composition and fabrication of printing materials and presses are commonly called Post-Digital Letterpress Printing. As a post-digital design activity, it hybridizes analog and digital processes without a hierarchy bias. Explores the physical nature of its processes and materials with the digital and algorithmic nature of the digital realm. Contemporary designers and printers sample, remix, and mash-up these analog and digital techniques in innovative processes and creative experimental results. These are usually documented and shared online with the different communities of practice and with the broader audiences, promoting the practice and harnessing the collective wisdom of the audience.

Hence, today, "Letterpress", in its post-digital "incarnation" can be understood (1) as technology for cultural expression; (2) for use in educational contexts; (3) for the exploration of practices in a broad social international spectrum (e.g., printers, makers, designers, and educators, students, hobbyists, amateurs, professionals, old and new). Firstly, Letterpress, as a technology for cultural expression, is a rich field for social and historical research since it produces cultural artifacts that record social values, prejudices, forms of expression, and aesthetics, encapsulated over time. Secondly, as a technology that has been used in educational contexts over time, it is important to analyze and reflect on the different pedagogical approaches and benefits in the education of designers and artists. Thirdly, contemporary letterpress practices are explored by printers, makers, designers, and educators in their ongoing work, or pedagogical practices, contributing not only to the revival of Letterpress –maintaining its legacy– but most importantly sustaining its evolution.

Contemporary research & development initiatives

In recent years there have been a growing number of international initiatives that aim to discuss, present and further develop the education, practice, and research on letterpress printing in art and design education and practice.

Letterpress Workers International Summit

The "Letterpress Workers International Summit" (LPW)[1] was established in 2012 by Officina Tipografica Novepunti. It is a short-term collaborative artist residency where letterpress workers from Europe and the Americas work together to share knowledge, cultural approaches, and ways of thinking (not only about letterpress). Letterpress workers are Printers, typographers, graphic designers, calligraphers, stone carvers, educators in these areas, and artists of all kinds that share a love of letters, type, ink, and experimentation. In its ranks, the "workers" consist primarily of well-established printers, but with the participation of amateurs alike, from a wide range of international locations.

Letterpress Printing: Past, Present, Future

The University of Leeds organized and hosted the "Letterpress Printing: Past, Present, Future"[2], in 2018, "an AHRC-funded Research Network [event] that explores the survival of historical printing equipment and how it is used today" By hosting a conference aiming at the presentation of educational and artistic practices throughout the world, it brought together scholars, museum professionals, printers, scholars and other interested people to explore the legacy of historical presses and type.

TIPO: A Letterpress Printers Meeting

TIPO[3] brought together for the first time in Portugal practitioners and people interested in traditional typography to promote the diversity of approaches that it is currently subjected to.

Organized by the CADA, it took place in 2019 in the Azores and counted on the participation of practitioners, educators, and former national printing office managers from different nationalities. Despite its traditional approach, it encouraged the participation of all kinds of printers, designers, and artists with traditional or artistic approaches, showcasing their work in an international exhibition and catalog (Garcia & Diogo, 2022).

Post-Digital Letterpress Printing (PDLP)

The Post-Digital Letterpress Printing international conference[4] (PDLP) aimed to present and reflect on the status of letterpress practice and research, in Portugal but especially comparing it to the international revival of the letterpress scene. Hosted in 2020, at the Faculty of Fine Arts of the University of Porto (FBAUP) it was geared toward researchers, educators, and modern graphic and editorial designers, artists, printers, and typesetters. Keynotes counted with the participation of museum curators, professional type designers, educators, and researchers such as Richard Kegler and Amelia Fontanel (US), Catherine Dixon (UK), and Jorge dos Reis (PT). And mainly, several educational workshop experiences were shared – either in formal or informal contexts– from a wide international provenience ranging from the United States to Russia. The result from the presentations was further expanded and

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[1] More information about the Letterpress Workers International Summit (LPW) available online at: https://letterpressworkers.org/
[2] More information about the conference Letterpress Printing: Past, Present, Future available online at: https://letterpress.leeds.ac.uk
[3] More information about TIPO available online at: https://tipoumencontro.pt/
[4] More information about the Post-Digital Letterpress Printing international conference (PDLP) available online at: https://pdlp.fba.up.pt/

published in a final academic textbook (Amado, Silva, & Quelhas, 2021). Several workshops were held with national and international educators and practitioners. And focused on a wide range of materials tools and techniques ranging from Some –such as the VPRP computational design and traditional printing workshop– have been adapted and deployed in similar academic and cultural heritage promotion activities (Amado, Martins, 2021).

LEAD: Letterpress Educators of Art & Design

LEAD is an organization fostering a network of letterpress educators to facilitate sharing of knowledge and expand connections in the community[5]. Put together during 2020, it hopes to provide opportunities to inspire convivial discourse, advance research, and scholarship, and work to substantiate the value of letterpress education as an essential practice in contemporary learning, especially geared toward the educational contexts in higher education its founding members are mainly higher education professors, but also highly experienced and renowned printers – such as Erin Beckloff and David Wolske.

Hands—on Type: Learning from letterpress heritage

Hands-on Type[6] sought to explore and reflect on graphic design production with the use of letterpress today and the promotion of teaching methodologies based on available know-how. Held in 2021 at the ESAD – College of Art and Design, it consisted mainly of a set of practical workshops aiming at the promotion of traditional and experimental approaches to using letterpress printing for international students, hobbyists, and educators. The keynotes and workshop leads were Alan Kitching, Daffi Kuhne, and Rick Griffith, and a set of resulting texts reflecting on the event and these approaches are to be published soon.

Contemporary development of tools and processes

Current explorations of letterpress and other analog printing techniques within a post-digital or hybrid design process are far-reaching and encompass several realities. Usually within educational contexts – for example, the previously mentioned workshops at the ESAD, or pedagogical initiatives within formal academic contexts such as the ones held in Lusófona (Carvalho, 2021) –, or promoted by non-profit organizations or associations — like Oficina do Cego (Amado, Quelhas, & Silva, 2019).

There are, nonetheless, other initiatives that seek to provide a way for individuals and institutions that do not have the financial or environmental means to accommodate this kind of investment in printing equipment. These initiatives focus on the digital fabrication of manual proof presses that can be assembled using currently available fabrication tools such as 3D printers, or laser cutters. This section focuses on identifying and analyzing some of these projects or initiatives and their creations: the provisional proof presses.

Open Press

The Open Press[7] is a 3D-printed printing press. Designed to make printmaking accessible. Created in 2018 by Martin Schneider and Dominik Schmitz, two designers from Cologne, Germany. It is very small, can be 3D printed, and is affordable. The print plans can be

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[5] More information about LEAD available online at: https://letterpresseducators.com
[6] More information about Hands-on Type available online at: https://handsontype.esadidea.pt/
[7] More information about the Open Press available online at: https://openpressproject.com

downloaded for free, or the printer can be bought ready to use for whatever the buyer wants to give. Open Press' biggest inspirations for XT Press are the idea of autonomously producing a printer at an affordable value, and that through the free download of 3D printing plans can be assembled anywhere in the world and by anyone, but mainly among the student community.

Provisional Press

The Provisional Press[8] is a letterpress printer sold in kit form or already assembled, it was created by Steve Garst and his wife Liz in 2020. The print kits are manufactured in America by a small team. During the pandemic, the original Provisional Press was redesigned – in conjunction with Scott Moore of Moore Wood Type – so that it could be marketed in kits to meet the needs of universities and their students forced to deal with the social lockdown. The kit is centered on the creation of an affordable printing press, made with high-quality parts that will last for thousands of prints if used correctly.

Provisional Press is perhaps the biggest reference for the XT-Press due to its design and because it consists of parts that can then be assembled. The biggest difference is that to build the XT-Press, users still must manufacture the parts based on instructions they can download online.

People Powered Press

Built in 2019 by JKN OilTools in Batley, the People Powered Press[9] is the largest [metal] letterpress printer of its kind in the world. Designed by design studio Split, the People Powered Press was made last year as part of their project and book These Northern Types. It is used by various groups of people, through writing and printing workshops, to make large format prints – to amplify the voices and words of local community groups – which are then displayed locally in both indoor and outdoor spaces.

Like People Powered Press, XT-Press aims to create dynamic engagements with the local community, enabling local people to create, print, and disseminate their messages.

F-Press

In 2019 Tom Boulton in Sussex created the Franken-Press (predecessor to the F-Press)[10] named so because it was made from bits of scrap metal. In 2020 Covid 19 came along and with it the impossibility of running face-to-face workshops. For this reason and personal issues, the motivation arose to create a new version of the Franken-Press that people could use at home.

The XT-Press, just like the F-Press, is a desktop printer accessible to everyone. The main difference is that the XT-Press plans, as with the original Provisional Press, are open and available for free online.

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[8] More information about the Provisional Press available online at: https://www.provisionalpress.com
[9] More information about the People Powered Press available online at: https://www.split.co.uk/work/the-people-powered-press/
[10] More information about the F-Press available online at: http://typetom.com/f-press/

TIMOS

TIMOS[11] is a project developed by the Portuguese master's student Angelo Gonçalves in the context of the Master in Design at the School of Media Arts and Design of the Polytechnic Institute of Porto, under the supervision of Prof. Dr. Vítor Quelhas. Design education and research initiative consisting of a modular set of digitally fabricated letterpress sorts, a modified provisional press, and a stencil ruler that were designed and developed to be used together within formal or informal educational or recreational contexts. Tried and tested, the various iterations of these tools and processes aim at using [post-digital] letterpress printing process to contribute to new literacies by promoting the cultural and artistic heritage, practitioners help and nurture each other, supported by digital platforms.

With Timos, XT-Press shares the fact that it is inspired by the provisional press and promotes media literacy on a hybrid basis, i.e. based on the cultural heritage of printing techniques and the digital medium as a platform for the creation and dissemination of knowledge.

Developing and assessing the XT-Press

Previous educational workshop experiences such as the VPRP Workshop (Amado & Silva, 2021), informed us that being able to iterate back and forth between design, fabrication, and composition with our own (custom) tools and processes provides better and more comprehensive graphic design skills, as well as a more comprehensive media literacy. Also, having full control and intervention in all stages of the design and production, and distribution process greatly enhanced the participant's perception of the graphic and editorial design process in a holistic way (figure 2).

Figure 2: Different views from the sequential stages from procedural digital programming to modular letterpress printing.

Due to the lack of materials and bureaucratic constraints of our institutions, and to research for a better and more responsive process to deploy the use of a similar initiative in the current [Portuguese] higher educational formal contexts, we've decided to build our press and

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[11] More information about TIMOS available online at: https://recipp.ipp.pt/handle/10400.22/18247

modular printing sorts (Amado, Ferreira, & Woloszyn, 2022). Currently, denominated the XT-Press, it's being developed within the Experimental Type and Image Media Research Project (XTIM) in the i2ADS research unit.[12]

Harnessing some main findings from the state-of-the-art previously described, this research project aims to conceptualize, design, develop [iteratively] and test a custom "Vandercook-style" (self-inking) flat-bed cylinder provisional proof press in the context of editorial or graphic design. Meaning that the equipment has to fulfill the graphic and editorial design target audiences' needs and expectations. But mainly, within this process, it was expected for the participants to learn and acquire new skills such as 3D Modeling, classical fabrication, and understanding of traditional printing processes — and although predictable but unexpected, one of them was motivated to self-learn creative coding to produce her custom printing modules.

It should feature a self-inking "Vandercook-style" mechanism to improve ink distribution speed and allow it to be easy and simple enough to be used during time-limited classes. Also, it should be large enough to be able to print small impositions within an editorial design context. Which meant developing a printer with a minimum of an A3 printing bed area. This means it can use the maximum area of a digital laser print. And also, to be able to impose a small "work-and-tumble" imposition, allowing to bind small A5 edition booklets. As such, it will allow using it to develop and promote full classical editorial design skills with graphic design students and thus focusing on the speed of reproduction of multiples.

To be able to transfer this knowledge and for it to be used in other institutions or by individuals, it should be built with low-cost and "over-the-counter" available materials. Mainly sourced in local material and hardware stores. And requires simple tools to build such as a Power drill and a set of drill bits to punch holes, glue or bolts to hold the wood together (and Phillips screwdriver), and a wood and metal hacksaw.

Its design implied the research ad adaptation of the Vandercook printing head design, by adapting its principles and features and mashing them up with the provisional press simplicity (figure 3)

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[12] More information about the XTIM artistic research project available online at:
https://i2ads.up.pt/projetos/xtim/
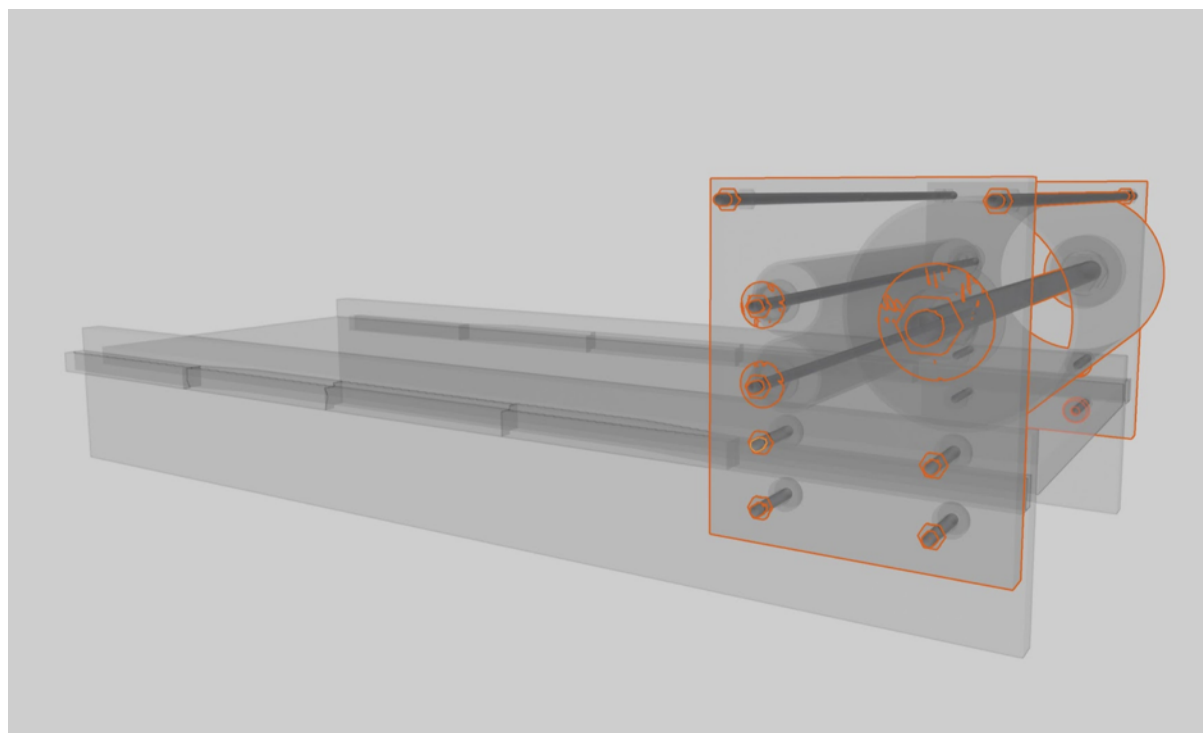
Figure 3: Printing head and proof press bed and railing system design adaptation from existing Provisional Presses.

The PVC-based cylinder design was maintained from the Provisional Press, despite the design being simplified and position guaranteed by nuts, and the cylinder diameter increased to be able to print the large A3 impositions. The squaring of the islets of the print head was simplified by the use of simple threaded rods similar to the F-Press.

An original system of side-sliding rails was designed by Pedro Amado – one of the authors and participants of this research – to easily set the trip and inking and print position of the rollers (figure 4). And a cylinder and simplified self-inking mechanism. Using two equal-diameter PVC-rollers, a design adapted from the original Vandercook. We later concluded that it's better to use different size diameters in the rollers to improve ink distribution and to coat the bottom roller in a 0.7 mm PVC surface to improve its contact with the form.
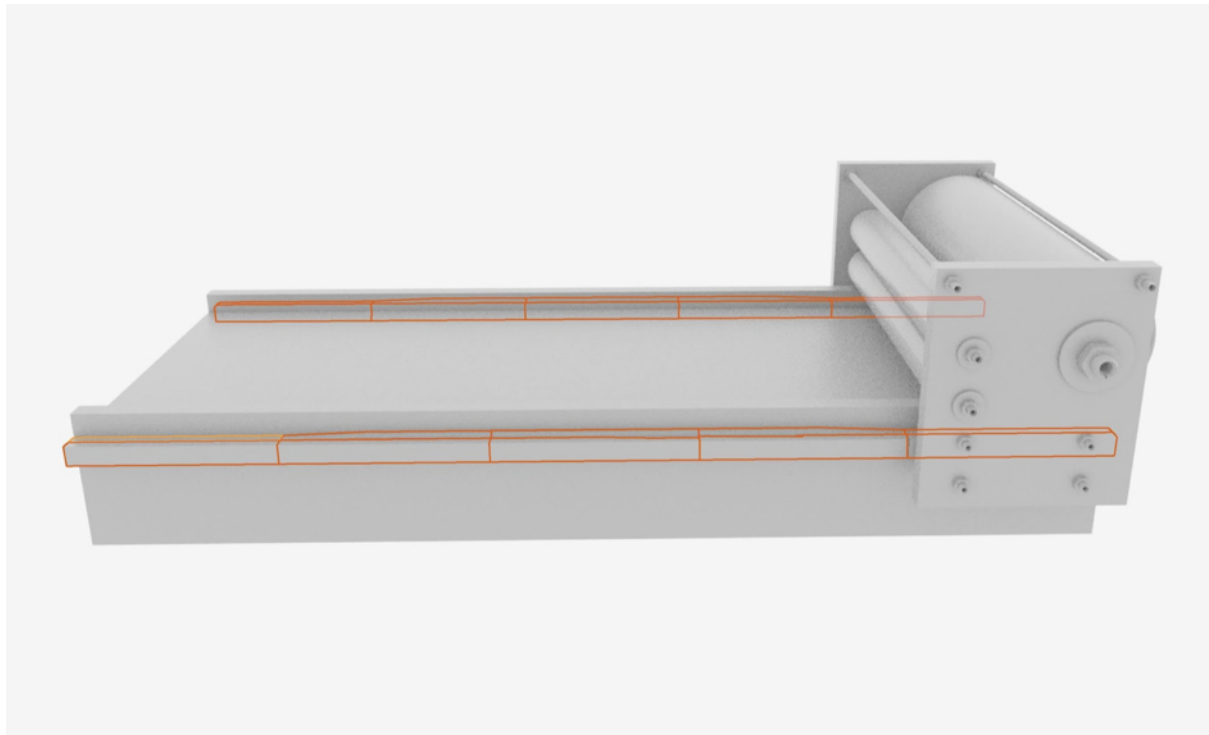
Figure 4: The adaptation of the Vandercook self-inking design into an original side-sliding custom rail system.

Building the press took the team to the school workshops, interacting and learning with professors, technicians, and by themselves. Encouraged digital 3D modeling, manual drawing, working, and assembling in a trial-by-error method (figures 5 & 6).

Figure 5: MDF boards and steel rods were cut by hand and holes were drilled with machines or by hand.

Figure 6: Figuring out the little tweaks need to operate the printer more efficiently.

We discovered the need to 3-D print alternative and additional bolts and washers to get the print head islets clearance to the railing system. And the height was fine-tuned – as with traditional printers trucks and beds – with paper tape. For the second print run, we used an original type – wood letterpress characters – and an image – a laser-printed black and white edited digital photograph from one of the participants – in a frisket-masked imposition (figures 7 and 8).

Figure 7: Planning and designing the type and image composition by hand.

Figure 8: A sample of the resulting experimental type and image composition.

Operating the XT-Press took its toll on the MDF rail system. The wear and tear of using to produce around 50 copies and the lack of continuity in the inking system have been revealed to be problematic but were simply addressed by using paper masking tape to protect or to increase the height of the rollers or friction. An additional issue was found as we needed to fix the axes' rims and spoke system as they move with the rotation for prolonged print runs — thus revealing the need to add simple PVC tube sections as long spacers to keep the spoked rims in place (as implemented by Steve Garst in the Provisional Press). Also, a tricky human use[r] operating issue was found, as the size of the press is too unwieldy for a single-person operation — as one has to stretch his or her body over the press to operate the full A3 bed size. Thus, a smaller size should be considered for individual use, especially within the class context of use. Most of these are still being addressed, but the technological and aesthetic results were very satisfactory, considering the result from a low-cost provisional press.

Conclusion

Post-Digital Letterpress and Design can be seen as the use of traditional typographic and classic design know-how, equipment, and printing technologies combined with, or converging in contemporary digital design, computation, and fabrication processes. Crossing the natural physical and digital realms, between the atoms and bits that naturally extend the design practices into new hybrid fields of research and development of not only artifacts but especially of new hybrid experiences. These have been "so conceptually integrated with the aesthetics of letterpress — as it has become embodied in digital platforms" (Drucker, 2021)

Post-Digital Letterpress and Design can be seen as a mash-up of processes and technologies, making use of classical as well as digital design and fabrication. These transform the analog to digital barrier into a continuum space of free exploration giving rise to new hybrid experiences to be shared. Merging the classical and computational processes are seen throughout this article as a means to an end, and not an end by themselves. Using these processes and approaches in the formal or informal learning context promotes a more inclusive and nurturing path and the acquisition of a comprehensive set of Classical and Computational Design literacies in a holistic way.

As we discovered by witnessing the research and development path of one of the master students participating in this research project team, she voluntarily and independently discovered a process to develop custom-made computation design patterns to be digitally fabricated and printed by different designers in an editorial design context. This highlights the importance of understanding the relationship between analog and digital systems in an integrated and interconnected way, not just as parts that are added together in isolation, but rather that interact and combine with each other. Adding this final "anecdotal" evidence to the already accumulating experience of that team and the state-of-the-art survey analysis, we can safely assume that using a post-digital approach to pursue a cultural or user-centered objective such as the one we have shown, encourages and nurtures the acquisition and development of important Classical and Computational Design literacies socially and holistically. And, as Dafi Kühne also promotes in his courses and workshops, this approach is singular and new, by considering it as "Analog & Digital" working together instead of using "Analog or digital" approaches to complement each other.

There are several steps still to do. We still need to iterate and tune the design and build of the proof press, especially the faulty inking system – as the print cylinder has proved to be more than efficient –, as well as the robustness of the mechanics — especially the railing system. The full specification and build plan will soon be made available (Amado, Ferreira, & Woloszyn, 2022) and we expect to continue to experiment with the XT-Press, widening the sample of practitioners and hopefully engage with active participants of more than or network of design students and move it from an informal to a formal classroom context of use.

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Contact email: Pamado@Fba.Up.Pt
　　　　　　　　Cfonseca@Fba.Up.Pt
　　　　　　　　Maira.Projetar@Gmail.Com

Study Abroad Programs as Means to Connect Culture, Art, and Design

Hans-Peter (Hepi) Wachter, University of North Texas, United States

Abstract

This Presentation examines a study abroad program as a means to promote the intersection of culture, art, and design and to help students across art and design majors to connect the dots between the three concepts. The study abroad program offers students to visit two cities in Germany in a faculty lead program, giving them a cultural and historical overview of relevant sites, artifacts, and design examples, bringing to light the relationships between a shared visual world constructed by visual artists and designers, and the impact to the culture of a society. A study abroad program can be larger than consideration of visiting works of art or design as discrete objects and can seek to examine the networks of culture in which these artifacts and objects play a role. While traveling, the student has been engaged in analyzing social histories and resulting cultural influences significant to cultural monuments and artifacts. Furthermore, oral histories on site, and narratives from natives, offer an interpretation of the *Zeitgeist* and the interconnection to the art and environmental design.

Keywords: Study Abroad, Design Education, Culture and Design, Study Abroad Programs as Means to Connect Culture, Art, and Design

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Introduction

What is study abroad?

Study abroad programs are offered through colleges and   are programs anywhere from a week to a full academic year. Those programs provide an opportunity to study in a foreign country where students either attend lectures, engage in research, or follow a faculty led travel program. The numbers of study abroad programs continue to increase, specifically programs that last eight weeks or less (Donnelly-Smith, 2009.) Sometimes a university has an agreement with another university abroad where students can enroll in a given set of courses, or a student can arrange their own course schedule. Universities have often made arrangements to prearrange housing with the host university. Study abroad programs can be faculty led group trips around a country or continent and may have the purpose to learn a language or to immerse in specific topics related to the participants major. These study abroad experiences are typically structured and formal and students stay with their cohort of peers for the cultural experiences and the programs curriculum. The programs are designed as academic experience, students leave their home country to study another countries culture, monuments, artifacts and the like, and, while the primary intent is for students to learn about them in their original setting, the study abroad experiences have been often referred to as tourist experiences (Litvin,2003.) The faculty led programs offer academic credits toward a student's degree plan and usually organize for students' accommodations and provide travel between locales, entry to museums and venues and many other day-to day costs through a program fee. Universities do often partner with program providers who are familiar with the destination and arrange for the travel itinerary, hotels, transportation and the like. Universities face an increase in diversity of their student body, seeking an international education experience (Oguro, 2017). When students on North American campuses get exposed to the incoming international students and curious about learning more of places where those students come from, they may seek for a study abroad program that has been designed to deepen their intercultural learning and engagement.

Who are the participants?

The program I am introducing here is organized out of the College of Visual Arts and Design at the University of North Texas (UNT), and it provides for students in the Design, Art and Art History disciplines, however all students at UNT from all majors can participate. Figure one indicates that about half of the study abroad programs participants are in a cluster of interior design and studio art majors. About one third of the program participants are students in the fashion design and art history program and approximately one quarter are students from various majors across the UNT campus in Denton Texas (Figure 1.)

The visited sites, monuments, and artifacts and the context they play within German culture are one aspect why students are drawn to participate in this study abroad opportunity. In addition, society aspects of live in Germany seem to be attractive to interior design and studio art students who usually represent the largest group in the program, followed by fashion design and art history majors, and a group of students outside of the College of Visual Art and Design from language programs, forensic science, nursing, anthropology, social sciences, and merchandising.
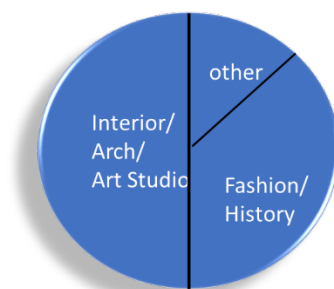
Figure 1 Distribution of study abroad program participant by major

What is the *Program?*

Students get to know each other

Prior to traveling, two to three orientation meetings provide the opportunity for student participants to see each other, get to learn more about the program details, and hear from program alumni about their experience.

The orientation meetings cover required preparations before traveling, offer to find a roommate while traveling, and explain academic requirements, assignments, and expectations. The program cohort typically starts organizing themselves as a group during or right after an orientation meeting using social media apps such as *WhatsApp* or *GroupMe.*

A more in depth "get to know each other" is provided on the day of arrival in Germany. The group of students and the faculty leader meet at an adequate space in the hotel after checking in and are engaged in an exercise called life-mapping.

A life-map (Figure 2) is tracing key episodes, or those of which a student is comfortable sharing with others, from the time one is born to the present day. It represents a visual timeline of key moments. Life mapping is a positive exercise that can help to learn about other people's ideas and things they value in life, the episodes they experienced and activities they have cherished.
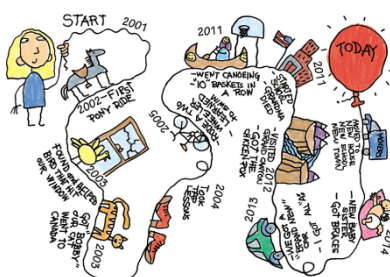
Figure 2 Life map example

Fun Passport

Participating study abroad students receive a *Fun Passport (Figure 3)* when they arrive in Germany. During the trip, the passport will be filled with stickers, associated with travel or sites the program is visiting during the study abroad travel. The stickers are used as an

incentive for students to collect for either engaging in conversations about program sites or for presenting details to the study abroad group about a monument, site, or artifact.

Figure 3 Fun Passport with stickers

New Year's Eve

The participating students are not offered a formal New Year's Eve activity through the study abroad program. It is time they can plan and spend as they wish. The program *Germany, Culture, Art and Design* has offered students to participate in an evening performance that is a one of its kind in Germany and is performed at the Berliner Tempodrom. In the year 2003, the Berliner Tempodrom, by accident, booked the *Deutsches Symphonie Orchester* (The German Symphony Orchestra) and the *Circus Roncalli* during the New Year's Eve. Born out of the necessity to deal with a double booking, the evening combined both performances and turned into a New Year's Eve mega success. Now for two decades, for this one evening, the two meet, perform, and create the magic of beauty, elegance, excitement and enchantment of sound. Most students opt to join the programs faculty leader and spend the beginning of their New Year's Eve celebration in Germany at the Berliner Tempodrome (Figure 4), followed by a group dinner and then joining to watch the fireworks over Berlin. Although a voluntary event, almost all students participate and it brings them together enjoying the arts together, tightening the cohort and their camaraderie.

Figure 4 Berliner Tempodrome New Year's Eve Performance

Promoting and Recruiting

The study abroad program is promoted through the University of North Texas International affairs study abroad office and their website as well as the website of the College of Visual Arts and Design. Students apply through the study abroad portal for a program, and after fulfilling certain criteria, get accepted into a study abroad program.

Recruiting is more complex and requires getting the program information and the dates for info sessions in front of students "just in time." Recruitment activities seem to be more successful if flyer's (Figure 5), posters and class visits to introduce the program are scheduled within two weeks of scheduled info sessions offering students details about the program.

Figure 5 Program recruitment flyer

Study abroad program itinerary

The study abroad program *Germany, Culture, Art and Design* is visiting the cities of Berlin and Munich in Germany. The overall duration of the program is 16 days and has typically been scheduled between December 27 (arrival in Berlin) and January 11 (departure in Munich)

The program connects students to landmarks, museums with relevant artifacts (historical and contemporary) public places, and sites which have socio-historic relevance and is organized in an itinerary (Figure 6) organized by day-to-day activities.

Berlin:
Kaiser Wilhelm Memorial Church
Christmas Market Europaplatz
Charlottenburg Palace
German Parliament, Dome of the Reichstag
Brandenburg Gate
Memorial of the murdered Jews in Europe and Place of Information Exhibit
Eastside Gallerie, Berlin Wall
Urbania Gallery
Berlin Wall Memorial
Pergamon Museum
Hamburger Bahnhof Museum of Contemporary Art
Berlin Cathedral
Bauhaus Archive
Jewish Museum

Munich:
Michaelis Church
Marienplatz
Alter Peter and visit of Church tower
Assam Church
Wittelsbacher Residenz (Kings City Palace) and Treasury
Theatiner Church
Church of our Lady
Olympic Park and Olympic Tower
BMW museum
BMW design center (Welt)
Castle Neuschwanstein
Bavarian countryside Mittenwald
Nymphenburg Palace and Marstall
Lehnbach Haus, Joseph Beuys, The Blue Rider group
Information Center of the National Socialist
Pinakothek

Figure 6 day-by-day itinerary

Academic outcome expectations

The study abroad program has a series of writing and presentation assignments. Students in the course are expected to engage in a critical discourse developing an understanding of diversity, intercultural competence, and a sense of global citizenship. Through traveling in Germany, students can experience an unfamiliar setting that promotes the above-mentioned outcome goals.

Students start with a pre-departure essay in which they critically review their biases and their perception of the country, region, and cities the group will visit, including the known monuments, sites and artifacts of the particular area.

They finish with a final report at the end of the program, which includes a narrative comparing their pre-departure expectations with the lived experiences and observations during their travel, evaluating experiences of inclusivity while examining ethnocentrism.

While traveling, students present prepared lectures and engage in discussions with their peers with a particular focus on how a monument, memorial or artifact represents its time in which it was created and the connecting cultural forces.

Conclusion

Program exit interviews and surveys

What are student surveys suggesting?

The findings of the student surveys after they return from the sojourns are derived from them (N=180) Students for example report that their degree of openness to cultural differences changed (82%), students learned adaptive stress management while exposed to new cultural environments during the trip (56%). Although students participated in the same *Germany: Culture Art and Design* short term study abroad program, personality attributes led to differences in the cultural and personal development of the student travelers.

Excepts of the post sojourn survey are below.

> "I was expecting that we would go from site to site and see the standard things every tourist will see. Far from it. The lectures we received, the conversations and discussions we had, connected the dots for me between the meaning of monuments and the Art we experienced in relationship to German Culture."

> "The study abroad really brought together what I had learned in the classroom and had seen in books and on slides during classroom lectures. Of course, you know that building styles and Art and Design of a certain period relate to each other somehow. But this trip opened my mind to a new dimension, and I understood that a social setting and the resulting culture is driving the context of Art and Design."

> "I was delighted to see the monuments, the artifacts, the public places 3-D, in real and how they fit into an environment that creates a place. I know most of them from courses and textbooks, but understanding through the discussions we had and the stories our professor shared, how they related and developed out of a society, expressing their culture, was a treat I would never had in a classroom setting."

Over the span of 10 trips with 180 participants:

100% Expressed overall satisfaction of the program.
 95% Reported that the content of the program was relevant to their overall college
     experience and learning.
 90% Stated the cost of the program was affordable and represented a value.

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The Role of Design in Health Observational Studies

Daniela F. Marques, Polytechnic of Leiria, Portugal
Constança Netto-Rocha, Polytechnic of Leiria, Portugal

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Official Conference Proceedings

Abstract
The specialization in "Design for Health and Well-being" has recently emerged in Portugal. This branch aims to bridge different fields, Design, Health, and Well-being. At the moment, we are working to identify what our role as designers is in the area, namely in a Cohort Study in Leiria, with 10 years duration. The present project arose from the cohort study's necessity to better reach the population. The study's objective is to monitor the population's health literacy level, through an inquiry-driven by a group of targeted selected interviewers. In this project, designers focused on User-Centered Design and Participatory Design supported by Service Design methodologies, through "Interviews", "Personas" and "Workshops" with "Service Blueprint", to grasp cohort studies' common concerns and the best way to tackle them. Understanding this new design approach was challenging. As part of a multidisciplinary team, we found that designers need to be involved in the project from the beginning and that design methodologies assist the organization of observational studies. Resulting, in this particular case, in the development of a set of communication guidelines for the study. In the future, our aim is to validate the role of a Designer specialized in Health and Well-being in this type of study, and further justify their attendance in the early stages of any project, since design methodologies can be applied to aid in multiple fields.

Keywords: Design for Health and Well-Being, Observational Studies, Cohort Study, Service Design, User-Centered Design, Participatory Design

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Introduction

Recently, a new design practice has been emerging in Portugal. It is called "Design for Health and Well-being" and until now, only two Portuguese institutions guarantee designers this specialization, one being a master's degree and the other a post-graduate degree. This type of design aims to bridge the fields of "Health and Well-being" and "Design".

The World Health Organization (WHO) designates "Health and Well-being" as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" (World Health Organization, n.d.). The knowledge of this definition aids in the description of what Design for Health and Well-being can be, but it's also essential to understand what design is, and what can be done by applying it. According to Aakhus (2007) "design is an activity of transforming something given into something preferred through intervention and invention". Therefore, a designer with this specialization can be described as someone that can use design methodologies, creative practices, and implementation of knowledge in order to aid organizations, institutions, companies, or services to improve health and well-being, change lifestyle behaviours or allow a better experience of a determined audience.

Throughout this paper, we will explain the role a designer for health and wellbeing can have in health observational studies, focusing on the work of two designers that were integrated into a multidisciplinary team of a health observational study.

Background

Observational studies belong to a category of analytic study designs, where the researcher monitors the connection between an exposure and an outcome, not intervening with actions (i.e. in experimental studies the researcher introduces a treatment to a specific group in order to understand its effects) (Song & Chung, 2010). This category of analytic studies can be divided into different types of studies: case-control studies, cross-sectional studies, and cohort studies (Song & Chung, 2010). In this specific case, the observational study is a prospective cohort study - a study that will monitor a group of people, from the present until the future, with some follow-ups to identify a specific outcome (Hulley et al., 2007).

The conception of this study began with public health doctors, from ACES Pinhal Litoral, noticing that the emergency systems of the county were overloaded because of system misuse. This brought up the question: "Do people go to the hospital emergency section with everyday issues because they don't understand their needs?". Adding to this, there was also a suspicion that the number of comorbidities and metabolic illnesses was a bit higher in the county of Leiria than in the surrounding areas (ACES Pinhal Litoral, 2019). These questions, made the City Hall of Leiria introduce the notion that the health and health literacy of the county of Leiria should be monitored to understand people's decisions (Câmara Municipal de Leiria et al., 2021), leading to the cohort study LISA - Longitudinal Study of Health Literacy in the County of Leiria.

As the name says, LISA is a cohort study that aims to understand the cause of these issues, by monitoring the health literacy levels of the adult population of Leiria's county. Adding to this, it also proposes to compare them with the lifestyle habits, drinking and smoking behaviours, predisposition to metabolic diseases, and mental health conditions of the same target population. Such monitoring is done via a questionnaire, delivered by previously

selected interviewers, who will randomly knock on the door of the population living in the county of Leiria.

Organizing the Lisa Cohort Study is a group of institutions formed by two research centres of Polytechnic of Leiria (ciTechCare - Center for Innovative Care and Health Technology,   and LIDA - Research Laboratory in Design and Arts), ACES Pinhal litoral (the headquarters of healthcare facilities in the region), the City Hall of Leiria, and the Leiria Hospital Centre. This cooperation is reflected in a multidisciplinary team, composed of Researchers, Designers, Public Health Doctors, City Hall Representatives, Nurses, etc., that intend to keep the study running for ten years, doing a follow-up every two years.

Designers' Role in LISA

The journey to find the designers' role in this study began in meetings held with the stakeholder team, during these meetings some preconceptions held by the stakeholders on what a designer could do were brought to light, but by explaining what we as designers for health and well-being can do, and how our proposed design process could help expedite the study's development, those preconceptions were cleared, opening the road for the definition of our role in the study.

The purpose of being in the LISA cohort study's team ultimately is the definition of the communication model and the identification of adequate and suitable interviewers to carry out the study's ambitions. Our role is also to use design methodologies, (which will be further explained in the next section) to aid the structuration of the LISA Cohort Study, and improve the communication between the stakeholders.

Design Process

The communication strategy of LISA was divided into two topics, what information is displayed and how it's presented. What information is displayed has to do with the study's branding, its objectives and structure, this is because if the study has a recognizable brand before it launches the population will be more receptive to it. How information is presented relates to the places where it's available, as in the website, the printable (i.e. flyers and posters) and other digital supports (i.e. social media), the expected outcome of this process is the increased trust of the population.

To aid in the development of this study the design team made use of Service Design, User-Centered Design and Participatory Design. These design approaches have the ability to create a connection to the user and their needs (Stickdorn et al., 2018). The methods and methodologies used in the design process belong to either one or both of the chosen design approaches.

Interviews were the chosen method to kickstart this design process. This method allows the interviewees to feel comfortable while talking about their experiences and needs (Martin & Hanington, 2012; Seidman, 2006). There were two goals in using this methodology, to understand what has been done in other cohort studies in Portugal, by interviewing experts, and to understand the expectations and preconceptions the population of Leiria's county might have had concerning the LISA study. For this, two sets of interviews were planned, the first with cohort experts and the second with a sample of the target population, the elements of this sample were chosen by their ability to represent different socio-economic

backgrounds. By the end of these interviews, we were able to compile a list of identified challenges.

Expert	Affiliation
Sara Dias	School of Health Sciences, Polytechnic of Leiria, Leiria, Portugal Center for Innovative Care and Health Technology (ciTechCare), Polytechnic of Leiria, Leiria, Portugal
Carla Lopes	Epidemiology Research Unit (EPIUnit), Medical School of University of Porto
Helena Canhão	EpiDoC Unit, CEDOC - Center for Chronic Disease Studies NOVA Medical School / Faculty of Medical Sciences CHRC Comprehensive Health Research Center
Ana Rodrigues	EpiDoC Unit, CEDOC - Center for Chronic Disease Studies NOVA Medical School / Faculty of Medical Sciences CHRC Comprehensive Health Research Center

Table 1. List of Interviewed Experts and their affiliations

Gender	Age (years)	Geographic Placement	Education Level
Female	24	City	Masters Degree
Female	62	Village	6th Grade
Female	43	Outskirts	12th Grade
Female	55	City	12th Grade
Female	78	Village	4th Grade
Male	24	Outskirts	TESP (professional higher technical courses)
Male	22	Village	Bachelor's Degree
Male	41	City	PhD

Table 2. List of the sample of the population interviewed.

Following the interviews, the personas (Miaskiewicz & Kozar, 2011) were developed. This method was chosen because of the need to create profile models that could be used when hiring the LISA's study interviewers. By using the information gathered in the interviews it was possible to create more accurate profile models for the personas (Ferreira et al., 2015) as well as an outline of the physical appearance the interviewers should have. In total nine personas were developed, accounting for their place in the team structure - supervisor, team coach, or interviewer - and their possible motivations - voluntary, voluntary with something to gain (i.e. a benefit other than monetary gain) or paid worker. These nine personality templates went through a validation process during the Red and Green Feedback workshop.

During this process, the stakeholders took into consideration the responsibilities and demands of each rank and chose the personas that would benefit the study.
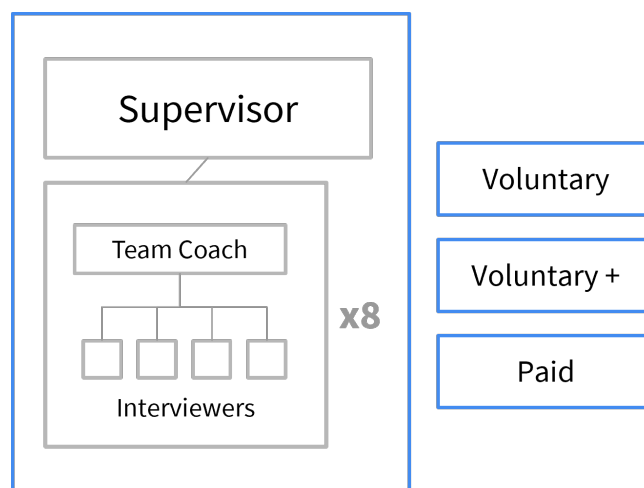
Figure 1: Field team structure and possible persona motivations

The last methods to be used were the Service Blueprint and Red and Green Feedback workshops. Both were held on the same day, in a face-to-face format, in ciTechCare research centre. The participants were chosen from among the stakeholders belonging to the institutions organizing the study - doctors, researchers, and representatives of the municipal council. Belonging to the User-Centered Design and Participatory Design methodology, these workshops will allow a horizontal interaction between participants from diverse fields, with no perception of their hierarchical levels within the institutions (Postma et al., 2012). These approaches will also aid in the making of a strategic plan that will address the need to adapt communication with the LISA population (Kumar, 2013).

The first one to be conducted was the Service Blueprint, where two stakeholders from each institution were present. The objective was to foresee the actions of the population, actions of the interviewers, the interactions between them, and also the actions of the staff and the supports, which usually are invisible to the population (Design Council & Technology Strategy Board: Driving Innovation, 2015). This workshop was divided into two sessions of one hour, and twelve stages that were related to the phase of the study. The First Session had four stages - Interviewer Recruitment, Interviewer Training, Itinerary, Communication of the Study. The Second Session was formed into eight stages, where six belong to the implementation of the questionnaire - First Contact, Study Explanation, Document Delivery and Explanation, Questionnaire, End of the Questionaire, Time for Rescheduling-, and two of the stages were related to the End of the 1st Phase of the study, and the other was what will be needed for the Next Phase of LISA. The participants had in their possession post-its, with each color corresponding to a group: Actions of the Population, Actions of the Interviewers, Touchpoints, Action of the Staff, and Materials. In each stage, the participants were able to discuss and write their ideas for ten minutes, and then the facilitator would ask for the notes, putting them on the board. The process was repeated throughout the rest of the stages until it was possible to visualize the majority of the actions that will possibly occur during the Implementation of the LISA cohort Study. The workshop last step was a moment of discussion between the participants and designers regarding the bigger picture of LISA's Structure.
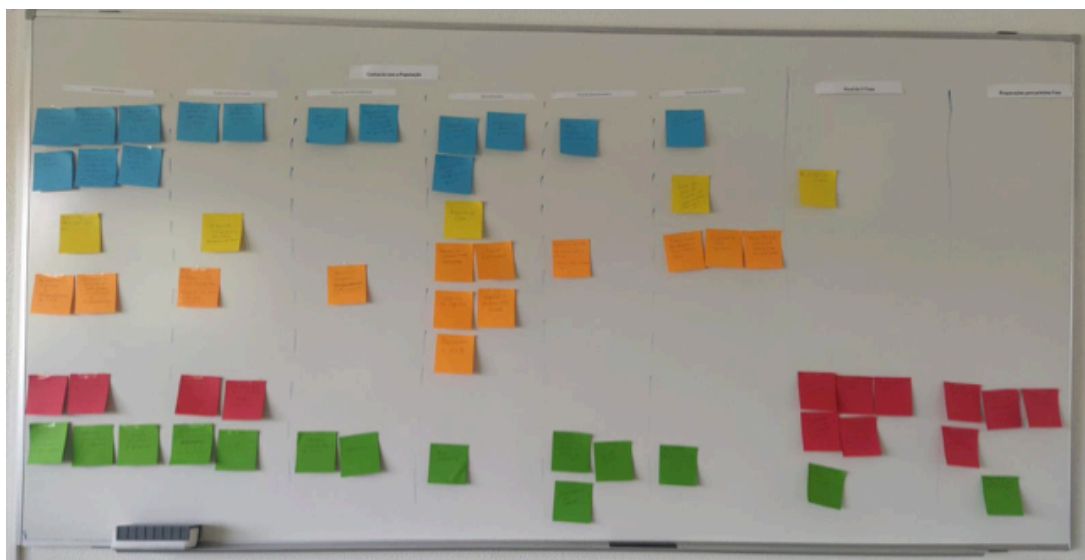
Figure 2: Board of the 2nd Session of the Service Blueprint

Red and Green Feedback is an approach that is connected to the Service Design methodology and allows the interaction between the stakeholders and designers (Stickdorn et al., 2018). The main objective of this method is the validation of the personas, leading to the ideal profile for the interviewers, team coaches, and supervisors. In this workshop, only five of the six previous participants were available.

This workshop had one session with a duration of one hour. There the moderator would present one of the personas and the stakeholders could write on post-its of two colours. The colour red would mean something needed to be improved. The colour green would mean that something was right and that they agreed with it. Participants had five minutes to write their ideas in silence, and then the moderator would collect the post-its and paste them on the board. In the end, there was a moment of discussion where the participants could look at the board and decide if something essential was missing. The feedback collected helped define the characteristics that the study should look for in each of the available field team positions.
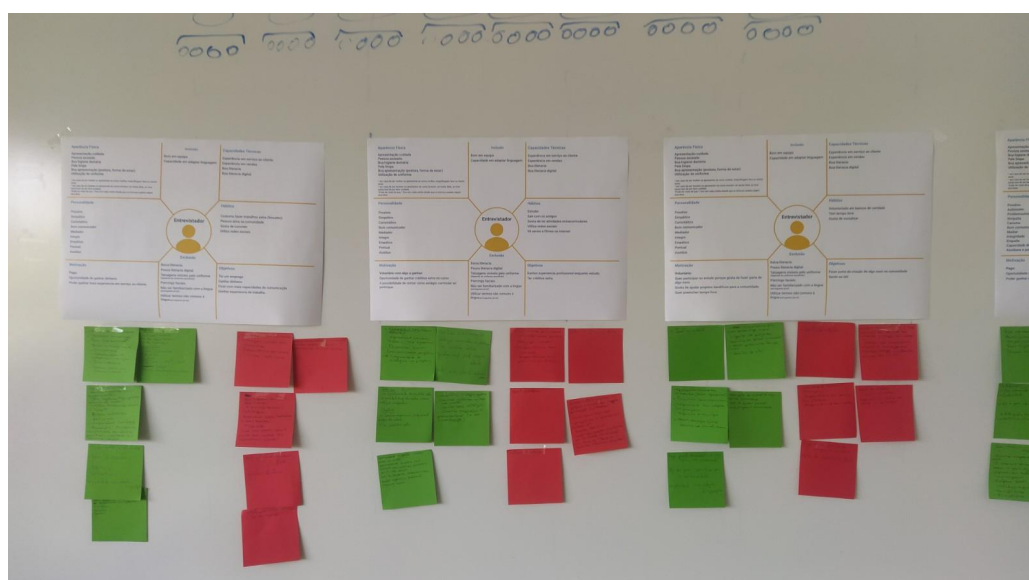
Figure 3: Red and Green Feedback workshop with personas.

Outcomes

Although the design team's work is not yet concluded, by following the charted design process the team was able to obtain some outcomes, they come from the used methodologies and are elements that helped the designers steer the project closer to its objectives.

One of the outcomes of the design process, from the used methodologies, is a list of identified challenges. This list was compiled with the information provided in the interviews with the experts and the population, in it are common cohort issues, as described by the experts, and possible barriers identified by the population. Some of these identified challenges are as follows:

- Getting a sample large and diverse enough to be representative of the whole population is one of the most demanding tasks.
- From one interval of the study to the next, it's common to have a large drop in participants, so it's important to keep both the team and the participants motivated.
- The team members must be capacitated so they can adapt to different kinds of participants and maintain the study's efficiency.
- The communication and advertisement must be adequate to the target population, taking into consideration the possible socio-economic differences, so the message of the study can be properly conveyed.
- The study and its purpose must be attractive to the participants.
- The population may be suspicious of the interviewers at first, good identification is key.
- The duration of the interview shouldn't go past the 30-minute mark, or it may become cumbersome.

By having this list the team was able to focus on adapting pre-existing study assets to better comply with the solutions to the identified challenges and to develop the design process in the way that would most benefit the study.

Another outcome of the employed methodologies is the "Structure of the LISA Cohort Study". This document results from the analysis of the collected feedback in one of the aforementioned workshops, the Service Blueprint. In it, is possible to find all the stakeholders' "assumptions" regarding the scenarios they will encounter during the implementation of the study, from the recruitment of interviewers to the preparation for the next follow-up.

And lastly, the final outcome is the developed personas, validated through a Red and Green Feedback workshop. These personas were developed so that the stakeholders could have a template of the kind of person they should look for when hiring interviewers. The result of their development process was the final four chosen personas, the voluntary with something to gain interviewer, the voluntary team coach, and finally, it was decided that the supervisor should be a voluntary with something to gain connected to one of the involved institutions or a paid worker.

Final Considerations

Regarding the communication process, no conclusions can be drawn as of yet, since the LISA Cohort Study is in its preparatory phase. The outcomes of this process can only be identified

after two follow-up phases of this study. Even though the ideal personas were identified, the team selection process has not yet started. It is also crucial to register that the workshops were implemented only with stakeholders because the study's population will be randomized. Considering this research it is possible to see that the role of a designer for health and wellbeing can be highly flexible, as a designer has various skills and knowledge that can be employed in this type of observational studies. However, it is crucial to show how the designers can in fact impact the preparatory stages of a study, by using their design competences and methodologies. It should also be noted that their function can be influenced by the team in which the designer is included, and the preconceived notions that these people have about the designer's work.

In the future, we intend to have a better understanding of how this type of design can be integrated into any stage of a variety of studies, not only cohort studies or observational studies, validating the specialization in the process.

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Contact email: danielasfmarks@gmail.com
                        constancanettorocha@gmail.com

Effects of Social Media Features on Music Teaching and Learning During the COVID-19 Movement Control Order (MCO)

Jinky Jane C Simeon, University Malaysia Sabah, Malaysia
Resot Iggau, University Malaysia Sabah, Malaysia

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Abstract
The COVID-19 pandemic has caused many education organisations to make full use of various online communication platform technologies to continue teaching. This study aims at gaining a deeper understanding of the usefulness of an e-learning platform for teaching and learning activities. It focuses on the trends of social media usage as well as a student's attitude towards knowledge sharing. A survey research was conducted to examine undergraduate music students on their music instruments learning during the lockdown period. The study's sample consisted of 70 music undergraduates of Universiti Malaysia Sabah (UMS). Data were collected via online questionnaires using Google Forms. The music instruments teaching and learning activities during the lockdown were analysed via statistical analysis. Based on the analysis, the majority of undergraduates gained less knowledge from online learning. Besides, this study found that their experience accompanied them as part of their studies. Network connectivity, especially in the rural areas was a major issue for their online learning. In conclusion, online teaching has both strengths and weaknesses.

Keywords: Online Music Teaching, Musical Instruments, Social Media Usage, E-Learning, Music Instruments Learning

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Introduction

Malaysia announced the first COVID-19 case on 25 January 2020, whereby an infected Chinese national travelled to Malaysia from Singapore (Profdten & Ahmad, 2021). On 15 March 2020, Malaysia reported the highest number of coronavirus cases in Southeast Asia. As a result, on 18 March 2020 Malaysia implemented the movement control order (MCO) or lockdown (Department of Statistic Malaysia, 2020). Moreover, on 4 May 2020 MCO was replaced by the conditional movement control order (CMCO) and thereafter, on 10 June 2020 CMCO was replaced by the recovery movement control order (RMCO). Therefore, the global COVID-19 pandemic has forced closure of the country's economic, education and social systems.

During such situations, social media are important for communicating and sharing information amongst the community. Based on a study by Amir (2020), the use of social media or online platforms remained the norm for Malaysians until the end of MCO. This led to teaching and learning methods shifting towards the online platform (Biwer et al., 2021; Henriksen et al., 2020; Xhelili et al., 2021; Rucsanda et al., 2021). In terms of music education, Groulx and Hernly (2010) stated that online music education is served as an additional teaching tool. It was neither exclusive nor inferior, or superior to traditional coursework. In an online teaching, teachers are encouraged to use and explore the effectiveness of technology resources.

One related issue at the universities was that the music education teachers have no experience in distance teaching. According to the recent research findings, the subject matters that were appropriate to this system would be theoretical and group (music theory, composition, music history, anthropology, teacher's education, aesthetics, semantics, etc.) (MacLeod, 2013; Albert, 2014; Schmidt-Jones, 2017).

Theory based studies are easier to transmit and present in online settings (Biasutti, 2017). It is difficult for practical lessons, such as music performance or instrumental studies. In this context, a teacher cannot correct the student's posture or finger position physically and techniques of playing via online teaching. However, a music teacher can demonstrate sound, rhythm pattern, dynamics, phrasing as well as explain the characteristic of the music (Rucsanda et al., 2021).

Based on these backgrounds, the objectives of this study are: i) to evaluate the level of online learning readiness for music major study courses through the aspects of self-efficacy, subjective norms, experiences, perceived ease of use, perceived usefulness and behavioural intention; ii) to identify the main problems frequently faced by undergraduate music students during the implementation of online learning for major study courses; and iii) to identify the challenges and values faced by undergraduate music students in continuing the use of online learning methods for major study courses in the future.

Methodology

This survey was conducted in five months or one semester from March to July 2021 at the Academy of Arts and Creative Technology (ASTiF), Universiti Malaysia Sabah (UMS) during the MCO. Online survey method was used to obtain the data from respondents using Google Forms. This study used a purposive sampling technique, whereby the selection sampling was due to the existence of certain characteristics (Jacqueline, M. G. et. al, 2006). A

total of 70 undergraduate music students were involved in this study. Furthermore, this study adapted the study by Pangayan (2021), which contained a total of six categories and 29 items. The categories were self-efficacy, subjective norms, experiences, perceived ease of use, perceived usefulness and behavioural intention. This study also used a 5-point Likert scale as the data collection tool.

Several steps had been taken to refine and improve the validity and reliability of the study's instrument. Each item in the questionnaire had undergone a refining process for satisfactory application in the field of music. The researcher conducted a back-to-back translation process from the English language to Malay language and vice versa. This was done to enable each item to be clear-cut. The majority of respondents understood the Malay language, however, there were also foreign students. A pilot study was conducted for the purpose of correcting any weaknesses inherent in the items of this questionnaire. The Cronbach's alpha range values for each category were 0.787 to 0.921. According to Awang (2012) Cronbach's alpha value of >0.7 was sufficient and acceptable. The obtained data were analysed using the Statistical Package for the Social Sciences (SPSS) version 25. The findings were analysed with an illustrative description to observe the frequency, percentage and mean for each part of the instrument to achieve the study's objectives.

Results

A total of 70 undergraduate students from the music programme, ASTiF, UMS were involved in this study, which included 27 students from Year 1, 24 students from Year 2, 15 students from Year 3 and 4 students from Year 4. Table 1 shows the percentage of respondents by year of study. In terms of gender, overall there were 34 males and 36 female students (Table 2).

Table 1. Percentage of respondents by year of study

Year of Study	Frequency	Percentage
Year 1	27	38.6%
Year 2	24	34.3%
Year 3	15	21.4%
Year 4	4	4%

Table 2. Percentage of gender

Gender	Frequency	Percentage
Male	34	48.6%
Female	36	51.4%

Table 3. Percentage of residency area category

Category Area	Frequency	Percentage
Urban Area	22	31.4%
Sub Urban Area	15	21.4%
Rural Area	33	47.1%

All respondents started online learning studies from March to July 2021 during MCO. The respondents also registered for the subject of Major Study I CM10302 for Year 1, Major Study III CM21502 for Year 2, and Major Study V CM32902 for Year 3. These subjects involved musical instrument playing skills offered throughout the study until the end of their

music degree programme. Amongst the musical instruments learned by the students were Classical Vocal, Classical Piano, Jazz Piano, Drum, Electric Guitar, Classical Guitar, Electric Bass, Violin, Viola, Cello, Clarinet, Flute, Alto Saxophone, Tenor Saxophone, Trombone and Trumpet. Each student was taught online individually by a lecturer or tutor for one hour weekly within 14 weeks. Furthermore, the respondents' demographic data on residency area category was also explained in this study. A total of 31% of the respondents live in urban areas, 15% live in sub-urban areas and 33% live in rural areas (Table 3).

Self-Efficacy

This category was to evaluate the student's online learning readiness in major study through the aspect of self-efficacy. The overall mean and standard deviation (SD) were used to explain and answer the research questions. The percentage of responses to each item by the respondents was also explained (Table 4).

Table 4. Percentage, mean and standard deviations for self-efficacy category

Items	Strongly Disagree	Disagree	Not sure	Agree	Strongly Agree	Mean	SD
I can use e-learning systems for Major Instrument subjects (e.g., Google Classroom, SmartV3UMS, WhatsApp and YouTube) without the guidance of others.	5.7 %	10%	17.1%	**51.4%**	15.7%	3.61	**1.0535**
I can use the e-learning system for Major Instrument subjects even if I have never used the system before.	2.9%	12.9%	17.1%	**57.1%**	10%	3.58	0.94013
I can use the e-learning system for Major Instrument subjects just by referring to the instructions as a guide.	2.9%	10%	17.1%	**64.3%**	5.7%	3.60	0.85804
I am able to deal with any technical issues when using the e-learning system for Major Instrument subjects.	1.4%	22.9%	18.6%	**47.1%**	10%	3.40	0.99990
I can use the e-learning system for Major Instrument subjects at any time.	1.4%	12.9%	15.7%	**60%**	10%	**3.64**	0.88524
Overall mean and standard deviation						**3.56**	0.947362

Overall, the mean value and SD value for self-efficacy category were 3.56 and 0.94732, respectively. According to Ahmad, J. (2002), the mean value of 1.00 – 2.33 was low, 2.34 – 3.66 was moderate and 3.67 – 5.00 was high. This indicated that the overall mean value for this construct was moderately good. The findings of this study showed that most of the students had a moderate level of self-efficacy in their online major instruments learning during MCO. More than half of the students (51.4%) were proficient in using e-learning platforms, such as Google Classroom, SmartV3UMS, WhatsApp and YouTube. A total of 64.3% of the respondents agreed that they know how to use the e-learning platform only with the manual guidance as a guideline. Meanwhile, 60% of the respondents agreed that they could use the e-learning system for learning purposes at any time. The findings also found that the item, *"I can use the e-learning system for Major Instrument subjects at any time"*, had the highest mean value of 3.64. However, the item, *"I am able to deal with any technical issues when using the e-learning system for Major Instrument subjects"*, had the lowest mean value of 3.40. While the lowest SD value was 0.85804 for the item, *"I can use the e-learning system for Major Instrument subjects just by using the instructions as a guide"*. Overall, most of the music students had a moderately high level of confidence and perseverance despite facing various obstacles when online learning was conducted.

Subjective Norm

The overall mean value for the subjective norm category and SD were 3.43 and 0.935935, respectively, (Table 5). The findings of this study indicated that the respondents' level of subjective norm was at a moderate level. It is undeniable that the environment plays a big role in the readiness of students to implement the online learning class. However, the findings found that 45.7% of the respondents reported that they were skeptical whether peers and lecturers had an impact in using online learning during MCO. This may be because the students were less able to interact with peers or lecturers during the MCO. Therefore, cooperation needs to be enhanced between students, lecturers and faculty to monitor the students' involvement in online learning sessions. Two-way communication between the students and lecturers needs to be improved to enable the teaching process to run smoothly and to avoid students from being left behind, failed or dropouts during the MCO online learning.

Table 5. Percentage, mean and standard deviations for subjective norm category

Items	Strongly Disagree	Disagree	Not sure	Agree	Strongly Agree	Mean	SD
My peers think and expect me to use an e-learning system for Major Instrument subjects.	7.1%	15.7%	**45.7 %**	24.3%	7.1%	3.08	0.98897
My lecturer thinks and expects me to use an e-learning system for Major Instrument subjects.	4.3%	5.7%	**45.7 %**	32.9%	11.4%	3.41	0.92459
The management of my University/Faculty thinks and expects me to use the e-learning system for Major Instrument subjects.	4.3%	8.6%	32.9%	**42.9%**	11.4%	3.48	0.95921
Generally, I will do what is expected by the lecturer on the use of e-learning systems in Major Instrument subjects.	1.4%	5.7%	25.7%	48.6%	18.6%	**3.77**	0.87097
Overall mean and standard deviation						**3.43**	0.935935

Experience

Table 6. Percentage, mean and standard deviations for experience category

Items	Strongly Disagree	Disagree	Not sure	Agree	Strongly Agree	Mean	SD
I enjoy using computers for Major Instrument subjects.	7.1%	**38.6%**	22.9%	17.1%	14.3%	3.01	1.14253
I learn to use the internet for Major Instrument subjects.	2.9%	11.4%	21.4%	**48.6%**	15.7%	3.33	0.98056
I am proficient at saving and finding files online for Major Instrument subjects.	1.4 %	11.4%	20.0%	**51.4%**	15.7%	3.40	0.92537
I enjoy using emails for Major Instrument subjects.	5.7%	15.7%	24.3%	**45.7%**	8.6%	3.36	1.03610
I know how to upload and download files online for Major Instrument subjects.	1.4%	4.3%	10.0%	**58.6%**	25.7%	**3.41**	0.81599
Overall mean and standard deviation						**3.30**	0.98011

Table 6 shows the percentage, mean and SD for the experience category. Overall, the mean value and SD were 3.30 and 0.98011, respectively. This mean value was moderately high and indicated that the level of student satisfaction to use the computers during online learning throughout the MCO was moderately high. The data collected showed that 48.6% of the respondents agreed that they were learning by using the internet for their online learning major study. However, 51.4% of the respondents agreed that they were proficient in saving and finding files online and 58.6% were proficient in uploading and downloading files for major study subjects. However, 38.6% of the respondents expressed dissatisfaction when learning a major study subject online. This may be because the subject of major study is a subject that involves fully practical skills that require lecturers or tutors to make detailed teaching demonstrations through individuals. Instrument playing techniques need to be clearly shown before students will understand to play the instrumental techniques. Unclear sounds and displays during online teaching will affect the delivery of learning content. Students also need to have some basic installation of microphones in the computers and cable instruments to get a clear sound during online learning. Sometimes there are instruments that need to use more than one camera to get a clear screen display, such as Drum and Guitar instruments. What more if the student is just starting and a beginner, then this online learning is less effective in delivering the practical lessons. The faculty and university should address

these issues because it shows the students' low level of readiness to fully switch to online learning.

Perceived Ease of Use

Table 7. Percentage, mean and standard deviations for perceived ease of use category

Items	Strongly Disagree	Disagree	Not sure	Agree	Strongly Agree	Mean	SD
The e-learning system simplifies my learning process in Major Instrument subjects.	4.3%	14.3%	34.3%	**38.6%**	8.6%	2.95	0.77388
The e-learning system is easy to use in Major Instrument subjects.	4.3%	**47.1%**	14.3%	10.0%	24.3%	2.91	0.57059
The e-learning system makes it easy for me to get the information needed for Major Instrument subjects.	5.7%	15.7%	**32.9%**	**32.9%**	12.9%	2.85	0.76555
The interactions in e-learning system are direct and easy to understand for Major Instrument subjects.	5.7%	21.4%	20.0%	**40.0%**	12.9%	2.93	0.72574
I find that e-learning systems in Major Instrument subjects are flexible to interact with.	8.6%	**37.1%**	22.9%	20.0%	11.4%	2.45	0.65685
It is easy for me to become proficient in using e-learning systems for Major Instrument subjects.	8.6%	11.4%	25.7%	**42.9%**	11.4%	2.85	0.60560
Overall mean and standard deviation						**2.82**	0.68303

The perceived ease of use aspect of students in online learning and teaching was also a concern in this study analysis. Table 7 shows the percentage, mean and SD for the perceived ease of use category. The overall mean and SD values were 2.82 and 0.68303, respectively. This mean value was relatively low and showed that the students faced various difficulties while implementing online learning. According to the data collected, 32.9% of the students reported that they were unsure whether the e-learning system could help in their online learning. However, 37.1% of the respondents reported that the online e-learning system was

inflexible for major study subjects. Additionally, 47.1% of respondents stated that the e-learning system used was not user friendly. This situation might be due to the existing e-learning system was unable to meet the needs of students in learning major instruments, which were much related to technical aspects and sound. The application used was also less flexible, causing students or lecturers to have less choice. For example, the Outcome Based Education System (OBE) application for attendance is sometimes difficult for students to access if the internet connection is bad, therefore the need for other alternative ways that are easier to access.

Perceived Usefulness

The next objective is how the students perceived the usefulness of online teaching and learning of the major instruments subject during MCO. Table 8 shows the overall percentage, mean and SD values for the perceived usefulness category. The overall mean and SD values were 2.28 and 0.586446, respectively, which were at a low level. The findings showed that the students felt less favourable in the major study online learning. According to the data obtained, the majority of respondents (30%) strongly disagree with the implementation of online learning for the music subject that requires hands-on learning. They also disagree that the use of e-learning systems made their major instrument learning easier. Furthermore, 34.3% of respondents also expressed disagreement that the use of e-learning systems improved their learning achievement in major study subjects. Consequently, 41.4% of respondents disagree that the use of e-learning systems helped to complete their major instrument assignments faster. This is obviously due to the nature of this subject, which is entirely practical. This subject requires a lecturer or tutor to demonstrate clearly in terms of playing techniques either through visuals or sound during the online lessons. This is quite difficult to do through online learning, especially if the internet connection is bad with frequent interruptions. This situation makes it difficult to achieve the learning objectives set by the program.

Table 8. Mean and standard deviations for perceived usefulness category

Items	Strongly Disagree	Disagree	Not sure	Agree	Strongly Agree	Mean	SD
I feel that the e-learning system is helpful in my Major Instrument study that requires hands-on (practical) learning.	**30.0**	15.7	20.0	18.6	15.7	2.08	0.55927
The use of an e-learning system made my Major Instrument learning easier.	5.7	**30.0**	28.6	21.4	14.3	2.26	0.52528
The use of e-learning system improves my learning achievement in Major Instrument study.	8.6	**34.3**	32.9	12.9	11.4	2.36	0.69922
The use of e-learning system increases my learning effectiveness in Major Instrument study.	8.6	**31.4**	15.7	30.0	14.3	2.28	0.45075
The use of e-learning system helps me complete my Major Instrument assignments faster.	5.7	**41.4**	22.9	15.7	14.3	2.42	0.69771
Overall mean and standard deviation						**2.28**	0.586446

Behavioural Intention to Use

Behavioural intention to use was also included in this analysis. Table 9 shows the overall percentage, mean and SD for behavioural intention to use category. The mean and SD values as a whole were 2.48 and 0.60951, respectively, and it was considered as low level. The findings indicated that the overall student's behavioural intention to use for online learning implementation was very low and unsatisfactory. The results of the Likert scale percentage are shown in Table 7. The majority of students (40%) stated that they disagree to use the e-learning system for major instrument courses in the future. Moreover, 34.3 % of respondents stated that they disagree with the recommendation on the use of e-learning systems for major instruments to others. This may be due to the inadequacy of major instruments taught online as they are entirely practical. This also indicated that the students were not fully prepared to undergo online learning lessons, moreover, when they often face problems of poor internet connection, unconducive environment and lack of training facilities. Therefore, the university may need to think of other alternative ways, such as holding hybrid classes in the future so that practical classes can be conducted face-to-face. However, 44.3% of respondents agreed to use online learning for examination preparations and to complete assignments for the

subject of Musical Instruments. This may be because the students have relatively easy access to materials on the internet for preparation of examinations and assignments.

Table 9. Mean and standard deviations for behavioural intention to use category

Items	Strongly Disagree	Disagree	Not sure	Agree	Strongly Agree	Mean	SD
I will use the e-learning system for Major Instrument study more often in future.	8.6	35.7	12.9	**31.4**	11.4	2.24	0.59592
I will recommend the use of e-learning systems for Major Instrument study to others.	7.1	**34.3**	30.0	12.9	15.7	2.38	0.52021
I plan to use the e-learning system for Major Instrument study in the future.	8.6	**40.0**	30.0	8.6	12.9	2.40	0.59545
I intend to use the e-learning system in preparation for exams and completing assignments for my Major Instrument study.	2.9	11.4	20.0	**44.3**	21.4	2.90	0.72646
Overall mean and standard deviation						**2.48**	0.60951

This study also identified the main issues often faced by music students during the implementation of online learning in major study subjects. Table 10 shows the percentage value of the main issues category. The findings indicated that poor internet connection (48.5%) was the highest problem faced by the music students. Followed by difficulty to understand the teaching content (12.8%), unclear audio and visual (11.4%), unconducive environment (8.5%), lack of motivation (4.2%), lack of communication between lecturer and student (2.8%), nothing (2.8%), lack of discipline (1.4%), electricity supply disruption (1.4%), undeveloped skills (1.4%), lack of exposure to face-to-face class (1.4%), lack of focus (1.4%) and lack of proper guidance (1.4%).

Table 10. Percentage of main issues category

Reason	Frequency	Percentage
Poor internet connection	34	**48.5%**
Difficulty to understand the teaching content	9	12.8%
Audio and visual issues	8	11.4%
Unconducive environment	6	8.5%
Lack of motivation	3	4.2%
Lack of communication between lecturer and student	2	2.8%
Nothing	2	2.8%
Lack of discipline	1	1.4%
Electricity supply disruption	1	1.4%
Undeveloped skills	1	1.4%
Lack of exposure to f2f class	1	1.4%
Lack of focus	1	1.4%
Lack of proper guidance	1	1.4%

Discussion

One of the steps taken by the university to continue teaching and learning during the COVID-19 MCO was through the implementation of teaching online learning. Although this online learning method has long been implemented at the university level, it was not comprehensive until the COVID-19 pandemic hit worldwide. This has resulted in online learning methods being fully implemented in the education system, including in all institutions of higher learning in Malaysia. This implementation had a negative or positive impact on the overall quality of teaching and learning delivery to the students.

Similarly, the learning of undergraduate music students at UMS was still carried out even during the MCO. Based on the results of the analysis, the findings showed that the students' level of preparation for online learning was low. A large number of respondents reported that they were less prepared in conducting online learning classes. The findings supported the studies by Pangayan (2021), Lee (2020), Isa and Latiff (2020), Chung et al. (2020) and Choong (2020). Therefore, the music students also showed a low level of satisfaction when following online learning and showed a less satisfactory perception of the effectiveness of its implementation. Furthermore, the findings showed that they were less confident to continue with the online learning classes in the next semester if given the choice. This low level of student readiness was due to various factors related to the online learning system, instructor training and speed of internet usage.

The study's findings showed that *poor internet connection* was the highest problem faced by the music students followed by *difficulty to understand the teaching content* and *unconducive learning environment.* Moreover, 48.5% of the students reported that they often faced the problem of insufficient internet connection during e-learning. The study's finding was in line with previous studies conducted by Pangayan (2021), Lee (2020), Isa and Latiff (2020), Chung et al. (2020) and Choong (2020). This might also be closely related to the respondents' (47.1%) area of residence, who mostly live in rural areas (Table 3). Obviously, internet connection in urban areas was much better compared to rural areas. Therefore, the study's findings were influenced by factors of the respondents' living area.

The music students also faced challenges in terms of the computer equipment that suits the needs for online education, especially a clear sound as well as good screen display equipment. Students need to incur the cost of purchasing microphones and cables suitable for

musical instruments and for the computers to get a good sound quality and display during the online learning. However, not all students have the ability to buy expensive equipment, especially students from the B40 or low-income group. As a result, students have to continue online learning with poor or bad sound and display quality. Therefore, this affected the effectiveness of learning delivery.

Additionally, most students were more comfortable using mobile phones when following e-learning because it was easy and fast to use compared to laptops. This situation somewhat makes it difficult for students to focus on the learning topics because of small screen display and not user friendly. The university needs to give some consideration to this issue to overcome the problem, which still existed until today.

According to Free Malaysia Today (2020) and Imm (2021), one of the most significant constraints faced by students, especially from the low-income B40 families was family economic factor. Prior to MCO, music students relied entirely on facilities provided by the faculty, such as recording studios, cubical for music practice rooms, equipment, computer labs and performance stage. These learning facilities are important to the students in their music learning study. However, after the MCO was implemented, students were unable to use all the facilities and only rely entirely on their own equipment and facilities in their homes. This situation somehow affected the students' learning due to the unconducive learning environment.

However, the findings of the study found that music students have high self-efficacy when using computers for online learning purposes. Furthermore, the students had good skills in using computers, such as getting material on the internet, uploading, emailing and many others. Nevertheless, the students were also faced with the issue of e-learning platform design that was unconducive and less user-friendly, especially in relation to the production of sound and good display. Therefore, the university should consider this matter, whereby appropriate measures should be taken, such as creating a platform for learning that suits the needs and requirements of their respective fields.

In addition, the findings found that music students were more comfortable and preferred to hold face-to-face learning sessions in the future, especially for major instrument classes. Therefore, the majority of students reported that online learning was less appropriate for practical subjects, such as musical instruments. This issue was closely related to the problem of poor internet connection and inadequacy of online learning for major instrument subjects, which is entirely practical in nature. The problem of internet speed had a huge impact on the implementation process of online learning. This included the internet's ability to download content, complete and submit assignments, answer exams, search for materials and many others. The government needs to take serious steps to address this internet speed issue to enable students have better experience for online learning.

Conclusion, Recommendation and Future Work

The online learning method has given tremendous benefits to our education system, even during the MCO learning is still being carried out. However, the overall online learning implementation needs to be improved from time to time so that it does not affect the quality of teaching and learning. Some fragilities had been found in this study, such as poor internet connection, limited broadband data, practical courses were less suitable to be taught online, lack of computers that supported online learning, audio and visual issues, unconducive

learning environment, lack of technical support, lack of communication between lecturers and students and difficulty to understand the teaching content. These are very significant issues to be considered to help in the implementation method of online learning music classes run smoothly in the future.

Furthermore, the findings of this study found that the online learning method was unsuitable to be implemented on music topics that involved practical rather than theory. This was because learning musical instruments required instructors to demonstrate in-depth instrument playing technique individually. Demonstrations that were less clear and often get distracted affected the students' poor comprehension, especially for the beginners' music students, who just started their studies. Each instrument also has a size and technique of play that varies according to their respective disciplines. Therefore, teachers and students need to make more preparation before conducting online classes, for example, they need to install more than one video camera to get a clear point of view. Additionally, teachers or students need to buy an extra computer microphone to get a clear musical instrument sound, not all musical instruments are able to produce a loud sound.

Knowledge of microphone installation techniques and microphone setting also plays an important role during the online learning session. Lecturers or tutors and students need to know how to install and set the microphone correctly to produce a clear sound during online lessons. Therefore, to increase the readiness of music students in this kind of situation, the university needs to organise more computer skills training sessions, especially involving microphone setting techniques and help explain all the computer equipment that are needed. The university should always provide help desks and technical infrastructure to students at all times for the students to get help at any time if they encounter technical problems.

Consequently, the university needs to increase the effectiveness of the online platform by providing more appropriate learning methods according to the field of course taken for the lecturers, tutors and students to manage and obtain learning materials in a better way. In addition, this e-learning method could be carried out more systematically and effectively according to the needs of each field. Through strengthening the university's platform, it is hoped that it will be able to minimise the usage issues of the various platforms that are less suitable for the needs of local students.

The issue of poor internet connection and limited broadband data were important findings in this study, which were also in line with previous studies by Pangayan (2021), Lee (2020), Jesus and Latiff (2020), Chung et al. (2020) and Choong (2020). A total of 47.1% of the respondents took online classes and live in rural areas with very poor internet access during MCO. There were students who live in the rural areas, who went to town every time an online learning lecture was conducted to get a good internet connection. This situation makes it difficult for both lecturers and students to carry out online learning classes and affected the students learning throughout the semester.

Various measures have been taken by UMS to address this problem. Amongst them was by encouraging students to stay on campus for the university to provide free internet facilities to these students. Chung et al. (2020) stated that the speed factor and the university's internet system were important to enable online learning methods to be carried out successfully.

A more in-depth study on the satisfaction of online learning can be done in the future by adding more constructs and categories in the instrument as well as conducting detailed

interview sessions for students and lecturers. Apart from that, the issue of suitability of online learning platforms is also a concern in this study, especially in terms of function, sound clarity and display specifically for learning the subject of major study for students in the music programme. Proposals to develop a specific online learning system for the major study subject are recommended. However, further discussions between students, lecturers and faculty on the appropriate design of the e-learning system should be done to resolve any issues and challenges that arise during online learning in the future.

Further studies on the effectiveness of the implementation of online learning during MCO could be extended to other music subjects, such as theory, ear training, history, audio technology and composition. The sample population of respondents could also be increased by involving students from other universities or music colleges to enable the obtained study's results to be more accurate and comprehensive. It is hoped that this study could provide data and information to help the university improve the quality and implementation of online teaching and learning of music programmes in the future.

Acknowledgment

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Contact email: jinkysoo@ums.edu.my

Tell Me Your Story: Digital Storytelling as a Teaching and Communication Tool

Silvina Félix, University of Aveiro, Portugal
Violeta Clemente, University of Aveiro, Portugal

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Abstract

The paper describes an exploratory study focused on the use of Digital Storytelling (DS) as a tool for design students to communicate their self-reflection process and reveal their soft skills to a future employer. Digital Storytelling is widely recognised in the literature, as an innovative learning strategy supported by practical cases with implementation in classrooms. Based on the premise that DS can be used as a vehicle to help students "think about your own identity", the creative process of finding students' narratives led them to reflect on themselves and their life experiences. This study aimed to help students to reflect on their own cognitive profile during problem design solving and communicate creatively their soft skills to a future employer using a digital narrative. Product design students worked on their narratives for four weeks in practical classes during a course concerned with visual communication techniques. Students used digital technologies and computer software to create an individual short videos and communicate autobiographical narratives with original images and audio where the narrator is the story's protagonist. The stories were visualized in a group session with an invited DS specialist and a focus group was held to find out teachers' perceptions about the suitability of the DS as a tool for students' self-reflection. As an outcome, students' narratives focused on remarkable personal life experiences or academic involvements, some of them showing a significant emotional charge, others trying to highlight singular characteristics which may be appreciated and valued by a future employer.

Keywords: Digital Storytelling, Teaching Tool, Communication Techniques, Student's Self-Reflection

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1. Introduction

Digital storytelling (DS) is a way to communicate ideas, and experiences to an audience using multimedia (Hartsell, 2017). The relevance of Digital Storytelling as an innovative learning strategy has been widely disseminated in the scientific literature through reports with practical examples of its implementation in the classroom. (Robin, 2008; Jakes & Brennan, 2005). DS can describe autobiographical narratives, with strong emotional content, in which the narrator is the protagonist of the story (Lambert, 2003; Herreros, 2012). Creating stories using personal voice to be shared with others, according to Hartsell (2017) can encourage students' self-expression and develop their confidence in life. To Herreros (2012), DS "activa en el alumno elementos cognitivos y emotivos que promueven la reflexión sobre su Yo y le ayudan a pensarse y comprenderse" (p. 72).

Based on the premise that Digital storytelling can be used to help students to "think about their own identity" Herreros (2012) a short activity (four weeks) was designed for which students had to perform a DS aiming to promote self-reflection on their cognitive profile as future product designers. The development of cognitive skills should constitute explicit learning objectives in design education. Kim and Kim (2015) defend this idea by stating that "education should be able to identify the cognitive style of each student and nurture a competitive expertise while managing the strengths and deficiencies of their cognitive style" (p.33). The process of story-making for a DS can promote critical reflection on experience which can be useful in design education and practice (McDonnell, et al., 2004)

Design problems are "underdetermined problems" (Dorst, 2003), ill-structured, or even 'wicked'. Design problems are open, undefined, and unstructured problems. Open, because they allow multiple solutions. Undefined, because it lacks a well-defined problem definition, and its inputs are not available at the beginning. Not structured, because its resolution does not follow a "recipe", the problem is redefined and modified as the solution emerges (Cross, 2007). This 'openness' of a design problem requires the mobilisation of different thinking styles and design is then constituted as a mix of cognitive styles so closely related "that, as a designer, you fluently flow from one to the other" (Dorst, 2006, p. 81).

The development of digital stories can provide students with different skills and literacies combining different competencies described by Robin (2008) as 21st Century Literacy, Digital Age Literacies, or 21st Century Skills. Technology literacy is the ability to use computers and other technology to improve learning, productivity, and performance. Visual literacy is concerned with the ability to understand, produce, and communicate through visual images. Therefore, from an educational perspective, the use of DS tool in this study aimed to help students to: (1) reflect on their own cognitive profile and communicate their soft skills to a future employer using a digital narrative, (2) discover their cognitive weaknesses during a problem design solving and be aware of their strengths to take advantage of it and (3) communicate creatively their soft skills to a future employer.

2. The story of a digital storytelling

2.1 Digital storytelling activity context

Twenty-three students of the 3rd year Product Design and Technology course from School of Design, Management and Production Technologies Northern Aveiro (ESAN) - University of Aveiro worked on their personal DS in practical classes from a course unit concerned with

visual communication techniques under the supervision of a communication design professor and a researcher from the Education field. The objectives of the course unit

namely at the level of technical skills of image edition and video editing were fully compatible with the proposed activity. Communication Techniques (CT) is a course unit for 3rd year, where the students have initial contact, over three years of graduation, with content about graphic and communication design. CT is divided into one hour of theory and two hours of practical work where the tools to support communication design, such as image editing and vector drawing, are taught and applied. This is also the first time that a DS project was proposed in the CT programme.

As an activity it was proposed that each student had to create a digital narrative with original graphic content, resulting from self-reflection about their personal journey as an individual and as a product design student. To guide and help students during the digital storytelling process, the syllabus was written and delivered in the first class explaining the purpose of the exercise, DS activity timeline, expected tasks and deliverables, and communications tools that should be used along the activity and video requirements (Table 1).

Purpose	DS activity deliverables Communications tools	Video requirements	Competences to be acquired	
Create a digital narrative to communicate student self-reflection process and reveal their soft skills to a potential employer.	· Empathic map · Cognitive styles model (before DS activity) · Cognitive styles model (after DS activity) · Mood board · Original and autobiographical final text · Video	· Video length: 2-5 minutes · Format: 1920 x 1080 (AVI, MOV, MPEG, MP4) · Original text and images · Student must be the narrator · Use of graphics, audio, and video · image editing software	Technical	· Image editing · Video editing · Use of communication tools (such as empathic map, storyboard, mood board)
			Others	Reflexion

Table 1: Syllabus topics deliver to students at first class

2.2 Digital storytelling phases

The conception of digital storytelling follows several steps. Usually, the Digital Storytelling process begins with writing a script to communicate a specific issue. In this case, before writing their personal narrative, students had to find a particular story from their life or reflect on their singular characteristics that could be important for an employer in the design area. Of the 23 students enrolled in the course unit, 21 (91%) had attended a previous semester's course unit Product Design and Development (PDD) concerned with problem-solving by design, in which they already had contact with the Thinking Style Taxonomy (Table 1) proposed by Clemente at. al. (2016). A set of "thinking styles" that design student mobilises in problem-solving. The developed taxonomy indicates seven thinking styles and relates each one of those styles with a profession and the behaviour and attitudes required by that activity:

Imaginative (Artist); Focused (Olympic athlete), Determined (Surgeon), Empathic (Anthropologist), Analytical and evaluative (Judge), Holistic (Professional traveller) and Reflexive (Travel writer). According to Clemente (2017) "that parallelism is expected to facilitate taxonomy comprehension and memorisation by students" (p. S1536).

Job (Thinking style)	Attitudes	Actions
Artist (Imaginative)	Unconventional Fun Observer with all senses Emotional Dreamer With a certain amount of madness	Generates a lot (a "torrent") of ideas Identifies possibilities, what could be
Olympic Athlete (Focused)	Ambitious, Visionary Injects huge amounts of time and energy in their work Attention and concentration in a field	Focused on Objectives Distinguishes the essential from the irrelevant Has a clear vision of the desired output
Surgeon (Determined)	Lives well with uncertainty and ambiguity Determined, Independent Sees error and failure as an opportunity to evolve Relies on his own intuition Ability to work / manage a multidisciplinary team	Performs activities to achieve objectives Considers deadlines and events Takes advantage of the skills of each team member.
Anthropologist (Empathic)	Impartial Rejects preconceived ideas Curious Thirsty for knowledge Sensitive Attentive to details	Puts himself in the role of the other Identifies and assesses the emotional state of another Relates various information about a context to achieve a holistic picture
Judge (Analytical & Evaluative)	Disciplined, Rigorous Shrewd, Cautious	Evaluates ideas according to predefined criteria Compares what he has, given the intended purpose
Professional Traveller (Holistic)	Global and systemic thinking Ability to plan, manage and control the process Acceptance of chaos, Openness with respect to random events	Sees the process as a whole Understands the structure of the problem Determines the next step of the process
Travel Writer (Reflexive)	Self-conscious Ability to take advantage of the merits (strengths) Recognise personal singularities and use then to their advantage	Analyses the driven learning process Reflects on experiences, transforming them into useful knowledge

Table 2: Thinking Style Taxonomy (Clemente et al. 2016)

In the first lesson, students reflected on their cognitive profile from the experience they had in the PDD course unit on the previous semester. This first exercise consisted of filling in the Cognitive Profile model (before DS activity) (Figure 1) and creating an Empathy Map for which a template was provided. The Cognitive Profile model fill in by the students before and after DS activity included a task in which students had to paint their cognitive profile using the taxonomy of thinking styles (profession), assigning percentages to each one, until they reached a total of 100% (Figure 2).

Figure 1: Cognitive profile model to fill assigning a percentage value to for each Thinking Style perceived

Figure 2: Student filling the Cognitive Profile model

The Empathy map (Figure 3) is a visualization tool divided in 4-6 areas (Think and Feel, Hear, See, Say and Do Strengths and Weaknesses) widely used to understand users' needs, feelings, and desires. In this case, the Empathy Map was used as a technique of self-knowledge and not to deepen the knowledge about the target -audience as usually used in the design process. To encourage a questioning attitude and through the responses, help students define their cognitive profile, the template had questions such as "Which elements/factors influence your cognitive profile?"; "What do your attitudes and behaviours reveal about your

cognitive style?" or "What do you do to improve your cognitive profile?". In the Strengths and Weakness areas, students are encouraged to reflect on their performance during a problem-solving project "When you think about working on a project what are the cognitive aspects you are most/less capable of".
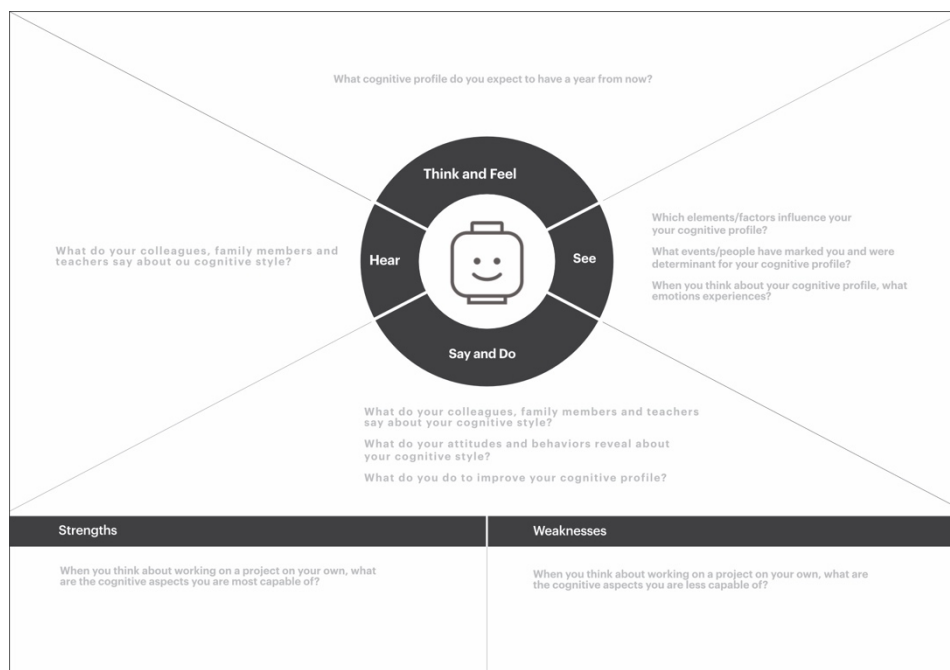
Figure 3: Empathic map template

Lesson two was facilitated by an invited researcher, a DS specialist who explained the DS concept, exposed the ingredients for a good story and exemplified the use of DS tool to create a digital curriculum. The visualization of DS examples designed and built by students in the scope of a course unit motivates the students for the proposed DS activity.

Students were encouraged to find a remarkable event or journey through life that illustrated personal characteristics that they would like to highlight. Once found, students write the first draft of their personal story. The task of writing the story script was assisted by the teacher in charge of the course unit, the researcher in the education area and the DS specialist invited for the session. After students generated ideas for their DS, the teacher/researcher/DS specialist team suggests the use of analogies and metaphors to enhance creative thinking.

In addition to the written text, the task requires students to carefully choose images to further illustrate the concepts they want to communicate. To empower the student with theoretical knowledge about communication through images, the teacher of the course unit prepared a theoretical lesson of one hour showing practical examples from the book "Pensar con imágenes" (Jardi & Costa, 2012) that demonstrate how images can be used to express and communicate ideas. All students had to create or take original images for their stories, and they could choose the type(s) of visual representation (illustration, photography, video, among others) they wanted.

In lesson 3, students start to collect original images/pictures/ drawings and generate ideas for communicating their stories. To organize the narrative flow, students design a storyboard with plans sequence, timings, transitions, voice-over text, and soundtrack. Figure 4 shows a storyboard delivery for one student. All students were advised to make a storyboard, which

was also an element of the assessment, however, some students preferred to start working on the video editing software straight away.

Figure 4: DS Storyboard describing the animation flow and the voice-over

In the last lesson dedicated to the activity, the students did the DS video edition and delivered the first version of their personal narrative. Students used digital technologies and computer software such as Movie Maker or Adobe Photoshop to create and build their videos.

After the delivery of the video's first versions, students were asked about the possibility of showing the videos to their colleagues in the classroom. Only one student didn't mind showing her work to the class, because she already shared it on social networks.

Students were free to choose what kind of visual language they would like to use. Some of them use animation mixing text with original illustrations (Figure 5) and others filmed themself as an actor (Figure 6).
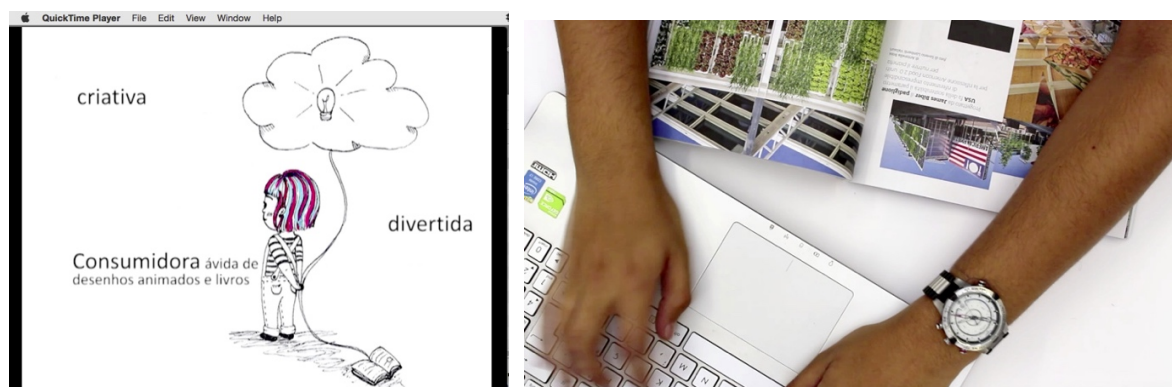
Figure 5 and 6: Pictures from students' DS

The deliverable videos were examined in a group session with the teacher in charge of the TC course unit, the researcher, and the invited DS specialist, where technical, formal, and content aspects were discussed. For each DS assignment, suggestions for improvement were proposed, which were then communicated to the students to improve the final version, to be delivered later. At the end of the session, the group discussed the rubrics that should be included in the DS evaluation grid.

In a later session, the videos were viewed by the same group of teachers involved in the activities developed in the previous semester's course unit Product Design and Development (PDD). After viewing the stories, the teachers were interviewed in a focus group session. The objective was to find out teachers' perceptions about the suitability of the DS as a tool for students' self-reflection about their cognitive profiles.

To assess the evolution of student's perception of their cognitive profile along DS activity, the students filled again the Cognitive Profile model (after DS activity). In the end, students' perceptions regarding the interest of the DS and its suitability to the objectives set for it were also collected. The infographic in figure 7 systematises visually the whole process of the proposed DS activity.
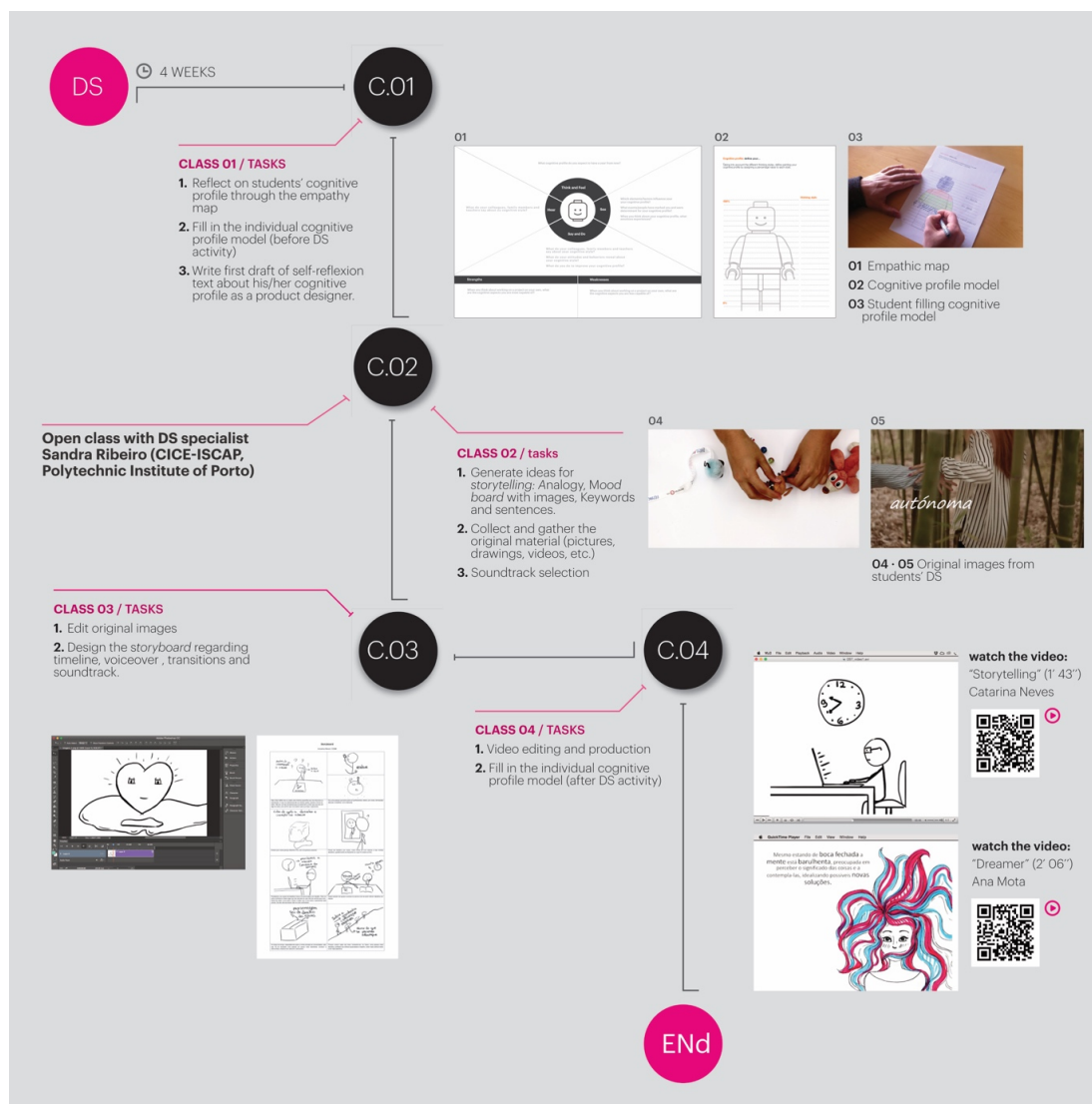
Figure 7: Infographic of DS intervention

2.3 Students' perceptions about DS activity

Students who simultaneously participated in the DS activity and in the intervention that took place in the course unit of the previous semester, only 16 responded to the questionnaires carried out before and after the activity. After the activity, the students responded to five questions, on a scale from 1 to 5, they rate their perception about the effect of the DS activity on their ability of self-reflection, self- knowledge, and cognitive profile as future designers. Table 3 shows the averages of the responses collected. In the DS activity questionnaire, the topic best evaluated by the students was the contribute of the activity to the perception of their strengths as future designers. On the other hand, they considered that the activity contributed less to their self-knowledge. However, in both cases, the values were very close to the central value of the scale.

Question	Mean	Pattern deviation	Mode	Median
DS activity promoted my capacity for self-reflection	3,23	1,01	3	3
DS activity helped me to better define my cognitive profile	3,00	0,91	3	3
DS activity contributed to self-knowledge	2,92	0,95	3	3
I have a better perception of my cognitive strengths as a future designer	3,31	0,63	3	3
I have a better perception of my cognitive weaknesses a future designer	3,23	0,73	3	3

Table 3: Students' perceptions about DS activity

Graphic 1 shows the individual perceptions of the 13 students (S1 to S13) who responded validly to the Cognitive Profile model filled in by the students before and after the DS activity. In the beginning it was expected that, with the exercise of self-reflection provided by the DS activity, the cognitive profiles would weaken, i.e. that students would be able to fix their cognitive profile around a smaller number of thinking styles, this did not happen for most of the students. On the contrary, some students identified themselves with a greater number of thinking styles after the activity. Except for one (S7), all students changed their perception of their cognitive profile with the DS activity. However, the analysis of the graphic does not evidence any overall trend, which reinforces that the activity was experienced differently by each student.
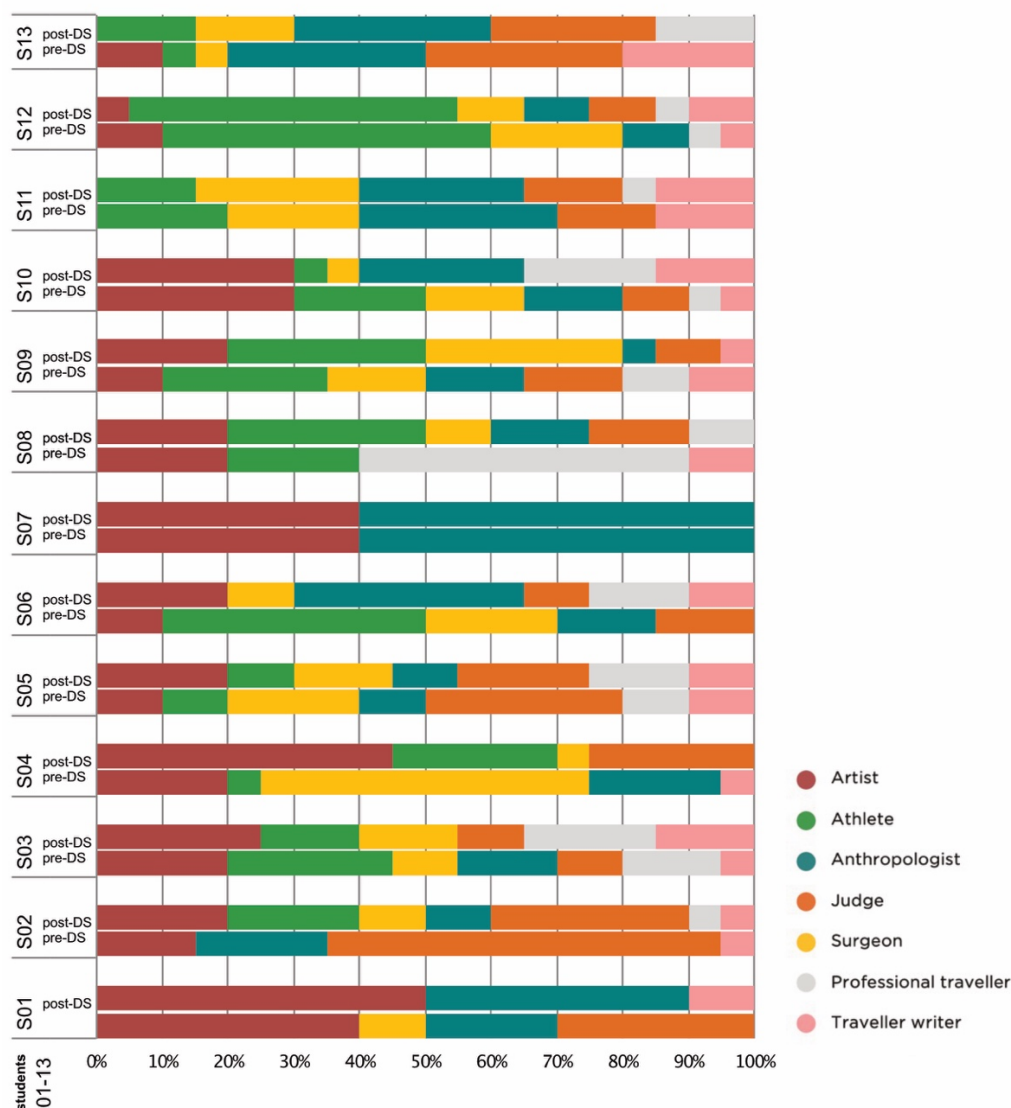
Graph 1: Students' perceptions, before and after DS activity about their cognitive profile

Without having used explicitly the cognitive styles proposed, students have managed through their exercise of self-reflection, to trace and communicate a personal and unique cognitive profile, that can be related to the type of thinking that is required during a design project. Among the 23 DS completed and evaluated, several students used a personal life event as a subject from which they drew attention to their personal characteristics, like having played a federated sport or scouting, having experienced adverse situations in childhood such as a move to a different country, adapt to another culture, bullying or other discrimination. Other students used more elaborate analogies like considering a designer has a kind of superhero. In some personal narratives the correlation with the thinking styles proposed in the taxonomy is evident:

> Empathic (Anthropologist) - *"A designer is a dream maker. (...) To make dreams come true dreams requires responding to several dreamers. It is necessary to understand others and put yourself and put yourself in their shoes."*

> Determined (Surgeon) - *"Persistent, I am capable to work long hours to finish a project (...) I also enjoy helping and teaching others and feel useful in teamwork."*

Imaginative (Artist) - *"Since childhood, creativity and imagination were always with me, occupying the always with me, occupying the space of silence (...) I found myself diving in a sea of ideas from which a story would emerge a story would emerge (...) a pencil and the empty side of already written already written to lose me in my mind (...) Even with my mouth closed my mind is noisy."*

2.4 Teachers' perceptions about DS activity

Teachers of Product Design and Development (PDD) course unit were interviewed in a focus group session aiming to collect their perceptions about the implementation of DS activity in product design education. They perceived the activity proposed to the students as a "good idea", especially with the intention of enhancing a situation that put students "thinking":

(...) putting a challenge like this (...) makes them have to think (...) This is a great idea so that they can have a better perception better understanding of what they are, what they want

After viewing the personal narratives, their opinion was consensual about which videos have a higher emotional charge and that only six of the 23 fully met the objectives set for the task. According to all, the other stories fell short in what concerns the exercise of self-reflection that was intended to be encouraged.The teachers were unanimous in stating that, according to their perception, the activity worked only for some of the students.

However, the ability to self-reflect, confronting the way "a designer is supposed to think" with one's own cognitive profile - according to the teachers - depended more on individual and particular characteristics of each student than on the activity carried out. Thus, according to them, a possible reason why the exercise would not have worked for many students would be the level of maturity, experience and life journey of each one:

(...) it also has a lot to do with growth and maturity of each one of them. (...) I think that (...) it has to do with the course and life experience they have had up to now. (...) Some have had a life experience, hard (...) that made them grow up quickly. E others not so much.

A second reason emphasized by teachers was that students generally do not respond well to tasks that call upon abilities which they are not used to mobilising. Finally, the teachers recognised that the proposed task based on self-knowledge was "not exactly easy" to do.

With regard to the use of DS tool, teachers mentioned as an advantage, the fact that students can only use original material:

It's another advantage, is that it has to be... everything has to be original (...) they have always, over the years, based their work on copy paste (...)

and being a "strong" communication medium and be easily disseminate something useful for contacting future employers:

We were able to see things in these videos that we wouldn't be able to see in an interview. It gives us much more information than looking at CVs or interviewing the person for half an hour. interviewing the person for half an hour.

In the case of some videos, the teachers were surprised by life stories they had no awareness, changing their perception about the student and, in part, explained the attitude and performance of some students:

> *And this is also a warning for us, not to get into wrong analyses of people. As teachers (...).*

3. Findings

Students' narratives focused on remarkable personal life experiences or academic involvement. Some DS show a significant emotional charge, others highlighted singular characteristics like resilience, determination, creativity which may be appreciated and valued by a future employer. Some students showed a certain resistance in doing this work probably because they were not able to establish the relationship between the proposed activity and the objectives of the course unit, or simply didn't find the DS activity interesting. Noteworthy that it was the first time that a DS tool was proposed in the scope of the Communication Techniques (CT) course, this "novelty" surprised the students more reluctant to change.

The requirement to use only original material (pictures/text/ illustrations) was a problem for some students. The work did not leave room for "copy paste" and only source of information was the students themselves. They had to "turn to themselves" to find for material.

This resistant position, adopted by some students, seems to have ended up determining the overall perception of the class. Students and teachers' perception's revealed that the activity did not work effectively for all students and most of the students did not feel comfortable showing their stories to other colleagues. The presence of the external researcher, specialist in DS, was advantageous for students' motivation and very helpful in DS evaluation. From the research team's perspective, some narratives revealed unknown facts about the students, potentially explaining their attitude and performance. Overall, DS reflected the depth of the self-reflection process achieved by the students. If in some cases the exercise provoked evident discomfort, in others it seemed almost to respond to a need to tell one's own story.

4. Conclusion

Based on this first experience of introducing DS in Visual Communication Techniques course, the teaching/research team believes that, in addition to promoting digital, technological, and visual literacy (Robin, 2008), the DS presents itself as a learning tool with a huge potential in the development of self-reflection, writing, narration, information selection and thought structuring skills, among others. Jakes & Brennan (2005) emphasised the importance of listening to the student stories through DS, "Everyone has stories, including our students." (p.1), stories can break the ice and establish a closer link in the teacher-student relationship, highlighting difficulties of the students which are unknown to the teachers but somehow influence their performance in academic career and behavior in the classroom. DS is a tool students can use throughout their lives to tell stories and improves communication abilities. This kind of communication tools allows teachers to know their students better identify problems that maybe blocking student's learning.

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Contact email: silvinafelix@ua.pt

Creative Strategies for Making Technology-Based Decisions in Education

Tsvetelina Ivanova, Paisii Hilendarski University of Plovdiv, Bulgaria
Nevena Mileva, Paisii Hilendarski University of Plovdiv, Bulgaria

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Abstract
The article is dedicated to the specifics of creating creative strategies for making technology-based decisions. The rapid development of digital technologies requires a new type of design of creative thinking, which requires instant, correct and original making of technology-based decisions in the learning process. A study was conducted with a developed author's questionnaire for creative thinking and the formation of creative strategies for making technology-based decisions for education. The study was conducted with 89 students from different specialties of higher education institutions. The results demonstrate that knowing digital technologies from different classes and types, and the skills to needed to use their functionalities, are a predictor, but also a barrier to creative thinking. The advantages and challenges for creative thinking in making technology-based decisions are interpreted. The structuring of creative strategies depends on the knowledge of the technologies used, the motivation to learn and the self-effectiveness of the learners. Respondents form ten spaces of creative strategies for making technology-based decisions in education. According to the analysis of the data received from the respondents, creative strategies for making technology-based decisions motivate active learning and increase the efficiency of daily functioning.

Keywords: Technology-Based Decisions, Creative Strategies, Creative Thinking

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Introduction

The use of digital technologies is a daily occurrence in the learning process both for the teachers from HEIs / higher educational institutions / and for the students from HEIs. The day-to-day running of HEIs students and faculty is also unthinkable without digital technology. In this process of rapid application of digital technologies in education and in life, it is necessary to make technology-based decisions in several aspects.

The first aspect of decision-making is related to decision-making regarding the use of a certain type of technology, the second aspect of decision-making is related to the use of individual functionalities of the chosen technology, the third aspect of decision-making requires a creative interpretation of the acquired knowledge of technologies and their functionalities for the most effective solution of certain problems or implementation of certain activities.

The first two aspects of making technology-based decisions require primarily the application of acquired knowledge and skills, usually decisions are made according to familiar and routine models and traditional performances are made both in everyday life and in the educational process.

The third aspect of making technology-based decisions not only implies, but also requires technology-based decision-making to be based on creative thinking and to construct creative strategies to deal with problems in learning and in everyday life. "Creativity is defined as the ability of the performer to produce decisions that are both new (ie original, rare) and appropriate (ie adequate, useful) in different situational contexts." (Sternberg & Lubart, 1999). The authors place a special focus on the development of creativity by "developing solutions to problems in different gradients of difficulty" in science and education. By providing opportunities for teachers and students of HEIs to make various technology-based decisions with analysis, evaluation and selection of results for solving a problem, conditions for critical and creative thinking are created. "Creativity is needed to generate new ideas to solve problems, and critical thinking evaluates and improves an idea." (Lau, 2011). New creative ideas lead to the conceptualization of creative strategies. The structuring of creative strategies for technology-based decisions in education is influenced by the very specification of technology, motivation to learn and self-effectiveness of students from HEIs, which in turn provoke creative thinking and creative solutions.

Main part

The process of making technology-based decisions in education is dynamic, continuous and is linked to specific solutions that have arisen, such as in education these are problems related to the learning content.

The definition of "decision making" is most often presented as:

✓   "selection of a course action from among two or more possible alternatives in order to arrive at a solution for a given problem" (Trewatha & Newport, 1976);
✓   "a course of action which is consciously chosen from among a set of alternatives to achieve the desired result" (Drucker, 1999);
✓   "cognitive process during which the decision maker is involved in choosing a strategy for action from different options."

✓　　　Decision making is the selection based on some criteria from two or more possible alternatives (Terry, 2009) and others;

Similarly, "technology-based decision making" in education can be defined as choosing the most correct and effective solution from a variety of alternatives by selecting the most appropriate technology and / or its most appropriate functionalities for solving the problem/ specific solutions in the learning process in the specific situation.

According to the most popular decision-making characteristics rational thinking is included. (Dimitratos, Petrou, Plakoyiannaki & Johnson, 2011; Musso & Francioni, 2012; Parsons, 2016, etc.), Decision-making implies freedom and choice of decision according to the personal characteristics of the decision-maker, his intellectual, emotional and social potential. It is the inclusion of personal characteristics that takes decision-making beyond rationality and includes the creativity of the individual, who brings a new type of creative thinking design with correct and original technology-based decision making in the process of self-teaching or learning.

Decision-making, including technology-based decisions, can be differentiated into strategic, tactical and operational decisions.

Strategic decision-making based on technology is most often implemented at the management level in the following process: goal setting, information retrieval, creating a set of variable solutions, comparisons and interpretation of variable solutions, SWOT analysis of alternative solutions and selection of the right decisions. Strategic decision-making is influenced by "competencies, personality and demographic characteristics and decision makers typology" (Musso & Francioni 2012), reflection (Figueira, Greco, Ehrgott, 2005), artificial intelligence (Elliot, Paananen & Staron, 2020), etc. The strategic making of technology-based decisions is related to the overall goal, which includes many sub-goals in conditions of increased risk and uncertainty and the derivation of multi-alternative scenarios. Usually, strategic technology-based decisions are long-term. Strategic decision-making is associated with rationality (Musso & Francioni, 2012), but the very creation of alternative solutions, their interpretation and selection require creative thinking and a creative approach. In essence, strategic technology-based decision-making involves creative strategies based on the rational handling of facts, processes, multiple goals combined into a common goal and predicting results. In the learning process, strategic technology-based decision-making is more often taken by the HEIs lecturer, who provides, offers and/or allows the use of certain technologies (including digital) according to the curriculum and content. In this context, whether strategic decision-making depends on the creativity of the HEIs teacher. Innovative learning models that lead to the active learning of HEIs students involve the strategic making of strategic technology-based decisions by the teacher and HEIs students. The use of innovative learning models will increase the effectiveness of the decisions made, because it will include the result of brainstorming from creative decisions of students and teachers from HEIs. For the HEIs teacher, strategic technology-based decision-making is about adapting the curriculum to the use of different technologies (including digital), electronic resources used with and from different technologies and deriving their own flexible teaching styles according to the curriculum and potential of HEIs students. Creative thinking, creative decisions and creative performances are introduced into this flexibility. While HEIs students structure (together with the HEIs lecturer) creative creative technology-based decisions that they implement in building their own learning styles.

Tactical decision-making is related to a specific goal, a specific scenario in which the risk is minimized and the achievement of the goal leads to a result. Tactical technology-based decision-making is usually short-term and mediates between strategic and operational technology-based decisions. When making tactical technology-based decisions in the training, creative decisions can also be made by students and teachers from HEIs in the context of solving the specific problem. Again, the assumption is made that the active learning of HEIs students increases due to the opportunities provided to express the creativity of the individual learner and achieve a positive satisfying experience of the result of a proposed or jointly structured specific creative tactics. In the learning process, the teacher from HEIs brings creativity in teaching certain learning content with included technologies, ie. can be creative in choosing models, methods and specific teaching techniques. While HEIs students can realize creative thinking and creative behaviour in various ways, to master certain learning content and dynamics of learning styles.

Operational decision-making based on technology is less common because the use of certain technologies (including digital technologies) is characterized by limitations in the functionality of the technological systems and/or products themselves. Operational technology-based decisions are a consequence of strategic and tactical technology-based decisions, are medium-term and are usually implemented according to a certain algorithm until the effective implementation is mastered. Operational technology-based decision-making in teaching also allows for creativity, because each HEIs teacher/student can bring creative thinking and creative behaviour that will achieve a higher level of individual presentation of teaching or learning.

In the process of making technology-based decisions, new and original ideas inevitably appear creativity in the search for alternative solutions, in evaluating unexpected aspects of alternative solutions and in choosing the right solution. "Creativity is also associated with producing original, high-quality, and "elegant" solutions to complex, novel, or ill-defined problems"(Forte-Celaya, Ibarra & Glasserman-Morales, 2021).

Creativity synergizes with technology-based decision-making, especially in structuring alternative solutions. "Creativity is also related to narrower traits in the areas of emotions and motivation, cognition, social expression, and self-regulation" (Ivcevic & Mayer, 2006).

To realize creativity, technology-based decision-making requires critical, rational and creative thinking. The characteristics of critical thinking refer to: "noticing perceptively and establishing careful connections; asking probing questions and making meaningful distinctions. Critical thinking involves analyzing, interpreting, and evaluating evidence; applying knowledge; thinking independently and interdependently… and includes evaluating and self-direction" (DiYanni, 2016). Critical thinking is the first step for creative thinking as it brings out options for existing but also promising alternative solutions. As noted by Snyder & Snyder (2008), "simply put, students who are able to think critically are able to solve problems effectively" and can obviously make the right technology-based decisions.

Method

The research methodology is composed of constructs from technology-based decision-making theories (Trewatha & Newport, 1982; Drucker, 1999; Terry, 2009; Darioshi & Lahav, 2021); theories of creativity (Taylor, 1971; Getzels & Csikszentmihalyi, 1976; Gardner, 1983; Sternberg, 1985; Kaufman & Baer, 2004; Dietrich, 2004; Kaufman, Glăveanu & Baer,

2017; Jorlen, 2013); self-efficacy theory (Bandura, 1997); to specify and analyze factors that influence the creation of creative strategies for technology-based decision-making in learning.

Research method

An author's questionnaire with 30 items was used for the study. The questionnaire is structured in three parts, with the first and second parts including nine items each, and the third part including 12 items. The first part is related to knowledge about digital technologies of different class, type and skills to use the functionalities of different technologies to make creative decisions. The second part of statements is related to the motivation for learning and making creative technology-based decisions with the output of one's own learning style. The third part of the questionnaire is related to self-efficacy in learning and in daily functioning with making creative technology-based decisions.

Procedure

Respondents answer the questionnaire with "yes" or "no", thereby rating individual statements as true or false.

Results and discussion

89 respondents - students from higher educational institutions - took part in the survey. The distribution by gender is presented in Table 1.

Participants	Female	Male	No answer	Total (N=89)
Students from HEIs	50	33	6	89

Table 1: Distribution by gender

Answers by gender are presented dichotomously and are not derived in interpretive models even in those cases where respondents did not specify gender, there were no significant differences in responses. All study participants responded to all of the items in the three parts of the questionnaire. In the first group of items, all respondents indicate their preferences for educational and life functioning with the inclusion of digital technologies. Some items have almost ceiling answers ("I make technology-based decisions by searching for information on the Web" - 98% answered "yes"), while at the same time a high emotional commitment to digital technologies in the learning process is presented ("I like to experiment with new digital technologies and new functionalities in the learning process" - 97% answered "yes"). Respondents decisively provide an answer that digital technologies increase their learning outcomes (96%). The answers obtained can be interpreted in two aspects. On one hand, the respondents have digital devices, they use them both for the learning process and in everyday life, the Internet connectivity is high and any necessary information can be found on the Internet. Even efficient Internet surfing requires creative strategies and bears the marks of creativity, because there are many answers on the Internet, but finding the right ones requires correctly specifying search words, phrases, expressions, etc. On the other hand, the forced conducting of training in an electronic environment at a distance in recent years /due to pandemic conditions/ additionally created sustainable attitudes towards and for the digitization of everyday life and the educational process. The use of digital technologies, including the Internet of Things, facilitates educational, social and life functioning and is quite logically preferred and liked.
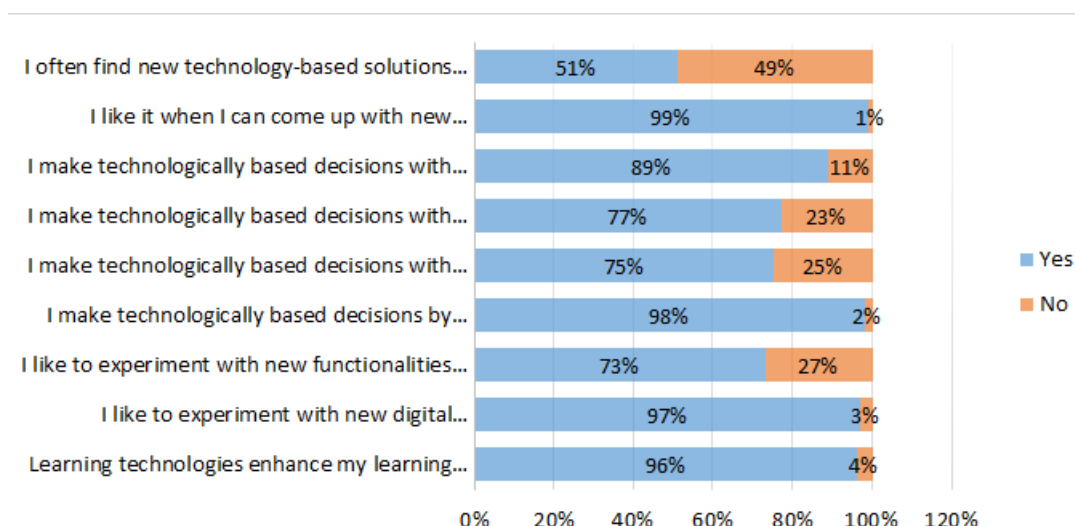
Figure 1: Knowledge and skills of technologies and their functionalities

It is noteworthy that the respondents apply new tactics to facilitate their learning and to increase its results (51%). Although the result is almost average, the very fact of looking for different and new tactical technology-based decisions is eloquent enough for a creative approach to one's own learning with the application of technology-based decisions. Creative behaviour is accepted with a positive emotional commitment by all respondents ("I like it when I manage to make new original technology-based decisions that improve my own learning" 99% answered yes), even those respondents who do not apply creative tactics in and to their own learning. There is clearly an orientation towards a creative approach, the problem-solving algorithm has passed through the stage of critical thinking and follows the direction of creative thinking and creative strategies with the selection of digital technology-based decisions until the problem is solved. The action strategies that present the action plan for solving a problem that has arisen, are based on critical thinking and creative thinking, are associated with setting certain goals, tasks and decision-making for implementations and actions, including technology-based decisions, and achieve a solution of the problem that arose. Technology-based decisions are based on and include different types of strategies: ordinary strategies; coping strategies; creative strategies. According to *Csikszentmihalyi* (1996): "Creativity is about capturing those moments that make life worth living." According to him,

> *creativity,…., consists of three main domains: a set of symbolic rules and procedures; a field that includes all individuals who act as gatekeepers to the domain and decide whether a new idea or product can be accepted; and the individual who uses the symbols of a domain invents a new idea or sees a new pattern. His thoughts or actions change a domain or establish a new domain. The level of creativity in a place at a given time does not depend only on the size of individual creativity. It also depends on how appropriate the respective domains and fields are for recognizing and disseminating new ideas. It is in the space of recognizing and disseminating new ideas that technology-based decisions and their creative creation and implementation are included.*

Undoubtedly, it is necessary to distinguish between solving a technology-based problem and making a technology-based decision. Problem solving is a process related to the analysis of the problem and / or the problematic situation and assumptions about possible different

options for solutions and related choices. Decision-making is an action related to the choice itself and is based on judgment and assumptions. Both problem solving (analytical process) and decision making (active process) are related to competencies (knowledge, skills, values and attitudes) and critical thinking. Creative thinking is the thinking that enables students to apply their imagination to generating ideas, questions, and hypotheses, experimenting with alternatives and to evaluating their own and their peers' ideas, final products and processes." (Kampylis & Berki, 2014).

In the learning process in HEIs, there could be no greater challenge than the possibility of individual/team technology-based decision-making in both faculty and students of HEIs. When this kind of challenge is brought out interactively between teachers and HEIs students, then the responsibility given to HEIs students increases their motivation to succeed and creates conditions for the expression of self-efficacy that creates both subjective and team creative strategies. In this context, an algorithmic scheme can be structured with the domains "creating creative strategies" and "making technology-based decisions" included, which are presented in Figure 2.
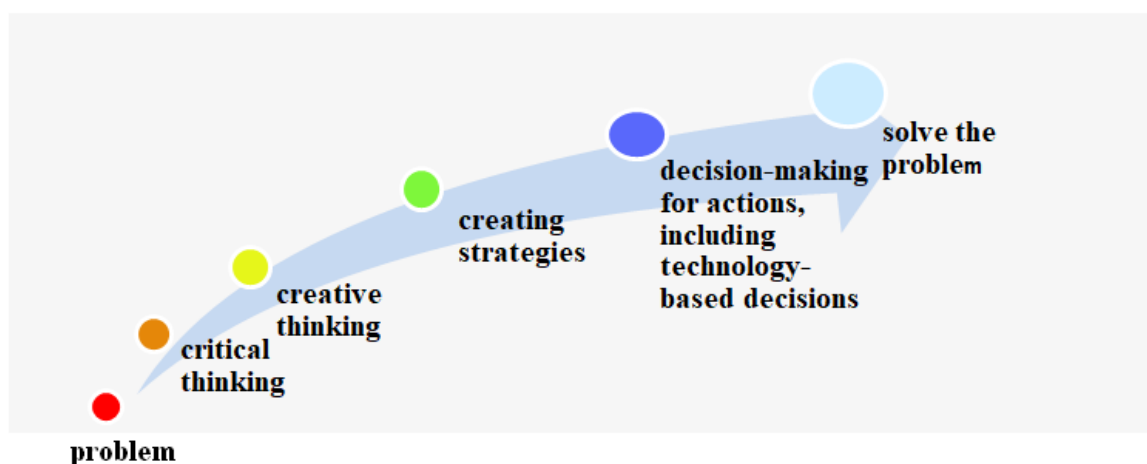
Figure 2: Decision-making algorithm with creative strategies

In turn, creative strategies are determined by:

✓   the very nature of the problem that has arisen;
✓   digital competences, self-efficacy, motivation and personal characteristics of the individual;
✓   environmental factors that stimulate or do not stimulate creativity in decision-making, including technology-based decisions;
✓   creative thinking.

A pyramid of the derivation of creative strategies for technology-based decision-making can be formed, which is presented in Figure 3.
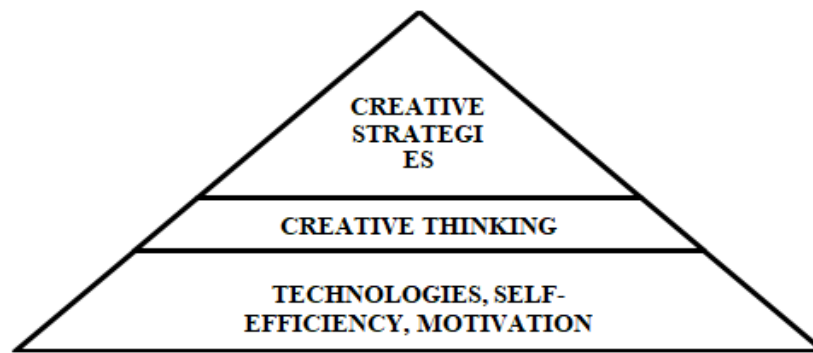
Figure 3: Pyramid of deriving creative strategies for making technology-based decisions

The results of the second part of the questionnaire related to motivation for creative solutions demonstrate internal motivation for making creative technology-based decisions. Indeed, every person daily realizes rational thinking, creativity, critical thinking and creates creative strategies whether or not using technology. But, motivation for creative solutions forces creative behaviour. The highest score for motivation to make creative decisions through technology-based decisions predictably occurs when there is a clear transfer of learning content to real life ("Making technology-based decisions motivates me to understand the application of learning information in real-life situations" - 94% answered "yes") and infers a relationship with emotional positive engagement ("Learning by making technology-based decisions gives me pleasure" - 98% answered "yes"). Learning tasks that are related to challenges such as finding technology-based decisions provoke the setting of goals and sub-goals and support successful achievements. Respondents' preferred models for making technology-based decisions in learning activities are brainstorming (I like making technology-based decisions in brainstorming with my fellow students - 72% answered yes) and collaborative learning ("I am motivated to find solutions of educational tasks in digital collaboration with my fellow students" - 62% answered "yes").
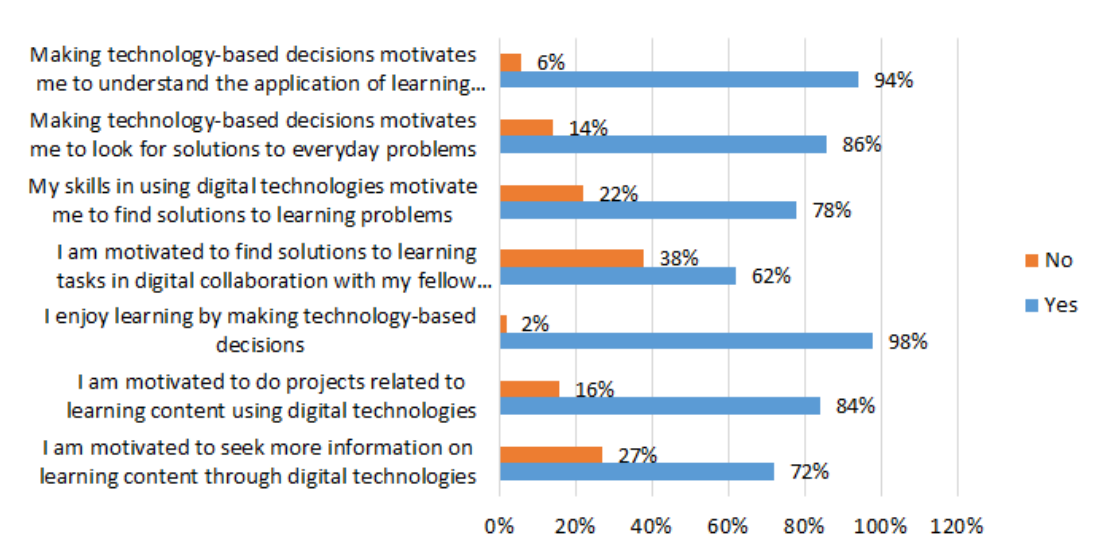
Figure 4: Motivation for creative solutions

At the same time, it relies on making conventional and ordinary solutions to problems (I try out various functionalities of digital technologies to achieve better results in my studies - 46%

answered "yes"), which do not require additional motivation. In a generalized pattern, respondents prefer finding learning information through digital technologies ("I am motivated to search for more information on learning content with digital technologies" - 72% affirmative answers). The stated preferences positively affect the self-efficacy expression of the respondents in making creative technology-based decisions. It is evident from the answers, however, that the respondents are still in a hesitant and unsettled position about the motivation for learning through user and innovative models despite the expressed affinity for digitization with creative applications in their learning. Respondents prefer finding and learning learning content digitally (72%), but they are still in a situation of trying out different functionalities of digital technologies to achieve better results in their studies (54%). Undoubtedly, these results can also be interpreted in the context of increasing digital literacy and digital competences of learners.
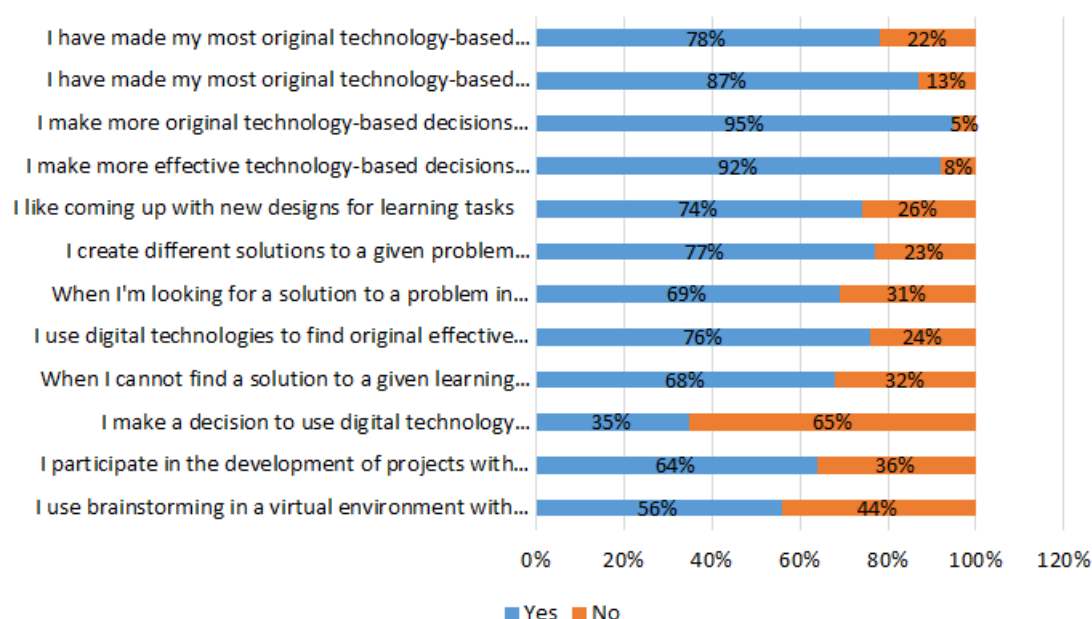
Figure 5: Self-efficacy in making creative technology-based decisions

Any given opportunity to make decisions about the content and style of learning provokes creativity and responsibility for one's own learning. In this context, the self-efficacy of the respondents is high, since the respondents are mainly from the generations "Z" and "Millennials", which are characterized by an active digital presence and an almost digital lifestyle. This fact is also evident from the results obtained related to self-efficacy in making creative technology-based decisions ("I create different solutions to a certain problem using digital technologies and choose the best solution"-77%; "I use digital technologies to finding original effective solutions to problems in learning and in everyday life" - 76%; "When I cannot independently find a solution to a given educational task, I use digital technologies to find options for solutions" - 68%). As influencers for the highest learning self-efficacy project-based digital collaborative learning (64%), virtual collaboration with people from social networks (69%) and virtual brainstorming (56%) are reported. It is noteworthy that differences are introduced regarding the use of digital technologies for different learning tasks (I decide to use digital technologies routinely and equally for all learning tasks - 35% answered "yes"). The obtained results speak eloquently about the creativity of the

respondents, who are not satisfied only with conventional technology-based decisions, but look for opportunities to apply and demonstrate their own creative original strategies and models when making technology-based decisions. The subjective presentation of creative strategies can be interpreted primarily in the context of the motivation for learning and the A-efficiency of learners. The connection between A-efficacy and performance should not be overlooked, because as noted by Levterova-Gadjalova &Tsokov (2021), "even for respondents with the strongest personally perceived self-efficacy, mastery is not unequivocally clear. Self-efficacy has to overcome the barriers of real achievement."

The arsenal of learning strategies with technology-based decision making that turn out to be creative according to the respondents are 10 and can be referred to: digital brainstorming with fellow students (56%), team digital projects with fellow students (64%), finding variants of technology-based decisions from the Internet (68%) and choosing the most effective technology-based decision (77%), digital engagement of people from social circles (69%), creating new designs of learning tasks (74%), making an instant technology-based decision (78%) , intuitive technology-based decision making (87%), technology-based decision making while in a good mood (95%), interactive learning with technology-based decisions (92%).

Undoubtedly, each of the proposed strategies has its strengths and its problematic sides, but when the problematic sides are known then they can be avoided or another strategy can be applied. The choice of one or another proven creative strategy is a symbiosis between tactical and strategic creativity, and in the specific situation of research it is digital creativity. The respondents' digital expertise is important for realizing digital creativity; situational context and environmental factors; engagement (behavioural, emotional and cognitive) and self-efficacy. Kahu, Picton, and Nelson (2019) found those learners' self-efficacy influences interest and enjoyment, and behavioral engagement in technology learning.

Conclusion

Creative technology-based decision-making requires knowledge and skills about the functionalities of different technologies. It is not at all easy to create creative strategies for technology-based decisions for learning tasks. According to Vesisenaho (et al., 2017), the process of creative use of ICT begins with a development of (or coming up with) ideas (creativity, improvisation), which then can be further elaborated by the use of technology for linking ideas or people (capturing, filtering, consolidating, transferring). When motivation to learn is present and HEIs' students show confidence, see that their efforts are valued, demonstrate critical and creative thinking towards learning tasks, work in a positive team environment and exchange concepts and ideas, then engagement and self-efficacy for taking of creative technology-based decisions. As noted by Kahu, Picton, Nelson (2020), engagement is a manifestation of learner reflection and indicates the learner's framework, evaluation of himself in relation to the current learning task or context, and may also manifest as self-efficacy, belonging and/or well-being. In the future research spaces, questions remain open about the influences and relationships of self-efficacy in structuring creative strategies in technology-based decision-making with the results obtained and the productivity of the applied creative strategy in the learning process.

It is undeniably clear that when innovative learning models are implemented with active learning models created in a virtual environment and with digital technologies, then students from HEIs go beyond the boring passive reproduction of knowledge and skills and become

active creators of their own and other competences, create creative strategies that they can apply both in the learning process and in any area of real life, in any life situation.

Thus, the art of structuring creative strategies for making technology-based decisions in the learning process acquires a personalized meaning and is relevant to the entire life cycle of learners.

Acknowledgments

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Typography Education as a Tool to Potentiate Art Nouveau Museums

Olinda Martins, ID+ Research Institute for Design, Media and Culture,
University of Aveiro, Portugal
Francisco Providência, ID+ Research Institute for Design, Media and Culture,
University of Aveiro, Portugal

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Abstract

This article results from a masterclass given to *European Réseau Art Nouveau Network* technicians. Its main objectives were to raise awareness of the potential of Art Nouveau museum collections of the different cities aggregated to the Art Nouveau network, in contemporary typographic development and the implementation of museographic practices involving different audiences for this thematic. Art Nouveau acquired very different typographic expressions in each of the regions where it appeared. Austria's style differs from Scotland's, and Belgium's differs from Catalonia's. Starting from a brief historical context, supported by the observation of several specimens (two-dimensional and three-dimensional) from the 1880s to the 1920s, it was intended to foster interest and critical discussion on the morphological differences between the design of the letters (micro-typography) and its use in different contexts (macro-typography). By presenting some Art Nouveau typographic case studies (original fonts, revivalist types, or new creations inspired by Art Nouveau), the theme of design and creation of typographic fonts was approached, anticipating possibilities for future development in this area of activity. From this masterclass emerged a set of potential actions that not only promote the specific area of Typography (such as the creation of fonts from the graphic collection of these museums) but also integrate it as a museological practice, namely through actions of investigation of the local Art Nouveau typographic heritage and its use in the design of specific activities of museums and their respective educational services.

Keywords: Typography, Art Nouveau Museum, Type Design

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Introduction

It is imperative to create strong connections between Academy and the community. In an attempt to bring these two worlds closer together, the masterclass that gave rise to this article explores Typography as a discipline and its potential for application in contexts and communities that do not yet recognize its value. This article presents a masterclass given to technicians from the European Réseau Art Nouveau Network, making the connection between Typography and Art Nouveau and foreseeing possible paths of exploration in the museum context.

The masterclass was organized by topics to enlighten the participants about the Typography discipline in which they had no previous knowledge. This allowed for navigation through new content and relating it to the participant's field of expertise (Art Nouveau).

Type and Lettering: possibilities and limitations

The term typography applies to a couple of complementary areas. It is the name given to the printing technique with movable type invented by Gutenberg and it's the activity of drawing and building letters. We will center our attention on this last idea of creating letters or better said, of developing a system of forms and motifs that are repeated and can be used over and over again, to compose different words, phrases, or various compositions, without ever having to change any of the letter drawings.

As for lettering, it doesn't need to respond to this idea of adaptability and reconfiguration, just fulfilling the requirements of a specific application. In lettering, it's all about designing a solution to a specific problem, being, in a large part of the situations, designed from scratch.

However, typography can also be used as a starting point, adjusting the letters to a specific situation and transforming it into lettering.
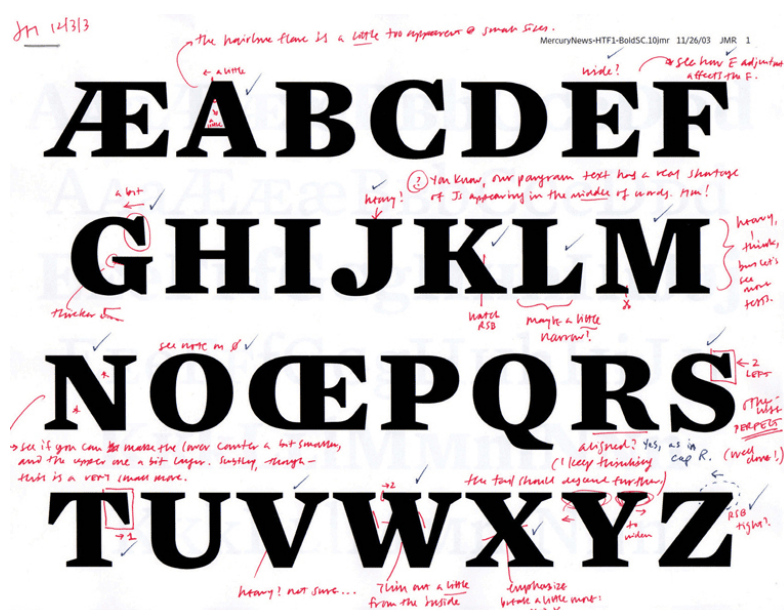
Figure 1: Example of typography. Retrieved from *Thinking with Type* (Lupton, 2004, p. 48)

Figure 2: Example of lettering. Retrieved from *Lettering & Type* (Willen & Strals, 2009, p. 74)

Figure 3: Example of typography manipulated, where several letters are merged and adjusted to a specific composition (lettering). Retrieved from *Lettering & Type* (Willen & Strals, 2009, p. 83)

O Democrata is an Aveiro newspaper published in the early 20th century, where it can be found typography and lettering working together in the same graphic object. Typography that already shows some signs of Art Nouveau aesthetics, by incorporating curvilinear details and lettering in the headline of the newspaper with different solutions for the letter A or a special design of the letter C, in a clear adaptation to the graphic needs in the composition.

Figure 4: Front page of O Democrata newspaper. Made available by
Aveiro's Art Nouveau Museum

Letters in the context of Art Nouveau

For over 400 years, typography dictated the aesthetics of compositions. Composing with movable type brought some limitations to graphic composition and this cycle was only interrupted by artists who took advantage of (the new) lithographic printing techniques creating new approaches to type design and letter use.

Based on the writings of Meggs (2012), Hollis (2000), Hauffe (1998), and Julier (1997), a selection of authors and works in the Art Nouveau movement was made to contextualize the movement and illustrate the typographic presence in the various productions of that time.

Figure 5: Some of the images presented in the masterclass illustrated the historical context.
Retrieved from various sources

Two of the most important graphic artists in the transition from the Victorian era to the Art Nouveau aesthetic were Jules Cherét and Eugène Grasset. Note the contrasting approaches in the visual languages explored by each of these artists, Cherét with a more exuberant one, using color, with condensed letters and diagonal or arched lettering compositions. And Grasset with a much modest approach, with images that project a more mythical and ethereal feel, using classic and traditional typography to complement the composition.

Lithography allowed a creative exploration hitherto unthinkable and Toulouse Lautrec was one of the artists who knew how to take advantage of this technology to develop numerous advertising posters visually influenced by Japanese Art, Impressionism, and Degas' outline drawings. In his works, sans serif and condensed letters, which emerged precisely in the last half of the nineteenth century, can be found as well as letters, drawn in contour and with shapes in a close relationship with the rest of the compositions.

For the masterclass, different examples were presented illustrating the variety of approaches that numerous artists from different locations had taken.

Téophile Alexandre Steinler did a lot of advertising work and book covers and one of his recurrent themes was cats, one of his great passions. In his body of work, Japanese influences can be seen, through the use of oriental motifs and the use of large patches of color that become the focal point of the composition. From a typographic point of view, Steiner is quite eclectic, drawing letters to fit de composition and reinforce the narrative or using calligraphic letters to emphasize the tenderness of the portrayed scene.

In Mucha's work, the dominant theme was the female figure surrounded by stylized forms derived from natural motifs, Moravian folk art, and Byzantine mosaics. Exploring the use of medieval-inspired lettering, geometric ornaments, and the organic and stylized forms of the female figures' hair he also explored ornamental patterns and the relationship between illustration and text areas, promoting the perfect dialogue between them.

In the United States, Art Nouveau specimens can also be found, initially created by French and British artists. Grasset, for example, designed several covers for Harper magazine, and Louis Rhead produced a vast array of posters, magazine covers, and assorted illustrations. Using the French poster as a model and, in particular, the work of Grasset, figures of slender maidens were portraited by Rhead, always preferring the use of vibrant and unexpected colors. He used a wide range of inspirations in his projects, from Victorian decorative ornaments to Arts and Crafts movement inspired shapes and curved and abstract linear patterns. In the letters that he draws, the warmest and most ornamental presence of French inspiration can be felt.

Another name in the US scene was Will Bradley. Influenced by English examples, he explored the technical limits of photomechanics to produce, repeat, overlap, and invert images. One of Bradley's most iconic projects is the American Chap-Book collection, comprising 12 small books that would become reference objects for many designers, not only for the general approach to editorial design but also, for the detailed use of type and the creation and use of new ornaments.

Undulating illustrations with symbolic shapes and colors accompanied by some organic and some geometric letters make up the set developed by Henri van de Velde for the Troppon brand. In addition to the well-known poster, several labels and advertisements were produced

by the author, always preferring to involve the spectator with symbolic references rather than providing them with the information in a very exhaustive way.

In 1908 van de Velde designed Thus Spoke Zarathustra, one of the most beautiful Art Nouveau books, teemed with vigorous shapes that, for example, fill the front pages of the core of the book. This project uses George Lemmen's typography, designed specifically for this project. This publication combines gold and dark red or black in unusual compositions. Gold ornaments that crown the column of text, chapters starting in the center of the page, or sections included in the text and marked by visual layouts are some examples of the unusual approach to page design in a book.

In the Netherlands it was the Art Nouveau movement that sowed the seeds of the future De Stijl and Art Deco movements, with book design being one of its main means of expression, promoting eccentricity and innovation. Strongly influenced by its colonies, the East Indies, Dutch artists integrated techniques (e.g., batik) and assimilated motifs (abstract shapes based on nature, linked to mathematics and geometry) that came from those faraway places. Groot and Chris Lebeau were two reference artists in the Dutch Art Nouveau scene.

In Germany designs that combined curvy styling with traditional realism is easy to find. Slightly inspired by French art nouveau, letters mimicked the fluidity and sweetness of the forms, set in pages with creative natural motifs.

In addition to Japanese and the Arts and Crafts movement inspirations, Art Nouveau in England also had its roots in Gothic Art, and it was with the inaugural publication of The Studio magazine that there was an opening towards a more international style.

Charles Ricketts, a specialist in woodcuts and typography, combined in his creations a meticulous knowledge of the Graphic Arts. He approached the book as a total entity, concentrating on the harmony between all the parts that compose it: text, image, and all graphic paratexts (binding, guard sheets, cover sheet, typography, and ornaments). In, The Sphinx, one of the most important works of his career, the text is set in small caps, printed in two colors (rust orange and olive green), and the composition, full of white spaces, is unprecedented.

From Scotland, a mention of the Glasgow School and some typographic examples created by Mackintosh, McNair, and the Macdonald sisters are characterized by lyrical originality and symbolic complexity, exploring a more geometric line of work, populated by floral and curvilinear elements with a strong straight structure.

Many others were influenced by The Four, and Talwin Morris was one of them. He became Art Director at Blackie and Sons, where he developed many books combining typographic and illustration approaches.

To finish the brief contextualization and display of Art Nouveau typographic examples, a reference to Koloman Moser and Alfred Roller and the posters created for the exhibition of the Viennese Secession, that show two very different approaches. One with a non-serif and more geometric font, printed in two colors on yellow paper, the other circumscribed in rectangles and whose typographic forms appear due to their minimal counter form, drawn only with fine lines.

Typefaces in the Art Nouveau Epoch

As seen in some of the previous examples, there were several typographic fonts developed between 1890 and 1920. We get to know them, not only from graphic objects where they were used but also, from the catalogs that type foundries printed to promote their creations.

At that time, those catalogs did not contain typographic specimens exclusively of Art Nouveau as they were collections that compiled several different styles and aesthetics. The main purpose of those catalogs was to feed the needs of the market and by so, they had a lot of different possibilities to choose from. However, it is possible to find many examples like the ones presented in Figure 6 and Figure 7, that fulfill the requirements of the Art Nouveau ideals. The first with a more expressive and decorative type, the second balancing typography and composition in a way closer to some Art Nouveau aesthetics and ideals.

Figure 6: A collection of Book Plate Designs by Louis Rhead. Retrieved from
https://archive.org/details/collectionofbook00rheaiala
(*A Collection of Book Plate Designs: Rhead, Louis, 1857-1926*, n.d.)
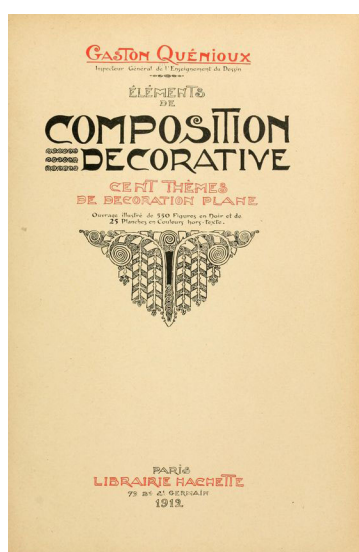
Figure 7: Composition Decorative. Retrieved from
https://archive.org/details/lmentsdecomposit00quni/page/n5/mode/2up (*Éléments de Composition Décorative; Cent Thêmes de Décoration Plane: Quénioux, Gaston*, n.d.)

In Portugal, many foundries approached the market this same way. In the pages of the Fundição Tipográfica Portugueza catalog, examples can be identified where the Art Nouveau spirit is present, and the drawings explore a more organic and undulating feature of the letters or mix visual references of Roman and Gothic letters.
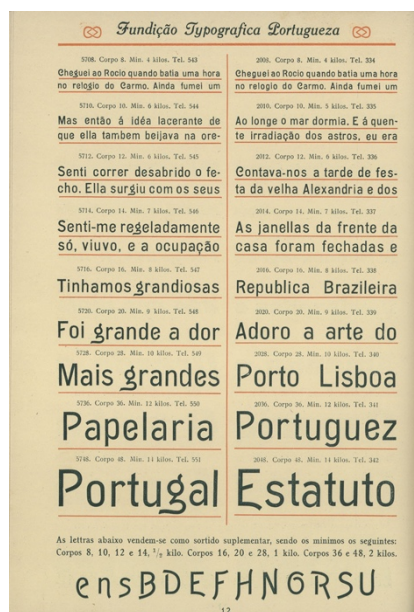
Figure 8: Fundição Tipográfica Portugueza catalog, page 12. Retrievied from https://purl.pt/39322 (*Biblioteca Nacional Digital*, n.d.)
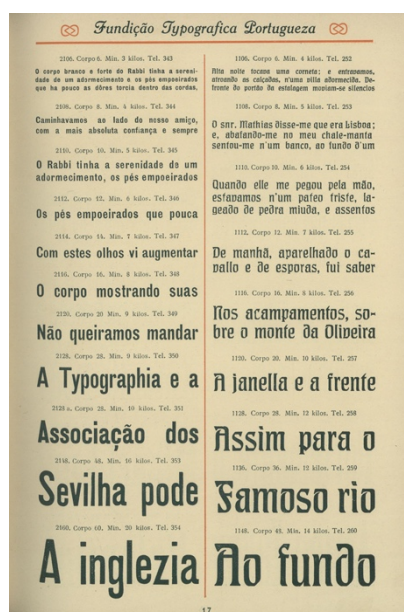
Figure 9: Fundição Tipográfica Portugueza catalog, page 17. Retrievied from https://purl.pt/39322 (*Biblioteca Nacional Digital*, n.d.)

Ornaments also played a very important role in the compositions of Art Nouveau publications, being made available by the foundries showing how they could be used in the composition of the page itself.
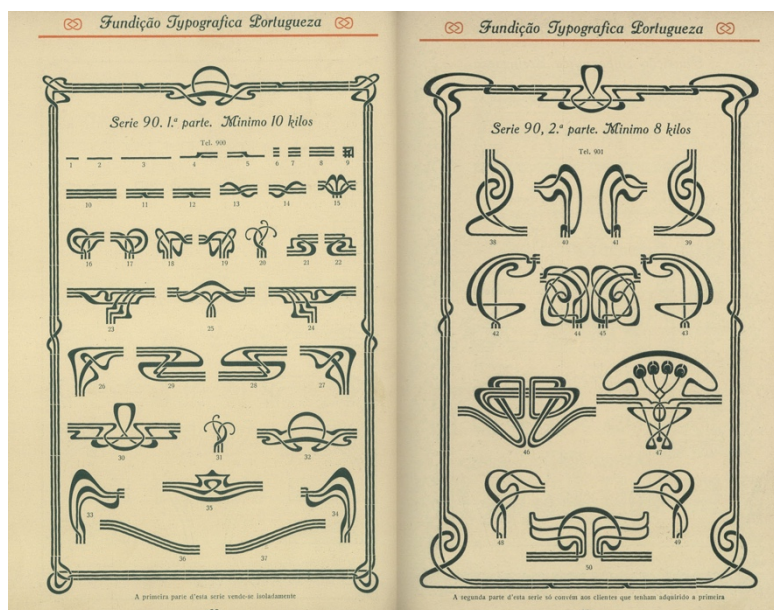
Figure 10: Fundição Tipográfica Portugueza catalog, page 39 and 39a. Retrieved from
https://purl.pt/39322 (*Biblioteca Nacional Digital*, n.d.)

The existence of this activity of type design and casting leads to another possibility in the contemporary typographic scene which is typefaces revivals.

Art Nouveau revivals in digital type

As Quelhas et all (2021) referred "type revival is defined as the practice of taking a historical artifact as a reference in order to reproduce it, or reinterpret it, transforming it into something new, capturing its essence, but reinventing its shapes or in-use possibilities, adding something new and unique to the project".

In this specific case of Art Nouveau, revivals can be seen as just the digitization of a specimen that already existed and that is transferred to digital format and made available on our computers. However, the idea of a more interventionist and creative posture in which the author is not only inspired by something but also reinterprets it in the light of his own experience is equally interesting and explored by some Type designers.

Another possibility is that "many Projects are not revivals of historical typefaces in themselves, but of letterforms, labels, lettering or calligraphic specimens, among other ephemera" (Quelhas et all, 2021).

Once again, several examples were presented to make the participants aware of the variety and richness of typefaces that meet these requirements and can be called revivalists, and that came from different approaches.
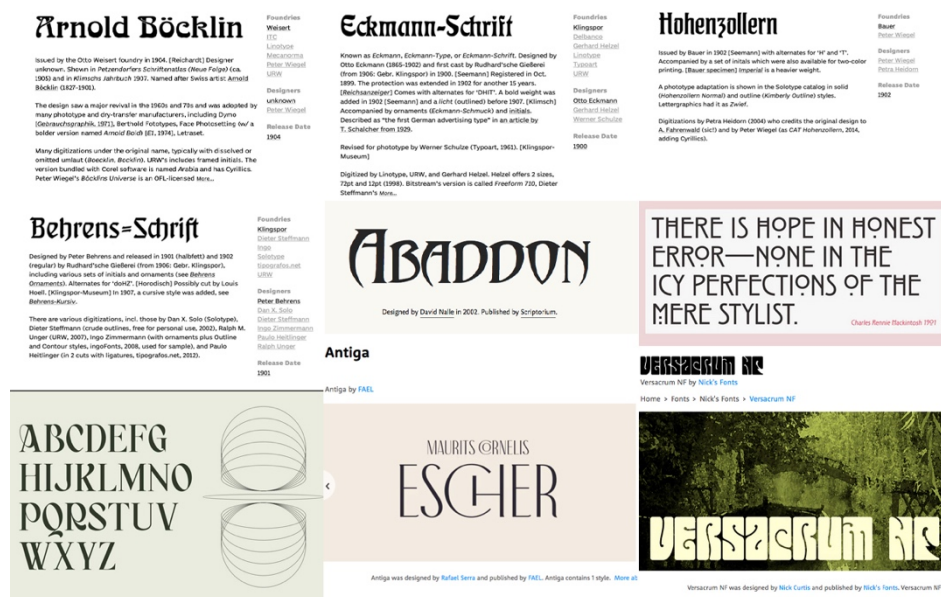
Figure 11: Some of the images presented in the masterclass illustrated the typefaces revivals. Retrieved from various sources

Arnold Böcklin is a typeface for display use that was released in 1904 by Otto Weisert foundry and named after the Swiss Artist who died in 1901. It´s probably one of the best-known Art Nouveau typefaces that had a renaissance in the 1960s and 1970s as part of the general Art Nouveau revival in popular design.

Traces of the floral forms of the Jugendstil can be recognized in this typeface that was used mainly for larger point sizes and for that reason used on many posters. This is a font that explores a more decorative feeling rather than legibility.

Today many digital versions of this typeface can be found with slight differences, published by different type foundries. It's a heavily pirated font with many free versions available online.

This is something transversal to most of the typefaces that will be presented in this paper. However, it´s important to note that these free versions don´t always have all the necessary characters to write in a certain writing system. They often don´t include, for example, accents, diacritics, or specific glyphs that are more unusual but needed for writing in some specific language.

Eckmann is a typeface that Otto Eckmann developed as a typographer in 1899. It was cast for the first time in 1900 (by the Rudhard'schen GieBerei foundry) and the drawings of the letters were strongly influenced by Japanese calligraphy. In this typeface, it is quite visible how the use of a specific tool (in this case the brush) formally influences the final result of the typeface.

Hohenzollern was designed by Carl Albert Fahrenwaldt and Peter Wiegel in 1902 and the last revival (digitization) released was made by Petra Heidorn in 2004. This typeface presents itself as a hybrid that combines roman and gothic forms through the language of Jugendstil and, like other fonts like this, presents a set of alternated characters. In this case the letter "T" and "H".

As in the previous example, the *Behrens Schrift* (1902) was also considered by its author, the architect and designer Peter Behrens, to be a hybrid typeface. Behrens describes the final visual solution as the result of a whole set of procedures and decisions. The use of a specific tool (feather), common to Gothic calligraphy, and the decision to follow the principles of proportions, height, width, and stroke thickness used in German letters, discarding all that was superfluous. This font was complemented with an initials and ornaments version in 1906 and a cursive version in 1907, specifically designed to work with the Behrens Schrift, featuring a design with a faster and more loose rhythm.

Abaddon is a font designed by Dave Nalle of Scriptorium Fonts, inspired by the poster lettering of Art Nouveau, Alphons Mucha. With some characteristics of gothic lettering, with pointed demi-serifs and extended, very pointy descenders, it has been a very popular and widely used font for rock bands, tattoo artists, and many in the goth culture.

Willow is a contemporary typeface released in 1990 reminiscent of the work of Mackintosh and based upon a sign for the Willow Tea Room, one of three tea rooms in Glasgow designed by the artist. The typeface is distinct for the double crossbars on the uppercase A and H, and the unusual design of the uppercase O, which is raised above the baseline, with two dots centered beneath the bowl.

With design choices inspired by the Art Nouveau era, *Bagerich* is a font designed by Reza Rasenda & Riska Candra Dewi. Having a generous x-height, and high contrast, the organic design allows for refined visual compositions. Bagerich comes with stylistic, alternates, and ligatures and supports multilingual languages.

Developed by the Portuguese Type designer Rafael Serra (Fael), *Antiga* was inspired by both Roman font and Art Nouveau. The result is a light and condensed font, that includes a set of ligatures (e.g., CH) and diacritics that explore a lot of the Art Nouveau typographic composition and aesthetics.

Created from the letters drawn by Alfred Roller, Nick Curtis released *Versacrum NF* in 2015, as a very faithful interpretation version of the original. Black blocks are carved only by thin lines that reveal the letter's counterforms. This isn't the only revival of its kind, and many more can be found through a quick online search.

Approaches, methods, and tools in contemporary type design

Throughout this paper, it was possible to grasp, just like Willen and Strals state, that "like a set of building blocks, a typeface is a kit of parts that can be reconfigured and reworked into countless forms on a moment's notice" (2009).

Centering on the process of creating digital fonts, and as Karen Cheng (2006) mentions "there is no single, 'correct' process for creating a typeface. (…) the methodologies of individual designers are as unique and varied as the designs themselves. (…)", assuming that different authors have different theories and approaches to the type design process.

However, in her book Designing Type, Cheng suggests a methodology quite close to what some professional type designers use. A set of steps where different tasks are developed, thus systematizing the act of designing typography.

Being a subtle activity, type designing needs to balance the difficulty to alter the shape of a letter without losing legibility. It is possible to experiment with structural variation and that comes from the knowledge of the variables in type design, like the x-height, the existence or not of serifs, the stress of the letter and its contrast, the weight or the set of characters made available.

The motivation behind the design of a typeface may vary and inspiration might come from different places. In this case, all the examples presented before were from Art Nouveau printed artifacts, buildings, or letters.

Type designers usually start by drawing two characters, a round letter like o and a semi-round letter like n. Beginning with lowercase letters is always better because they have greater variation in shape (with ascending and descending elements). Only with these two letters, it is possible to retain much of the font's DNA.

The process continues with de creation of a few more letters, with a more complex and unusual form. Once again letters that contain a lot of genetic information such as the g and the s and letters that had descender or ascender strokes, like the letters p or d, are preferable.

After finishing a small set of letters, it´s possible to start testing the font in small words, this being one of the most important aspects of type designing. The letters don't exist alone, they are made to walk together, forming words and sentences, being essential to test how they relate to each other in terms of thickness, shapes, and counter forms.

In the Latin alphabet, some letters formally relate to others, allowing the reuse of the shapes for the construction of other letters, making the overall work much easier and faster. However, in the final design, all letters need adjustments so that the shapes are visually balanced.
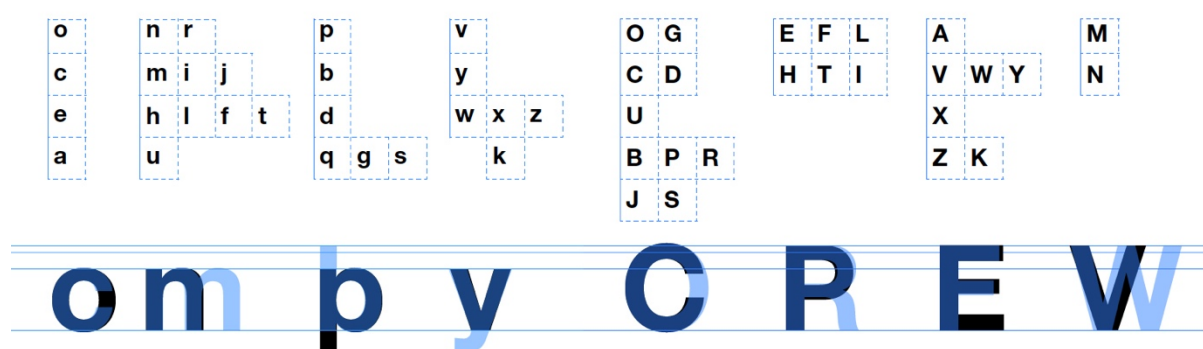
Figure 12: Formal relationship between characters

During this process, word tests should be carried out and the drawings adjusted accordingly. It is at this point that the drawings are digitized and inserted into specific software for font implementation.

There are many options available on the market, some for professional use others more amateur, some paid, and some free. In the masterclass, a paid option was presented (Fontself, a Photoshop plugin), allowing less experienced designers to take the first approach to type

design. After a brief demonstration, it was clear that it was very easy to use and the learning curve for this specific tool was almost non-existent.

Outcomes (Conclusions)

At the end of the masterclass, a short exercise was launched, to bring to the discussion everything presented. Taking as a starting point O Democrata newspaper and its typographic samples, and assuming a font based on the newspaper's headline would be developed, the audience was asked which typographic variables should be taken into account to do it. Some features were identified, and it was clear that these technicians were more sensible to typographic details than at the beginning of the session.

The approach to this masterclass was an adaptation of some contents of the Typography Curriculum taught at Aveiro University, made intelligible to people without any training in this area. By providing this new perspective on letters in Art Nouveau, it was possible to open the debate on the possibilities that each technician envisioned in the context of their museums.

They referred to the possibility of researching and studying existing materials in museums (either 2 or 3D specimens) from this new typographic perspective. Up until that moment, they weren't aware of this kind of opportunity, but with this new viewpoint, made that possibility viable.

They talked about creating oriented visits centered on Art Nouveau typography alone and developing promotional graphic materials on that behalf and mentioned the possibility of creating specific activities in the educational service, centered on observation and development of new typefaces.

As educators ourselves and part of an academic institution, we add the possibility of new connections and partnerships between museums and the Academy. Supporting research and survey of existing materials, bringing specific knowledge to the museums, and developing typographic projects that enlarge their meaning. For this matter, we foresee the creation of typographic fonts, seminars, or establishing new connections with local industries that are related to this trade.

As a final note, this master class had a great receptivity from these museum technicians, who, by knowing a little more about this very specific area, realized that they could explore it as another argument for the creative dynamization of museums.

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Contact email: olinda.martins@ua.pt
              fprovidencia@ua.pt

Designing an Adrenaline Auto-Injector: The Perception of Shape as an Affordance of Use

Clara Serrano, University of Aveiro, Portugal
Eduardo Noronha, University of Aveiro, Portugal
Ivo Fonseca, University of Aveiro, Portugal
Fábio Fernandes, University of Aveiro, Portugal
Alice Coimbra, Centro Hospitalar Universitário de São João, Portugal

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Abstract
Adrenaline auto-injectors are considered an effective and immediate emergency treatment for severe allergic reactions that may result in potentially fatal anaphylaxis if not treated on time. These auto-injectors are designed to be self-administered intramuscularly by the patient or the carer, who are generally instructed on how to apply them; however, studies indicate that these are often used incorrectly, causing accidental injuries and failed administration of the dose. A significant number of such failed deliveries can be attributed to the shape of the injecting device which according to conducted surveys is un-intuitive, especially in situations of stress and emergency, and when the person administering has no previous knowledge or experience of using the device. In conjunction, this paper argues that the shape of the auto-injector is crucial towards communicating how to use the device correctly and describes a research project that aims to develop an intuitive, accessible, and user-friendly auto-injector that can be used without previous training, and wherein the shape can promote natural associations towards ensuring correct usage. The paper also discusses key design considerations, such as common usage errors, and the patients' perceptions of, and relation with, auto-injectors. It emphasizes how by focusing on use-case affordances, the device can foment a functional rather than arbitrary relation with the user, restricting the way the device can be used and, thus, allowing it to be properly administered in emergency situations.

Keywords: Product Design, Adrenaline Auto-Injector, Affordance, Common Usage Errors, Emergency Device

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Background

"Anaphylaxis is serious allergic reaction that is rapid onset and may cause death" (Sampson et al., 2006, p.392). This is the definition encountered to define anaphylaxis, purposely universal and broad, given the complexity and variability of the condition. It can be characterized as a serious systemic allergic reaction, which happens suddenly after contact with an allergen which, by the activation of mast cells and basophils, leads to the release of active chemical mediators, that originates this acute response. Anaphylaxis may present a wide variety of symptoms, differing from patient to patient and can affect one or multiple organ systems. Reactions may be categorized as mild, moderate, or severe, depending on the degree of allergy and the dose of allergen present in the body (Suzanne C. & Smeltzer, 1999), which results in a lack of harmonization in its epidemiological data (Tanno et al., 2018).

Due to its quick response, Epinephrine, commonly known as Adrenaline, is the preferred medication for treating anaphylaxis' symptoms. This drug can be given via an Adrenaline Auto-Injector (AAI), which is currently considered the best first-line treatment for anaphylaxis, since these devices are simple to use in an emergency and deliver a constant and fixed dose of adrenaline (Hill et al., 2016). The injection must be given intramuscularly, ideally into the outer mid-thigh muscle, in order to ensure a fast absorption of the drug and to lower the risk of hitting a bone, which can result in further complications. The dosage depends on the weight of the patient: children weighting less than 30kg are advised to receive a dose of 150mg of adrenaline, while children or adults weighting more than 30kg are advised to take either 300 or 500mg of adrenaline, depending on what AAIs dosages are available in the patient's country (MHRA, 2014). In order to ensure proper administration, AAIs must be able to be administered by anybody, with no margin for error – which usually does not happen – as there are several reports on improper administration of these devices (Knibb and Morton, 2014) (Kessler et al., 2019). These failures are frequently attributed to the device's shape, which is commonly described in an emergency and stressful situation as perplexing and unintuitive (Money et al., 2013). In addition to taking into account patients' perceptions of AAIs and common use errors, designers of new AAIs should concentrate on developing affordances that foster a functional rather than arbitrary relationship with the user, restricting the way the device can be used, and enabling it to be administered correctly.

Methodology

This article follows the current state of work developed at the University of Aveiro with the aim of designing a new Adrenaline Auto-Injector that is accessible, intuitive and that can be used by anyone, whether the user has had previous training or contact with such devices.

Firstly, literature research was conducted using PubMed and ResearchGate databases to understand: a) what is anaphylaxis and its symptoms; b) currently available adrenaline auto-injectors (AAI) and its technologies; c) common use-errors and patients' perception of, and relation with, their devices; d) the concept of affordances and their importance in Design. An analysis of emergency devices was also conducted to better understand how these devices communicate with the user and ensure a rapid and correct use of the object in a stressful situation.

Interviews were conducted to understand patient's perceptions on EpiPen® and Anapen® and later compared with current research. Patients who had previously been prescribed an AAI were interviewed after their routine vaccine appointment at the Centro Hospitalar

Universitário de São João, in Portugal. Seven patients were interviewed between April and May 2022 (ages between 14 and 56 years old) and consent was obtained to record the interview with a digital voice recorder. Patients were asked to discuss their allergy history, experience as an AAI carrier and/or user, aspects of the device design they would change and whether they consider that anyone would be able to use the device if needed.

Lastly, several shapes were designed, and foam mock-ups were tested in six subjects, with ages between 23-65 years old, that had no previous contact with an AAI, to understand: 1) which shape best identifies the needle-end of the device, to prevent accidental injections and 2) which shape best restricts the way the device can be used, to ensure a correct administration of the dose of adrenaline.

Emergency Device's Analysis

James Gibson (1979) introduced the term *affordance* in his book "The Ecological Approach to Visual Perception". Donald Norman later used and adapted the term in Design to describe "… the relationship between the properties of an object and the capabilities of the agent that determine just how the object could possibly be used" (Norman, 2013, p. 11), which is in charge of assisting the user in handling the object without the need for labels or instructions (Norman, 2013). Norman (2013) defends that affordances play an important role in understanding how an object must be handled: it is the relationship between the properties of an object and the capabilities of the agent that determine how the object might be used. The affordances of an object may or may not be visible, but they always exist. The more visible the affordance is, the more likely the user will understand how the object works. This is especially important when designing an AAI or any medical emergency device, given the stressful situation the user is facing and/or the lack of knowledge on operating these devices.

An analysis of different emergency devices was conducted to understand how these communicate with the user and what cues they give so the user understands how they can be handled. These were analyzed in terms of colour, shape, material, labeling and then related to the way they should be handled in order to function. An emergency hammer is a safety feature used to break through window glass that may be found in vehicles and some buildings to aid in the emergency extrication of its occupants. This is an excellent example of good design for an emergency as its shape restricts the way the user can handle the device, making sure that it is always handled correctly. Its handle's size as well has the bumps present in the handle give an obvious affordance that that is where the person should grab the object, leaving a very small margin for the user to grab it in any other way. A fire extinguisher is an object known by many to combat small fires and it is mandatory in many buildings and vehicles. It is also a good example of a well-designed emergency device, since it is intuitive enough so every user is able to use it and its shape restricts the way it can be used. Just like the emergency hammer, its handle has bumps to guide the user's hand, which then naturally grabs the handle of the device correctly. Besides its shape, simple illustrations instructing how it should be handled are also present in the body of the device. Emergency buttons are a universal object often used in emergencies. When pressed, the user expects it to be followed by some kind of action, either to begin or stop it. All devices have in common the use of the colour red, usually a colour associated with danger and to grab the user's attention, which is a must-have in an emergency situation.

Adrenaline Auto-Injectors

AAIs are considered the best first-line treatment for anaphylaxis and users are advised to carry with them two AAIs, in case there is a need of a second dose of adrenaline to subside the symptoms. Adrenaline does not cure anaphylaxis, instead, it lessens its symptoms, so even after receiving the adrenaline dose, the patient must be rushed to the hospital to receive further examination and treatment, as anaphylaxis may reoccur up to 24 hours after the first symptoms. They allow the user to self-administer the drug when in an anaphylactic episode, which is beneficial when working with anaphylaxis as it is a condition that has a very rapid onset where the symptoms can get worse in a matter of seconds or minutes, so waiting of emergency services might be a problem. These devices are mainly used by the patients, but there are cases where the patient is unable to self-administer the dose of adrenaline, either due to extreme symptoms or even panic generated by the situation, so the device will have to administered by a family member or even by a third-party person, who may have never received any type of training on how to work with these devices and may not even know anything about them. It is therefore important that these devices be intuitive enough to be used by anyone.

Auvi-Q®[1]   EpiPen®[2]   Jext®[3]   Adrenaclick®[4]   Emerade®[5]   Anapen®[6]

Figure 1: Currently available AAIs

There are currently six available AAIs globally (figure 1): Auvi-Q®[1], EpiPen®[2], Jext®[3], Adrenaclick®[4], Emerade®[5] and Anapen®[6]. To note that authorized generic versions of EpiPen® and Adrenaclick® are marketed in some countries, without the brands' name, and are usually cheaper than the original devices (U.S. Food and Drug Administration, 2018). These devices are available in different dosages of adrenaline (table 1), depending on the country where they are sold: Adrenaclick®, Anapen®, Auvi-Q®, Emerade®, EpiPen® and Jext® all have versions with 150mg or 300mg of adrenaline solution; Auvi-Q® also sells a version with 100mg of adrenaline for toddlers, and Emerade® and Anapen® a version with 500mg of

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[1] Source: www.auvi-q.com/about-auvi-q

[2] Source: www.epipen.co.uk/en-gb/patients/your-epipen/how-to-use-your-epipen

[3] Source: www.adults.jext.co.uk/about-jext/how-to-use

[4] Source: www.adrenaclick.com/convenient_packaging_options.php

[5] Source: www.emerade.ca/

[6] Source: www.anapen.com.au/anapen

adrenaline, which is only available in some countries. The ideal dose of adrenaline is prescribed by the patient's doctor depending on the patient's weight.

	100mg	150mg	300mg	500mg
Adrenaclick®		×	×	
Anapen®		×	×	×
Auvi-Q®	×	×	×	×
Emerade®		×	×	×
EpiPen®		×	×	
Jext®		×	×	

Table 1: currently available doses of adrenaline in each AAI

These devices all have their own method of administration. To use an EpiPen®, the user must remove the safety cap and swing it in the direction of the thigh. Emerade®, Auvi-Q® and Jext® are activated by removing the safety cover, positioning the needle end on the outer thigh, and pushing the auto-injector against it. For Adrenaclick®, one must remove the needle and safety cap, position the needle end on the outer tight, and press the auto-injector to activate it. Anapen® is activated by pulling the black needle shield, taking off the grey safety cover, putting it on the outer thigh, and pressing the red button. Whereas the majority of the AAIs rely on images and/or text to instruct the user, Auvi-Q® is the only device that gives sound cues to guide the patient to ensure its correct administration. The majority of the devices have a pen-like shape, which in some cases prove to be problematic. To understand if users could correctly use their AAIs, different authors conducted usability tests. Carneiro-Leão et al. (2016) evaluated the patients' capacity to use AAIs, the effect of switching devices, and the patients' preferences by comparing Anapen®, EpiPen® and Emerade®. Out of 32 patients, 11 (34%) (5 with an Anapen® and 6 with an EpiPen®) were unable to show effective delivery of adrenaline. When switched devices, 11 out of 17 patients who had been prescribed EpiPen® where unable to administer Anapen®, whereas 9 out of 15 patients who had been prescribed Anapen® were unable to administer EpiPen®. The Emerade® auto-injector, which was chosen as the most favoured auto-injector by the majority of the participants, was only improperly used by 2 participants. In a study by Kessler et al. (2019), the usage of Auvi-Q® and EpiPen® Jr. in 96 inexperienced adults was compared. The results show that a larger number of participants were able to correctly administer Auvi-Q® (85.4%) than EpiPen® Jr. (19.8%). Auvi-Q® did not cause any accidental thumb-injections, whereas 14 participants would accidentally be hurt when using EpiPen® Jr. Participants explained that given the design of the EpiPen®, which resembles a pen, this mistake may happen and that the bright orange tip might have suggested that the end needed to be interacted with. With 90 participants, (Knibb and Morton, 2014) compared Jext®, EpiPen®, and Emerade® to evaluate the devices' accuracy and intuitiveness of usage, both with and without instructions. Results indicated that, without instructions, none of the volunteers could successfully administer EpiPen® and Jext®, however when utilising Emerade®, there was an 82 percent success rate. All subjects were successful in administering the dosage of adrenaline using Emerade® after reading the instructions, as opposed to Jext® (64%) and EpiPen® (33%). On average, patients took less time using Emerade® than Jext® or an EpiPen®. With or without instructions, participants considered Emerade® to be simpler and more intuitive since pictures were easier to follow.

Interviews were conducted at the Centro Hospitalar Universitário de São João on 7 patients to understand their opinions on their AAI (6 use or have used EpiPen® and 1 once used Anapen®). Results show that most patients feel that the size of these devices should be smaller, as it is a hindrance to carry around:

> *#4: "It's big, I think it's big. To carry around a bag: yes. Because we also have to carry other medication with us, right? So, I had a case where I stored (...) everything. Especially the length, as it is difficult to find cases for it."*

Patients also revealed a certain fear on whether they were able to administer the AAI, if it reached the muscle, if it was activated, if it passed through clothes. The feedback the device gives back seems to worry patients.

> *#3: "I find it quite violent. It's not about courage, but about the self-administration part of it. The first times must be quite stressful: (...) there's a specific place, fear if it went through clothing or not, if it delivered everything or not."*

The instruction images present on the EpiPen® are considered important and necessary to be able to understand how the device must be administered.

> *#6: "(...) but if I ever need to use one, I will have to look at the images to understand how to do it, because the doctor did teach me, but a person tends to forget it".*

A study conducted by (Money et al., 2015) to understand patients' perceptions of the EpiPen® revealed that participants believed that: there was a lack of public awareness on what AAIs are and their purpose; there is uncertainty as to when is the right time to deliver the dose of adrenaline and whether it works or not; and the size of the device and lack of a clear transportation feature prevents them from carrying it.

Product Development

Frew (2011) outlined five requirements to design the "ideal" adrenaline auto-injector: a) it must have a sufficient needle length to deliver adrenaline intramuscularly, across a variety of body types; b) it must deliver adrenaline within the correct timeframe, the quicker the better, given the unpredictability of anaphylaxis; c) it must deliver the correct dose of adrenaline and offer a range of concentration; d) it must be reliable to withstand real-life use, meaning it must operate without failure, given any circumstances and e) it must be easy to use and safe for the user. This study focuses on this last requirement outlined by Frew (2011) in the development of this new AAI.

Considering previous investigation, the authors identified a need to design a more intuitive AAI. Currently available AAIs' shapes do not ensure that the user handles the device correctly, hence the accidental injuries or administration failures that occur with these devices. The pen-like shape is often associated with a normal pen so the movable piece of the device, which is usually the needle-end, can be understood as a button that should be pressed to activate the device, resulting in accidental thumb injections and further complications.

This new AAI should be designed keeping in mind that it should be universal and intuitive enough that, just by itself, it is able to communicate how it should be handled. This way, it is guaranteed that every user can use this device, whether they have had previous contact or

training with said device or not. It should also restrict the way the device can be handled, in order to prevent any accidental injuries and/or administration failure, which can be solved by designing an AAI that can only be administered when the user is handling it correctly. Any other way of handling the device must not be allow to activate it. The shape of the device is one of the major factors in charge of communicating with the user how it should be handled. If it is not immediate, the user will not be able to understand how to handle it and fail to use the device.

Emergency devices that involve an injection, which is the case of most auto-injectors, must guarantee the safety of the user. This can be done by:

a) having the needle-end of the device clearly identified.

b) restricting the way the device can be used.

The authors defend the shape of the device is capable of giving the clues necessary so the user understands correctly how the device must be handled.

Five different shapes were designed (figure 2) to test how the shape can dictate how the device must be used. All shapes were designed keeping in mind the ergonomics of the hand, in order to make this device as comfortable on the hand as possible. Mock-ups of all five shapes were built using foam and tested by six subjects, to analyse if it was possible to identify the needle-end of the device and whether there were other options for handling the device beyond the defined one.

A   B   C   D   E
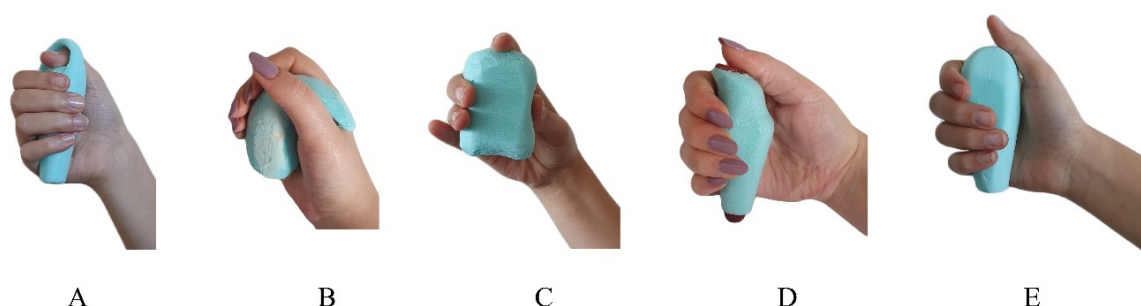
Figure 2: Mock-ups of different shapes

	Was the needle-end identified?	Was it grabbed correctly?
A	yes	yes
B	no	no
C	no	no
D	yes	no
E	yes	yes

Table 2: Test results

With the tests results, it can be concluded that some shapes work better than others. With mock-up A, all six subjects were able to identify the needle-end and how the device should be handled, by placing one or two fingers inside the loop. This shape has many benefits since, besides helping in identifying the needle-end of the device, this loop can act as a protection of an activation button, preventing accidental presses and accidental thumb injections, in case the device is handled upside down, which was not verified in the tests. One problem

identified was that the finger placed inside the loop changes between the thumb and the index-finger, which may reveal a problem since depending on it, the way the device is grabbed and the angle of injection changes. If not injected perpendicularly to the leg, it can result in the needle not reaching the muscle, raising the time of absorption of adrenaline. With mock-up B, the needle-end could not be identified, with two subjects saying the needle would come out from the smallest extremity. With more rectangular shapes like mock-up C, the needle-end could not be identified and the tests showed two possible ways of handling and using the device, since it could be interpreted in different ways: five subjects said the device resembled an arrow, thus placing the rounded end against the body, while one subject said the curvature of the device resembled the curvature of the thigh, hence placing the other end against the thigh. With mock-up D, all subjects were able to successfully identify the needle-end of the device, placing it against the body. Even with both ends painted red (one to symbolise a button and other the needle-end), it was still possible to identify which side should go against the leg. With mock-up E, the needle-end and how it should be handled were successfully identified by the subjects.

With shapes with a tapered end (mock-ups A, D and E) the needle-end of the device seems to be easily identified. All subjects were able to correctly point that the needle would come out of that extremity and placed that side of the device against a part of their body. The subjects then explained that by having this tapered shape, it was obvious that the needle would come out from that side. Ergonomic shapes like mock-up B and D prove not to be enough to restrict the way the device must be handled. As shown with mock-ups A and E, vertical symmetry seems to work best to prevent wrongful ways of handling the device. It also allows the devices to be grabbed from both sides.

Conclusion

In emergency devices, the affordances must be visible and clear to the user, to ensure that it is handled correctly. Currently available AAIs fail to communicate to the user how they should be handled, mainly given their shape which can be confusing in emergency situations. Some are too confusing, or have too many steps, which makes the user doubt whether someone without previous training with such devices would be able to correctly administer it if needed. Users complained that most of these devices are too big, and would prefer something smaller, so it is easier to carry. To prevent accidental injuries, the affordances created in these kinds of devices must be clearer and restrict the way the device can be handled with its shape itself.

Testing showed that shapes with a tapered end seem to be a better option to identify the needle-end of the device. Each participant successfully pointed to the extremity from where the needle would emerge and placed that against a region of their body. The subjects went on to say that it was evident that the needle would emerge from that side due to its tapering design. Even so, the shape of the device itself is not enough to instruct that the device must be place in the outer-third part of the leg, since most of the subjects placed the devices against either the arm or belly. The presence of a button seems to be the most intuitive way of activating the device, as most subjects looked for a button or simulated the pressing of one.

This is an ongoing research and further developments are underway. These shapes give good foundations for the development of the project, and they should be improved.

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Homeostatic Designs: How the Theories of Antonio Damasio Can Inform Design Thinking

Andrea Macruz, Tongji University, China

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Abstract

This paper discusses the role of homeostasis through the lens of the neuroscientist Antonio Damasio and its potential relation to design. The understanding of physiological regulation has evolved from the Greek idea of body humors, through Claude Bernard's "milieu intérieur", to Walter Cannon's formulation of the concept of "homeostasis. This evolution was important to the homeostasis concept. However, these views of homeostasis do not usually conjure up the fact that there are two kinds of control of internal milieu parameters. The first one is the traditional one: a non-conscious form of physiological control which operates automatically without awareness or deliberation on the part of the organism. There is a second, additional regulatory system in humans and most animals that can be conscious and involves feelings of the simplest variety, also known as homeostatic feelings. Feelings are the main contribution of Damasio to homeostasis theories. It is important to understand what homeostatic sensations are and how they function because how we feel can start to serve as homeostatic guides. The relevance of the body's homeostasis and emotional reactivity in our brain is becoming increasingly evident in neuroscience yet difficult to incorporate into the design fields; therefore, this paper offers an opportunity as a line of research inquiry. Discussing homeostasis theory in design offers insight into how this can contribute to the built environment, privileging design and outcome.

Keywords: Antonio Damasio, Neuroscience, Design, Homeostasis, Well-Being

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Introduction

The scientific validity of the hypotheses related to psychology, psychoanalysis, and phenomenology addressed in design has been supported by contemporary neuroscience research and rigorous methodologies. This paper debates the role of homeostasis through the lens of the neuroscientist Antonio Damasio and its possible connections to design. Damasio's research has contributed to understanding the neurological foundation for feelings and emotions, as well as demonstrating the importance of affect in social cognition and decision-making. His work has significantly impacted our present knowledge of the brain mechanisms that underpin memory, language, and consciousness (Faculty Profile, n.d.). Besides all the research he has been developing, perhaps Damasio's Homeostasis Theory might be the most useful for design discourse. For him, homeostasis is a state in which human physiology is maintained within a range that allows survival and flourishing: a balance of energy with a surplus capable of ensuring a future (Man and Damasio, 2019). It is mainly defined as a self-regulating process by which an organism can maintain internal stability while adjusting to changing internal and external conditions, resulting in well-being (Damasio, 2018).

The understanding of physiological regulation has evolved from the Greek idea of body humors, through Claude Bernard's "milieu intérieur" (Bernard, 2013), to Walter Cannon's formulation of the concept of "homeostasis" (Cannon, 1929). The theory of the four humors (blood, phlegm, yellow bile, and black bile) first appeared with the Hippocratic treatise called The Nature of Man, in which good health is defined as the balance and mixture of the humors, and their imbalance and separation are causes of disease (Hippocrates et al., 1931). Claude Bernard was a French physiologist who first described the idea of homeostasis, analysing that plants were capable of plenty of nonobvious, stealth movement (Damasio, 2021). Their network of underground roots grew toward the region with most water and nutrients. Walter Cannon, an American physiologist, coined the word "homeostasis" and the application of control theory (feedback and feed-forward regulation) to explain how a constant internal environment is achieved (Cannon, 1929). This evolution was important to the homeostasis concept.

However, these views of homeostasis do not usually conjure up the fact that there are two distinct kinds of control of internal milieu parameters. The first one is a non-conscious form of physiological control which operates automatically without awareness or deliberation on the part of the organism (traditional concept of homeostasis). For example: when water balance is low, the kidneys automatically slow down their operation to reduce diuresis and restore hydration (Kotas and Medzhitov, 2015). The conventional concept of homeostasis draws attention to this non-conscious physiological control without the organism's awareness or consent. Still, there is a second regulatory system in humans and most animals, besides automatic control, that involves feelings (Damasio and Damasio, 2016; Damasio and Carvalho, 2013); the main contribution of Damasio to homeostasis theories (Damasio, 2021). This second regulatory system involves simple feelings, also known as homeostatic feelings, that resolve critical life-control issues. Examples include thirst, hunger, desire, pleasure, well-being, malaise, and certain kinds of pain.

Therefore, feelings are regulatory interfaces with a double side. The first is that feelings are regulatory interfaces partly related to standard physiological operations. These include the chemical and cellular mechanisms that typically allow for the automatic regulation of internal body variables. However, the other side of feelings is mental, providing organisms with something evolutionarily new: a direct and explicit experience. It enables the person with

such experience to perceive the state of their organism. For example, airway entering the lungs limitation when someone is submerged. Our organism has a quick and automatic motor response to acquire access to air. The fact that this reaction is also perceived as air hunger and panic is a plus that ensures our attention to the organism's danger. So, the feeling experience has a content that refers to what the feeling describes, for example, difficulty breathing. Also, it has an intensity (weak or strong) and valence (positive or negative) that gives a pleasant aspect (joyful, energetic, relaxed) or unpleasant aspect (disagreeable, painful, sick). The sum of these emotional dimensions is informative as it tells the individual whether the current state of the organism is usually conducive to sustained health or flourishing, for example, well-being, or whether it needs to be corrected, in a quick, summary style (hunger, malaise). Feelings, in other words, are regulatory interfaces that provide information and transform the individual into a potential regulator. The fact that feelings are felt in the mind motivates the organism's owner to behave and encourages learning. Memory efficiency increases when a situation is present via mental states imbued with positive or negative valences, incentives or disincentives, and attractive or aversive conditions (Damasio and Damasio, 2016).

In addition, feelings may strongly impact reason. The brain systems needed for both are intertwined together with the systems that control the body. It appears that a drive that begins in the brain's core and spreads to other levels of the nervous system and manifests as either feelings or unconscious biases to guide decision-making (Damasio, 2005). The conscious feeling of homeostatic regulation engages with complex affects, drives, motivations, and emotions shaped through evolution and individual sociocultural experiences. The responses to homeostatic feeling states are influenced by the basic homeostatic variable and many of the phenomena associated with affect processes and cultural group tuning (Damasio et al., 2000). Frequent engagement of such responses through time adds to building human preferences and, ultimately, what is known as rationality in individuals and cultural communities (Damasio and Damasio, 2016; Damasio, 2000). It is important to understand what homeostatic sensations are and how they function because they could guide the design process. How we feel then starts to serve as a homeostatic guide and helps us to achieve well-being.

The traditional concept of homeostasis doesn't capture the depth of the notion and the range of situations in which it can be applied to biological systems. The purpose of this paper is to take a broader look at homeostasis, according to Damasio's theory. It comprises systems in which the presence of conscious and deliberative minds, both individually and in social groupings, allows for the establishment of additional regulatory mechanisms aimed at creating balanced and thus survivable living states (Damasio and Damasio, 2016). This essay proposes that design can be an example of such a regulating mechanism and that information about human homeostasis could be useful in studying this field. It raises some questions such as: how might the Theory of Homeostasis contribute to understanding perception in design? Could design be seen as an extension of ourselves, acting as psychic stabilizers or destabilizers? How might design play a role in the concept of homeostasis or allostasis? It discusses how the reality of human homeostasis expands the views on preferences and rational choice and how designers could use feedback to create projects with greater intelligence and performance. It pins emotions and feelings as basic forms of cognition. Also, it affirms their importance in well-being, especially because emotions and feelings have been undermined in neuroscience and design discourse for a long time.

Since the relevance of the body's homeostasis and well-being (Damasio et al., 2000) is becoming more and more obvious in neuroscience but difficult to include in the design fields, this work provides a distinct prospect as a line of scientific investigation. Discussing the Homeostasis Theory provides insight into how this may enhance the built environment in a way that prioritizes design and outcome. It places this work within a larger field of design theory aligned with neuroscientist Antonio Damasio's survival concept, which relies on the homeostatic range for optimized life regulation.

Finally, for this paper's purpose, the word "design" will embrace the fields of design and architecture because these blurred identities help us focus on the process and relationship between person, outcome, and environment rather than the result itself. It also stimulates new intersections between those disciplines and dissolves pre-established functions and characteristics.

How the Theory of Homeostasis might contribute to understanding perception in design

According to Damasio, the Central Nervous System (CNS) continually monitors our interior and exterior environments. Changes in the external environment are perceived via the exteroceptive senses (smell, taste, touch, hearing, and sight) and changes in the internal environment (the degree of contraction of visceral muscles, heart rate, levels of metabolites in the internal milieu, among others) are sensed by the interoceptive system (Craig, 2003). The main contributors to interoception are chemosensation, thermo-algic sensation (temperature and pain perception) and visceral sensation (Craig, 2003; Parvizi and Damasio, 2001). Also, proprioception, the vestibular sense and light and non-discriminative ('limbic') touch may constitute additional interoceptive modalities (Parvizi and Damasio, 2001; Olausson et al., 2002; Damasio and Carvalho, 2013). The interoceptive process begins with peripheral sensing of homeostatic changes, whether visceral or humoral. It plays an essential role in producing feelings and, specifically, accounts for their subjectivity: the fact that they are spontaneously conscious (Carvalho and Damasio, 2021).

The neuroscientist Anil Seth complements that by stating: "Perception doesn't depend largely on the signals coming into the brain from the outside world (exteroception), it depends as much or if not more, on predictions flowing in the opposite direction…Our experiences of being an embodied self are more about controlling regulations than figuring out what is there" (Seth, 2014; Seth, 2017).

If design focuses on creating perceived value for the user through the physical and psychological bonds, they develop with the outside world, using sensory experiences to evoke positive feelings can increase design value (Becerra, 2016). The tricky part is that positive feelings can be elicited even with a stimulus not perceived as happy. As stated by Damasio, for instance, music perceived as sad can lead to mixed" emotions, in which positive and negative affects are experienced simultaneously, or even to a positive affective state. This situation happens when the music is aesthetically pleasing, promotes psychological and emotional rewards such as understanding feelings and emotional assurance, triggers specific memories and distracts from current problems, and engages imaginative processes and intense emotions without real-life implications. There is an interaction between personality, social context, learned associations, and mood in pleasurable responses to sad music. How these factors interact can be understood from the perspective of homeostasis regulation (Fig.1). When and how music elicits a pleasurable response may depend on whether or not there is an initial homeostatic imbalance and whether or not music can successfully rectify it.

If there isn't a pleasant response to sad music, there may not have been a homeostatic imbalance, or the musical stimulus did not correct the imbalance (Sachs et al., 2015).

This paper proposes that design, such as art, allows for various emotions to be experienced and expressed indirectly and without the need for language and might have the capacity to communicate, regulate, and enhance emotions. So, it could help an organism or a group to a state of homeostatic equilibrium. For instance, if there is a distressing situation, generating a negative mood and an absorptive kind of personality, seeing something sad but aesthetically pleasing could make the person focus on the beauty of the design, repairing their negative mood and correcting the previous homeostatic imbalance. In the same way, if a person is in a neutral mood but has a personality that is open to experience, seeing something sad could induce a variety of emotions, causing pleasure and experiencing an optimal state of well-being. So even a culturally considered "sad color" on a space or a "sad photography" can lead to a positive affective state if a homeostatic imbalance existed previously and was corrected. This point is interesting because a design's affective state might depend on an ongoing homeostatic control: the relationship between the user's personality, background, context, and mood might be more important than the individual and situational factors associated with enjoying a design.
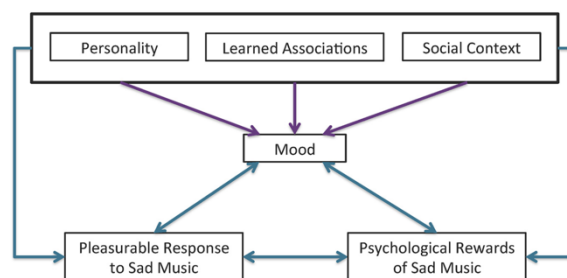

Figure 1: Influence of a person's mood
Retrieved from: Sachs et al., 2015

Figure 1 shows that personality, learned associations, and the social context can influence a person's current mood, and the interaction of one's mood with certain combinations of these three factors form the psychological rewards associated with sad music and, ultimately, the pleasurable response. The resulting pleasurable response can, in turn, influence the current mood, and there is a reciprocal nature between psychological rewards and pleasurable responses.

The neuroscientist Chatterjee extends that thought by saying that the environmental signals that give rise to aesthetic judgments might be born from those that regulate biologically more fundamental behaviors. We could manipulate design parameters to heighten these adaptive evolutionary responses for aesthetic sensation and emotion. For him, the aesthetic experience relates to a triad of knowledge and meaning, sensory-motor, and emotion-valuation (Coburn and Chatterjee, 2017). Herry Malgrave complements that "Emotion becomes an aesthetic value that shapes who we are and what we perceive" (Mallgrave, 2013), and Neil Leach points toward the important social role of the aesthetic domain as a means of reinserting the individual within society (Leach, 2006).

Therefore, this paper suggests that designers could pay attention to external stimuli and how they affect what we perceive, but also to homeostasis and how it affects what we perceive. It

could be interesting to emphasize a homeostasis-based, inward-directed perception. Could designs address ongoing homeostatic imbalances, physical and psychological? Especially nowadays, with biodata measures, wearable technologies, and Quantified Self practices? (Macruz et al., 2022)

Could be seen as an extension of ourselves, acting as psychic stabilizers or destabilizers

In Damasio's Theory of Consciousness, every person has more than one state of consciousness. The conscious mind is formed by the mind that receives a flow of sensory information from our senses and the self, which introduces a subjective perspective. The self is always felt: you can see something and "feel that you see". Damasio traced a gradual progression of self-processes; according to him, three levels of self can inhabit the mind: The "Protoself," which is the feeling of knowing that my body exists, and the "Core Self", that is the feeling of knowing that my organism has relationships with objects and events and I can act upon them, and the "Autobiographical Self " that is the feeling of knowing that I am me and I have a memory: I know that I have a past and a future and social and cultural relations. Going through the progression of self-processes is the theme for homeostatic regulation because the self is a repeatedly reconstructed biological state. (Damasio, 2005).

The neural substrate for the self inhabits with the continuous reactivation of at least two sets of representations. One set relates to significant events in a person's autobiography, which can be used to reconstitute a notion of identity repeatedly. In essence, a significant portion of the state of self is comprised of the continual reactivation of new representations of our identities (a combination of memories of the past and the anticipated future). By the time we take an assessment of the present, it has already become the past. We are preoccupied with making plans for the future, which we accomplish by building on the foundation of the past. There is never a present. The second set underlying the neural self consists of the primordial representations of a person's body: not only what the body has been like generally, but also what the body has been like recently, just before the processes leading to the perception of an object. Subjectivity may depend greatly on the changes in the body state during and just before the processes leading to object perception. So, a representational object, a responding organism, and a state of self-evolving due to the organism's response to the object are held simultaneously in working memory and attended, side by side or in rapid interpolation. (Damasio, 2005).

Understanding the three levels of the self and the importance of subjectivity, could we design for different states of consciousness? For instance, patients with Alzheimer's tend to remember the things that are emotionally charged, such as their first house and native language. Could we use affective memories as emotional strategies to ground them and empower them, helping them to use an object or navigate a space? Could we focus on the identity of the users, individual histories, familiarity, and empowering them? This paper suggests the term affective functionality because this could be seen as an optimization related to physio psychological data.

Therefore, Damasio's theory shows that the environment is never static. It is constantly updating itself, it is different for every person, depending on the self, and it is different for the same person because of the updated mental construction and varying consciousness with circumstances. As a prerequisite for existence, one must constantly uphold and maintain the boundary between oneself and their surroundings. This concept is closely related to Autopoiesis' created by the neuroscientists Francisco Varela and Humberto Maturana, in

which systems continuously construct themselves and define their own relations to the environment (Maturana and Valera, 1980).

Damasio hypothesizes that primordial images of the body in action might have influenced consciousness. The brain would represent what we currently consider a three-dimensional space based on the body's anatomy and movement patterns in the environment. They would serve as a core for the neural representation of self, providing a natural benchmark for what occurs to the organism inside or outside of its boundary (Damasio, 2005).

This view is similar to the psychologist James Gibson. He says that the words animal and environment are linked; the meaning of each term is implied by the other. Without its surroundings, no animal could survive. He redefined visual perception as the involvement of the entire organism as it moves through the surroundings. So, perception is the process of actively obtaining invariants or patterns from the environment and animal behavior is controlled by what he calls "affordances", how animals perceive possibilities in the environment (Gibson, 2014).

However, according to Damasio, our body as a whole and our brain take part in the interaction with the environment. "Think of viewing a favorite landscape. The iris not only lets light through but also adjusts its size and shape in response to the scene before them. The eyeball is positioned by several muscles to track objects effectively, and the head and neck move into optimal positions. These adjustments depend on signals from the brain to the body and related signals in vice-versa direction. Subsequently, signals about the landscape are processed inside the brain…As knowledge pertinent to the landscape is activated internally from dispositional representations in those various brain areas, the rest of the body participates in the process. Sooner or later, the viscera are made to react to the images you are seeing, and to the images, your memory is generating internally, relative to what you see. Eventually, when a memory of the seen landscape is formed, that memory will be a neural record of many of the organismic changes just described, some of which happen in the brain itself (the image constructed for the outside world, together with the images constituted from memory) and some of which happen in the body proper" (Damasio, 2005).

Therefore, to comprehend the environment, more than merely direct brain impulses from given stimuli are required, let alone seeing visual images. The body actively adapts itself to facilitate the best interaction possible. The fact that the organism needs environmental interactions to sustain homeostasis is maybe no less significant as to why most environmental interactions occur. The organism constantly interacts with its surroundings (actions and exploration came first), allowing it to facilitate the interactions required for survival. But to successfully escape danger and be effective at finding food, sex, and shelter, it must be able to detect its surroundings (via smell, taste, touch, hearing, and sight), allowing it to respond appropriately to what is sensed. As much as it involves receiving messages from the environment, perception also consists in acting on it. In essence, brain circuits continuously represent the organism as it responds to and is influenced by stimuli from its physical and sociocultural environments. (Damasio, 2005).

Andy Clark contributes to that view, pointing towards the concept of "extended mind". As stated by him "with the advent of texts, PCs, coevolving software agents, and user adaptive home and office devices, our mind is just less and less in the head. In other words, the separation between the mind, the body, and the environment are seen as an unprincipled distinction." (Clark, 2004).

So, if the environment is never static, neither might be design. This paper proposes that design is constantly updated with the construction of the conscious mind, which in turn affects the design, affecting the conscious mind in a feedback loop. Following this line of thought, design would be an extension of ourselves, an "extended mind", constantly re-defining us and sustaining our homeostasis.

How design might play a role in the concept of homeostasis or allostasis

According to Damasio, first, only a portion of the brain's circuitry is determined by genes. The human genome specifies the overall design of the brain and our bodies in detail. However, not every circuit actively develops and functions as determined by genes. At any given time in adulthood, a large portion of each brain's circuitry is unique and individual, reflecting that specific organism's history and environment. Second, each human organism functions within clusters of like beings. The mind and behavior of people who are a part of these collectives and who live in particular cultural and physical settings are not solely shaped by the activity-driven circuitries. They are even less shaped by genes alone. It is important to consider human behavior's social and cultural background to comprehend how the brain creates the human mind (Damasio, 2005).

We were born with a built-in system that would allow us to experience both pain and pleasure. The threshold at which it starts to be triggered, its intensity, or our ability to reduce it can all be affected by culture and personal history. But the necessary tool is a given. Suffering alerts us to something. The likelihood that people will pay attention to pain signals and take action to stop their source or reverse their effects is increased by suffering, making it the best form of protection for survival. It follows that behavioral impairments should accompany changes in pain perception since pain is a lever for effectively deploying drives and instincts and developing related decision-making strategies (Damasio, 2005).

Civilizations are transferred throughout people and generations through language, the items, and rituals that the cultures developed in the first place. The process of creativity and cultural innovation might have been continued and monitored by cognitive means and the actual felt value of life outcomes. In his theory, connecting cultures to feelings and homeostasis deepens the cultural process's humanization and increase their ties to nature. Feelings and creative cultural brains were created throughout a long process in which homeostasis-guided genetic selection played a key part (Damasio, 2018). In line with this thought, design could play an important role in building culture.

The neuroscientist Lisa Barrett complements this view, by describing how culture is important to regulate our nervous systems (Barrett, 2017; Barrett, n.d.). She states that we collectively impose meaning to certain signals that they do not have on their own, and our ability to agree on what something means is essential to regulate our nervous systems. So, the brain imposes meaning on the signal itself, and that is how we create and nurture our social realities. "If you grow up in a culture that does not have the concept for sadness, you don't experience sadness, and you don't perceive sadness because your brain becomes wired to make metal events that are existing in your particular culture." (Barrett, n.d.).

She expands that thought by saying that we also regulate our nervous systems and other people's because the metabolic cost of the brain is expensive, and evolution couldn't make our brains any bigger. Hence, it trained other brains to regulate ours as well. "You can affect the nervous system of someone by just speaking on the telephone because they feel affected

or connected only by your voice because we are social animals…When you are feeling horrible, and someone gives you support, says kind words, or hugs you, they are physically interfering with your body. The other person is helping your body maintain allostasis when it probably can't do it by itself." (Barrett, n.d.). Allostasis is the active process of maintaining or regaining equilibrium. (McEwen and Wingfield, 2010). The basis of love or affection is the ability to affect someone's allostasis." (Barrett, n.d.).

Neil Leach extends that by saying that cities and towns themselves must be understood as amalgams of 'processes', as spaces of vectorial flows that 'adjust' to differing inputs and impulses, like some self-regulating system (Leach, 2022). Lovelock also expands this concept by posing the earth as a self-regulating entity (Lovelock, 2016).

In Damasio's Somatic Maker Hypothesis, homeostasis is the basis of emotions and behaviors, experienced as punishment or reward, pain or pleasure, affecting decision making, learning, attention, memory, reasoning, creativity, social functioning, morality, and human ethics. If humans are fundamentally emotional and social creatures, these processes mentioned previously are emotional, embodied, and social (Damasio, 2005). This understanding expands our views on preferences and rational choices. It raises the question of how designers could use feedback to create projects with greater intelligence and performance, emphasizing embodiment, emotion, and social processes.

Two scientific experiments are interesting for the understanding of embodiment. The first one is called the Rubber Hand Illusion, in which the person's real hand is hidden from view, and the person stares at a fake rubber hand. Both hands are simultaneously stroked with a paintbrush while the person looks at the fake one. After a while, this leads to the sensation that the fake hand is part of the body. The congruence between seeing touch, and feeling touch on an object that looks like a hand and stands where a hand should be is enough for the brain to make the best guest that the fake hand is part of the body (Seth, 2017). The second one is called rubber hand illusion in virtual reality. It is a virtual hand that flashes red and back-in-time and out-time with people's heartbeats. When the heartbeat is in time, people have a stronger sense that it is part of their body. So, the experiences of having a body are deeply grounded in perceiving our body from within (Keisuke et al., 2013). These experiments might suggest that a physical or digital design aligned with the body could be a more effective feedback strategy to modify our affective state.

Therefore, would it be possible to enhance this interrelationship between environment, design, and people? Could new technologies help extend our perception and transform us, improving this triad? Could design be more interactive, making people more aware of its effect, affecting people's behavior that affects back design? As Damasio points out, the use of soft robotics, cross-modal information processing, and multisensory integration could help us to embrace ambiguity, redundancy, feedback, and abstraction (Man and Damasio, 2019; Man et al., 2013). An open-ended design structure like this might be helpful to gain more interactivity between the environment, design, and people. Lastly, how might design play a role in the concept of homeostasis, allostasis and well-being?

Conclusions

Contemporary neuroscience and rigorous methods are used to support theories that relate to architecture and design. This paper explores the function of homeostasis and its potential connection to design through the eyes of neuroscientist Antonio Damasio. It starts with a

general explanation of homeostasis and how the understanding of physiological regulation evolved throughout the years, with Hippocrates, Claude Bernard, and Walter Cannon, culminating in Damasio's Homeostasis Theory. The main difference between these traditional views on homeostasis and Damasio's is the addition of homeostatic feelings that can be conscious on top of the non-conscious forms of physiological control. So the main addition Damasio made to homeostasis theories is feelings. We must comprehend homeostatic sensations and how they work since they can begin to act as homeostatic guides.

It is becoming increasingly clear in neuroscience that the body's homeostasis and emotional response are relevant to our brain's functioning but difficult to incorporate into the design domains; therefore, this work presents potential as a path of research inquiry. This paper suggests that design might serve as an illustration of such a controlling mechanism. It raises questions such as: how the Theory of Homeostasis might contribute to understanding perception in design? To what extent might design be seen as an extension of ourselves, acting as psychic stabilizers or destabilizers? How might design play a role in the concept of homeostasis or allostasis? Neuroscience is beginning to show the importance of the body's homeostasis and emotions; however, applying this knowledge to design domains is challenging. This essay provides a chance to conduct the study. Understanding how homeostasis affects the built environment can be insightful for design thinking.

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Contact email: andrea.macruz@uol.com.br

Sustainability, Aesthetics, and Value Proposals and Practices of Colombian Slow Fashion Brands

Daniela Ordoñez-Suárez, Industrial University of Santander, Colombia
Miguel Enrique Higuera-Marín, Industrial University of Santander, Colombia
Carolina Raigoza-Díaz, Industrial University of Santander, Colombia

Abstract

The Slow Fashion model emerged as a sustainable approach in the fashion industry through characteristics like localism, equity, authenticity, exclusivity, and functionality. The objective of this study was to identify proposals, and practices of Colombian brands, in terms of brand identity, aesthetics and timelessness, sustainability, and communication strategies. For this purpose, we chose a qualitative approach by observation and analysis of the information that brands provide on their social networks and official websites. The study included 38 Colombian slow fashion brands of women's casual-wear clothing, and whose prices do not exceed US$90. The results include aesthetic proposals inspired by visual elements of the country's flagship cities, as well as the construction of a style brand identity through artistic expressions and collaborations with Colombian illustrators for their prints. Aesthetics meets social sustainability by applying manual and artisanal techniques together with indigenous and artisan communities, and mothers who are heads of households. Also, these strategies provide a timeless character due to their cultural recognition. On the other hand, environmental sustainability is approached from technical factors such as the material, and the management and use of textile waste. Overall, this study allowed us to identify the diversity of approaches influenced by the sociocultural context of the brands, in addition to visualizing opportunities for the intervention of the design discipline in the strategies for communication of the value proposition. Further research could analyze local consumers' perceptions, needs, and criteria to opt for purchasing Slow Fashion brands.

Keywords: Slow Fashion, Design, Colombia, Timelessness, Brand Identity

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Introduction

The fashion industry has sought to reinvent its models and practices to minimize the environmental and social impact that has cataloged it as the second most polluting on the planet (Villeiman, 2019). For this reason, the Slow Fashion movement arises, which despite the literal meaning of the term does not exactly refer to speed. This movement implies a philosophy of meeting the needs of stakeholders and promoting variety in practices for production and consumption. Likewise, slow fashion contemplates values such as transparency, awareness, and concern for the impact that the industry or brands can generate on resources, allies, and communities (Fletcher, 2008). This means an opportunity to design diverse products that blend with experiences, rather than globalized styles that can be perceived as standardized (Fletcher, 2010).

So then, Slow Fashion according to Jung & Jin, (2014), is based on five pillars: equity, authenticity, exclusivity, functionality, and localism. The equity seeks to make the products affordable for all users under fair working conditions for the employees. Authenticity involves the use of artisanal and high-quality processes that print a character of exclusivity and a high emotional value. This, combined with localism, implies support for local businesses and the use of resources from the region. Finally, functionality is related to the design of useful, versatile, and durable products, which provide a positive use experience.

In Colombia, the fashion industry is a very important sector of the economy. The fashion system encompasses approximately 14000 companies, which include raw material production and clothing. In addition, by January 2022, Colombian households invested about COP \$2.38 billion in fashion products such as clothing, accessories, and footwear. Export figures for these items reached US\$583 million by 2021 and are projected to reach US\$602 million by 2022 (INEXMODA et al., 2022). This shows the potential of the Colombian fashion industry to configure products and business models, as well as to propose strategies for sustainability and responsibility in the sector.

Additionally, the fashion system in Colombia employs around 600,000 people, among whom are women heads of household. Also, most of the workers and artisans have their workshops in their homes (Marca País Colombia, 2020). In fact, 80% of the garments of Colombian brands are produced locally in these satellite workshops in which up to two thousand products are made every week (Fashion Revolution, 2022).

That's why, various national brands and designers have chosen to join Slow Fashion and models for the circular economy, to respond to the needs of the environment, the consumer, and the industry (PROCOLOMBIA, 2021). This is through proposals and innovation that include the choice of materials or textiles recovered or of less impact, the use of manual techniques, short production series, or initiatives to motivate the consumption of national products. One of them is *Vístete de Colombia* (Dress up in Colombia), which seeks to support more than one and a half million people who work in the country's Fashion System. Thus, it brings together more than 590 Colombian brands and designers who are supported through the exhibition, interaction, and training. Additionally, this collective includes artisan communities that benefit by allowing them to profit from their products through alliances and exhibition or dissemination of their work (Vístete de Colombia, 2020).

The concept of Slow Fashion is based on sustainability and social responsibility. In addition, it usually includes in its practices and policies the use of environmentally friendly fibers and textiles, innovation in production processes to reduce waste and encourage more responsible consumption (Pookulangara & Shephard, 2013). Since this is an emerging and diverse movement, studies have been carried out to provide a clear definition, concerning other concepts such as ecological fashion or corporate social responsibility. Thus, it must be seen from a holistic perspective and not only from the point of view of the frequencies and quantities of production, costs, and the use of classics.

The philosophy of the Slow Fashion model is oriented to a small to medium scale production, to the generation of confidence in the consumer, to provide the opportunity to the user to express their style and individuality, as well as to take advantage of the diversity in the design proposals and to promote localism (Fletcher & Grose, 2012). This last factor is crucial to understand the strategies and dynamics of this movement, given the differences in which each context addresses and configures its proposals. The sociocultural text exerts influence on the criteria and habits of purchase, in addition to the interpretation of symbols (Chapman, 2021). Additionally, each country has its aesthetic expressions and knowledge of traditional crafts that represent resources for the configuration of products and their experiences.

Therefore, this study had the purpose of identifying proposals, models, or practices of Colombian brands such as Slow Fashion. This is in terms of brand identity, aesthetic proposals, timelessness, strategies for sustainability, and communication and interaction with the community. To do this, a qualitative approach was used through the observation of the statements and contents that these brands share through their digital channels like social networks and official websites. The visualization of these aspects can guide the work of design around the configuration of business models, practices, and strategies of interaction, design, and sustainability. In addition, to identify a new possibility for research around sustainability in fashion, Slow Fashion, and the role of the consumer.

Materials and methods

Social networks and digital platforms play a very important role in the interaction with the consumer and in their experience with brands and products. The content displayed through these channels and the possibility of interconnection and globalization exert an influence on interests and purchasing decisions (Chapman, 2021). E-commerce has represented an increasingly used channel for sales in Colombia, and clothing is one of the best-selling categories by this medium (BlakSip, 2020). Through a qualitative approach, we proceeded to observe the statements, descriptions, and audiovisual content of a public nature shared through social networks like Facebook and Instagram, as well as on official websites and virtual stores.

In total, 38 brands of women's clothing, cataloged as Slow Fashion with origin and operation in Colombia were included. These brands design and produce their garments and include in their portfolio the universe of Casual-Wear clothing. This is characterized by its versatility, freedom, and comfort for the development of different activities amid different climatic conditions and scenarios of use (Cooper et al., 2013). Therefore, it is one of the favorites among consumers and provide various possibilities considering the different climates throughout the national territory. Of these, 23 have a face-to-face point of sale, and the remaining 15 carry out their commercial activity purely digitally. In addition, 18 of the

brands have coverage for domestic shipments and the others market their products internationally.

The aspects that were investigated were, in the first place, the description of the brand identity. According to Orozco & Ferré Pavia, (2012), brand DNA includes the conceptualization of individuality or the differential factor, brand objectives and values, as well as value proposition. Next, the characteristics of the products marketed were studied, such as the description of the type of materials used, conceptualization, aesthetic identity, trends, and timelessness. In terms of sustainability, content referring to both environmental and social sustainability was sought, considering the description of processes and materials, as well as their relationship with stakeholders. Likewise, the existence of additional services to the commercialization of clothing was analyzed, such as personalization or recovery of materials; as well as approaches and campaigns for the invitation to responsible consumption and use; and communication and interaction strategies with the consumer. This is to identify the different proposals of processes, practices, and strategies of the brands around Slow Fashion, and their values. The aspects included in each of these factors are described below in Figure 1.

Brydges, (2018); and Legere & Kang, (2020) mention timelessness as a strategy to raise the value perceived by customers in the cost-benefit ratio, since a greater investment in a garment with a longer life expectancy could contribute to the motivation of customers to buy responsibly and to be more interested in movements such as slow and sustainable fashion. It should be noted that this concept is still considered ambiguous and many of the characteristics considered timeless fall on the perception of users. Even though design and timeless aesthetics are commonly related to minimalism and the classic, it still lacks a definition of design codes for it. However, as cited in Pin & Shin, (2020), there are four established timeless design strategies like simple appearance, product efficiency by removing unnecessary elements, selection of durable materials, and, the generation of a pleasant user experience. In this sense, this study analyzed the approach and the proposal of the timelessness of the brands from the aesthetic and emotional attributes, the description of the role of trends during the conceptualization of garments, the product portfolio, and the creation of experiences for the consumer.
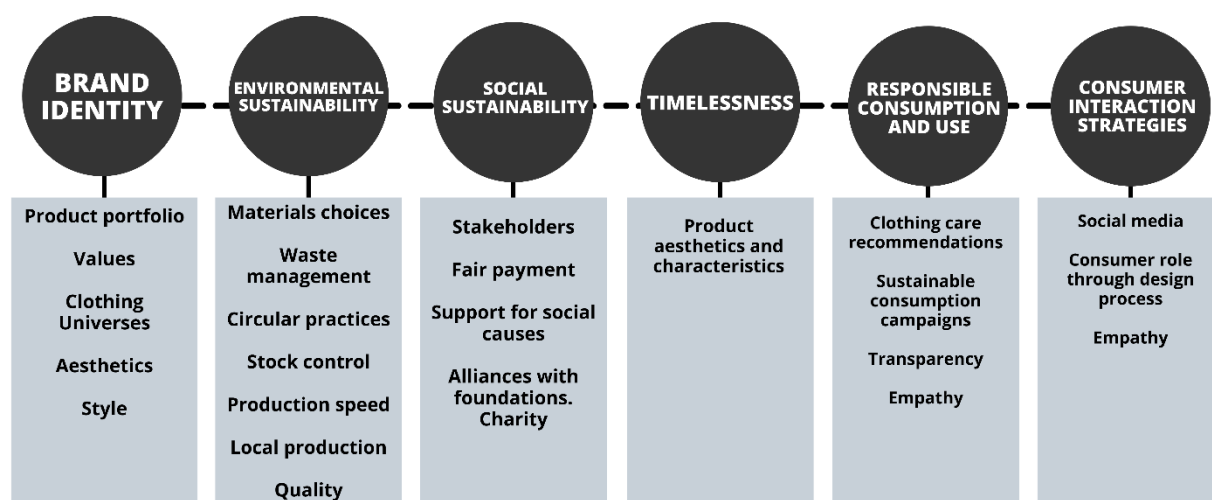

Figure 1: Aspects for which it was investigated[1]

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[1] *Source: own elaboration*

Results

The brands studied propose a wide diversity in terms of product typology, wardrobe style, and practices to address environmental and social sustainability. In the first place, several of these companies offer in their product portfolio different universes of clothing with different purposes of use, like casual, comfy, or formal wear. Others specialize in certain types of pieces like dresses or urban garments. In addition, the target audience included in these brands corresponds to several types of consumer profiles, such as male users, children, or unisex garments, who are usually of legal age and are allowed to decide their purchase habits.

It is noteworthy that digital channels, especially social networks, are crucial for commercial activity and the communication of brand practices and attributes of their products. However, not all of them make specific statements about their brand values, collaborators, or suppliers. Despite this, environmental and social sustainability is a criterion repeatedly mentioned as one of the main objectives of these business proposals. In addition, localism in terms of production, origin, and impact of its employees and raw materials is highlighted as part of the values of garments, as well as a way for social sustainability and the invitation to responsible consumption.

Brand identity

First, it was observed that the values and foundations of the identity of the brands studied revolve around sustainability, localism or declaration of origin and national operation, timelessness, and exclusivity. Sustainability and localism are related to other concepts like social and environmental responsibility, which are combined with proposals based on the exclusivity of manual and artisanal work, as well as on an aesthetic and design inspired by the natural, cultural and climatic diversity of the country. This is how brand concepts oriented to comfort, freshness, and rest arise, with design codes inspired by a holiday environment, or a minimalist and natural lifestyle, which in turn seeks to enhance the value of clothing, design, and national techniques.

On the other hand, several of these brands seek to make visible causes and social movements such as equality and inclusion. Feminism and female empowerment are frequently mentioned within the brand identity through campaigns, graphic elements in communication channels and garments, as well as in the inspiration concepts of collections, within which you can find tributes to influential women and representatives of these causes.

Finally, the quality and functionality of the products are highlighted as values and value propositions of the brands. This, through a detailed confection and with textiles of high durability, which are used in timeless, versatile, and functional designs, under the premise of lasting over time and being suitable for the different activities and occasions of the day to day. The values and attributes that were identified in the observation are illustrated in Figure 2.

Figure 2: Brand identity and attributes

Sustainability strategies

Sustainability is approached from its social and environmental pillars, although not all the brands studied specify strategies for both approaches. The efforts identified are more oriented to the environmental component through different practices like the use of materials and processes of lower impact, circular economy, responsible consumption, sustainable marketing, and alliances for the protection of fauna and flora. The social component is included in the 38 brands through fair hiring and local production. Additionally, other of these brands choose to partner with different organizations in favor of the well-being of communities in Colombia.

The most recurrent strategy for the social sustainability of these brands is the use of ecological materials. Eighteen of these brands produce their garments with natural or biodegradable fibers such as cotton, linen, hemp, or even banana fiber. The latter is used by one of the brands to reinforce its concept of the collection inspired by the banana plantations of Colombia which in turn looks for highlighting the values of the country such as its biodiversity and culture. For this, the brand generated an alliance with a sustainable textile company that is dedicated to recovering the waste of banana trees in Colombia, while generating employment for farmers in the region.

Fourteen brands opt for the circular economy by using materials derived from consumer waste such as PET, recovered and processed textile fibers, which can be synthetic or natural such as cotton. On the other hand, thirteen of the brands use synthetic materials such as polyester under the premise of quality and durability. Sometimes, durable materials are used exclusively in basic, classic, or wardrobe bottom garments, with the aim that they can be used for an extended time due to their functionality, while the natural fibers are chosen for fashion garments or with greater detail in their preparation.

The circular economy is present in five of the brands through the upcycling technique. One of them bases its identity and value proposition on this alternative in alliance with other clothing and textile companies to reuse materials considered waste like scrap or damaged products. Three of them make use of the material waste of their own in production to design and make exclusive or limited-edition garments, or, for the realization of elements such as labels, belts, or buttons. Likewise, these materials are donated to other emerging local brands which produce accessories to support their commercial activity. Another brand recovers garments that users have in disuse to intervene them from the dyeing and printing with natural elements, either to extend their use by the owner of the garment, or, for resale directly from the brand. Likewise, there is the practice of granting incentives such as discounts to consumers who donate or return their disused garments, either for recycling, donation, or intervention.

In respect of processes, the 38 brands allude to slow production and stock control to avoid greater use of resources and generation of waste. To do this, we opt for a production model on request or short series for each reference, which contributes to the construction of the exclusivity attribute. Additionally, these practices are combined with timelessness and quality to offer durable products on a smaller scale and durability, to slow down the productive practices of the fashion system in general.

Additionally, dyeing, and stamping processes are approached in a way that consumes as little water as possible and produces less pollution in the soil and water sources. Therefore, digital stamping techniques are used to allow brands to design their own prints under conditions of less impact and with the capacity for series production. Minimalism-based brands choose to maintain the natural qualities of the textiles they use, especially when it comes to organic fibers, or, to use manual techniques that takes advantage of natural elements for dyeing. This is the case of two of the brand proposals, whose concepts of value proposition are natural inspiration, through the use of natural dyes from plants, oxidized pieces, and even organic waste and kitchen spices like turmeric. This in turn uses natural fiber textiles and rainwater collection for the process that seeks to reduce water consume.

Manual and artisanal processes are repeatedly mentioned in both environmental and social sustainability strategies. From the environmental point of view, it essentially seeks to reduce energy use and avoid mass production, as well as to guarantee the quality and control of clothing. These include weaving on a loom, manual embroidery on yarn, mustache or gimp, block printing for printing, knitting, macramé, or Wayuu. These techniques are combined with social sustainability by working together with indigenous communities, artisans, mothers heads of households, and even former combatants of armed groups, especially the FARC. In this sense, most brands that communicate social strategies highlight the value of localism by employing artisans and collaborators from their region.

Part of the artisan communities are from regions such as Santander, La Guajira, Cundinamarca, and Risaralda, which know traditional weaving techniques and motifs and the transformation of natural fibers such as fique. The participation of these actors allows to make visible and recognize the work of these groups, and to print these design codes in new garments that have the attributes of exclusivity and timelessness, associated with cultural and symbolic elements. Likewise, one of these brands is dedicated to working with former combatants of the FARC armed forces, linked to a cooperative in favor of supporting the reintegration into civilian life after the Peace Agreements in Colombia. This brand is based on the slow and local production model and aims to give visibility to the Agreements and

their impact on people who now seek to orient their life projects to the Fashion System. In addition, they design aesthetic elements such as prints with political content for demonstrating its support and defense of the Peace Accords, through techniques such as screen printing.

These brands with a social focus make emphasis on fair and ethical hiring conditions in terms of salaries, cultural recognition and transparency with the audience. Three of these brands are part of the Fashion Revolution collective that seeks to make visible the collaborators responsible to produce the garments under the I Made Your Clothes emblem. In addition, two of these brands include internships to support the ventures of their employees through training in technical and professional studies, or investment support for their workshops and businesses.

On the other hand, sixteen of the brands describe alliances with academic entities, foundations, artists, or other local brands. This to contribute to social and environmental causes through donations and destination of profits, providing visibility and promotion to emerging brands, promoting environments and co-creation activities. In environmental terms, twelve of these brands have allies for research and consumers around sustainability in the fashion industry. This is through studies of the environmental impacts of the productive practices of the brands, as well as strategies for their mitigation from manufacturing and consumption. Others provide financial support to foundations or institutions dedicated to the preservation of ecosystems such as the Amazon rainforest or the Colombian paramos, which are crucial in the country's water supply. Others allocate profits derived from collections designed in conjunction with conservation entities of species such as the tigrillo. One of these strategies includes directing a percentage of garment resale profits that users return to the brand to reforestation activities.

The social alliances observed in eleven of these brands include work with foundations and emerging brands. These include two aimed at supporting ex-combatants, one directly as described above, and the second through the allocation of profits. Others provide financial support to institutions for the protection of territory and ancestral knowledge, as well as the provision of services to indigenous communities and children in Colombia. On the other hand, collaborations with local brands of greater and lesser scale, as well as graphic artists and illustrators seek to print emotional values such as the exclusivity of limited editions, as well as support for national talent through exposure to the public.

Finally, participation in collectives and movements for inclusion, diversity, and female empowerment is enunciated by three of these brands with a social focus. These include participation in workshops and conferences in which there are expert and influential personalities in these movements. Likewise, one of these brands directs its social efforts to support mental health through donations and financial support.

Timelessness

Timelessness is an attribute addressed by the 38 brands observed from different approaches such as differentiation in the portfolio of products (wardrobe basics and fashion pieces), minimalism, exclusivity or limited editions, artistic interventions, recognizable and exclusive aesthetic identity of the brand, and the application of Colombian artisanal or ancestral techniques. Thirty-four of the brands describe their proposal of timelessness from very diverse design codes and with different objectives.

First, the minimalism addressed by eight of the brands is based on the use of design codes such as wide silhouettes, solid and neutral colors, as well as pastels and earthy, which avoid the use of additional elements such as closures, flights, belts, or closures. It is related to comfort as a fundamental part of the functionality of the garments, under the purposes of designing garments suitable for different body types, versatile at occasions and scenarios of use, and that provides freedom of movement and freshness. One of these brands, for example, bases its proposal on the design of silhouettes, prints, and campaigns on the concept of vacations for each day. To do this, it uses as some tourist sites in the country such as the Caribbean region as inspiration to configure silhouettes suitable for a time of enjoyment in that location, as well as graphic elements such as fauna, flora, architecture, and culture, which will be used in the creation of figurative prints.

Later, there are the classics or wardrobe basics, which are versatile garments widely known and used, such as jeans or leather jackets. In this sense, timelessness is built from nostalgia and retro aesthetics, offering silhouettes recognized by users as from times of yesteryear, with the use of colors, materials, and prints that represent the character of topicality. Likewise, one of the brands declares a differentiation in the product portfolio, maintaining in its permanent stock basic garments made with high quality durable materials. In addition, multifunctionality is addressed through the freedom of assembly and use of garments, and two of the brands go back to double-sided garments. One of these brands proposes its timelessness through pattern making that allows adapting to different sizes, in such a way that it can be used despite changes in the size of the user.

Another focus is on the construction of an aesthetic identity or recognizable style. This involves the construction of design codes that are repeatedly included in the design of garments and that identifies them as part of the brand, and, to its consumer, as part of a community. Some of these elements are both abstract and figurative prints and manual techniques. The conceptualization of these prints includes Storytelling and inspiration from indigenous elements of Colombia such as the representation of Palenquera communities, indigenous, and aspects of popular culture. It also alludes to species of animals and plants native to the country such as birds or the wax palm or even, issues of empowerment, inclusion, unisex garments, and political issues. Part of the added value of these aesthetic attributes is the artistic and exclusive value when performed by the creative directors of the brand, or, in collaboration with recognized and emerging artists and illustrators from the country who identify with the concept of the brand. These are combined with flagship garments that allow the positioning of these companies and that are relaunched with variations in colors and prints.

Services

Of the 38 brands included, four offer additional services to the marketing of garments and the guarantee. These are essentially around personalization and mass customization. In one of the cases, the brand offers a basic silhouette of reference, which the consumer can intervene when choosing between various options of print, color, texture, or material, as well as the arrangement of these elements in the garment. In the remaining three, this customization corresponds to the size under the model of production on the measure. However, no concepts of co-creation with the consumer were identified in terms of aesthetics and clothing.

Communication strategies and interaction with the public

Together, social networks represent the main channel of interaction and dissemination of information about these brands. Through them, audiovisual content is shared to communicate the identity of the brand and its collections, style and advertising guides, phrases, and content alluding to support for causes and social movements, as well as transparency and visibility of processes and stakeholders. The official websites are used by the 38 brands to describe their products and carry out marketing processes. However, eight of them do not make use of this channel to communicate their concept and brand identity, or information about their processes and collaborators.

In terms of responsible consumption and use, these brands make general or specific recommendations for care and maintenance. Eight of them seek to motivate their audience towards awareness of the impact of consumption habits on the environment. Therefore, they propose campaigns in favor of recycling, extended use, or recovery of garments for reuse. One of these refers to conscious consumption directly inviting users to establish purchasing criteria such as the underlying processes and their impact, materials, durability, and the role that the garment will have in their wardrobe, so that it is used for a considerable time, to raise awareness about the generation of waste and accelerated or impulsive consumption.

Additionally, eighteen of these brands inform the consumer about the impact of the production processes of the fashion industry on the environment and society. Likewise, they communicate the actions undertaken with the purpose of contributing in a positive way to the communities and the mitigation of climate change. Three brands submit periodic reports through their official websites through blogs or manifestos on the reduction of resource consumption and waste generation, or the goals achieved through collaborations for social causes. Through these, it seeks to achieve transparency with the consumer, while making visible these criteria that represent an added value in brands.

Finally, brands use blogs to share information about lifestyle (recommendations, brands, products, and habits), according to their concept. These include recommendations for sustainable habits such as care and washing of clothes, reuse of waste from consumption or recycling, as well as instructions and campaigns for planting plants in association with reforestation. One of these brands seeks to make visible emblematic places of Colombia to motivate ecotourism and highlight the importance of the country's natural treasures for their care and conservation.

Conclusions

The present study allowed us to identify, in the first place, the emphasis of Slow Fashion brands on actions for environmental and social sustainability. This is shown repeatedly in the brand identity, description of products, production strategies and services, as well as interaction with other actors such as brands, suppliers, and consumers. The proposals for timelessness are varied and correspond to the identity, capacity, and objectives of each of the brands. For this reason, a subsequent study could investigate consumers' considerations around the aesthetics of timeless design, considering the diversity of styles and universes of clothing, as well as the climates of the regions of Colombia. In addition, to identify the attributes and purchasing criteria of Colombian consumers when deciding, or not, to buy from a certain brand such as Slow Fashion. These aspects could mean inputs for product

design, processes, and communication strategies in favor of transparency and customer loyalty.

Given the limitation of the study due to the lack of access to information on several of the brands, a joint investigation could be carried out with these actors around the challenges and values of the brands, in addition to the characteristics they have identified of consumers in the Colombian context. This is to configure strategies that strengthen the practices and visibility of Slow Fashion in Colombia, to contribute to sustainability in the country's fashion system.

Finally, it was observed that the services offered for personalization are not explored by most of the brands studied. Thus, an opportunity was identified for the design of services around techniques already applied by brands such as restoration, repair, or remodeling (upcycling). This is from the fundamentals of Slow Fashion and the needs of the fashion consumer in Colombia.

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Contact email: daniela2208478@correo.uis.edu.co

The Cognitive Effect of Spatial Contiguity in Procedural Training Using Mixed Reality

Sara Gutiérrez, Industrial University of Santander, Colombia
Luis Bautista, Industrial University of Santander, Colombia
Fernanda Maradei, Industrial University of Santander, Colombia
Julián Núñez, Industrial University of Santander, Colombia

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Abstract
New technologies such as Mixed Reality (MR) are often used in procedural training to provide information to the trainee. When a trainee is faced with a visual scene with learning material, MR shows the information as a set of visual and/or auditory resources. Thus, the apprentice must perceive which resources are directly associated with the task to be executed. For this, the visual attention guide components are important, which have an impact on the improvement of information processing and on the optimization of cognitive resources. The objective of this study is to determine the cognitive effect of one of the visual attention techniques called Spatial Contiguity on students engaged in a procedural training scenario using Mixed Reality. Through a systematic literature review (SLR), related to the use of graphical user interfaces visual elements or techniques to guide visual attention in training, it was found that there are certain techniques of visual elements that guide the user's attention. Spatial contiguity, color codification, movement, and blinking are the most used. In organizing observed information, cognitive processes beyond attention influence the direction and duration of eye movements; because of this to analyze visual attention processes in the study Eye-tracking is implemented, which is a tool used to record the eye movements of subjects while they perform tasks, this allowed to measure cognitive processing of stimuli from learning materials presented. Statistically significant differences are expected to be found in measures of cognitive processing, based on different forms of spatial contiguity presentations.

Keywords: Spatial Contiguity, Procedural Training, Mixed Reality, Cognitive Load, Eye Tracking

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1.   Introduction

Learning involves a cognitive process in which an individual obtains and puts into practice knowledge [1] and procedural training refers to the training of how to perform a specific skill or task, and is considered knowledge related to methods, procedures, or operation of equipment [2], in relation to this, cognitive load measures have been shown to be an important factor in establishing a relationship between the learning performance of students and cognitive load as an indicator of their mental efforts. Eye-tracking data provides information about eye movements, the areas where people focus their attention, the information they ignore, and the objects that bother them [3]. The purpose of the developed experiment is to determine the cognitive effect of spatial contiguity in procedural training using mixed reality (MR) based on cognitive processing measures of the student during a learning activity through the implementation of the principle of multimedia learning design: Spatial Contiguity [4], showing the presentation of learning material through graphics and text which are separated from each other within the visual field of 27°, 45°, 60° or 75°; this by using Eye-Tracking.

The experiment is based on comparing four groups of four participants each who learned with knee anatomy material for taking direct measures of cognitive processing, such as the duration of fixation, the number of fixations and saccade velocity. For this study, we start from the assumption analyzed by Johnson and Mayer [5], where it is indicated that the principle of spatial contiguity establishes that people learn better when the corresponding words and images are presented close to each other instead of far from each other in the visual scene observed by the student. Therefore, it is inferred that the cognitive processing measures will show a statistically significant difference for the material shown through different separation between the graphic and the text in the procedural training, in turn, the objective measures of cognitive processing will be lower for the material presented in a contiguous configuration. The results showed, first, for the objective measure of the number of fixations lower values for the learning material presented with discontiguous content and for the objective measure of total time of the task development, higher values for the learning material presented with discontiguous content, and second, for the measurements of the duration of fixations and saccade velocity, lower values for learning material presented with contiguous content.

2.   Theoretical background

2.1   Cognitive load

It refers to the resources used by working memory and that affect the student while performing a cognitive task [6][7]. According to cognitive load theory (CLT), there are three types of cognitive load that interfere with learning: (a) intrinsic load caused by the inherent complexity of instructional information, (b) germane load directly related to schema construction and automation, and (c) extraneous load caused by instructional elements that are unnecessary for learning [8]. The intrinsic and extraneous load are additive, together they determine the total cognitive load imposed by the learning material, which determines the working memory resources necessary to process the information. Currently, researchers and professionals of visual computing want to reduce the extraneous cognitive load so that most of the working memory resources can be dedicated to learning through the correct design of instructional material [5].

2.2   Mixed Reality in procedural training

In the article "What Is Mixed Reality, Anyway? Considering the Boundaries of Mixed Reality in the Context of Robots", the authors refer to MR as an application of human-computer interaction to combine virtual and real-world elements [9]. Likewise, Melanie J. Maas and Janette M. Hughes in their bibliographic review "Virtual, augmented and mixed reality in K–12 education: a review of the literature" comment that MRI allows to offer a means to incorporate the complete body with real elements and virtual through the continuum of reality [10], additionally, Enrico Costanza, Andreas Kuns and Morten Fjeld mention that MR systems are designed in such a way that they give users the illusion that digital elements they are in the same space as physicists [11].

Due to the technological development that has been presented today, MR applications are increasingly implemented in human-machine interfaces, education and training. In the document "Mixed Reality in Learning Factories" [12], the authors comment that the use of RM can improve the delivery of knowledge and skills, since it helps to understand processes, data, methods and systems. The implementation of this technology favors production processes due to increased productivity, reduced downtime and improved employee safety [13]. Additionally, another field in which valuable advances have been made is in medicine, especially in surgical training, as for example in an implementation carried out in the Department of Orthopedics at Tongji University, Sahngai, China, whose findings can be seen in the document "Mixed Reality-Based Preoperative Planning for Training of Percutaneous Transforaminal Endoscopic Discectomy: A Feasibility Study" [14], where the objective was to explore the effect of preoperative planning using MR in training of percutaneous transforaminal endoscopic discectomy, the researchers concluded that an effective and repeatable training method was needed to help inexperienced surgeons, so they relied on MR technology.

2.3   Evaluation of cognitive load using Eye-Tracking

Objective cognitive load measurement methods are of great importance for research on learning, since they measure cognitive load while it occurs [15], that is, while the participant is observing the stimulus, they do not present interruption in the learning processes for the assessment of cognitive activity and load. One of the objective methods for evaluating cognitive load is Eye-Tracking, which focuses on capturing eye movements [16]. Eye-Tracking allows for very detailed analysis, as it provides a deep insight into the processing of human information regarding the allocation of visual attention and cognitive activity in the process and integration of learning information presented in text or image [15].

2.4   Measurement of cognitive load using Eye-Tracking

Eye-Tracking allows the identification of fixations, saccades, pupil dilation and blinking. These movements provide evidence of voluntary and open visual attention, because the goal of eye movement measurement and analysis is to obtain information about the attentive behavior of the viewer [17]. However, this study will focus on the analysis of fixations and saccades, as these are the basic unit of data for most Eye-Tracking analyzes [18]. The increase in fixation duration, the number of fixations and saccade velocity show a higher level of cognitive load, which indicates a greater effort in processing the learning material and greater attention resources [19].

2.4.1 Fixations

They are voluntary movements and correspond to a focused state in which the eye remains immobile for a period of time, lasting from 200-300 milliseconds to several seconds. The number of fixations indicates the number of times a user looked at a given area of the stimulus. Duration of fixation has been related to the level of cognitive processing with a high duration of fixation indicating greater tension on working memory [20].

2.5 Spatial Contiguity Principle

Spatial Contiguity Principle indicates that students learn better when the corresponding words and pictures are presented close to each other than when they are presented far from each other, since students do not have to use cognitive resources to do a large visual search in the scene and are more likely to be retain the information presented in the working memory at the moment [4]. The learning material can be presented in different ways, one of them is a version with integrated content or contiguous, in which the words and images are presented as close as possible or guiding the student from the text to the graphic or vice versa, so that encourages students to build mental connections with each other. Students do not have to search to find a graphic that corresponds to displayed text; therefore, they can dedicate their cognitive resources to active learning processes, including building connections between words and pictures. In a presentation with discontiguous or non-integrated content, words and images are far from each other in the scene, as when text appears in a section of the visual scene and graphic in a separate section. Therefore, it is inferred that when estimating cognitive processing measures using Eye-Tracking for material presented with contiguous content, these will be lower than for material with discontiguous content [5].

In relation to the additional configurations, a study carried out by Ramona E. Su y Brian P. Bailey [21] will be taken into account, who studied different screen configurations and how the physical separation between screens affected performance, subjective workload and satisfaction, in the study carried out, they reached the conclusion that the screens should be placed at an angle of 45 ° or less to each other, as this allows the user to see the screens more easily, so for the proposed study, it will be taken into account for the contiguous presentation configuration at most a width of 45° of separation between the graphic information and the text, and as discontiguous a maximum width of 75°.

3. Method

3.1 Ethical Implications

The study requires participants to use a head-mounted Eye-Tracking device and a Mixed Reality Glasses (Hololens 2), however it is considered non-invasive and the risk to participants is classified as minimal. Each participant received and signed an informed consent document. To preserve the confidentiality of the information, they were previously identified with coded serial numbers.

3.2 Experiment

An experimental design was developed, and the elements can be observed in Table 1. The presentation of the learning material was done through the Hololens 2 and the capture of

cognitive load data using Eye-Tracking was proposed in a controlled environment, where the participants were randomly assigned a learning material with a type of content, in order to measure the load cognitive and make a comparison between the four ways of presenting the learning material.

Participants	16 participants (9 female and 7 male)
Taks	Procedural training activity about the anatomy of the knee
Stimuli	Random assignment of stimuli with different separation: 27°, 45°, 60 and 75°
Independent Variables	- Procedural learning activity with 27° separation between graphics and text. - Procedural learning activity with 45° separation between graphics and text. - Procedural learning activity with 60° separation between graphics and text. - Procedural learning activity with 75° separation between graphics and text.
Dependent Variables	Eye-Tracking metrics: fixation duration.

Table 1: Experiment Design

The proposed study was established as a quasi-experimental research project, it is a prospective, cross-sectional study, and finally, it is proposed with a descriptive scope.

3.3   Apparatus

A setup was determined on a MR glasses (Hololens 2) shown in the Figure 1 to display the stimulus as the Eye-Tracking data was captured. A head-mounted ocular tracker SMI shown in the Figure 2 was used, implemented to allow free mobility of the participants. SMI software was used to set up the experiment and compile the results: Experiment Center and BeGazeTM 3.7.

Figure 1: Microsoft Hololens 2

Figure 2: SMI Eye-tracking Glasses

3.4   Participants

This study was developed with volunteer participants who had no experience or knowledge related to the capture of measures for the evaluation of cognitive load through Eye-Tracking. In total, 16 participants, 9 female and 7 male subjects between the ages of 18 and 30 participated, who participated under the same environmental conditions.

3.5   Stimuli

In this study, four stimuli were used which present the learning material in four different forms, where information is provided about the   knee and how the perforations of the portals are made to introduce the tools during an arthroscopic intervention of knee. In the first stimulus, the graphic information is separated from the text by 27° of amplitude in the visual field, in the second the separation is 45°, in the third it is 60° and finally in the fourth it is 75°. The learning material shown can be observed below in the Figure 3.
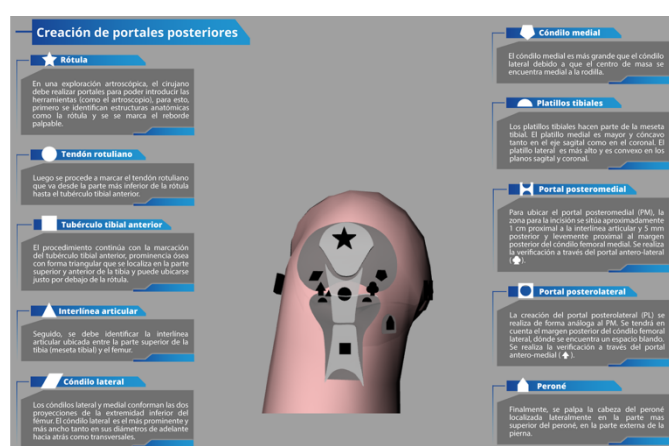
Figure 3: Procedural training activity about the anatomy of the knee

3.6   Procedure

Before the development of the test, each participant is informed about the risks and conditions of the test, and later they were asked to complete a survey about previous knowledge on the learning topic, through a Likert scale, where the score of "1" referred to not having knowledge at all with the subject, and "5" having a lot of knowledge about the subject. For this pretest, all of the participants affirmed not having knowledge related to the subject of the learning material. During the development of the test, the participant puts on the MR and SMI glasses and the Eye-Tracking system is calibrated; later, the participant is located in front of real knee model where the 3D information is superimposed, where the stimulus assigned in a random way is shown and the Eye-Tracking data is captured while the participant performs the recognition of the stimulus. The participants did not receive any type of financial reward and took part in the study freely and voluntarily. Below in Figure 4, a participant is shown taking the test.

Figure 4: Participant taking the test

3.7   Hyphotesis

For the hypothesis below, the variables mentioned in Table 1 were taken into account.

•H1: There is a significant difference in the fixation duration and saccade velocity for the learning material presented with different forms of spatial contiguity presentations.

3.8   Definition of variables

3.8.1   Independent Variables

As mentioned above, four presentations are used with learning material, in the first presentation, the graphic information is separated from the text by 27° of amplitude in the visual field, in the second the separation is 45°, in the third it is 60° and finally in the fourth it is 75°.

3.8.2   Dependent Variables

•Duration of fixations: Time in which the participant focuses the eye and it remains immobile.

4.   Data analysis and results

The experimental design is considered as unifactorial, since it aims to study the influence of the independent variable on the response variable. The equation Yi presents the model.

$$Y_i = \mu + \tau_i + \varepsilon_i$$

4.1   Descriptive analysis

By general inspection of the data, the results shown in Table 2 are observed.

Stimuli	Average of Duration of fixations [s]
27	0,270
45	0,277
60	0,280
75	0,277

Table 2: Experiment data

An analysis of descriptive statistics related to the duration of the fixations was developed, where it can be observed that the mean measure is greater for the learning material displayed in 60° with a value of 0.28[s] compared to the value obtained for the material displayed in 27° of 0.27 [s], which indicates that the longer the fixations last, there will be a greater effort on the working memory for the 60° configuration. According to the data obtained, it can be inferred that the visualization of discontiguous content could generate greater effort on working memory, as well as greater difficulty in the task.

4.2 Statistical analysis

4.2.1 Durations of Fixations

A normality test of the data of Duration of Fixations was developed, for this a Shapiro- Wilk normality test was executed, for which the following statistical hypotheses are established:

• H0: The distribution of the data is normal value significance p-value> 0.05
• H1: The distribution of the data is different from the normal p-value <0.05

For the analysis of the Durations of Fixations data, normality test yielded a p-value = 0.0, so H0 is rejected and H1 is accepted, which indicates that the distribution of the data it is different from normal.

Therefore, the data will be handled as non-parametric, using the Kruskal-Wallis test and establishing the following statistical hypotheses:

•H0: There are no statistically significant differences in the data p-value> 0.05
•H1: There are statistically significant differences in the data p-value <0.05

This result yields a p-value = 0.000, therefore, it is determined that there are statistically significant differences between the comparisons of pairs of stimuli. An Error Diagram of Duration of Fixations was made through visual analysis to determine which are the possible significant differences, as can be seen in Figure 5. A logarithmic curve behavior was expected but a sine curve behavior is obtained as a result, which does not show a constant behavior of error growth or decrease.
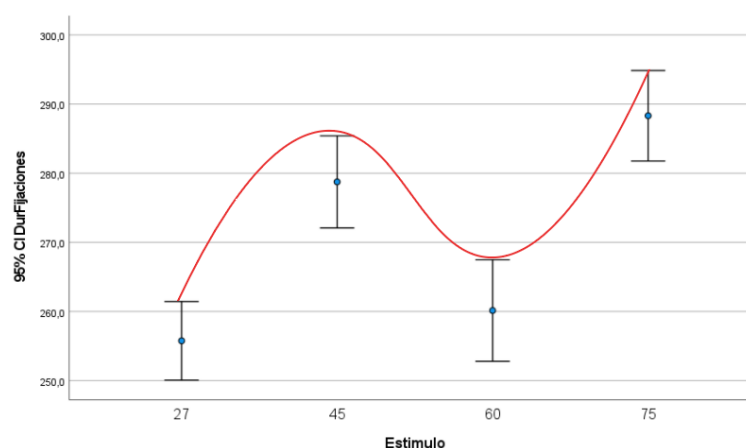
Figure 5: Error Diagram of Duration of Fixations

To determine in which of the pairwise comparisons there is a statistically significant difference, a Post-Hoc Tukey analysis was carried out. The p values obtained for each group of couples can be seen in Table 3. In the analyzed data it can be seen that the p-value <0.005 for all groups, so we can say that there are statistically significant differences between all groups.

Compared groups	p-value
60-27	0.006
60-45	0.000
60-75	0.000
27-45	<0.001
27-75	0.000
45-75	0.002

Table 3: P-value for Post-Hoc analysis of Duration of Fixations

5.   Discussion

During the development of the investigation, a study developed by M. Andrzejewska and A. Skawińska [22] was found, in which two program codes were analyzed, significant differences were found for the subjective measures of mean duration of fixation, in two experimental conditions analyzed. The results obtained showed that these values for the objective cognitive load processing measures were associated with the development time of the task, obtaining measures that signified high cognitive load in the experimental conditions that required more time for the development of the activity. Other results of a study developed by T. Zu, J. Hutson, L. C. Loschky, and N. Sanjay Rebello[23] analyzed measures based on Eye-Tracking, since it was intended to make a comparison between two forms of presentation of learning content, according to the results obtained, the percentage of time spent was the objective measure which was mainly associated with extraneous cognitive load, it was found that the percentage of time spent observing animation by students in a non-redundant condition (low cognitive load) was significantly higher than that of those in a redundant condition (high cognitive load). Which, according to the authors, means that students invest more attentional resources to observe the animation and establish connections between definitions with a non-redundant condition, instead of using a redundant condition, since in this there is little time of permanence in the animations which present the lesson demonstration.

Taking into account the approaches made, the results of the present study differ with the theories and experiments developed by Mayer, Johnson, M. Andrzejewska and A. Skawińska and T. Zu, J. Hutson, L. C. Loschky, and N. Sanjay Rebello [5][23] since the results show that the presentation that has the highest levels in the duration of the fixations was the 60° configuration, and the one that showed the lowest levels was the 27° configuration, which does not show a homogeneous behavior in the variable. In contrast, the studies cited showed a homogeneous behavior of the data is presented regarding the spatial contiguity principle, which presumably ensures that the application to multimedia material leads to cognitive processing measures that indicate a lower cognitive load, than those obtained when the spatial contiguity principle is not applied. This could be due to two aspects, firstly, the size of the sample, since this was study with 16 participants and the studies analyzed for the development of this experiment had a minimum sample of 24 participants, secondly, the nature of the activity, due to the complexity of the task, since, in the studies developed on the subject, tasks with low complexity content are presented, or related to the area of expertise of the students.

6.   Conclusion

In the study developed, there was no accurate results of the cognitive effect of spatial contiguity or evidence that the principle affected the objective measure of Duration of Fixations, that is, the presentations of the learning material, did not show exact results that indicated a homogeneous behavior of the dependent variable, since a logarithmic curve behavior was expected as a result, but a sinusoidal curve behavior is obtained as a result, which does not show a constant behavior of growth or decrease of the error. Additionally, there was no similar behavior of the variable for the treatments with a condition of closeness between graphics and text or between the pair of treatments with a condition of distance between graphics and text, which also indicates that the variable has a different behavior than previously analyzed in other studies.

7.   Limitations and future work

The experiment developed was limited by the number of participants, which would have been beneficial to have a larger datasheet. One possible alternative interpretation of the results of this study is that the heterogeneous behavior of the fixation duration variable could attributed to the demands of the task, because it was a topic with high complexity of information, that is, a learning material could have been used of which the students were not aware, but which presented simpler information. Another limitation of the study is that only one set of learning material was used (information about the anatomy of the knee), so future research is needed to determine if the findings of the cognitive processing measures continue the behavior established in the cognitive theory of multimedia learning and additionally, if the studies are generalized to other sets of learning materials.

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Contact email: sara2208474@correo.uis.edu.co
　　　　　　　　lueduba@uis.educ.co
　　　　　　　　mafermar@uis.edu.co
　　　　　　　　julian2182367@correo.uis.edu.co

Creative Strategies for the Communication of Science in a Context of Digital Hegemony: Experiencing Hands-On Visual Arts Techniques

Heitor Alvelos, University of Porto, Portugal
Najla Carolina Storck Leroy, University of Porto, Portugal
Santiago Luiz Gonçalves Mourão, University of Porto, Portugal

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Abstract

This paper points out the benefits of technical and technological revisitation as a mechanism for aesthetic and narrative improvement in the context of science communication. Through a fanzine production workshop, which served as an introduction to graphic arts, we sought to influence new strategies towards the promotion of scientific knowledge in a context of digital hegemony. The epistemological standpoint is largely based on media archeology, as a "way to investigate the new media cultures through insights from past new media" (Parikka, 2012). Two ongoing doctoral studies (in Design and Fine Arts) ensured an exploratory workshop as a way of encouraging participants to exercise new approaches to communication through an analogue medium: the fanzine. The workshop was held within the framework of the 10th Annual SciComPT Science Communication Congress. The activity was carried out in two stages: experimentation with printing techniques (stamps, stencils, monotype and photocopies) and graphic production (editing, reproduction, assembly and binding). From this revisitation of analog visual communication practices, often considered obsolete, the research revealed the processes of analog mimicry present in digital image editing software. Furthermore, the research points towards the materiality and specificity of print media as a singular environment for the construction of discourse and knowledge.

Keywords: Aesthetic and Artistic Education, Communication Design, Infodemic, Media Archeology, Science Communication

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Introduction

This article is an integral part of a doctoral research in design that seeks ways to bring design closer to scientific communication and together mitigate pseudoscience-based disinformation. The main objective of this study is to identify strategies to promote science communication as a topic in design teaching in Portugal, bringing future designers closer to scientific dissemination. In this communication, we will demonstrate the experience carried out in the context of the 10th Annual Congress of Science Communication SciComPT, which was the workshop "The fanzine as an experimental laboratory of graphic arts and principles of self-publishing", developed by designer and doctoral student Santiago Mourão in partnership with artist and doctoral student Najla Leroy, supervised by Professor Heitor Alvelos.

In this experiment, we defend the potential benefits that technical and technological revisitation in visual arts can provide in the creative and communication processes of scientific communicators. Based on the assumption that experiments with traditional techniques and non-digital media can contribute to influence new strategies for promoting scientific knowledge in a context of digital hegemony, we held an introductory workshop on graphic arts within the scope of the 10th SciComPT Congress, which took place on the 11th May 2022, in Ponta Delgada, Azores, Portugal.

Based on the congress motto "Stop, listen and act: reflect on the past to build the future" and epistemologically supported in one of the fields of media studies, Media Archeology, which is a "a way to investigate the new media cultures through insights from past new media, often with an emphasis on the forgotten" (Parikka, 2012), we worked on the practice of self-publishing production as a way of provoking participants to exercise new communication approaches from a non-digital media: the printed fanzine. Notably recognized as a symbol of do-it-yourself (DIY) communication, fanzines played "a fundamental role in the general evolution of the media and, more specifically, of marginalized cultural forms" (Lara, 1976). From the return to the practice of the fanzine, independent self-publishing and small circulation, we worked on formal parameters and creative freedom with the aim of provoking critical reflections on the different ways of producing images, even in a context of digital hegemony.

Here we point out that science and technology communication was heavily impacted by the Covid-19 pandemic, gaining unprecedented prominence around the world, where all segments of society sought reliable information about the disease, crisis mitigation measures and about the future solutions that were suggested. It was in this context of urgency, restrictions and on a global scale that science communication was challenged to adapt to new communication technologies, expanding into video platforms, podcasts, lives and the most diverse communication formats that current digital social networks allow.

However, it is important to point out that in the same way that digital tools and social networks have benefited scientific dissemination, they have also reinforced the impact of disinformation campaigns based on pseudoscience. In 2020 the World Health Organization classified coordinated attacks against the credibility of science communications as Infodemia (According to the WHO, this is an excess of information, some accurate and some not, which makes it difficult to find reputable sources and reliable guidance when needed). Online disinformation based on pseudoscience predates the pandemic but was accentuated during the periods of confinement imposed by the health crisis. Anti-vaccination campaigns also increased during this period.

There are many initiatives that seek to find solutions on how to mitigate or combat online disinformation, and they are mostly through the development of new digital technologies, such as the use of Artificial Intelligence to identify harmful patterns, improvement of platform algorithms, automated data visualization systems, among others. And in order to contribute to the repertoire of strategies to combat the challenges imposed by online disinformation, we chose to experiment with the technological return in media in order to pluralize and expand the expressive and aesthetic capabilities of scientific disseminators.

The workshop

Unlike digital communication platforms, fanzines do not have pre-determined formal parameters, such as character limits, dimensions, typographic selection, pagination and pre-established layouts. The fanzine, due to its origins in amateur and independent movements, is a medium marked by creative freedom and production without technical refinements, demonstrating to be a good format to experiment with graphic and self-publishing principles in a simple and fast way. The main design feature of fanzines is the elaboration of matrices that are later reproduced, usually in photocopying machines.

The ability to develop matrices with the aim of reproducing informative content is the basis of several technological revolutions in the media that date back to Gutenberg's press, around 1450; passing through the pamphlets with the theses of Martin Luther, in 1517; Thomas Edison's mimeograph in 1880; and, directly inserted in the context of this workshop proposal, the revolutionary automatic photocopiers, commercially introduced in the 1960s.

With the advent of modern computers and the use of graphic editing software, there was a gap between the creation of graphic pieces and their reproduction processes. This change in the visual creation environment, from the material to the digital one, impacted the way of creating graphic pieces, where the technical domain of printing and reproductive processes are not mandatory to create layouts and communications that will later be printed. In the chromatic field, for example, it is not necessary to know how to combine colors to find the expected shade, nor is it necessary to know the most appropriate sequence when printing a piece in polychrome. Creation dissociated itself from the materialization of printed pieces, allowing designers and communicators to focus only on the composition of their communications. However, this dissociation between the processes of creating and reproducing graphic pieces impacts on the expanded understanding of the potential of the printed media, reducing the assimilation of the inherent capabilities of this media (the qualities of the different papers, the relationship between inks and solvents, etc.) and the complex management between technical control and the unexpected results inherent to the use of materials in the natural world. This hypothesis is in line with the concepts of creative processes by the artist and researcher Fayga Ostrower (1987, p. 10), who said that "The processes of creation occur within the scope of intuition (...) they are essentially intuitive processes (...) are not reduced to operations directed by conscious knowledge".

Inserted in this context, this experiment sought to demonstrate to an audience of science communicators how materiality and learning through the artisanal practice of the visual arts can bring aesthetic qualities and results different from those produced through digital devices.

The format

As part of the 10th SciComPT Congress, the largest science communication event in Portugal, the experiment was designed to meet the workshop format proposed by the organizing committee: a single 3-hour session. The activity was face-to-face, practical, in Portuguese and conducted by trainers Najla Leroy and Santiago Mourão. The workshop took place on May 11, 2022, at the Ponta Delgada Public Library and Regional Archives and had 15 registered participants. The dissemination of the workshop was in charge of the organizing committee of the congress and registration was voluntary and open to the entire audience of the 10th SciComPT Congress, with a maximum participation of 20 participants. For the evaluation, an informal collective conversation was carried out at the end of the event and, later, unstructured interviews with a sample of the participants and with the organizing committee of the congress. In the evaluation phase, the objective was to identify the perception of this focus group of science communicators regarding the relevance of experimenting with traditional visual arts techniques as a creative process and aesthetic education.

Figure 1: Workshop "The fanzine as an experimental laboratory of graphic arts and principles of self-publishing" (Renan, 2022)

To fulfill the goal of demonstrating that the creative process through a hands-on approach contributes to enhanced learning in visual arts, the activity served as an introductory experimental laboratory of graphic arts and self-publishing principles, divided into two main parts: 1) printing techniques and 2) self-publishing principles. In part 1 was worked on the following printing techniques: stamp, stencil and gelatine-based monotype. In part 2 was worked on the elaboration of the content of the publication, printing/copies, assembly and binding/sewing (the content was mostly visual, combining the productions of part 1 with additions of free intervention, such as collages or direct interferences in the matrices).

Total time: 3 hours			
9:30	9:45 - 11:00	11:30 - 12:20	12:30
Presentation	**Printing techniques**	**Self-publishing principles**	**Conversation**

Table 1: Workshop structure

As a result of the practices carried out in the workshop, a collection of a collective 20-page fanzine, with a print run of 20 copies (copies were distributed among participants and the organization). All materials were provided by the organization. For the stamps and stencils, the organizers provided ready-made templates and also encouraged participants to build new templates from the available materials.

Figure 2: Printing Techniques (Renan, 2022)

The workshop provided an opportunity for participants to explore the fundamentals of graphic arts in order to contribute to a better understanding of the potential of printed resources, whether from an analog matrix or digital. During the workshop, the participants experienced the techniques of printing with stencils, stamps, gelatine-based monotype and photocopying. Even in a short period of time, we encouraged experimentation with free-form prints, exploring different colors, overlays of different techniques and/or colors, with an emphasis on learning through the practice of making images.

The second part explored the self-publishing principles and the production of fanzines. Based on the results of the printings obtained in the first part, the participants were guided to collectively conceptualize a mostly visual publication, with an emphasis on visual narratives, based on the congress motto "Stop, listen and act: reflect on the past to build the future" . Subsequently, the authors were encouraged to organize and produce the pages of the publication, in individual or collective work. From the matrices produced and organized collectively, photocopies were made of the 20 fanzines that composed the collection, and in the sequence the participants assembled and finalized the publications (production line for the

assembly of the pages, inclusion of the covers, and sewing). Finally, a collective conversation about the process and the results of the workshop took place.

Figure 3: Sample of original matrices produced (Renan, 2022)

Figure 4: Participants with the fanzines produced in the classroom (Renan, 2022)

Collected data and discussion

The most relevant topic to be analyzed in this experiment is the perception of the audience of science communicators regarding the relevance of experimenting with traditional visual arts techniques as a creative process and aesthetic education, so we start by analyzing the profile of the focal group worked on: the workshop participants.

The audience was made up of 15 participants who signed up of their own free will, mostly Portuguese (one of the participants is of Brazilian origin but has lived in Portugal since childhood), between 25 and 50 years old, and all of them work with science communication but with different academic backgrounds and professional approaches. 11 participants have their first training in the field of traditional sciences, namely natural sciences; 4 participants have their training in the field of communications (journalism and communication design). Even though it is a focus group made up of only 15 individuals who work in the same field, it is necessary to point out that this is a group with a remarkable diversity of approaches within scientific dissemination. Among the participants are professors, press officers, science journalists, facilitators at Science Centers and university institutes, book authors, podcast

producers and designers (participants reported that these different approaches often merge in the daily lives of science communicators).

Here we reinforce that the Covid-19 pandemic has strongly impacted the science and technology communication field globally, giving them visibility on a scale never seen before, which also puts them in front of new challenges. During the various confinements around the world and the uncertainties regarding measures to mitigate the impacts of the pandemic, science communicators found themselves pressured to work under severe conditions, including the accelerated adaptation to new online information technologies. And all these efforts were reflected in good results related to the promotion of scientific literacy in Portugal, as pointed out by the Eurobarometer - Science and Technology 2021.

"Portugal now leads the group of countries with the greatest interest in science and technology. In 2010, only 14% of respondents showed interest in these matters, a very different number from the 62% who responded in the affirmative in 2021. Almost 30 percentage points separate our country from the European average, which stands at 33%. Almost half of the respondents (49%) said that the influence of science and technology on society is "very positive.""

As identified in a group interview at the end of the activity, all participants showed enthusiasm with the results of the workshop and were interested in continuing to explore traditional graphic techniques in order to improve their creative skills. Interests in knowing better the fields of typography, calligraphy and visual narratives (illustrations and infographics) were mentioned. Two participants who work in institutes for the promotion of experimental science teaching (Centro Ciência Viva), reported their interest in reusing the techniques learned in the transmission of knowledge through the educational sector of the institutes where they work. With less emphasis, it was also pointed out the interest in autonomously continuing the production of their own notebooks in order to serve as a graphic diary or notebook for notes. Still during the collective conversation, we identified that the participants with less intimacy with the printed media were the most positively impacted by the activity, namely with the demystification of the book/notebook being a time-consuming and complicated support to work with. All participants were positively surprised that they were able to produce a collection of fanzines in just three hours. Another relevant data pointed out in the collective conversation was the use of visual narratives as a creative process, as it distanced itself from the inherent rigors of science communications, giving freedom to work on creativity during the workshop.

In addition to the collective conversation, we also carried out 3 individual unstructured interviews (a cut of 20% of the focus group), and we also held a meeting with the organizing committee of the congress (the SciCom PT Network) to identify the possible impacts of the activity in the context of the congress.

The individual interviews were intended to validate or refute the aspects identified in the collective conversation and deepen the question of the relevance of experiencing traditional visual arts techniques as a creative process and aesthetic education. The 3 interviewees considered it relevant to experiment with artistic activities in order to amplify their aesthetic vocabularies and technical resources within communication. Two of the interviewees emphasized that the workshop motivated them to seek complementary artistic training, namely in calligraphy and illustration. All of them considered the learning of traditional

techniques in visual arts relevant for aesthetic improvement and a mechanism for expanding their knowledge about communication through images.

In a meeting with the organizing committee of the congress, we received positive feedback on the impact of the workshop on the congress. They considered a workshop with an artistic bias to be positive, which, although it was not a training of utilitarian tools for science communicators, served to strengthen the visual literacy of the participants. They also highlighted the importance of reinforcing the approximation of creative areas that are complementary to scientific communication. At the end of the meeting, we were informed that the organizing committee intends to include workshops and roundtables with professionals and researchers from creative areas in the next editions of the SciComPT Congress. We also received proposals to apply the workshop, and variations on the same theme, in other science communication events in Portugal.

We consider it important to reinforce the atypical situation in which the activity was inserted, as it was the first face-to-face congress after the outbreak of the Covid-19 pandemic, which gave this edition a special connotation, a kind of celebration, which may have contributed to generosity with the feedback received. It is also relevant to point out that the activity did not include performance or efficiency evaluations of the participants. More important than the results, was the process. The focus of the workshop was on experimentation and interaction, and these goals were achieved as everyone participated with curiosity and enthusiasm. The feedbacks pointed to the success in using practical visual arts workshops for aesthetic education with an audience of science communicators.

Conclusions

Considering the special moment of science and technology communication, especially given the enormous challenge imposed by Infodemia, it is opportune to bring the arts and design together to contribute to the fight against disinformation and to identify new strategies that increase the interest and engagement of audiences for the promotion of scientific culture.

The workshop "The fanzine as an experimental laboratory of graphic arts and principles of self-publishing" proved to be successful as a way of promoting the improvement of visual literacy among scientific disseminators. The approach through the technical and technological revisitation of printed media, here specifically represented by the fanzine, was pointed out as a good method to introduce the habit of experimenting with traditional visual arts techniques among professionals used to working mostly through digital tools. The "exotic" character of working with obsolete techniques and materials adds subjective qualities to the exercise, as it is a context that is both new and familiar. The novelty lies in the revisitation of the obsolete, and the familiar lies in the fact that the printed media (including the fanzine) is part of the common imagination of communicators.

As the representations of image editing tools in software are mimics of traditional techniques (pencil, brush, scissors, stamp, copy/cut/paste, etc.), it was quick to understand the use of analog tools. As it was an audience of communicators, the assimilation of the exercises took place quickly and efficiently - which allowed the completion of the publications in an activity of just three hours. Even though part of the class has a background in science, and later specialized in communication, there was no problem for the assimilation of the exercises - which demonstrates a great potential for success in replicating the activity in similar contexts.

Thus, we conclude that the experiment tested was successful in demonstrating the good potential of using traditional visual arts workshops as a model for promoting aesthetic education and broadening visual literacy for science and technology communication professionals.

Acknowledgments

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Contact email: up201501316@fba.up.pt

Design Research as an Instrument of Empathy and Resilience: A Case Study in Porto on Reclusion in a Collective House

Marcela Rosa, University of Porto, Portugal
Teresa Franqueira, University of Aveiro, Portugal
Susana Barreto, University of Porto, Portugal

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Abstract

Considering the reality of international students who were quarantined in Portuguese student halls of residence during the initial confinement period of the SARS-CoV-2 pandemic in 2020, this article argues for the role of design research as an instrument of empathy to foster resilience in situations of heightened emotional stress such as the reclusion lived during this period. The study is driven by the participant observation of increasing isolation, fear, and emotional distress experienced by international students in confinement in a hall of residence at the University of Porto, Portugal. We base our theoretic discussion on concepts of empathy and sense of belonging, applied to the reality of student halls of residence and international students' experience. We used the ethnographic method, namely participant observation, semi-structured in-depth interviews, and capture of images to analyze the testimonies of thirty-six international students interviewed between May and September 2020 about their confinement and welcoming experiences within the residence. Research findings range from a relevant repository of interviews on international students' feelings towards the pandemic period while in halls of residence, the need for resilience in identifying opportunities amid adversity, to a lag in the current welcoming model of the residence. The expected outcomes are to design a prototype of a welcoming program at the University of Porto halls of residence that include but is not limited to a welcome package based on the identified lagging in the current residence welcoming model, literature review, and other case studies on Porto student halls of residence.

Keywords: Design and Welcoming, Empathy, Sense of Belonging, Porto Halls of Residence, COVID-19 Pandemic

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Introduction

This paper is part of ongoing research on the use of design to foster empathy in multicultural contexts. The main purpose of this study is the creation of a pedagogy of interculturality and appreciation of student cultural diversity within University of Porto residences. For this, we are designing a welcome program with practices that encourage integration, interculturality, and the development of a sense of belonging in displaced students, especially international ones.

In this paper, we argue for the role of design research as an instrument of empathy to foster resilience in situations of heightened emotional stress such as the reclusion lived during the SARS-CoV-2 pandemic crisis. The main purpose of this study is to analyze the welcoming conditions and quarantine experiences of students within the University of Porto halls of residence, managed by the University of Porto Social Services (SASUP). Students were lodged at this residence prior to the beginning of the pandemic crisis and stayed quarantined there during the emergency state declared in Portugal, from March 18 to May 2nd (Figure 1).
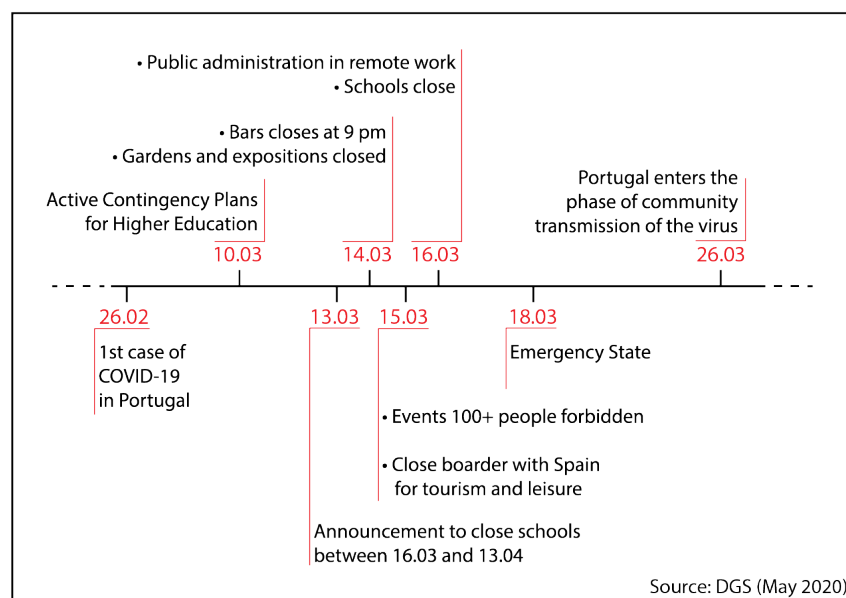
Figure 1: COVID-19 initial phase in Portugal (Source: Rosa & Alvelos, 2022)

The study is driven by the participant observation of increasing isolation, fear, and emotional distress experienced by international students in confinement in a hall of residence at the University of Porto, Portugal. We portray the emotional state of these students during this unusual time and collect their thoughts about life in the residence.

Method

The method of this study is a combination of literature review and fieldwork, with the aid of semi-structured in-depth and in-person interviews as the main resource (respecting the physical distancing guidelines), but also participant observation, field diary, autoethnography, and multimedia records. Data were collected over a year between November 2019 and September 2020 and interviews were held between May and September 2020, ergo during the COVID-19 pandemic crisis. Thirty-six international students living and confined in one residence of the University of Porto residence hall were interviewed, 18 male and eighteen female from thirteen nationalities. Interviews had twenty-two original questions, and more

were included according to the statements of the participants, in an informal conversation that lasted between 30 min and 2 hours in length. This paper analyses the scope of seven of them. Respondents are not identified to comply with data protection policies in Portugal.

Data analysis

This section presents the answers of the students to the following questions: 1) Do you feel at home at the residence? 2) Do you feel welcomed at the residence? 3) Do you feel the space, the residence's structure, is welcoming? 4) What would you improve in the residence? 5) How was this period of isolation during the quarantine for you? 6) Do you feel you received the necessary support from SASUP? And 7) Do you feel SASUP's communication with the residents is sufficient?

DO YOU FEEL AT HOME AT THIS RESIDENCE?
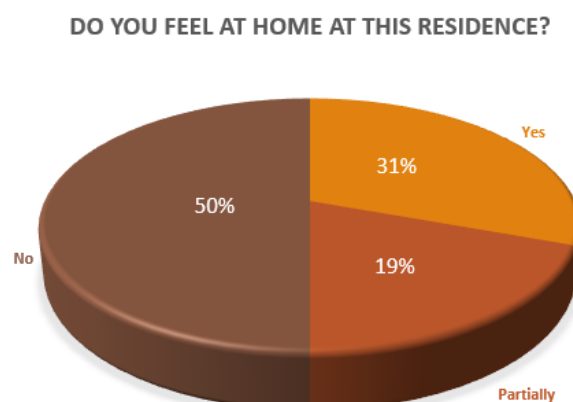
Figure 2: Question 1: Do you feel at home at this residence?

50% of the resident population does not feel at home, and 19% stated they feel 'at ease', mainly because of the people they live with, but not at home, ergo only 31% of the students stated to feel at home. Some students linked the feeling at home directly with the people, explaining: "Feeling at home depends on the people that you're living with. So, feeling at home is so tricky and I think it depends on the people.

DO YOU FEEL WELCOMED AT THIS RESIDENCE?
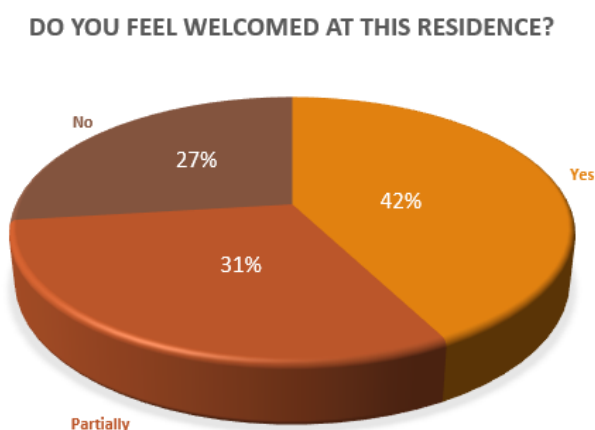
Figure 3: Question 2: Do you feel welcomed at the residence?

42% of students answered they felt welcomed both by the space and people. 31% felt welcomed by their fellow neighbors and 27% answered they don´t feel welcomed at the residence, providing statements like "there is no one to welcome, how would I feel

welcomed?", "who is here to give you that kind of welcome in the residence?" and "I feel in a professional environment where I came to achieve a goal and leave. It's not an environment where I feel good".
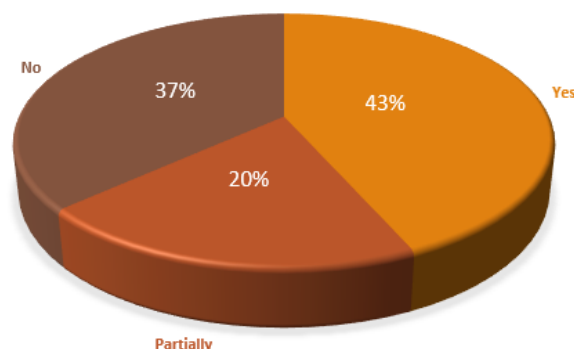
Figure 4: Question 3: Do you feel the space is welcoming?

43% of the students feel welcomed by the space, 20% feel partially welcomed, liking their rooms but missing the existence of living spaces to connect with other residents and 37% don´t feel the space is welcoming. Some statements were "I like it, but you don´t feel at home and you don´t feel welcomed. I just like it.", "It's welcoming in your room, on your balcony, in those kinds of places, but it's welcoming to stay not to connect" and even it "Looks like a psychiatric hospital".
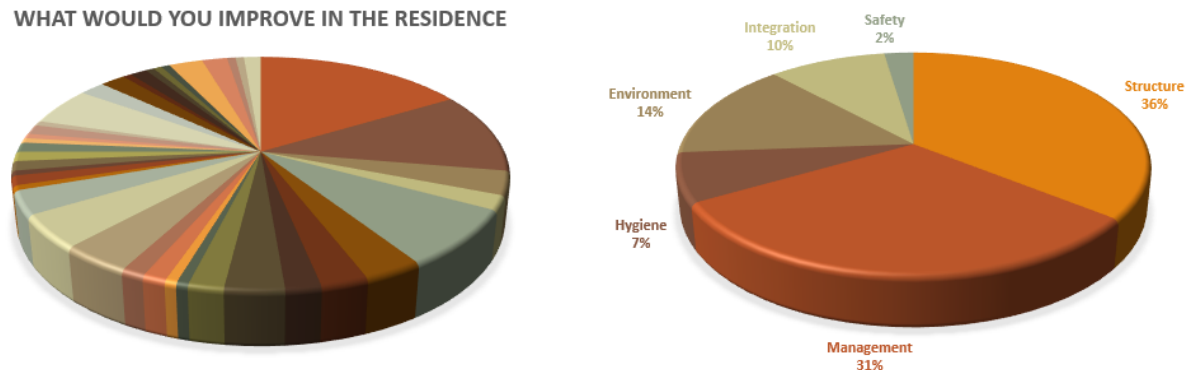
Figure 5: Question 4: What would you improve in the residence?

Since this was an open question there were many different answers, so we categorize them into six groups, as described in Table 1: Structure (36%), Management (31%), Environment (14%), Integration (10%), Hygiene (7%) and Safety (2%).

Structure	Management	Environment	Integration	Hygiene	Safety
16% Kitchen 11% Living área 8% Segregation 5% Laundry 4% Space to exercise 3% Bedroom sizes 3% Garden 3% Building structure 3% Internet 2% Maintainance 1% Library 1% Electric wires 1% Acoustic isolation 1% Close skylight 1% Paved path to FLUP	3% SASUP Assistance 2% Staff training 2% SASUP communication 2% Rules equality and compliance 1% Bedroom distribution 1% Sensibilization of collective living 1% Visitation rules 1% Suggestions 1% Staff overload 1% Abandoned bicycles	2% Environment colors (floor, walls) 2% Chairs 1% Room furniture 1% Move room furniture 1% Room lighting 1% Signaling	5% Integration 1% Entertainment 1% Shared kitchen supplies 1% Student body representation	3% Cleaning service 1% Mold 1% Insects	2% Security
36%	31%	14%	10%	7%	2%

Table 1: Question 4 answers stratification

The main item students would change was the kitchen facilities (16%) suggesting to add a proper exhaust fan, more machines such as stoves and fridges and adding an owen that does not exist at the moment, also making it open 24h (currently opening hours are from 6h to 23h) and creating more kitchens (currently there's one kitchen for 6 floors and 39 bedrooms – students have suggested putting one in every floor, as it is in the other blocks that lodge Portuguese students).

The second most asked improvement was to create living areas (11%) to connect with other students, play games, relax and watch television without noise problems, with special mention to being able to do so after 23h. About this matter, one student has said:

> When someone arrives at a place, they must have a space like the courts, a space in the center. Here you arrive directly to the residence, you don't see people, you don't live together, anything. If people want to be together they have to leave [the residence]. People don't know who they live with. In fact, people who live on the other side don't know who there is

The third most quoted change was ending segregation (8%) which refers to the separation of Portuguese and international students in different areas of the residence building. Students feel strongly about this matter. One student stated:

> As we all contribute and make improvements in the residence, they should work on this oppression and try to integrate all the students. There shouldn't be divisions. Just

put everyone, citizens or international students, we have to mingle, so we could learn more of the Portuguese culture and traditions. Portugal is a great country and some of us will always want to learn from the Portuguese, so I think this would be what I want them to improve. We should try to merge all the students, couldn't be separations.

Another student has spoken:

…so taking down polarization of the residence would be very very good, not to the international students alone but to the local people as well, for the national students, because they'll go home and talk to their parents about the kind of things they learned from me or any other international student. And I would too, a similar thing would happen to me. You go to class together, so if you can't be in the same residence with them why do you go to class together? You talk to them in class, this should happen in the residence as well. So if the school is not with that kind of polarization then the residence should do the same. It would help international and local students to learn from each other. It's better to learn than to stay away from people

This item is directly linked with the next brought-up issue: integration (5%) where students have expressed the desire to have more entertainment options, share kitchen supplies, take care of a community garden together, and have student representation to voice students' needs to the management, among other activities. One student said:

I think integration is very important. Especially when we notice there are people who find it more difficult to integrate, I think it's a function of the house to do this and of the people who are in it. I think it's important. Because most, almost all, are not from Porto, all are from abroad even if not from outside the country, and this moment of feeling at home helps, even for the studies we are doing here, the psychological issue is very important for a positive result in the studies and this happens a lot with integration. This integration is linked to the issue of reception, the issue of encouraging study, and the friendships that we can make here and outside, it is linked to the closest social relationships, which help a lot in all aspects of our lives. This is very important for our complete development as a being.

Subsequently, we asked the students how was the period of quarantine and isolation in the residence during the COVID-19 pandemic's initial phase, and based on their answers we created a word cloud to portray this moment (Figure 5). The most quoted words were 'difficult', 'isolation', 'alone', 'not easy' and 'bedroom', since for these students quarantine was mainly in their bedrooms, since shared areas of the residence were to be avoided.

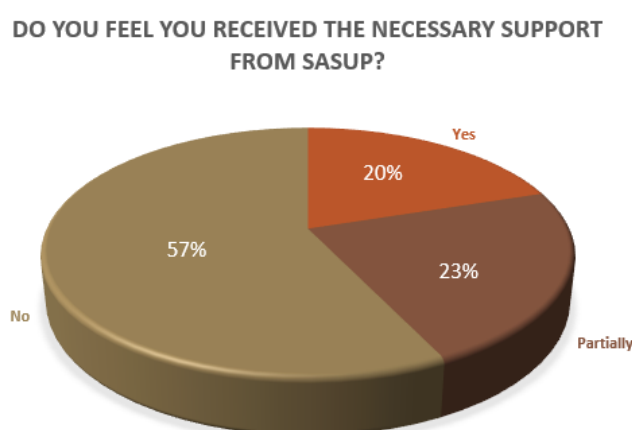Figure 6: Question 5: How was this period of isolation during the quarantine for you?

Figure 7: Question 6: Do you feel you received the necessary support from SASUP?

When asked if they felt they received the necessary support from SASUP 20% said yes, and 23% said partially stating the implemented decisions were correct but not enough and there should have been more initiatives at a more efficient pace. Overwhelming 57% said no. Some statements in this regard were, "I think they took a long time to take action, I think they, in general, didn't have the control to maintain our safety.", "My professor is a person and did better than SASUP. I expected regular checkups, financial aids, and questionnaires to see how we were doing, at least. Feel insecure.", "I feel like about SASUP under COVID-19. I think they gave up on us easily", and "I'd have to say SASUP performed poorly when it comes to isolation period.". One statement portrayed a picture of that period in the residence:

> SASUP disappeared at the time of quarantine. SASUP later issued emails that were of little use. SASUP showed little interest in the students in the residencies. SASUP acted in small packages late, at the necessary moment when SASUP intervention was needed, it did not appear. It appeared very late, for example in the questions of disinfectants placed too late, or not sharing elevators, restriction of non-resident students, restriction of colleagues sharing the same room, SASUP did very little at the time it was needed. Luckily there were no major incidents, but I think the lesson remains. SASUP acted little. If I'm not mistaken, the hand disinfection points were installed in June, I've been adrift since March. The rooms will be separated in

September, and I live with a colleague who works [outside]. SASUP could have done more, even if it was conditionally, it could have acted faster.
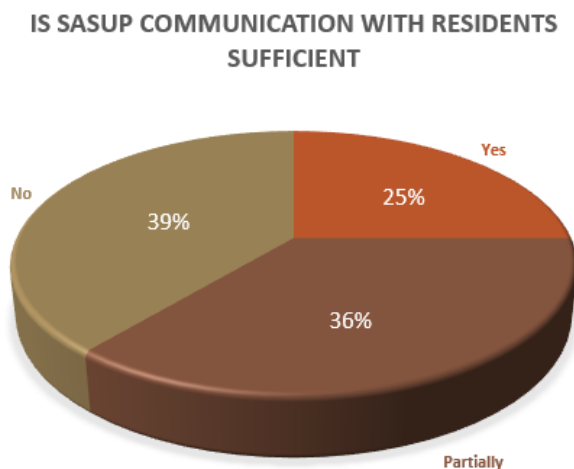
Figure 8: Question 7: Do you feel SASUP's communication with the residents is sufficient?

For the final question, we asked if the students felt SASUP communication was sufficient, to which 25% replied yes, 36% partially, saying communication through email is very fast and efficient, but not enough, and 39% replied no, stating communication should include more than just notices, asking about students' experiences, considering their opinions, and opening dialogues instead of only informing the decisions reached by management. One student said, "When there is a situation, we have to talk in the WhatsApp group, and we have to send an email. It's much more up to us wanting to solve something. Usually, we initiate the communication.". Another student was very unhappy and justified it:

Awful. It's not enough, it's not good. Nothing changes, it's always the same thing, we're always looking for information, we want to solve things. It is very simple sometimes to solve things here at the residence if we start to communicate here, but communication beyond SASUP is never the same, they make it very difficult, the bureaucracy is very large. Like it or not, we pay for it here, you know.

Discussion

We have analyzed students' responses regarding the residence in aspects such as their welcoming experience, physical accommodation, management, and communication, including a portrayal of the confinement period lived during the SARS-CoV-2 pandemic crisis.

Rosa & Alvelos (2022) have illustrated the impact of different communication techniques on this residence and discussed adequate communication strategies in student halls of residence. And, although this paper will not focus on students' living conditions, we agree with Margolin & Margolin (2002:26) that "Inadequate or inferior physical surroundings and products can affect the safety, social opportunity, stress level, sense of belonging, self-esteem, or even physical health of a person or persons in a community.". In the interviews, students related cases of anemia and depression developed due to the residence facilities, and this analysis should be further developed. Perhaps this could even be an opportunity to advance research in a way where designers "could participate in a team process with human

service professionals (…), particularly the designer's involvement in the physical/spatial domain" (Margolin & Margolin, 2002:27).

The low index of students that feel at home (31%) and welcomed (42%) at the residence indicates there is room for improvement. 50% of the international students interviewed do not feel at home, and if we add the 19% that stated to feel 'at ease' because of fellow residents this sum up to an overwhelming index.

Some students linked staff training directly to the impossibility of feeling at home, arguing there was not possible to do so when there is a lack of privacy and control over their bedrooms – their homes: staff could enter at any given time of the day, without the proper authorization to clean the place, and they feel staff would comment about the particularities of their bedrooms with others. Other aspects that made it difficult were not being able to change room furniture or personalize the bedroom.

Students declared to feel welcomed by their neighbors (31%) and the ones that don´t feel welcomed (27%) have expressed missing people on some level. Students have linked feeling at home with the people they live with, which corroborates with Moores & Popadiuk (2011:296) finding that by having comfort and support in their living environment, people can create a type of sanctuary away from the frustrations they might experience in their daily lives.

Currently, students' association with one another is fortuitous, depending directly on students' initiative. Ergo less sociable people may not form connections, as cited in the interviews. This shows the importance of initiatives promoted by the residence administration to integrate such students into the community. Activities promoted by management would benefit the integration between all residents: internationals and Portuguese and help to establish a welcoming intercultural environment.

Once again, our findings comply with Moores & Popadiuk (2011), which emphasize the need for and importance of adequate support from the university community through the international student sojourn: "support within the international student community is valuable and should be fostered. Regular gatherings through the university departments that support international students would help to establish these connections" (Moores & Popadiuk, 2011: 303).

The students' quarantine in the residence, although a portrait of a very specific time with heightened emotional distress, shows the necessity for human support, beyond logistical accommodation aspects and quick response in dealing with residential matters.

One example of the eagerness for human support from these students was the interviews, which lasted approximately two hours in the beginning (May) and thirty minutes in the end (September) when the quarantine was over and students were heading back to 'normal' lives. At that moment interviews were an instrument of empathy to provide comfort and allow students to vent and receive support about their struggles and difficulties. They were also an instrument of resilience allowing this researcher to dive into the research to escape from part of reality and to help students endure that phase of isolation, fear, and insecurity through talk and human connection.

There are various definitions of empathy, but here we consider the summary definition of Cuff et al. (2016: 150) where "Empathy is an emotional response (affective), dependent upon the interaction between trait capacities and state influences" and empathic processes can be "shaped by top-down control processes. The resulting emotion is similar to one's perception (directly experienced or imagined) and understanding (cognitive empathy) of the stimulus emotion, with recognition that the source of the emotion is not one's own" (Cuff et al., 2016: 150). This particular aspect can be used to foster empathic experiences among students within the residence.

We don´t intend to blame culprits but to contribute to the improvement of the student community's well-being in halls of residence. There are challenges for both the student and the university (Moores & Popadiuk, 2011) but students are willing to contribute to improving their living environment and can provide useful feedback for the University about what they want and need. To start, they have a desire for integration within the residence as an extension of the University itself. They want to mingle with national students, learn about their culture and provide insights into their own culture as well.

In this sense and based on the presented evidence we argue it is necessary to implement a welcome program at the University of Porto halls of residence that can address students' well-being in a broad perspective: welcoming students on their arrival to a new home, offering support through their sojourn, providing opportunities for students to connect, and hearing students' voice about the services provided and general experience in the residence. Implementing a welcome program can lead to the emergence of a pedagogy of interculturality in the residence, which benefits the students, university, and civic society.

Conclusion

The main findings of this paper include a relevant repository of interviews on international students' feelings towards the pandemic period while in halls of residence, the need for resilience in identifying opportunities amid adversity, interviews as an instrument of empathy and resilience during the SARS-CoV-2 pandemic, and the existence of a lag in the current welcoming model of the residence. We also contribute with a case study to the social design field, responding to Margolin & Margolin's (2002:28-9) call about the "lack of research to demonstrate what a designer can contribute to human welfare" and that "the social design field should have a compendium of case studies (…) that document examples of relevant practice."

We verified the positive and negative aspects of the residence and students' perceptions of it. On the positive side, students have gratitude towards the residence, knowledge of bureaucratic impediments to implementing change in the residence, hold affection for part of the staff, have a strong connection with fellow international residents, and have an interest and desire to contribute to change in the residence.

On the negative side, students' have disclosed having developed or accentuated mental disorders during the quarantine (like anxiety, depression, loneliness, and feeling of giving up), they notice a lag in cultural integration in the residence, and they feel there is a lack of communication between residence management and the residents, and they would like the staff to be trained, having raised different issues regarding staff treatment with students, including difficulties in communication due to language barriers.

Two main problems were identified: 1) The current model of University of Porto residences does not foster student socialization and cultural exchange and 2) it does not comprise students' emotional and psychological needs, existing a lack of human support beyond the logistical aspects.

We also identified students' relief in talking to someone in person during the interviews. The interviews allowed students to connect to someone out of a screen and vent. Between May and July interviews used to last almost 2h and from July to September, when students were back to the 'real world' they used to last around 30 minutes – That is because they didn't feel as strong a need to connect during interviews, since they were back to their non-virtual lives in one sense or another. Interviews were also an instrument of resilience both for this researcher and for the students, to help all of us endure such difficult moments sharing our experiences and finding comfort in each other.

Implications of these findings include future studies about implementing welcoming initiatives to foster student integration, interculturality, and a sense of belonging at selected residences. We also suggest studies on the physical aspects of the residence and how it affects students.

Acknowledgments

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Contact email: marcela.cavalcantir@gmail.com

Reference Framework for Tacit Knowledge in Craft-Based Manufacturing Processes for Updating Their Practices With Digital Interventions: A Systematic Review

Jesus Alexis Machuca Gelvez, Universidad Industrial de Santander, Colombia
Clara Isabel Lopez Gualdron, Universidad Industrial de Santander, Colombia
Luis Eduardo Bautista, Universidad Industrial de Santander, Colombia

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Abstract

This study aimed to build a framework to define key attributes in the tacit knowledge of craft-based manufacturing processes, used to update the technique through digital interventions. Currently, with the integration of CAD/CAM technologies into craft-based processes, the development of new products is possible, but it is important to recognize the prior tacit knowledge and how they can be integrated with digital manufacturing. through a systematic literature review methodology by bibliometric technique focus on identifying case studies. Web of Science and Scopus databases was tool search, and the information was analyzed in nvivo® software for content analysis. The review indicated that technological interventions in craft-based processes consider aspects present in the skills and experience of expert people who master a technique, as well as manual gestures, strength, and movements performed during activities of the crafting process, and that allows the transformation of a material into an artifact. On the other hand, the content analysis allowed tacit knowledge to be categorized into three key atributes: skills in the knowledge of the technique, body gestures, knowledge of the material. It is concluded that to carry out a digital intervention in a craft-based process that allows guarantees the reliability of the technique, the responsible integration of the tacit knowledge of the technicians or craftsmen who dominate the process is necessary. In addition, it is concluded that despite the efforts made in the studies, not all tacit knowledge can be translated or integrated into digitization or automation, especially regarding decision-making and body gestures.

Keywords: Tacit Knowledge, Craft-Based Manufacturing , Digital Intervention, Automation

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Introduction

Currently, the technologies of industries 3.0 and 4.0 transform the development of tangible products, especially those that have a manufacturing process based on craftsmanship, so that their traditional methods are intervened with CAD/CAM technological integrations, which has allowed processes that are traditionally carried out manually to switch to digital media (Bernabei & Power , 2018). In which processes that are done under the experience and manual skills of a craftsman or technician are made with CAD software and digital manufacturing in the product conceptualization and manufacturing stages. (Di Rome, 2017). Or, on the other hand, they are taken to total automation directed by robots that execute the manual tasks of the process (Ravihandar, Polydoros, Chernova, & Billard, 2019). This tendency to change new technologies in traditional practices has had three main advantages, the first is the optimization of practices in terms of avoiding reprocessing due to human error and reducing production times (Alexandre, Salguero, Peralta, & Ares., 2017) (Ismail, I, Mooney, Poolton, & Arokiam, 2007). The second is oriented toward mass customization and custom product design, given that the advantages of both methods are taken advantage from craftsmanship to flexible manufacturing and digital media allow tasks to be systematized within the process flow (Trzepieciński, 2020) (Hermann , Pentek, & Otto, 2015). And a third of an exploration of forms is based on the combination of artisanal and digital techniques for the development of complex geometries with a strong aesthetic value that would be difficult or unfeasible to carry out with conventional techniques alone (Zoran, 2013) (Bernabei & Power , 2018).

However, intervening in craft processes in this way poses significant challenges in terms of the effectiveness of emulating a craft-based technique with digital technology, since much of the knowledge for its execution resides in the experience and skills of technicians or craftsmen. who carry it out (Wood, Rust, & Horne, 2009), that is, it is of a tacit type, it is internalized in the body and mind of expert people (Polanyi, 1966), and in the artisanal context this tacit dimension is manifested in bodily and manual skills to transform a material into an artifact (Risatti, 2007). In addition, this knowledge is difficult to transfer verbally, in writing (Herschel, 2001) or codified for its systematization (Balconi, 2002), requiring a learning process to appropriate it, and in most craft-based processes time to master a technique can take several years or even decades (O'Connor, 2017). Therefore, there is a gap in how to translate this knowledge into a digital medium, either to be emulated through CAD software by replacing manual activities with computational commands (Siu & Dilnot, 2001), or to be fully automated by replacing manual labor with manual tasks. robots (Bowen, Music, Erdinc, & Shokrani, 2021).

In this sense, the purpose of this research is to define a referential framework for the type of tacit knowledge that is necessary to translate or codify in technological interventions to craft-based design and manufacturing processes, in other words, to specify in detail its characteristics in the form of key attributes through different case studies, with a systematic review of the literature, for which the following review question is posed: What characteristics of tacit knowledge are taken into account to make a digital or technological intervention of a craft-based process? On the other hand, this research also investigates how this knowledge in the form of tacit attributes is translated or codified. Consequently, we pose the second review question: How are the tacit artisanal attributes transformed/codified in a digital adaptation of the traditional method?

Materials and methods

To resolve the research questions raised, our study is based on the systematic review model proposed by Vom brocke et al (Vom Brocke, et al., 2009), due it is relevant for the structuring of knowledge and information identified in a specific domain that in the case of this work revolves around tacit knowledge. And our work describes how the articles or documents were selected for the final research report (Savino, Messeni Petruzzelli, & Albino, 2017). On the other hand, the literature review was structured in four main parts: 1 Definition of scope and context; 2 Identification of Keywords; 3 literature search 4 content analysis, these steps are based on the work carried out by (Manfredi, Frattini, Messeni, & Berner, 2018), and in turn show a systematic, replicable, and transparent approach (Greer & Lei, 2012).

In the first definition and context part, the scope of our research is in the identification of the tacit knowledge found in a craft-based process and how this knowledge is used to intervene in the process with digital technologies to improve the technique, in addition to the ways or tools that were used to translate or codify said knowledge. Furthermore, the context is found in the search for research that takes artisan-based case studies that are carried out manually, and where the technological intervention is directed by CAD / CAM technologies and automation by robots.

On the other hand, for the identification of keywords in the main concepts of tacit knowledge and craft-based manufacturing process, we made a preliminary search, in which we grouped with their thesauri, with these keywords we built the first equation in the Scopus database, which yielded 129 results that we refined by articles in English, we used a time interval from 2000 to 2022 and the following subject categories from the database were discarded: energy, earth and planetary sciences, environmental sciences, mathematics; chemistry, physics and astronomy, and immunology and microbiology, as they were not relevant to the study, this refinement reduced the equation to 81 results, of which we selected 31 documents to complete lecture by reading the title and abstract, and we found 13 relevant results. table 1 shows the inclusion and exclusion criteria for the reading and selection of articles.

Time interval	2000-2022
language	English or Spanish
documents	Papers with case study of craft-based process
Topic	Intervention to the process with digital technologies Tacit knowledge of the technique in the intervention with digital technologies
discarded categories in databases	energy, earth and planet sciences, environmental sciences, mathematics; chemestry, physics and astronomy, y inmunology and microbiology

Table 1: Inclusion and exclusion criteria

We also expanded the preliminary search, since we identified new keywords, this time we used the WOS database for the search, which returned 395 results, in the same way, we refined the equation excluding non-relevant thematic categories and used the same time interval, reducing the results to 139 results, of which we selected 25, which due to their total reading, 16 relevant results were identified. Table 2 details the preliminary search; Comparing the two equations we find 5 repeated results, 7 articles per snowball for a total of 31 relevant results.

Finally, with the 31 results of the preliminary part, we expanded the keywords of both groups and also added a new group of emerging technologies to the search equations, although this topic was implicit in the first searches with the aim of greater rigor. in approaching the subject we built this group with the corresponding keywords and thesauri subdivided into the technologies of CAD/CAM, digital manufacturing, and subtractive manufacturing, this wide range of technologies is identified by the various case studies where technological interventions used this type of digital media.

The final equation comprises the sum of the 3 main themes: ((((craft* OR handcraft*)OR (handmade) OR ("traditional craft") OR ("art and craft") OR (craft process*) OR (traditional process*) OR (craft method) OR (traditional method) OR (traditional practices) OR (craft practices) OR (traditional workflow) OR (craft based) OR (craft based approach)) AND (manufact* OR fabricat*OR Produc*)) AND ((cad) OR ("comput* aided design*") OR (cam) OR ("comput* aided manufact*") OR (Cax Technologies) OR (computer-aided technologies) OR (CNC machin*) OR (additive manufact*) OR (3d print*)OR (digitalization) OR (digital fabrication) OR (digital manufact*) OR (digital technology) OR (digital retrofitting) OR (digital design) OR (computational design) OR (3d technologies) OR("virtual craft") OR ("computational craft") OR ("hybrid craft") OR (converging technologies) OR (disruptive technologies) OR (rapid prototypes)) AND (("craft knowledge") OR ("know how") OR (skill*) OR ("tacit knowledge") OR ("implied knowledge") OR (“knowledge workers”))). And we ran the equation on both Scopus and WOS databases. In WOS we identified 78 results, by filtering non-relevant categories, 56 were closed, of which we selected 18 results by reading the abstract and title with 13 relevant articles. On the other hand, Scopus 214 were identified, by the same filtering the results were they closed 152 of which 30 were selected and finally we took 18 relevant documents. As shown in table 2.

Groups				
	Craft-based manufacturing process	(((craft* OR handcraft*)OR (handmade) OR ("traditional craft") OR ("art and craft") OR (craft process*) OR (traditional process*) OR (craft method) OR (traditional method) OR (traditional practices) OR (craft practices) OR (traditional workflow) OR (craft based) OR (craft based approach)) AND (manufact* OR fabricat*OR Produc*))	((((craft* OR handcraft*)OR (handmade) OR ("traditional craft") OR ("art and craft") OR (craft process*) OR (traditional process*) OR (craft method) OR (traditional method) OR (traditional practices) OR (craft practices) OR (traditional workflow) OR (craft based) OR (craft based approach)) AND (manufact* OR fabricat*OR Produc*)) AND ((cad) OR ("comput* aided design*") OR (cam) OR ("comput* aided manufact*") OR (Cax Technologies) OR (computer-aided technologies) OR (CNC machin*) OR (additive manufact*) OR (3d print*)OR (digitalization) OR (digital fabrication) OR (digital manufact*) OR (digital technology) OR (digital retrofitting) OR (digital design) OR (computational design) OR (3d technologies) OR("virtual craft") OR ("computational craft") OR ("hybrid craft") OR (converging technologies) OR (disruptive technologies) OR (rapid prototypes)) AND (("craft knowledge") OR ("know how") OR (skill*) OR ("tacit knowledge") OR ("implied knowledge") OR ("knowledge workers")))	
	Tacit knowledge	(("craft knowledge") OR ("know how") OR (skill*) OR ("tacit knowledge") OR ("implied knowledge") OR ("knowledge workers"))		
	emerging technologies	((cad) OR ("comput* aided design*") OR (cam) OR ("comput* aided manufact*") OR (Cax Technologies) OR (computer-aided technologies) OR (CNC machin*) OR (additive manufact*) OR (3d print*)OR (digitalization) OR (digital fabrication) OR (digital manufact*) OR (digital technology) OR (digital retrofitting) OR (digital design) OR (computational design) OR (3d technologies) OR("virtual craft") OR ("computational craft") OR ("hybrid craft") OR (converging technologies) OR (disruptive technologies) OR (rapid prototypes))		
	Databases		SCOPUS	WOS
	filtred		152	56
	fully read		30	18
	Relevant		18	13

Table 2: Final equation

Analysis of content and results

Once we read all the relevant documents found both in the preliminary and final search, for the content analysis we classified each of the study cases found in the documents by groups and subgroups, this classification helped to find the key attributes of tacit knowledge that It was necessary to use the different techniques for the digital interventions, and from the key attributes, we found the tools or ways by which this knowledge was translated or used in the digital environment. The following sections describe the analysis process.

Due to the variety of the study cases found in the systematic review, we classify them according to the digital intervention approach, 3 groups were found: 1. CAD/CAM digital adaptation that corresponds to interventions where the craft-based technique is modified by CAD modeling software, in some cases obtaining reference models by reverse engineering,

and the use of digital manufacturing, either additive or subtractive; 2. Robots for automation This group refers to studies that try to intervene in the craft-based process so that there is total automation without the intervention of humans and carried out by robotic arms that imitate manual operations; 3 Exploratory of traditional techniques with digital technologies, this last group refers to a mixture of both techniques with more exploratory purposes of developing new forms or artifacts from the combination of both techniques in a kind of digital craft. In the same way, in each main group, the case studies are organized according to their area, respectively, we identify Medical devices, architecture, carving, metal work, and other techniques that were not possible to group as Basketry, traditional glass, Ceramics, footwear. , pattern making for dressmaking, manufacture of fiberglass molds. Figure1 illustrates the categorization carried out.
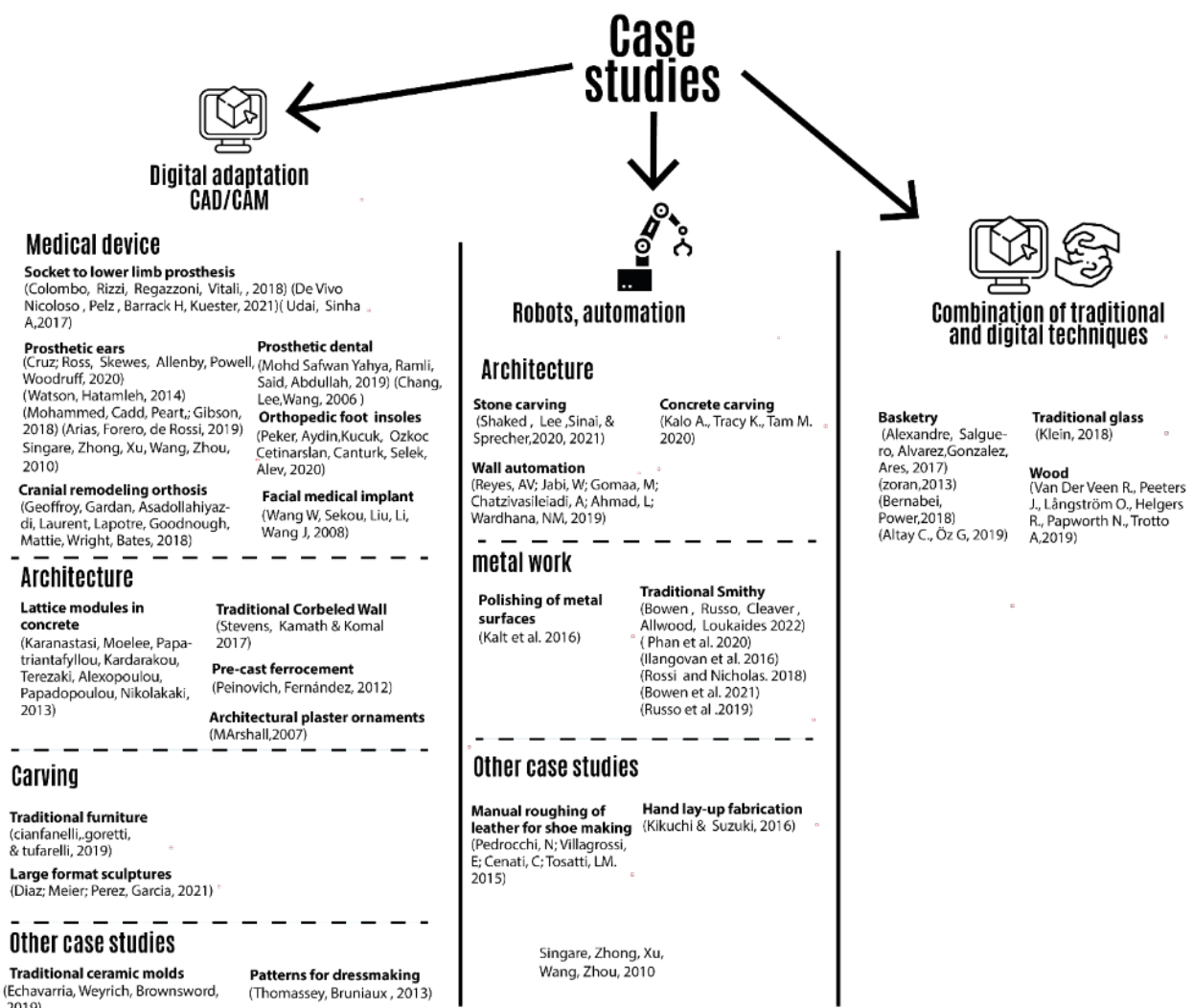
Figure 1: Characterization of the case studies

Digital adaptation CAD/CAM

The case studies grouped in this category showed the integration of CAD/CAM technologies in their craft-based workflows, updating their techniques allowing the development of custom products, or mass customization, on the other hand, the integration tries to reduce costs and time in addition to reducing the specialized knowledge in its operations, that is, the tacit nature, to facilitate the development of the technique. Next, we describe the subgroups regarding the nature of their craft-based process and technological intervention.

Medical devices

In this area we identify orthosis and prosthesis manufacturing processes oriented to custom design for medical cases, where adjustment with the patient's body is necessary for its use, in the case of sockets for lower limb prostheses, it refers to the development of the component socket that is the interface between the patient's body and the prosthesis that replaces a lost lower extremity, and its design is made taking into account the geometry of the patient, loading and unloading regions where there are bony protuberances or nerve endings, the lifestyle of the patient among others (Herbert, Simpson, William, & Ion, 2005) (Mak et al, 2001). On the other hand, the ear prosthesis is used when a person loses this part of the body or is born with some malformation (Mohammed, Cadd, Peart, & Gibson, 2018) (Cruz, et al., 2020) (Watson, Muhanad, & Hatamleh , 2014) (Arias, Forero, & Estrada, 2019) (Singare, Zhong, Xu, Wang, & Zhou, 2010). Dental prostheses are used to replace missing teeth in patients (Mohd, Ramli, Said, & Abdullah, 2019) (Chang, Lee, & Wang, 2006). In the case of cranial remodeling orthosis, it is used in patients under one year of age when there is a malformation in the patient's head and this device allows the head to mold to the orthosis as the patient grows, recovering the normal shape of the skull (Geoffroy, and others, 2018). Orthopedic inserts are used to correct defects in the foot and allow the patient to walk normally (Peker, et al, 2020). And medical facial implants are used in medical procedures to correct defects that require taking data on the geometry of the bone, which serves as the basis for sculpting or custom designing the implant (Wang, Sekou, Liu, Li, & Wang , 2008).

Although the case studies of medical devices are different, their flow of operations in the craft manufacturing process is very similar and is guided by: 1. Obtaining the geometry of the human body with plaster bandages (negative mold), the only A different case was that of the cranial remodeling orthosis, where the data was collected from the patient's positive mold due to the difficulties of scanning a child under one year of age (Geoffroy, et al., 2018). 2 positive mold by emptying, and 3 modification of the mold according to the case study, 4 thermoforming of the mold and final finishes; In turn, the intervention with technologies is carried out in a general way in all the study cases by obtaining reference models of the part of the human body of interest, which in some cases was carried out by 3D scanning and in others by CT (computer tomography), refinement of the mesh, modification of the geometry of the model according to the patient's specifications, and 3D printing of the orthosis or prosthesis (Colombo, Rizzi, Caterina, Daniele, & Vitali, 2018) (Nicoloso, Pelz, Barrack, & Kuester, 2021) (Udai & Sinha, 2017), in the case study of ear prostheses, after this process, an artisan process of lost-wax casting of the printed model was continued (Mohammed, Cadd, Peart, & Gibson, 2018) (Cruz, et al., 2020) (Watson, Muhanad, & Hatamleh, 2014).

Architecture

In this area, we find different techniques for applications in architecture such as the traditional construction of cantilevered walls, in which an expert mason positions rows of bricks to achieve a curved effect on the wall without it taking over, also for this technique the expert modifies the bricks by carving them by hand (Stevens, Kamath, & Sharma, 2017). On the other hand, the ability to manufacture casting molds in various techniques such as the manufacture of plaster ornaments (Marshall, 2007), lattice modules in concrete (Karanastasi, et al., 2013), and prefabricated ferrocement (Peinovich & Fernandez, 2012). As well as manual skills for the construction of tessellations, or geometric compositions (Marshall, 2007) (Karanastasi, et al., 2013), and knowledge of the material to achieve an adequate mix of components.

Regarding the intervention with digital technologies in the case of the cantilever wall, the researchers, after observing the traditional technique and empathizing with expert masons, managed to take part of the tacit knowledge of the masters to build a parametric CAD model that guides the construction of a wall similar to the one built conventionally, also with a 3-axis CNC machine they carved the bricks, resembling the traditional carving they do in the conventional technique (Stevens, Kamath, & Sharma, 2017). About the other three techniques, their technological intervention was also given by observation and exploration with craft-based processes, and they focused on developing molds designed in CAD software and prototyped in laser cutting machines (Marshall, 2007) (Karanastasi, et al. , 2013).

Carving

In this area we identify techniques that are similar to manual skills for carving and sculpting material, we find two related to wood, for carving traditional bowls or plates (Grimshaw, 2017), and carving ornaments in traditional Italian furniture (Cianfanelli, Goretti, & Tufarelli, 2019), and clay carving for large-format sculptures, in addition, in this technique a small-scale model is first made, which is then scaled to a large format that exceeds one meter in height. height, skill, and experience of the sculptor are necessary for this task (Aleman, Meier, Perez, & Garcia, 2021).

We found different ways for the digitalization of the technique, for carving wooden bowls the researcher analyzed the process regarding the behavior and properties of the material, to define cut parameters in a CNC machine imitating manual labor (Grimshaw, 2017). In traditional furniture, researchers used reverse engineering with 3D scanners to obtain a bank of digital reference models of wood carvings, and thus safeguard the knowledge embedded in the objects (Cianfanelli, Goretti, & Tufarelli, 2019), and in large-format sculpting, they propose scanning the sculptures on a small scale and using the digital model in CAD software to scale the size of the model, to build cross-sections of the piece that will be used as polyurethane foam cutting guides and form the sculpture from serial plans (Aleman, Meier, Perez, & Garcia, 2021).

Other case studies

We grouped techniques that did not belong to a specific area, we identified two craft-based processes, the traditional pottery of Stoke-on-Trent United Kingdom, in which the researchers focused on the skills for the construction of molds (Echavarria, Weyrich, & Brownsword , Preserving ceramic industrial heritage through digital technologies, 2019), and for their digital intervention, they followed a strategy similar to that used in traditional furniture, the researchers used reverse engineering with a 3D scanner to obtain a bank of virtual models of the molds in order to safeguard the knowledge embedded in these artifacts since these objects have an important traditional value. The other case study deals with the traditional technique of 2D templates for dress pattern making, from the digital part the process was approached with 3D scanning of the body of the person who requires the dress, and from its digital model key points for construction were identified. of the templates from the digital model, this was done with the aim of making clothes that fit better to the size of each person.

Robots and automation

In this category we group the case studies that had as their objective, digital intervention, total automation of the technique without human intervention, directed by robotic arms that are programmed to carry out the manual activities of the workflow, emulating traditional techniques (Ravihandar , Polydoros, Chernova, & Billard, 2020). The purpose of this automation is to achieve more efficient processes (Phan, Kana, & Campolo, 2017), and the development of flexible manufacturing for mass customization and custom design (Trzepieciński, 2020). As in the previous group, the case studies were classified into common areas: Architecture, metal work, and other case studies, which are described below.

In the area of architecture, we identify research related to stonemasonry, on stone carving for architectural elements, in which it is necessary to have the ability to use the tools and make decisions regarding the way to carve the material since this it is not homogeneous (Shaked, Bar-Sinai, & Sprecher, 2021), (Shaked; Bar-Sinai; Sprecher, 2020). Similarly, the sand sculpture technique is in which special concrete blocks are prepared and carved with hand tools such as chisels and hammers (Kalo, Tracy, & Tam, 2020). On the other hand, the traditional adobe technique was found, which is a mixture of water, clay, sand, and organic fibers, in this work the material and its characteristics for the construction of walls were studied (Reyes, et al., 2019).

Another area of metalworking was also identified where we found study cases of traditional blacksmithing in which manual skill and experience with different tools, hammer, craft former, English wheel, and turning lathe for the manufacture of metal artifacts are shown (Russo B ., Cleaver, Allwood, & Loukaides, 2022) (Ilangovan, Monfared, & Jackson, 2016) (Rossi & Nicholas, 2018) (Bowen, Music, Erdinc, & Shokrani, 2021) (Russo, Cleaver, & Allwood, 2019) Similarly, we found a case study on manual skill in polishing metal parts (Kalt, Monfared, & Jackson, 2016). In addition, two particular case studies were identified on the skills for manual roughing of leather parts for shoe assembly, since it is an operation that requires great skill and experience on the part of the operator (Pedrocchi, Villagrossi, Cenat, & Tosatti , 2015). And this case the manual technique of manufacturing fiberglass molds requires dexterity and ability in decision-making during its operations (Kikuchi & Suzuki, 2016).

Regarding the digital adaptation of the techniques mentioned in the different areas, the researchers analyzed the body and manual gestures that the operator or technician performs when executing manual operations with movement recording tools as well as pressure sensors to measure force. of the elements with which they interact, this data serves as input to program or train the robotic arms that imitate the gestures of people, this process was repeated in all the analyzed cases of this group except for the traditional adobe technique in which a robotic arm was used for the trajectory of an extruder of the adobe material similar to 3D printing by the fused deposition technique (Reyes, et al., 2019).

Conclusion

We identify the characteristics of tacit knowledge that are used in several case studies to carry out a digitization of an artisanal process, in the form of 3 key attributes: Skills in the knowledge of the technique, corporal gestures and knowledge of the material and we show that the responsible integration of these attributes guarantees the reliability of the technique when intervened with digital technologies.

On the other hand, we find that despite the efforts of the investigations in the different case studies, not all the tacit knowledge of an artisanal process can be digitized, especially that which corresponds to the decision-making carried out by the expert in the different techniques. Workflow activities, as evidenced in the tests of robots that imitated the tasks of an artisanal process, only managed to carry out simple tests of the process, requiring greater efforts to achieve complete automation.

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Contact email: jesus2208480@correo.uis.edu.co

A Biometric Method for Spatial Experience Analysis:
A Case Study of Airport Design and Traveler Stress

Humbi Song[1], Harvard Graduate School of Design, United States
Isa He[2], Harvard Graduate School of Design, United States
Zach Seibold, Harvard Graduate School of Design, United States
Allen Sayegh, Harvard Graduate School of Design, United States

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Abstract
Why do certain built environments and events induce stress? How does the design of our spatial environment affect our mental state? What can we do to measure and understand these interactions? Interdisciplinary collaborations between architecture and psychology have given rise to a new frontier of architectural research, and emerging biometric sensor technologies lead to innovative research methods that can provide a unique insight into human spatial experiences. This research uses the passenger experience of air travel as a case study for prototyping methods of quantifying and understanding individual spatial experience. The airport presents a potent case study environment; though significant energy has gone into engineering the passenger experience, the prevailing cultural perception of air travel remains tinged with unease and anxiety. The presented research outlines a methodology for quantitatively measuring the passenger experience of the airport design: equipping passengers with biometric electrodermal activity (EDA) sensors – a biomarker significantly correlated to emotional stress response, analyzing first-person video footage worn by participants to map contextual information, and conducting interviews to assess the participant's perception of the air travel experience. A dashboard was then developed to facilitate visual cross-referencing and analysis of aspects of airport design and social stressors at airports with the biometric data of the passengers and their self-reported perceptions. The overall aim of this research is to identify key elements to help rethink and redesign airport architecture and experience. Future research can utilize this methodology to facilitate speculations on alternative scenarios for designing not only airport architecture but also other analogous public spaces.

Keywords: Biometric Wearables, Spatial Experience, Stress, Built Environment, Airport, Interdisciplinary Research Methods

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[1] Co-first authors

[2] Co-first authors

1. Introduction

Occupants experience spaces in ways that are difficult to anticipate. Why do we get frustrated in certain spaces and at certain times? Why do certain built environments and events induce stress? What can we do to measure and understand these interactions? These fundamental questions about the human experience of the built environment have challenged architects, engineers, and experts in human factors alike.

This paper proposes the integration of psychology and neuroscience research tools – specifically emerging biometric wearables technology – into architectural research as an essential toolkit for gaining insight into the human experience of spatial conditions. Using the passenger experience of air travel as a case study, this research presents a methodology and a data analysis dashboard for identifying stress triggers through the airport by tracking physiological changes with biometric sensors. The proposed method of quantifying spatial experiences is intended to be eventually adaptable to a wider variety of built environment settings.

Air travel presents a potent case study environment for observing the effects of designed spaces and systems on the individual experience. Notorious as a stressful experience, airports are tightly controlled, sequential spatial environments with set expectations on the manner of navigating through spaces. To test the validity of the research methodology, preliminary experiments were performed at airports in the United States where passengers were equipped with biometric sensors and cameras. Through a series of trial and error, these studies allowed the development of an appropriate equipment and experiment set-up to quantify the effects of different spatial and contextual elements on passenger stress.

In addition, a prototype dashboard was developed to visualize the collected data for analysis. The dashboard facilitates a visual cross-referencing of video footage, biometric data, spatio-temporal stress map, critical for understanding the context surrounding stressful situations within diverse traveler experiences in airports. From it, a taxonomy of air travel specific stress triggers were determined through examining the antecedents of stress, including event characteristics, people and technology interactions, and location specific qualities.

The overall aim of this research is to invite a rethinking of architecture and systems design by bolstering the dialogue with individual experience data. This research proposes an evidence-based design approach for air travel design professionals as an alternative to conventional precedent-based design approach. Future research can utilize this biometric methodology to gain a detailed interdisciplinary knowledge of how people experience emotions in different spaces. This would empower human-centered individual perspectives during design decision making, and facilitate alternate design speculations by architects, designers, and stakeholders.

2. Measuring the Human Experience at Airports

2.1 Airport as Case Study

Airport presents a compelling case study context for researching the effects of designed spaces and systems on the individual experience, with a particular focus on understanding stress in the built environment. Air travel is commonly regarded as a stressful ordeal, with most passengers able to recount their own previous airport horror stories (Schaberg, 2012). Additionally, airports are tightly controlled spaces that explicitly and implicitly guide people

through a sequence of spatial environments (Adey, 2003). These factors make airports a particularly appropriate setting for examining these research topics.

The airport, as a site of governmental border control, is designed to facilitate the controlled flow of large numbers of people. To do so, individuals within the airport are surveilled and tracked, with a limited freedom of movement. Because of this, passengers can feel a lack of autonomy and agency, and at the mercy of the environment, airport processes, and personnel. This contributes to the creation of a new airport culture, consisting of a collection of unspoken norms, etiquette, and social expectations (Schaberg, 2012).

In addition, airport architecture is commonly regarded as sterile and generic spaces that suppress diversity of culture and society, despite the heterogeneity of the travelers and the specific geographic locality of the airport (Augé, 2008; Sharma, 2009). Regardless of the actual location of the airports, airport buildings frequently feel distinctly similar to each other and "function effectively when their occupants need not confront the challenge of otherness—unique places, politics, and personalities" (Wood, 2003).

Though significant energy has gone into improving the passenger experience, the prevailing individual experience of air travel remains tinged with unease and anxiety (Airport Cooperative Research Program et al., 2011). Design discipline commonly looks at existing precedents and tries to improve upon them. However, in the highly regulated air travel sector, driven by needs of safety, efficiency, and logistics, existing designs often deprioritize the human experience. Thus, iterating on previous designs frequently reproduces the same frustrations. The air travel sector may benefit from a more human-centric evidence-based design methodology.

2.2 Biometric Sensing Wearables

While architects have contemplated the human experience of the built environment from arguably the origins of the discipline itself, attempts to methodically research this experience came to the foreground around the 1960s (Karakas & Yildiz, 2020). These foundation studies by Kevin Lynch, Jane Jacobs, and William Whyte relied on observational studies and surveys as their primary research techniques (Lynch, 1960; Jacobs, 1961; Whyte, 1980). Today, advances in biometric sensing tools provide an extraordinary opportunity to build upon this work, allowing novel methods of tracking physiological responses, and adding quantitative understanding of the human experience of the built environment (Sagl et al., 2019). In addition, these methods can offer a measure of systematic repeatability in their studies. Interdisciplinary collaborations among architecture, psychology, and neuroscience have given rise to this new frontier of architectural research, incorporating biometric tools such as eye trackers, proximity sensors, brain electroencephalography scanners, wrist-worn health monitors, body cameras, and others. (ESUM, 2017; Karakas & Yildiz, 2020; Poh et al., 2010; Schlickman et al., 2019).

To glean potential areas for intervention, this research is particularly interested in understanding changes to emotional stress during an experience. A range of biomarkers were explored for possible correlation to stress, including heart rate, heart rate variability. respiration rate, electrodermal activity, eye gaze, pupil dilation, blood pressure, skin temperature, brain electroencephalography, and more (Gao et al., 2022; Healey & Picard, 2005; Kyriakou et al., 2019; Schmidt et al., 2018). Following a review of the relevant literature, this work focused on electrodermal activity, as a leading candidate for tracking

stress and emotional changes (Kyriakou et al., 2019; Picard et al., 2016; Poh et al., 2010; Sagl et al., 2019).

2.3 Antecedents of Stress

An abundance of existing research investigates the cause of stress (Greco & Roger, 2003; Grupe & Nitschke, 2013; Neubauer et al., 2018; Van Hedger et al., 2017), ranging from environmental triggers to personal characteristics, from acute stress to chronic stress. Due to the focus of this paper, the authors are most interested in identifying stress triggers within the air travel experience.

Within the cross-cultural environment of the airport, the passengers' individual cultural differences can have a large impact on their perception of the passenger experience (Pantouvakis & Renzi, 2016) Therefore it is important to separate the situational and environmental influences on stress from individual cultural specificities. Existing research examining the experience of stress concludes that certain settings and environments are prone to triggering particular emotions such as stress (Scherer, 1986; Gatersleben & Griffin, 2017). Thus, understanding the antecedent situation of stress can help reveal situation-specific characteristics that influence the emotional state. Scherer's framework dissects the aspects of emotion clearly into person-specific characteristics and situation-specific ones. The separation of person specific and situation specific characteristics allows for researchers to focus on aspects of emotion independent of individual differences such as personal characteristics, behavioral tendencies, and perceived social and cultural norms.
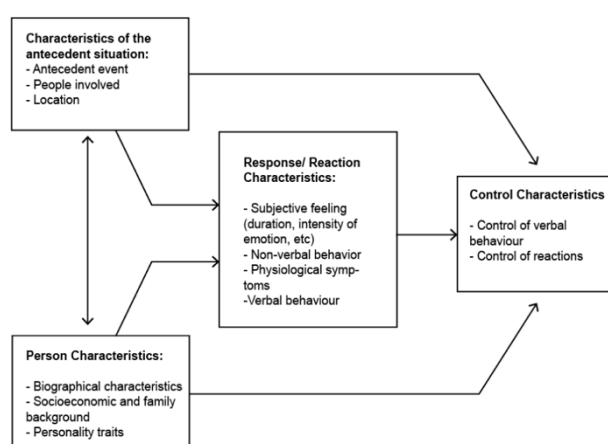
Figure 1. Scherer's diagram of "Relationships between the different aspects of emotion" in Experiencing Emotion: A cross-cultural study (Scherer, 1986).

Within the experience of air-travel stress, this research work is specifically interested in acute stress triggered by an event's nuanced characteristics. Activity qualities such as time sensitivity and uncertainty, while not exclusive to air travel, are significant air travel specific characteristics that affect individual's stress and event perception (Greco & Roger, 2003; Grupe & Nitschke, 2013; Neubauer et al., 2018; Van Hedger et al., 2017). By tackling the characteristics of the antecedent situation of an individual's emotional state, using the lens of Scherer's analysis, this research work strives to clearly determine the exact aspects of air-travel design that trigger passenger stress.

Comprehensively analyzing the context surrounding an activity is critical to understanding passenger experiences and sources of stress. Research by Kirk et al. categorized airport activities into eight taxonomic groups – processing, preparatory, consumptive, social, entertainment, passive queuing, and moving – to better understand passenger experience at airports (Kirk et al., 2012). This activity-centered approach is a useful model for categorizing and analyzing antecedent situations as stress triggers, as a taxonomy of activities can be easily matched to heightened physiological changes.

3. Methodology

3.1. Selection of Biometric Wearable Devices

This case study examines the passenger's physiological responses throughout the air travel experience, focusing on the time of their arrival at the airport to becoming seated at the airplane. In order to better understand one's stress and emotional changes, the researchers focused on electrodermal activity (EDA) in particular.

Electrodermal activity (EDA) is understood to be one of the most useful indicators of stress (Picard et al., 2016). Also known as galvanic skin response (GSR), or skin conductance (SC), this biomarker tracks changes in the skin sweat response on the body's extremities such as fingers, palm, wrist, and feet. Subconscious changes in cognitive and emotional states affect the body's sweat gland production, which can be detected as increased electrical conductance by electrodes placed on the skin. It has been noted to be "one of the most sensitive and valid markers of emotional arousal" (Kyriakou et al., 2019), where emotional arousal refers to the intensity of an emotional state such as anger, excitement, stress, joy, and fear.

Of the variety of wearable types worn at different locations on the body, wrist-worn wearables quickly became a strong preference. Because one of the major stressors at the airport is adhering to numerous anti-terrorism security protocols, researchers chose to explore wearables with a visual similarity to a watch, specifically commercial-grade wearables (Fitbit, Apple Watch, WHOOP), and medical-grade wearable Empatica E4. Not only are security personnel unlikely to mistake these devices as threatening, but also participants often feel more comfortable using these devices in the field. This lessens the potential for the participant's biodata to be contaminated by additional stress response due to the presence of the device itself. In addition, due to their prior familiarity with commercial health trackers, these participants are better equipped to understand and predict how their experience may be altered by agreeing to the study.

Wearable Device	Empatica E4	Shimmer Consensys GSR	Fitbit Charge (and others)	WHOOP	Apple Watch
Location	Wrist	Finger and Wrist	Wrist	Wrist	Wrist
HR	Yes	Yes	Yes	Yes	Yes
HRV	Yes, outputs continuous data	Yes, outputs continuous data	Yes, outputs daily average (Unverified accuracy)	Yes, outputs daily average (Unverified accuracy)	Yes, outputs daily average (Unverified accuracy)
EDA	Yes, med accuracy	Yes, high accuracy	No	No	No
Data Output + Timestamp	Output is .csv file of data points per (<) second	Output is .csv file of data points per (<) second	Cannot export directly. Can screenshot from web interface.	Cannot export directly. Can screenshot from mobile interface.	Cannot export directly. Can screenshot from mobile interface.
Type	Medical grade	Medical grade	Consumer grade	Consumer grade	Consumer grade

Table 1. Comparisons of different biometric sensing hardware available to researchers

3.2.   Air Travel Passenger Experiments Set Up

Through numerous trial runs with different participants, the researchers assembled and refined a preferred methodology for measuring the passengers' emotional changes during the airport experience, that allows long term measurement and presents minimal disturbance to their typical behavior. This method collects data through two main devices: (1) an Empatica E4, a wrist-worn wearable which collects HR, HRV, EDA, Accelerometer, Skin Temperature, and Blood Volume Pulse; and (2) a microcamera to be clipped on a shirt pocket which captured a first-person video footage to allow researchers to understand the spatial and situational contexts corresponding to any changes in biodata levels. The experiments consisted of the following steps:

Step 1: Ten Participants who had existing plans to fly out of Boston Logan International Airport were recruited. To ensure the navigation of similar initial spaces,the subject pool was limited to participants flying out of Logan. Many also experienced other airports on layovers.

Step 2: Participants were outfitted with two wearable devices. 1) the wrist-wearable Empatica E4 device, and 2) a microcamera, a small pen-like video camera wearable that can be clipped onto a person's shirt pocket.
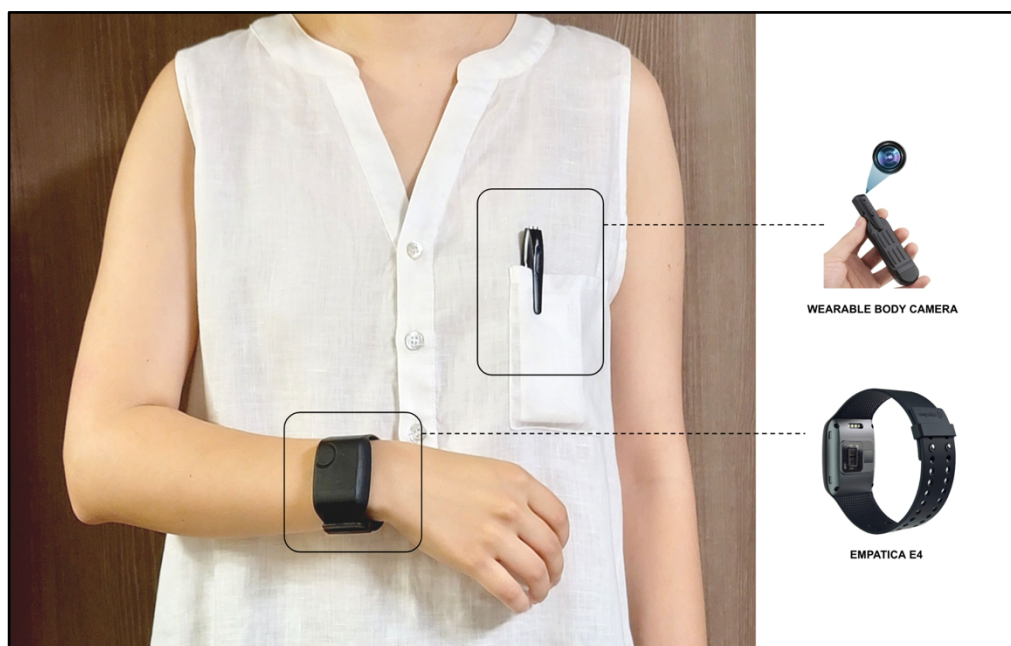
Figure 2: Participant outfitted with Empatica E4 and microcamera.

Step 3: Participants were instructed to turn on both devices as they leave home. Both devices should be left on during their transportation to the airport, and throughout the airport, except for the moment of going through the security scanner. As a privacy measure, the microcamera has a sliding cover over the lens which participants may use whenever desired.

Step 4: Participants were instructed when to turn off the devices. Due to privacy reasons and battery longevity, the microcamera is to be turned off once seated in the flight, and the Empatica is to be turned off after exiting their destination airport.

Step 5: Participants were interviewed after the flight. Because EDA biodata correlates to the intensity of emotional arousal response, rather than the valence – interviews were conducted to record whether a recorded spike in EDA corresponded to a positive (i.e. excitement) or negative emotion (i.e. stress).

The data output from these two devices were then compiled by the researchers (Figure 3). The Empatica software provides an initial visualization interface and allows the exporting of data as a .csv file. The microcamera provides video footage which is then stabilized through a video editing software.
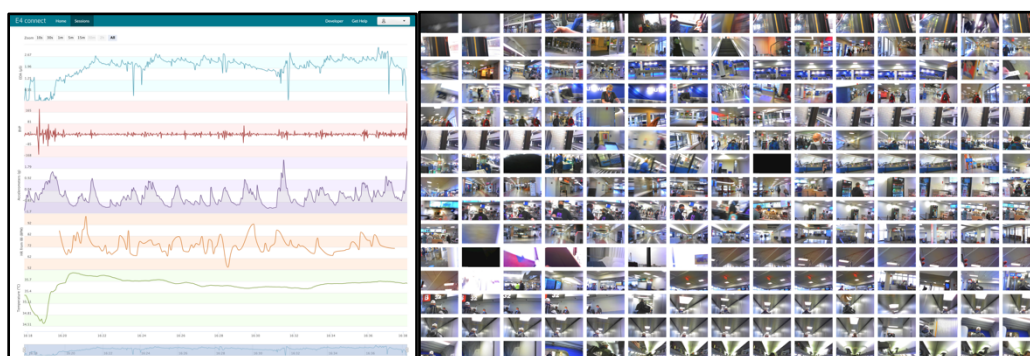
Figure 3: Empatica visualization interface (left), and video footage from microcamera (right).

4. Data Analysis Methods and Dashboard

To understand the effects of air travel activities on passenger stress, the initial analysis method involved manually analyzing the video footage frame-by-frame (Figure 5), rigorously documenting activity events by timestamp (Figure 6), and corresponding the events to the EDA levels collected from Empatica (Figure 7). With this method, researchers were able to identify the specific antecedent events that caused an increased EDA, such as interactions with human or technology, or location specific characteristics.

Figure 4. Documentation of the sequence of events from video footage.

Figure 5. Documentation of macro and micro events corresponding to biometric data collected from the Empatica E4.

4.1 Development of the Dashboard

Researchers found that this initial method, while extremely detailed and informative, was not conducive to easily cross-referencing the different aspects of the air-travel experience. To streamline the analysis process, a draft dashboard was developed to simultaneously view all biometric data, video, stress trigger activities, and location within the airport (Figure 8). After initial testing of the draft dashboard, areas of improvement were identified and a finalized dashboard was developed (Figure 9). The resulting dashboard facilitates concurrent analysis of the spatial and social stressors at airports with the quantitative biometric data of the passengers and their qualitative self-reported perceptual experiences. This allows the identification of the antecedent situations affecting stress level changes in airports.
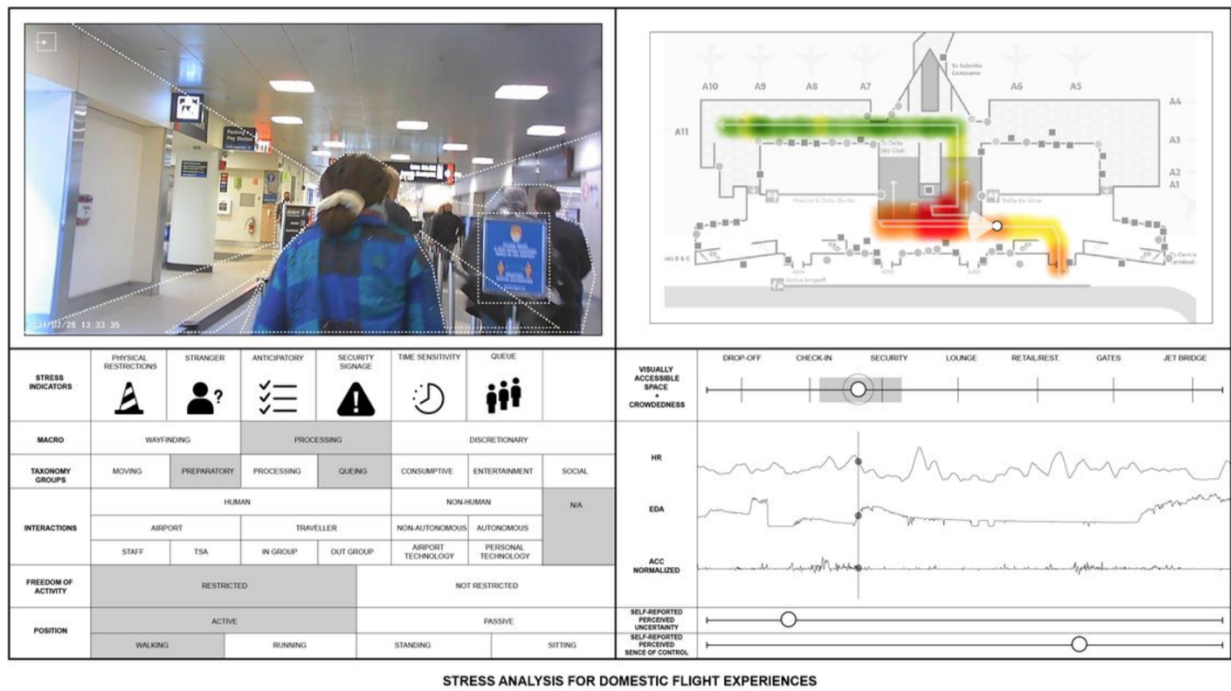
Figure 6. Draft dashboard visualizes biometric data, video, stress trigger activities and location within the airport.

Figure 7. Finalized dashboard allows for cross-referencing of raw biometric data, video footage, spatial representation of stress, and stress trigger analysis.

I Video	II Spatial Visualization
III Biometrics	
IV Stress Trigger Analysis	

Figure 8. Finalized dashboard organization.

The proposed dashboard consists of four major sections (Figure 10). Section I contains video footage collected from passengers via traveler's microcamera. The footage is processed to identify spatial and physical elements, traveler activity and surrounding context. Section II indicates the traveler's geographic movements mapped onto the airport terminal plan. Section III contains a modified visualization of the biometric data collected from Empatica E4, which allows for easier identification of the heightened physiological change. Section IV provides analysis of the type of stress trigger causing the change in biometric markers. Stress indicators are identified using the macro activity, taxonomy groups, interaction types, and additional environmental contingencies.

A cross comparison of data can help indicate build up, climax, and dissipation of stress as it relates to different stress triggers. Through this dashboard, analysis can expand beyond the identification of moments of stress, to understanding the longer-term experience surrounding various stress triggers.

4.2. Identification of Stress Triggers

To pinpoint the exact cause of stress for passengers in airport settings, researchers used Scherer's method of analyzing emotion which separates situation-specific characteristics from person-specific characteristics (Scherer, 1986). This helps identify specific qualities of the airport experience as possible stress triggers, without the interference of idiosyncratic personal characteristics, behavioral tendencies, and cultural norms.

Researchers used the aforementioned method, using biometric markers as indication of physiological stress and video footage to identify aspects of the antecedent situation of stress. Borrowing and modifying the activity centered approach taken by Kirk et al, air travel activities were cataloged according to Scherer's definition of the antecedent situation. The taxonomy of spatial-social conditions were drawn from video analysis, interviews, and prior research (Calvo & Gutiérrez-García, 2016; Fink, 2016; Kirk et al., 2012; Scherer, 1986) to identify a collection of possible stressors during air travel. Stress triggers were categorized into three types: airport specific events, interaction types, and the location characteristics.

Airport specific events: The majority of airport specific events are preparatory and processing activities (Kirk et al., 2012) and are assumed to induce stress more readily in individuals (Dohrenwend & Martin, 1979; Grupe & Nitschke, 2013; Neubauer et al., 2018). These events and activities have characteristics, such as uncertainty and time sensitivity.

1. **Unfamiliarity of events** occurs when a traveler is uncertain about the acceptable conduct associated with an event, or is unfamiliar with the context surrounding an event. Traveling during the Covid-19 pandemic is a good example of a recent external event that was unfamiliar to both beginner and seasoned travelers.

2. **Decision-making events** require the passenger to perform an action without perfect information and frequently under time constraint. The uncertainty of the subsequent result, and the consequences in a highly regulated and controlled environment with a clear hierarchy of authority makes even small decisions in an air travel experience seem high stakes.

3. **Anticipatory events** occur before a known event. In air travel it happens before *processing activities,* such as security checks, passport control, and boarding. Anticipation is associated with the event prediction and the effects of an individual's actions and responses (Canaveral et al., 2020).

Interaction Types: Stress triggers associated with interactions are often accompanied by a clear delineation of authority, whether it is through security personnel or physical signage, and are heavily influenced by external forces beyond their control such as the involvement of powerful others (Steptoe & Poole, 2016).

1. **Interaction with strangers** is an active form of engagement that involves traveler interaction with a stranger. Aspects of the interactions, such as social anxiety, differences in cultural norms that may affect individuals' understanding of personal space and acceptable social behavior, may induce stress.

2. **Interaction with authority** involves travelers' interaction with airport staff or security personnel. Majority of these interactions happen within three areas - check-in, security and the boarding gate. Stress that is triggered by interaction with authority involves lack of agency, sense of surveillance, and restriction on personal freedom.

3. **Interaction with airport technology** involves travelers interacting with technology used for processing activities, before or during security, at the airline check-in counter and security checkpoints. These interactions can include the use of Automated Screening Lanes (ASLs), Biometrics Technology, and Credential Authentication Technology (CAT).

Location Characteristics: The location of the air travel related activity is crucial in determining if an event is stressful for the passenger. Spatial and social qualities of a location provide situational context that can change the passenger's perception of the situation. For example, a tense confrontation within a confined space would be perceived differently than if the same interaction took place within a more spacious environment.

1. **Presence of security signage** reminds passengers of security measures before and during processing events. These include signs such as preparatory requirement signs, prohibited item signs, stop signs and warning signs.

2. **Spatial restriction** occurs in areas with more security and mainly were found within security checkpoints and jet bridges. They often occur as a transition between a less

controlled environment and a more controlled environment. Queuing, for example, occurs before processing events and interacting with authority or airport technology.

5. Discussions

5.1. Discussion on Case Study Methods and Findings

As air travel trends change, the identification of airport stress triggers can provide valuable insights to designing better air travel experiences. A major advantage of the proposed dashboard is the ability to discern the build up, climax, and dissipation of extended stress, as well as identifying the emotional spikes corresponding to momentary stress. For example, a stressful encounter from an interaction with a human, may cause a longer residual stress as compared to momentary stress caused from an interaction with an airport technology. This is critical because the majority of people have difficulty recognizing the exact cause for stress, often misidentifying and generalizing the stress trigger (Censuswide, 2019).

Through using the research methodology detailed in this paper, researchers were able to go beyond subjective generalizations and assumptions long taken for granted. For example, while there is widespread understanding that security processing is among the most stressful events within the passenger experience, this methodology allows researchers to gain a more nuanced understanding and pinpoint the specific moments within the process that triggered notable spikes in EDA (Figure 11, 12). In this participant example, heightened physiological response was not present during the majority of security processing activities, including queuing, canine checks, security bins, and only began dramatically increased during one-on-one conversations with TSA agents. Residual stress following the conversation contributed a newly increased baseline for all subsequent stress triggers. Through similar analysis, airports and airlines can better understand the root cause of the stress and make more informed design decisions to improve the air-travel experience.
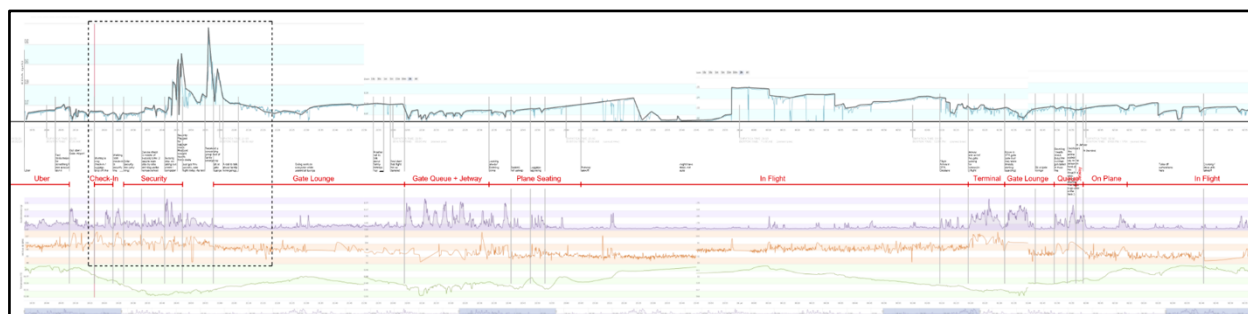

Figure 9. Macro-view of participant EDA levels throughout the experience, and subjective memory of stress during security. Figure 12 extends are outlined in a dashed line box.

Figure 10. Micro-view of participant's activity and biometric data during security.

Understanding the antecedent situation draws a clearer picture of the context surrounding stress triggers, such as the activity performed, the types of human interaction encountered, and unique spatial characteristics of the airport. The study found that there were certain characteristics of the antecedent situation that were more likely to trigger stress in individuals. Participants' elevated EDA levels were correlated with situational characteristics such as time sensitivity, uncertainty, interacting with people in confined spaces, and interaction with a person of authority. For example, interaction with strangers and authority tended to result in more prominent stress responses within confined spatial configurations than open spaces.

By mapping stress levels within the air-travel experience and understanding airport specific stress triggers, designers and planners can design airports to anticipate and alleviate expected high stress situations.

5.2 Discussion on Limitations

The researchers' final combination of wearable technologies relies on Empatica E4's ability to accurately collect EDA data. However, verification studies of the E4 report mixed results, because sensors worn on the wrist were document to be accurate than sensors worn on the fingertips, palm, or soles of the feet (Kleckner et al., 2020; Milstein & Gordon, 2020; Sagl et al., 2019) as there are more sweat glands on the latter areas. However, due to this paper's less stringent requirements, wrist wearable is enough to collect data on changes to the EDA value. Wrist wearables also dampened participant's initial anxiety and concerns about gathering data in the highly controlled airport environment.

In addition, further refinement should be done to allow better differentiation between positive and negative emotions when analyzing EDA data. Interviews conducted after the experience allowed for some insight, but other modes could be explored. Examples of contemporary efforts to better understand valence include a mood-logging app and a PHQ-9 Depression Test Questionnaire by FitBit, and Amazon Halo's "emotion tracking via voice detection" facilitated by Amazon's Alexa devices (Charara, 2020). The existence of these research efforts indicate the rising interest in quantitatively tracking emotions, providing a fertile research field.

While there are limitations to the method described above, this case study demonstrates that the above methodology is useful in concurrently analyzing various types of data including biometric data, video footage, spatial data and activity data to understand the reason behind changes in the emotional state. The aggregation of results can then help identify not only stress points within the travel experience, but entire stress areas, leading to a more comprehensive understanding of air travel stress. In subsequent research, the dashboard should be used to test the effects individual stress triggers identified through this research.

6. Conclusions

This research proposes a biometric methodology for measuring and quantifying the psychological and physiological impact of designed spaces on occupant experience. Using the airport as a compelling case study location, the authors conducted preliminary tests of quantifying the emotional experiences of spatial environments, putting the human experience at the forefront to rethink how to design spaces, experiences, and systems. A dashboard was prototyped to allow analysis of both the resulting biometric data from a wrist-worn wearable Empatica, and the visuospatial data from a microcamera video footage. The resulting findings allows airport designers and management to rethink ways to identify nuanced stress triggers within respective airports, and ultimately create less stressful air-travel experiences.

The authors hope that the biometric methodology can easily be adaptable to other similar and dissimilar contexts. Similar indoor contexts include other public buildings, such as retail, transportation hubs, hospitals, and government facilities such as DMVs. Conducting experiments using this methodology in dissimilar contexts may bring forth greater improvements to the method. For example, outdoor contexts such as urban neighborhoods and parks may be intriguing case study environments to understand how people phenomenologically and physiologically respond to the different visual and other sensory stimuli.

The research work hopes that further interdisciplinary research on individual experiences can enable better designs of spaces, systems and processes. The authors and other interested researchers may benefit from further exploring the following questions: How can we predict behavior and emotional responses in different spatial and material environments? How can this knowledge empower and enable better design the experience of various spaces?

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