ARTeFACTo2024MACAO

4TH INTERNATIONAL CONFERENCE ON DIGITAL CREATION IN ARTS, MEDIA AND TECHNOLOGY

CREATIVE DIGITAL INTELLIGENCE | 5 - 6 DECEMBER 2024

CONFERENCE PROCEEDINGS

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ARTeFACTo is a transdisciplinary studies journal and conference centered around the concept of digital media and computer artifacts, which were the genesis of its name.

It aims to give visibility to all digital media and technology-based artifacts, creators, or contributors from a transdisciplinary, humanistic, and holistic perspective of integration and composition.

The main objective is constructing and disseminating knowledge through descriptions of artistic practice, authorship or co-authorship (including the narration and description of other works), and graphic data (images, diagrams, animations, drawings, sketches).

The Journal is open to international contributions from all those studying digital media/computer artifacts, embracing their conceptualization, design, creative and research processes, computational implementation, exhibition and fruition, and role in today's information and knowledge society. Also welcomed are articles fostering the establishment of the conceptual foundations of an artifact theory in the digital media world. Accepted articles shall be original (in compliance with the standards of conduct of the COPE – Code of Conduct and Good Practices) in Portuguese and English, with a mandatory abstract in English.

The Conference has the same goals as the Journal but provides a specific floor for the concrete exhibition of artifacts along with their presentation and discussion.

All submissions will be evaluated by peer review, including two advisors from the Scientific Council. All feedback will be sent to the authors, indicating their approval, refusal of publication, or requests for correction or recast. The authors will be notified of the publication once the entire selection process has been completed.

ARTeFACTo is a joint project between Artech International and Universidade Aberta.

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Authors were invited to submit papers and exhibition artwork proposals covering various aspects of creative digital art, with a particular focus on artifacts, art installations, and general-purpose interactive artworks. These submissions underwent a review process conducted by an international committee.

Descriptions of artistic practices, authorship, or co-authorship accompanied by graphic records—such as images, diagrams, links to dynamic images, drawings, and sketches—were highly valued.

The ARTeFACTo 2024 MACAO conference took place in a hybrid format, allowing on-site and online participation. The event featured technical sessions, invited talks, discussion panels, and exhibition areas dedicated to artifacts and installations. Contributions were accepted as full papers, short papers, and proposals for artifact exhibitions or art installations.

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TABLE OF CONTENT

FULL PAPERS ||

1. Virtualization for Kintsugi Art: Damaged Porcelain Figurine Recreation Supported by 3D Modeling Computer Technology
2. *Digital Authors*: Tackling online hate speech through storytelling
3. The art of making systems: reflections on generative paradigms and their authorship
4. AI MoCap for Artists
5. Méliès, the *inventor* of TikTok: From Early Cinema Innovations to Media Education
6. Fios de Silere: a silence made of sound and light
7. Weaving Digital Narratives: The Creation of Artefacts in Multimedia Production and Digital Games
8. Among Carnations and Fragments: Bodies in Video Performance
9. Cycle to Learn: Exploring Human-AI Relation Through Breath-Driven Interactive Art Installation
10. As narrativas digitais pessoais como instrumento de ensino e aprendizagem online culturalmente sustentável
11. MultipliCity, a case study in generative AI-assisted immersive illustration workflow
12. EXPLORING PORTUGUESE TILES (AZULEJOS): Revealing Macau's Cultural Heritage through Embroidery Artefacts and an Augmented Reality Experience
13. Shared literacies in technological, artistic practice: New sensitizations, critical thinking, ancestry, and multiculturalism
14. Ab Ob Sub Ject
15. Bridging Cultural Gaps in AI Art: Hypernetworks Conditioning for Contemporary Chinese Abstract Acrylic Painting Generation

SHORT PAPERS ||

1. Endless Moments: Generative music in the browser Narrative Environments in Digital Art
2. The Faro Museum poster collection II: a virtual exhibition
3. Graus de interação em obras de média-arte digital Interactional levels on digital media artworks
4. *spectral spaces*: from 19th-century stereoscopy to 21st-century generative IA
5. Violência de gênero na videoinstalação Intrusa[s] / Gender violence in the videoart Intruder[s]
6. *right to copy* & *memórias em movimento*: textual, visual, and dynamic collages using PowerPoint
7. Development of an untouchable interactivity system for the live cinema performance: SSL2020
8. There is no truth / just sensual objects
9. Hands - Reimaginando as Tradições Artesanais e a Expressão Urbana - Hands - Reimagining Craft Traditions and Urban Expression
10. Interactive Places: Exploring Visual Systems and Storytelling through Immersive Experiences Abstract
11. Virtual Journey through an Immersive Interactive Environment: A Sensory Exploration of an Artistic Space Modeled by Dynamic Painting and Emotional Music by Domingos Mateus
12. VR Center for Cultural Heritage Presentation: Old Bosnian Town of Dubrovnik and Kopošići Stećak Necropolis
13. "Agreement. Energycorn": A Ceramic Installation Glazed Using Corn Biomass Waste

ARTIST TALKS ||

1. The Forest ... Looks at you!
2. The Tahigami Music Project
3. This is an evolving artwork

TABLE OF CONTENT

4. Tangible Scores: instruments, notation, and the hand

ABSTRACTS ||

1. The Cycle of Life and Decay
2. Ideological Distortion
3. Grains of Temporality: Methods for Eclecticism and Polystylism in Hybrid Music Composition

FULL PAPERS

Virtualization for Kintsugi Art: Damaged Porcelain Figurine Recreation Supported by 3D Modeling Computer Technology

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Abstract—This paper describes the application of 3D virtualisation for the traditional Japanese art of Kintsugi to recreate a seriously damaged vintage porcelain figurine. We use the figurine "Pantalettes" (HN1412) produced by Royal Doulton between 1930 and 1949 to demonstrate the approach from both practical and cultural perspectives. The phases of technology-enhanced restoration involve high-precision 3D scanning, 3D modeling, 3D printing, and virtual rendering, and the latter can be beneficial for further integration of the artwork into virtual environments. The project bridges several insightful perspectives of cultural interinfluence and technological innovation, including the dialogue between English and Japanese pottery-making and restoration traditions, the connection between the cutting-edge 3D modeling technology and the time-honored traditional techniques, as well as educational and training potential for Kintsugi simulation in virtual environments.

Keywords—computer 3D modelling, 3D scanning, 3D printing, virtual rendering, decorative art, Kintsugi, restoration

I. INTRODUCTION

The traditional Japanese Kintsugi technique, a transformative repair of broken ceramics using *urushi* lacquer infused with precious metals, has been an art, a craft, and a philosophy since the 15th century. It's a part of a rich cultural heritage that celebrates the beauty of imperfection and impermanence. In this paper, we aim to bridge this historical and cultural significance with the modern world through the restoration of a fine porcelain figurine using 3D modelling computer technology.

Applying Kintsugi art to damaged pottery or porcelain objects is not only about partially restoring their diminished value but also about the (re)creation of new artifacts with their unique value. In the book *"Kintsugi: Finding Strength in Imperfection"* [2], its author, Celine Santini so´ eloquently and almost poetically describes this concept as *"Even more beautiful, even more resilient, even more precious, even more...present!"*.

A. Object



Fig. 1. Damaged Figurine.

Our interest in Kintsugi art was kindled by the story of the "Pantalettes" (Royal Doulton code HN1412), a renowned creation by Leslie Harradine, which Royal Doulton produced between 1930 and 1949. Unfortunately, the figurine suffered severe damage (Fig. 1), prompting a thoughtful exploration of its restoration using the traditional Japanese Kintsugi technique.

B. Background

Applying this remarkable Japanese pottery restoration technique to an object of English fine porcelain traditions presents an interesting way to fuse two distinct cultural traditions, especially in the context of the existing links between these traditions. Thus, our idea has been grounded not only on a straightforward attempt at cross-cultural interaction but also on the long-ago inter-influential contacts between English and Japanese pottery makers, mutual discovery and interchange of the art language idioms [3], a trend existing in various domains of arts [4]. Such a cross-cultural synthesis strengthens the story of

English porcelain traditions brought to Japan at the beginning of the 20th century, including, for example, the famous willow pattern which became one of the flagship designs of Nikko Ceramics, or the founding of the first British pottery studios in Mashiko town, now a noted pottery region in Tochigi prefecture [5], [6]. Naturally, during an exceptionally long and successful history of Japanese ceramic production, one of the oldest in the world, Japanese masters, while introducing their own unique approaches, have been influenced by many other traditions, mainly from China and Korea. From the start of the Meiji Restoration, foreign influence and trade increased, and Japanese ceramics appeared in the collections in European countries. Japanese ceramic artistry inevitably influenced English and continental European traditions [7].

Kintsugi has a historical and cultural significance. The philosophy of *Wabi-Sabi* celebrates the beauty of imperfection and impermanence and underpins the techniques and materials used in Kintsugi. By illustrating how Kintsugi transcends mere repair to become a form of art, Mochinaga [8] establishes a foundation for understanding how this ancient craft can be combined with modern technology to create new, unique artefacts.

The paper [9] presents "Kintsugi VR," a project exploiting the concept of "Fractured Objects" to design virtual and mixed-reality experiences. Through a qualitative analysis of artistic activities, the study explores how reconnecting fractured parts enhances the overall object, drawing on principles of *Seamful Design* and *Wabi-Sabi*. This approach highlights the aesthetic and philosophical aspects of visible repair [10] while introducing new possibilities for artistic interaction within virtual environments, demonstrating how traditional techniques can inspire modern design practices drawing on digital technology, virtualisation, and AI.

C. Positioning

Our project harnesses the synergy between cultural heritage and technological innovation. Through the high-precision virtualisation of Kintsugi, we showcase a harmonious blend of historical artistry and contemporary digital techniques. By integrating advanced 3D scanning, modeling, printing, and virtual rendering, we preserve and enhance the value of the "Pantalettes" figurine while creating a platform for educational and training applications in virtual reality. This interdisciplinary approach offers unique insights into cultural inter-influence and technological improvements, thus contributing to the broader discussion on the impact of technology on traditional art forms, highlighting the potential for virtualization to transform and innovate art restoration and creation practices.

II. METHOD AT A GLANCE

Figure 2 illustrates the major phases of the restoration process involving the following activities:

1) High-precision 3D scanning to capture the object's details, with particular focus on the edges of the fragments;
2) 3D modelling enabling the reconstruction of the damaged elements in a virtual environment;
3) Kintsugi design simulation in the 3D modelling environment;
4) 3D printing of the modelled and reconstructed elements;
5) Assembly of the 3D printed models using the Kintsugi technique, which validates the precision of reconstructed parts and provides a trial before handling actual porcelain pieces;
6) Validation from the 3D modeling and simulation guide the application of Kintsugi to the actual damaged objects.

Additionally, virtual rendering can help use the reconstructed art in virtual environments.

III. TECHNOLOGY IMPLEMENTATION

This section discusses the central computer technology-supported processes, tools, algorithms, and produced artifacts in detail.

A. Capture the Essential – 3D Scanning

For 3D scanning, we used the RevoScan MINI 2[1] scanner and its software. (Fig. 3) shows the key stages in the scanning process.

More significant parts are usually scanned using feature tracking.
(Fig. 3 (a–b)), while for smaller parts, marker tracking (Fig. 3 (c–d)) is usually required. The raw scanned point clouds are then processed using the merge/mesh/fill holes algorithms supported by the scanning software, creating clean, high-precision models. The merging process can mess up the captured colors; however, in our case, the captured geometry and not the colors of the models are critically important.

Several scans might be required from different angles to capture the wafer-thin edges of the damaged parts (especially the smallest fragments) and further work on the scanned models in 3D modeling software. The mesh files produced by the scan

post-processing software are exported as PLY files for further geometrical adjustments in Blender[2].

B. Mixing Realities – 3D Modeling

In the Blender environment, the models are brushed up to make them suitable for 3D printing. To enable printing, the model must meet the following requirements:

- Models must-have *volume* (i.e., no plane mesh on the model). Since the 3D printers can print only solid geometry, if there is a hole in the mesh, it must be filled manually in Edit mode.

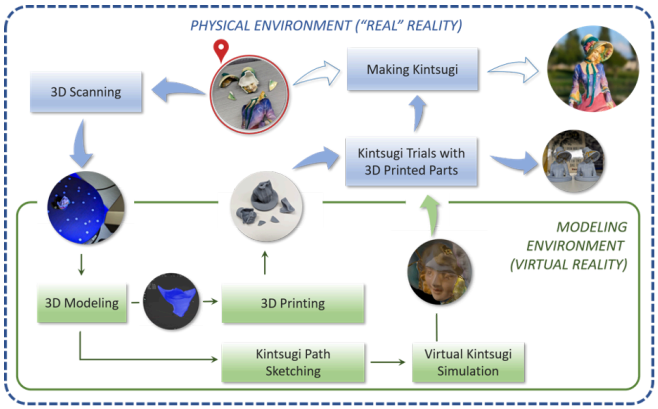


Fig. 2. Project Workflow.

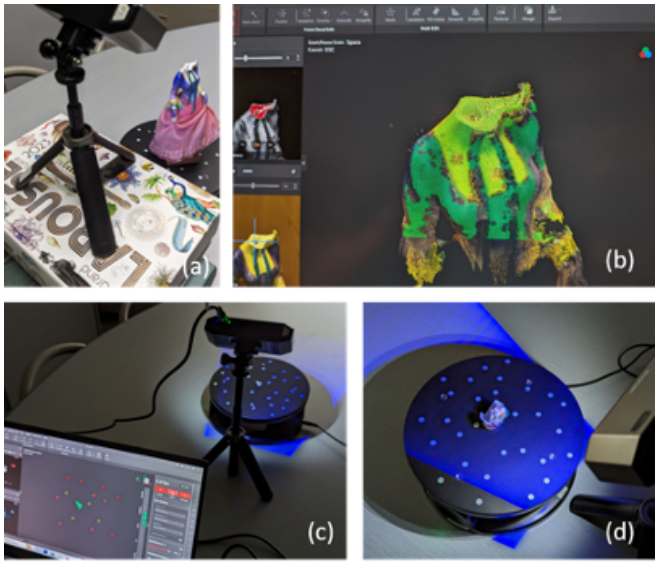


Fig. 3. 3D scanning process.

- Align face in normal directions. In 3D modeling, *normals*, which are vectors extending perpendicular from the face of a polygon used to determine which direction the face is "pointing," must be correctly aligned (see Fig. 4). Specifically for 3D printing, ensuring that all face normals are pointing outward is crucial for proper printing because this defines the inside and outside of the 3D model.
- Complex floating parts may need supporters to be produced by the printer. The supporters are to be carefully

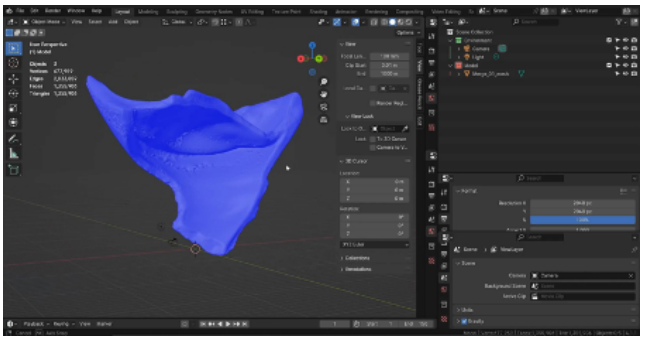


Fig. 4. Finishing models in Blender for further 3D printing.

Removed manually after 3D printing. One needs to decide about the most suitable places for supporters (for example, one must avoid connecting the supporters to the most critical surfaces, such as broken edges, where the highest degree of modeling accuracy is required).

The model is exported as an STL file for the printing software.

C. The Virtual Materialized – 3D Printing

Before 3D printing, the model has to be converted into multiple layers with a slicing application. For this project, Photon Mono 2[2] (SLA type, resin liquid filament) is used for 3D printing, while the slicing software Anycubic Photon Workshop[3] was selected. After importing the STL files from Blender, further preparation is required (especially for the intricately detailed fragments), namely, the generation of the necessary supporting scaffolding to ensure structural integrity during the printing process.

Figure 5 depicts the 3D-printed parts, while the inset image shows two original ceramic fragments.



Fig. 5. 3D printed parts.

D. Virtualized Aesthetics – Kintsugi Simulation in a Modeling Environment



Fig. 6. Kintsugi simulation in a virtual environment.

A geometry nodes modifier is used to implement virtual Kintsugi simulation in Blender (Fig. 6), which provides procedural node-based modeling and automatic mesh generating with the help of the visual scripting language (Fig. 7).

Hence, the paths sketched on the model surface automatically convert to golden and volumetric glue mesh objects simulating the Kintsugi junctures. It enables the use of simulation features even by beginners who can use the stylus device of an LCD tablet. Thus, with the help of the intuitive interface, designers and digital artists can model the Kintsugi technique in the virtual environment. However, for 3D printing and further trials with replica models, the geometry of fragments is more essential than colors and decorations. For virtual Kintsugu, the scanned color data can be visualized on the model with material (shader) node assets. Since the colors scanned for different fragments can vary due to the lighting conditions and the scanning modes (such as feature or marker-based tracking), some noise may be generated by merging point clouds in RevoScan software. The RGB curve nodes are applied to the model material to interpolate and adjust the colors.

E. Test Drive – Assembling 3D Printed Parts

The 3D-printed parts enable a trial assembly that would help the Kintsugi designer to be better prepared for real-world operations and to pay attention to a variety of factors such as operation time, amount of glue composition required for each step, the possible order of steps, glue drying time, the fragment orientation while assembling, the stickiness of the junctures for gilding, etc. (Fig. 8).

F. The Beauty Reborn – Assembling Original Fragments with Kintsugi Technique

We are prepared to recreate the shape from the original porcelain fragments based on the knowledge acquired during the virtual modeling and prototyping stage using 3D-printed parts. Figure 9 highlights some of the most interesting areas of the restored figurine.

IV. ART OBJECT

Figure 10 shows the final result of applying the Kintsugi technique to the broken porcelain fragments. The new concept name “Transfigured Reminiscence” complements the original name of Leslie Harradine’s design to portray metaphorically our experience of restoring this vintage porcelain figurine, which has been more than repaired; it has been recreated with the help of 3D modeling and virtualization technology supporting the traditional Japanese art of ceramics restoration, and with an artistic idea to express the subtle dynamics and fragility of human memories and relationships.

V. DISCUSSION

This work reflects a broader trend of blending technology with traditional arts, specifically by integrating 3D modeling with the ancient Japanese art of Kintsugi. This fusion not only preserves the cultural heritage but also makes it accessible to new generations and cultures in a novel and engaging manner.

A. Enhancements and Challenges

The application of 3D scanning, modeling, and printing in this project allowed for high-precision re-constructions of damaged ceramic pieces, capturing intricate details that are often challenging to replicate manually. This can serve as a blueprint for restoration, enhancing the repaired artifacts' accuracy and

aesthetic fidelity. Challenges include the selection of appropriate 3D scanning cameras and

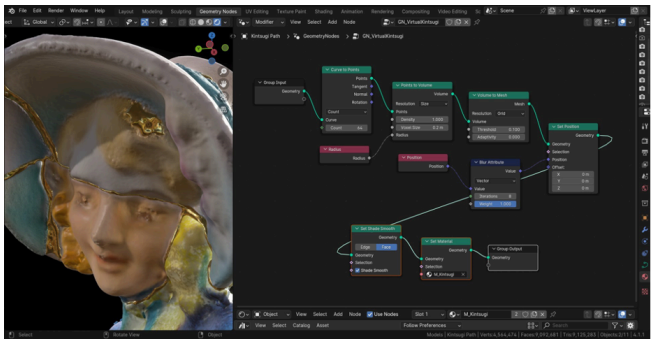


Fig. 7. Kintsugi Virtualisation in Blender.



Fig. 8. Assembling 3D printed parts.

The difficulty of scanning small parts. While increasingly affordable, access to high-quality 3D printing equipment remains a barrier, particularly in regions with limited technological infrastructure.

B. Cultural and Ethical Considerations

A potential criticism from Kintsugi purists is that including a digital restoration step might overshadow traditional skills and artistry inherent in Kintsugi. Kintsugi is not merely a repair technique but an art form that embodies the *Wabi-Sabi* philosophy of finding beauty in imperfection and transience. Virtualization and 3D modeling practices may seem at odds with the essence of Kintsugi, as they could be perceived as detracting from the authenticity and the intimate, hands-on nature of the traditional craft. This disjuncture raises essential questions about the balance between preserving the spirit of Kintsugi and embracing modern technological advancements.



Fig. 9. Assembling the original fragments.

While digital techniques can prevent physical intervention on fragile artifacts, thereby preserving their original state, the use of synthetic materials in 3D printing raises environmental concerns. Unlike traditional Kintsugi, which uses natural, biodegradable materials, 3D printing may contribute to plastic pollution.

C. Hybrid Approaches

A hybrid approach that combines digital precision with traditional crafts could offer a balanced solution, leveraging modern technology's and age-old techniques' strengths. Such an approach would ensure the preservation of cultural essence while utilizing the advancements in digital technology.



Fig. 10. *Transfigured Reminiscence* – The beauty reborn through Kintsugi and virtualization technology.

Future developments in digital restoration techniques promise further innovations. Enhanced precision in 3D scanning and modeling, improved

materials for 3D printing, and the evolving capabilities of Virtual Reality (VR) for simulation and training can potentially lead to new forms of artistic expression that honor traditional practices while embracing modern technological capabilities.

D. Broader Implications

Although art objects are usually assumed to be unique [11] (thus, the possibility of reproduction is naturally not a primary property of an art object), the presented technological solution may be incorporated into a reproducible restoration workflow. In a broader sense, using VR and 3D modeling opens up new avenues for the education and training of traditional crafts. By providing a virtual environment for practice, these technologies can make learning more accessible and less resource-intensive. Studies have shown that immersive technologies such as VR can effectively teach complex skills in various disciplines, from surgery [12] to traditional crafts like Kintsugi [13].

Furthermore, digital techniques revolutionize how cultural heritage is preserved and experienced [14]. Technologies like 3D modeling and VR support the conservation of physical artifacts and enable the digital recreation of cultural assets for archival and exhibition purposes [15]. This allows for a broader dissemination of cultural knowledge and the potential for future generations to experience cultural heritage in immersive and interactive ways.

Integrating 3D modeling with Kintsugi art represents a step forward in the intersection of technology and traditional crafts. It offers a promising pathway for preserving and revitalizing cultural heritage in the digital age, fostering a deeper appreciation and understanding of traditional practices through a modern technological lens.

VI. CONCLUSION

The study [16] investigates how metaphors from the domains of literature and fine arts can enhance the teaching approaches and understanding of software concepts. The current paper contributes to the discourse in a different direction – how digital modeling technology can support artistic manifestations even in centuries-old traditional practices to increase the number of connoisseurs, connect knowledge available in other disciplines, and rediscover the links between modernity and antiquity.

While conveying the historical, cultural, technological, and educational implications and addressing the manifold aspects of reality and virtuality, this project is a good effort to contribute to the themes and perspectives of the *2024 Artefacto* conference.

This interplay explores the artistic experience employing cutting-edge technologies for traditional techniques and enriching collective and collaborative cross-disciplinary findings.

REFERENCES

[1] G. Keulemans, "The geo-cultural conditions of kintsugi," *The Journal of Modern Craft*, vol. 9, no. 1, pp. 15–34, 2016.

[2] C. Santini, *Kintsugi: Finding strength in imperfection*. Andrews McMeel Publishing, 2019.

[3] M. Barasch, *The language of art: studies in interpretation*. NYU Press, 1997.

[4] E. Pyshkin, "Alvar Aalto and Japan: Mutual discovery of environmental integration architecture idioms," *Academia Letters*, 2021.

[5] S. Olding, M. Odundo, Y. Matsuzaki, and S. Suzuki, *Bernard Leach: discovered archives*. Crafts Study Centre, University for the Creative Arts, 2020.

[6] S. Peterson, *Shoji Hamada: a potter's way and work*. Bloomsbury Publishing, 2023.

[7] A. S. Morton, *The Japanese Influence in Late Nineteenth Century British Art, 1862-1880*. University of Glasgow (United Kingdom), 2000.

[8] K. Mochinaga, *Kintsugi: The Wabi Sabi Art of Japanese Ceramic Repair*. Tuttle Publishing, 2023.

[9] A. Rostami, K. Karlgren, and D. McMillan, "Kintsugi VR: Designing with fractured objects," in *Proceedings of the 2022 ACM International Conference on Interactive Media Experiences*, 2022, pp. 95–108.

[10] Y. Saito, "Aesthetics of visible repair: The challenge of kintsugi," in *Repair*. Routledge, 2022, pp. 58–65.

[11] R. Meager, "The uniqueness of a work of art," in *Proceedings of the Aristotelian Society*, vol. 59. JSTOR, 1958, pp. 49–70.

[12] S. Yoganathan, D. A. Finch, E. Parkin, and J. Pollard, "360 virtual reality video for the acquisition of knot tying skills: A randomized controlled trial," *International Journal of Surgery*, vol. 54, pp. 24–27, 2018.

[13] S. Ban, M. R. Ferrara, *et al.*, "Promoting a teaching platform for "traditional skills c virtual reality technology." *Applied Human Factors and Ergonomics International*, vol. 44, pp. 117–124, 2022.

[14] A. Georgopoulos, "Contemporary digital technologies at the service of cultural heritage," *Heritage Preservation: A Computational Approach*, pp. 1–20, 2018.

[15] K. Reaver, "Three case studies in virtual preservation. Applying virtual reality to cultural heritage," *Agathon—International Journal of Architecture, Art and Design*, vol. 6, pp. 210–217, 2019.

[16] E. Pyshkin and J. Blake, "A metaphoric bridge: Understanding software engineering education through literature and fine arts," *Terra Linguistica*, vol. 11, no. 3, pp. 59–77, 2020.

[1] https://www.revopoint3d.jp/products/industry-3d-scanner-mini

[2]https://www.blender.org/

[2] https://store.anycubic.com/products/photon-mono-2-3d-printer

[3]https://store.anycubic.com/pages/anycubic-photon-workshop-3d-slicersoftware

Digital Authors: Tackling online hate speech through storytelling

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Abstract—This article explores the role of digital storytelling in raising awareness about emerging social issues, specifically focusing on online hate speech that affects children and adolescents in their daily digital activities. Through multimodal digital tools, digital storytelling may contribute to a deeper understanding of these issues and enhance students' research, writing, and critical thinking skills. The study highlights how digital storytelling supports active learning and the development of essential competencies. It also examines how the availability and dissemination of student work on public platforms contribute to building a community where these contributions are recognized and valued, encouraging engagement and furthering educational and creative growth. The findings corroborate existing research that emphasizes the effectiveness of digital storytelling in promoting media literacy and providing meaningful educational experiences.

Keywords—digital storytelling, online hate speech, media literacy, multimedia learning, story jumper

I. DIGITAL STORYTELLING: FROM EARLY INTERACTIVE FICTION TO CONTEMPORARY PLATFORMS

Digital storytelling represents a powerful convergence of timeless storytelling traditions with contemporary technological skills, using digital tools to build narratives that incorporate multimodal elements, such as images, videos, audio, and dynamic interactions like hyperlinks [1, 2]. Integrating these technologies transforms the traditional experience of telling, reading, and interpreting stories, allowing for a more immersive and interactive engagement with the audience.

Reflecting technological advancements, digital storytelling emerged in parallel with the development of digital technologies. As digital media radically changed how narrative content is created, shared, experienced, and interpreted, digital narratives quickly established themselves as a significant mode of communication [3]. From the earliest stages, as digital technology started to reshape communication and access to information, these new forms of storytelling evolved, keeping pace with technological innovations and growing into increasingly sophisticated and interactive expressions.

The roots of digital storytelling trace back to the 1970s, with the advent of text-based Interactive Fiction. Early interactive fiction games, such as *Colossal Cave Adventure* (1976) and *Zork* (1980), marked the inception of digital narratives [3].

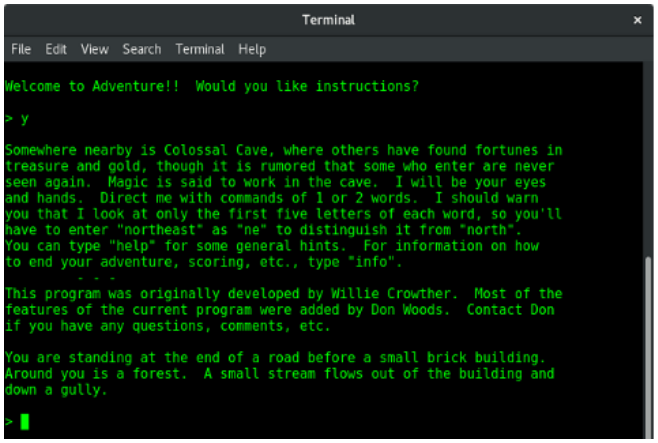


Fig. 1. *Colossal Cave Adventure* (1976). Source: opensource.com (*figure caption*).



Fig. 2. *Zork. Source: opensource.com* (*figure caption*).

These adventures were text-based, where players interacted with virtual environments by typing simple commands. The player would navigate through detailed descriptions of settings and scenarios, making decisions like "go north" or "pick up the key," which would influence the unfolding of the narrative. These early forms of interactive fiction laid the groundwork for more complex narrative forms.

However, the concept of digital storytelling was further developed and popularized in the 1980s by Dana Atchley, a pioneer in the field and a founder of the Center for Digital Storytelling in Berkeley, California [4]. Atchley and his colleagues at the Center worked to combine traditional storytelling with digital technology, creating a method that incorporated multimedia elements such as video, audio, and images. This approach enhanced the storytelling experience and made it more accessible to a broader audience, providing tools and methods for individuals to create and share their own digital stories.

The Center for Digital Storytelling played a key role in advancing this practice, promoting the use of digital media to support personal and community narratives [4]. This development marked a significant change in how stories are told and shared, establishing a foundation for the various uses of digital storytelling seen today in education, social issues, and entertainment.

As digital technology advanced, the narrative possibilities expanded beyond text. The 1980s and 1990s saw the rise of Hypertext Fiction, which allowed authors to create stories that could be navigated non-linearly through links embedded in the text. This innovation was closely followed by other interactive forms such as Interactive Cinema, Interactive Installations, Interactive Drama, and Video Game Narratives, each exploring different aspects of user interaction and narrative immersion [2, 5].

The emergence of the World Wide Web in the 1990s further revolutionized digital storytelling by providing a platform that was not only accessible but also highly extensible [6]. Authors were no longer confined to HTML or basic hyperlink structures; they began experimenting with other platforms like Flash, which enabled the integration of animation and multimedia elements into their narratives [1, 3]. As the 1990s came to a close, many of the pioneers of hypertext narratives began to explore these new possibilities, moving towards more dynamic and visually rich storytelling experiences.

With the proliferation of new devices in the 2000s—such as smartphones, tablets, and locative media—digital storytelling was significantly shifted from desktop-centric works to narratives specifically designed for these new mobile environments [6]. This transition marked a move away from traditional link-and-node hypertext as the dominant form of literary experimentation in digital media. Instead, it gave rise to a diverse range of new narrative forms, many of which continued to build on the principles established by earlier hypertext experiments while incorporating the affordances of emerging technologies [6].

One of the most significant developments in digital storytelling has been its application in education [7, 8]. The use of digital stories as an educational tool has brought about a shift towards student-centered learning, encouraging creativity and self-reflection.

Students are empowered to shape stories according to their imagination, make autonomous decisions, assess their progress, and improve their communication skills. This approach makes learning more engaging and facilitates the development of critical thinking.

II. TAKING ACTION THROUGH DIGITAL STORYTELLING

Digital storytelling can be a valuable tool for enhancing media use in educational contexts. Research on digital storytelling indicates that it can foster the development of skills such as searching, retrieving, processing, and sharing information, as well as communicating and collaborating within online networks [9]. These skills are crucial for integrating data and information effectively, creating more profound and critical knowledge. This approach aligns with the constructivist principles, emphasizing the importance of students building their understanding through their experiences and interactions [10].

Engaging in digital storytelling, students are empowered to create and share digital narratives, transitioning from passive observers to active participants. This method reinforces acquired knowledge and supports deeper learning by allowing students to focus on specific research topics, gather and analyze information, write scripts, and incorporate multimedia elements. As a result, students enhance their research, writing, and critical analysis skills [10].

The narrative becomes a medium through which the human body and technological system communicate and immerse, transforming computers into storytellers. This transformation is achieved by combining signs and significances, where the interaction between text, image, and audio creates a rich and engaging experience [11]. For this to be effective, creators must develop a system where the content appears in readers' imagination as if they were indeed part of the narrative world [2]. In this way, the narrative is not just a linear story but a mental construction, where the readers' actions and interactions trigger responses within the system, deepening their immersion and engagement.

Digital Narratives are characterized by their participatory and spatial nature [12]. The interactivity and feedback allow real-time information exchange, selection, and interpretation processes involving speculative, generative, and creative actions [11]. This approach enables students to engage in complex actions that generate meaning and understanding [10].

The advent of Web 2.0 and the growing prevalence of social media and mobile devices has opened new avenues for active engagement and content creation. In this digital ecology, young people are increasingly moving beyond passive content consumption to participate actively in its production and creation. This shift reflects a broader transformation in how individuals interact with media, where content creators' and contributors' roles are becoming as significant as consumers' [9, 13].

By creating and sharing digital narratives on topics such as human rights, social justice, and local issues, students can raise awareness and foster community participation [8], promote civic engagement, and facilitate community involvement. This method allows individuals to represent their experiences using a shared infrastructure [14], which can support community interaction and response, serving as a platform to address various topics and engage with social issues.

Integrating digital storytelling into educational practices has garnered significant attention in academic research and is recognized as an effective method for enhancing storytelling skills while introducing new technologies. Classroom activities that involve creating digital narratives, such as movies or interactive storybooks, have improved students' communication abilities and digital literacy [8, 10, 14]. This approach fosters technical skill-building, promoting creativity, collaboration, and critical thinking. It encourages students to effectively analyze and critique the media they engage with, making it a valuable tool in diverse educational settings.

III. *DIGITAL AUTHORS*: AN INITIATIVE TO TACKLE ONLINE HATE SPEECH

The issue of online hate speech is urgent and emerging, particularly among children, adolescents, and young adults who are increasingly exposed to this phenomenon due to the growing use of digital technologies, especially video games and social media. Online platforms, where interactions are often anonymous or distanced, can facilitate the spread of toxic behaviors and hate speech, negatively influencing the emotional and psychological development of young people [15]. Continuous exposure to such content can lead to the normalization of verbal aggression, social isolation,

decreased self-esteem, and, in extreme cases, mental health problems such as anxiety and depression [16].

Research has shown that children and adolescents are particularly vulnerable to online hate speech due to their developmental stage, where identity formation and the need for social acceptance are crucial [15, 16, 17, 18]. This age group can be both targets and perpetrators of hate speech, often without full awareness of the consequences of their actions.

The intersection of factors such as online anonymity, lack of supervision, and the absence of empathy mediated by a screen contributes to the proliferation of hate speech among young people [19].

The PROPS project, Interactive Narratives Propose Pluralist Speech, hosted by the Research Center for Arts and Communication at the University of Algarve and funded by the Portuguese Foundation for Science and Technology, proposes an innovative approach to address hate speech by developing interactive narratives designed to engage educators, teachers, students, and young people, motivating them to combat online hate speech actively. Emphasis is placed on promoting active consumers and the active role that the public assumes throughout the process: decoding, interpreting, and recreating media messages.

Fig. 3. *Logo of the project PROPS. Source:* https://props.ciac.pt/en (*figure caption*).

This project operates at the intersection of media education, forging collaboration between researchers, political institutions, the educational community, and the public, seeking to promote democratic values and digital citizenship through media literacy, participatory methodologies, and playfulness as cross-cutting themes. The project intends to appropriate game culture, narrative interaction, and the concept of gamification to foster positive behaviors and counteract online hate speech.

This research approach's educational, transformative, and emancipatory nature is emphasized, with a strong focus on effectively communicating findings to a diverse audience. This effort goes beyond academic boundaries to ensure results are accessible through appropriate channels and formats. Integral to this approach is the active involvement of the community, which aims to engage the audience as active participants in the project. This community engagement is designed to deepen the impact of the research and foster a collaborative effort to address the issues that have been explored.

As part of this broader strategy, the PROPS project has partnered with the fifth edition of the initiative *Digital Authors*, organized by the Information and Communication Technologies Competence Center at the Escola Superior de Educação, Instituto Politécnico de Santarém. This collaboration represents a significant effort to involve the community by integrating research objectives with educational practices.

Fig. 4. *Logo of the Digital Authors initiative. Source: https://www.dge.mec.pt/noticias/concurso-autores-digitais-20232024* (*figure caption*).

In this context, the PROPS project has established a strategic partnership with the *Digital Authors* initiative, organized by the Information and Communication Technologies Competence Center at the Escola Superior de Educação, Instituto Politécnico de Santarém. This collaboration is designed to merge research goals with educational practice, fostering a more interactive and inclusive approach to online hate speech.

The *Digital Authors* competition, which emphasizes the development of creativity and literacy through digital storytelling, is a practical extension of PROPS' objective to engage the public effectively. For this purpose, preschool children, students from the 1st and 2nd cycles of basic education, and their educators were invited to partake in this initiative through a structured yet flexible platform for digital media exploration. Participants in this edition were challenged to create, illustrate, and publish original digital stories using the Storyjumper platform. This tool facilitated the creative process by providing users with resources such as image libraries and customizable templates, making it accessible for students of varying ages and technical skills. The stories submitted addressed themes related to

dialogue, respect, and the fight against verbal violence, contributing to the broader conversation about online hate speech.

Consequently, this partnership highlights the commitment to cultivating a collaborative environment, exemplifying how community involvement and research objectives can intersect to tackle significant issues such as online hate speech and digital literacy.

The competition was designed with several key objectives: fostering literacy and creativity, enhancing technological skills, and reinforcing the partnership between educational institutions and families. Integrating technology into the educational process allowed students to refine their creative abilities and acquire hands-on experience with digital tools and resources. This initiative facilitated a more profound connection between schools and families, creating a supportive network that extended beyond the confines of the classroom.

IV. *DIGITAL AUTHORS*: PROCEDURES AND IMPLEMENTATION

The fifth edition of the Digital Authors Competition proceeded in line with established practices, including announcing and promoting the contest within schools. This year's focus was on the theme of online hate speech, in collaboration with the PROPS project, with the primary aim of raising awareness about this critical issue. The competition's core objectives remained consistent with previous editions: to enhance students' engagement with reading and writing through creativity in digital storytelling and develop text creation and illustration skills while interacting with various technologies and information sources.

To participate in the competition, teachers were required to submit a link to their students' work and identify the authors through a registration form provided by the initiative webpage. Teachers could submit their entries in various formats, such as a single collaborative story from the entire class, multiple collaborative stories from different student groups, or individual stories created by students. Active involvement from parents was encouraged to support students' efforts at home, and close cooperation with school libraries was recommended to assist with the projects.

Through the inscription to participate, teachers could benefit from training sessions on Storyjumper, designed to enhance their skills and enable them to guide students in creating engaging digital stories.

All participants had the formal authorization of their legal guardians, who signed an informed consent form before participating in the project. Additionally, strict measures were implemented to ensure data anonymization and to protect the identity of the participants in compliance with ethical research standards.

Following this, participants were required to submit their work and provide identification details for the authors. This phase ensured all entries were cataloged correctly and linked to their creators. Once submissions were collected, all entries were publicly displayed on the CCTIC website, and the public was invited to vote by assigning star ratings to the works. This stage aimed to generate initial feedback and gauge public interest in the submissions.

The next phase involved the evaluation of the entries by a multidisciplinary jury composed of experts from various fields related to education and digital media. The jury assessed the submissions considering public votes and their detailed analysis. Although public voting contributed to the overall feedback, the final judgment was based on a comprehensive evaluation of each entry's adherence to the theme of online hate speech.

The evaluation parameters for the Digital Authors Competition were designed to ensure a thorough assessment of each submission, reflecting creative and technical digital storytelling skills.

Design and Graphics were evaluated to gauge the digital stories' visual appeal and overall design quality. Effective graphic design enhances user engagement and the overall impact of digital content. This criterion examines layout, image use, and aesthetic presentation to ensure the final product is attractive and functional [3].

Content and Language assessment focused on adherence to the theme of online hate speech, originality of the narrative, and linguistic accuracy, which are crucial for effective communication and comprehension. Adhering to the theme ensures relevance and aligns with the competition's objectives, while originality measures the uniqueness and creativity of the content.

Digital Integration evaluated multimedia elements, such as sound and interactive features, crucial for a multimodal storytelling approach. This criterion assessed how well digital tools enriched the storytelling process.

Creativity and Originality were central to assessing the innovative use of digital features and narrative approaches, emphasizing that originality and creative expression are fundamental to compelling interactive fiction [6]. This parameter ensured that submissions met technical standards and demonstrated inventive storytelling techniques.

These evaluation criteria collectively ensure that submissions were assessed on creative merit and technical proficiency, supporting the competition's aim to promote excellence in digital storytelling.

The final phase of the competition was dedicated to announcing the winners and distributing awards. This step highlighted the most outstanding entries and recognized the participants' efforts. The results were publicly shared, and awards were presented to celebrate the top entries.

V. DEVELOPING DIGITAL COMPETENCE AND LITERACY WITH STORYJUMPER

The Storyjumper platform is highly suited for initiatives to develop digital literacy and linguistic competence among students. As a digital book creation tool, Storyjumper enables students to craft multimodal stories by integrating text, images, and audio, thus enhancing their ability to engage with and produce diverse forms of digital content.

The platform supports a range of functionalities that align well with educational goals. Teachers can manage multiple classes by providing access to students through unique codes and assigning individual and collaborative projects. Storyjumper offers the flexibility to create books from scratch using a blank template or to utilize pre-designed models, which can simplify the storytelling process and cater to various project needs.

Students benefit from an extensive library of images, including scenes and characters, and the possibility to upload external images to enrich their stories. This multimodal approach allows for the combination of text, visuals, and voice, which broadens the scope of storytelling and aids in developing digital literacy skills. The platform also provides access to various books organized by topic, encouraging students to explore different genres and styles.

Teachers can provide real-time feedback and comments during the story creation process or after completion, and the platform facilitates the sharing of finished works, promoting collaboration and peer engagement. Storyjumper is accessible across various devices, making it convenient for classroom and at-home use.

Regarding security, the platform incorporates measures to protect personal data and allows teachers to control privacy settings for the books created. Content moderation is in place to prevent the publication of inappropriate material, and technical support is available to report security issues. The platform also includes parental controls to oversee the activities of younger users, ensuring a safe and supportive environment for creative learning.

VI. OUTCOMES OF THE THE FIFTH EDITION OF THE INITIATIVE *DIGITAL AUTHORS*

The fifth edition of the *Digital Auth*ors Competition received 126 submissions from students across various educational stages from every region of Portugal with a broad geographical representation. The distribution of entries was influenced by the different formats and group structures employed at each academic level.

Among the submitted works, themes related to the reception and inclusion of migrants, racism, exclusion due to physical or mental characteristics, and cyberbullying stand out prominently. A recurring theme in the entries chosen by digital storytellers is the concept of children disconnecting from screens, embracing, playing, and everything being okay, highlighting digital disengagement as a factor contributing to the well-being of both the group and individuals.

Most illustrations in preschool and early primary education result from manual work, including drawings, three-dimensional constructions, and puppets. In contrast, for the 2nd cycle, there is a greater incidence of digital drawing, with some content created using artificial intelligence programs. Although few, some works used the galleries available on Storyjumper for backgrounds and character designs.

In the 2nd cycle of education, there were 69 submissions. This higher number can be attributed to the fact that students in this stage worked in groups within their respective classes. This approach allowed for multiple entries from each class, as students collaborated in smaller groups to create their digital stories, thus increasing the overall number of submissions.

For the 1st cycle, there were 48 submissions. Like the preschool category, the projects in this cycle were

primarily completed in class groups. This collective approach meant that each entry represented the collaborative effort of a whole class.

In the preschool category, nine entries were received. These submissions were also generated through group work within the classes. The limited number of entries reflects the smaller scale of participation typical of this educational stage, where younger students, guided by their teachers, created their digital stories as a class effort.

In the 2nd cycle, the winning entry addressed cyberbullying, data protection, and the impact of online actions on offline life. This project was a class-wide effort, guided by several teachers, and utilized digital tools to create visual and textual content. The project effectively incorporated digital images and multimedia elements to convey its message, reflecting a comprehensive understanding of the theme.



Fig. 5. Cover from the 2nd cycle winner "Além do Jogo." *Source: https://www.storyjumper.com/book/read/171262511/660f38dfc8732* (*figure caption*)



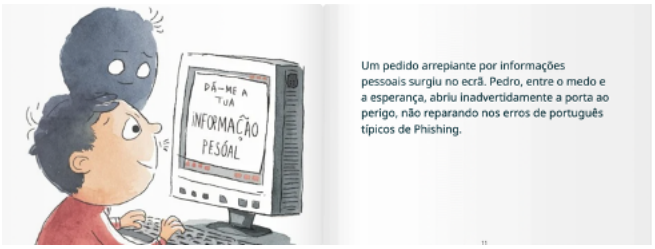


Fig. 6. Winning entry in the 2nd cycle "Além do Jogo." *Source: https://www.storyjumper.com/book/read/171262511/660f38dfc8732* (*figure caption*).

In the 1st cycle, the competition recognized separate winners for the 1st and 2nd years and another for the 3rd and 4th years. For the 1st and 2nd years, the selected entry addressed the theme of difference through a metaphor involving uniformity of hair in a kingdom where everyone was expected to have the same hairstyle. The story, presented in a blog format, used this metaphor to explore how an individual's unique hair is initially met with resistance but eventually accepted by the community, reflecting on the broader issue of online hate speech and acceptance.

This digital story was illustrated with hand-drawn artwork created by the students, which was then digitized and incorporated into the book. The book also features an audio dimension where the students perform a dramatized reading of the narrative. This integration of visual and auditory elements enriches the storytelling experience and enhances inclusivity, making the book more engaging and accessible to a broader." audience.



Fig. 7. Cover from the 1st cycle winner "O Reino dos Cabelos Dourados". *Source: https://www.storyjumper.com/book/read/171978551/6626b8d32db6* (*figure caption*).

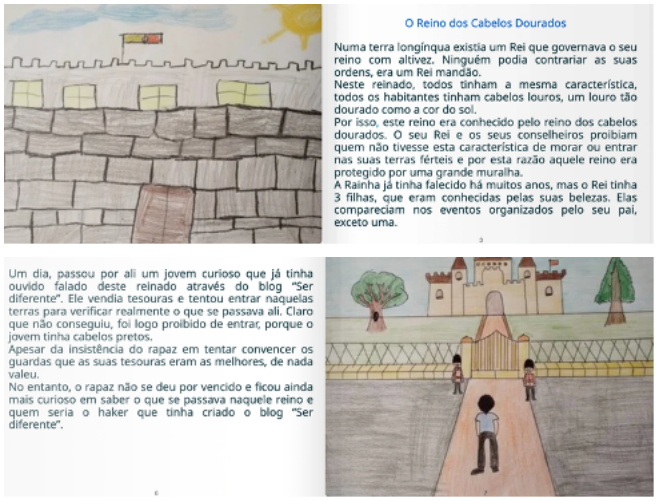


Fig. 8. Winning entry in the 1st cycle winner "O Reino dos Cabelos Dourados." *Source: https://www.storyjumper.com/book/read/171978551/6626b8d32db6* (*figure caption*)

In the 3rd and 4th year category, the winning entry created a fictional realm called "Virtulândia," where both the positive and negative poles of the Internet coexist. This book, illustrated by the students, features drawings and designs the entire class group manually developed. The project incorporates local traditions and vocabulary from Bragança, a remote region in Portugal, reflecting the community's cultural context. Through this collaborative effort, the book explores the complexities of online interactions, presenting them within a culturally rich and imaginative framework.



Fig. 9. Cover from the 1st cycle winner "Virtulândia, o Reino Mágico das Palavras." *Source: https://www.storyjumper.com/book/read/165080231/65fb3f8ec4216* (*figure caption*).

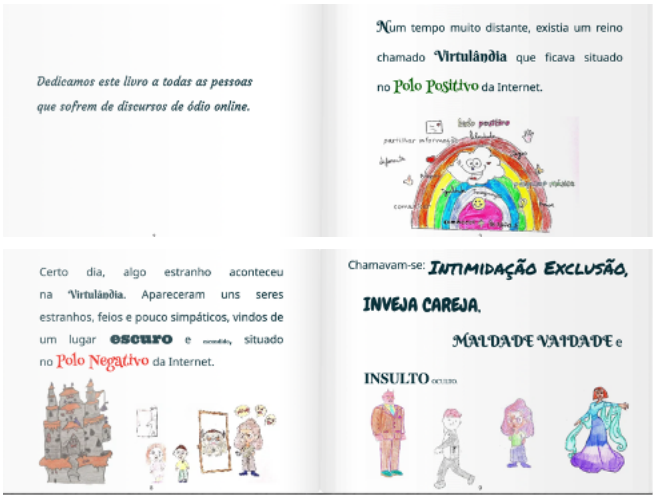


Fig. 10. Winning entry in the 1st cycle winner "Virtulândia, o Reino Mágico das Palavras." *Source: https://www.storyjumper.com/book/read/165080231/65fb3f8ec4216* (*figure caption*)

This challenge was also extended to preschool students, based on studies that demonstrate the exposure of children at this early age to hate speech [20]. This approach aligns with the media education framework, which includes preschool education [21]. However, there was less participation from this educational level, as it traditionally focuses on other topics. Some submitted works deviated from the central theme, addressing issues like the 25th of April (marking the 50th anniversary of the Carnation Revolution) or focusing on themes related to family and friendship. Nevertheless, some works remained within the proposed theme, with the standout being "Lindo Dia," which directly addressed the issue of online hate speech. This story is told from the perspective of a child who shares his drawing on social media, only to become the target of hateful comments, effectively exploring such discourse's emotional and social impact.

VII. CONCLUSIONS

Using a descriptive research methodology, this study has investigated how digital storytelling can raise awareness of emerging social issues, specifically focusing on the prevalence of online hate speech and its impact on children and adolescents' daily digital interactions.

The participation of students across various educational levels, from preschool to the second cycle, demonstrated widespread acceptance of the theme. While participation from some levels, such as preschool, was lower, the submissions showed a firm grasp of the topics and effective use of digital tools. Different educational cycles exhibited varying levels of

digital proficiency. Preschool and first-cycle students used mainly manual illustrations, while second-cycle students employed advanced digital techniques, including artificial intelligence and multimedia resources.

The submitted projects addressed critical social issues, including cyberbullying and inclusion. This initiative demonstrated the students' ability to engage with these topics meaningfully and creatively, supporting their research, writing, and critical thinking skills. The incorporation of digital technologies into the storytelling process facilitated active learning and contributed to the enhancement of students' competencies.

The availability and dissemination of students' works on a public platform help build a community where these contributions are recognized and valued. This approach encourages engagement and acknowledgment, fostering the participants' educational and creative development.

Digital storytelling has proven to be a practical methodology for promoting educational media use. This approach has demonstrated its value in enhancing skills such as searching, obtaining, processing, and exchanging information and communication and collaboration within online networks. These outcomes align with findings from previous studies, which highlight that digital storytelling supports data integration and fosters more profound and critical knowledge.

As anticipated by earlier research, storytelling serves as a means to reflect on and derive meaning from experiences, transforming them into symbolic expressions. Codifying and storing new experiences influences our ability to recall and understand previous ones.

VIII. RECOMMENDATIONS & SUGGESTIONS

Implementing competitions such as *Digital Authors* is important for fostering creativity engagement and raising awareness about social issues. However, several areas could be enhanced to strengthen the effectiveness further in the future and similar editions.

Expanding participation to encompass a broader range of educational levels could provide a more inclusive and varied experience. Encouraging engagement from different stages of education, from early childhood through advanced levels, broadening the impact of the competition, and ensuring that all students can engage with relevant themes.

For this inclusion in other study levels, exploring more complex platforms beyond Storyjumper, with new tools and opportunities for developing digital storytelling skills, would be essential.

Another critical area for development is the regulation and identification of artificial intelligence in student projects. Establishing clear guidelines and ensuring that AI contributions are correctly identified will help maintain the integrity and originality of the submissions.

Finally, expanding educator training is also essential. Providing support and training for platforms like Storyjumper and editorial and publication processes will improve the quality of submissions. Training educators in editorial management, proper credit attribution, and clear identification of student contributions will enhance the overall experience for participants.

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REFERENCES

[1] B. Alexander, *The New Digital Storytelling: Creating Narratives with New Media*. Santa Barbara, CA: Praeger, https://doi.org/10.5040/9798216979456

[2] H. Koenitz, G. Ferri, M. Haahr, D. Sezen, and T. İ. Sezen, "Introduction: Perspectives on Interactive Digital Narrative," in *Interactive Digital Narrative: History, Theory, and Practice*, H. Koenitz, G. Ferri, M. Haahr, D. Sezen, and T. İ. Sezen, Eds. NY: Routledge, 2015, pp. 1-14.

[3] N. Montfort, *Twisty Little Passages: An Approach to Interactive Fiction*. Cambridge, MA: The MIT Press, 2006.

[4] D. Atchley, "Interactive Fiction and Digital Narratives," Center for Digital Storytelling, Berkeley, CA, 1980. [Online]. Available: http://www.digitalstorytelling.org. [Accessed: 3 Sep. 2024]

[5] M. Rossiter and P. A. Garcia, "Digital storytelling: A new player on the narrative field," *New Directions for Adult and Continuing Education*, vol. 2010, no. 126, pp. 37-48, 2010.

[6] S. Rettberg, *Electronic Literature*. Polity Press, Cambridge, UK. 2014.

[7] J. Lambert, *Digital Storytelling: Capturing Lives, Creating Community*, 3rd ed. Digital Diner Press, Berkeley, CA, 2009.

[8] A. Molnar and P. Kostkova, "Learning through Interactive Digital Narratives," in *Interactive Digital Narrative: History, Theory and Practice*, H. Koenitz, G. Ferri, M. Haahr, D. Sezen, and T. İ. Sezen, Eds. Routledge, London, April 2015, pp. 200-213, https://doi.10.4324/9781315769189-16.

[9] M. Guerrero, M. J. Masanet, and C. A. Scolari, "Toward a typology of young producers: Teenagers' transmedia skills, media production, and narrative and aesthetic appreciation," New Media & Society, vol. 21, no. 2, pp. 336–353, 2018, doi: 10.1177/1461444818796470.

[10] T. M. Duffy, J. Lowyck, and D. H. Jonassen, "Designing environments for constructive learning," in *NATO ASI Series*, 1993. [Online]. Available: https://doi.org/10.1007/978-3-642-78069-1.

[11] M. Mateas and P. Sengers, "Narrative Intelligence," J. Benjamins Pub., 2003.

[12] J. H. Murray, *Inventing the Medium: Principles of Interaction Design as a Cultural Practice*. MIT Press, Massachussets, 2012.

[13] H. Jenkins, M. Ito, and D. Boyd, "Participatory Cultures in a Networked Era: A Conversation on Youth, Learning, Commerce, and Politics." Polity Press, 2015.

[14] N. Couldry, "Digital storytelling, media research, and democracy: conceptual choices and alternative futures," in *Digital Storytelling, Mediatized Stories: Self-Representations in New Media*, K. Lundby, Ed. New York, NY: P. Lang, 2009, pp. 41-60.

[15] S. Costa, B. Mendes da Silva, A. F. Martins, and A. Martins, "Perceptions about online hate speech in games and gaming communities: results from a survey in Portugal," *Journal of Cyberspace Studies*, vol. 8, no. 1, pp. 145-176, 2024, doi: 10.22059/jcss.2024.95910.

[16] B. Mendes da Silva and A. F. Martins, *Interactive Narratives Propose Speech: Results of a Project Aimed at Researching Countering Online Hate Speech in Video Games*. Edições CIAC, 2024. https://doi.org/10.34623/ggqf-0g28.

[17] S. Woral, M. Bilewicz, and M. Wisniewski, "Exposure to hate speech increases prejudice through desensitization," *Aggress. Behav.*, vol. 44, no. 2, pp. 136–146, 2018. https://doi.org/10.1002/ab.21737.

[18] I. Gagliardone, D. Gal, T. Alves, and G. Martinez, *Countering Online Hate Speech*, United Nations Educational, Scientific and Cultural Organization, 2015. Available: https://unesdoc.unesco.org/ark:/48223/pf0000233231

[19] S. Wachs, A. Wettstein, L. Bilz, and M. Gámez-Guadix, "Adolescents' motivations to perpetrate hate speech and links with social norms," *Comunicar*, vol. 71, pp. 9-20, 2022. doi: 10.3916/C71-2022-01.

[20] J. Kansok-Dusche, C. Ballaschk, N. Krause, A. Zeißig, L. Seemann-Herz, S. Wachs, and L. Bilz, "A systematic review on hate speech among children and adolescents: Definitions, prevalence, and overlap with related phenomena," *Trauma Violence Abuse*, vol. 24, no. 4, pp. 2598-2615, Oct. 2023, https://doi.10.1177/15248380221108070

[21] S. Pereira, M. Pinto, E. J. Madureira, P. Meireles, S. Tavares, A. Matos, B. Simões, B. Afonso, C. Costa, D. Catalão, E. Mendes, F. Matos, J. Azevedo, M. Toscano, M. J. Brites, M. Crespo, P. Lopes, T. Pombo, and V. Tomé, *Referencial de Educação para os Media*. Ministério da Educação, Direção-Geral da Educação, Lisboa, 2023.

The art of making systems: reflections on generative paradigms and their authorship

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Abstract—This paper explores the concept that, in both generative art and contemporary practices, the primary creative act lies in designing systems that generate art rather than in the resulting artifacts. It reflects on how generative art emphasizes systems that allow for creative autonomy, contrasting it with traditional perspectives on artistic creation, where the human artist's agency is central. The paper delves into the history of generative systems, referencing key artists and theorists, and compares generative art to systems art, which is defined by its self-sustaining nature rather than producing outputs. The author argues that systems themselves can be considered artworks, highlighting the importance of creating new arrangements and processes in art. Concluding with a call to expand our understanding of artistic creation, the paper argues that the design of generative systems represents a nuanced and sophisticated form of artistic expression deserving of critical recognition.

Keywords—Generative Art, Creative Systems, Artistic Autonomy, Systems Theory, Procedural Art, Conceptual Art

I. INTRODUCTION

This article explores the idea that within generative art and other contemporary practices, the main act of creation lies in the system's design that produces the artifacts and not in the generation of the artifacts. This might sound like an obvious idea, and it sometimes appears within the texts of generative art theory. However, a disproportionate weight is often placed on the generative, mechanical act. At a moment when, once again, the discussion on the possibility of autonomously creative computing processes appears (usually referred to as artificial intelligence), it is essential to draw attention to the origination of creative systems. Extrapolating these reflections towards the general artistic practice is also useful to explore how expressive media are inherently generative, given that art's rise was always associated with the development of tools — from oral language to GANs. Finally, the relation of creative acts in the practical field—encompassing inventions and products—to the expressive field that outputs artworks is explored.

II. STARTING FROM GENERATIVE ART

Theories built around generative art regularly raise the critical question of how much creativity lies within the generative method and how much results from the artist's agency. "The Art of Programming," a milestone book in computer science written in the nineteen-sixties, starts its preface by saying that the act of programming "can be an aesthetic experience much like poetry or music."[1] When asked, "What can computational creative art tell us about creativity?" McCormack suggests that to make such questions more transparent, we need to be "explicit about where this creative agency is attributed (and in what proportions)."[2] Margaret Boden and Ernest Edmonds also asked, "Is it the case that a computer can ever 'do its own thing'? Or is it always doing the programmer's (artist's) thing, however indirectly?"[3] These authors do not dare answer these questions, nor will this article. The goal here is to draw attention to the implicit fact that the decision of how much agency is given to the machine is entirely human. Hence, machines do not lead the creative act in these works. Would this tension between humans and generative support not happen in any type of art?

To reflect on what we consider generative art and how much of its features can be seen in art practices in general, let us begin with its most known definition, drawn by Philip Galanter:

> "Generative art refers to any art practice where the artist uses a system, such as a set of natural language rules, a computer program, a machine, or other procedural invention, which is set into motion with some degree of autonomy contributing to or resulting in a completed work of art." [4]

The definition will be sliced to focus on a few important elements, aiming not to challenge this characterization. Although limited, it will examine how it could exclude some generative art forms while still serving as a helpful framework for building a discourse around computational creativity. While there are challenges in using it to distinguish generative art from a generic artistic practice, these limitations can help demonstrate the need to expand the act of creation beyond the resulting artifact.

First, the systems' examples will be analyzed: "A set of natural language rules, a computer program, a machine, or other procedural invention." Next, the idea of the output—the "completed work of art"—will be examined, regardless of whether the system contributed to a part or was responsible for the outcome of the whole artifact. Finally, the first sentence will be revisited to question the artist's notion of "using a system" versus the possibility of creating a system.

III. PROCEDURES

The fact that Galanter, in his definition, mentions natural language rules before computer programs makes it seem explicit that generative art does not depend on such machines to be made. The textbook example here is the work of Sol LeWitt, who devised paintings through instructions. His *Wall Drawing*, for instance, consisted of four sets of instructions, one for each wall in the room. The fourth wall's drawing should be executed as such:

> "4th wall: 24 lines from the center, 12 lines from the midpoint of each of the sides, 12 lines from each corner" [5]

That is not meant to say that computers didn't play a pivotal role in developing generative art. The work of pioneers such as Vera Molnár, Frieder Nake, Michael Noll, and George Noll appeared in the 1960s exactly because that was when these devices became accessible for creative use. Today, it is difficult to find examples of generative artists who do not use computing machinery. But there is an important argument against complete mechanization, which LeWitt himself gives in the *Doing Wall Drawings* manifesto: "The artist conceives and plans the wall drawing… (that) … is realized by the draftsmen. The plan is interpreted by the draftsmen" [6].

In other words, by leaving room for interpretation, the artist adds another layer of creative agency that does not appear in symbolic machines. This gesture suggests a controlled lack of control, a careful waiving of agency that sets the stage to let a particular type of very human randomness into pieces. Not by chance, programmers willing to make art usually resort to random functions to add some element of surprise to an otherwise strict and repetitive process of following instructions to the letter.

Generative art is more about creating a concept than the instructions to make it real. In the early 20th century, the Dadaists created recipes to make art. *Object to be destroyed* (1923) is a metronome with a photo of an eye attached to its arm, created by Man Ray, had precise orders on its backside:

> Cut out the eye from a photograph of one who has been loved but is seen no more. Attach the eye to the pendulum of a metronome and regulate the weight to suit the tempo desired. Keep going to the limit of endurance. With a hammer well-aimed, try to destroy the whole at (sic) a single blow. [7]

Tristan Tzara's poems like *To Make a Dada Poem* take the shape of a computer program organized line by line:

> Take a newspaper.
>
> Take some scissors.
>
> Choose from this paper an article of the length you want to make your poem.
>
> Cut out the article.
>
> Next, carefully cut out each word that makes up this article and put them all in a bag.
>
> Shake gently.
>
> Next, take out each cutting one after the other.
>
> Copy conscientiously in the order in which they left the bag.
>
> The poem will resemble you.
>
> And there you are – an infinitely original author of charming sensibility, even though unappreciated by the vulgar herd. [8]

These examples were created very close, chronologically, to the landmarks that define the appearance of conceptual art, in particular, Marcel Duchamp's submission of the *Fountain* to the exhibition of the Society of Independent Artists in New York in 1917.

But where can we trace a limit between concept art and generative art if Lewitt puts so much weight on the idea rather than the execution? "The idea or concept is the most important aspect of the work (...) The idea becomes a machine that makes the art," and "the idea itself, even if not made visual, is as much a work of art as any finished product [9]."

A possible dividing line would be the term *procedure* from Galanter's proposal: "... or other procedural invention". This would make clear that to produce generative art, there must be a set of procedures, a recipe, and an algorithm that must be followed to bring forth the generation.

Would this mean that generative art is contingent on language? After all, how can we create instructions without a pre-established communication system that will allow the procedures to be interpreted and followed? This reliance on instructions provides a logical leap: generative art happens when the artist delegates parts of the process through thorough explanations. We can imagine that it began when a master painter ordered a pupil a minutely detailed illustration and later had to bear the consequences of their aesthetic choices or when a Maecenas hired a sculptor to represent a God according to the former's concepts. Much as art was born with the advent of tools, perhaps generative art arose when humans learned how to communicate.

The problem is that this is not the only possible connotation of the term. On the contrary, the first definition from the Oxford dictionary says that procedure is "a way of doing something, especially the usual or correct way," which suggests something entirely different and yet very interesting for the context of this paper. In this sense, a procedural invention would be done differently at the heart of conceptual art.

After all, art can include any variety of physical, chemical, bodily, or societal methods. Sol Lewitt didn't only define the instructions for his paintings; what is more critical about his work is that he proposed a new paradigm of painting, which included the instructions but was mainly composed of the concept of writing instructions and delegating the manual execution to someone else. These inventive ways of doing things, the skill of building things that generate art and other outputs, are what I'm trying to fathom within this article.

IV. GENERATIONS

"... contributing to or resulting in a completed work of art". The way Galanter's sentence is built, with a singular object, imprints a uniqueness in the output of generative art. This is only true in such systems' ability to generate individual outputs that are not identical, unlike the characteristic production of a car factory or a printing press. Nevertheless, what is particular about generative art is its capacity to produce a myriad of outputs. There might be generative pieces where the author chose specifically to produce or release just one instance of the work, but that requires a conscious choice to exclude all other possible specimens. In any case, it is a gesture that goes intuitively against the notion of *generative*.

The appearance of these mechanical methods to generate works changed art making, which is analogous to the mechanical reproduction of art. The analogy is clear and has been studied by scholars searching for insights from Walter Benjamin's investigation on photography's reproducibility [10]. Although talking specifically about AI art, Park suggests it "necessitates a redefinition of authenticity, shifting it from the human creator to the uniqueness of the algorithmic process and its outcomes" [11].

If Benjamin noted how the artwork's aura was vanishing in the face of printed copies, the availability of endless, yet unique, instantiations of one work of art poses an even more significant challenge to the concept of originality. The concern is as old as the notion of generative art and has been addressed under different approaches [12], [13], [14]. The undertaking will start with a sentence from Benjamin's text that he highlighted: "The unique value of the 'authentic' work of art always has its basis in ritual." To be clear, the German philosopher offers this statement as evidence that technical means of reproduction have disentangled the art object from the ritual, which is true when we consider mechanical prints in opposition to handcrafted paintings. This is his starting point to claim that politics replaced ritual, a proposition also expanded toward conceptual art's imagination.

To make this point, the recycling ritual must be rescued from Benjamin's destruction into two new

propositions. The first is the realization that the ritual didn't cease to exist but became mechanical. Fascination remains with the robotic inception of artworks—watching a 3D printer reproduce a sculpture or a swarm of drones building a wall still carries the magical markings of spiritual enactments. These acts continue to captivate observers, much like the *umarelli*, who watch construction sites— a term referring to individuals, usually retired men, who pass the time observing the work of others.

The second and most important aspect is that the ritual of creation, while more and more distant from the final object, still resists. The machine may perform it, but it happens when the system is designed. This gesture is, in fact, unavoidable. When tackling the problem of developing creativity in computers, Jennings shares that "creative artificial intelligence must always fight the impression that it is simply a fancy tool for expressing the programmer's creativity" [15]. Here, the human-initiated configuration of the system seems to be an embarrassment: we must hide it to obtain a sensation of complete machinic autonomy.

Computer generations bear a different relation to matter. Cutting a piece of wood or manipulating clay by hand directly affects the work while typing codes in a computer or configuring connections between neural networks establishes more of a trial-and-error effort. But as distant and cold as keyboards or conceptual musings might be, the ritual of the work's inception is always there, no matter how embarrassing this might be for a practitioner aiming for complete autonomy of the artificial system.

To underline the precedence and importance of the generative system compared to its outputs, these outputs can be referred to as byproducts—"an incidental or secondary product made in the manufacture or synthesis of something else" (Oxford Languages). To be clear, the *something else* is the generative system itself.

Let us look at two generative works and consider the complexity needed for their development. Take, for instance, the work by the duo Varvara & Mar, the installation *Dream Painter [16]*. Its output consists of drawings made from visitors' accounts of their dreams. However, a complicated contraption is set up to get these results through a mechanical process, which includes two AI systems and an industrial robot. As the visitor approaches the piece, the robot arm picks up a microphone and holds it close to their mouth, which is achieved using infrared distance sensors. They may now utter a description of a dream. Four buttons allow them to choose the language used. A speech-to-text will convert the dream into words and feed them into a text-to-image model. The resulting picture is adapted so the robot arm can draw it by tracing lines of different colors. The whole process takes about 10 minutes. A motor turns the paper roll so that another blank space can be used. In the specific site described, the drawings are not cut but cascade from above a railing on the second floor into the common atrium of the building, creating an impromptu exhibition that flows constantly into the void.

Let us reflect on the effects this work provokes on the assistants of the center. What is more impactful: the finished drawings or the big machine behind them? Will people spend more time admiring the strip of images or the actions of the robot? Without a study to evaluate such receptions, the machine likely attracts much more attention. Much of the value bestowed upon it derives from its complexity.

Of course, evaluations are subjective, and the fascination with machine voyeurism, much like that of the *umarelli*, is a common tendency. In any case, the feat accomplished by the authors, which is concretized in the complexity of the whole mechanism, appears far more impressive than the resulting pictures.

An example that does not exist in a physical space can be introduced, unlike *Dream Shaper*. Depending on the approach, it can be seen as a website, a distributed community, an investment fund, or an autonomous artist. Botto is a generative system where the agency is distributed among users who can afford to spend cryptographic currency to vote for the image they like most.

Every week, a large language model creates several prompts, generating four thousand competing images using a text-to-image diffusion model, automatically filtered down to 350. These are voted on by community members who have invested the minimum amount of cryptocurrency into the organization. The most voted image is minted as an NFT (non-fungible token, a digital ledger used to notarize art pieces based on the blockchain) and sold in a public auction. The proceeds are returned to the community in several ways, including direct distribution to members.

The minimum investment necessary to vote is 2,000 $BOTTO, approximately 1,140 euros as of August 2nd, 2024. A paper from the project leaders states that 9,000 people voted on the artworks, implying an investment of about one million euros in the project. However, confirmation is lacking on whether the minimum stake is required for every voter [17].

There is a lot to unpack about this project. The documentation places great emphasis on its decentralized and autonomous aspects. As their frequently asked questions section describes, "Botto controls itself: it makes its prompts and filters images. All of the prompts and images are untouched by human hands." The selling point here is that no one controls the generation of the pieces and that, once in motion, the system is continuously producing works (and auctioning them). But this autonomy has little to do with Ada Lovelace's concept of *origination,* as the machines in question still rely heavily on human evaluations to run. The system merely organizes the wishes of a collective of authors, a very particular group that can afford to spend such a significant sum. This claim is not meant to dismiss the feat of putting such a system in place, much less its generative platform, based on large language and diffusion models.

On the contrary, the claim here is that the community votes, prompt generation, or text-to-image models do not do the main artwork. The most important creative act was done by Mario Klingemann (a.k.a. Quasimondo), an artist who has been working with a generative year since its emergence. In 2018, he wrote an unpublished white paper that is said to contain the blueprints for Botto. With the availability of primitive text-to-image models like VQGAN in 2021, the site was brought to life. Since then, Klingemann has been guiding the project into several iterations as its "guardian", although the documentation also mentions the contributions of users "ElevenYellow" and "Carbono."

Much has been reflected on the art object and its autonomy, that is, the ability to shine independently, regardless of the circumstances it carries within. This surrounding context would include not only the author but also the reception of the work by society in a given moment, and even its purpose [18, p. 185], [19, p. 139], [20]. But to elaborate on these examples: would NFT collectors buy the artifacts produced by Botto if this contraption had not made them that a renowned generative artist ultimately designs? Would *Dream Shaper*'s tableaux find a place in a museum without the gigantic machinery that spits them out? For the intentions of this research, it just makes more sense to me to see these artifacts as byproducts of the main creative act, which is the act of designing the system.

V. SYSTEMS

Galanter's definition suggests that generative art happens when an artist "uses a system" instead of designing one. It could be that there is an implication that the usage of the generative device also refers to the decisions taken in building them. Otherwise, it is hard to conceive an example of a generative piece whose authorship lies in the machine's operator instead of its designer. No matter how generous LeWitt has been in sharing and executing his paintings, they will always be listed in museum collections as Sol LeWitt's. And I don't suppose the draftsmen are entitled to the same compensation given to him or his estate.

Does this gesture establish authorship if one of Ana Carrera's algorithms is used to produce an image? The value of the painting is derived from the artist's fame, making any effort to profit from it unwise. Even if the generative software were published under a permissive license, selling its outputs as personal creations would constitute a form of intellectual theft—unless a new artwork is devised within a different context, such as *a collection of artworks made with other generative artists' algorithms*.

Generative art is closely related to the design of productive systems because it needs a system to execute the automation described by the artist, and this system will weigh the results obtained. Giving written instructions to laymen is part of the system devised by LeWitt, which proves that such processes do not have to be intermediated by a machine as long as the instructions can be understood somehow. If we extrapolate this view, we can conclude that every art is supported by a system of production that previous artists and inventors refined.

One of the foundations of Vilém Flusser's philosophy of photography is the concept of the black box. Although directly related to the camera as ca losed, opaque space, this metaphor is expanded to reflect on the artistic practice in general. Such devices (*apparatus*) operate according to a *program;* opening the black box is understanding how the program

works and effectively controlling the creation process. "The camera is programmed to produce photographs, and every photograph is a realization of one of the possibilities contained within the program of the camera" [21, p. 113]. Within this thinking, generative art becomes the paradigm of the deconstruction of the black box: the artist is the one defining what is the *program.*

After all, a program is a set of instructions in its essence. In Flusser's vocabulary, artists who master the black box become *functionaries.* Reclaiming the black box is never a complete process; for an artist, using a medium open to meddling is almost impossible. To conquer support is to engage in a fight and an exchange: the artist molds the tools, and the tools influence the artist and the artifact.

The second important element of this excerpt is the choice of the word *system.* Although we have been using the word without much care, the study of systems, also known as systems theory, is a vast field. And one of its most significant challenges is to define exactly what a system is. In the same paper where Galanter defines generative art, he delves into the issue of complexity: "Given that systems are a defining aspect of generative art, complexity science has much to offer the generative artist (Galanter 2003)." The paper contains a detailed examination of the complexity of generative art. The first important observation is that we haven't been using the term (e.g. when describing *Dream Shaper* and *Botto)* the same way complexity scientists refer to it. The science of complexity, albeit not easy to define, looks into the ability of systems to self-organize or at least display emergent behaviors that go beyond their organizational rules. The weather is based on basic physics principles, yet it is tough to predict. The human mind is based on the biological neuron, which is an easy model to describe. However, their organization within the brain leads to the emergence of phenomena we can still not explain, like thoughts and reasoning. So far, we have used the term complex as a synonym for complicated. It seems hard to defend that a new behavior emerged spontaneously from the systems developed in the previous examples. They purposefully induce a particular kind of aesthetics, which is not the same. The beauty of complex systems, paradoxically, lies in their simplicity: simple rules or settings that cause elegant, new behavior. The examples we just discussed are not simple; they are much the opposite.

This realization should be enough to dismiss complexity science tools as methods to evaluate generative art. Galanter says the same and explores this idea further, primarily through the optics of order and disorder in systems. However, this attribute is not particularly relevant to art: great works of art can be organized as Mondrian or chaotic as a Pollock painting. The conclusion, with which I agree and share here, is that "while complex systems dominate our current attention, and in many ways represent the future of generative art, complex systems are not 'better than' simple systems."

This dismissal does not mean systems theory is useless for understanding art based on systems. The field is vast and in constant evolution. One of its most interesting concepts is *autopoiesis.* Developed in the 1970s by Chilean biologists Humberto Maturana and Francisco Varela, it refers to the capacity of a system to auto-organize, maintain, and perpetuate its existence. The reference example would be the biological cell, which has a set of components such as proteins, a membrane, and DNA, which enables it to nourish itself, dispense rejects, and define it as an individual system. Such components "(i) through their interactions and transformations continuously regenerate and realize the network of processes (relations) that produced them, and (ii) constitute it (the machine) as a concrete unity in space in which they (the components) exist by specifying the topological domain of its realization as such a network [22]".

I will return later to autopoiesis, but we shall take a short detour to review a related concept proposed by the same authors. For them, *allopoietic* systems produce an output. The canonical example mentioned in their text is a car factory. These organizations (different from organisms) are defined more by *others* than themselves. They exist to fulfill a demand from another being, an industry, or a market. They are built or emerge within a productive logic instead of an ontological need. They fit the definition laid out earlier on generative art, as it yields artifacts such as *Botto's* pieces or the sheet of paper spat out by *DreamShaper.* "Allopoietic machines have an identity that depends on the observer, and is not determined through their operation, because its product is different from themselves; allopoietic machines do not have individuality", while "Autopoietic machines do not have inputs or outputs [22, p. 80]".

Granted, applying these biological concepts to art is a far stretch. Maturana himself advised against their application outside of life sciences. But this didn't stop scholars from various fields from reflecting on autopoiesis as the quintessential ability to define and support individualities. One particular hurdle is that the Chilean scientists were concerned with living entities displaying emerging biological features, and this text examines exclusively artificial, human-made contraptions. But, alas, there is nothing more human than comparing our inventions to the high standards of functionality exhibited by natural machines – animal bodies, ecosystems, and cells. The founding cybernetics text compared "control and communication in the animal and machine [23]". For this paper, the appropriation is even more appealing because of the subtle hierarchy the biologists established between these concepts, placing autopoiesis above allopoieisis.

Some other obstacles appear in appropriating their theory for the reflection on the arts. Artworks are always subordinate to an observer or an audience, even if they don't submit to the productive needs; it is art to argue for art without receivers. Also, autopoietic machines define their boundaries, while artworks have their structure defined by their authors. Hence, we should keep in mind that we are simplifying these categories to be able to reflect on the systems of art making.

VI. NON-GENERATIVE OR SYSTEMS ART

Now we circle back to the initial question: how to we think about artworks that have the hallmarks of a closed system but do not generate outputs? To think of that, let's approach a concept that has decades in the making: systems art. In the early sixties, Hans Haacke developed his *Condensation Cube,* a transparent box where water condenses on the wall according to ambient temperature changes. Hence, the appearance of the work depends on the environment to which it is being exposed. Having no inputs or outputs, its product is not different from itself: it will maintain its self-production independently "of their interactions with an observer". Following the reasoning in the last section, we will adopt the reductionist view that *systems art* is autopoietic, while generative art is allopoietic.

Before delving further into this concept, a review of previous literature is necessary. Although the term lacks a clear definition, Francis Halsall's 2008 book *Systems of Art* provides valuable insight. The author offers a thorough description of system theory and situates the concept of systems aesthetics—closely related to the work of artist and critic Jack Burnham—at the origins of systems thinking in the arts. Halsall also explores not only artworks as systems but also the entire art sphere as a system, including, for example, the gallery as a system.

This approach, while valid and reasonable for reflecting on the art system, is not helpful in this particular case, as the focus here is on considering the system as an artwork rather than the artwork as a system. In other words, every system designed to produce art (and perhaps even any human-made system) can be regarded as a piece of art.

The incursion into generative art was a good starting point because it is counterintuitive to posit a generative artist who can refrain from creating their art generation system. As we argued, anyone using a pre-existing generative system will likely produce more instances of someone else's work. However, not all systems invented for artistic purposes yield outputs. They often cause ephemeral and performative effects, avoiding a productive purpose.

In the 1960s, Jan Dibbets made a piece where he placed eighty sticks in the sea, a few inches below the surface, and watched them oscillate in the water from fifty feet above: "That," he said, "was the work" [3], [24]. A more recent example is Ana Laura Cantera's *When Forces Meet*[1] (2024), who used strategically positioned magnifying glasses to "burn, cut, melt, and glue together" materials collected and organized around the installation site at a beach. In both cases (and in many others), the output is contingent on several natural factors over which the authors have no say. Denise Alvez-Rodriguez developed the *D.K.A. (Desenhador Kósmico Artesanal)* as a tool to create graphic representations of the night sky; it was first exhibited as a standalone art object[2], although she later used it to make drawings and displayed its production.

Liberated from the need for by-products, systems art objects are free to explore an existential sense of significance that is not limited by the aesthetic purpose of the generated artifacts. *Storm in a Seacup*[3] is a work by Tuula Närhinen that consists of a hose

[1] https://www.analauracantera.com.ar/copia-de-when-forces-meet

[2] https://web.archive.org/web/20160316085521/http:/arteenorbita.diferencial.org/category/artistasartists/

[3] https://www.tuulanarhinen.net/artworks/clapotis/storm.html

immersed in the ocean that displays the rise of the waves in a transparent tube nearby. Eduardo Imasaka's *Microvawore*[4] is an interactive system with an invisible effect that destroys itself from the inside.

In all these cases, the artists offer new procedures (in the sense of new *ways of doing something*). And the systems invented are both innovative and effective (in the sense of producing effects). However, these methods only make sense in a given context and go beyond the support. We need a concept highlighting the difference between making artifacts and making new systems productive yet depicting them as creative practices.

VII. Medium, support, device: arrangement

The term arrangement has been appropriated for various purposes. The use I claim derives from the organization of creative elements and is closely related to the musical arrangement [25]. While important for a song's sound, the arrangements remain in the background regarding authorship. When a song is registered, the score will denote the melody and harmony, and, in the best scenario, only a few snippets of these notes are ultimately responsible for the way the music sounds [26].

Here, song arrangements will convey a metaphor for the set of practices and context that enable artworks in general. The media, or supports, are part of it, but they are also necessarily grounded in a historical context. As Halsall notes, building on Rosalind Krauss [27]:

> "The idea that medium be understood as the 'technical support' for a work of art means that its definition is grounded upon a set of historically situated practices rather than a particular set of material conditions. Thus, painting, for example, is not explicable by the existence of paint, canvas, and brushes alone but instead must be understood as the set of historical conditions that allow for the identification of a set of technical procedures (such as historical precedents and studio practices) to be acknowledged as painting. This is, crucially, a description of medium that is expansive enough to include system as a medium." [19, p. 117]

The point here is that, with artists' increasing appropriation of technology over the last hundred years, art has also become the practice of designing new, innovative supports. The arrangement, therefore, is the set of conditions that allow an artifact to be produced. There has not been enough differentiation between innovation in artworks and innovation in their means of production.

Take cinema, for instance, as an art form with movies as artifacts. What Burch identifies as the *Institutional Mode of Representation [28]*, also called *Classical Hollywood Cinema [29]*, is a well-defined arrangement that includes a technical medium and a narrative style, with the whole context of the Hollywoodian industrial complex behind it. However, when neo-realists, in the Italian post-WWII years, started creating fictional movies in locations with non-professional actors as main characters, they proposed an innovative arrangement within cinema. Without downplaying the strength of movies like *La Terra Trema*, we can also see them as byproducts of the real innovation powering them, proposing a new way of making cinema.

What I describe as arrangement shares significant similarities with the system concept, yet it proposes a category that distinguishes human creativity from purely functional productivity. Unlike productive systems approaches, arrangements are fundamentally human constructs embedded in specific social and temporal contexts and not necessarily bound by utility. For instance, art styles and artistic works derive their meanings from the precise conditions of their emergence. In contrast, an artificial tool like a hammer maintains its intrinsic purpose across different eras, and organic systems like plants operate independently of human interpretation or need. However, arrangements share some characteristics with systems—they can be self-organizing and emerge spontaneously within human consciousness, revealing human creative expression's complex, intuitive nature.

Of course, there is no need for a new arrangement for every new artwork, nor even for masterpieces. However, when working in art fields that are very close to technological discourse, making a new piece often entails a new form of expression. For instance, Arcangel Constantini and Julian Oliver are artists who will develop a new system with almost every new piece. In the case of the Mexican artist, every sound piece is accompanied by a never-seen method to produce sounds, like the inductoKhor[5] or e-kebana[6]. And while the New Zealander developed a whole new

[4] https://eduardoimasaka.com/2019/03/05/microvawore/

[5] https://arc-data.net/info/es/inductokhor/

[6] https://arc-data.net/info/es/e_kebana/

narrative system for the piece levelhead[7], he didn't reuse the support with different content.

One reason could be that these new arrangements bear too much weight in the final artifact for a different artist to claim authorship. Let's consider the innovation developed by Jackson Pollock in creating paintings with punctured ink cans. Anyone using the same technique would risk being categorized as a copycat, no matter how different the artifacts might become. Other painters who resorted to painting with drips, such as Sam Francis, crafted their differentiated techniques. A generation of artists shared other new inventions in representation, such as Cubism or even the advent of perspective.

VIII. CONCLUSIONS

This introductory essay aimed to draw attention to the fact that artists working with technology are creating new artistic artifacts and often also the arrangements necessary for their production. Quite frequently, there is no generative quality in the arrangements, and the systems themselves are the artwork, dispensing with the need for any output. Nonetheless, whenever a new arrangement yields by-products, they are far less important than developing the medium that generated them. From this perspective, conceptual art is an art of arrangement, as it is more concerned with crafting a new procedure (a way of making things) than manufacturing an artifact.

With this view of contemporary production, the roles of artists and inventors are brought together once again. A person who, even without the pretension of making art, develops innovative systems should not be considered any less creative than the media artists of today. The differentiation between artist and scientist is historically recent; art refers to the general ability to make things, from bridges to statues, shoes to poems. With the recent incursions of generative creators, or systems artists, into the realm of technological innovations, this gap is closing once more.

The arrangement concept should be seen as a discourse on what is considered art. Every human enabling the development of new means of expression should receive as much recognition as society bestows on artists. This includes programmers, designers, engineers, and the endless crafters who intuitively and ingeniously propose new solutions to problems and new procedures for making things, even without formal education every day. These arrangements are autopoietic, as they do away with any requirement of output, and are self-defined in the sense that their inner organization and purpose define their meaning. However, this relation to the theory of systems must be left for further development, which is another opportunity.

[7] https://julianoliver.com/projects/levelhead/

REFERENCES

[1] D. E. Knuth, *The art of computer programming*, 3. ed. Amsterdam: Addison-Wesley, 2011.

[2] J. McCormack, O. Bown, A. Dorin, J. McCabe, G. Monro, and M. Whitelaw, "Ten Questions Concerning Generative Computer Art," *Leonardo*, vol. 47, no. 2, pp. 135–141, Apr. 2014, doi: 10.1162/LEON_a_00533.

[3] M. A. Boden and E. A. Edmonds, "What is generative art?," *Digital Creativity*, vol. 20, no. 1–2, pp. 21–46, Jun. 2009. doi: 10.1080/14626260902867915.

[4] P. Galanter, "What is Generative Art? Complexity Theory as a Context for Art Theory," presented at the GA2003–6th Generative Art Conference, Milano, 2003, p. 21. [Online]. Available: https://www.mat.ucsb.edu/~g.legrady/academic/courses/21s255/r/galanter.pdf

[5] S. LeWitt, "4th wall," Whitney Collection. Accessed: Sep. 16, 2024. [Online]. Available: https://whitney.org/collection/works/25530

[6] S. LeWitt and G. Garrels, *Sol LeWitt: a retrospective*. San Francisco, Calif. : New Haven: San Francisco Museum of Modern Art ; Yale University Press, 2000.

[7] T. Dreher, "Conceptual art and software art: Notations, algorithms, and codes," in *Lecture presented*, 2005. Accessed: Aug. 28, 2023. [Online]. Available: https://www.academia.edu/download/42280677/Conceptual_Art_and_Software_Art.pdf

[8] T. Tzara, "Dada manifesto on feeble love and bitter love," *Seven Dada Manifestoes and Lampisteries*, pp. 31–48, 1920.

[9] S. LeWitt, "Paragraphs on conceptual art," *Artforum*, vol. 5, no. 10, 1967.

[10] W. Benjamin, M. W. Jennings, B. Doherty, T. Y. Levin, and E. F. N. Jephcott, *The work of art in the age of its technological reproducibility, and other writings on media*. Cambridge, Mass: Belknap Press of Harvard University Press, 2008.

[11] S. Park, "The work of art in the age of generative AI: aura, liberation, and democratization," *AI & Soc*, May 2024. doi: 10.1007/s00146-024-01948-6.

[12] S. Kenderdine and A. Yip, "The proliferation of aura: Facsimiles, authenticity, and digital objects," in *The Routledge Handbook of Museums, Media and Communication*, Routledge, 2018.

[13] G. Cowan, "Generative Systems: Sonia Landy Sheridan as Artist/Master of the Machine," *Visual Resources*, vol. 22, no. 4, pp. 325–342, Dec. 2006, doi: 10.1080/01973760601010309.

[14] D. Quaranta, *In your computer: or how I learned to love art that comes to you through your computer screen, and why you should learn to love it as well*. Breskia: Link Ed, 2011.

[15] K. E. Jennings, "Developing Creativity: Artificial Barriers in Artificial Intelligence," *Minds and machines (Dordrecht)*, vol. 20, no. 4, pp. 489–501, 2010.

[16] M. Canet Sola and V. Guljajeva, "Dream Painter: Exploring creative possibilities of AI-aided speech-to-image synthesis in the interactive art context," *Proceedings of the ACM on Computer Graphics and Interactive Techniques*, vol. 5, no. 4, pp. 1–11, 2022.
doii: https://dl.acm.org/doi/abs/10.1145/3533386.

[17] M. Klingemann, S. Hudson, and J. P. Thompson, "Cluster #069," in *ACM SIGGRAPH 2023 Art Gallery*, Los Angeles California: ACM, Jul. 2023, pp. 1–2.
doi: 10.1145/3588428.3593818.

[18] I. Kant, *Critique of the Power of Judgment*, 1st ed. Cambridge University Press, 2000.
doi: 10.1017/CBO9780511804656.

[19] F. Halsall, *Systems of art: art, history and systems theory*. Bern ; Oxford: Peter Lang, 2008.

[20] C. Haskins, "Kant, Autonomy, and Art for Art's Sake," *The Journal of Aesthetics and Art Criticism*, vol. 48, no. 3, p. 235, 1990, doi: 10.2307/431766.

[21] V. Flusser, *Towards a philosophy of photography*. Göttingen: European Photography, 1984.

[22] H. R. Maturana and F. J. Varela, *Autopoiesis and Cognition: The Realization of the Living*, vol. 42. in Boston Studies in the Philosophy and History of Science, vol. 42. Dordrecht: Springer Netherlands, 1980.
doi:10.1007/978-94-009-8947-4.

[23] N. Wiener, *Cybernetics: Or Control and Communication in the Animal and the Machine. 1965 ed*. MIT Press, 1948.

[24] L. R. Lippard, Ed., *Six years: the dematerialization of the art object from 1966 to 1972 ; a cross-reference book*. New York, NY: Praeger, 1973.

[25] B. Caldas Vianna, *The poetics of autopoiesis : visual arts, autonomy, and artificial intelligence*. Taideyliopiston Kuvataideakatemia, 2024. Accessed: Apr. 27, 2024. [Online]. Available: https://taju.uniarts.fi/handle/10024/8130

[26] R. Niles, *The Invisible Artist: Arrangers in Popular Music (1950-2000)*. Createspace Independent Publishing Platform, 2014.

[27] R. E. Krauss, *"A voyage on the North Sea": art in the age of the post-medium condition*, 1. publ. in paperback. in Walter Neurath memorial lectures, no. 31. London: Thames & Hudson, 2000.

[28] N. Burch and B. Brewster, *Life to those shadows*. Berkeley: University of California Press, 1990.

[29] D. Bordwell, J. Staiger, and K. Thompson, *The classical Hollywood cinema: film style and mode of production to 1960*. London: Routledge & Kegan Paul, 1985.

AI MoCap for Artists

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Abstract—Artificial Intelligence (AI) motion capture represents a significant advancement in capturing and manipulating human motion, offering a more accessible and cost-effective approach to creating lifelike animations and interactions within digital media. Traditionally, motion capture has been employed to generate realistic character movements for film and video games. However, its applications extend beyond figurative representation, enabling motion mapping onto diverse visual forms in various contexts, such as artistic installations and live performances. Despite its potential, traditional motion capture systems are prohibitively expensive, limiting their accessibility for creative applications. AI-driven motion capture has democratized this technology, introducing numerous low-cost or free solutions that empower artists to explore innovative and abstract visual approaches. Nonetheless, a critical question arises: do these AI-based tools deliver acceptable and meaningful results within diverse artistic contexts, particularly in non-figurative applications where visuals deviate from the original form? This paper undertakes a comparative study of low-cost AI motion capture solutions to assess their suitability for artistic purposes, helping artists choose which platform to use. Quantitative and qualitative analyses are conducted, and the captured movements taken from these AI solutions are integrated into prototypes that explore abstract and non-representational visual interpretations.

Keywords—media arts, artificial intelligence, motion capture, performance animation

I. INTRODUCTION

Motion captured the process of tracking live motion and translating it into digital data. [1]. This technology has a wide range of applications, such as medicine, sports, film production, and video games. With the democratization of technology, low-cost solutions have emerged that have opened their use in other fields, particularly in artistic practice. Motion capture (MoCap) is typically employed in production to animate human characters realistically, replicating the original movement as closely as possible.

MoCap encompasses a variety of technologies that convert physical motion from the environment into a dataset, which can then be mapped onto the skeleton of a virtual character. While motion capture refers specifically to the technology used to translate a performer's physical movements into usable digital data, performance animation is an expressive art form that pertains to the real-time animation of a performing object by a performer, independent of the underlying technology used [2]. Several MoCap technologies are available, including mechanical, magnetic, inertial, and optical systems, with the latter being the most widely utilized in the industry. Although AI-driven motion capture solutions are advancing rapidly, this remains a relatively new field within artificial intelligence. Nonetheless, the number of available applications is increasing swiftly, making it increasingly challenging to determine which platform to choose.

This paper presents a comparative study of low-cost (free) computer applications (both stand-alone and web-based) for AI-based motion capture (AI-MoCap) that can be applied in artistic practices. While there are also low-cost AI-MoCap applications available for mobile devices, these are not included in the scope of this comparative study.

II. OVERVIEW

A. Motion Capture

Motion capture is a technology that facilitates recording human or object movement translating it into a digital dataset. It captures realistic movements and gestures that can be applied to virtual characters, creating lifelike animations. A related term, motion tracking, refers to the monitoring and following of the movement of a human or object and can be applied across various fields, such as visual effects and augmented reality. Motion capture is employed in diverse domains, predominantly for animation and creating realistic movements in video games, film, and virtual and augmented reality. It is extensively employed for motion analysis to understand the biomechanics of movement, often within medical

contexts, as well as in sports [3], dance [4], [5], and gesture recognition, including sign language [6]. Furthermore, motion capture can be approached artistically, mapping human motion onto non-human figures or visual effects using techniques such as digital puppetry [7], [8].

B. AI in Motion

Artificial Intelligence (AI) significantly contributes to the development and democratization of motion capture by providing low-cost solutions based on standard video cameras. AI is applied across multiple motion capture processes, including pose estimation, facial motion capture, gesture recognition, and data processing and analysis. AI can be employed not only for motion capture but also for motion generation. AI-driven motion capture (AI-MoCap) leverages AI methodologies to recognize human motion and clean and smooth motion data and map this data onto a skeleton or virtual character. Conversely, AI-generated motion refers to animations produced by AI based on trained motion capture datasets. For instance, motion capture can be utilized to build datasets for machine learning, enabling the autonomous generation of human motion that can adapt to adversities, such as those addressed by the Adversarial Skill embedding (ASE) framework [9]. ASE facilitates the learning of versatile and reusable motor skills for physically simulated characters, making it particularly useful in video games by providing a wide range of motions and overcoming typical limitations associated with player animations. It is also possible to generate motion from in-between poses using the RRobustMotion In-betweening method [10], taking advantage of the LaFAN1 dataset.

C. AI MoCap

AI-based motion capture (AI-MoCap) is commonly used for pose estimation of human motion, which can be extracted from 2D video frames. Neural networks are employed to infer the position and rotation of joints, allowing for precise motion tracking [11], [12]. The quality of the video images significantly impacts the accuracy of motion prediction. For practical training, obtaining high-quality motion data using high-resolution optical or high-quality inertial motion capture systems and ensuring diverse motion content with various styles is essential. The datasets used in training play a crucial role in the success of the AI-MoCap process. These datasets should encompass a wide range of motions, recorded in different styles and genres (including both male and female subjects), and maintain a consistent rig structure to facilitate accurate results [10], [13], [14]. However, recent research indicates that generating realistic motion using a single-pose motion capture dataset is plausible, reducing the dependency on massive datasets [15].

Although motion capture data can yield high-quality results, the expressiveness of the performance itself may be limited if executed by a non-actor. To enhance expressiveness, a style transfer method can be applied to the original data by blending or overlaying a different motion that conveys a specific emotion [13], [14], [16], [17], [18], [19], [20], [21]. Motion style transfer has been a prominent area of focus in AI-based motion capture research in recent years.

D. AI MoCap Applications

AI-based motion capture is transforming the process of capturing and animating virtual characters or objects, significantly enhancing its accessibility to users. It offers flexibility by supporting diverse environments, enabling real-time capabilities with instant feedback for live applications, and providing user-friendly processes that simplify the setup. The number of AI MoCap applications is increasing exponentially, encompassing standalone computer applications, web-based platforms, and even smartphone apps. Most of these applications utilize machine learning and computer vision techniques to analyze video footage or sensor data, extracting movement patterns without requiring specialized suits or equipment. Computer vision enables markerless tracking by processing images and using machine learning to interpret human motion from standard video input. Pose estimation is accomplished by tracking human joints in space through AI algorithms that analyze video data to identify key points, which are then used to reconstruct movement. Deep learning techniques are widely employed for pose estimation, employing neural networks trained on extensive human motion datasets to predict body parts' positions, allowing the AI to generalize and estimate poses even in complex scenarios. While many AI MoCap systems rely on a single-camera or single-video input, others support multi-camera setups to reduce errors and improve depth perception.

E. Motion Retargeting

After capturing motion, a process known as motion retargeting transfers the captured data to a virtual character, which may have different proportions

or skeletal structures from the source. Most AI MoCap applications map the motion capture data to a predefined skeleton or virtual character. Motion retargeting enables animators to transfer motion onto their custom virtual characters. Various applications support this retargeting process, ranging from specialized software like Autodesk MotionBuilder to game engines such as Unreal Engine.

While retargeting human motion (source) to a biped character (target) is relatively straightforward, the process becomes more complex when there are significant differences between their skeletal structures. In virtual reality (VR) contexts, tracking only body parts, such as the hands and head, commonly use headsets and controllers. Retargeting this sparse tracking data to a full-body skeleton can be challenging, but research is ongoing to address this few-to-many mapping using physics-based approaches [22]. Additionally, motion retargeting for non-human characters or characters with skeletal structures that differ significantly from the source poses considerable challenges [23], [24].

III. ARTISTIC MOTION CAPTURE

Artistic approaches using motion capture are not new. At the end of the 1990s, the European project eRENA [25], [26] explored motion capture with theatrical performance to develop production tools for *Electronic Arenas*. One of the earliest projects to integrate motion capture with dance was the *Hand-drawn Spaces* [27] created for SIGGRAPH 1998, showcasing an artistic performance by Merce Cunningham in collaboration with artists Paul Kaiser and Shelly Eshkar, along with the OpenEnded Group. The OpenEnded Group later collaborated with choreographer Bill T. Jones to develop *Ghostcatching* (1999) and with Trisha Brown (Fig. 1) to create *how long the subject lingers at the edge of the volume...*(2005) [28].

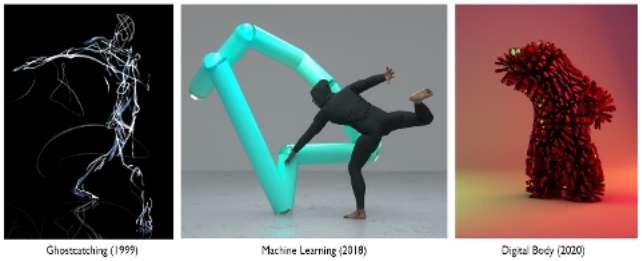


Fig. 1. Artistic projects using motion capture.

Since then, numerous artistic projects have employed motion capture to translate human motion into visuals and sound, including *Seventh Sense* (2011) by Anarchy Dance Theatre, *Apparition* (2012) by Klaus Obermaier and Ars Electronica Futurelab, *Hakanaï* (2013) by Adrien M & Claire B, and Presence (2013) by the art collective Universal Everything. *Aeolus* (2014), developed by Ersin Han Ersin, is an artistic work that explores body motion to express the imaginary relationships between movement, space, time, forces, and flow. Studio Schnellebuntebilder has also developed artistic projects with motion capture that explore sound and point clouds, such as *Momentum* (2014) and *Sisi Rada-Sunday* (2015). Alexander Whitley created an experimental collaborative web-based platform called *Digital Body* (2020), where artists could access motion capture data from dancers of the Alexander Whitley Dance Company and share their motion visual experiences with the community. Academic research has also explored the artistic potential of motion capture, with works like *Digital Soul* [29, and studies examining color and movement to communicate emotions [30]. *Machine Learning* (2018) is another artistic project developed by the art collective Universal Everything in collaboration with the choreographer Dwayne-Antony Simms that asks whether humans can teach machines to move. This project combines research, technology, and art, presenting a suman-machine motion dialog.

IV. LOW-COST APPLICATIONS FOR MOCAP

Currently, numerous AI-based motion capture (MoCap) solutions are available. Low-cost mobile device applications use their built-in cameras, with some specifically designed for iPhones that leverage their depth-sensing capabilities, such as Move One. Open-source libraries like OpenPose provide real-time pose detection, tracking, and analysis, while systems like Freemocap support multi-camera setups for more detailed motion capture. There are also standalone applications for computers and web-based applications that can run on multiple devices. Specific platforms, such as Wonder Dynamics, offer advanced features like multi-person motion capture, camera tracking, and light tracking, enabling the compositing of virtual characters into live-action scenes. For this study, a selection of representative AI MoCap applications with a free plan was chosen for comparison, even if these free plans have certain limitations. The tools selected include Cascadeur, DeepMotion, Plask, Radical, and Rokoko. It is important to note that, at the time of writing, Wonder Dynamics no longer offers a free plan.

TABLE I. AI MOCAP SOLUTIONS FEATURES

Features	AI Mocap				
	Cascadeur	*DeepMotion*	*Plask*	*Radical*	*Rokoko*
Fullbody Tracking	✓	✓	✓	✓	✓
Face Tracking		✓		✓	✓[a]
Finger Tracking		✓		✓	
Multi-Person		✓			
Multicam					✓[a]
T-Pose	✓	✓	✓		✓
Foot locking	✓	✓	✓[a]		✓
Motion smoothing	✓	✓			✓
Physics filter	✓		✓		✓
Streaming				✓	✓[a]
Price	99$ 1596$	108$ 996$	216$ 600$	96$	240$ 600$

a. Not available in the free version

Several key functionalities are critical when selecting an AI motion capture solution, as they may directly impact its relevance to specific applications. Certain features, such as the T-pose, are essential for motion retargeting, while others, including foot locking, motion smoothing, and the physics filter, are valuable for compensating for movement inaccuracies. Functionalities like face tracking are fundamental for projects focusing on facial expressions. Conversely, capturing the movement of multiple performers (multi-person tracking) or detailed finger tracking might take precedence, depending on the context. Streaming capabilities can be a decisive factor in scenarios such as live performances.

Additionally, cost considerations often play a significant role in the selection process, mainly when working within budget constraints. Not all solutions offer the same features. The key features of each of these tools are summarized in Table I.

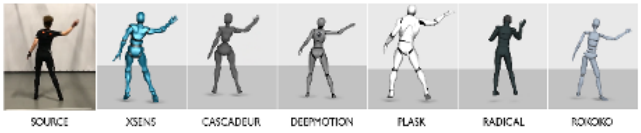


Fig. 2. Frame of motion capture for all applications

A motion capture session was conducted in a studio with controlled lighting to evaluate each solution. An iPhone camera was positioned 5 meters away from the performer and 1 meter above the floor (Fig. 2). The Xsens aWinda inertial capture system was also employed as a reference for comparison. To compare the different solutions, 11 distinct movements were identified to evaluate tracking performance across various body parts and in complex situations, such as body part occlusion. Movements like push-ups aim to assess foot tracking, ensuring they remain fixed to the ground. Movements such as clapping, pointing, and touching evaluate whether the tool accurately tracks hand positioning and contact with the body. The climbing movement can challenge specific motion prediction algorithms, as the ground is no longer the primary support point for the feet. Body rotation movements may also be particularly challenging due to the occlusion of body parts. The fast move test analyses the algorithms' ability to track high-speed motion; however, this can be affected by camera speed and the extent of motion blur. Additional movements, such as jogging, balancing, dancing, and hopping, aim to evaluate overall body tracking in diverse scenarios. Some tools provide movement smoothing options; however, these were deliberately not used in this study. The video recordings of the movements were synchronized with the data captured by the Xsens system and subsequently processed by the respective tools at 30 frames per second (fps). Each tool may vary in the skeleton structure and its visual representation (virtual character). The duration of each movement varies between 5 and 15 seconds.

Initially, a composition was created for each movement, incorporating the various animations generated by the different systems. These compositions allowed for the visualization of differences in the trajectory of each joint across the animations. The puppets were distributed along the X-axis only while maintaining the original Y and Z coordinates, with an ID marker on the head. As illustrated in (Fig. 3), there is a significant deviation in the trajectory of the joints when compared to the Xsens reference.

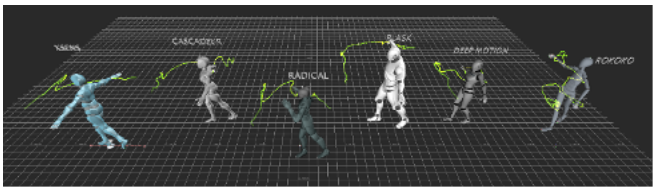


Fig. 3. Motion trajectory offset of each system in perspective

In addition to the compositions containing all the animations, a separate composition was created featuring the original video alongside the visual representation of the motion capture. These compositions facilitate the understanding of differences between each animation and their

deviations from the original video. The analysis of trajectories, animation curves, and the animations themselves is an empirical basis for conclusions. A critical aspect of this study is comparing the movement captured by each application with the Xsens system. Measuring the differences between two motion capture files involves comparing the data points representing the joints' motion over time. Several approaches could be employed for this comparison, including: a) coordinate comparison for each joint; b) calculating the root mean square error (RMSE); c) computing the mean and standard deviation of the angular differences; d) utilizing Dynamic Time Warping (DTW) for motions with varying timings; e) applying Principal Component Analysis (PCA) to reduce the dimensionality of the motion data. In this study, we computed the mean of the angular differences over time for each skeleton joint (Fig. 4) to understand the average difference and its variability. This analysis could be further enhanced by applying a paired t-test to determine the significance of the differences.

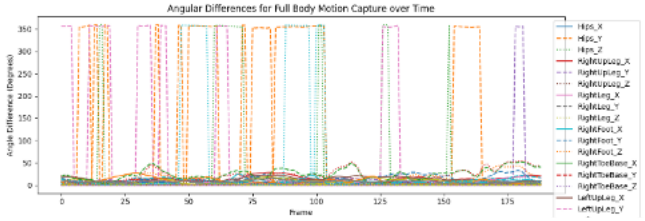


Fig. 4. Angular Differences for full body motion capture.

For these comparative tests, it was essential to a) ensure that the movements were fully aligned and synchronized, b) retarget the movements of each system to the same skeleton, and c) export the movements in CSV format using the BVH Converter tool developed in Python [31]. To calculate the angular differences between corresponding joints, we utilized Python along with the following libraries: a) NumPy for mathematical operations; b) Pandas for data handling; c) Matplotlib.pyplot for plotting the differences; and d) SciPy for working with rotations. Table II presents the results of the angular differences for the joints of the skeletons between Xsens and each system. Initially, we calculated each joint's mean and maximum angular differences to quantify how much the motion differs. Subsequently, the global average difference was computed, providing a single value representing the average deviation of all joint movements between the two motion capture files. The same approach was employed to calculate the global maximum angular difference. Each cell in Table II presents two values: a) the mean angular difference and b) the maximum angular difference. Lower angular values indicate minor differences, suggesting the movement is closer to the original.

V. RESULTS

TABLE II. MIN/MAX ANGULAR DEVIATIONS OF THE APPS FOR EACH MOTION COMPARED WITH THE SENSE AND REFERENCE

Features	AI Performance				
	Cascadeur	*DeepMotion*	*Plask*	*Radical*	*Rokoko*
Jogging	18°162°	20°206°	16°177°	20°218°	22°359°
Push-ups	24°228°	35°257°	24°279°	18°104°	28°358°
Balancing	19°259°	23°299°	15°265°	23°258°	24°332°
Pointing	13°100°	24°308°	16°222°	17°236°	19°273°
Dancing	18°171°	24°285°	15°153°	20°257°	23°285°
Clapping	19°275°	24°335°	12°126°	22°302°	23°311°
Touching	22°251°	22°219°	16°114°	21°219°	25°291°
Hopping	20°223°	21°249°	16°159°	25°217°	21°351°
Fast Move	18°161°	23°258°	15°173°	22°264°	22°286°
Rotating	18°190°	22°283°	17°192°	18°222°	22°330°
Climbing	18°166°	19°194°	19°242°	22°209°	24°351°

The results presented appear consistent, allowing for some insights into how AI systems respond to different movements. The videos of these motion capture studies are available online [32]. Regarding the mean angular differences, the push-up movement exhibits the highest deviation (mean), which is expected since only part of the body is visible. In contrast, the pointing movement achieved the best results due to its highly recognizable posture. Movements involving clapping show variable results (mean), with the Plask system exhibiting a very low deviation (12°) and the DeepMotion application showing a higher deviation (24°).

Concerning the maximum angular deviations, it is evident that the Rokoko system faces the most significant challenges, with a maximum deviation of 358° out of a possible 360° during push-ups. This system struggles to estimate pose accurately when using only one camera, leading to significant deviations that compromise the animation. However, using a second camera helps mitigate this issue, and many of these problems can also be addressed using Rokoko Studio. Nevertheless, none of these alternatives were considered for evaluation purposes. The system that achieved the lowest maximum deviation was Cascadeur in the pointing movement. Fig. 5 illustrates the angular differences for all movements, with the blue bars representing the mean

angular differences and the orange bars indicating the maximum differences.

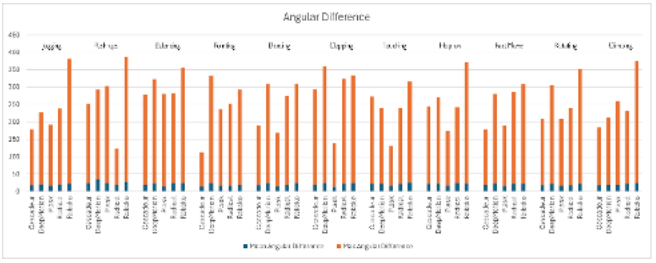


Fig. 5. Angular difference for all movements.

A. Quantitative Analysis

Overall (Fig. 6), the Plask system demonstrated the best results, with a mean angular difference of 16.3° (4.5%) and a relatively low maximum deviation, averaging 191.1° (53.1%). Cascadeur also produced good results, with a mean difference of 18.9° (5.2%) and a maximum deviation of 198.7° (55.3%). The Radical system ranked third, showing a mean deviation of 20.7° (5.8%) and a maximum of 227.8° (63.3%). Finally, DeepMotion and Rokoko shared the last position. DeepMotion exhibited the worst performance regarding mean deviation, with a value of 23.4° (6.5%) compared to Rokoko's 23° (6.4%). However, Rokoko had the poorest performance regarding maximum deviation, with a value of 320.6° (89%) compared to DeepMotion's 263.0° (73.3%).

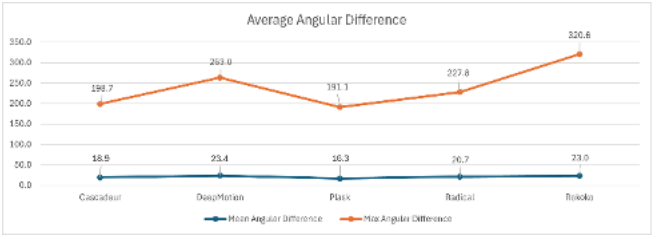


Fig. 6. Global results.

B. Qualitative Analysis

Based on the observation of the movements obtained from the different systems, it was possible to conduct a qualitative analysis presented in Table III.

TABLE III. KEY FINDINGS FROM THE QUALITATIVE ANALYSIS

Feature	Analysis
Jogging	**Rokoko**: Erratic movements, positional jumps, and significant noise make results unusable without postprocessing.
	Deep Motion: Displays instability and minor noise.
	Radical, Plask, Cascadeur: Deliver the best results, although Cascadeur shows limited movement fidelity.
Push-ups	**Rokoko**: Struggles with arm and hand bending, poor leg tracking (especially furthest from the camera), and introduces noise.
	Radical: Misaligned body rotation, with tracking issues for limbs distant from the camera.
	Plask: Hands do not bend.
	Cascadeur, Deep Motion: Achieve the most accurate results, with Deep Motion excelling in ground contact representation despite minor initial deviations.
Pointing	Most systems perform well, except **Rokoko**, which is noisy and fails to track body movements in space.
	Plask, Deep Motion: Track finger movements but with Plask deviating from the original motion.
Dancing	**Rokoko**: Severe arm tracking issues, noise, and lack of spatial body movement.
	Cascadeur, Radical: Limited flexibility but follows the general motion.
	Plask, Deep Motion: Capture movement nuances with some noise; Deep Motion represents finger motion effectively.
Clapping	Overall, it performs well, though Rokoko fails to account for body movement in space and adds noise.
	Plask, Deep Motion: Exhibit incorrect hand rotations.
	Cascadeur, Radical: Provide the most accurate results.
Touching	**Rokoko**: Persistent tracking failures and noise.
	Other systems: Generate acceptable results, with **Plask** and **Deep Motion** producing more expressive outputs.
Hopping	**Rokoko**: General tracking problems and noise.
	Other systems perform well, though Radical shows deviations in limbs furthest from the camera.
	Deep Motion: Most expressive but introduces more noise.
Fast Move	**Rokoko**: General tracking failures with frequent positional jumps.
	Plask, Deep Motion: Demonstrate expansive movement representation with minor deviations.
Rotating	**Despite noise and balance issues, all systems** effectively track rotation, including **Rokoko**.
	Plask, Deep Motion: Deliver the most flexible results.
Climbing	**Rokoko**: Tracks body position in space despite posture issues and noise.
	Radical: Fails to calculate climbing motion accurately, producing inconsistent arm and head rotations.
	Plask, Deep Motion: Achieve the most reliable results.
	Xsens: Unable to capture multi-level movement.

Plask and Deep Motion consistently outperform other systems across most tested movements, excelling in tracking expressiveness and flexibility despite occasional noise and deviations. Rokoko requires substantial postprocessing due to its tracking instability. Cascadeur and Radical deliver reliable but

less flexible results, making them suitable for simpler, constrained movements.

C. Considerations

The results from the comparative study of different AI-based MoCap solutions are varied. While some movements are processed with satisfactory outcomes, others fall short, mainly when applied in fields such as film, video games, or healthcare. Post-processing techniques can mitigate some of the issues identified throughout the study. Nevertheless, when the captured motion is applied to more abstract forms with less detail or used as a layer to generate visuals or sounds that do not need to reflect the performer's movement precisely, these tools present themselves as an enjoyable alternative.

It is also essential to understand that some of these tools can track finger movements and facial expressions, but achieving optimal results may require multiple captures from different camera angles. It is important to consider the capture conditions to obtain high-quality results, including lighting, camera setup, setting, and clothing. Systems that support multiple cameras, like Rokoko or Freemocap, can deliver better results; however, they are more time-consuming as they require camera calibration using markers. In contrast, tools like Wonder Dynamics, which were tested before this study with very positive results, offer comprehensive film solutions, allowing the replacement of actors with virtual characters with facial expressions directly in the scene, along with the calculation of lighting and camera movement. Despite their potential, these tools may not be as relevant for more experimental work. Some of these solutions also support live streaming, making it possible to create performative works.

VI. PROTOTYPE

The captured movements were tested in two small non-figurative approaches (Fig. 7). The movements extracted from Plask, which exhibited the best results, were implemented using the following methodologies: a) an offline video production and b) an online approach for live projection contexts.

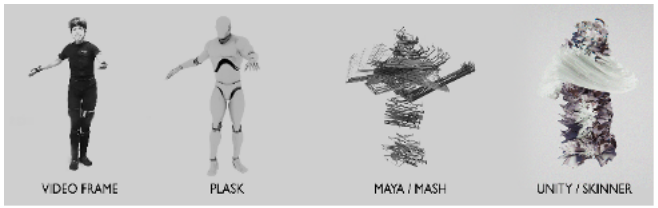


Fig. 7. Visuals generated with real-time and offline AI MoCap

In approach a), Autodesk Maya was used with the Mash functionality specifically designed for Motion Design. The motion captured from Plask was transferred directly from MotionBuilder to Maya, where a series of invisible cubes were assigned to the skeleton and distributed along its structure using the functionality above. A trail effect from Mash was applied, employing various configurations guided by the invisible cubes. The resulting visual effect creates a scribble appearance that gradually fades, with trace lines that are continuously redrawn over time.

In approach b), the objective was to simulate a live visual generation ecosystem by streaming the motion from MotionBuilder to Unity3D. The Skinner framework [33], which facilitates the production of real-time visual effects, was utilized. In this context, the geometry of the virtual character's body was employed to emit graphical shapes and illuminated particles. Multiple layers could be combined to create a variety of effects. The primary aim of this approach was to generate and deconstruct triangular geometric shapes of varying sizes while also creating condensed particles that formed a luminous area, particularly evident during rapid movements.

The results presented in these two experiments indicate that the capture quality may not be a decisive factor in achieving artistic plasticity. In these examples, the motion is synthesized into visual shapes generated over time, leading to a consistent transformation. However, this is not universally applicable, especially when the intention is to explore the detailed movement of a dancer, even in abstract representations. The detail and precision of movement can be critical to our artistic creation, and any movement synthesis may compromise the integrity of our production.

VII. CONCLUSION

Motion capture has long captured the interest of artists. However, traditional hardware-based motion capture systems are prohibitively expensive, rendering them inaccessible to many practitioners in the artistic community. Low-cost motion capture solutions have been explored for some time, employing gaming devices such as the Microsoft Kinect, Nintendo Wiimote, Leap Motion, and HTC Vive [8], [34], [35], [36], [37]. With the advent of artificial intelligence, current systems have become more efficient, enabling motion capture directly from a single camera or frames of a video. Artificial intelligence has been democratizing motion capture, making it more accessible. This development allows creators to utilize

this technique to explore new artistic approaches, opening new possibilities. The quality of motion capture provided by AI systems based on a single camera is variable, depending on imaging conditions (camera angle, lighting conditions, surrounding environment, performer's clothing) and the specific movements performed. Body parts that become hidden during the recording can pose considerable challenges for AI systems if no historical movement data reveals the position of the joints to estimate body poses.

This article compared low-cost AI-based motion capture systems with free plans to the Xsens inertial capture system. The results demonstrate that, for most movements, the motion capture data is acceptable for contexts that do not require precise motion accuracy. However, conducting further comparative studies, particularly analyzing joint positions, would be beneficial. A prototype was developed by applying captured movements from AI systems in two distinct contexts: a performative context (real-time) and a video context (offline). In the performative context, the Unity game engine was employed, and visual effects were produced in real time, generating abstract forms and luminous particles that react to movement. In the video context, Maya was used with the Skinner framework to produce visual trails that progress over time, following the body's movement. The visual outcomes of both studies demonstrate consistent motion and reveal that motion capture, even with low-cost systems, can provide a diverse palette of artistic possibilities. In the future, we aim to explore other AI systems and mobile applications, describing artistic practices that can be applied in visual and auditory contexts.

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REFERENCES

[1] A. Menache, *Understanding motion capture for computer animation*. Burlington: Morgan Kaufmann, 2011.

[2] L. Leite, 'Virtual Marionette: Interaction Model for Digital Puppetry', Doctoral Thesis, Faculdade de Engenhariada Universidade do Porto, Porto, 2018.

[3] C.-C. Liao, D.-H. Hwang, and H. Koike, 'AI Golf: Golf Swing Analysis Tool for Self-Training,' *IEEE Access*, vol. 10, pp. 106286–106295, 2022. doi: 10.1109/ACCESS.2022.3210261.

[4] J. C. P. Chan, H. Leung, J. K. T. Tang, and T. Komura, 'A Virtual Reality Dance Training System Using Motion Capture Technology,' *IEEE Transactions on Learning Technologies*, vol. 4, no. 2, pp. 187–195, 2011. doi: http://doi.ieeecomputersociety.org/10.1109/TLT.2010.27.

[5] W. Guo *et al.*, 'AI-Driven Human Motion Classification and Analysis Using Laban Movement System,' in *Digital Human Modeling and Applications in Health, Safety, Ergonomics and Risk Management. Anthropometry, Human Behavior, and Communication: 13th International Conference, DHM 2022, Held as Part of the 24th HCI International Conference, HCII 2022, Virtual Event, June 26 – July 1, 2022, Proceedings, Part I*, Berlin, Heidelberg: Springer-Verlag, 2022, pp. 201–210. doi: 10.1007/978-3-031-05890-5_16.

[6] A. Moryossef, I. Tsochantaridis, R. Aharoni, and S. Ebling, 'Real-Time Sign Language Detection Using Human Pose Estimation,' 2020, pp. 237–248. doi: 10.1007/978-3-030-66096-3_17.

[7] L. Leite, 'Pull-the-strings – Generic Interaction Model for Digital Puppetry', *Multimedia Tools and Applications*, vol. 81, no. 1, pp. 1–26, 2022. doi: 10.1007/s11042-021-11876-y.

[8] L. Leite and V. Orvalho, 'Mani-Pull-Action: Hand-based Digital Puppetry,' *Proc. ACM Hum.-Comput. Interact.*, vol. 1, no. EICS, p. 2:1-2:16, Jun. 2017, doi: 10.1145/3095804.

[9] X. B. Peng, Y. Guo, L. Halper, S. Levine, and S. Fidler, 'ASE: large-scale reusable adversarial skill embeddings for physically simulated characters,' *ACM Trans. Graph.*, vol. 41, no. 4, Jul. 2022, doi: 10.1145/3528223.3530110.

[10] F. G. Harvey, M. Yurick, D. Nowrouzezahrai, and C. Pal, 'Robust Motion In-Betweening,' *ACM Transactions on Graphics (Proceedings of ACM SIGGRAPH)*, vol. 39, no. 4, 2020.

[11] Z. Cao, G. Hidalgo, T. Simon, S.-E. Wei, and Y. Sheikh, 'OpenPose: Realtime Multi-Person 2D Pose Estimation Using Part Affinity Fields', *IEEE Transactions on Pattern Analysis and Machine Intelligence*, vol. 43, no. 1, pp. 172–186, 2021, doi: 10.1109/TPAMI.2019.2929257.

[12] J. Wang *et al.*, 'Deep High-Resolution Representation Learning for Visual Recognition,' *IEEE Transactions on Pattern Analysis and Machine Intelligence*, vol. 43, no. 10, pp. 3349–3364, 2021, doi: 10.1109/TPAMI.2020.2983686.

[13] K. Aberman, Y. Weng, D. Lischinski, D. Cohen-Or, and B. Chen, 'Unpaired Motion Style Transfer from Video to Animation,' *ACM Transactions on Graphics (TOG)*, vol. 39, no. 4, p. 64, 2020.

[14] I. Mason, S. Starke, and T. Komura, 'Real-Time Style Modelling of Human Locomotion via Feature-Wise Transformations and Local Motion Phases,' *Proc. ACM Comput. Graph. Interact. Tech.*, vol. 5, no. 1, May 2022. doi: 10.1145/3522618.

[15] Q. Zhao, P. Li, W. Yifan, S.-H. Olga, and G. Wetzstein, 'Pose-to-Motion: Cross-Domain Motion Retargeting with Pose Prior,' in *Proceedings of the ACM SIGGRAPH/Eurographics Symposium on Computer Animation*, in SCA '24. Goslar, DEU: Eurographics Association, 2024, pp. 1–10. doi: 10.1111/cgf.15170.

[16] D. Holden, I. Habibie, I. Kusajima, and T. Komura, 'Fast Neural Style Transfer for Motion Data,' *IEEE Computer Graphics and Applications*, vol. 37, pp. 42–49, 2017.

[17] D.-K. Jang, S. Park, and S.-H. Lee, 'Motion Puzzle: Arbitrary Motion Style Transfer by Body Part,' *ACM Trans. Graph.*, vol. 41, no. 3, Jun. 2022, doi: 10.1145/3516429.

[18] D.-K. Jang, Y. Ye, J. Won, and S.-H. Lee, 'MOCHA: Real-Time Motion Characterization via Context Matching,' in

SIGGRAPH Asia 2023 Conference Papers, in SA '23. New York, NY, USA: Association for Computing Machinery, 2023. doi: 10.1145/3610548.3618252.

[19] W. Ma, S. Xia, J. K. Hodgins, X. Yang, C. Li, and Z. Wang, 'Modeling Style and Variation in Human Motion,' in *Eurographics/ ACM SIGGRAPH Symposium on Computer Animation*, Mz. Popovic and M. Otaduy, Eds., The Eurographics Association, 2010. doi: 10.2312/SCA/SCA10/021-030.

[20] Y.-H. Wen, Z. Yang, H. Fu, L. Gao, Y. Sun, and Y.-J. Liu, 'Autoregressive Stylized Motion Synthesis with Generative Flow,' in *2021 IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)*, 2021, pp. 13607–13607. doi: 10.1109/CVPR46437.2021.01340.

[21] S. Xia, C. Wang, J. Chai, and J. Hodgins, 'Realtime style transfer for the unlabeled heterogeneous human motion,' *ACM Trans. Graph.*, vol. 34, no. 4, Jul. 2015. doi: 10.1145/2766999.

[22] D. Reda, J. Won, Y. Ye, M. van de Panne, and A. Winkler, 'Physics-based Motion Retargeting from Sparse Inputs,' *Proc. ACM Comput. Graph. Interact. Tech.*, vol. 6, no. 3, Aug. 2023, doi: 10.1145/3606928.

[23] X. Huang and T. Kanai, 'Video-Based Motion Retargeting Framework between Characters with Various Skeleton Structure,' in *Proceedings of the 16th ACM SIGGRAPH Conference on Motion, Interaction, and Games*, in MIG '23. New York, NY, USA: Association for Computing Machinery, 2023. doi: 10.1145/3623264.3624473.

[24] T. Li, J. Won, A. Clegg, J. Kim, A. Rai, and S. Ha, 'ACE: Adversarial Correspondence Embedding for Cross Morphology Motion Retargeting from Human to Nonhuman Character,' in *SIGGRAPH Asia 2023 Conference Papers*, in SA '23. New York, NY, USA: Association for Computing Machinery, 2023. doi: 10.1145/3610548.3618255.

[25] J. Bowers *et al.*, 'eRENA 4.5', *Production and Management of Events in Electronic Arenas*, pp. 1–70, Sep. 2000.

[26] S. Hirtes, M. Hoch, B. Lintermann, and S. Norman, 'eRENA,' *Royal Institute of Technology*, pp. 1–137, Aug. 1999.

[27] J. Abouaf, 'Artful Media: "Biped"': A Dance With Virtual and Company Dancers', *IEEE MultiMedia*, vol. 6, no. 3, pp. 4–7, Jan. 1999.

[28] J. Birringer, 'Thinking Images,' *PAJ: A Journal of Performance and Art. The MIT Press.*, vol. 30, no. 2, pp. 17–37, May 2008.

[29] B. Paixão, 'Interação com corpos andantes', Masters Thesis, ESMAD, IPP, Vila do Conde, 2021. [Online]. Available: http://hdl.handle.net/10400.22/18938

[30] S. Gonçalves, 'Separadores para o Canal180: a cor e o movimento como meio de comunicação de emoções', Masters Thesis, ESMAD, IPP, Vila do Conde, 2022. [Online]. Available: http://hdl.handle.net/10400.22/21103

[31] W. Tekulve, *BVH Converter*. (2018). Python.

[32] L. Leite, 'AI Mocap for Artists - Comparative Study Video,' Virtual Marionette. Accessed: Oct. 25, 2024. [Online]. Available: https://www.grifu.com/vm/?p=1948

[33] K. Takahashi, *Skinner*. (2017). Accessed: Jan. 07, 2024. [Online]. Available: https://github.com/keijiro/Skinner

[34] L. Leite and V. Orvalho, 'Anim-actor: Understanding Interaction with Digital Puppetry Using Low-cost Motion Capture,' in *ACM Proc. International Conf. on Advances in Computer Entertainment Technology*, New York, NY, USA: ACM, 2011, pp. 488–501.

[35] S. Maier, S. Oberdörfer, and M. E. Latoschik, 'Ballroom Dance Training with Motion Capture and Virtual Reality', in *Proceedings of Mensch Und Computer 2024*, in MuC '24. New York, NY, USA: Association for Computing Machinery, 2024, pp. 617–621. doi: 10.1145/3670653.3677499.

[36] D. G. Rodrigues, E. Grenader, F. da Silva Nos, M. de Sena Dall' Agnol, T. E. Hansen, and N. Weibel, 'MotionDraw: a tool for enhancing art and performance using Kinect,' *CHI EA '13: CHI '13 Extended Abstracts on Human Factors in Computing Systems*, Apr. 2013, doi: 10.1145/2468356.2468570.

[37] S. Vacchi, G. Civati, D. Marini, and A. Rizzi, 'Neo Euclide: A Low-Cost System for Performance Animation and Puppetry,' A. Camurri and G. Volpe, Eds., Berlin, Heidelberg: Springer Berlin Heidelberg, 2004, pp. 361–368.

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Abstract— This paper proposes an analysis of a set of videos shared on TikTok, focusing on their mise-en-scène and editing techniques, such as jump cuts, dissolves, matte shots, and double exposures, which are reminiscent of the cinema of Georges Méliès. Analyzing the innovations introduced by this pioneer of audiovisual communication serves as a starting point to explore the specificities of TikTok's language as a medium for audiovisual production and consumption. The educational purpose of this study is to develop a media education activity that enhances film literacy among first-year university students by using TikTok, thereby fostering critical analysis, evaluation, and understanding of media messages, as well as the ability to create relevant media content.

Keywords—TikTok; digital culture, social media, media education, film literacy, George Méliès, editing

I. INTRODUCTION

Social media has become increasingly central to daily life, transforming how content is accessed, researched, and shared. It influences what is liked or disliked, alters interpersonal relationships, and shapes the promoted interests and content.

According to recent data, approximately 59% of individuals in the EU actively participate in social networks, marking a significant increase in daily engagement compared to previous years [1]. Globally, platforms such as YouTube, Instagram Reels, and TikTok increasingly influence video consumption habits. Research indicates that these platforms drive a surge in video content engagement, with mainstream and alternative accounts—including creators and influencers—gaining notable attention for entertainment, advertisement, and news consumption [2]. Therefore, it is crucial to study and leverage these platforms to enhance digital competencies, which are vital for developing more informed, engaged, and active participation in society [3].

The phenomenon of prosumerism [4] [5] [6] has played a significant role in transforming digital media, especially on platforms like YouTube or TikTok.

Prosumers—consumers who are also content creators—are at the forefront of this shift, creating and sharing videos that not only consume but also shape cultural and technological trends. This ability to act simultaneously as creator and viewer redefines the role of individuals in media production, reflecting a democratization of audiovisual creation.

TikTok, one of the five most significant social media platforms with over 1 billion active users [7] [8], offers a dynamic and interactive environment for exploring audiovisual communication. This paper examines how the platform utilizes editing techniques—such as jump cuts, dissolves, matte shots, and double exposures—pioneered by Georges Méliès, enhancing the critical understanding of the contemporary media

landscape, and analyzes how these elements can be explored to enhance media education and promote film literacy among first-year university students. This approach highlights the continuity of filmic innovation from the origins of cinema to today's digital media environment, examining how TikTok's interactive features can deepen students' critical media engagement.

Given the growing popularity of social media platforms, educators are increasingly adopting tools like TikTok to enhance media literacy and training activities. Research has demonstrated that TikTok can significantly boost student engagement; this effectiveness is further reinforced by its widespread use and appeal among Gen-Z students, who often prefer integrating social media into their educational experiences [9] [10]. Studies indicate that these students favor short video content for expression and reflection over traditional assessment methods, finding it a more creative and effective way to engage with curriculum material.

The first section of this paper focuses on the current statistical data concerning TikTok and some methodological challenges regarding using this social network as an object of study. In the second section, the contribution of Georges Méliès to cinematography is briefly examined, focusing on the editing and special effects he experimented with and their prevalence within TikTok. The third section proposes an analysis grid applicable in an educational context. This grid is then applied to four videos to illustrate its application and value for media education and film literacy. Finally, discussion topics arising from this analysis are highlighted.

This project aims to develop domain-specific knowledge of film history and audiovisual techniques and skills for critically analyzing, evaluating, and understanding media messages. This will enable students to make informed decisions regarding media consumption and participation, fostering a more nuanced and engaged approach to contemporary digital content.

II. SOCIAL MEDIA AND AUDIOVISUAL CONTENT PLATFORMS: THE CASE OF TIKTOK

A. Metrics

Facebook and YouTube remain as the platforms with the most users globally. TikTok ranked 5th in this list and registered more than 1 billion active users in January 2024, remaining the most popular with younger groups [8].

As of April 2024, Statista reports that 17.3% of TikTok's global audience comprises women aged 18 to 24, while men in the same age group make up approximately 18.9% of the platform's users. Additionally, 14.6% of female users are between the ages of 25 and 34, compared to 19.3% of male users in that age bracket [11].

Launched in 2016 by the Chinese company ByteDance, TikTok has been asserting itself internationally as an entertainment network and the leading destination for short-form mobile video, with the mission of stimulating the creativity and enjoyment of its users [12]. The features provided by this platform encourage its users to quickly create and share content, similar to other social media websites that promote user-generated content. This has been a main driving factor of its growth. Additionally, TikTok fosters a creative environment where users are in dialogue with each other while also giving them the freedom to create without conforming to traditional visual styles, narratives, and cultural norms [13], favoring improvisation and short-term content [14]. This makes it particularly attractive to young people. Nevertheless, in many of the videos created and shared on TikTok, either by personal or by commercial accounts, we can recognize editing techniques used in video, television, or cinema. In this way, many of the effects found on the videos from this social network can take us back to the beginning of cinema, namely one of its pioneers – George Méliès.

B. TikTok as an object of study: methodological and ethical issues

TikTok has increasingly garnered attention from researchers across various fields, employing different methodological approaches [14] [15]. Despite the difficulties in accessing its Application Programming Interface (API) [16] [17], TikTok has been the subject of numerous studies employing diverse approaches [15] [19]. Some research focuses on young people's attitudes and experiences with the platform [9] [13], while others explore socio-political and economic topics by integrating data from various social networks [15]. Studies have also examined TikTok's key features and their impact on user experience [14], as well as aspects related to uses and gratifications [13] [20]. Common methods used to research TikTok include case studies and content analyses, combining quantitative and qualitative approaches [15]. These methodologies are also applied to studies on TikTok's use in educational contexts [9] [10] [18] [21], which aligns with the aim of this study.

TikTok's algorithm and its influence on the content presented to users are important aspects to consider in the methodological approach to studying the platform, as highlighted in recent research [22] [23] [24] [25]. The recommendation system aims to achieve four primary goals: "user value," "long-term user value," "creator value," and "platform value." It relies on two key metrics: "retention" and "time spent," with the intent of keeping users engaged with the platform for extended periods without satisfaction [23] [24]. Additionally, it is important to examine TikTok's content recommendation system, mainly as it operates within the platform's "For You" section. According to TikTok, the recommendation process considers several factors: user interactions (such as liked and shared videos, followed accounts, comments, and created content), video data (including captions, sounds, and hashtags), and socio-demographic data (such as language and geographical location) [25]. In addition to these aspects, the analysis of TikTok videos and public data implies consideration of the GDPR, ensuring legitimate purpose, data minimization, and, where possible, anonymization to avoid unnecessary exposure or identification and per TikTok's terms (under development at the time of writing).

III. CREATING ILLUSIONS: FROM CINEMA TO SOCIAL MEDIA

A. Georges Méliès: the father of visual and special effects

The role of Georges Méliès is well described and portrayed by several film historians [26] [27] [28] [29]. Fascinated by the short film demonstrations of the Lumière Brothers in 1895 [26], Méliès, as an illusionist, knew how to recognize, from the outset, the potential of cinema and its possibility to create visual effects to build a narrative [30]. As the father of special and visual effects, Méliès conceived various techniques on camera and in the editing room. When filming *Cendrillon* (1899), Méliès stopped recording at a certain moment, turned the roll of film back in the camera for a few seconds, and exposed the film again for the next take. In 1904, he used that technique to transform himself into different characters in the film *Le roi du maquillage* (1904). In the more than 500 films he directed, Georges Méliès worked on various genres, from fantasy to reconstructed newsreels [26], creating different visual tricks such as fade-in, fade-out, stop-motion, double exposure, and jump cut. These techniques are still used today in film, television, and social platforms like TikTok, which embrace this illusion effect in a particular way. A brief overview of four such techniques is presented to further the discussion.

Jump Cut. A jump cut is a technique used in film editing to create a jarring or abrupt effect in the flow of a scene. It occurs when a portion of a shot is removed, and the next shot immediately follows, creating a noticeable visual discontinuity between the two. Méliès employed it to heighten the impact of his magical tricks and illusions. He aimed to incorporate the jump seamlessly cuts into his films, blending them to enhance the illusionary experience. Méliès used this technique extensively throughout his movie-making career. Of the many examples, in the film *La Sirène* (1904), Méliès uses the jump cut to change between outfits during his magic performance (Fig. 1).



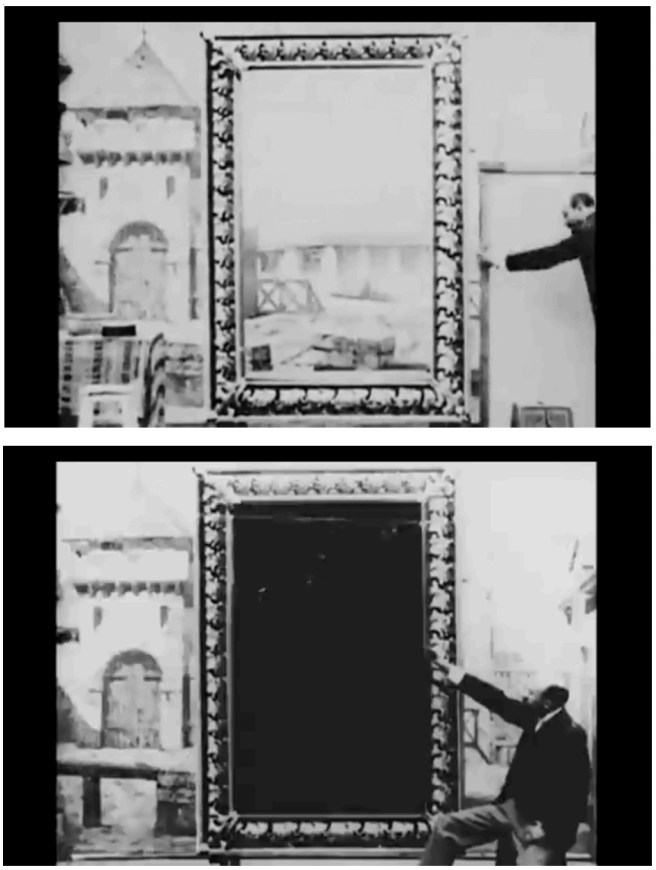
Fig.1. Use of the jump cut to change outfits in the same shot, *La Sirene*, 1904, Georges Méliès (Source: Archive.org).

Dissolve. Another common editing technique is the dissolve effect, an element of audiovisual storytelling in which one shot merges into another. The first image is exchanged for the second, and for a short period, the two images overlap. This facilitates the transition and can transport the audience from one place to another. This technique was first used by Méliès in the 1899 film *Cendrillon* [26] [27]. One instance of this effect in the movie demonstrates a smoother transition from the Fairy Godmother to the royal ball scene (Fig. 2).



Fig.2. Use of dissolve to transition between scenes, *Cendrillon*, 1899, Georges Méliès (Source: Archive.org)

Matte Shot. A matte shot is a visual effects technique used to combine multiple elements into a single, seamless image. To achieve this, Méliès covered part of the camera lens to produce a blank spot; the negative would then be re-exposed to record a new sequence, but only this time, everything was covered except for the previous blank spot. This is a technique that can be seen in Méliès' *Le portrait Mystérieux* (1899) [26] [27], where he uses it to make a copy of himself into a previously empty portrait, resulting in a brief sequence where two Méliès interact with each other (Fig. 3).



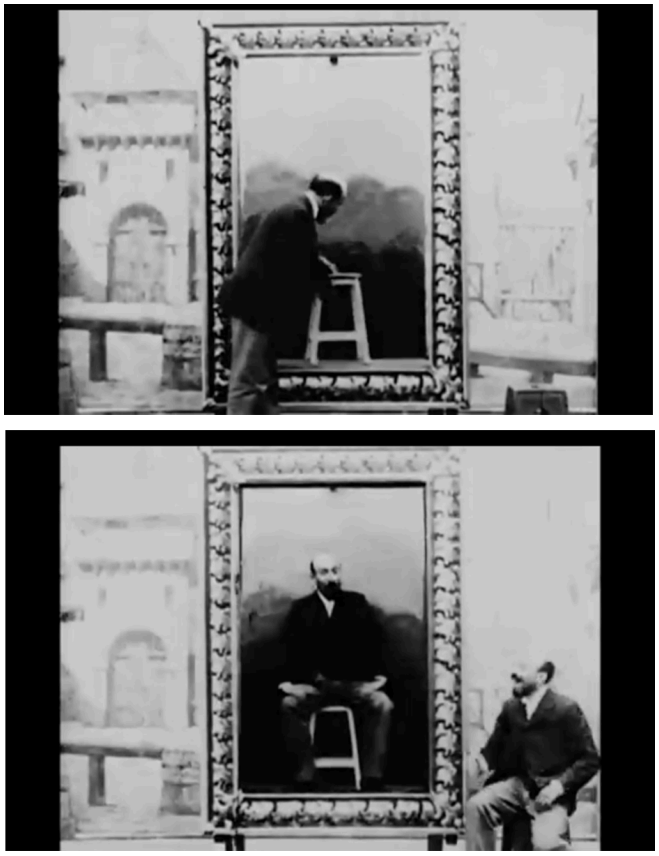


Fig. 3. Use of matte shot to transform a static painting into a live one with a replica of Méliès inside, *Le portrait Mystérieux*, 1899, Georges Méliès (Source: Daily Motion)

Double Exposure. The double exposure technique involves exposing the same film frame multiple times to different images, typically resulting in a superimposed effect. Méliès used this technique in *L' Homme orchestre* (1900) and in *Le Mélomane* (1903) [26] [27]. By using this method, Méliès achieved illusions, transformations, and other supernatural effects in his films, contributing to developing early cinematic special effects. Like *Le Portrait Mystérieux*, Méliès uses the double exposure in *L' Homme Orchestre* to copy himself multiple times and create an entire band out of one person (Fig. 4).





Fig. 4. Use of double exposure to create an entire orchestra from one person, *L' Homme Orchestre*, 1900, Georges Méliès (Source: Archive.org).

Drawing on his background in magic, Méliès developed cinematic techniques to create visual illusions featuring effects that included scene manipulation and image overlays. These techniques set new standards in cinema and profoundly influenced the future development of special effects [28]. Méliès's legacy is evident in the lasting impact of his inventions, which continue to inspire filmmakers and shape modern cinema [28].

For analyzing cinematic techniques on TikTok, jump cuts, dissolves, matte shots, and double exposures were chosen due to their historical significance, ongoing influence on cinematic practices, and applicability in digital content creation. The selection

is also supported by literature that emphasizes the effectiveness and impact of these techniques in visual media, ensuring the basis for the study [30] [31].

B. Méliès effects in the digital landscape of the XXI century: a methodological approach

Although the visual and special effects described above were developed over a century ago, these techniques continue influencing various forms of audiovisual media, from films and TV series to video installations and social media videos.

On social media platforms, TikTok stands out as an example of how these traditional techniques are still in use or subject to recreation. The platform provides a wide range of editing tools, including overlays, stickers, text elements, transitions, visual effects, short audio clips, and audio effects. These tools allow users to create videos directly within the app, where technical proficiency in using special effects is highly valued.

This is evident in both personal and business accounts, as videos incorporating transition techniques often have a higher likelihood of going viral, fostering trends where users replicate and learn from each other [24] [33].

TikTok's role in the digital landscape has introduced new communicative dynamics shaped by the creative experiments of its predominantly young user base that challenge conventional media practices. The platform's appeal lies in its ability to deliver light, engaging entertainment that is easy to consume. Additionally, the growing investment by brands and commercial industries in TikTok highlights its strategic importance in modern business operations.

To ensure a thorough examination of the transitions and the visual effects the audiovisual languages of TikTok produce, a framework was developed based on two key dimensions: a) the platform's algorithm and features, and b) the four filmic techniques referenced in this paper (Table 1).

Morphological TikTok analysis grid	
Account ID	
Username	*@username*
Name	*name*
Number of followers	1 000
Number of likes	10 000
Bio	*"Lorem ipsum dolor sit amet"*
Account longevity	if possible, determine from the first post
Video	
Date of publication	yyyy-mm-dd
Caption/description	*"Lorem ipsum dolor sit amet"*
Sound (sound label)	*"Lorem ipsum dolor sit amet"*
Number of views	10000
Number of likes	1000
Number of comments	100
Hashtags	#hashtag1; #hashtag2; #hashtag3; …
Video length	00m.00s
Video description	Description of the main aspects that occur in the video
Editing Technique(s)	Identification of the editing technique(s) used in the video (Jump Cut, Dissolve, Matte Shot, Double Exposure)
Diegetic elements	Identification of the main diegetic elements of the video (if possible, focus on aspects that are relevant to the editing technique)
Sound elements	Identification of the sound elements of the video (if possible, focus on aspects that are relevant to the editing technique)
Morphological elements	Identification of morphological elements in the video: camera angle/position (e.g. wide shot); video dimensions (portrait/ landscape); camera movement (e.g. tilt); ...
Effect produced	Comment on the effect(s) produced by the editing technique(s) used in the video.

TABLE 1. MORPHOLOGICAL TIKTOK ANALYSIS GRID

This morphological analysis grid provides a structured approach to examining the application of traditional cinematic techniques on TikTok and their impact on video performance. The framework

assesses editing techniques, diegetic and sound components, and morphological aspects, offering insights into how these elements affect a video's appeal and engagement metrics, such as likes, shares, and comments.

Additionally, the analysis demonstrates how TikTok's interactive features can enhance students' understanding of media practices by showing the continuity of film techniques from early cinema to today's digital content. This approach highlights traditional techniques' relevance and influence on modern media creation, encouraging a more thorough understanding of their role in effective media production and analysis.

C. Jumping between outfits, merging different places: analysis of four TikTok videos

As previously outlined, these grids were developed within media education and film literacy, specifically for training university students in audiovisual communication. Their use encourages critical analysis among students, complementing hands-on practice through application and discussion in theoretical-practical classes. A brief analysis of four TikTok videos from different accounts is proposed to understand better how this exercise can be developed. This approach aims to demonstrate how the various topics within the grid can be addressed with practical examples. Examining diverse content will allow students to see and analyze cinematic techniques in real-world scenarios, deepening their understanding of the subject matter and enhancing their analytical skills. This method engages students with relevant content and gives them insights into how theoretical concepts are applied in contemporary media. In addition to topics directly related to film literacy, this exercise enables discussions with students on the role of platforms in prioritizing certain content and profiles, as well as ethical concerns surrounding copyright and the collection and analysis of data available on social networks.

The four profiles were selected from the accounts of the research team, both teachers and students, to showcase various technically successful applications of the previously identified editing techniques. The chosen examples represent a range of distinctions, including the degree of professionalism and types of social network usage. The analyzed and reproduced data are entirely public, but in some cases, anonymization was applied. The first example is Bimba y Lola, a Spanish fashion brand. This choice allowed us to analyze how commercial accounts on TikTok utilize editing techniques and the purposes behind their application. The remaining three examples focus on individual accounts, categorized as "the average user," "the influencer," and "the technical master," each demonstrating varying levels of professionalism and amateurism. This categorization supports the research objectives by providing a nuanced view of how editing practices are utilized and how they impact user engagement across different types of TikTok accounts.

Starting with "the average user," we have chosen an anonymized profile for this publication, which currently has 45 followers (as of October 21st). This type of profile could be categorized as being outside of the influencer level and belongs to the individual creator: a person who might not have the biggest proficiency regarding audiovisual content creation but still might make use of some tools provided by the platform/app to improve his videos, or even external ones, like a video editing software.

The next one, "the influencer'', might be considered a blend between the individual and the commercial dimensions. Although it does not belong to a brand, this type of account can be as big or bigger as brands, making them more influential/impactful in the current digital media ecosystem. In this case, we chose the profile of Marta Sierra, one of the most recognized fashion, lifestyle, and travel Spanish influencers with 278.6K followers [34], which, much like Bimba y Lola, makes videos about fashion with hundreds of videos presenting/advertising different clothes, accessories, and brands. Unlike the "average user," "the influencer" can produce more expensive content, resulting in better-produced content with better quality techniques.

Finally, we have "the technical master." This could be someone who is an expert in using editing techniques and software, either for professional reasons or because he has interests in this particular field, which then applies their previous knowledge in these types of audiovisual digital platforms. In this category, we picked the profile EDITSON, with 126.7K followers, a creator with a clear mastery in editing tricks and special and visual effects to produce videos that might be considered contemporary analogs to the cinematic illusions of Méliès. The other interesting factor - which won't be analyzed here but shouldn't be omitted - is the distinct fact that this user complements its videos with other ones where he explains how the "tricks" or "illusions"' were obtained, always using the easy-to-edit tools characteristic of this social platform.

1) Bimba y Lola

Bimba y Lola is a Spanish clothing brand that, like numerous other companies from the fashion industry, uses TikTok as an advertising tool.



Fig. 5. Sequence that uses a jump cut transition to change between outfits, 2022 (Source: @bimbaylolaofficial).

The data concerning the selected video (Fig. 5), as of July 1st, 2023, is presented in the table below (Table 2).

TABLE 2. TIKTOK ANALYSIS GRID - BIMBA Y LOLA

TikTok analysis grid - Bimba y Lola	
Account ID	
Username	@bimbaylolaoffical
Name	BIMBA Y LOLA
Number of followers	103.3K
Number of likes	951K
Bio	From Spain to the world
Account longevity	1st post: 03-11-2020

Video	
Date of publication	2022-12-02
Caption/description	"In this special time of the year… You go to bed; you wake up, and are finally #BIMBALOLIZED ¡ Merry Bimbaylolized starring @natalialacunza13."
Sound	"sonido original - BIMBA Y LOLA" ("original sound – BIMBA Y LOLA")
Number of views	9,949
Number of likes	236
Number of comments	7
Hashtags	#BIMBALOLIZED; #Merrybimbaylolized; #BIMBAYLOLA
Video length	00m.15s
Video description	The video is from a Christmas campaign by Bimba y Lola. In this clip, a woman repeatedly falls into/rises from a bed, changing her clothes/handbags. At the end of the clip, the woman disappears, and a handbag falls on the bed.
Editing Technique	Jump Cut
Diegetic elements	A bed with two pillows, a woman, six outfits and handbags, and Christmas decorations.
Sound elements	Some synthesized notes were initially used (*Silent Night*, 1818, Franz Xaver Gruber). Followed by a classical music piece.
Morphological elements	Full shot; Vertical shot (portrait); Fixed camera.
Effect produced	The jump cut shows the transition between different outfits and handbags. As the woman falls into the bed, the moment when she's about to touch the mattress, there is a jump cut, changing her attire into a completely different one while also altering her movement's direction.

2) "The average user"

This video, published on March 24, 2023, uses dissolve as a transition technique (Fig. 6).



Fig. 6. Sequence that uses dissolve to transition between an old picture of a building and its physical counterpart, 2020, anonymized creator.

Of a personal nature, this account presents metrics and a technical mastery distinct from the previous video (Table 3).

TABLE 3. TIKTOK ANALYSIS GRID - INDIVIDUAL CREATOR

TikTok analysis grid - anonymized	
Account ID	
Username	-
Name	-
Number of followers	45
Number of likes	433
Bio	--
Account longevity	1st post: 21-08-2019
Video	
Date of publication	2020-03-23
Caption/description	-
Sound	"original sound... "
Number of views	2,181
Number of likes	176
Number of comments	5
Hashtags	#heritagehall #vancouver #1922 #timetravel #beforeandafter #crossdissolve #specialeffects #trickphotography #photomatch #vancouver #hall
Video length	00m.08s
Video description	The video shows a toilet seat and a framed picture placed above it. The image then morphs into the place shown on that picture and the video finishes with a man looking at the camera. The man sings throughout the video.
Editing Technique	Dissolve
Diegetic elements	A man; a toilet seat, a framed old picture of a building, the street with the real building.
Sound elements	The man sings throughout the video (song: *Forever* by Jesse & The Rippers): starting in the bathroom, the sound accompanies the transition (dissolve), ending with the man looking at the camera while singing.
Morphological elements	Mid-shot - Full shot - Close-up; Vertical shot (portrait); tilt shot (bottom to top) - whip pan shot (right to left).
Effect produced	The dissolve is used to smoothly transition between an old picture of a building and the same building in the present and its physical manifestation.

3) Marta Sierra

With 278,600 followers, influencer Marta Sierra has built her positioning and communication with the brands she represents and her followers through regularly posting videos in which she masterfully explores various audiovisual techniques (Fig. 7).

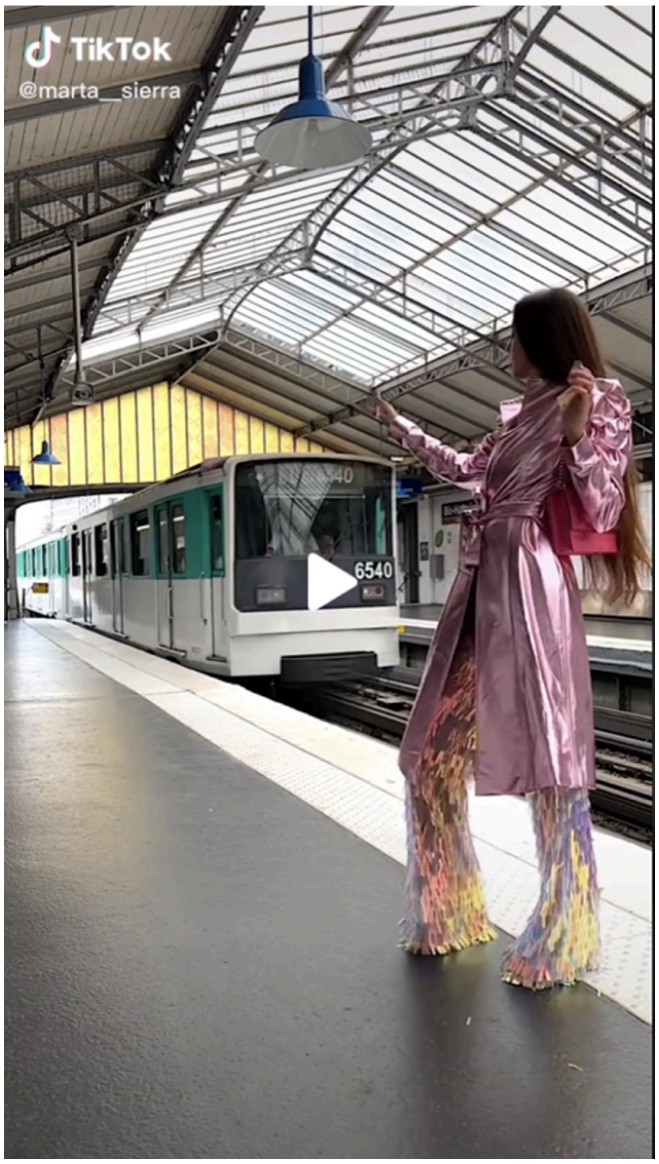


Fig. 7. Video that makes use of matte shot technique to create a comedic effect of a train stopping and going back, 2022, Marta Sierra (@marta_sierra)

This analysis highlights the matte shot technique. The table details the video's elements, including its editing technique, sound, and visual composition. Comparing this with the previous analysis, we can observe different stylistic choices and their effects on the overall impact of the videos (Table 3).

TABLE 4. TikTok analysis grid - @marta__sierra

TikTok analysis grid - @marta__sierra	
Account ID	
Username	@marta__sierra
Name	Marta Sierra
Number of followers	278.60K
Number of likes	6.9M
Bio	Fashion, transitions, and lots of color 🦄more vids on IG (1,3 Mill)
Account longevity	1st post: 19-01-2020
Video	
Date of publication	2022-10-29
Caption/description	When your makeup is not ready, you just ask the train to return in 5 min 🤣 who else is always late?
Sound	"CUFF IT" (Beyoncé)
Number of views	1.7M
Number of likes	41K
Number of comments	75
Hashtags	-
Video length	00m.06s
Video description	A woman (rushing) arrives at the train station while putting on makeup. She sees the train arriving and gestures as if ordering the train to stop and go back. The train stops and then goes back. The woman finishes her makeup and leaves the shot.
Editing Technique	Matte shot
Diegetic elements	A woman in bright clothes, makeup, hand mirror; train station, train. The diegetic elements in this video are a woman dressed in a bright pink coat, pants with colorful stripes, a red bag on one arm, and a mirror and a makeup pencil on the left. The train platform has a skylight with natural light, blue lamps, and a white and green train.
Sound elements	Throughout the video, we hear an excerpt of a song (*Cuff it* by Beyoncé).
Morphological elements	Full shot; vertical shot (portrait); fixed camera; zoom in
Effect produced	Through the matte shot technique, Marta Sierra's video begins with a medium shot of a train platform where the character Sehi is applying makeup as the train approaches. Sehi gestures with her right hand to signal the train to wait, and through the matte shot, the train appears to freeze in place. When Sehi gestures again with her right hand, the train reverses. The character then exits the frame from the right side.

4) EDITSON

The EDITSON video was published on October 25, 2021, and is an advertisement for the McDonald's brand. In this case, the effect adopted was the double exposure (Fig. 8).



Fig. 8. Screenshot using the double exposure effect, the digital creator replicates himself, 2021, Ed.it.son (@ed.it.son)

Table 5 presents the analysis of the Ed.it.son video according to the proposed grid.

TABLE 5. TIKTOK ANALYSIS GRID - ED.IT.SON

TikTok analysis grid - Ed.it.son	
Account ID	
Username	@Ed.it.son
Name	EDITSON
Number of followers	126.7K
Number of likes	2.6M
Bio	Not just your average jump-cut wizard! 👇 my links👇 youtu.be/7zCvq-nPUQE
Account longevity	1st post 5-10-2019

Video	
Date of publication	2022-03-21
Caption/description	#ad Run, don't walk! 🏃 For a limited time, earn 2X the rewards points on every order with your #mymcdonaldsrewards McDonald's app! #teammcds
Sound	"original sound - EDITSON"
Number of views	8,538
Number of likes	187
Number of comments	3
Hashtags	#ad #mymcdonaldsrewards #teammcds
Video length	00m.10s
Video description	
Editing Technique	Double exposure. The video employs the technique of superimposition. It begins with a medium shot of a miniature man walking on a cell phone screen. A second character—identical to the first—enters the scene through superimposition. Both characters then appear to run across the cell phone screen together. Eventually, the first character falls into the cell phone as though disappearing into it.
Diegetic elements	Diegetic elements: black desk with a monitor connected with the image trees. Part of a keyboard for video editing and part of a MIDI instrument are also present. A cell phone is being charged with a white cable. On the image of the cell phone is the text McRewards with the McDonald's logo. The characters are dressed in blue jeans, a black t-shirt, and a black cap. Red and white circular images with the McDonald's logo are square-shaped, and the McDonald's logo has 2X text points.
Sound elements	Sound elements: the video uses an excerpt from the song *Race* by Brock Hewitt.
Morphological elements	Regarding morphological elements, there is a medium shot in a vertical position with a fixed camera.

Effect produced	Double exposure creates a visually engaging effect by superimposing two identical characters interacting with the cell phone. This technique captures the viewer's attention and emphasizes the promotional content. The integration of McDonald's branding elements—such as the McRewards text and logo—within the video enhances the connection between the visual effects and the brand's promotional message. The playful and dynamic interaction of the characters with the McDonald's branded cell phone attracts attention and reinforces the brand's promotional campaign.

This experience provides a practical perspective on how traditional cinematic techniques can be applied within TikTok through the analysis of videos from various types of accounts—commercial brands, average users, influencers, and technical experts. Each example, from Bimba y Lola's dynamic jump cuts to the nostalgic dissolve effects seen in the "average user" content, demonstrates how established film techniques are adapted to capture and retain viewer attention in the digital landscape.

The evaluation of these videos reveals the continued relevance of these cinematic techniques in influencing engagement metrics such as visualizations, likes, and shares. For example, Marta Sierra's use of matte shots highlights the sophisticated application of filmic methods to create visually compelling and engaging content. This analysis bridges historical techniques with modern media practices, illustrating how traditional methods can enrich contemporary content creation.

Conducting this analysis within an educational framework can pave the way for broader research. Students can better understand how cinematic techniques affect digital media engagement by expanding the study to include a larger sample of TikTok videos. This extended research would offer deeper conclusions about the impact of these techniques and contribute to a more nuanced exploration of the relationship between historical film practices and current media trends.

D. Special effects that aren't quite that: the place of the creator

TikTok empowers its users by offering a range of tools and resources to enhance their content creation. This empowerment is evident through various editing tools, comprehensive tutorials [32], and incentives such as Creator Next, a reward program designed to support and motivate content creators [33]. This environment encourages users to experiment with different techniques, including special effects, to increase the appeal and engagement of the videos.

The role of the creator on TikTok can be examined through the lens of the concepts of prosumer, introduced by Alvin Toffler in the 1970s [4], and Emerec (Emerging Media and the Changing Role of the Consumer), as proposed by Cloutier [5]. These concepts are particularly relevant to TikTok, where users are content creators and active consumers of others' posts. This dual role highlights a blurred line between production and consumption, where the boundaries between content creation and interaction are increasingly fluid.

Users on TikTok produce original videos and consume or respond to others' content, illustrating how the platform fosters a dynamic interplay between these two roles. This convergence exemplifies the shifting landscape of digital media, where traditional distinctions between creators and consumers are increasingly intertwined.

Creators utilize special effects as integral elements that enhance their content's visibility and engagement. Techniques such as superimposition, double exposure, and transitions are employed to capture viewers' attention, create visually compelling narratives, and drive user interaction.

Ultimately, the role of the creator on TikTok is multifaceted. They are not just content producers but also active participants in shaping the platform's culture and trends.

IV. FINAL CONSIDERATIONS

The comparative morphological analysis underscores the relevance of traditional cinematic techniques, such as those pioneered by Méliès, within the contemporary digital media landscape. This framework offers a comprehensive view of how these techniques are employed on platforms like TikTok, illustrating their continued impact on engaging audiences through diverse video content. The focus on attention marketing amplifies the concept of non-things proposed by B. C. Han [35], where the value of content is derived from its capacity to engage and capture viewers' attention in a participatory environment.

An essential aspect of this analysis is the democratization of audiovisual production. Today, every TikTok user has the potential to become a modern-day Méliès, with a viewing potential that can rival that of historical filmmakers. Just as Méliès's innovations laid the groundwork for cinema as an entertainment industry, the experimentation of TikTok users contributes to the evolution of digital content today, highlighting the ongoing relevance of cinematic techniques in shaping modern media.

However, the study's limitations include fully mapping the extent to which Méliès' techniques influence TikTok.

Examining early media techniques alongside current social media practices promotes cross-media learning. This approach reveals their similarities and differences by comparing traditional media and modern digital platforms. This more profound understanding of media convergence enriches students' media literacy and enhances their ability to engage with contemporary media content critically.

Future research should broaden this analysis to include a broader range of TikTok content, offering deeper insights into how Méliès' cinematic techniques influence contemporary digital media. This extension will advance the study's objectives and contribute significantly to media education. The next phase of the project, "Méliès, the Inventor of TikTok," aims to explore and update Méliès' techniques, examining their relevance and impact in modern digital contexts. This will provide a more comprehensive understanding of these techniques' aesthetic, technical, and narrative elements and their role in evolving media practices.

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REFERENCES

[1] European Union, "European compilers manual for statistics on the use of ICT in households and by individuals", in *Publications Office of the European Union*, Luxembourg, 2024. https://doi.org/10.2785/521306N.

[2] Kepios, "Global social media statistics," in *Datareportal 2024*. [Online]. Available: https://datareportal.com/social-media-users.

[3] UNESCO, *Media and Information Literate Citizens: Think Critically, Click Wisely!*, Paris, France: UNESCO, 2021. [Online]. Available: https://unesdoc.unesco.org/ark:/48223/pf0000377068 [Accessed: Jul. 29, 2024].

[4] A. Toffler, *A terceira vaga*. Lisboa: Edição Livros do Brasil, 1984.

[5] J.Cloutier, *A era de Emerec ou a comunicação audio-scripto-visual na hora dos self-media*. Lisboa: Instituto de Tecnologia Educativa, 1979.

[6] R. Alonso, "Sobre el uso de los conceptos prosumer y emirec para estudios sobre comunicación mediada por internet", *Sphera Publica*, n. 19, vol. I, pp. 2-23, 2019. [Online] https://sphera.ucam.edu/index.php/sphera-01/article/view/361 [Accessed: Jul. 29, 2024].

[7] S. J. Dixon, "Most popular social networks worldwide as of April 2024, by number of monthly active users", *Statista*, 10 July 2024.[Online]. Available: https://www.statista.com/statistics/1299771/tiktok-global-user-age-distribution/ [Accessed: Oct. 20, 2024].

[8] S. Kemp, "Digital 2024: Global Overview Report, *Data Reportal*, 31-Jan-2024. [Online]. https://datareportal.com/reports/digital-2024-global-overview-report [Accessed: Oct. 20, 2024].

[9] A. Jacobs, Y.-C. Pan, and Y.-C. Ho, "More than just engaging? TikTok as an effective learning tool," in *UK Academy for Information Systems Conference Proceedings 2022*, 2022, p. 3. [Online]. Available: https://aisel.aisnet.org/ukais2022/3

[10] S. Seif, "Social media as a pedagogical tool in class: TikTok case study," *The American University in Cairo*. https://doi.org/10.24377/LJMU.jsml.article697

[11] Ceci, "Distribution of TikTok users worldwide as of April 2024, by age and gender," *Statista*, 30-May-2024. [Online]. Available: https://www.statista.com/statistics/1299771/tiktok-global-user-age-distribution/ [Accessed: Jul. 29, 2024].

[12] TikTok, "Our Mission," [Online]. Available: https://www.tiktok.com/about [Accessed: Jul. 29, 2024].

[13] A. Duarte and P. Dias, "TikTok: usos e motivações entre adolescentes em Portugal," *Chasqui: Revista Latinoamericana de Comunicación*, vol. 147, pp. 81-103, 2021. https://doi.org/10.16921/chasqui.v1i147.4419

[14] A. Miltsov, "Researching TikTok: Themes, methods, and future directions (preprint)," in *The SAGE Handbook of Social Media Research Methods*, 2nd ed., A. Quan-Haase and L. Sloan, Eds. SAGE, 2022, pp. 664-676. https://doi.org/10.4135/9781529782943

[15] A. Rejeb, K. Rejeb, A. Appolloni, H. Treiblmaier, and M. Iranmanesh, "Mapping the scholarly landscape of TikTok (Douyin): A bibliometric exploration of research topics and trends," *Digital Business*, vol. 4, no. 1, pp. 100075, Jun. 2024, doi: 10.1016/j.digbus.2024.100075.

[16] M. Sato, "Researchers will get access to TikTok data — pending company approval," *The Verge*, Feb. 21, 2023. [Online]. Available: https://www.theverge.com/2023/2/21/23604737/tiktok-research-api-expansion-public-user-data-transparency. [Accessed: Jul. 29, 2024].

[17] TikTok, "Supporting independent research," [Online]. Available: https://www.tiktok.com/transparency/en-us/research-api/. [Accessed: Jul. 29, 2024].

[18] A. O. M. Cahyono and W. C. Perdhani, "Using TikTok in EFL Class: Students' Perceptions," *Journal of English Education and Teaching (JEET)*, vol. 7, no. 1, pp. 59-77, Mar. 2023. e-ISSN: 2622-5867, p-ISSN: 2685-743X.

[19] C. Abidin, "Mapping internet celebrity on TikTok: Exploring attention economies and visibility labours," *Cultural Science Journal*, vol. 12, no. 1, pp. 78-103, 2021. https://doi.org/10.5334/csci.140.

[20] J. Vaterlaus, and M. Winter, "TikTok: An Exploratory Study of Young Adults' Uses and Gratifications," in *The Social Science Journal*, September 1–20, 2021. https://doi.org/10.1080/03623319.2021.1969882.

[21] C. Golum, "Cinema Year Zero: Tik Tok and the Grammar of Silent Film," *Notebook Feature, MUBI,* 25-Feb-2021. [Online]. Available: https://mubi.com/en/notebook/posts/cinema-year-zero-tik-tok-and-the-grammar-of-silent-film [Accessed: Oct. 20, 2024].

[22] D. Klug, Y. Qin, M. Evans, and G. Kaufman, "Trick and Please: A Mixed-Method Study On User Assumptions About the TikTok Algorithm," in *Proceedings of the 13th ACM Web Science Conference 2021 (WebSci '21)*, Virtual Event, United Kingdom, June 21–25, 2021. New York, NY, USA: ACM, 2021, pp. 1-9. https://doi.org/10.1145/3447535.3462512

[23] B. Smith, "How TikTok reads your mind," *The New York Times*, Dec. 5, 2021. [Online]. Available: https://www.nytimes.com/2021/12/05/business/media/tiktok-algorithm.html?smid=url-share [Accessed: Jul. 29, 2024].

[24] P. Wang, "Recommendation Algorithm in TikTok: Strengths, Dilemmas, and Possible Directions," *International Journal of Social Science Studies*, vol. 10, n. 5, pp. 1-15, May 2022. doi:10.11114/ijsss.v10i5.5664

[25] TikTok, "How TikTok recommends videos #ForYou," [Online]. Available: https://newsroom.tiktok.com/en-us/how-tiktok-recommends-videos-for-you. [Accessed: Jul. 29, 2024].

[26] D. Bordwell and K. Thompson, *Film Art: An Introduction*, 11th ed. New York, NY, USA: McGraw-Hill, 2015.

[27] D. Bordwell and K. Thompson, *Film History: An Introduction*. New York, NY, USA: McGraw-Hill, 1994.

[28] A. Williams, *Republic of Images: A History of French Filmmaking*. Cambridge, MA, USA: Harvard University Press, 1992.

[29] E. Ezra, *George Méliès*. Manchester, UK: Manchester University Press, 2000.

[30] B. M. Silva, *Comunicação Audiovisual: O comboio do amor*. Coleção Humanitas. Grácio Editor, 2021.

[31] C. Einsle, J. García-Fernández, and G. Izquierdo, "TikTok video formats' impact on user interaction – evidence from the Ocean Race." *Managing Sport and Leisure*, vol. 30, no. 1, pp. 1-15, Mar. 2024. doi: 10.1080/23750472.2024.2327506

[32] TikTok, "Growing your audience," *TikTok Support*, [Online]. Available: https://support.tiktok.com/en/using-tiktok/growing-your-audience. [Accessed: 29-Jul-2024].

[33] TikTok, "Creator Next," *TikTok*, [Online]. Available: https://www.tiktok.com/creators/creator-portal/en-us/getting-paid-to-create/creator-next/. [Accessed: 29-Jul-2024].

[34] M. de La Calzada, "Conoce a Marta Sierra, la influencer española del millón y medio de seguidores que pasó de "comerse" un arcoiris a ser amiga de Coco Rocha", *Telva*, 25-April-2024. [Online]. https://www.telva.com/moda/2023/04/25/6443c57602136efb678b45d4.html [Accessed: Oct. 20, 2024].

[35] B. C. Han, *Não-Coisas. Transformações no mundo em que vivemos*. Lisboa: Relógio D'Água, 2022.

Fios de Silere: a silence made of sound and light

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Abstract—Fios de Silere (2024) is a sound and light installation that dives into the question: "How can silence be materialized in an audiovisual work of art?". Silence has no singular meaning but rather diverse constructions and complex meanings. It is not merely the absence of sound. Each person is in contact with silence and creates it alone and with others. The diversity of literature on this topic makes it clear that no consensus is possible. Thus, silence is elusive. How do we materialize the elusive? This artistic research project delves into this problem by looking at and studying how artists materialize silence, write and talk about it, and also look at how humans experience and relate to it. Extending the scope of research beyond the auditory world to embrace light as another dialectic force to address the materialization of silence, sound and light become the vehicles for expressing our thoughts. They permeate the exhibition space with metaphorical silences, making the materiality of silence tangible through the interplay of technological devices and physical structures, allowing it to be experienced by both bodies and minds.

Keywords—silence, materiality, audiovisual installation, sound art, lumia

I. INTRODUCTION

While common sense usually links noise to undesirable sounds and chaotic soundscapes, silence tends to be linked with the absence of sound and a moment where nothing can cause disturbances. A quick look at the dictionary and one finds definitions such as being something "calm" or an "omission" [1], directly influenced by a way of understanding the world through measurements and rationales. But common sense is not just about numbers, as we can easily mention the so-called "embarrassing silence," which is not a "peace of mind," just as the silence of someone suffering from fear or oppression is not "rest" for either the individual or society. To make things more interesting, as John Cage pointed out, one of the most popular artists on silence is not a void or an absence but rather something complex and intriguing: "Is there such a thing as silence? Even if I get away from people, do I still have to listen to something? Say, I'm off in the woods. Do I have to listen to a stream babbling? Is there always something to hear, never any peace and quiet?" [2]. So, what is silence after all, and how do we relate to it? If silence is not an absence, what is it made of?

Fios de Silere was born from the idea that silence is neither an absence nor an auditory phenomenon. The literature about this concept is diverse and demonstrates that our relationship with it is as complex as its definition. Although silence is often associated with sound, it transcends this aspect by provoking feelings in our bodies and minds, happening in a context and, in a way, inhabiting a space or a place. Consequently, it is relevant to consider that silence can also be a visual phenomenon. The absence of light is defined by darkness, but what is the visual equivalent of auditory silence? What would visual silence be?

If silence is not an absence, then it can be made by some kind of matter – and all the matter that constitutes a given silence can be named as the materiality of that silence. Therefore, we can address the matter as the materiality of a silence created to understand it better and how we, as human beings, relate to this phenomenon. The conception of Fios de Silere is influenced by the concepts of "audiovisual materialism" and "materialism" expounded by the artist Mo H. Zareei [3], which leads to a detailed treatment of everything that inhabits the exhibition space. Since sound and light are non-material media, Fios de Silere takes all the technological apparatus, the physical structures that contain them, the soil and plants that integrate the work, and the characteristics of the exhibition space as a crucial part of its silence composition.

Throughout Chapter II, this paper examines the multifaceted nature of silence through literature and diverse artworks, concluding with reflections on how

we relate to silence and perceive its materiality and where the boundary lies between the materiality of silence and noise. In chapters III and IV, this paper covers the creative process behind the art installation Fios de Silere, from its initial sketches to its first silent exhibition. Finally, Chapter V presents some final thoughts on this artistic research project and its artwork outcome.

II. BACKGROUND

A. Defining silence through literature and art

Many authors have written about silence and our relationship to it and have proposed various theoretical frameworks. Despite the differences in their approaches, one aspect unites them all: silence is not merely an absence, nor is it determined solely by the cessation of something else. Most authors posit that silence is a discrete entity with its meaning and significance, capable of conveying much about the context in which it occurs.

Bernard Dauenhauer puts forth the proposition that silence can be conceived of as the absence of sound expression rather than the absence of sound itself [4]. The author distinguishes between two types of silence: perceived as a pause in speech and that which exists as speech itself. The latter can occur between at least two individuals or between a single person and a non-human entity or object (e.g. the silence of praying). Dauenhauer refers to this as "deep silence" and emphasizes that this kind of silence is not a solitaire human performance.

Conversely, John Cage sees the sounds of silence as a form of musical expression and suggests that we should listen to all sounds as music [2]. For Cage, listening to silence was a way of being in the world that sought to challenge established standards of taste. Consequently, he believed that listening to these sounds should be done in a disinterested way. This line of thought is controversial because, as Douglas Kahn has observed [5], it undermines the distinction between silence and noise, and because Cage's stance is self-contradictory in that he deliberately muted contexts that he found unpleasant without even considering their sounds in a disinterested way. It should be noted, however, that discussing Cage's concept of silence is not merely examining the domain of sound and music and how we listen to the world. More than an act of disinterested listening to sound, listening to silence was, for Cage, an interesting act of questioning the present and our way of being in the world. In this line of thought, Azevedo asserts that silence produces meaning because it awakens us to our surroundings and drives us toward social and personal change and transformation [6]. Therefore, Cage and Azevedo speak of an auditory silence to tell us about a silence that goes far beyond sound: a silence that acts as an enhancer of critical thinking.

Salomé Voegelin posits that silence represents the most lucid moment of sound production, wherein the boundaries between real and unreal sounds are blurred in our perception [7]. In line with John Cage [2], the author's primary interest is not in our relationship with silence but rather in the sounds that inhabit it — the more obvious matter of silence. Conversely, Dauenhauer does the opposite: he is concerned with the relationship we establish with silence but not with the tangible matter it is made of [4]. Although Voegelin's book Listening to Noise and Silence: Towards a Philosophy of Sound Art focuses on silence as a foundation for a philosophical theory of sound art, in the chapter entitled "Silence", the author states that "[s]ilence is about listening, listening to small sounds, tiny sounds, quiet and loud sounds out of any context, musical, visual or otherwise" [7]. Voegelin does not elaborate on this question, perhaps because it is inconsistent with her thesis that there is no visual source for the sounds of silence during what she identifies as the most lucid moment of sound production. However, this statement is relevant to emphasize that despite the common association of silence with hearing, it is felt in the body and within a context: auditory, visual, or otherwise. If "[s]ilence is about listening, (...) out of any context, (...) visual or otherwise" [7], what sounds do we hear in a silence that is only visual, i.e. not sonorous? An examination of artworks that conceptualize silence through a visual medium reveals how such works evoke a physical sensation of silence that extends beyond the realm of hearing. Artworks such as Akio Suzuki's Hana [8] and Maria Leonor Borges' albums "Silere" [9] are characterized by the use of certain elements, such as simplicity and a certain minimalism, that are capable of evoking a sense of silence in the audience's body.

Kris Acheson suggests that silence can be conceptualized as a spatial, temporal, physical, and emotional phenomenon created and/or found in both solitary and together with others [10]. We argue that silence can be found and created not only in the context of living beings' interactions but also in a wider environment, including objects and works of art.

Furthermore, it is also important to note that the creation of a context for the silence by an artistic object is relevant to its understanding. This context creation can occur in various ways; for instance, through a noisy cascade, as in Marianne Heske's Aggregate [11], or through a disquieting program note, as in the aforementioned Hana.

Given the multiplicity of ways and contexts in which silence can occur, we can affirm that there isn't just one silence, but rather "silences" – in a plural form. As previously stated, Acheson postulates that silence is both a phenomenon created and encountered, experienced both alone and in the company of others [10]. Erling Kagge's Silence: In the Age of Noise is one of the writings that focuses on relating these encounters in a multisensory manner: from the visual silence to the interior one [12]. Kagge's analysis primarily concerns the relationship between humans and silence; however, the author restricts it to a pleasant coexistence, perceiving it as a necessary condition for individual happiness. For Kagge, if one is uncomfortable with silence, one has failed to achieve happiness in that moment. Nevertheless, the experience of silence can be perceived as awkward or irritating without these encounters being unsuccessful ones or some kind of echo of hyperstimulation and noise. Perhaps Kagge [12] needs to fully consider the materiality of silence and admit its benign and malignant aspects, as Dauenhauer [4] did, e.g., concerning the silence of hate.

Silence can be quiet, grief, oppression, and happiness. Ultimately, silence can be regarded as an expression or discourse, as Erling Kagge notes [12]. In Marina Abramovic's The Artist is Present [13], [14] two individuals create silence together, experiencing and communicating through it in both benign and malign forms. The duo could be face to face and ignore the materiality of their silence – it would continue to exist and be felt by their bodies – but it is when they focus their attention on the materiality of their silence that they can establish communication through it.

B. Silently becoming silence

We do not choose to feel silence, but we do choose to face it to address its materiality – in fact, facing silence implies a willingness to make tangible its materiality. This distinguishes it from noise, where there is no choice to feel or face it. Noise enters our ears and eyes, disrupting the body and space without invitation. Noise brutally exposes its materiality.

When we become hosts to noise, we create a bubble that closes off our senses in this symbiosis and detaches us from the surrounding environment [7]. This phenomenon is not inherently negative; it occurs, for instance, when attending a rave with loud, intrusive music, which impairs our ability to hear and see others. Conversely, when the materiality of silence is the focus of attention, it becomes evident that our bodily disposition involves holding our breath and movements while simultaneously making attention available for detail. This sensory openness makes silence an enhancer of the senses, critical thought, and creative output. In any case, noise and silence are not necessarily antithetical; we may even find situations when they are materialized by the same matter, e.g., the ticking of a clock that bothers us immediately and the ticking of a clock that is only heard when we focus on it. Noise and silence are, in short, distinct contexts or locales wherein a given matter assumes a particular personality. At this juncture, we must endeavor to comprehend the concept of matter in a wide sense, material and immaterial, as real and unreal. As we will see in the following pages, Fios de Silere (2024) attempts to pose these questions by materializing silence through sound, light, and all the humans and non-humans that inhabit the exhibition space. This art installation performs alone and with the space to create a silence, a context for its silence, and a noise out of the matter of silence. The audience encounters the silence but ends up being part of it.

C. The principles of sound composition built into Lumia

In addition to understanding how light and sound can create silence, it is crucial to recognize that all the objects that constitute a silence's space and context are part of its materialism[1]. This phenomenon can be explained by the principle of added value, as put forth by Chion, which suggests that the presence of other media influences our perception of a given medium. Consequently, when creating an audiovisual object or even just a composition that incorporates some kind of artifact, it is essential to consider all the sensory components and their interrelationships [3]. This approach assumes that the artwork is a multisensory entity, with all its components relevant to understanding the work.

Moreover, light can be considered a matter of silence in conjunction with sound, given the numerous similarities between a musical composition and a

Lumia composition, as Thomas Wilfred and Nerea Vicente have highlighted [16]. A Lumia composition, created following principles of rhythm and melody, evokes a gesture and expression that is simultaneously audible and inaudible. In other words, the body may perceive the rhythm and melody created visually, just as it perceives rhythm and melody produced by auditory means. Furthermore, this perception may occur even if the Lumia composition is not conceived according to those principles a priori. The same occurs with visual silence.

III. STUDIES FOR FIOS DE SILERE

Following all the reflections and conclusions that have emerged from theoretical research on silence as a discourse, as an entity, as art, and our relationship with it, the first compositional statement *asserts that we can craft silence by creating the context and space necessary for it to occur. When silence is crafted out of nothing by the work of art, it becomes fundamental to create a context in which this silence can be experienced as such by the bodies and minds of the audience.*

As expected in an artistic project, material tests, mock-ups, and prototypes were conducted throughout creation. The project was subdivided into three principal phases of testing. In the initial experimentation phase, a K-Line black box mock-up, LED strips, and a high-brightness LED were employed to explore the potential for creating a context for silence through light. The second testing phase involved studies of the physical structures and artifacts to be developed for the installation, and aesthetic modifications were made by the first exhibition space. Ultimately, it is important to consider that this work of art extends to its surroundings or the whole place filled with silence. The third phase involved using an inverted plant stand (which served as a prototype for the structure), a loudspeaker measuring approximately 5 cm in diameter, and an initial version of the lamp with incandescent bulbs as a prototype. These were employed to assess the material properties of sound and light and the interaction between the various media in the audiovisual composition. Although the test phases are presented in numerical order, it should be noted that the second and third phases overlapped continuously in time.

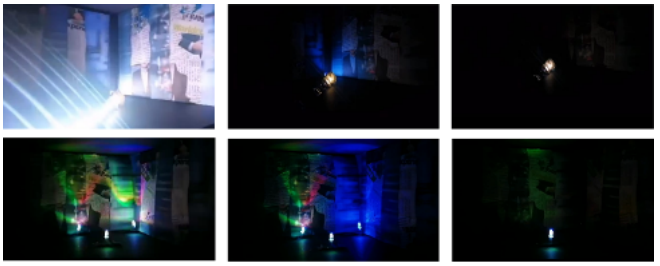


Fig. 1. Material tests on a K-line model with LED strip (top) and high-brightness LEDs (bottom).

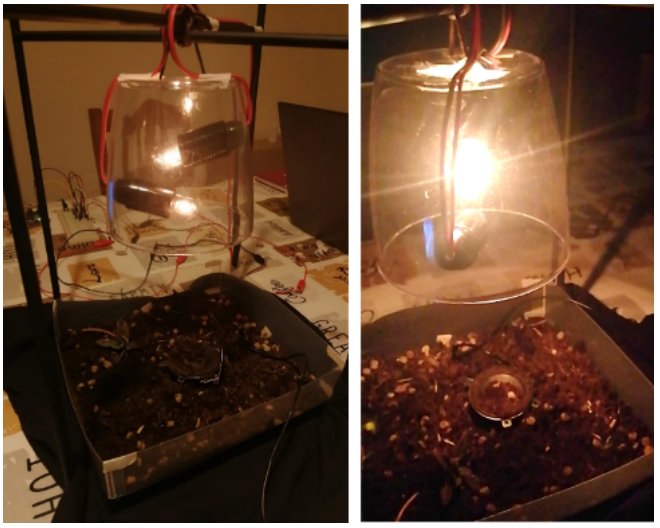


Fig. 2. Prototype a top structure with an inverted plant table and a small speaker.

A. Sound and light as more than immaterial media

In Fios de Silere (2024), context creation consists of a moment of very intrusive noise – it happens by contrast. In the final version of the installation, this visual noise is created by strobe lights through a strip of white LEDs. At the same time, the silence is materialized by incandescent bulbs, combined in a lamp, and independently dimmed by a Mosfet module. While the white LEDs dazzle our eyes, the bulbs' filaments are warm and comforting and can only be seen properly when focused. The choice of small incandescent bulbs to create silence is due to the detail of their filament: it is possible to detect slight imperfections in the line that emits the light, especially when the brightness is low. The color is a very warm orange. Moreover, once the human eye becomes aware of these changes in brightness and chooses to focus on this aspect, it can detect (unintentional) variations in the brightness of the bulbs that are so slight that it is impossible to tell whether they are real, influenced by the other bulb in the lamp, or just imagined[2]. Considering how Lumia compositions can be created according to musical concepts, using two bulbs looks for luminous rhythms or even a counterpoint of two luminous voices.



Fig. 3. The lamp with incandescent bulbs.

While light and sound are immaterial media, some materials and artifacts are responsible for their creation. In the case of light from incandescent bulbs, it is the filament together with other elements of the lamp; in the case of recorded sound, in addition to the material that was recorded in the first moment and which we no longer see, there is the speaker itself. In an aesthetic aligned with audiovisual materialism[3], Fios the Silere reveals the speaker responsible for sound emission through its membrane. In addition, the cone is submerged in a material that enables sound visualization by oscillating by the speaker's membrane. The underlying principle is analogous to that observed in Chladni plates; however, in this instance, no plate is positioned above the speaker, and the organic material is directly applied to its membrane. This results in a more free and chaotic vibration of the organic material, which is superimposed on itself due to the funneled shape of the speaker. It is important to note that this setup and effect can only be built using passive speakers connected to an amplifier.

Experiments were conducted to identify the most interesting organic material to use in the installation. Various sand and soil types were subjected to testing, and it was observed that all of them affected the sound produced by the speaker. Therefore, these materials above the speaker's membrane serve as a visual materialization of sound and a contributing factor in its generation, integrating what can be seen as an additive synthesis process. Of the materials tested, the soil proved to be the most intriguing. Thus, it was incorporated into the final composition due to its complex texture and olfactory subtleties, which can introduce another dimension to the multisensory character of the installation.



Fig. 4. The soil vibrates above the loudspeaker in Fios de Silere.

At the outset of the installation, the context creator is characterized by a highly synthesized and dissonant sound, encompassing extreme bass and treble frequencies. At this point, the soil exhibits a pronounced vibration: it jumps from the speaker like a trampoline. This phenomenon is further accentuated by the strobe lighting, which intensifies the visual impact while the sound intensifies it. For the silence composition, a sound library was constructed comprising samples evocative of heartbeats and air and a multitude of samples whose base material is a recording of my soup ladle, which produces a sound reminiscent of a Tibetan bowl whenever it touches something. The idea behind incorporating the sound of a soup ladle into the installation came about curiously: in short, this sound was discovered precisely in the context of silence, and I couldn't figure out its source for a while. It was fascinating.

The sound material that constitutes the silence samples library seeks to allude to phenomena typically heard upon focusing on (or facing) silence. These phenomena may be perceived as real or unreal, originating from our body or external entities, and consequently, they retain a certain degree of fragility. The sound material causes minimal or no soil vibration above the speaker. Still, when the lamp illuminates the speaker, subtle movements are created, prompting the question of whether the slight soil movements are a product of our imagination or a genuine occurrence.

B. The sympathetic, silent, and tangible structures

From the project's preliminary stages, the idea was to create structures resembling bookshelves, with a central shelf to display a speaker and a mechanism above for suspending a lamp. The initial design for the speaker's shelf involved the incorporation of a terrarium comprising soil and plants. However, in the final design, the speaker's shelf is filled with a thin layer of moist soil, while the sound-light apparatus forms a subtly symmetrical composition. The lamp is made of a transparent vase, while the speaker rests atop a similar vase that serves the dual purpose of a

terrarium containing succulents. A lower shelf accommodates a second speaker in the same setup but without the lamp, and the configuration of the two speakers forms a vertical stereo. It should be noted that the installation comprises two structures; however, only the taller one incorporates the sound-light apparatus. The second structure, replete with moist soil and plants, reverberates the light and sound sympathetically.

The material and design of the structures underwent a process of evolution in parallel with the selection of the exhibition space: the Torreão of Centro de Memória of Vila do Conde (Portugal). Although not entirely site-specific, the artwork was designed with its premiere venue in mind. The exhibition space is within a stone tower, and visitors must pass through a garden to reach it. This preliminary journey establishes the ambiance and prepares visitors for the subsequent experience of silence. Indeed, the walk through the garden and the ascent of the tower in darkness serves as an antechamber to Fios de Silere.

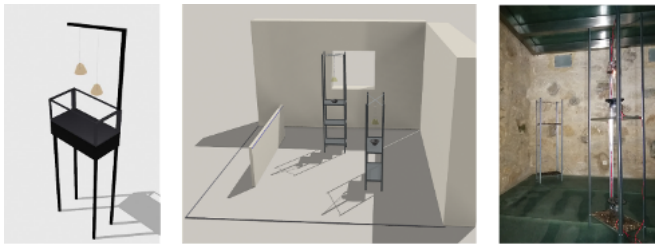


Fig. 5. First sketches of ideas for the structures (left); plan of the exhibition in 3D, with the new ideas for the structures (center); final structures in the exhibition space (right).



Fig. 6. Fios de Silere's antechamber on its first exhibition at Torreão from Centro de Memória of Vila do Conde.

The interior space is characterized by the juxtaposition of stone walls – an organic material like soil – with a frosted glass floor, metal beams, and metal stairs. Given that the objective is to extend the composition of silence across all elements, the two structures designed for the installation, which are themselves towers, changed from wood to metal during the design phase to better integrate with the space.

IV. FIOS DE SILERE (2024)

In Latin, "tacere" refers to the silence of discourse, whereas "silere" refers to the silence of nature. Neither of these terms implies an absence, nor do they represent merely an auditory phenomenon. For approximately fifteen minutes, Fios de Silere materializes silence through the filament of small incandescent bulbs and the light they emit through the vibration of the speaker cones that produce sound and cause the soil they rest upon to vibrate, within the stone walls of the exhibition space, and in the scent of damp soil that fills the room. Fios de Silere presents a performance of all these elements, whereby silence develops in an audiovisual manner over time, beginning with an initial moment when noise invades the senses of those in the room. And among those elements are the visitors themselves.



Fig. 7. A macro view of Fios de Silere

A. A descriptive memory

The audiovisual composition of Fios de Silere has an approximate duration of fifteen minutes. It is unclear whether the silence that persists after the first five minutes can be defined as such; however, the slow, repetitive, intimate, and somewhat minimalist nature of the work requires the visitor-subject to maintain a state of focused attention throughout the entire session to comprehend its materiality, similar to the one required by the action of facing silence. In other words, one could coexist with the silence of Fios de Silere without paying any particular attention: the material unfolds at a gradual pace, and maintaining focus can prove challenging, as thoughts may tend to wander. Nevertheless, one may choose to concentrate on its details and perceive a place where the sounds of the street and the sounds of the speakers blend with the holes of the stone walls and where the visual perception of subtle movements is influenced by the light from the small bulbs along with the window light slits, existing somewhere between the real and the imagined.

In light of the reflections that emerged throughout the research process, it became evident that

establishing a context for the installation, particularly its silence, was a crucial aspect of the project. As discussed in the previous chapter, the composition of Fios de Silere is divided into two temporally unbalanced moments: the first is the creation of a context for silence, which lasts approximately one and a half minutes and marks the beginning of the installation's performance; and the second moment is the silence itself, which is materialized through various means already outlined and occupies nearly the entire remaining duration. The audiovisual noise abruptly ceases upon reaching its climax, resulting in a sudden blackout. During this moment, the visitor-subject undergoes a perceptual shift, wherein the external auditory stimuli are abruptly supplanted by an internal auditory experience of silence materialism: their mind still perceives lights, and sounds still echo in their head – are they real or imagined? What is the essence of this silence, where, as Voegelin observed [7], the sounds of the outside world intermingle with those of our inner world? Following this blackout, a faint drone gradually emerges from the speakers, reinforcing these questions.

The installation's performance is a controlled generative composition created in Max MSP that communicates via OSC with an Arduino, which serves as the hardware controller for all lighting components. In the moment of silence materialization, the composition's program contains five individual sample players, which are activated and deactivated by a pre-determined temporal sequence. Each player contains a set of samples that can be played back and distributed across the two speakers within the main structure. The samples and the behavior of the lights exhibit a degree of controlled unpredictability, which is also managed over time by the same Max MSP program. The randomness inherent in the program makes Fios de Silere a generative audiovisual composition, thus ensuring that each new installation session is always different from the previous ones. Consequently, this fact, combined with the fact that unpredictable sounds of the street merge with those of the composition and the fact that the window light slits change throughout the day, ensures that the audience will not experience the silence of Fios de Silere in the same way twice.

The composition of silence is also subdivided into three parts, progressing from the simplest to the more complex in terms of sound and light programming. At the commencement of the third section, approximately eleven minutes into the composition, a new moment of noise gradually emerges, now constructed from the elements that once were a matter of silence. In other words, in this new context, the light emitted by the incandescent bulbs and the samples produced by each player assumes a different personality. Once again, the transition from noise to silence is abrupt. Still, the remainder of the third part consists of an extended fade-out of all the elements, departing one by one until only the audience remains, immobilized by the uncertainty of whether they will hear another sound or see another bulb light up again. Is this silence after silence? Thus, the end of the performance of Fios de Silere concludes with a question mark, as silence continues through the sounds entering the building from the street – distant yet present, through the tiny shafts of light – now visible to those who have become accustomed to the darkness; and through the path retraced in the gardens upon leaving the stone tower. At the end of the performance of Fios de Silere, we find ourselves back in the antechamber where silence truly began, if indeed it is possible to identify the exact moment in time where this occurred. Perhaps the antechamber is now going to be extended beyond the garden gates.

B. A silence molded by the details and the audience

In addition to sound and light, or even the physical structures themselves, the composition of Fios de Silere comprises many other subtle details. These include the stark contrast of the black and vivid red cables against the metal and the texture of the soil and plants, which appear to move in response to shifting shadows. The rope at the top of the structures, which supports the lamp, is also visibly taut. It could be postulated to be holding its breath if it were capable of lung function. These details are of the utmost relevance to the silence sought by the composition, as our attention to them compels us to remain motionless, fearful of disturbing them.



Fig. 8. Some details of Fios de Silere: soil plus plants; black and red cables.

When creating silence, it is important to avoid overwhelming the senses and, thus, the environment in which it occurs. During the fifteen-minute session,

visitors are free to move around the exhibition space to find and be part of different audiovisual silences or to find different details within one, depending on where they choose to be. Nevertheless, the tension of moving through the room without disturbing the silence that inhabits it is something desirable, and the final iteration of Fios de Silere provides the necessary conditions for the construction of silence. However, in the context of a relatively small room, as exemplified by the venue where the piece was first presented, it is recommended that only one or two visitors attend each session. We create and encounter silence, both alone and together, since the installation acts as a performative agent, enabling each visitor to experience silence within the space while simultaneously contributing to its creation in conjunction with the installation. The necessary tension for perceiving the materiality of silence can be discerned in the dyad of visitor-installation and the triad of visitor-visitor-installation. Visitors who experienced the installation alone or in the presence of a second person mainly referred to the work as an inducer of hypnotic and meditative states of mind - i.e., they could focus on the materiality of the installation's silence. However, more than two people in the room make the context noisy and invasive, affecting the body and senses: the tense silence between visitors turns the installation into noise[4].

In truth, it was observed that in sessions with more visitors than desired in the exhibition room, there was a tendency for the audience to avoid walking around, to become withdrawn, and to impact the other person's experience negatively. As previously discussed, humans do not actively choose to experience silence. Instead, it manifests as a range of sensations, some antagonistic, such as tension and calm. Could the presence of multiple individuals in a given space have initially resulted in a tense silence that constrained our movements to avoid disturbing others but evolved into a noise that invaded the senses of those present and prevented them from focusing on anything else? Indeed, silence is a fragile phenomenon.

In certain situations, when the participants know each other beforehand and can find something similar between them, e.g., in Dauenhauer's "silence of the intimates" [4], more people may be at the installation without becoming noise to each other.



Fig. 9. Fios de Silere's visitors.

V. FINAL THOUGHTS

Silence enhances the senses, critical thought, and creativity because its comprehension requires our focus, questioning, and time. To create Fios de Silere's silence, this project gains a profound understanding of the concept of "silence", differentiating it from both noise and a state that is neither silence nor noise. Furthermore, Fios de Silere invites the audience to consider the materiality of silence, whereby the visitor's body is a constituent element. Aligning with this, the main objective of this project is to highlight the nuances inherent in the materiality of silence, its capacity to enhance our sensory experience, and, ultimately, to prompt the audience to discover and cultivate other silences in their daily lives. It is possible to coexist with silence without acknowledging it. Still, by directing our attention towards it, silence can transform ourselves and our perception of what surrounds us.

From a more practical and personal standpoint, while this installation may undergo future adaptations, the presented iteration represents a significant advancement in both my technical proficiency and conceptual understanding, largely due to the extensive research conducted. It was of the utmost importance to ensure that the technological exploration did not overshadow the aesthetic aspect; otherwise, there was a possibility that the artistic object would devolve into a mere technological exercise.

Furthermore, Fios de Silere aims to demonstrate the vital importance of maintaining the artwork as a continuous reflection of itself throughout the artistic creation process. The pursuit of silence became increasingly evident with each test, prototype, and model. This was also clear in every technological adjustment that failed to align with the aesthetic intent and in each essential aesthetic change that proved to be strikingly loud and not silent.

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REFERENCES

[1] Dicionário infopédia da Língua Portuguesa, "Porto Editora – silêncio," Porto: Porto Editora. Accessed: Jul. 04, 2023. [Online]. Available: https://www.infopedia.pt/dicionarios/lingua-portuguesa/silêncio

[2] J. Cage, Silence: Lectures and Writings. Wesleyan University Press, 1961.

[3] M. H. Zareei, "Audiovisual Materialism," Organised Sound, vol. 25, no. 3, pp. 362–371, Dec. 2020. doi: 10.1017/S1355771820000321.

[4] B. P. Dauenhauer, "On Silence," Source: Research in Phenomenology, vol. 3, pp. 9–27, 1973.

[5] D. Kahn, "John Cage: Silence and Silencing," The Musical Quarterly, vol. 81, no. 4, pp. 556–598, 1997, Accessed: May 18, 2023. [Online]. Available: http://www.jstor.org/stable/742286

[6] M. Azevedo, "4'34'' Sobre o silêncio e da sua entropia a partir de John Cage," Universidade do Porto, 2017. Accessed: Jan. 16, 2024. [Online]. Available: https://hdl.handle.net/10216/108606

[7] S. Voegelin, Listening to noise and silence : towards a philosophy of sound art. Continuum, 2010.

[8] E. Flügge, "Silent Sound Art: Performing the Unheard," ACT – Zeitschrift für Musik & Performance, vol. 3, no. 4, Apr. 2012, [Online]. Available: http://ablinger.mur.at/docu01.html

[9] M. Borges, "O silêncio na fotografia e/ou a ideia de 'natureza a desenhar-se a ela própria,'" 2016.

[10] K. Acheson, "Silence as gesture: Rethinking the nature of communicative silences," Communication Theory, vol. 18, no. 4, pp. 535–555, 2008, doi: 10.1111/j.1468-2885.2008.00333.x.

[11] M. Meyer, "A space for silence: exhibiting and materialising silence through technology," Cult Geogr, vol. 23, no. 2, pp. 321–336, Apr. 2016, doi: 10.1177/1474474015588708.

[12] E. Kagge, Silêncio na Era do Ruído. Quetzal Editores, 2017.

[13] M. Akers and J. Dupre, Marina Abramovic: The Artist Is Present, (2012).

[14] M. Abramović, "The artist is present." Accessed: Jan. 16, 2024. [Online]. Available: https://www.moma.org/calendar/exhibitions/964

[15] M. Chion, A audiovisão: som e imagem no cinema, 1ª. texto&grafia, 2011. [Online]. Available: www.texto-grafia.pt

[16] N. C. Vicente, "In Praise of Shadows: Study for a Light Composition in Space," Universidade do Porto, Porto, 2017.

[1] The use of the terms "materialism" and "silence materialism" throughout this paper serves to emphasize the relationship between this artistic research into the materiality of silence and the practice of "audiovisual materialism" [3].

[2] Given incandescent bulbs' environmental and manufacturing constraints, a future installation model should replace them with bulbs offering greater sustainability, such as LED bulbs. This transition should be undertaken with a bulb model that aligns with the desired aesthetic.

[3] The term "somewhat" is used because, according to Zareei [3], in works integrated as "audiovisual materialism," the sound is mainly generated by a mechanical or electronic apparatus, which also serves as a key visual element in the artwork. In Fios de Silere, however, the sound is composed of pre-recorded audio played through speakers rather than being created live.

[4] This feedback was informally obtained from some of the visitors to the first exhibition of the installation, from 8th to 11th of June 2024 at Torreão do Centro de Memória de Vila do Conde (Portugal)

Weaving Digital Narratives: The Creation of Artefacts in Multimedia Production and Digital Games

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Abstract—This article explores the methodology and creative processes involved in the development of digital artifacts by students from the unit of study in Art, Culture, and Communication in the Digital Age in the first year of the Multimedia Production and Digital Games course at Institution X. The investigation is grounded in artistic practices and the intersection of art and technology, aiming to create works that reflect contemporary reality. Students were encouraged to utilize the Processing programming language to develop interactive artifacts exploring open themes. The results demonstrate that 83% of students completed their work, underscoring the effectiveness of the applied methodology. The creations include works such as "Creative Sky," which promotes freedom of expression in an interactive night sky; "De lá para cá," which applies Gestalt principles to create an optical illusion; "Solar System," which provides a historical educational, and interactive experience; "Nirvana," which addresses existential cycles; and "Lines of Arte," which combines minimalism with digital art. The investigation emphasizes the relevance of critical reflection on the interconnection between art and technology, providing a space for developing creative and technical skills. The conclusions indicate the need to expand this approach in future initiatives, encouraging students to explore emerging themes and develop relevant works within the current cultural context.

Keywords—digital art, creative process, artifact, interactivity, teaching methodology

I. INTRODUÇÃO

Este artigo apresenta a metodologia e os processos criativos envolvidos no desenvolvimento de artefactos produzidos por alunos do primeiro ano do curso de PMJD (Produção Multimédia e Jogos Digitais), na unidade curricular de Arte, cultura e comunicação na era digital no IPMaia (Instituto Politécnico da Maia), no Porto, em Portugal, de fevereiro a julho de 2024, no segundo semestre do ano letivo 2023/2024. Tendo em vista que foram desenvolvidos quatorze artefactos pelos alunos, nesse trabalho foram escolhidas cinco obras para análise, Criative Sky (Inês Ângelo); De lá para cá/Sistema solar (Edgar Pereira); Nirvana (Samuel Nogueira) e Line of Artes (Jorge Rocha).

O desenvolvimento de artefactos digitais exige, em primeiro lugar, um entendimento da média-arte digital, além de um envolvimento prévio com a arte. Assim, é imprescindível criar um ambiente propício que possibilite aos alunos a vivência tanto de aspetos teóricos quanto práticos relacionados à arte e à sua evolução ao longo do tempo. A análise do diálogo entre arte, cultura e comunicação, ao considerar suas dimensões temporais, pode contribuir para uma melhor compreensão das especificidades da sociedade digital atual, estimulando, desse modo, o surgimento de temas, críticas e conceitos mais sofisticados. Nesse panorama, durante a fase inicial do processo criativo, os alunos foram introduzidos a um robusto enquadramento teórico e histórico, embora tenham encontrado desafios relacionados à apropriação dos termos académicos e à interpretação da literatura pertinente à área. Observou-se também que, apesar de utilizarem ferramentas como o ChatGPT, muitos alunos não têm a habilidade de refinar ou intervir de maneira crítica nas pesquisas realizadas por essas inteligências artificiais. Essa constatação evidenciou a importância de abordar essas questões no âmbito académico.

Na sequência, apresentamos o software de arte generativa “Processing”, que se destaca como uma

linguagem de programação e ambiente de desenvolvimento utilizado nas artes visuais desde 2001, devido à sua abordagem simples e objetiva. A escolha deste software para os alunos do primeiro ano do curso de PMJD foi influenciada pelo seu já existente suporte nos computadores da universidade e pela familiaridade prévia dos alunos com linguagens de programação. Utilizando a plataforma Moodle, facilitamos a aprendizagem do software enquanto os alunos desenvolviam o seu processo criativo individual, proporcionando uma experiência estética significativa e reflexiva.

Ao longo do texto são exploradas a metodologia do ciclo de criação de arte pós-digital [1] e o processo criativo realizado em cada artefacto, de modo a detalhar conceitos, narrativas, inspirações, experiências e implementações. Analisando criticamente a criação de artefactos híbridos que intrinsecamente unam arte, cultura, sociedade e tecnologia computacional.

II. GÉNESE DOS ARTEFACTOS DIGITAIS

A primeira criação de artefactos digitais passa pelo entendimento da média-arte digital e, acima de tudo, pela familiaridade com a arte. Nesse sentido, antes de criar é preciso favorecer um ambiente criativo e propiciar que os alunos experienciem o contacto tanto teórico quanto prático sobre a arte e sua evolução cultural. Refletir sobre a arte, a cultura e a comunicação tendo um viés temporal poderá facilitar a compreensão da atual sociedade digital e das suas particularidades, o que por si só já estimula o desenvolvimento de temas, críticas e suscita a criação de conceitos de obras mais elaboradas. "O surgimento de uma nova arte que seria, de fato, uma necessidade de um novo homem e de sua própria consciência espaço-temporal" [2]. Consciência esta, que se torna fundamental na génese da criação em média-arte digital.

Ainda na fase da "consciência", onde os alunos foram dotados de um sólido enquadramento teórico e histórico, os mesmos manifestaram suas dificuldades, principalmente no domínio e conhecimento dos termos académicos e no que tange a interpretação dos artigos e livros da área. Nos deparamos com alunos que usam o ChatGPT e outros softwares, mas que não sabem refinar, melhorar ou mesmo intervir sobre as pesquisas que essas IA's apresentam. "A tecnologia evoluiu tanto que, agora, pela primeira vez, enfrentamos a possibilidade real de outras entidades- entidades criadas por nós- possam vir a tornar-se inteligentes".[3] Uma vez que, a inteligência humana que utiliza a máquina, não esteja preparada o suficiente para discernir sobre o certo e o errado, sobre o criar e o plagiar, sobre os limites e origens dos resultados das pesquisas realizadas, percebemos que é preciso trabalhar com os nossos alunos na academia também essas questões. Desse modo, passamos a integrar o uso do ChatGPT e Microsoft Copilot para que investigassem termos, conceitos e tudo o que ultrapasse a compreensão relativamente aos textos e temas abordados em aula, potenciando assim, a aprendizagem autónoma e crítica.

Na fase pós-consciência apresentamos um dos sotfwares de arte generativa o "Processing". O Processing é uma linguagem de programação, um ambiente de desenvolvimento e uma comunidade online desde 2001. Inicialmente, promoveu-se a difusão deste software no âmbito das artes visuais. Pela sua simplicidade e objetividade, foi criado com o propósito de servir como ferramenta para o ensino de fundamentos de programação de computadores num contexto visual [4].

O Processing é tanto uma linguagem quanto um ambiente de programação integrado. Desde a sua criação, o Processing foi concebido como software livre e de código aberto (FOSS), com o objectivo de ser acessível e flexível. Reas salienta que esta acessibilidade tem dois significados: primeiro, que o software pode ser obtido gratuitamente, e segundo, que é compreensível pelo público em geral. Embora simples, o Processing não é simplista. [5]. Além do Processing há outras alternativas no mercado, todavia, a sua escolha foi motivada pelo facto dos laboratórios da Universidade já o terem em todos os computadores e os alunos, em sua maioria já terem visto uma linguagem de programação no primeiro semestre do ano letivo de 2023. A utilização de uma mesma linguagem na primeira etapa da criação dos artefactos tinha como objetivo que todos os alunos tivessem uma mesma ferramenta e estratégia para desenvolver o trabalho.

Nesta etapa utilizamos a plataforma Moodle para mediar a aprendizagem no software ao mesmo tempo que desenvolvíamos o processo criativo dos artefactos individuais. O processo de criação em média-arte digital normalmente é direcionado para o design da experiência que se pretende oferecer através do artefacto ou instalação. Todo o desenvolvimento conceptual e computacional do artefacto, assim como os diversos ciclos de reflexão e análise, têm como objetivo principal proporcionar uma experiência

estética significativa que surge da fruição do artefacto. [1] A investigação, a prática em média-arte digital e arte computacional nas últimas duas décadas indicam que, à medida que o processo criativo se torna mais aprofundado, há uma maior probabilidade de se alcançar obras com um elevado valor estético. [6]. No nosso caso em particular, não tínhamos a intenção de ter como resultado obras de elevado valor estético, mas que os alunos do primeiro ano do curso em Produção Multimédia e Jogos Digitais, adquirissem habilidades para a criação e implementação de artefactos.

III. A METODOLOGIA

A investigação baseada na prática artística (Arts-Based Research - ABR) não se limita a ser uma pesquisa "sobre a arte", mas sim uma pesquisa "através da arte". No contexto da média-arte digital, o processo criativo é compreendido como um caminho de criação estética e conceptual, que se foca na comunicação de uma mensagem por meio de artefactos, numa constante dialética de fazer, refazer e refletir. Nesta abordagem, a prática artística, tal como performances ou criações digitais, não só constitui o objeto de estudo, como também serve como meio de gerar conhecimento e novas perspetivas dentro do campo. A média-arte digital, em particular, depende da tecnologia, seja como meio de criação, transformação e mutação, ou como a própria matéria-prima do processo artístico. Assim, a prática criativa torna-se, simultaneamente, o modo de investigação e a fonte de insights, unindo teoria e prática numa investigação contínua e reflexiva, que articula o fazer artístico com o desenvolvimento teórico. [3]

Muitos autores defendem estudos que discutem a relação entre prática criativa e a pesquisa, explorando como o ato de criar arte pode, por si só, ser uma forma de investigação. Entre eles temos Candy [7], Sullivan [8], Eisner [9], as variações dessa abordagem que culminam na A/R/Tografia, da Irwin [10], a adaptação realizada por Marcos [1] para a criação em arte digital/computacional e a mais recente A/R/Cografia do autor Alves da Veiga [11]. Esta última abordagem constitui uma extensão da a/r/tografia, uma meta-metodologia centrada na prática artística experienciada, que orienta o processo de investigação criativa em três dimensões: a arte (art - A), a investigação (research - R) e a comunicação (communication - C). Neste contexto, a comunicação é compreendida como um conceito bidirecional mais abrangente do que o ensino/aprendizagem, que são característicos da a/r/tografia. Além de ser uma parte integrante dos processos criativos na arte, a comunicação é inerente à própria natureza da arte e um dos objectivos centrais da produção de conhecimento. Assim, a a/r/cografia amplia o alcance da a/r/tografia, ao integrar de forma mais explícita a comunicação no processo criativo e investigativo.

Assim, a presente investigação fundamenta-se em um ciclo de produções na unidade curricular de "Arte, cultura e comunicação na era digital", no curso de PMJD, no IPMaia, onde propomos projetos de criação artística individuais (1ª fase) e coletivos (2ª fase). Tendo como objetivos:

- Explorar criticamente a produção de artefactos híbridos arte – cultura – sociedade;
- Utilizar plataformas "end-user" - ambientes de programação - Processing, entre outros, para a produção de artefactos híbridos e/ ou para a gamificação da arte;
- Planear e executar projetos de criação artística digital;

A pedagogia da programação criativa fundamenta-se em princípios de aprendizagem experiencial, interdisciplinaridade e interação contínua. Adotamos o ciclo de criação que oferece aos alunos um framework estruturado, mas flexível, estimulando tanto a autonomia criativa quanto o rigor técnico. Nesse sentido, o aprendizado do Processing, passou um processo. Primeiro, conhecemos o software e funções de cada botão, depois começamos a criar pequenos objetos com comandos simples como "desenhe com uma linha, criando um novo sketch e depois copiando o código do exemplo". E em seguida eram estimulados a realizer alterações e "brincar" com o código. Ex:

EXEMPLO 1

```
1     void  setup() {
2           size(300, 300);
3           background(0);
4           smooth();
5     }
6
7
8     void draw() {
9           strokeWeight(30);
10          stroke(100);
11          line(100, 100, 200, 200) ;
12    }
```

Fig. 1. Exemplos de atividade em linguagem de programação Processing. Manual parte 1- Arquivo da autora. (2017).

Depois, passamos para a criação de objetos e a proposta era alterá-los (cor, formatos, tamanhos) e por fim dar movimento a eles em cada etapa. Em cada passo foram disponibilizados manuais, vídeos/tutoriais em AVA (Ambiente Virtual de Aprendizagem), no caso, na plataforma Moodle. Possibilitando a aprendizagem autónoma e colaborativa.

A pedagogia da programação criativa descrita está alinhada com as ideias de Resnick (2017) [12] sobre aprendizado criativo e com a abordagem de Papert (1980) [13] no Constructionism, que enfatiza o aprendizado por meio da criação de artefatos significativos. A utilização de ferramentas como Processing não apenas facilita a implementação de conceitos abstratos em formas concretas, mas também reforça habilidades críticas e colaborativas nos alunos. Essa metodologia, quando aplicada em ambientes de aprendizagem STEAM (Ciência, Tecnologia, Engenharia, Artes e Matemática), conforme destacado por Maričić e Lavicza (2024) [14], amplia o engajamento estudantil e promove a integração de competências técnicas e artísticas.

Após desenvolveram as primeiras habilidades no software, propomos que os alunos desenvolvessem por meio do ciclo de criação em arte digital um processo criativo que desse vida a artefactos. Desse modo, realizaram suas obras artísticas por meio de nove passos do ciclo de criação em arte digital, onde fizeram o desenho do conceito; desenho da narrativa; desenho da experiência; meditação estética; inovação tecnológica; desenho do artefacto; implementação do artefacto; planeamento da exibição do artefacto; artefacto final [6]. Abaixo descrevemos os passos seguidos, de acordo com o método do ciclo de criação pós-digital, no desenvolvimento do processo criativo dos artefactos:

1. Desenho do conceito: Ideia inicial, pedimos para que cada aluno criasse um conceito, um tema para criar a sua obra. Esta é uma fase de caráter exploratório e potencia uma real necessidade da investigação e experimentação; nela são produzidos desenhos, esquissos e apontamentos que ajudam o artista a dar forma ao seu artefacto.

2. Desenho da narrativa: Após o conceito pré-desenvolvido pedimos aos alunos que elaborassem a composição do cenário e poética da obra; criando uma ligação com a mensagem que desejavam transmitir e as partes conceitualmente previstas. Como resultados tivemos descrições, roteiros, guiões que apoiaram o potencial narrativo.

3. Desenho da Experiência: Nessa fase, os alunos procuraram criar uma interconexão entre o conceito desenvolvido e a narrativa, envolvendo interfaces, mecânicas e abordagens tecnológicas, buscando como principal foco a figura do público e a experiência que o artefacto lhe proporcionará.

4. Meditação Estética: É o momento de contemplação, onde os alunos foram convidados a revisar o artefacto produzido até então e garantissem coerência e unidade, estabelecendo um elo entre o domínio da mensagem e o desenvolvimento do artefacto (técnica).

5. Inovação Tecnológica: "Consiste na integração da novidade tecnológica, apropriação da técnica de forma inovadora ou inesperada" [4]. Nessa primeira fase do projeto a inovação tecnológica não foi uma preocupação, uma vez que, todos estavam a utilizar o mesmo software a apresentariam em um mesmo suporte. Também não foi exigido complexidade em termos de programação criativa, pois, não era uma UC de exploração do domínio de programação, mas do entendimento entre arte e tecnologia.

6. Desenho do Artefacto: Tendo em vista a vertente tecnológica, os alunos foram convidados a realizarem testes e revisitas que permitissem afinar o diálogo entre a intenção do artefacto e a possível experiência a ser proporcionada ao público. É o momento que especifica a produção e detalhamento do sistema e são realizadas as experimentações que antecipam eventuais defeitos e dificuldades na fase seguinte.

7. Implementação do Artefacto: Nessa fase os alunos já estavam com os códigos todos refinados e a rodar sem erros. Então, foi realizada a concretização efetiva do artefacto: estética, programação, eletrônica, etc. Todavia, esse processo é dialético, podem surgir obstáculos, reformulações nas ideias iniciais, dificuldades com a interface, entre outras

8. Planeamento da Exibição do Artefacto: Instalação no espaço de exibição, momento em que podemos considerar como a fase final. O artefacto já está implementado e agora faz-se o planejamento logístico do local de exposição. Esta também não foi uma fase contemplada, pois, não havia espaço e nem equipamentos suficientes para todos os alunos exporem ao mesmo tempo. Assim, realizamos as apresentações em sala de aula, um de cada vez.

9. Artefacto Final: "O resultado, a obra em exibição ao público e aos pares" [4]. Os alunos apresentaram em uma aula avaliativa para a professora e os colegas e explicaram todos esses passos.

Todas as fases do ciclo de criação foram realizadas na plataforma moodle e pudemos acompanhar o desenvolvimento de cada artefacto.

IV. ARTEFACTOS DESENVOLVIDOS

A turma era composta por dezessete alunos frequentes, sendo produzidos um total de quatorze artefactos. Ou seja, 83% dos alunos conseguiram concluir o processo criativo e apresentar o resultado final da obra implementada. Todas as obras são de arte generativa criadas no Processing. O processo interativo do ciclo de criação acima descrito, do refinamento técnico ao planeamento da exibição fortaleceu a conexão entre forma e função, conforme discutido por Lieser [15] Sanders [16].

A seguir partilharemos quatro obras desenvolvidas:

· Creative Sky (Inês Ângelo)

A obra "Creative Sky", de autoria da aluna Inês Ângelo, consiste em um céu noturno estrelado, povoado com diferentes formatos de estrelas, inclusive cadentes. A a interatividade é estimulada na audiencia por meio da criação de formas e junção de estrelas, remetendo a ideia de constelações.

De acordo com a autora esta obra dá liberdade de expressão ao público, incentivando-os a criar as suas constelações.

O conceito surge de uma experiência pessoal da autora em uma "inesquecível" noite estrelada, noite em que a autora afirma ter sido a que sentiu mais paz em sua vida. Ela cita: "Quando estamos rodeados de quem amamos, uma paz imensa cai sobre nós e uma atividade tão simples como olhar as estrelas, pode tornar-se o momento mais especial de suas vidas". Em termos estéticos o ceú representado na obra, foi o resultado de vários testes e tonalidades, onde prevaleceu o azul escuro, com estrelas embaçadas, o que para a autora seria o mais próximo de uma experiência mais natural para o público.



Fig. 2. Céu estrelado. (Creative Sky). Fonte: Inês Ângelo (2024).

Nessa fase, o conceito e a narrativa já estavam prontos e começou-se o desenho da experiência, onde diversos experimentos foram feitos para se chegar a um código perfeito que traduzisse as ideias da autora. Após a definição estética da obra e ja ter o céu estrelado pronto, iniciou-se a fase de testes da interação da audiência.

Nas palavras do autor Lieser [15] nas instalações interactivas um dos maiores desafios para os artistas é

criar um artefacto onde a tecnologia se subordine ao posicionamento estético de um trabalho criativo e que, por sua vez, esteja em consonância com o conteúdo do mesmo. É difícil, muitas vezes, encontrar uma interface que, de um ponto de vista estético, se integre de modo satisfatório no conjunto da obra artística.

O livro Interactivity and the Future of the Human-Computer Interface, organizado por Kathryn E. Sanders (2020) [16] complementa a visão de Lieser ao explorar o desafio de integrar a tecnologia às interfaces interactivas de modo a que estas não se sobreponham ao conteúdo ou à estética da obra. Tal como Lieser sublinha a dificuldade dos artistas em encontrar uma interface que se alinhe satisfatoriamente com a dimensão estética e criativa, Sanders também destaca as interfaces modernas e como elas devem ser desenhadas para melhorar a experiência, sem comprometer a integridade artística. Busca examinar a importância de um equilíbrio entre forma e função, seja nos jogos digitais, na realidade aumentada ou no e-learning, reforçando a necessidade de subordinar a tecnologia ao conteúdo, de modo a garantir uma coesão estética e funcional que potencie a interação.

A autora pensou em dar a possibilidade do público criar as suas próprias formas no céu a partir da união de estrelas. Ou seja, quando o indivíduo clica em duas estrelas irá formar-se uma linha suave entre elas, se clicar em diversas estrelas irá desenhar uma linha contínua, formando constelações ou formas originais. Após inatividade (sem cliques na tela) a linha contí nua irá quebrar-se dando a possibilidade do individuo criar outras constelações em outros lugares da tela. (Inês Ângelo).



Fig. 3. A interação (Creative Sky). Fonte: Inês Ângelo (2024). Vídeo disponível em https://www.youtube.com/watch?v=PW8KFCveQ9I.

Após ter a obra pronta a autora iniciou o processo de implementação, momento pelo qual, começou a pensar em como a obra seria exposta, chegando à conclusão de que a melhor forma seria em uma sala com 4 metros quadrados, com capacidade máxima de duas pessoas, onde o chão seria preto sem interatividade. Somente as paredes seriam interativas, com uma forma de meia esfera dando a sensação de infinito, sem arestas das paredes. Equipada com sensores de toque e projetores. Eis algumas referências:



Fig. 4. O espaço/execução (Creative Sky). Fonte: Aluna I (2024).

No apresentação do projeto e auto-avaliação, a autora indicou orgulho e satisfação em ver o artefacto pronto, após todas as fases, destacou ainda que a obra é altamente indicada para casais que queiram partilhar um momento íntimo e romântico a observar as estrelas, possibilitando sobretudo, a oportunidade de escrever palavras bonitas no céu e admirar as estrelas cadentes.

· De lá para cá e Sistema Solar

A obra de arte denominada "De lá para cá" é uma ilusão de ótica criada pelo aluno E, utilizando a linguagem de programação Java em Processing. O aluno desenvolveu uma composição visual abstrata,

que ultiliza princípios da Gestalt, provocando uma perceção distorcida da realidade.

A Gestalt é uma palavra de origem alemã que pode significar forma ou figura. Conforme essa teoria, o que acontece em nosso cérebro difere do que é captado por nossos olhos pois o ser humano não percebe as partes de forma isolada, mas seu todo. Nesse panorama, para se compreender as partes, é preciso antes compreender o todo [17], [18] e [19].

Na junção entre Gestalt e Processing, a utilização da programação permitiu explorar conceitos de profundidade, movimento e transformação, resultando em uma experiência visual e imersiva. Esta obra exemplifica a interseção entre arte e tecnologia, demonstrando como a criatividade pode ser expressa através do código.



Fig. 5. De lá para cá. Aluno Edgar Pereira (2024). Disponivel em https://youtu.be/bics1yWT4hc.

Nessa primeira obra Edgar Pereira, já notava-se algum refinamento e habilidade em programação, mas todavia ainda apresentava algumas lacunas no projeto, principalmente no desenho da narrativa e na meditação estética, a obra também não abarcava a audiência de modo ativo e nem apresentava uma experiência inovadora.

As cobranças nesse sentido apenas foram inseridas num contexto em que sabiamos que o aluno tinha capacidades de produção e maior evolução, que poderemos verificar no trabalho posterior.

O artigo "Enhancing student engagement through emerging technology integration in STEAM learning environments " de Maričić1 e Lavicza (2024) [14] destaca como a integração de tecnologias emergentes em ambientes de aprendizagem STEAM pode aumentar significativamente o engajamento dos alunos e fomentar a criatividade. Ao utilizar ferramentas digitais e arte interativa, os alunos tornam-se não só mais motivados, mas também desenvolvem competências críticas para a produção criativa. Além disso, o trabalho colaborativo em projetos digitais permite a troca de ideias e feedback, fundamentais para a evolução dos seus trabalhos. Assim, ambientes que promovem essa interação e utilização de tecnologia emergente favorecem processos de criação dinâmicos, onde os alunos podem interagir e aprimorar as suas produções, evidenciando o seu crescimento ao longo do tempo.

Nesse âmbito, na segunda fase do projeto, onde os alunos poderiam apresentar obras coletivas e utilizando outros softwares, além do Processing o aluno criou um dos trabalhos mais bem elaborados da turma. Sistema Solar consiste em um artefacto interativo. O sistema permite que os participantes visualizem os planetas girando em torno do sol e interajam com diversas funcionalidades, como ativar ou desativar a visualização das órbitas, ajustar a velocidade dos planetas, e visualizar um mini mapa do sistema solar. Outras funcionalidades incluem a capacidade de mover a câmera livremente, ajustar o zoom e obter informações detalhadas sobre cada planeta ao passar o rato sobre eles ou clicar. O projeto visava proporcionar uma experiência educativa e interativa, permitindo explorar o sistema solar de uma maneira envolvente e informativa.

O artefacto desenvolvido pelo aluno, impressionava pela riqueza de detalhes e as muitas funções desenvolvidas, ele não inseriu apenas o nome do planeta nas informações, mas todas as informações em detalhe como: Ano de descoberta, quem descobriu, tamanho e posição, entre outras, que poderão ser visualizadas no vídeo.

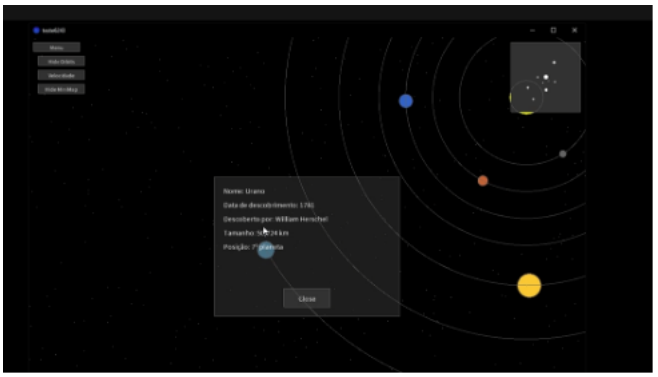


Fig. 6. Sistema Solar. Edgar Pereira (2024). Vídeo Disponível em https://youtu.be/81VIJQXw-n0.

A obra inicia-se quase que como um jogo: como o botão “start” e um menu onde a audiência escolhe a função que deseja ver, podendo interagir de várias formas. Nessa perspectiva, a gamificação na arte digital integra elementos de jogos para estimular a participação ativa, envolvimento criativo e compreensão estética. Ela transforma o processo de

criação artística em uma experiência interativa, onde os participantes exploram e co-criam a obra, ampliando o acesso e promovendo uma relação mais dinâmica entre arte e público [20].

· Nirvana (Samuel Nogueira)

A obra Nirvana, criada pelo aluno S, é inspirada nas séries animadas Jujutsu Kaisen (2020), dirigida por Sunghoo Park e baseada no mangá de Gege Akutami, e Chainsaw Man (2022), dirigida por Ryū Nakayama e escrita por Tatsuki Fujimoto. Em Jujutsu Kaisen, o personagem Mahoraga carrega uma Roda do Dharma (Dhammachakka), símbolo budista que representa o caminho para a iluminação. O aluno reflete sobre o ciclo de vida dos demônios em Chainsaw Man, onde eles renascem continuamente entre a Terra e o Inferno. Isso o levou a pensar sobre ciclos naturais, como o da água, oxigênio e a alternância entre dia e noite. Com essas influências, ele concebeu uma obra que explora a ideia de ciclos eternos na natureza e no universo.



Fig. 7. "Mahoraga", personagem da série Jujutsu Kaisen e o imagem do ciclo de oxigénio, inspirações da obra Nirvana. Samuel Nogueira (2024).

Durante o processo criativo, o aluno relata que inicialmente havia decidido fazer algo semelhante à roda do darma, que permitisse ao público interagir com a mesma. Chegou à conclusão que para além da roda principal, uma outra roda seria gerada no local e durante esboços e testes optou por um outro design, diferente do havia planeado no começo do projeto, entretanto, que o deixara mais interessado. Ao criar diversos quadrados continuamente não apenas implementaria o simbolismo de ciclos como também formaria uma ilusão de óptica que simulava uma forma tridimensiona, formada por quadrados sobrepostos cuja rota seria alterada pelo público ao interagir com o rato do computador.

O processo criativo é dinâmico e muitas vezes não linear; ao longo do desenvolvimento, surgem novos insights que levam a alterações no plano original. Tais mudanças não indicam falha, mas sim evolução, onde o artista ou criador descobre soluções que melhor atendem ao conceito em transformação, resultando frequentemente em um trabalho mais inovador e interessante. A autora Cameron [21] destaca que o processo criativo é um caminho não linear, onde as ideias iniciais são frequentemente alteradas e desenvolvidas à medida que o artista interage com seu trabalho, levando a resultados inesperados e inovadores.

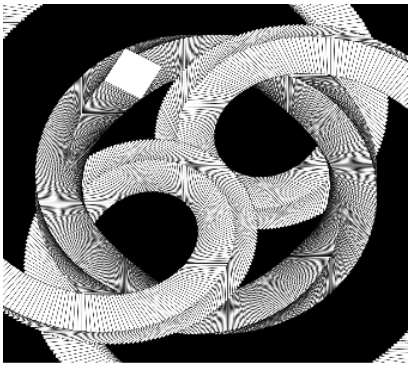


Fig. 8. Nirvana. Samuel Nogueira (2024). Vídeo disponível em https://youtu.be/EiWCYwET0jE.

Após o desenvolvimento e a implementação da obra, o autor menciona que enfrentou um segundo dilema: a escolha do nome. Ele desejava que o título refletisse de forma adequada o resultado final da obra. Considerando a ideia inicial da Roda do Dharma, o autor também se lembrou de outro conceito budista, o Nirvana, que representa um estado de espírito caracterizado por calma, paz e libertação. Ao contemplar sua obra, o autor experimentou uma sensação de tranquilidade e serenidade, e, dado que a Roda do Dharma é um conceito budista, concluiu que o nome "Nirvana" era a opção mais apropriada.

· Lines of Arte (Jorge Rocha)

O projeto Lines of Arte, do Jorge Rocha, representa uma intersecção entre programação e arte visual, utilizando a linguagem de programação Processing para converter imagens complexas em representações lineares simplificadas e expressivas. Inspirado pelo minimalismo e pela técnica de String Art, o projeto não apenas reinterpreta a estética visual por meio de um novo meio, mas também adota um processo criativo dinâmico e iterativo.

A influência do minimalismo se manifesta na ênfase em linhas limpas e na redução das formas à

sua essência, enquanto a inspiração na String Art se reflete na interação das linhas que criam padrões visuais. Essas duas influências se combinam para gerar uma obra que é simultaneamente simples e complexa, oferecendo uma nova perspectiva sobre imagens familiares. O uso tradicional de fios, pregos e madeira na String Art encontra um paralelo digital na aplicação de vetores e coordenadas no Processing, onde as linhas são "pregadas" na tela virtual.



Fig. 9. Inspirações do autor. Lines of arte. Aluno J (2024).

De acordo com o autor da obra Jorge Rocha, Lines of Arte não se limita a uma obra estática, mas se configura como um sistema dinâmico e em constante evolução. A documentação abrangente e o compartilhamento do código-fonte possibilitam que outros criadores adaptem e modifiquem o projeto, conferindo-lhe novas formas e significados. Cada participante da obra pode inserir fotografias e/ou imagens e o código pode ser alterado em tempo real. Esse aspecto colaborativo e evolutivo é fundamental para a filosofia do projeto, que enxerga a arte como um diálogo contínuo entre o criador, a comunidade e a tecnologia.

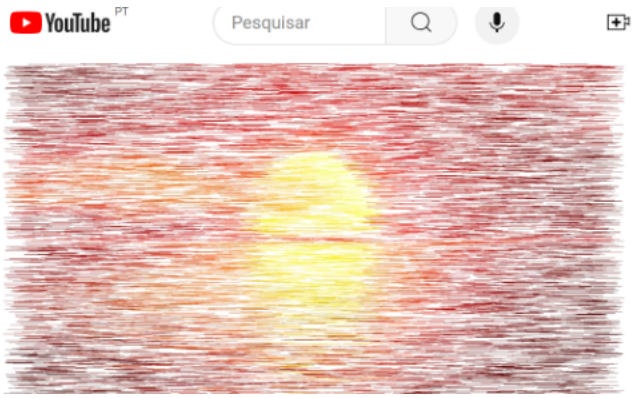


Fig. 10. Lines of arte. Jorge Rocha (2024).

Fig. 11. Em síntese, Lines of Arte exemplifica o potencial da programação como uma forma de expressão artística. O projeto demonstra como a tecnologia pode ser utilizada para reinterpretar e reimaginar o mundo visual, criando obras acessíveis, modificáveis e expansíveis. Como ressalta Paul Klee [21]: "A arte não reproduz o visível, mas torna visível" Assim, este projeto não apenas celebra a beleza das formas simplificadas, mas também convida à colaboração e à inovação contínua na intersecção entre arte e tecnologia.

V. RESULTADOS

As obras apresentadas foram desenvolvidas entre fevereiro e junho de 2024, no segundo semestre do ano letivo 2023/2024, com alunos do primeiro ano do curso de PMJD, na UC de Arte, cultura e comunicação na era digital, sob nossa regência, no IPMaia. A turma possuía 25 alunos matriculados, aos quais 17 eram frequentes e desses, 14 conseguiram desenvolver as obras digitais na linguagem de programação Processing, um total de 82,4 % de aproveitamento. Nesse processo criativo apresentar a obra significa completar todos os passos que iniciam com o desenho do conceito e concluem-se com a execução da obra, cujas apresentações se deram com as exposições dos artefactos na culminância do projeto em 07 de junho de 2024. Os resultados obtidos evidenciam a eficácia do ciclo de criação de arte pós-digital como metodologia de ensino.

Inicialmente, as quatro obras selecionadas para apresentação da presente análise destacam a diversidade criativa dos alunos e a capacidade de integração entre tecnologia e expressão artística. Cada obra reflete a aplicação dos princípios pós-digitais, que enfatizam não apenas a utilização de ferramentas digitais, mas também a reflexão crítica sobre o contexto cultural e social em que estão inseridas. O processo de criação descrito na metodologia, onde os alunos seguiram os 9 passos do ciclo de criação em arte pós-digital [6] permitiu que os alunos explorassem a intersecção entre arte e tecnologia de forma prática, fomentando a experimentação e a inovação. A pedagogia adotada incentivou o desenvolvimento de habilidades técnicas, como programação e design digital, ao mesmo tempo em que promovia a reflexão sobre temas contemporâneos, como a identidade digital, a estética da informação e a sustentabilidade.

TABELA 1. ANÁLISE DOS ARTEFACTOS

Artefacto	Artista	Técnicas Utilizadas	Temas Abordados	Feedback do Público
Creative Sky	Aluna I	Programação, Design Gráfico Interatividade	Identidade Digital, Natureza, Conexão entre Realidade e Virtualidade	Positivo, elogiado pela originalidade e leveza da abordagem do tema.

Sistema Solar	Aluno E	Programação, Animação, Interatividade	Astronomia, História, Estética da Informação	Elogiado pela complexidade e riqueza de informações, além da alta interatividade
Nirvana	Aluno S	Programação, Design Gráfico Interatividade	Séries e jogos Ciclos da vida Ilusão Optica	Apreciado pela criatividade conceptual, intersecções
Lines of arte	Aluno J	Programação Fotografia Digital, Edição	Programação, Design Gráfico Fotografia digital String Art	Comentários sobre a criatividade e o exercício proposto.

Tabela de análise das obras aoresentadas . (Fonte: Autora, 2024).

O trabalho colaborativo ao longo do semester gerou na turma um ambiente de troca de ideias e feedbacks construtivos, contribuindo para a evolução das obras ao longo do processo. Os alunos relataram um aumento na confiança em suas capacidades criativas e técnicas, resultando em propostas artísticas mais ousadas e reflexivas. A análise das obras finais revelou uma série de tendências comuns em relação às temáticas e conceitos, incluindo o uso de formas geométricas simples, ilusão óptica, a exploração de cores vibrantes e a incorporação de elementos interativos, das 14 obras apresentadas, apenas um explorava a arte sonora. Esses aspectos não apenas refletem o aprendizado individual, mas também as discussões coletivas que ocorreram durante as aulas, mostrando uma compreensão compartilhada dos conceitos abordados.

Em suma, os resultados demonstram que a implementação do ciclo de criação de arte pós-digital foi fundamental para o desenvolvimento artístico e crítico dos alunos, preparando-os para os desafios contemporâneos da prática artística em um mundo cada vez mais mediado por tecnologia. O sucesso das obras apresentadas não apenas destaca a competência adquirida pelos alunos, mas também reafirma a importância de metodologias inovadoras no ensino da arte na era digital.

VI. CONSIDERAÇÕES FINAIS

As obras desenvolvidas pelos alunos na unidade curricular de Arte, cultura e comunicação na era digital demonstram a eficácia da metodologia adotada e a capacidade dos estudantes em integrar tecnologia e expressão artística.

"Creative Sky", criada pela aluna Inês Ângelo, reflete uma experiência pessoal que evoca a liberdade de expressão e a conexão emocional com o céu noturno, permitindo ao público a interação na formação de constelações. exemplifica a conexão entre experiências pessoais e interatividade tecnológica. A autora transformou uma memória emocional em um artefato digital que permite aos usuários criar constelações, promovendo engajamento e liberdade criativa. Essa obra ilustra como a arte pode servir como um meio para transmitir sentimentos e criar momentos significativos de contemplação.

A ilusão de ótica apresentada na obra "De lá para cá" pelo aluno Edgar Pereira, utilizando os princípios da Gestalt, destaca a complexidade da percepção visual e a forma como o cérebro processa informações. Este trabalho não só provoca uma reflexão sobre a realidade, mas também exemplifica a intersecção entre arte e ciência, onde a programação se torna uma ferramenta para explorar conceitos psicológicos. Baseada em princípios da Gestalt, esse trabalho inicial demonstrou as potencialidades da programação para criar ilusões ópticas, mas também evidenciou a necessidade de equilibrar a técnica com a interação do público e a narrativa estética. Essa evolução pedagógica foi essencial para que o aluno desenvolvesse "Sistema Solar", uma obra mais madura que une interatividade e conceitos científicos, resultando em uma experiência educativa e visualmente rica. Essa obra não apenas proporciona uma compreensão mais profunda do universo, mas também incentiva a curiosidade e o aprendizado ativo.

A obra "Nirvana", desenvolvida pelo aluno Samuel Nogueira, demonstra a habilidade em amalgamar referências culturais contemporâneas por meio de series e videojogos com questões filosóficas sobre ciclos naturais e existenciais. Essa criação reflete um entendimento profundo das influências do meio e da cultura, e como estas podem ser incorporadas na arte digital, oferecendo ao público uma experiência de reflexão sobre a vida, a morte e a eternidade.

Por fim, "Lines of Arte", do aluno Jorge Rocha, representa uma inovadora abordagem na aplicação da programação para reinterpretar a arte visual, fundindo o minimalismo com a técnica da String Art. Essa obra exemplifica como a arte digital pode desafiar percepções tradicionais, oferecendo novas formas de expressão e interação.

Os resultados obtidos ao longo deste projeto são evidentes: 83% dos alunos conseguiram concluir e apresentar suas obras, refletindo um alto índice de aproveitamento e engajamento. O ciclo de criação em arte pós-digital desenvolveu habilidades técnicas em

programação e design além de fomentar uma compreensão crítica sobre a intersecção entre arte e tecnologia. A metodologia aplicada revelou-se eficaz para promover a reflexão sobre questões como identidade digital, arte conceptual, criatividade e a interação na obra de arte. A dificuldade de alinhar tecnologia e estética, um desafio central para artistas em todos os tempos é superada quando a pedagogia privilegia a reflexão crítica e a experimentação prática, garantindo que os artefactos finais sejam tanto tecnologicamente funcionais quanto artisticamente coesos

Em projetos futuros desejamos ampliar a exploração dessas intersecções, incentivando os alunos a aprofundarem-se em temas emergentes e a desenvolver obras que dialoguem com a tecnologia, mas que, sobretudo, sejam relevantes no contexto cultural e social contemporâneo. O fortalecimento dessa abordagem integrada poderá enriquecer ainda mais a formação dos alunos e contribuir para um ambiente académico que valorize a criatividade, a inovação e a reflexão crítica.

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REFERENCES

[1] A. F. Marcos. "Artefacto computacional: elemento central na prática artística em arte e cultura digital". Revista Lusófona de Estudos Culturais, 2017, vol.3, n.2.

[2] M. Tavares."Reflexões sobre o ensino e a investigação em Artes – do Positivismo à Complexidade." In: II Seminário Internacional Ensino da Arte: Culturas e Práticas do Cotidiano, realizado de 14 a 16 de Outubro de 2015, no Centro de Artes/UFPel, em Pelotas, RS. Paralelo 31. Disponível em https://periodicos.ufpel.edu.br/index.php/paralelo/article/view/10194/6723.

[3] A.Oliveira."Mentes digitais. A ciência redefinindo a humanidade." Tradução Jorge Pereirinha Pires. Lisboa: IST Press, 2018, p.7.

[4] R.Sapucaia. "Quintal dos sons: um caminho para a imersão sonora". Tese de doutoramento em Média-arte digital, Universidade aberta em associação com a Universdiade do Algarve, 2022. Disponível em http://hdl.handle.net/10400.2/12039.

[5] C. Reas. " Ideia, plataforma, processo, domínio". In: Configurações do pós-digital: Arte e cultura tecnológicas. Organizadores: Pablo Gobira, Tadeus Mucelli. Belo Horizonte: EdUEMG, 2017. ISBN: 978-85-62578-99-1.p. 19-23.

[6] S. Pereira; A.F. Marcos. "O processo criativo na era Pós-Digital: Uma reflexão crítica baseada na prática artística." In Proceedings of 2nd International Conference on Transdisciplinary Studies in Arts, Technology and Society. ARTeFACTo2020. November 26-27, Faro, Portugal, 2020. Disponivel em: https://repositorioaberto.uab.pt/bitstream/10400.2/10403/1/Pereira%26FMarcos-ARTeFACTo2020.pdf

[7] L.Candy. "Practice-Based Research: A Guide. Creativity and Cognition Studios".University of Technology, 2006.

[8] G. Sullivan, G. "Art practice as research: Inquiry in visual arts" (2nd ed.). Thousand Oaks: SAGE Publications, 2010.

[9] E.W.Eisner. "The arts and the creation of mind." Yale University Press, 2002.

[10] R.L. Irwin. "A/r/tografia: uma mestiçagem metonímia". In: Dias, Belidson; Irwin, Rita L. (Orgs.). Pesquisa educacional baseada em arte: a/r/tografia. Santa Maria: Ed. Da UFSM, 2013, p. 125-135.

[11] P.Alves da Veiga. "A/r/cografia – A Criatividade Investigada na Investigação Criativa". In Diogo Marques & Ana Gago (Eds.), Investigação-Experimentação-Criação: em Arte-Ciência-Tecnologia. Lisboa: Universidade Fernando Pessoa, 2020, pp. 51-74.

[12] M. Resnick. "Lifelong Kindergarten: Cultivating Creativity through Projects, Passion, Peers, and Play." Cambridge: MIT Press, 2017.

[13] S. Papert. "Mindstorms: Children, Computers, and Powerful Ideas." New York: Basic Books, 1980.

[14] M. Maričić1; Z. Lavicza. "Enhancing student engagement through emerging technology integration in STEAM learning environments". In: Education and Information Technologies, Springer, 2024. Available in: https://doi.org/10.1007/s10639-024-12710-2.

[15] W. Lieser. "Arte Digital". Tradução: Helena Morbey. Brandenburg: H.F Ullmann, 2009. ISBN: 978-3-8331-5341-9.

[16] K. Sanders. (Ed.). "Interactivity and the future of the human-computer interface". IGI Global. Hershey, PA: IGI Global, 2020.

[17] R. Arnheim. "Arte e Percepção Visual, uma psicologia da visão criadora". Livraria Pioneira Editora, 1998.

[18] A.Dondis. "Sintaxe da linguagem visual". São Paulo: Martins Fontes, 2003.

[19] J. Filho. "Gestalt do Objeto: sistema de leitura visual da forma". São Paulo, SP: Escrituras Editora, 2007.

[20] K. Delgado-Valdivieso; S. Sevilla-Vallejo & N. Suarez-Monzón. "Gamification and artistic education: History of education and application to the classroom with educational needs". Journal of Namibian Studies: History Politics Culture, 2023, 33(2), 3253–3275. Available in: https://namibian studies.com/index.php/JNS/article/view/967.

[21] J. Cameron, "The Artist's Way: A Spiritual Path to Higher Creativity." New York: Profile Books Ltd, 2021.

[22] P. Klee. "Schöpferische Konfession". Em H. B. Chipp (Ed.), Theories of Modern Art: A Source Book by Artists and Critics (pp. 182-185). Berkeley: University of California Press, 1968.

Among Carnations and Fragments: Bodies in Video Performance

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Abstract—This article explores the relevance of video performances in the contemporary context, highlighting how works such as "Fragments," "Am I?," "Ser," "Cravo," and "Ready?" address critical issues related to the body, identity, gender, and oppression. Through the analysis of these productions, the work underscores the capacity of video performance to challenge social norms and foster dialogue about the deconstruction of identity, allowing for a more authentic representation of human experiences. Positive outcomes include aesthetic innovation and the visibility of marginalized voices. However, the article also acknowledges the challenges artists face in expressing intimate experiences and seeking recognition within the art field. The objectives were achieved by providing a critical reflection on the intersection of art and identity, suggesting the continuation of research by exploring new themes, creating ciber performances, and interdisciplinary collaboration. The future of this work points towards a deeper understanding of audience reactions and the social impact of video and ciberperformances, emphasizing the need to broaden the understanding of the complexities of bodily representation in art.

Keywords—videoperformance, digital art, creative process, body, identity

I. INTRODUÇÃO

Este artigo apresenta os processos criativos envolvidos no desenvolvimento de videoperfomances, um exercício proposto durante as aulas da unidade curricular de ciberperformance, no corrente ano letivo, na Universidade da Maia, no Porto, Portugal. Esta UC, começou a ser selecionada no ano curricular de 2023/2024, enquanto continuidade do projeto de investigação CyPet (Desenvolvimento de um modelo pedagógico novo para o ensino de ciber-performance no ensino superior), financiado pela FCT (Fundação para a Ciência e Tecnologia) e acolhido pela Universidade do Algarve em parceria com a Universidade Aberta e a Universidade da Maia , tinha como objetivo explorar a teoria e prática da ciberperformance a partir dos ângulos criativo, performativo e comunicacional, bem como propor um modelo pedagógico para a inclusão da ciberperformance em currículos académicos.

São apresentados conceitos téoricos sobre a videoarte e como veio a desempenhar um papel crucial na documentação de performances e instalações na década de 1970, atraindo artistas pela ausência de uma narrativa consolidada no campo. A videoarte, enquanto videoperformance, nesse panorama, se difundiu por meio da transformação de performances em obras documentadas e da integração da linguagem do vídeo à linguagem corporal.

O termo performance é empregue em variadas áreas. Tendo origem proveniente do latim, a palavra é composta pelo prefixo *per* que significa executar ou desenvolver uma atividade, somada à palavra *formare*, que quer dizer formar, dar forma, estabelecer. De modo abrangente, o conceito de performance liga-se à noção de desempenho [1]. A linguagem performativa, nesse âmbito, explora em sua essência o corpo e os seus limites compreendendo que a performatividade do corpo não é apenas uma expressão, mas um meio de

escapar das normas opressivas, permitindo a construção de novas identidades em espaços performáticos [2].

Ao longo desse artigo são apresentadas cinco videoperformances: "Fragments", que investiga a multiplicidade da identidade humana; "Am I?", que aborda de modo intimista o borderline e a sua ligação com a glitch art; "Ser", que critica a estrutura binária de género; "Cravo", que aborda o abuso físico e emocional; e "Ready?" reflete sobre a interrupção da normalidade da nossa vida para entrar num estado de fuga constante. Esses trabalhos, elaborados na UC de Ciberperformance, com alunos do terceiro ano da licenciatura em Arte Multimédia, da Universidade X, exploram diferentes abordagens sobre a condição humana e as mazelas dos corpos, desde as fragmentações, aos transtornos, identidades, violências e refúgios. A seleção destas obras baseou-se na sua qualidade e relevância temática, visando proporcionar uma aplicação prática das teorias artísticas através da metodologia da investigação baseada em prática artística. (ABR).

As obras artísticas apresentadas são um primeiro exercício e ainda se transformarão em ciberperformances em uma segunda etapa a ser realizada ainda durante esse semestre letivo.

II. A VIDEOARTE, O CORPO E A VIDEOPERFORMANCE

No início, coube ao vídeo a tarefa de documentar os eventos de performances e instalações ocorridos na década de 1970. Muitos dos artistas que adotaram o vídeo nesta fase foram atraídos pelo meio precisamente pela ausência de uma história consolidada ou de um discurso crítico reconhecido no campo da arte [3]. O escritor norte-americano David A. Ross considerou essa carência de posicionamento crítico como um "Puro deleite… [4]. A responsabilidade pela cunhagem do termo "videoarte" é atribuída a Nam June Paik (membro do Grupo Fluxus), quando, em 1965, apresentou um vídeo a amigos no Café a GoGo, em Nova Iorque, EUA. Nesse contexto, o surgimento da videoarte coincide mais com uma operação comercial do que com uma descoberta propriamente artística. A autora também salienta que a difusão da videoarte ocorreu por duas vias: a primeira consistiu na transformação da obra performática em algo passível de ser documentado e registado após a sua realização; a segunda centrou-se na linguagem do vídeo, que se soma à linguagem corporal e aos processos de produção e manipulação do audiovisual [5].

Já a videoperformance ou performance vídeo, mais do que a junção entre videoarte e performance, carrega em si a imagem em movimento ou o corpo-objeto, traduzido em obra artística, que se doa em manifesto. Nesse sentido, a noção que o corpo do performer é em si uma imagem e que, por consequência, produz e reproduz e multiplica imagens, quer seja fotografado, videografado ou não, foi desenvolvida por Sophie Delpeux (2010) em seu livro "O corpo-câmera: o performer e sua imagem", que toma como empréstimo a expressão corps-camèra da filófosa Catherine Perret.[6]. De facto, o corpo do performer, longe de ser um corpo neutro, é certamente um corpo social, atravessado por um repertório específico de gestos que são repetidos em ação, de forma consciente ou inconsciente, e mimetizados, desdobrando-se em novas imagens diferenciais. Neste contexto, a câmara fotográfica, através dos seus recursos automáticos, capta e torna visíveis certas nuances mínimas do nosso repertório de expressões involuntárias, as quais passariam despercebidas, não fosse a imagem que as realça e enfatiza [7].

Durante as aulas, além do contexto histórico e conceptual sobre a performance digital, os alunos foram convidados a criar uma videoarte com tema livre e desses trabalhos foram selecionados cinco videoperformances, cujos processo criativos serão detalhados no próximo tópico. Essas obras em suas diferentes abordagens retratam corpos e suas mazelas. Os alunos, em sua maioria, não têm a intenção de serem artistas performáticos, uma vez que, "o artista performático utiliza seu próprio corpo como suporte para sua arte, exercendo essa atividade em espaços tradicionais ou não, que corre riscos reais" [8]. Mas buscam através da performance apresentar o corpo como forma de expressão, vislumbrando o ato performático sob o viés representativo de um meio ideal para materializar os conceitos de arte, e, como tal, proporcionar uma aplicação prática das teorias [9].

III. METODOLOGIA

As videoperformances foram elaboradas no âmbito da UC Ciberperformance, no terceiro ano do curso de Arte multimédia, na Universidade da Maia, neste primeiro semestre do ano letivo de 2024/2025. Em 19 alunos matriculados, 17 apresentaram suas criações. Desse total, as 5 obras representativas neste artigo foram selecionadas pela qualidade/maturidade

do trabalho e o tema em comum "As diferentes representações do corpo", quase uma metalinguagem, mas que nos remete a visões múltiplas sobre vivências na contemporaneidade.

Dentre os objetivos da UC, relacionam-se com o desenvolvimento dessa atividade: contextualizar e aplicar conceitos no domínio da performance digital; compreender o lugar da performance nas culturas artísticas do século XX e XXI; apreender as reconceitualizações da performance num contexto digital.

Para o cumprimento dos objetivos propostos foi-se utilizada a metodologia ABR (Arte-Based Research). ABR é uma metodologia que coloca a prática artística no centro do processo de investigação. Artistas-investigadores utilizam atividades criativas — como a produção de obras de arte, performances, instalações ou experimentos com materiais — como uma forma de gerar conhecimento.

Na ABR aplicada à arte, o fazer artístico não é apenas um meio de expressão, mas também um processo investigativo que leva à compreensão de conceitos, estéticas e questões sociais. Em vez de separar teoria e prática, a ABR na arte vê o processo criativo como um método de investigação. O artista-investigador desenvolve uma prática artística e, ao longo desse processo, reflete sobre as escolhas feitas, os materiais utilizados e as interações com o público ou com o espaço, gerando conhecimento novo. [10],[11] e [12].

Nesse sentido, os alunos desenvolveram em duas semanas seus arfetactos (videoperformances), cujos processos criativos, descritos por eles, partilhamos a seguir:

IV. DESCRIÇÃO DAS VIDEOPERFORMANCES DESENVOLVIDAS

1. FRAGMENTS (Shirley Lopes)

A videoperformance "Fragments" explora a multiplicidade da identidade humana por meio de filmagens de rostos isolados de diferentes indivíduos. A ideia central da obra é destacar como ao isolar e recortar partes especificas do rosto - boca, olhos, nariz - e combiná-las em composições híbridas, podemos criar uma fusão única. Embora essas colagens fragmentem os rostos, a singularidade de cada individuo permanece reconhecível, com seus traços distintos que, mesmo ao serem desconstruídos e reconfigurados, mantêm aspetos únicos da identidade e da essência de cada pessoa.

O conceito do projeto nasceu da ideia de que, ao recortar partes do rosto, é possível criar uma narrativa visual que se concentre nas particularidades que definem a identidade humana. A princípio, a intenção era explorar partes do corpo de forma mais ampla, abordando a diversidade das formas corporais, mas a decisão final foi focar no rosto como o principal símbolo de identificação. Essa abordagem dialoga com a conceção de que o corpo é o ponto de encontro entre a experiência individual e o mundo ao seu redor, onde a identidade se manifesta tanto de forma visível quanto invisível [13]. "Fragments", tem em seu nome referência à ideia de "pedacinhos" ou "partes", a objetivo central é que cada fragmento contribui para a construção da identidade humana, refletindo a noção de que a nossa essência é composta de diversas influências e aspetos únicos [14].

A identidade, nesse contexto, é fluida, sempre em transformação e constituída por diferentes elementos que vão alem do corpo físico. Essa abordagem encontra mais paralelos nas ideias sobre a construção social da identidade, onde as influências culturais e interpessoais desempenham papeis centrais na formação do sujeito, revelando a multiplicidade e a complexidade do ser humano.[15]

1.1 Detalhamento do processo criativo

A fragmentação dos rostos evoca uma reflexão sobre a maneira como o corpo, na contemporaneidade, é frequentemente visto como um conjunto de partes que podem ser separadas e reorganizadas, sem perder a essência de sua individualidade. A representação do corpo como algo fluido e fragmentado, longe de ser uma unidade fixa, sugere uma constante negociação entre o eu e as normas sociais [16]. Ao longo do processo de criação percebemos que, mesmo ao desconstruir e recombinar as partes dos diferentes corpos, ainda se manteve a singularidade de cada indivíduo, refletindo como a identidade se sustenta mesmo quando suas manifestações visuais são modificadas.

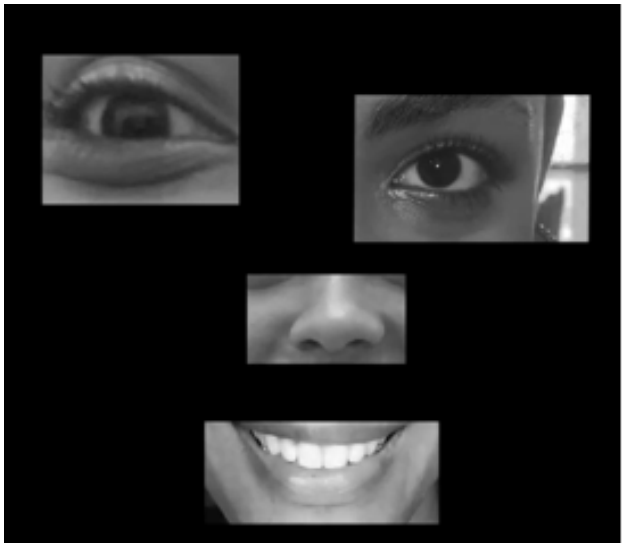


Fig. 1. Fragments. Fonte Shirley Lopes. (2024). Vídeo disponível em https://www.youtube.com/watch?v=zm2jjD94jxM.

Em relação às fases do processo criativo:

1º momento- Coleta de imagens: O trabalho começou com a coleta de vídeos de amigos e familiares, cuidadosamente selecionados para garantir uma diversidade de traços faciais e expressões. O uso de diferentes rostos enriquece o projeto, ampliando a ideia de multiplicidade dentro da identidade visual e emocional de cada pessoa.

2º momento- Edição e manipulação de vídeos: As ferramentas de edição digital, como a Rectangle Tool (Q) no After Effects, permitiram a fragmentação dos rostos em partes específicas, como os olhos, boca e nariz. Essa técnica de recorte foi usada para criar composições híbridas que, embora misturassem elementos de diferentes rostos, mantivessem as particularidades de cada um. Esse processo reflete a ideia de que o corpo e a identidade são fragmentados, moldados pela cultura e pelas interações sociais, mas nunca completamente dissociados de sua singularidade física [13][17].

3º momento- Manipulação da velocidade: A velocidade dos vídeos foi manipulada para acentuar momentos-chave, criando uma variação rítmica no vídeo. Por exemplo, uma piscada desacelerada no final do vídeo adiciona uma camada de introspeção e contemplação, reforçando a reflexão sobre o corpo e sua temporalidade. A desaceleração evoca uma sensação de proximidade, como se o tempo fosse alongado para permitir que se observe cada detalhe dos rostos apresentados.

4º momento- Estética visual em preto e branco: A escolha pelo preto e branco foi estratégica, servindo para destacar a textura dos rostos e as expressões faciais, enquanto elimina as distrações causadas pelas cores. A simplicidade visual remete à abstração do corpo, sugerindo que, apesar de suas características físicas, a identidade transcende a aparência externa [16].

5º momento- Som e atmosfera: A decisão de trabalhar com o som da respiração, elemento essencial à vida, fortalece a conexão com o corpo físico, trazendo o espectador para mais perto das figuras humanas representadas no vídeo. Esse som íntimo é complementado por risadas espontâneas, que adicionam uma camada emocional à obra, enfatizando o aspeto humano e único de cada indivíduo.

6º momento- Finalização: O equilíbrio entre fragmentação visual e sonora foi essencial na construção do projeto, que mantém um fluxo contínuo, apesar de trabalhar com pedaços desconectados de rostos. Ao final, o vídeo propõe uma reflexão sobre a complexidade do corpo e da identidade, sugerindo que, mesmo quando fragmentados, os indivíduos mantêm sua essência única.

"Fragments" não apenas questiona a ideia de identidade como algo fixo, mas também explora como a identidade humana é formada por múltiplas partes – sejam físicas, emocionais ou sociais. O vídeo representa a ideia de que a identidade não é monolítica, mas sim uma construção contínua, em constante transformação. A fusão de diferentes rostos no vídeo sugere que, apesar de sermos parte de um coletivo, cada pessoa carrega traços únicos.

2.AM I? (Patrícia Maia)

O tema representado na videoperformance, "Am I?", fala sobre a dificuldade constante que a artista tem em encontrar a sua personalidade, o seu verdadeiro eu. A obra tenta passar a impressão de desconstrução corporal utilizando a *glitch art* de forma a que o espectador consiga compreender o caos, sofrimento e desespero que a artista sente constantemente. A artista sofre de transtorno de personalidade *borderline* (TPB), o que faz que tenha os chamados "pensamentos preto e branco", ou seja uma instabilidade. Esta condição provoca dificuldades em manter equilíbrio na vida, incluindo a personalidade e o sentido do ser.

Este projeto traz revelações do íntimo da artista e sua partilha é um modo de espalhar empatia por outros que se sintam da mesma forma e sair da sua zona de conforto. O "Am I?" (traduzido "Sou?") é uma referência á confusão que a artista sente de não perceber quem realmente é. Sobre Transtorno de personalidade *borderline*: O transtorno de

personalidade *borderline* (TPB) é um distúrbio mental caracterizado por padrões de instabilidade emocional, relacionamentos interpessoais intensos e conflituosos, autoimagem distorcida e comportamentos impulsivos. As pessoas com TPB costumam ter dificuldade em regular suas emoções, o que pode levar a mudanças de humor intensas e frequentes [18]

Susanna Kaysen, autora do filme "Girl, interrupted"(1999) [19] escreveu uma autobiografia que detalha as suas experiências numa instituição psiquiátrica depois de ter sido diagnosticada com transtorno de personalidade *borderline*. O livro é um relato profundo da sua luta com a identidade, instabilidade emocional e saúde mental. Alguns artistas plásticos exploram temas relacionados ao transtorno de personalidade *borderline* nas suas obras, usando a arte como uma forma de expressar emoções complexas, instabilidade e experiências pessoais com o transtorno. Embora nem todos se identifiquem abertamente como pessoas com TPB, muitos usam as suas criações para abordar temas como a fragmentação de identidade, o medo de abandono e as emoções intensas.

2.I. Trabalhos relacionados

2.1.1. Infinity Mirror Rooms (2012)

A instalação possui salas espelhadas, cheias de luzes e padrões repetitivos que criam um ambiente imersivo onde o visitante perde a noção de tempo, espaço e, muitas vezes, de si mesmo [20]. A sensação de infinito e a incapacidade de distinguir o "eu" do ambiente podem ressoar com a experiência de quem sofre de TPB, que pode ter crises de dissociação ou instabilidade de identidade. A artista Yayoi Kusama é japonesa e amplamente reconhecida pelas suas instalações imersivas e obsessivas obras com bolinhas e padrões repetitivos. Embora Kusama não tenha sido diagnosticada com TPB, ela vive com uma série de transtornos mentais e já falou abertamente sobre lutas com alucinações e crises emocionais. A arte dela reflete a sua busca por controlo do caos interno, e suas obras frequentemente lidam com temas de obsessão, repetição e infinito, conceitos que podem ecoar as experiências de quem vive com instabilidade emocional intensa.

2.1.2. My Bed (1998)

Trata-se de instalação que mostra uma cama desfeita cercada de objetos pessoais, explorando sentimentos de vulnerabilidade, colapso emocional e crises pessoais. A obra é de autoria da artista britânica Tracey Emin [21], associada ao movimento dos "Young British Artists", e conhecida pelo seu trabalho profundamente pessoal e emocional. Ela frequentemente aborda questões sobre traumas, sexualidade, abandono e identidade, temas que muitas vezes estão conectados às experiências de pessoas com TPB. A sua arte conecta se fortemente à instabilidade emocional e aos comportamentos impulsivos.

2.2 Descrição do processo criativo

No caso da videoarte "Am I?" a artista tentou tornar visível os seus sentimentos e pelo que passa na sua experiência com *borderline*, materializar em diversas imagens o desespero, e o facto de parecer que existe sempre uma substância em si que não a deixa simplesmente ser. Essa substância, o TPB, está em todo o seu corpo, do interior ao exterior, parece que está sempre a encontrar espaços

Além das imagens com cenas caóticas a música utilizada como banda sonora é bastante confusa propositadamente para passar essa ideia de caos constante. Assim como a sobreposição de imagens em camadas, a utilização de *glitch art,* e a saturação exagerada das imagens para destorcer a realidade. Em termos técnicos de imagem, todos os planos foram gravados pela artista usando uma Canon 250d, a maioria dos planos foram gravados bastante perto do rosto da própria artista, de modo a potenciar que espectador possa captar as suas expressões de sofrimento. Todos os shots de tinta utilizados foram criados pela artista, uma técnica usada na arte do vídeo experimental, utilizando água e tinta chinesa preta. Todas as imagens foram sincronizadas com o respetivo som. Na execução foi usado a sobreposição de diversas imagens em movimento para causar caos intenso, para além disso o *color grading* tem um papel essencial na videoarte pois a extrema saturação e matiz mais azulada transmite uma sensação de confusão e solidão que a artista desejava passar.

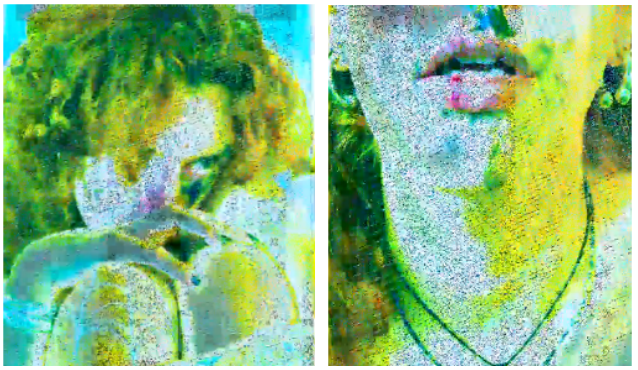


Fig. 2. Am I? . Fonte Patrícia Maia. (2024). Disponível em https://vimeo.com/1018196710/9060c226fe?share=copy.

A estética escolhida para a videoperformance apresentada foi a *glitch art*, que é uma forma de arte digital que utiliza erros, falhas e distorções em sistemas digitais como elementos estéticos, envolve a manipulação de arquivos digitais, software, hardware ou transmissões de dados para provocar esses "erros", que se tornam o próprio tema ou elemento da obra; é vista como uma crítica ou reflexão sobre a natureza da tecnologia e sua falibilidade. Ela desafia a noção de perfeição que muitas vezes é associada ao digital, transformando erros em parte integrante do processo criativo. Este movimento, embora recente, tem raízes em experimentações anteriores com erro e falha na arte analógica, como o movimento dadaísta e a arte concreta.

Muitos artistas de glitch art vêem beleza nos erros e nas falhas, utilizando essas imperfeições estratégia que converge na criação de mundos distorcidos e desorientadores, que representam e podem simbolizar a maneira como pessoas com TPB percebem o ambiente e sua própria identidade de forma instável. Um exemplo nesse campo é a artista Rosa Menkman, reconhecida pelas suas obras na *glitch art*. Ela não trabalha especificamente com o TPB, mas explora como a estética do erro e falhas tecnológicas, podem ser vistas como uma metáfora visual para a desordem interna e a dissociação, frequentemente experienciadas por pessoas com transtornos de personalidade. Em seu manifesto "The Glitch Moment(um), escrito entre 2006 e 2011 Menkman destaca sobre o valor das falhas e como elas revelam as fragilidades dos sistemas, algo que pode ecoar a vulnerabilidade psicológica em transtornos como o *borderline* [22].

Nesse sentido, a associação da *glitch art* e do *borderline* em Am I? busca de forma simbólica e conceitual, retratar como um TPB lida com a fragmentação, instabilidade e distorção da realidade.

3.SER (Kai Rocha)

"Ser" é um conceito que ressoa com a profundidade da nossa existência. Ser é mais do que apenas existir. Entre o que somos e o que o mundo espera que sejamos. Ser é questionar, é ir além das limitações impostas, é a busca por autenticidade. Como disse Jean-Paul Sartre, "o homem está condenado a ser livre" [23] ou seja, ser, envolve a responsabilidade de definir a própria essência num mundo que está constantemente a impor moldes. Ser é reconhecer que a essência humana é plural e multifacetada.

Heidegger [24] reforça essa perspectiva ao argumentar que a questão do ser é fundamental como ponto inicial da filosofia. Lembra-nos que ser não é algo estático, mas uma existência em constante transformação, sempre em diálogo com o tempo e o mundo. Assim, ser é habitar a liberdade de ser quem somos, sem amarras, sem categorias, simplesmente sendo.

A videoperformance "Ser" tem como intuito explorar questões de género, desconstrução de papéis e normas de comportamento. Propõe uma crítica à estrutura binária da sociedade, na qual apenas dois géneros são reconhecidos e onde expectativas rígidas moldam o que é "aceitável".

Como argumenta Judith Butler [17] o género é um ato performativo, ou seja, não é uma verdade interior, mas um conjunto de normas que são continuamente reiteradas através das nossas ações. "Ser" subverte essas expectativas ao expor a artificialidade das regras que governam o comportamento humano e ao revelar o desconforto social que surge quando os papéis de género são invertidos. Essa inversão revela a fragilidade das normas, que são mantidas apenas porque são repetidas e não porque têm um fundamento essencial.

Enfatiza como esses estereótipos limitam a liberdade individual e ignoram a diversidade de identidades e expressões de género. Simone de Beauvoir [25] na sua célebre afirmação "não se nasce mulher, torna-se mulher indica que o género é uma construção imposta pela cultura e não um destino biológico. Assim, ao explorar a inversão de papéis de género, "Ser" desafia a noção de que certas formas de comportamento ou aparência são inerentemente ligadas a uma identidade de género específica. Butler [17] complementa esta ideia ao afirmar que não existe uma identidade de género subjacente às expressões de género. Sugerindo que todas as expressões de género são apenas performances repetidas e não uma verdade oculta ou essencial sobre a pessoa.

A figura masculina, vestida apenas com um avental, faz uma crítica à sexualização da mulher. Ao adotar gestos e comportamentos estereotipadamente associados ao género feminino – como pintar as unhas, maquilhar-se e depilar as pernas – denuncia, de maneira irónica, a pressão constante sobre determinados grupos para manter uma imagem de perfeição. Butler [17] sustenta que o corpo de determinado género é performativamente construído pelas mesmas práticas discursivas que dissertam sobre ele. Isto é, ao assumir esses comportamentos, a figura expõe como certos corpos são moldados desde cedo a se verem como objetos de desejo, sujeitos a uma constante vigilância e controle, revelando como o

género é constituído pelas normas que regulam os corpos.

Por outro lado, a figura feminina adota comportamentos historicamente associados ao género masculino: gestos mais brutos, desinteresse pela aparência e atitudes descontraídas, muitas vezes grosseiras. Estes comportamentos, amplamente aceites em determinados contextos, geram desconforto quando performados por alguém que não se encaixa nas expectativas normativas de género. A sociedade patriarcal determina o masculino como o universal e o feminino como o particular, de modo que, ao romper com as expectativas impostas, as figuras no vídeo desafiam a norma hegemónica que dita o que cada género deve ser. Butler [17], por sua vez acrescenta que "os corpos não se encaixam perfeitamente nas normas reguladoras", indicando que os desconfortos gerados por essas performances alternativas expõem as falhas das normas em capturar a complexidade da experiência humana. Para Halberstam [26] as identidades de gênero são sempre instáveis e muitas vezes se rebelam contra as categorias rígidas que tentam defini-las, destacando como essas instabilidades revelam as limitações das normas sociais.

Ao ridicularizar os estereótipos de género, "Ser" denuncia a superficialidade dessas expectativas e expõe a necessidade de repensar os papéis de género como construções sociais e não como verdades naturais. A subversão das performances de género é uma forma de resistência, já que os atos performativos de género podem revelar e criticar a forma como as normas sociais são construídas. Essa ideia sugere que a performance de gênero não apenas reflete, mas também desafia as expectativas sociais existentes. Ao questionar a rigidez dos papéis de género, a videoperfomance abre espaço para novas formas de ser, que escapam às limitações impostas pela normatividade e permitem uma diversidade maior de identidades e expressões, livre de repressão ou opressão [17].

3.1. Descrição do processo criativo

A videoperformance "Ser" apresenta uma estética simples e crua, onde o lençol branco serve como fundo neutro, destacando as figuras e os gestos que elas performam. A escolha do lençol, com as suas marcas visíveis, sugere exposição e vulnerabilidade, reforçando a simplicidade do cenário e enfatizando que a ação e a performance são o centro da narrativa. Esta opção estética coloca a atenção totalmente nos corpos e na desconstrução dos papéis de género, permitindo que o espectador se concentre nas nuances de cada gesto e expressão.

A faixa preta que divide a tela não reforça apenas a ideia binária de género presente na sociedade, mas também sugere que as figuras parecem compartilhar o mesmo espaço, quando, na verdade, as suas experiências e realidades são distintas. Esta divisão visual enfatiza a artificialidade da dualidade de género e como ela é imposta socialmente, destacando como os papéis que associamos a cada identidade são limitadores e muitas vezes desiguais. A divisão não é apenas simbólica, mas uma crítica direta à rigidez das normas sociais de género.



Fig. 3. Ser. Fonte Kai Rocha. (2024). Disponível em https://www.youtube.com/watch?v=TYfUXJWlO-4.

Quando a figura masculina atravessa a faixa preta para entregar uma cerveja à figura feminina, ocorre uma inversão crítica dos papéis tradicionalmente associados a cada género. O gesto subverte a expectativa comum de que a mulher é quem serve o homem, criticando as normas sexistas que perpetuam a desigualdade. No entanto, apenas a mão atravessa a faixa na tentativa de simbolizar a fragmentação e objetificação, sugerindo que mesmo gestos que tentam transgredir a separação de género são frequentemente impessoais e desconectados de um reconhecimento verdadeiro da igualdade.

Esta passagem limitada, em que somente a mão ultrapassa a barreira, reflete como a tentativa de diminuir a distância entre os géneros é, muitas vezes, superficial e simbólica, sem realmente desafiar as estruturas que sustentam a desigualdade. A crítica, portanto, não se limita à existência de uma divisão, mas estende-se à forma como essa divisão é mantida e disfarçada por interações que parecem romper com as normas, mas que, na realidade, reforçam a sua rigidez. Ao evidenciar a persistência dos estereótipos, mesmo em ações que aparentam ser transgressivas, o vídeo revela a dificuldade de superar verdadeiramente os papéis de género socialmente impostos.

A paleta de cores neutras, focada no branco do fundo e nas roupas simples das figuras, juntamente com o uso de luz natural, contribui para uma atmosfera despojada e autêntica. Esta escolha estética tem como objetivo reforçar o caráter performativo e crítico do vídeo, afastando-se de qualquer tentativa de embelezamento visual, e apresentando as performances de maneira direta e sem distrações.

A música "Coronach", da Mad Gravity Studios, foi usada para ampliar o impacto emocional do vídeo. A peça começa com piano e violoncelo, o que transmite uma sensação de tristeza e aceitação do fim inevitável. À medida que as cordas entram, uma leveza é introduzida, mas o tom sombrio persiste, inalterado e absoluto. A intenção por trás dessa escolha musical foi criar um acompanhamento aparentemente calmo e simples, que, no início, está em sincronia com as imagens do vídeo, gerando uma harmonia que parece esperada. No entanto, à medida que o vídeo avança, o som começa a desalinhar de maneira milimétrica, rompendo a expectativa e provocando uma sensação de estranhamento e desorientação no espectador. Isto enfatiza a crítica aos papéis de género e reforça a ideia de que, por trás da aparência de normalidade, há algo profundamente dissonante nas normas sociais que governam a expressão de género. A música foi obtida gratuitamente através do site Freesound, um repositório de áudio que permite o uso de faixas sob licença Attribution 4.0, permitindo o uso livre desde que o criador seja devidamente creditado.

4.CRAVO (Ana Sofia Magalhães)

Cravo. Uma palavra que por si só enfrenta a dualidade inerente entre o compromisso à leveza e sedução de uma flor e enquanto verbo de forçar algo com profundidade. De cor sedutora e romântica, mas vermelha e sanguinária. Flor também reconhecida em Portugal, como símbolo da Revolução de 25 de abril, igualmente chamada de "Revolução dos cravos". A vídeoperformance "cravo", aborda temas como abuso sexual e físico, tendo duas camadas visuais representando a ideia do corpo emocional marcado através do corpo físico. O corpo emocional é sempre retratado como o subconsciente da personagem, local onde a morte da sua criança interior acontece.

Ao longo da obra, são utilizados objetos alegóricos, onde expressam a sensação de amarras e dor, por meio de uma fita cola, marcas, com tinta, e repressão, com um saco de plástico.

A escolha do título explora a ideia das marcas emocionais deixadas após uma violação física e emocional, fazendo uma metáfora ao ato de cravar algo. Dos temas abordados na obra temos:

4.1- Opressão e a Cultura do Silêncio

Numa sala onde o silêncio domina, não é o foco ou a concentração que prevalecem, mas sim uma quietude forçada. As vozes são suprimidas e os pensamentos condicionados à obediência, sem espaço para questionamento. Nesse ambiente, as pessoas estão fisicamente presentes, mas as suas mentes permanecem controladas, reféns de uma opressão constante que limita qualquer forma de liberdade interior. Este é o retrato da sociedade opressora: uma fábrica de silenciamento onde o conhecimento é administrado como veneno, e não como remédio.

Paulo Freire, um educador e filósofo brasileiro amplamente reconhecido por suas contribuições à pedagogia crítica, aprofunda a relação entre educação, opressão e libertação. Freire acredita que existe uma estrutura social que passou por todo um processo opressivo, que estará intimamente ligado a relações de poder. Este processo acaba por ditar um paradigma à base de instituições ou classes dominantes, o que resulta de uma "estrutura social, enquanto fechada opressora" [27].

A cultura, em sua plenitude, reflete tanto a sociedade que fala quanto a sociedade que ouve e mantém-se em silêncio. Os indivíduos são levados a adaptarem-se passivamente, assimilando mensagens, imposições e mitos alienantes, acabando por tornarem-se quase como "objetos", sem questionar ou participar ativamente da construção de sua realidade. Este conceito dá-se como "cultura do silêncio", um termo também utilizado por Freire, que acaba por descrever uma situação em que indivíduos ou grupos de pessoas, muitas vezes marginalizados ou oprimidos, são silenciados de forma sistemática, impedidos de expressar suas opiniões.

> A cultura do silêncio reflete não somente a incomunicabilidade humana, mas as condições sócio-históricas nas quais homens e mulheres vivem e permanecem emudecidos, excluídos, silenciados, proibidos de ser, de dizer a sua palavra, de expressar-se e expressar o mundo, e em que o direito de "falar" é privilégio de uns poucos que silenciam as maiorias (classes semi-mudas ou mudas) [28].

Este tipo de dinâmica acaba por ter influências negativas para o opressor, tais como a exclusão e o silêncio, mas também para desumaniza e explora os oprimidos, impedindo-os de se reconhecerem como

sujeitos de sua própria história [29].

4.2. Opressão, Mulher Enquanto "O Outro" e Male Gaze

A teoria de Freire pode ser muito facilmente adaptada para uma realidade feminina. Por exemplo, Simone de Beauvoir [25], acredita que para compreender a questão de "o que é ser mulher?" seria preciso refletir na estrutura que foi imposta para a criação desse mesmo conceito. Por outras palavras, o padrão de medida do que entendemos como mulher foi historicamente definido por uma classe dominante, neste caso, o homem.

Esta ideia é fundamentada no livro "O Segundo Sexo" onde, a mesma, argumenta que, ao longo da história, a mulher foi definida sempre em relação ao homem, e nunca como um ser autónomo. Ela critica a tradição filosófica ocidental que, desde Aristóteles até Santo Tomás de Aquino, retrata a mulher como um ser inferior. Beauvoir cita que para Aristóteles, por exemplo, "A fêmea é fêmea em virtude de certa carência de qualidades" enquanto Santo Tomás a vê como um "homem inacabado" ou um ser occasional [25, p.10] Esses pontos de vista repetem-se em várias doutrinas religiosas e culturais, como na história bíblica de Eva, descrita como uma criação derivada de Adão, por meio de uma costela do mesmo, reforçando a ideia de que a mulher é um apêndice ou uma extensão do homem.

A definição feminina através do homem fica muito óbvia quando abordamos o assunto Male Gaze. Uma teoria proposta pela feminista Laura Mulvey no seu ensaio "Visual Pleasure and Narrative Cinema" (1975) e refere-se à forma como o cinema, retrata as mulheres a partir de uma perspectiva masculina heterossexual, transformando-as em objetos de desejo para o prazer visual do espectador masculino. "demonstrando a maneira como o inconsciente da sociedade patriarcal estruturou a forma cinematográfica." [30]. Ela argumenta que, a mulher é o objeto erótico fundamental do olhar masculino, um elemento essencial do espetáculo no cinema, mas sua presença visual muitas vezes interrompe o desenvolvimento da narrativa, congelando a ação em momentos de contemplação erótica.

Em um mundo caracterizado pelo desequilíbrio sexual, o prazer visual é dividido entre esferas ativa/masculina e passiva/feminina. O olhar masculino projeta a fantasia sobre a figura feminina, que é estilizada para corresponder a essa visão. Nesse contexto, as mulheres assumem um papel tradicional de exibicionismo, sendo simultaneamente observadas e exibidas, com sua aparência projetada para gerar um forte impacto visual e erótico. Assim, pode-se afirmar que elas encarnam a condição de serem observadas, constituindo o *leit-motiff* do espetáculo erótico [30]. Desta forma, através da ideia de que a humanidade definiu o homem como sujeito absoluto, a mulher acaba por cair numa categoria do "outro".

4.3. Opressão enquanto Abuso Físico

Definir um acontecimento tão delicado quanto o abuso é quase superficial tendo em conta todas as questões atreladas.

No caso da Ordem dos Psicólogos, o abuso sexual é definido como um ato de agressão em que uma pessoa ou grupo força outra a participar ou presenciar atividades sexuais, sem que essa pessoa tenha consentido ou desejado. Além de ser uma questão de sexo, trata-se também de uma tentativa de impor controle e poder sobre alguém. "O abuso sexual não é apenas sobre sexo, é também uma tentativa de exercer poder sobre alguém" [31]. Já o The World Health Organization [32] define abuso sexual como qualquer ação de natureza sexual ou tentativa de realizá-la, usando pressão ou coerção, independentemente de quem seja a pessoa envolvida ou sua relação com a vítima, e pode ocorrer em qualquer situação. Isso inclui o estupro, que acontece quando há penetração forçada ou imposta da vulva ou do ânus com um pénis, outra parte do corpo ou objeto, tentativas de estupro, toques não desejados e outras formas de abuso que não envolvem contato físico direto.

A violência e o abuso sexual são problemas profundos e generalizados que afetam milhões de pessoas em todo o mundo. De acordo com uma análise da OMS, conduzida entre 2000 e 2018 em 161 países, cerca de 1 em cada 3 mulheres (30%) já foi vítima de violência física e/ou sexual, seja por parte de um parceiro íntimo ou por outras pessoas. Este dado revela o impacto alarmante e global do abuso, sublinhando a importância de uma resposta coletiva para proteger as mulheres e prevenir novos casos de violência [32].

Além disso, o abuso infantil também é uma preocupação crítica. Segundo estimativas recentes da UNICEF, quase 400 milhões de crianças menores de 5 anos sofrem regularmente agressão psicológica ou punição física em casa, com cerca de 330 milhões sendo vítimas de punições físicas. Este cenário evidencia a urgência de proteger as crianças de ambientes violentos e criar condições mais seguras para seu desenvolvimento [33].

Em Portugal, a violência íntima contra mulheres também apresenta números preocupantes. Um inquérito realizado em 2022 revelou que 10,3% das mulheres já sofreram violência física ou sexual nas suas relações, e esse número sobe para 22,5% quando se considera também a violência psicológica. Ainda, 77,4% dos crimes sexuais no país em 2022 tiveram como vítimas crianças e jovens, sendo a maioria (80%) do sexo feminino, e 90% dos agressores eram homens. Esses dados reforçam a necessidade de políticas públicas eficazes e de maior conscientização para combater a violência em todas as suas formas [34].

Posto isto, é possível dizer que o abuso sexual e/ou abuso físico é um problema sério social que adveio de questões estruturais e, consequentemente, patriarcais, que resultam num ato opressor onde a classe desmerecida é colocada como vítima. Como a autora Susan Brownmiller afirma no livro "Against Our Will Men, Women And Rape", embora nem todos os homens cometam estupro, o simples fato de que alguns o fazem é suficiente para criar medo e intimidar todas as mulheres. Esse medo generalizado é o que torna o estupro uma forma eficaz de "terrorismo sexual" no controle das mulheres. "Nothing more or less than a conscious process of intimidation by which all men keep all women in a state of fear." [35].

4.4. Descrição técnica

A videoarte "Cravo" está intimamente ligada ao abuso físico e/ou sexual e à sua forma de opressão e marcas emocionais que são, consequentemente, deixadas através de uma visível perfuração ou "cravamento", de limites tanto corporais quanto emocionais. A obra propõe-se leal ao posicionamento da vítima onde o corpo, o ato e as sequelas são os protagonistas.



Fig. 4. Cravo. Fonte Ana Sofia Magalhães. (2024). Vídeo Disponível em https://youtu.be/Umau_C9XpmU.

Decidiu-se, então, abordar ao mais real e crua a ideia de que existe um corpo, no sentido da palavra, físico, isto é, aquele presente na dimensão material e tocável, e um corpo emocional que está marcado, abusado e cravado pelos atos imposto no corpo principal. Uma espécie de carcaça onde apenas são visíveis as feridas num espaço interior humano.

Ambos cenários são representados numa dança entrelaçada e intermitente, onde o abuso em si é visível na camada "superior" e sensorial e as marcas desse mesmo espaço íntimo da vítima. Esta dinâmica é feita a partir de elementos alegóricos como a utilização da fita-cola que representa a dor e a restrição, o uso de tintas que faz associação as marcas que a mão do abusador deixou desenhado no corpo emocional da vítima, o som do choro do bebé que simboliza a morte da inocência, assim que o toque não consentido foi cravado e o saco de plástico que, quase como um casulo que conserva uma borboleta, simboliza a opressão da vítima e todas as consequências do abuso sexual e/ou físico. As consequências de abuso sexual podem ser devastadoras para o sentido de identidade e autoestima da pessoa. Vítimas de abuso frequentemente desenvolvem uma visão distorcida de si mesmas, sentindo-se culpadas ou responsáveis pelo que aconteceu [31].

A maior parte da exibição passa-se no universo físico, com o propósito de passar um mundo monótona, com o objetivo de trazer o espectador para uma linha temporal parecida com o real, deixando-a mais lenta e, naturalmente, mais tensa. Através do uso de filtro preto e branco, grande contraste entre sombras e luz e efeitos de ruído exagerados, acaba por provocar exagero no sofrimento, e o enaltecimento de ditas imperfeições e sensação crua ao sofrimento da vítima.

Em termos de processo técnico e criativo, utilizaram-se dois diferentes cenários para distinguir com maior facilidade ambos os espaços. No principal, num estúdio de fotografia, foi utilizado um fundo infinito preto, e um flash/projetor apontado num ângulo perpendicular com a personagem. Este efeito acaba por gerar mais contraste ainda nas sombras existentes, proporcionando o dramatismo procurado.
No secundário, foi-se concebido num ambiente caseiro onde, apenas com um lençol de fundo improvisado e com um led apontado a 40° da personagem. A ideia de filmagem num espaço intimista, acaba aproximando o espectador mais ainda do emocional da personagem, visto que retrata um espaço psicológico de subconsciente, onde é possível ouvir a morte da criança interior.

5. Ready? (Carlota Estrela)

"Ready?" surgiu de forma muito simplista há cerca de dois anos atrás, quando as guerras que nos revolvem atualmente os telejornais ainda estavam a estalar ou, no caso da maioria, começavam a ser

expostas na televisão. Com estes terrores a fazer os seus primeiros sismos na grande História, a autora começou a criar pequenas inquietações e de repente a questionar-se (também por ter a sorte de não estar tão próxima destes cenários), como será ter de interromper a nossa vida para entrar num estado de fuga constante.

Muitas pessoas - de várias regiões e países, muitos deles geograficamente nem sequer interligados - estão a ser obrigadas pela necessidade de salvaguardar a sua sobrevivência a deixar tudo para trás e, num ato horrível, correr. Correr do que as rodeou a vida toda, e levando consigo pouco ou nada, obrigadas a fugir de uma situação com a qual geralmente nem têm envolvimento. Em quantos livros se vê este tipo de cenários, a população numa corrida muitas vezes impossível contra uma bomba prestes a chegar? Este movimento intrínseco no ser humano, despoletado por tantas emoções e motivos, num quadro tão infeliz, injusto e mortífero.

Recuando um pouco no ato de gravação, existe uma clara tentação pelo conceito, metáfora, filosofia e ato de fugir no reportório da artista. O desenho do corpo na corrida, a tensão e relaxamento dos músculos num precipício constante que se procura controlar através de uma respiração muitas vezes irrefletida é de uma simplicidade bela e que desperta curiosidade. No interesse pelo estudo do corpo e do seu movimento, "Ready?" acaba também por revelar esta espécie de observação científica sobre um corpo que, limitado por condições pouco benéficas para a corrida, realiza vários sprints até perder o fôlego. De acordo com Abramovic [36] "Uma vez que você entra no estado de performance, você pode impelir seu corpo a fazer coisas que jamais você normalmente faria".

5.1. Descrição do processo criativo

O vídeo foi pensado para ser gravado no exterior de forma a integrar as reações e movimento das pessoas, numa espécie de paralelismo entre dinâmicas e estados. Apesar de ter sido pobremente transmitido na gravação, esteve muito presente no processo, seja por grupos que se juntaram a pedir fotografias como por pequenas interações de pessoas que, atrapalhadas, balbuciavam se deveriam ou não passar em frente, o que se transmitiu num pequeno tapete visual.

A nível de som, captado com os microfones Rode GO II, foi utilizado o áudio original da "respiração" - propositadamente descontrolada - captada durante a performance e tornou-se o som que dita o vídeo, algo que já tinha sido contemplado fazer mas que se revelou uma surpresa mais agradável do que o esperado.



Fig. 5. Ready? Fonte Carlota Estrela (2024). Vídeo disponível em https://youtu.be/vj6h6slu-K4.

Em termos de realizar o ato performático de correr, a performer acabou por ter de fazer mais sprints do que contava e o desgaste físico foi sentido. Para além disso, escolheu não aquecer previamente, visto que queria recriar essa surpresa de só partir numa corrida sem ter os músculos prontos, e ter a surpresa do comportamento do corpo sendo observado perante a situação. Tal como indica Goldsbeg [9] tivemos um corpo como o principal meio expressivo. O corpo da performer e em torno dele tudo se desenvolveu.

Relativamente à edição, o vídeo foi corrompido através de *datamoshing*, uma técnica que se inspira nos *glitches* que apareciam no início dos anos 2000. Este elemento surgiu com a intenção de seguir o mote de *glitch art*, ou seja, destruir a perfeição e encontrar a beleza no não tradicional (desconstruindo assim o encanto da corrida) e de forma a descontextualizar a imagem, tirando o espectador do espaço normalizado e comum da cidade, e colocando-o num cenário mais distópico. Isto foi experimentado através do *After Effects*, software também utilizado para o som, que relevou a vantagem de ter à disposição da artista uma liberdade de manipulação da imagem muito maior, podendo corromper os frames sem se apropriar de filtros e, portanto, de forma manual.

V. RESULTADOS

Os resultados deste trabalho evidenciam a relevância da videoarte e de modo especial, da videoperformances como uma forma contemporânea de exploração da identidade, do corpo e da experiência humana. As cinco obras analisadas—"Fragments", "Am I?", "Ser", "Cravo" e

"Ready?"—demonstram abordagens distintas e profundas em relação aos temas do corpo e das suas intersecções com questões de género, trauma e identidade.

"Fragments" destaca a multiplicidade da identidade ao isolar e recombinar elementos faciais, sugerindo que a desconstrução pode revelar a complexidade do eu. "Am I?" explora a luta da artista para encontrar a sua identidade, utilizando técnicas de *glitch art* para expressar a confusão e o sofrimento associados a transtornos de personalidade, mostrando como as experiências internas podem ser manifestadas através da arte. "Ser" propõe uma crítica à rigidez das normas de género, desafiando a estrutura binária e as expectativas sociais que moldam a percepção do que é aceitável na sociedade contemporânea. "Cravo" aborda o impacto do abuso sexual e físico, utilizando duas camadas visuais que representam o corpo emocional em conflito com o corpo físico, refletindo sobre as consequências psicológicas de tais experiências. Por fim, "Ready?" investiga o movimento do corpo em corrida, revelando a tensão entre limitação física e a busca pela liberdade, enfatizando a beleza e a complexidade do movimento corporal.

Esses resultados nos permitem avaliar positivamente como as videoperformances, enquanto artefactos, oferecem um meio poderoso para a reflexão crítica sobre a condição humana, possibilitando novas narrativas e formas de expressão que desafiam as normas estabelecidas. E também como os alunos desenvolveram suas habilidades de relacionar conceitos, criação artística e competências técnicas no que tange a gravação, edição e montagem das obras. A metodologia aplicada, permitiu uma análise rica e multidimensional, que contribui para o entendimento das relações entre arte, identidade e experiência corporal na contemporaneidade. E de modo objetivo cumprimentos os

VI. CONSIDERAÇÕES FINAIS

As conclusões apresentadas neste artigo ressaltam a importância das videoperformances como um meio significativo para explorar e expressar as complexidades da identidade e da experiência corporal na contemporaneidade. A análise das cinco obras apresentadas—"Fragments", "Am I?", "Ser", "Cravo" e "Ready?"—revelou como estas produções artísticas abordam questões críticas relacionadas com o corpo, oferecendo diferentes perspectivas sobre as vivências humanas.

Os resultados positivos incluem a capacidade das videoperformances de desafiar as normas sociais e de género, promovendo um diálogo sobre a desconstrução da identidade e a luta por reconhecimento e autonomia. Além disso, as obras demonstraram a versatilidade do meio, permitindo que artistas emergentes explorem novas linguagens e abordagens estéticas que capturam a complexidade da condição humana.

Entretanto, alguns desafios foram identificados, como a necessidade de uma maior visibilidade e reconhecimento da videoperformance no contexto artístico mais amplo, bem como a dificuldade que os artistas enfrentam ao tentarem expressar experiências íntimas e traumáticas de forma acessível ao público; aquisição de equipamentos mais avançados e estúdios na universidade que ofereçam melhores condições em termo de câmaras, microfones e iluminação;

Os objetivos propostos foram alcançados ao se proporcionar uma reflexão crítica sobre a intersecção entre arte e identidade, mostrando como a videoperformance pode servir como uma plataforma para a expressão de vozes marginalizadas e experiências sub-representadas.

Para o futuro, este trabalho poderá ser expandido através da realização de novas videoperformances que explorem outras temáticas relevantes, a realização de ciberperformances que aprofundem esse tema e a inclusão de uma análise mais profunda das reações do público e do impacto dessas obras na sociedade contemporânea. A pesquisa pode também beneficiar da colaboração interdisciplinar, envolvendo áreas como a psicologia, para enriquecer a compreensão das complexidades que envolvem a performance e a representação do corpo na arte.

REFERENCES

[1] R.Sapucaia; C.Vieira., M. Tavares e I.Guerra Santos. "Da performance digital à ciberperformance: Transformação, transposição e inovação". ROTURA – Revista de Comunicação, Cultura e Artes, 3(1), 2023. eISSN: 2184-866. Disponível em : https://publicacoes.ciac.pt/index.php/rotura/article/view/135.

[2] Goodley and J. Perryman, "Beyond the 'terrors of performativity': dichotomies, identities and escaping the panopticon," London Review of Education, vol. 20, no. 1, Article 29, 2022. [Online]. Available: https://doi.org/10.14324/LRE.20.1.29.

[3] R.Sapucaia. "Quintal dos sons: um caminho para a imersão sonora". Tese de doutoramento em Média-arte digital, Universidade aberta em associação com a

Universdiade do Algarve, 2022. Disponível em http://hdl.handle.net/10400.2/12039.

[4] C. Meigh-Andrews. "A History of Video Art". 2ª ed. London, U.K.: Bloomsbury Academic, 2014, p.9.

[5] R.Ribeiro, R. "Corpo, videoarte e o papel das linguagens midiáticas na construção de sentido e visibilidade das artes visuais". Revista Comunicação Midiática, v.8, n.3,2013, pp.87-107, set./dez.

[6] S. Delpeux, Le corps-caméra: le performer et son image, Paris, France: Éditions de la Différence, 2010.

[7] L. Vinhosa." Videoperformance: corpo em trânsito." Revista Estado da Arte, Uberlândia. v.1, n.2, p.293-303, jul./dez, 2020. https://doi.org/10.14393/EdA-v1-n2-2020-57782.

[8] A.Andrade Bittencourt Silva. "O caráter multidisciplinar da arte de Celina Portella: um estudo sobre as inter-relações entre linguagens na obra Movimientos Detenidos". Trama: Indústria Criativa Em Revista, 2024, 10(1). Disponível em https://estacio.periodicoscientificos.com.br/index.php/trama/article/view/3129.

[9] R.Goldberg, R. "A arte da performance". Lisboa: Orfeu Negro, 2012. ISBN: 978-989-95565-0-8.

[10] L.Candy. "Practice Based Research: A Guide. Creativity and Cognition Studios".University of technology, 2006.

[11] G. Sullivan, G. "Art practice as research: Inquiry in visual arts" (2nd ed.). Thousand Oaks: SAGE Publications, 2010

[12] E.W.Eisner. "The arts and the creation of mind." Yale University Press, 2002.

[13] M. Merleau-Ponty." Phenomenology of Perception". London: Routledge & Kegan Paul, 1962.

[14] Bhabha, H. The Location of Culture. London: Routledge, 1994.

[15] Hall, S. Cultural Identity and Diaspora. In: Rutherford, J. (Ed.). Identity: Community, Culture, Difference. London: Lawrence & Wishart, 1990.

[16] Grosz, E. Volatile Bodies: Toward a Corporeal Feminism. Bloomington: Indiana University Press, 1994.

[17] Butler, J. Gender Trouble: Feminism and the Subversion of Identity. New York: Routledge, 1990.

[18] Chapman J, Jamil RT, Fleisher C. "Borderline Personality Disorder". Available: https://www.ncbi.nlm.nih.gov/books/NBK430883/. [Updated 2022 Jan 25]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022. Accessed 5/20/2022.

[19] J. Mangold, Director, Girl, Interrupted. Columbia Pictures, 1999.

[20] Y. Kusama. " Infinity Mirror Rooms" [Installation]. Tate Modern, London, UK, 2012.

[21] T. Emin." My Bed" [Installation]. Tate Gallery, London, UK, 1998.

[22] R. Menkman, R. "The glitch moment(um)". Amsterdam: Institute of Network Cultures, 2011. .Available: https://networkcultures.org/_uploads/NN%234_RosaMenkman.pdf.

[23] J.-P. Sartre. "O Ser e o Nada". 1st ed. Paris: Gallimard, 1943.

[24] M. Heidegger. Ser e Tempo. Lisboa: Edições 70, 1927.

[25] S.Beauvoir, S. de. "O Segundo Sexo". Lisboa: Dom Quixote, 1949.

[26] J. Halberstam, Wild Things: The Disorder of Desire. Durham, NC, USA: Duke University Press, 2020.

[27] P. Freire."Extensão ou comunicação?". Rio De Janeiro: Paz E Terra, 1983.

[28] D. C da Silva; L. Therrien. "Cultura do silêncio e educação libertadora". Educação, , 2022, 45(1), e38533. https://doi.org/10.15448/1981-2582.2022.1.38533.

[29] P.Freire. "Pedagogia do oprimido". Rio de Janeiro: Paz E Terra, 2019.

[30] G. O. Gabbard; K.Gabbard. "Film: Psychology, society, and ideology". Karnac Books, 1999.

[31] Ordem dos Psicólogos Portugueses. (s.d.). "Vamos falar sobre abuso sexual". Revisado por R. G. Barroso. Disponível em: https://www.ordemdospsicologos.pt/ficheiros/documentos/opp_vamosfalarsobreabusosexual_documento.pdf.

[32] World Health Organization. (n.d.). "Violence against women". Retrieved October 22, 2024. Available. https://www.who.int/news-room/fact-sheets/detail/violence-against-women.

[33] UNICEF." Nearly 400 million young children worldwide regularly experience violent discipline". Retrieved October 22, 2024. Available: https://www.unicef.org/press-releases/nearly-400-million-young-children-worldwide-regularly-experience-violent-discipline.

[34] N. Vásquez. "Uma em cada dez mulheres já sofreu violência física ou sexual na intimidade". PÚBLICO, 2016. Disponível em: https://www.publico.pt/2024/06/27/sociedade/noticia/dez-mulheres-ja-sofreu-violencia-fisica-sexual-intimidade-2095559.

[35] S. Brownmiller, Against Our Will: Men, Women, and Rape, New York, NY, USA: Simon & Schuster, 1975, p. 15.

M. Abramovic."Rhythm 0". Available:

https://artrianon.com/2017/10/10/obra-de-arte-da-semana-performance-ritmo-0-de-marina-abramovic/.

Cycle to Learn: Exploring Human-AI Relation Through Breath-Driven Interactive Art Installation

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Abstract—Knowledge of artificial intelligence emerges from the prior training process, where the parameters in the models repeatedly optimize themselves through iterations of forward and backward propagation. The unseen endeavors of these cycles fuel the accomplishment of the tools that are ultimately presented to the users. By penetrating the phenomenological results we are accustomed to, we critically reflect on the causality and materiality in this cyclical process. Just as AI models refine their understanding through countless data processing cycles, human life relies on the rhythmic breath cycle. This installation draws parallels between these two forms of intelligence, inviting participants to reflect on the shared cyclical nature of both. In the exploratory work Cycle to Learn (2024), we adopted real-time AI-powered generative tools to examine the rarely mentioned prior process of emergence together with the participants in an interactive audio-visual installation. The interaction design, which detects the unconscious cyclical breathing motion of the viewers, is also an experimental attempt in its instructional utterance and aims for deep embodiment and interrogative thoughts on the emergence of human intelligence and the relationship of our understanding to the knowledge and laws of the world through observations of periodicity.

Keywords—Artificial Intelligence, Creativity, New Media Art, Interactive Installation, Generative AI

I. INTRODUCTION

Cycle to Learn (2024) is an interactive audio-visual installation that fosters discussion on Artificial Intelligence in creativity from an unconventional perspective—the procedure during the training process. Models require numerous iterations to reach convergence. The repetition of the forward and backward propagation engines the emergence of this data-driven intelligence [1]. Penetrating the phenomenon of generative AI models, the artwork localizes its focal point on the odyssey of the process to emergence that comes from the cyclical gesture and its backstage endeavor that fuels the mechanics. It reclaims the underlying engineering methodology and the ontological evolution of AI as its artistic material, aiming to involve the participants through their logical understanding, tactile experience, and empathetic embodiment.

The artwork invites participants to enter the designated space without much instruction because the audience's breathing will be detected and interpreted by the real-time reactive audio-visual environment that synchronizes and flows with the distinct respiration patterns of each participant. We focus on breath because it is also the most fundamental cyclical activity being subconsciously executed to fuel and support a kind of intelligence—human intelligence. In many aspects, it is metaphorized by the procedure of AI, so we juxtapose them to foster a dual observation of these two types of intelligence. The use of a sensory system and real-time generative AI is critical in its prospect, as they facilitate the realization of vibrant interaction and immersive experiences and serve as wells from which we dig to see the inspiring results and insightful contemplation gush out.

The participant's breathing is also the main factor controlling the rhythm and interaction process. At different stages, human intelligence and artificial intelligence are emphasized. As shown in (Fig. 1), inhalation is the phase for exploring the human body, during which the participant will experience a deep inward listening to processed field recordings of body parts and organs while witnessing a slowly forming body; exhalation, in contrast, is the phase that shifts to AI when a cyclical event scene is being generated in real-time with iteratively improving audio and visual results. With generative AI tools for the visual aspect, we broaden the discussion to a universal scope on the dynamics of the emergence of knowledge and rules and the cyclical events that those processes root in. Walking into the space of the installation, the audience is not immediately well instructed but gradually learns how the audio-visual environment

reacts and follows their breathing while comparing the two emergent processes.

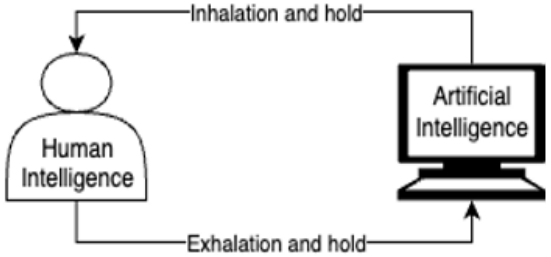


Fig. 1. The overall structure of respiration controlling different stages representing human intelligence and artificial intelligence.

The installation was presented as a performance installation at "Future Stage" in 2024 shown in (Fig. 2). It enables flourish conceptual discussion on the material and the interaction means, harvests artistic explorations on audio and visual creativity with AI-powered tools, as well as practical technical details that worth documenting. In the following sections, we will shed light on the mentioned aspects and conclude with some analysis of the feedback, discussions, and prospects.



Fig. 2. Performance of Cycle to Learn in Future Stage 2024. Photography by Dave Geffin.

II. CONCEPTUAL PROPOSITIONS

The piece offers two conceptual discussions. First, can the ontology of AI, including its materiality, causality, and chronic development, foster equally important and interesting insights as its functionality and phenomenon? Traditionally, various AI-powered tools for text [2], visual [3]-[5], and audio production [6]-[8] channel the art-making process with their results, the end point of their structure. Despite the black-box nature of machine learning models and their immediate disentanglement with semantic meanings within parameters and architecture [9], art practitioners still gain outcomes and confidence to work with them through epistemological inspections [10]. As the scale and complexity of the models expand, research interest for some AI scientists also lands around the behavioral phenomenon of the models [11], as some artists began to treat AI models

as communicative subjects as performers and audiences, highlighting the partnership and subjective decisions of AI models [12]. Although such an approach offers a promising interaction and is also an intended paradigm of many human-machine interfaces (HMI), it bypasses the step of becoming such an achievement, thus weakening the power of reasoning in their critiques. To extensively consider that contemplation, Neomaterialism [13] gives us a plausible perspective of reincarnating materiality in abstract symbols and behaviors. The training process of machine learning has similar habits in non-object structural data and neural network-based architecture and intellectualizes itself through recurrent processes of evaluation, optimization, and verification. Therefore, we march over the applicative surface that the models made ready for their users and inquiries in their often neglected no materiality.

The very piece of mosaic of the ontological material we analyzed and played with is the idea that the fundamental cyclical motions power the emergence of both artificial intelligence and human intelligence. Training iterations for AI and respiration for humans. However, these are not the only two cycles we live in and ride with. We artistically generalize the cyclical motion onto a broader scope to resolve the discussion of AI into a deterritorialized discourse. We scale the breathing period to a span that contains periods of many other cyclical events that humans have discovered, from a few milliseconds of subatomic particles to millions of years on the cosmic timescale,e as listed in Figure 3. Although not explicitly recognized as known intelligence behind those cycles, there are always rules and facts that we strive to understand and coexist with the two types of intelligence. For instance, the solar term in traditional Chinese agriculture is a cycle of 24 special stages that match particular astronomical activities or natural phenomena and lasts for about a year [14]. The invention of this calendar is an example of the ancestors trying to touch on the law of the earth and develop knowledge from the learning process by joining themselves into the repetitions. Life and death of ephemera, blossom and wither of flowers, waxing and waning of the moon, prosperity and declination of civilizations, glacier forming and melting of the

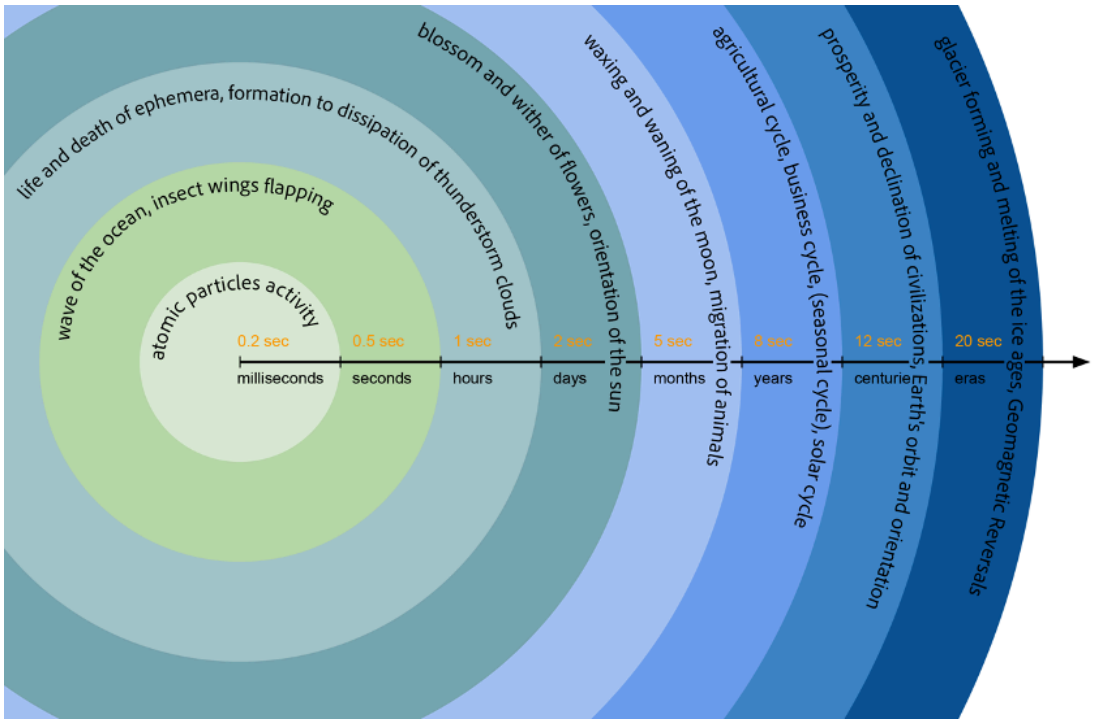


Fig. 3. Scaling the breathing period to a large span matches the tempos of various cyclical events. Above the scale in orange is the time of one breathing cycle. Under the scale in black is the time scope that the breathing period maps to. Inside the circle shows the symbolic objects that are used as prompts in the visual generation.

ice ages, whether perceivable by human beings or not, the cycles offer grippers for humanity to approach the world's truth. Moved by the unceasing and infinite periodicity, we display manifold cyclical elements as symbolic objects in the visual design to respond to the commonality of the emergence of understanding.

The second point for discussion is associated with the way of the interaction. Will realizing the unconscious activities of our bodies encourage deeper engagement and embodiment? In this piece, we discover the normally unaware respiration as a transcendent position that unifies different levels of embodiment. In the realm of cognitive philosophy, three levels of embodiment were coined as the neural level, the cognitive unconscious, and the phenomenological conscious experience [15]. Although many bodily-involved events mainly pertain to singular levels, the dependent constitution of the three is the key to the "personhood" of cognition [16]. Breathing interweaves among the three layers as the only medium of interaction. Controlled by the respiratory neural center, breathing inherits at the neural level in the model of cognition, and this piece grasps extraordinary awareness with interactive reinterpretation, nurturing a contextualized consciousness of the thematic core. We contradictorily enrich the most subconscious and autonomous breathing motion with the most intentional and exigent situation without setting prior anticipation with instructional utterance. Therefore, it becomes an unusual interaction experience in which the audiences are guided by their curiosity and comprehension. The interaction becomes more tangible and unexpectedly more engaging as the embodiment levels converge into the same gesture. It is described as a demanding setup due to the level of focus, the energy consumption, and eventually an uncanny hyperventilation feeling, according to the artists and some of the early experiences. In the end, plentiful physicality and tactile perceptions are brought to the foreground, opening up more channels for the nature of the bodies to communicate with the situation through a nurtured cognitive process.

III. RELATED WORKS

Various artists and researchers have explored the intersection of artificial intelligence, interactive art, and human physiology, each offering unique perspectives on the relationship between humans and machines. Our work, "Cycle to Learn," builds upon these foundations while introducing novel elements that emphasize the cyclical nature of AI learning and human respiration.

A. Generative AI and Interactive Art

The integration of generative AI into interactive art installations has evolved significantly over recent years, exploring themes of perception, intelligence, and human-machine interaction. Memo Akten's *Learning to See* (2017) [17] uses neural networks to interpret live camera input, creating abstract visualizations that challenge our perception of reality. Most recently, *Zhang's ReCollection* (2022-2024) [18] uses AI to create synthetic memories from participants' voice inputs, blurring the line between remembrance and imagination. Varvara & Mar's *Visions of Destruction* (2023) [19] employs generative AI and eye-tracking technology to transform viewers' gazing interactions into a critique of human impact on a generative landscape, emphasizing the urgency of ecological preservation. Scenocosme's *Phytopoiesis* (2024) [20] presents an innovative approach where a living plant generates images and sounds using AI, challenging our notions of intelligence and creativity. These works collectively demonstrate the potential of AI in creating dynamic, responsive environments that engage viewers in novel ways, each offering unique perspectives on the relationship between humans, machines, and creative expression.

B. Physiological Interactions in Art

The use of physiological signals in interactive art has a rich history, with artists exploring the creative potential of human biological processes. Christa Sommerer and Laurent Mignonneau's *Interactive Plant Growing* (1992) [21] was an early pioneer, using participants' biorhythms to influence the growth of virtual plants, creating a symbiotic relationship between human and digital life. Rafael Lozano-Hemmer's *Pulse Room* (2006) [22] uses participants' heartbeats to control an array of incandescent light bulbs, creating an immersive environment that visualizes collective human rhythms. George Khut's *Cardiomorphologies* (2011) [23] visualizes heart rate and breathing patterns, creating an intimate feedback loop between body and image. Scenocosme's *Souffles* (2011-2017) [24] transforms participants' breath into a tangible artistic medium, where breathing onto sensors generates and alters visual and auditory elements within the installation. These works collectively demonstrate how physiological data can be transformed into engaging, often poetic, visual experiences, bridging the gap

between the internal workings of the human body and external artistic expression.

C. Distinctiveness of Cycle to Learn

Our work, *Cycle to Learn* (2024), distinguishes itself through its innovative focus on the emergence of dual intelligence. Unlike most AI-driven artworks emphasizing results, this installation spotlights the iterative learning process, drawing a parallel between human respiration cycles and machine learning iterations. By incorporating real-time AI-generated visuals that respond to breath, the work creates a unique, personalized experience where participants witness and embody the emergence of intelligence. The multisensory engagement, combining breath-driven visuals with generative audio, creates a holistic, immersive environment that invites reflection on how human and artificial intelligence emerge through cyclical processes. This approach highlights the often-overlooked "neomateriality" of AI, focusing on its ontological evolution rather than just its outputs. By synchronizing the rhythms of breath with the iterative cycles of machine learning, *Cycle to Learn* challenges participants to consider how these two forms of intelligence emerge and evolve together, offering a novel perspective on the convergence of human and artificial cognition.

IV. METHODS

Implementing the conceptual idea involves the interaction design of the sensory system, the artistic decision of audio and visual with real-time generative AI, and the constitutive system that accomplishes the cohesiveness of the final presentation. We encountered various challenges regarding these facets, and this section elaborates on the solutions.

A. Technical Challenges

The realization of this interactive installation faces two principal technical challenges:

- How do we detect the user's breathing, a pivotal interactive element?
- How will we incorporate generative AI technology to create a real-time experience, and which AI framework will we utilize?

In the next two subsections, we will explain how we addressed the challenges that serve as the foundation for our system design in the following section.

1) Respiration Detection: To determine the best respiration detection methods for our art project, our preliminary research investigated common applications beyond creativity, including medical monitoring, fitness tracking, and wellness, to explore various techniques. We encountered two primary methods based on their technical requirements:

- Attached detection methods: These include techniques like Respiratory Inductive Plethysmography (RIP), Ecg-derived respiration (EDR), and Photoplethysmography (PPG), which require sensors to be physically attached to the body for monitoring respiration.
- Remote detection methods: These utilize technologies such as Ultra-Wideband Radar (UWB), Video-Based Detection, and Acoustic Signal Processing, which do not require physical attachment to the user's body.

Considering our objective to foster an interactive art experience that allows the audience to actively explore the installation, attached detection methods were deemed less suitable. They could introduce unintended medical or wellness connotations and restrict user movement during interaction. Consequently, we shifted our focus to remote detection methods.

Our exploration began with video-based detection, guided by Qiu's demonstration [25] using a standard webcam inspired by the Eulerian video magnificence framework [26]. This method tracks subtle color changes in a facial region of interest (ROI), indicating blood circulation and respiration. Although a typical webcam can detect these changes with a certain range of resolution color grades [27], challenges such as variable lighting conditions, user movement, and environmental factors limit its efficacy.

Further experimentation with a depth camera (KINECT) [28] also revealed limitations related to positional and postural constraints, proving impractical for our art installation setting, which requires providing a stable experience. After reflecting on these limitations and the need for flexibility in exhibition environments and participant interaction, we decided to pivot to Acoustic Signal Processing methods, which promise fewer constraints on user movement and environmental variability.

After evaluating the limitations of video-based detection for our art project and the technical challenges associated with timely access to radar technology, we have decided to utilize Acoustic Signal

Processing methods. In this approach, the sound produced by the participants is captured by a microphone directed towards the space. This audio is then analyzed in real-time using frequency subbands based on Fast Fourier Transform (FFT) methods implemented in Max for Live [29]. The energy distribution of the subbands is classified, and the breath is separated into four phases: the

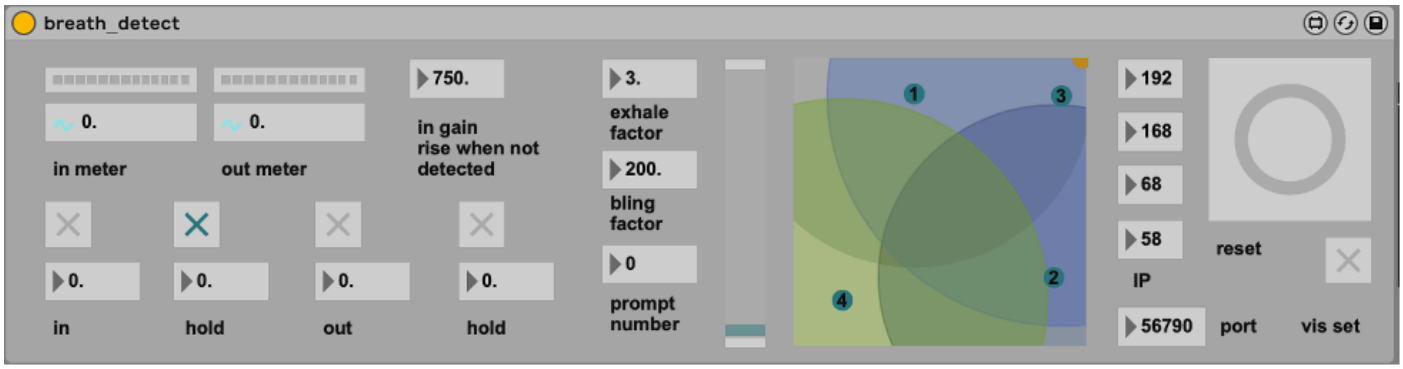


Fig. 4. Interface panel for breath detection. It comprises the illustration of the breathing phase, the relative amount of air in the lungs indicated by the fader.

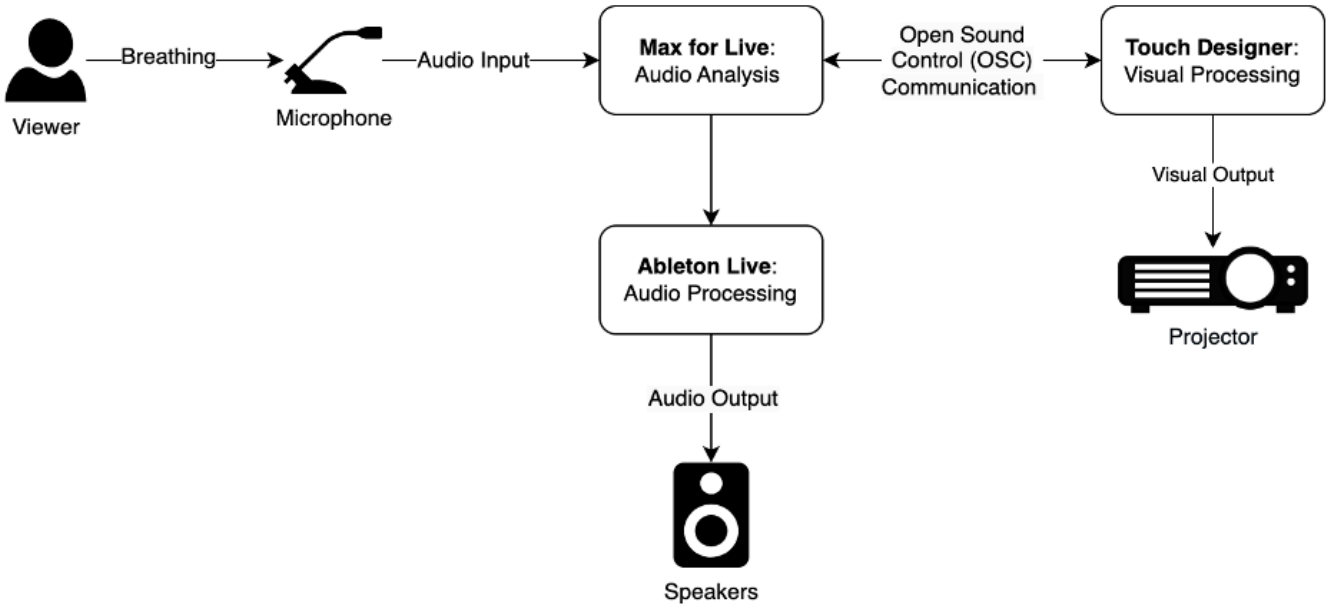


Fig. 5. Overview of the system architecture showing the interaction and communication among various elements.

Inhalation is the hold with air in the lungs, the exhalation and the hold with no air. This method supports sensitive capture of the breath period and the relative depth of the respiration according to the sound pressure. Figure 4 shows the interface panel that detects and illustrates the breathing phase, the relative amount of air in the body, and the rhythm and pattern of respiration.

1) Incorporating Generative AI for Real-Time Interactivity: Having confirmed using the Acoustic Signal Processing method with a directional microphone for real-time respiration monitoring, we now address the second technical challenge of integrating generative AI. Aiming to explore the core concept of intelligence's emergence through sound and visual design, we conduct different explorations in generative AI technology and seek what best serves our real-time performance.

- Image-based generative AI technology, particularly text-to-image generation, has

seen rapid advancements in recent years, driven by Latent Diffusion Models (LDM) [30]. These state-of-the-art synthesis methods, exemplified by models like Stable Diffusion, can produce a broad spectrum of realistic to abstract and conceptual images solely based on prompt input, employing extensive text-image pair datasets. While generation times can vary from a few seconds to several minutes depending on settings and computing power, the original framework for image generation still falls short of providing real-time experiences. Recently, research has shifted toward real-time generation solutions with LDM, including Latent Consistency Models (LCMs), which enable swift inference with minimal steps on any pre-trained LDMs [31]. SDXL-Turbo, a model that enhances real-time text-to-image generation by employing an Adversarial Diffusion Distillation technique [32], and StreamDiffusion, a diffusion pipeline designed for real-time interactive generation [33]. After exploring various methods, we found that StreamDiffusion has been adapted as a plugin for Touch Designer, a real-time visual programming tool. These plugins can utilize models like SDXL-Turbo to generate real-time imagery based on prompt and image-based inputs. TouchDiffusion [34] and StreamDiffusion-TD [35] offer convenient real-time AI artistic creation solutions. We ultimately decided to use StreamDiffusion-TD, which performs better with our limited graphics computing power and maintains a higher overall FPS for the project. The following section about the system design will explain how we integrate this technology into our workflow.

- Audio-based AI technology has plausible results in generating music-related material like symbolic-based notations or sample-based waveforms with high-level musicality, like music forms, chords, and melodies. However, regarding more undefined timbre and sound design, AI models rely heavily on training data of a generic style or input stimulus of the same modal due to abstractness and ambiguity. Despite the linguistic limitation, there are still efforts to understand and generate timbre and sound. RAVE [36] is one of the successful endeavors. It is a Variational AutoEncoder(VAE) [37] based real-time audio generation engine that transforms input audio to a particular quality and timbre of sound that the model studies. In this work, we use multiple models in RAVE to acoustically depict an emerging process from noise full of glitches to sounds with clear timbral features as a supplement to the visual generative process in the exhalation stage.

B. System Design

Based on our preliminary research, we first designed the overall system to conceptualize how the interactive elements function and communicate among different entities, as shown in Figure 5.

Using a directional microphone, we invite one viewer at a time to enter the space at a certain orientation to breathe towards it. The microphone captures the audio and feeds it into Max for Live at Ableton Live, the Digital Audio Workstation (DAW) for audio analysis as previously described. This analysis identifies the stages of "Breathing in, "Hold," "Breathing out," and "Holding," as well as the speed of breathing. The results are transmitted in real-time via Open Sound Control (OSC) to Touch Designer at the visual station, enabling audio and visual systems to utilize the respiratory data for interactivity. The following discussion in this section will separately detail our audio and visual systems.

1) Visual Design: For the visual design, the installation begins with an ambient scene of floating and sparkling particles, symbolizing the cyclical nature of existence. As the viewer interacts, their breath triggers a transformation: the particles synchronize with their respiratory rate upon inhaling, converging into a three-dimensional human body. Each body is uniquely generated through AI in real time, representing the collective existence of humanity. To develop these bodies, we employ StreamDiffusion-TD [35] as the live AI generation engine, with the output sent to TD-Depth-Anything [38] to create AI-generated depth maps. These depth maps are processed with OpenGL Shading Language (GLSL) to form the 3D symbolic objects, as shown in Figure 6.

During the holding phase, these AI-generated bodies remain static, symbolizing a pause or moment

of stillness. As the viewer exhales, the objects transform visually, echoing symbolic elements generated through dynamic prompt sequencing. First, the transformation is initiated by StreamDiffusion-TD. Then, visual effects are applied within the Touch Designer interface to create a sense of visual echoes before the objects gradually return to their particle state. The system selects prompts for the sequence based on the breath's duration, drawing from the conceptual cycle chart referenced in Section Ⅱ, which stores corresponding symbols. Each breath's characteristics dictate whether symbols representing fleeting moments like milliseconds or extended periods spanning years are displayed. The aesthetic reference can be seen in Figure 7.

In addition to focusing on individual breathing cycles, we expand the visual representation into the latent space for the "breathing out" stage. This reflects explicitly the "encoding" and "decoding" processes of diffusion models, where training images are compressed into noise or lower-dimensional representations in the latent space and later restored through decoding. To illustrate this process, we count each breath to transform the imagery—from scattered, fragmented aesthetics to clearer visuals as the number of breaths increases, as shown in Figure 7. If no breathing is detected for over 20 seconds, the count gradually decays back to zero, symbolizing a return to a formless state.

This sequence illustrates the fluid interaction between human and digital realms, emphasizing the synchronization of human and AI cyclical processes and the emergence of "dual intelligence." By creating these visual transitions, the design offers a ritualistic and exploratory experience, reflecting the seamless interplay between organic and engineered systems. This approach enhances both the technical integration and the immersive, reflective experience for the viewer, aligning with our goal of blending artistic expression with real-time interactivity.

2) Sound Design The sound design aims for a deep touchdown to both subjects and an organic collaboration with the visual. In line with the central theme of interaction, sounds that emulate body parts are played during the inhalation phase, whereas sounds with distinctive characteristics, such as unnatural glitches and artifacts, are introduced during the exhalation phase. Tinkling sounds resonate within the acoustic space during transitions, sonifying the particles that connect scenes.

In the inhalation phase, which focuses on the body, several field recordings and the real-time captured sound go through a live processing matrix of effects to create an inward listening experience. The resulting acoustics mirror the current state of breathing. For instance, steady, deep breaths trigger calming heartbeat sounds and a meditative ambiance, while rapid, shallow breaths result in turbulent, anxious sounds at a sophisticated tempo. These diverse sound types are mapped to the unique breathing patterns of each participant by compositional algorithms.

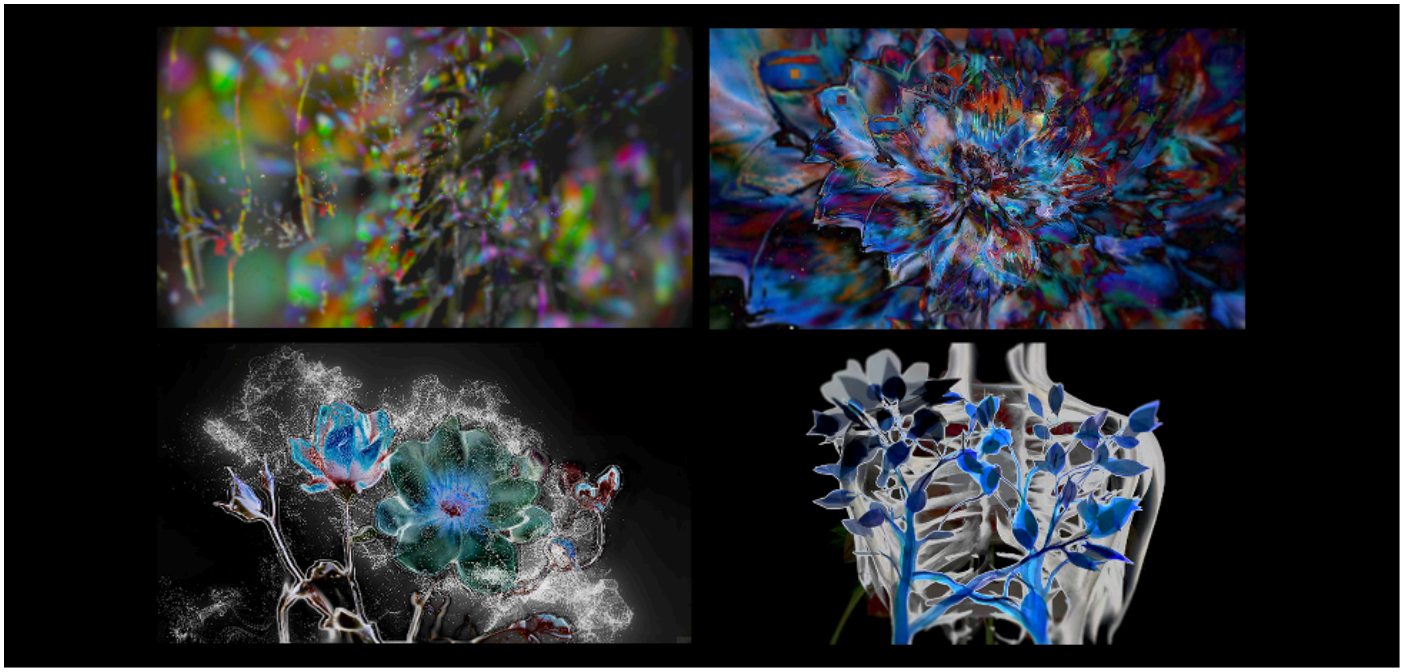


Fig. 6. Illustration of the transition from fragmented to clear visuals, reflecting diffusion models' encoding and decoding process driven by the viewer's breath pattern.

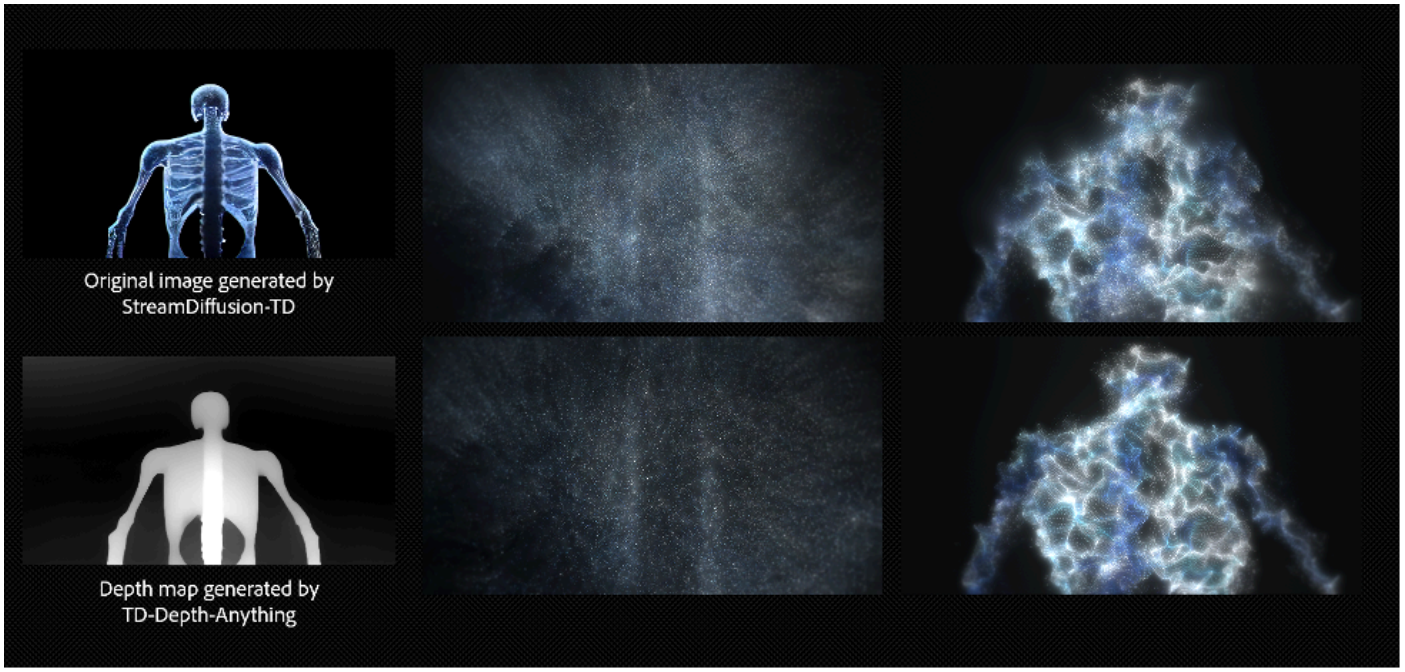


Fig. 7. A visual processing result showcasing the transformation of a 2D AI-generated image into a 3D particle-formed object, illustrating the interactive particles in response to the viewer's breathing pattern.

When the exhalation starts, the recordings are redirected to RAVE, the AI sound synthesis engine, to purposefully achieve artificial aesthetics. As the detected breathing accumulates, the models adjust their parameters in specific dimensions in the latent space of VAEs to reduce artifacts. Our aesthetic measurement determines those parameters to ensure the transformation gradually guides the sound into semantically interpretable instrumental sounds and human-like voices.

V. INSTALLATION AND EXHIBITION

Our initial iteration of *Cycle to Learn* was presented at the "Future Stages @ NYU" event, directed by Katherine Helen Fisher and produced by Caroline Haydon with Safety Third, and hosted by the Collaborative Arts Department at Tisch, New York University, in 2024, as shown in Figure 9. In line with the event's theme of blending digital technology and

performative elements, we chose an immersive setup rather than a typical gallery format.

A wide projection screen and stereo speakers surrounded the stage, with a central microphone for interaction. One of the authors acted as a performer, using their breathing to interact with the installation. The audience experienced how the respiration patterns, reflecting the natural rhythms of life, influenced the real-time audio-visual output, creating an evolving interaction that mirrors the cyclical processes of "dual intelligence." This proof of concept demonstrated how AI's iterative nature, embodied through breathing cycles, could be visually and sonically expressed, fostering a tactile and empathetic engagement with the otherwise opaque processes behind AI's development.

The overall setup for the gallery installation can be adapted from our initial iteration but designed to invite the audience to explore and interact with the piece freely. While the first iteration emphasized immersion through a large space and stage, the gallery version focuses on a more intimate, self-exploratory experience. This allows visitors to engage directly with the cyclical processes of the work, encouraging a personal interaction that mirrors the project's themes of dual intelligence and the convergence of human and AI systems.





Fig. 8. *Cycle to Learn* presented as an installation performance in Future Stage 2024. Photography by Dave Geffin.

IV. FEEDBACK, DISCUSSION AND FUTURE WORK

We received commentary feedback from our early-stage users and viewers from the first iteration. The work was well received as a very tangible experience and inspired insights into the mutual relationship between humans and AI. We are also particularly interested in feedback on the interaction since the method has not been very well tested in previous works. The people we received input mostly persisted in their curiosity and stayed for minutes. They responded that the vacancy of anticipation of what will happen encourages the desire for exploration. Once they understand the mechanics, they actively explore to test the boundary and search for hidden corners. It is fascinating to see people indulge in their subjective initiative to learn the setup through cycles of breathing attempts, which perfectly resonates with the title of the piece.

As AI evolves, the boundary between human and artificial intelligence becomes increasingly complex. With *Cycle to Learn*, we explore this convergence by linking the cyclical nature of AI's training process with human respiration—a subconscious rhythm that fuels human intelligence. This installation asks: What happens when the biological and artificial converge? Can the iterative breathing process, something we take for granted, become a metaphor for AI's learning cycles? By embodying both intelligence and real-time interaction, we invite participants to experience the emergence of dual intelligence—where humans and machines meet and influence one another.

As we reflect on our work, one area that stood out was the potential to expand how we detect and interpret breathing. Currently, we rely on acoustic signal processing, which requires the participant's deliberate position and orientation to interact with a microphone. This approach is practical but inherently limits the natural, unintentional interactions we aim to explore. Moving forward, we are interested in experimenting with ultrasonic-based sensors. This would allow us to detect subtle respiratory patterns without requiring direct participant engagement, creating a more seamless and passive interaction. With the sensors, the installation could respond to even the most minimal physiological signals, bringing the experience closer to an unconscious, effortless exchange between human and machine.

Ultimately, we envision *Cycle to Learn* (2024) is more than just an exploration of AI and human intelligence—a continuous dialogue between two evolving systems. "As breathing involves a continual oscillation between exhaling and inhaling, offering ourselves to the world at one moment and drawing the world into ourselves at the next" [39]. By

synchronizing the rhythms of breath with the iterative cycles of machine learning, we challenge participants to consider how these two forms of intelligence emerge and evolve together. As AI continues to reshape our understanding of creativity, this installation creates a space for reflection—inviting participants to actively engage with the dual nature of intelligence and reconsider the role of process, iteration, and rhythm in the creative act.

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REFERENCES

[1] D. E. Rumelhart, G. E. Hinton, and R. J. Williams, "Learning representations by back-propagating errors," nature, vol. 323, no. 6088, pp. 533–536, 1986.

[2] J. Achiam, S. Adler, S. Agarwal, L. Ahmad, I. Akkaya, F. L. Aleman, D. Almeida, J. Altenschmidt, S. Altman, S. Anadkat et al., "Gpt-4 technical report," arXiv preprint arXiv:2303.08774, 2023.

[3] M. D. M. Reddy, M. S. M. Basha, M. M. C. Hari, and M. N. Penchalaiah, "Dall-e: Creating images from text," UGC Care Group I Journal, vol. 8, no. 14, pp. 71–75, 2021.

[4] A. Ramesh, P. Dhariwal, A. Nichol, C. Chu, and M. Chen, "Hierarchical text-conditional image generation with clip latents," arXiv preprint arXiv:2204.06125, vol. 1, no. 2, p. 3, 2022.

[5] C. Saharia, W. Chan, S. Saxena, L. Li, J. Whang, E. Denton, S. K. S. Ghasemipour, B. K. Ayan, S. S. Mahdavi, R. G. Lopes, T. Salimans, J. Ho, D. J. Fleet, and M. Norouzi, "Photorealistic text-to-image diffusion models with deep language understanding," 2022. [Online]. Available: https://arxiv.org/abs/2205.11487

[6] K. Chen, Y. Wu, H. Liu, M. Nezhurina, T. Berg-Kirkpatrick, and S. Dubnov, "Musicldm: Enhancing novelty in text-to-music generation using beat-synchronous mixup strategies," in ICASSP 2024-2024 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP). IEEE, 2024, pp. 1206–1210.

[7] A. Agostinelli, T. I. Denk, Z. Borsos, J. Engel, M. Verzetti, A. Caillon, Q. Huang, A. Jansen, A. Roberts, M. Tagliasacchi et al., "Musiclm: Generating music from text," arXiv preprint arXiv:2301.11325, 2023.

[8] J. Copet, F. Kreuk, I. Gat, T. Remez, D. Kant, G. Synnaeve, Y. Adi, and A. D´efossez, "Simple and controllable music generation," 2024. [Online]. Available: https://arxiv.org/abs/2306.05284

[9] Z. C. Lipton, "The mythos of model interpretability: In machine learning, the concept of interpretability is both important and slippery." Queue, vol. 16, no. 3, pp. 31–57, 2018.

[10] B. Yenidogan, "How to talk about ai art and music: An onto-ethicoepistemological debate between transhumanism and posthumanism," in Proc. of the 2nd Joint Conference on AI Music Creativity, 2021.

[11] T. Pedersen and C. Johansen, "Behavioural artificial intelligence: an agenda for systematic empirical studies of artificial inference," AI & SOCIETY, vol. 35, no. 3, pp. 519–532, 2020.

[12] D. Grba, "Deep else: A critical framework for ai art," Digital, vol. 2, no. 1, pp. 1–32, 2022.

[13] J. Simon, "Neo-materialism, part two: The unreadymade," E-Flux Journal, vol. 23, no. 8, 2011.

[14] Wikipedia contributors, "Solar term," https://en.wikipedia.org/wiki/Solar term, 2024.

[15] G. Lakoff and M. Johnson, Philosophy in the Flesh: Cognitive Science Brings to Philosophy the Embodied Mind, the Cognitive Unconscious, and Metaphorical Thought. Copy Central, 1997.

[16] R. W. Gibbs Jr, Embodiment and cognitive science. Cambridge University Press, 2005.

[17] M. Akten, "Learning to see," 2017, available: http://www.memo.tv/works/learning-to-see/ [Online]. Accessed:

[18] W. Zhang, L. Cheng, and J. Luo, "Recollection: Creating synthetic memories with ai in an interactive art installation," in Proceedings of the ACM on Computer Graphics and Interactive Techniques, vol. 7, no. 4. ACM, 2024, pp. 1–10.

[19] M. C. Sola and V. Guljajeva, "Visions of destruction," in Proceedings of SIGGRAPH Asia 2023 Art Gallery (SA '23). New York, NY, USA: Association for Computing Machinery, 2023, pp. 1–2.

[20] S. G. Lasserre and A. met den Ancxt, "Phytopoiesis," 2024, available: https://www.scenocosme.com/phytopoiesi e.htm [Online]. Accessed: 2024-05-14.

[21] C. Sommerer and L. Mignonneau, "Interactive plant growing," [Online]. Available: https://www.interface.ufg.ac.at/christalaurent/InteractivePlantGrowing.html, 1992, accessed: 2024-5-17.

[22] R. Lozano-Hemmer, "Pulse room," 2006. [Online]. Available: https://macm.org/en/collections/oeuvre/pulse-room.

[23] G. P. Khut, "Cardiomorphologies: An inner journey through art," IEEE MultiMedia, vol. 18, no. 4, pp. 5–7, 2011.

[24] Scenocosme. (2011-2017) Souffles. Accessed: 2024-5-17. [Online]. Available: https://www.scenocosme.com/souffles 2.htm

[25] Z. Qiu, "Cv2 heartbeat and breathing detection," [Online]. Available: https://github.com/QiuZhaopeng/CV2 heartbeat breathing detection, 2021, accessed: May 14, 2024.

[26] H.-Y. Wu, M. Rubinstein, E. Shih, J. Guttag, F. Durand, and W. T. Freeman, "Eulerian video magnification for revealing subtle changes in the world," ACM Trans. Graph. (Proceedings SIGGRAPH 2012), vol. 31, no. 4, 2012.

[27] Z. Qiu, "Breathing detection using computer vision with webcam," [Online]. Available: https://dev.to/zqiu/breathing-detection-using-computer-vision-with-webcam-525g, 2021, accessed: 2024-05-14.

[28] A. Proch´azka, M. Sch¨atz, O. Vy˘sata, and M. Vali˘s, "Microsoft Kinect visual and depth sensors for breathing and heart rate analysis," Sensors (Basel, Switzerland), vol. 16, no. 7, p. 996, 2016. [Online]. Available: https://doi.org/10.3390/s16070996

[29] Ableton, "Max for live," 2023, accessed: 09, 2024. [Online]. Available: https://www.ableton.com/en/live-manual/12/max-for-live/

[30] R. Rombach, A. Blattmann, D. Lorenz, P. Esser, and B. Ommer, "High-resolution image synthesis with latent diffusion models," 2022. [Online]. Available: https://arxiv.org/abs/2112.10752

[31] S. Luo, Y. Tan, L. Huang, J. Li, and H. Zhao, "Latent consistency models: Synthesizing high-resolution images with few-step inference," 2023. [Online]. Available: https://arxiv.org/abs/2310.04378

[32] S. AI, "Sdxl turbo model," [Online]. Available: https://huggingface.co/stabilityai/sdxl-turbo, 2023, Accessed: 2024-05-14.

[33] A. Kodaira, C. Xu, T. Hazama, T. Yoshimoto, K. Ohno, S. Mitsuhori, S. Sugano, H. Cho, Z. Liu, and K. Keutzer, "Streamdiffusion: A pipeline-level solution for real-time interactive generation," 2023. [Online]. Available: https://arxiv.org/abs/2312.12491.

[34] O. Chomp, "Touchdiffusion," [Online]. Available: https://github.com/olegchomp/TouchDiffusion, 2023, Accessed: 2024-07-1.

[35] dotsimulate, "Real-time diffusion in touchdesigner - streamdiffusiontd setup + install + settings," [Online]. Available: https://www.youtube.com/watch?v=X4rlC6y1ahw, 2023, Accessed: 2024-05-11.

[36] A. Caillon and P. Esling, "Rave: A variational autoencoder for fast and high-quality neural audio synthesis," arXiv preprint arXiv:2111.05011, 2021.

[37] D. P. Kingma, "Auto-encoding variational bayes," arXiv preprint arXiv:1312.6114, 2013.

[38] O. Chomp, "Tddepthanything," [Online]. Available: https://github.com/olegchomp/TDDepthAnything, 2023, accessed: 2024-06-14.

[39] D. Abram, Becoming animal: an earthly cosmology, 1st ed. New York: Pantheon Books, 2010

As narrativas digitais pessoais como instrumento de ensino e aprendizagem online culturalmente sustentável

Personal digital narratives as a culturally sustainable online teaching and learning tool

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Abstract—Personal digital narratives have emerged as an innovative tool in online teaching and learning, fostering cultural interaction and enabling individual stories to be integrated into a global educational context. This article explores the impact of personal digital narratives in e-learning environments, emphasizing their contribution to cultural sustainability and the promotion of more inclusive and diversified pedagogical methodologies. Through a review of the literature and analysis of artifacts, this study aims to examine the significance of personal narratives in online teaching and learning, highlighting their potential to enhance cultural interaction, preserve intangible heritage, and shape identities. It brings to the forefront the central role that narratives can play in transforming higher education online, promoting more effective learning attuned to contemporary realities.

Keywords—Digital Personal Narratives, Online Teaching and Learning, E-learning, Cultural Sustainability

Resumo—As narrativas digitais pessoais emergem como uma ferramenta inovadora no ensino e aprendizagem online, promovendo a interação cultural e permitindo que as histórias individuais sejam integradas num contexto educativo global. Este artigo explora o impacto das narrativas digitais pessoais em ambientes de e-learning, com ênfase no seu contributo para a sustentabilidade cultural e a promoção de metodologias pedagógicas mais inclusivas e diversificadas. Através de uma revisão da literatura e da análise de artefactos, propõe-se analisar a importância das narrativas pessoais no ensino e aprendizagem online, destacando o seu potencial para fomentar a interação cultural, a preservação do património imaterial e a construção de identidades, visando trazer para discussão o papel central que as narrativas podem desempenhar na transformação do ensino superior online, promovendo uma aprendizagem mais eficaz e adaptada às realidades contemporâneas.

Palavras-Chave—Narrativas Digitais Pessoais, Ensino e Aprendizagem Online, E-learning, Sustentabilidade Cultural

I. INTRODUÇÃO

As narrativas digitais pessoais, entendidas como histórias de vida, do quotidiano pessoal e coletivo contadas na primeira pessoa e através de meios audiovisuais, apresentam-se como uma ferramenta poderosa para o ensino e aprendizagem online, não só pela sua capacidade de envolver emocionalmente os estudantes, mas também por contribuírem para a preservação do património cultural imaterial e a construção da identidade.

O recurso às narrativas em suporte audiovisual permite potenciar o processo de aprendizagem, apoiar a formação de identidades, preservar e difundir o património cultural. Com o acesso generalizado a ferramentas de criação audiovisual e a facilidade de disseminação de conteúdo através de redes sociais e outras plataformas, estas narrativas tornaram-se ferramentas educativas poderosas, especialmente em comunidades de periferia (ex. minorias culturais ou grupos excluídos). No ensino online, as narrativas digitais pessoais emergem como uma ferramenta inovadora, promovendo a interação cultural e permitindo que as histórias individuais sejam integradas num contexto educativo global face ao carácter aberto, em rede local ou mesmo global, dos sistemas de ensino e aprendizagem online.

No presente artigo, parte-se do estado da arte das narrativas digitais pessoais, com o objetivo de compreender o seu contributo para a sustentabilidade cultural e o seu potencial enquanto ferramenta pedagógica em contextos de e-learning. A transição

da educação presencial para o digital, que foi acelerada pela pandemia da COVID-19, trouxe novos desafios e oportunidades que têm vindo a ser explorados de forma mais aprofundada. A sustentabilidade cultural refere-se aqui à preservação e promoção das culturas, tradições e patrimónios culturais em vista às gerações futuras, garantindo que essas práticas e conhecimentos continuem a ser relevantes e valorizados. Ela envolve a conservação do capital cultural em suas diversas formas, como artes, património, conhecimento e diversidade cultural [1]. A sustentabilidade cultural é vista como um pilar independente da sustentabilidade social, destacando a importância de manter a diversidade cultural e promover respostas criativas aos desafios da sustentabilidade. Isso inclui áreas como consumo, artes, design, arquitetura, religião e literatura [2].

Como já referido, este artigo visa analisar a importância das narrativas digitais pessoais em ambientes de e-learning, discutindo a sua integração em um modelo pedagógico de forma eficiente e inovadora, potenciando ainda a sustentabilidade cultural.

O artigo inicia com uma breve revisão da literatura sobre narrativas digitais pessoais, focando-se no seu impacto na sustentabilidade cultural dentro das comunidades. São comparados artefactos fílmicos digitais que abarcam narrativas pessoais que influenciam a sociedade contemporânea, destacando a sua contribuição para a literacia mediática e a sua eficácia enquanto ferramentas de e-learning.

Adicionalmente, são analisados ambientes interativos e pedagógicos que incorporam narrativas pessoais, como filmes interativos e abordagens semânticas hipermédia. Estes ambientes são analisados com o objetivo de identificar características essenciais ao um modelo pedagógico virtual mais eficaz no ensino superior. Os resultados são comparados com o modelo pedagógico virtual da Universidade Aberta de Portugal, reconhecido como referência internacional.

Por fim, são delineados os elementos essenciais de um modelo pedagógico virtual para a aprendizagem online no ensino superior, com as narrativas digitais pessoais a servirem como componentes centrais do processo educativo, relevando-se o seu papel de promotor da sustentabilidade cultural.

II. AS NARRATIVAS DIGITAIS PESSOAIS – BREVE ESTADO DA ARTE

A. O conceito de narrativa pessoal

As narrativas pessoais têm estado presentes ao longo da história da comunicação humana, presente sob diversas formas, formatos e meios, em todas as épocas, sociedades e culturas. Segundo Barthes [3] e McAdams [4], a construção de identidade individual e coletiva está intimamente ligada à partilha de histórias pessoais, sendo estas fundamentais para a compreensão do "eu" e do seu contexto sociocultural.

A identidade narrativa refere-se à construção da identidade, do "eu" através da narrativa biográfica, revelando as relações mais significativas e complexas do indivíduo com a cultura e sociedade. As narrativas que construímos sobre as nossas vidas, têm a finalidade de nos enquadrar dentro do contexto social e cultural complexo da sociedade em que estamos inseridos. Ao construir as histórias sobre nós próprios, e sobre o que nos circunda, moldamos a nossa compreensão do "eu" e da forma como nos enquadramos no mundo. Paul Ricoeur [5] entende o conceito de identidade narrativa como um processo dinâmico que acomoda tanto a permanência como a mudança ao longo do tempo. A identidade pessoal é configurada através das narrativas, numa interação entre as dimensões do "mesmo" (idem) e a do "self" (ipse), o que faz com que o sujeito permaneça coerente enquanto evolui e se transforma ao longo do tempo. Estas narrativas são a forma de darmos corpo e transmitirmos a nossa experiência, de nos relacionarmos com os outros e com o nosso entorno social [4] [6]. Citando Paul Ricoeur [7], "somos seres criativos por natureza".

A narrativa pessoal está também ativamente relacionada com a construção da identidade coletiva, através da partilha de narrativas pessoais com os outros, criam-se conexões e constroem-se comunidades. Concordando com Geertz [8], quando afirma que "a identidade é uma construção social, forjada através de histórias compartilhadas e práticas culturais".

B. A narrativa audiovisual pessoal

Autores como Lambert [9] consideram que as narrativas audiovisuais pessoais contém, comumente, um conteúdo centrado na vida do narrador, são histórias de vida pessoais e experiências vividas na primeira pessoa, incluindo, na narrativa, fotos e vídeos

pessoais, a própria voz, imagens da comunidade, do grupo familiar e de amigos, etc.

As narrativas digitais pessoais são geralmente curtas, realizadas utilizando os próprios recursos tecnológicos (smartphone e computador pessoal), muitas vezes sem terem formação profissional na área, isto é o criador destas narrativas audiovisuais é um utilizador comum da tecnologia, e é o próprio que define o guião, realiza, produz e divulga nas redes sociais [10] [9]. Podemos definir assim que uma narrativa digital pessoal é um artefacto multimodal, que pode ser usufruído offline ou online, e tem um objetivo determinado, comunicar uma mensagem, defender uma causa, relatar um momento [11].

De acordo com Fernandes-Marcos et al. [11], a narrativa digital/audiovisual pessoal incorpora as seguintes características - notória, motivadora, pedagógica, lúdica, democrática e memorável - que lhe dá uma dimensão interventiva sociocultural, mas que também pode potenciar a aprendizagem online se se proporcional o contexto e a oportunidade.

C. A colaboração e a democratização online

A colaboração e a democratização dos media desempenham um papel central na difusão da cultura local, especialmente através do uso de narrativas digitais pessoais. Com o acesso generalizado às tecnologias digitais, através dos múltiplos dispositivos móveis, na contemporaneidade, os indivíduos participam ativamente na produção e partilha de conteúdos, sem a necessidade de uma formação técnica avançada ou do uso de equipamentos caros. Este fenómeno marca uma mudança significativa na forma como as histórias e as tradições locais são registadas e transmitidas, permitindo uma maior representatividade e inclusão de vozes anteriormente marginalizadas. Este conceito é particularmente relevante quando analisamos projetos como o *Mostra Goiás* e o *Conta.Me*, que utilizam as narrativas biográficas e audiovisuais para valorizar e preservar a diversidade cultural em contextos locais.

O projeto *Conta.Me*, desenvolvido pela Universidade de São José em Macau, tem como objetivo analisar o impacto das narrativas biográficas enquanto instrumento de afirmação social e promoção da diversidade cultural, com base nos princípios do desenvolvimento humano sustentável estabelecidos pela UNESCO. Este projeto centrou-se na recolha de histórias de vida de habitantes de Macau falantes de português, que representam a diversidade cultural do território, herdeiro de mais de quatro séculos de intercâmbio cultural entre o Ocidente e a Ásia. Através destas narrativas, as comunidades locais são empoderadas, permitindo que os seus membros relatem as suas próprias experiências e fortaleçam a sua identidade cultural [12].

Projetos como o *Mostra Goiás* exemplificam este processo de democratização mediática. Neste projeto, foram produzidos 87 documentários, criados por estudantes e membros da comunidade, utilizando telemóveis. Estes documentários, que retratam tradições e vivências locais, foram exibidos em cinemas e na televisão estadual, destacando como a tecnologia acessível pode facilitar a criação de conteúdo de qualidade e ao mesmo tempo amplificar as vozes das comunidades locais [13]. Esta prática promove uma participação ativa das comunidades na preservação e promoção das suas culturas, ao mesmo tempo que reforça os laços comunitários e a identidade cultural.

Tanto o *Mostra Goiás* como o *Conta.Me* exemplificam o poder das narrativas digitais pessoais na preservação e disseminação da cultura local. Estes projetos demonstram como o uso de tecnologias acessíveis, como os dispositivos móveis, pode democratizar o acesso à produção de conteúdos audiovisuais, permitindo que qualquer indivíduo se torne um produtor de media. Além disso, ao estimular a participação ativa das comunidades na produção das suas próprias narrativas, promovem-se laços culturais e a criação de registos históricos, essenciais para a preservação da memória coletiva e a promoção da diversidade cultural [11] [12] [13].

III. ANÁLISE NARRATIVAS DIGITAIS PESSOAIS ENQUANTO PARTE DE AMBIENTES INTERATIVOS E PEDAGÓGICOS

A. Análise de narrativas digitais pessoais

1. "*Vital Voices: Stories by emerging women leaders from around the globe*" (StoryCenter.org)



Fig. 1. Imagem do programa *Vital Voices Engages* [14].

Este projeto é fruto de uma colaboração entre a *Story Center* e o programa *Vital Voices Engages*, uma iniciativa que apoia mulheres líderes emergentes em mais de 185 países. Trata-se de uma partilha de narrativas pessoais sobre liderança, a superação de barreiras de discriminação, o confronto com normas sociais restritivas e desafios políticos e económicos (fig.1).

O projeto conta com 36 artefactos fílmicos, que incluem narrativas de mulheres parlamentares, jornalistas e líderes de ONGs (Organizações Não Governamentais), entre outras líderes, oriundas de várias partes do mundo. Estas histórias foram desenvolvidas durante 4 sessões online de workshop, num período de 6 meses, onde as participantes foram capacitadas para usar ferramentas digitais de criação de narrativas audiovisuais.

Esta iniciativa é demonstrativa de como as narrativas pessoais digitais podem ser integradas em plataformas educacionais para ensinar competências de liderança, comunicação estratégica e resiliência. As narrativas pessoais permitiram uma aprendizagem mais envolvente e personalizada, facilitando a empatia e uma compreensão mais profunda das desigualdades de género e do papel transformador das líderes [14].

2. "Young Voices from the Frontlines" (UNICEF)

O projeto da UNICEF (*United Nations International Children's Emergency Fund*) partilha as narrativas pessoais de jovens em situações de vulnerabilidade e pobreza extrema, gravadas através de dispositivos digitais simples, como *smartphones*. Nestas narrativas audiovisuais pessoais abordam temas como a educação, as dificuldades sociais e as esperanças para o futuro.



Fig. 2. Imagem do projeto "Young Voices from the Frontlines" da UNICEF [15].

Estas histórias compartilhadas educam o público sobre questões sociais através de uma perspetiva pessoal, capacitando simultaneamente os participantes na utilização de ferramentas de criação audiovisual e de comunicação digital.

Os vídeos abordam temas como a cidadania global, a justiça social e o desenvolvimento sustentável [15].

3. "Life in a Day"



Fig. 3. Imagem de apresentação do documentário "Life in a Day" [16].

"*Life in a Day*" e "*Life in a Day 2020*" são dois documentários colaborativos, produzido por Ridley Scott que se propõe a retratar um dia comum na Terra. Nestes projetos foram convidadas a participar pessoas de todo o mundo, para filmar e enviar vídeos gravados ao longo de um só dia. No primeiro o dia 24 de julho de 2010, e no segundo filme dia 25 de julho

de 2020, com o objetivo de captar a diversidade de experiências humanas.

O resultado no primeiro filme foi a criação de um filme de 90 minutos, editado a partir de 4.500 horas de filmagens enviadas por mais de 81.000 participantes de 192 países, que permitiu uma visão caleidoscópica de vidas em diferentes contextos culturais, económicos e sociais. No filme de 2021 participantes de 192 países contribuíram com 324,000 vídeos, fazendo o retrato de um dia vivido durante a pandemia por milhares de pessoas [17] [18].

Este projeto foi financiado por *crowdsourcing* para produção cinematográfica, demonstrando a democratização da produção dos media e a globalização da sua difusão através de plataformas online [16].

4. "*taurus homemade video*"

Em 2020 uma empresa de eletrodomésticos apresentou um artefacto fílmico usando vídeos pessoais de férias partilhados por pessoas comuns criando assim uma narrativa pessoal representativa das ideias e valores da empresa. O objetivo da marca, como é referido na publicação do YouTube, foi identificarem-se com a audiência "*we are just like you*" e passarem uma mensagem de esperança [19].

B. Análise de ambientes interativos pedagógicos que incorporam narrativas digitais

1. *Korsakow System*

Desenvolvido por Florian Thalhofer, o sistema Korsakow permite a criação de documentários interativos e não-lineares. Este ambiente é amplamente utilizado em contextos educativos para promover o pensamento crítico e a criatividade ao permitir que os utilizadores naveguem através de narrativas visuais e audiovisuais [20]. O sistema presta-se a criar ligações entre segmentos de vídeo que permitem encadeá-los de uma forma mais ou menos lógica para o autor mas sem pretensão de estabelecer uma narrativa definitiva. Este modelo enquadra-se bem numa forma narrativa generativa de quem vai descrevendo os acontecimentos que vivenciou ou encadeando os seus pensamentos na forma como vão ocorrendo.

2. *Mozilla Hubs*

Mozilla Hubs é uma plataforma de realidade virtual social que permite a criação de ambientes virtuais interativos onde os utilizadores podem partilhar conteúdo digital, incluindo narrativas pessoais. Embora não seja especificamente uma ferramenta pedagógica, tem sido utilizado em contextos educacionais para criar espaços de aprendizagem imersivos e colaborativos [21].

3. *Inanimate Alice*

Este ambiente digital interativo combina texto, imagem, som e jogo para contar a história de uma menina, Alice, que se desenvolve ao longo de episódios interativos. "*Inanimate Alice*" tem sido utilizado em escolas para promover a literacia digital e narrativa, permitindo que os estudantes se envolvam ativamente na construção da história [22]

IV. O ENSINO E A APRENDIZAGEM ONLINE CONTEMPORÂNEA

A. O Ciclo de Aprendizagem Experiencial de Kolb

Em 1984, David Kolb [23] definiu o ciclo de aprendizagem experiencial. Trata-se de uma teoria que descreve o processo de aprendizagem como uma sequência de etapas em que o conhecimento é criado através da transformação da experiência. Neste ciclo, a aprendizagem surge como parte de um ciclo sem início nem fim específicos.

O ciclo de aprendizagem de Kolb inclui quatro estágios principais (veja-se figura 4):

Experiência concreta: nesta fase, o estudante participa numa experiência nova ou vivencia uma experiência que já lhe é familiar, mas de uma nova maneira. O conhecimento surge da ação ou do envolvimento direto com o objeto de estudo ou situação;



Fig. 4. Ciclo de Aprendizagem de Kolb [23].

Observação reflexiva: Após a experiência, o estudante reflete sobre o que ocorreu, analisa as suas ações, as consequências e tenta entender o que aconteceu a partir de diferentes perspetivas;

Conceptualização abstrata: o estudante tenta construir conceitos abstratos e generalizar a experiência observada, formulando teorias ou hipóteses que possam ser aplicadas em situações futuras. Esta fase permite ao estudante começar a formar uma compreensão mais sólida do que foi observado;

Experimentação ativa: o estudante aplica os conhecimentos adquiridos em novas situações, testa a validade das hipóteses geradas na fase anterior, permitindo que o ciclo de aprendizagem recomece com uma nova experiência [23].

Este modelo coloca ênfase no ciclo contínuo de experiência e reflexão como fonte principal de conhecimento. É um processo cíclico que pode ser repetido em diferentes contextos promovendo o desenvolvimento de habilidades práticas e teóricas ao longo do tempo. A sua aplicação na aprendizagem online tem acontecido na medida em que a experiência concreta e ativa pode ser em parte realizada online, incluindo simulações, estudos de caso, jogos educativos ou projeto práticos individuais e em grupo e a sua partilha em rede. Por outro lado, os fóruns e as salas de videoconferência permitem acomodar os espaços de reflexão e partilha, de reverberação acerca das experiências, sucessos e dificuldades, proporcionando a aprendizagem colaborativa online e a construção coletiva de saber em rede.

B. O modelo da Universidade Europeia – IADE

O modelo pedagógico de ensino a distância adotado pela Universidade Europeia é resultado da adaptação do modelo *Experiential Learning Hyflex* adotado durante a pandemia [24] e do modelo de ensino a distância da Universidade Aberta de Portugal. Embora seja um modelo que se desenvolve completamente a distância e promova uma aprendizagem centrada no estudante é dada a possibilidade aos alunos de interagirem regularmente com um docente em aulas síncronas online semanais.

Adota-se assim do modelo da Universidade Aberta a centralidade das atividades assíncronas promovendo a autonomia dos alunos no estudo de materiais e atividades dedicadas, mas promove-se um conjunto de aulas facultativas regulares para acompanhamento ou discussão de tópicos.

Este modelo híbrido deriva da ponderação entre um ensino totalmente assíncrono e um modelo onde a componente síncrona pode ser explorada pelo aluno de acordo com a sua necessidade havendo apenas a necessidade de participar de um momento síncrono de avaliação.

As aulas síncronas são gravadas e disponibilizadas aos alunos na integra de forma automatizada permitindo assim que os alunos possam acompanhar esta componente do curso de forma assíncrona. Esta modalidade onde se estabelece um compromisso de os alunos seguirem um percurso de ensino baseado em conteúdos assíncronos, permite tornar as aulas síncronas em momentos verdadeiramente de partilha onde os alunos podem, por exemplo, ser convidados a apresentar temas para discussão numa lógica de sala de aula invertida, ou apresentarem momentos importantes do desenvolvimento dos seus projetos.

As aulas síncronas online usando sistemas de vídeo conferência prestam-se bastante bem ao modelo de aula não expositiva, por não haver aparentemente uma centralidade do professor. Ou seja, tanto alunos como professores encontram-se de forma idêntica em frente a um computador não havendo à partida alunos de um lado e do outro o professor com o tradicional quadro ou ecrã de projeção. Na maioria dos sistemas de aulas online a partilha de apresentações por qualquer dos participantes é simples, assim como a partilha de microfone facilitando ou mesmo democratizando o acesso à palavra.

Este modelo foi adotado em cursos de 1º e 2º ciclos creditados em Portugal desde 2020 tem neste momento mais de 18 cursos em funcionamento [25].

C. O Modelo Pedagógico da Universidade Aberta de Portugal

A Universidade Aberta de Portugal (UAb) é uma instituição pública de ensino superior exclusivamente à distância. O seu modelo pedagógico [26], aplicado aos cursos de 1, 2 e 3º ciclos, tem sido uma referência internacional pela inovação e adequação às necessidades dos estudantes em ambientes virtuais valorizando a flexibilidade e a autonomia.

Este modelo pedagógico virtual (MPV) é sustentado por 4 princípios que orientam a sua conceção e implementação:

1. Aprendizagem centrada no estudante: o estudante é o principal responsável pelo seu próprio processo de aprendizagem. O modelo promove uma educação baseada na autonomia e autodeterminação, incentivando o autogestão de tempo e de ritmo de estudo, a colaboração, o diálogo entre pares e a partilha de experiências;
2. Flexibilidade: Os estudantes podem aceder aos materiais e interagir com professores e colegas a qualquer momento e em qualquer lugar, independentemente das limitações espaciais ou temporais, de forma assíncrona;
3. Interação: É dada ênfase à comunicação entre estudantes e professores e entre os estudantes e os conteúdos de aprendizagem. A comunicação assíncrona permite que a interação seja reflexiva e focada, e a instituição incentiva a colaboração entre os estudantes através de fóruns de discussão e outras ferramentas digitais, promovendo a troca de opiniões e ideias;
4. Inclusão digital: A instituição oferece suporte e formação aos estudantes que não têm familiaridade com as tecnologias digitais, assegurando que todos consigam participar plenamente do processo educativo [26].

No 1º ciclo (licenciatura) o ensino é mais massificado, onde a autoaprendizagem tem um papel preponderante. A interação entre os estudantes e com os materiais de estudo é elevada. O tutor desempenha um papel essencial como mediador pedagógico entre aluno e professor. No 2º e 3º ciclos (mestrado e doutoramento) a aprendizagem colaborativa é mais intensa, com menos estudantes por turma, uma interação entre professor e estudante mais direta, privilegiando projetos colaborativos.

A UAb tem uma série de ferramentas e estratégias para apoiar o processo de aprendizagem, entre os quais fóruns de discussão, ambiente virtual de aprendizagem (moodle), gabinete virtual do professor, atividades formativas (veja-se figura 5).

O modelo de aprendizagem da UAb é inovador por ser um modelo que combina flexibilidade com uma forte ênfase na interação e na aprendizagem colaborativa. Ao contrário de outros modelos de ensino a distância que focam principalmente na transmissão de conteúdo, o MPV valoriza a criação de uma comunidade de aprendizagem rica e diversificada, na qual os estudantes são incentivados a refletir, colaborar e construir conhecimento de maneira independente. Este modelo é adaptável permitindo a sua utilização tanto em ambientes exclusivamente online quanto em formatos híbridos, onde a aprendizagem online é complementada por sessões presenciais [27].

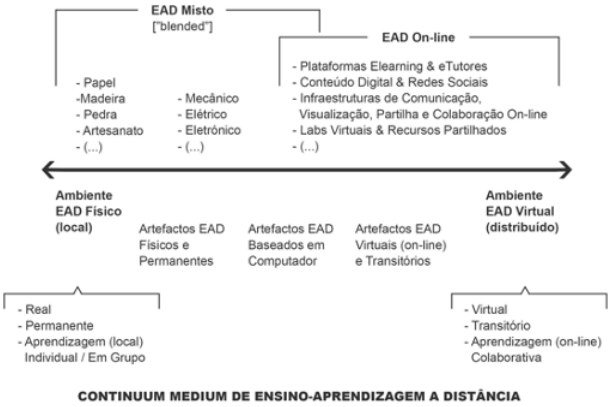


Fig 5 Diagrama explicativo do *Continuum Medium* de Ensino-Aprendizagem a Distância [27].

D. A aprendizagem online pós-covid

O rápido crescimento do ensino online, acelerado pela pandemia de COVID-19, evidenciou a necessidade de novas abordagens pedagógicas. A transição do ensino presencial para modelos híbridos ou totalmente online revelou a necessidade de uma adaptação profunda nas práticas pedagógicas, no design instrucional e na integração de ferramentas

que favoreçam a interação e o envolvimento ativo dos estudantes [28]. Durante este período, muitos professores e estudantes tiveram de aprender a utilizar plataformas digitais sem o tempo necessário para um planeamento adequado, o que levou a uma dependência acentuada de ferramentas de videoconferência, como o *Zoom* e o *Microsoft Teams*, que rapidamente se tornaram centrais na aprendizagem online. Contudo, este modelo inicial, amplamente reativo, revelou algumas limitações, incluindo a falta de interação significativa, dificuldades em manter a motivação dos estudantes, e desigualdades no acesso a tecnologias e infraestrutura [30].

Apesar dos desafios, a pandemia também acelerou inovações que, em circunstâncias normais, teriam levado anos a ser implementadas. A flexibilidade, tanto temporal como espacial, tornou-se um dos principais benefícios da aprendizagem online [31].

Fernandes-Marcos propõe a definição de um modelo pedagógico virtual de cariz geral que possa servir de referência, no planeamento, organização e implementação, para o ensino superior online nos tempos pós-pandémicos. O autor refere-se a estas experiências de adaptação do ensino/aprendizagem online durante o período da pandemia como "ensino remoto de emergência", resultante da mudança temporária do media instrucional [26].

Existe uma relação positiva significativa entre aprendizagem online, presença online e satisfação com cursos online. Confrontando autores que investigam o tema [26] [28] [33] [34] [35] podemos identificar importantes vantagens e desvantagens da aprendizagem online. Se por um lado, a aprendizagem online proporciona aos estudantes uma maior flexibilidade temporal e espacial, permite uma poupança nos transportes, proporciona o acesso a mais recursos digitais, facilita um maior número de contactos, assim como a integração em equipas com especialistas localizados a grandes distâncias geográficas a que de outra forma não teria acesso; por outro lado, os alunos podem encontrar dificuldades no acesso, e no domínio, da tecnologia, ou dificuldades de ligação à internet ou, ainda, que este modelo de ensino não lhes proporcione uma fácil construção do relacionamento interpessoal.

O ensino e aprendizagem online requer um planeamento e design instrucional cuidadoso, com base num modelo pedagógico sistemático, com princípios, regras e mecanismos de auto-avaliação bem definidos. Este planeamento não deve incidir apenas nos conteúdos, mas abranger diferentes tipos de interação que potenciem a eficácia do processo e o seu carácter significativo para os estudantes e professores [35].

A Interaction Design Foundation [35] considera que o design de aprendizagem deve visar resolver um ou mais dos cinco problemas do aluno: a falta de conhecimento, a falta de habilidade, a insegurança, a desmotivação ou a falta de recursos e de conhecimento das ferramentas. A esta recomendação acrescentamos que para o desenvolvimento de uma experiência de aprendizagem eficaz, esta deve acontecer dentro de uma comunidade que integra os estudantes, professores, o pessoal de apoio, mas também convidados e visitantes, num ambiente proporcionador de partilha de interesses comuns, co- e extracurriculares e socioculturais. Este modelo pedagógico proposto por Fernandes-Marcos [20], representado na figura 6 assenta em cinco princípios basilares:

a) o princípio da aprendizagem centrado no estudante;

b) o princípio da flexibilidade;

c) o princípio da interação online;

d) o princípio da inclusão digital;

e) o princípio do acompanhamento online.

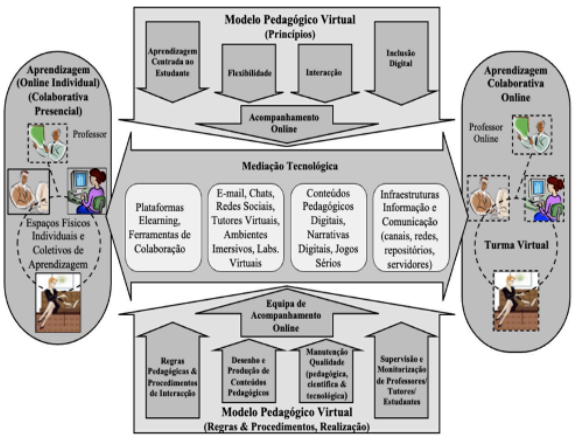


Fig. 6 Modelo Pedagógico Virtual [26].

O princípio de acompanhamento online assegura as condições institucionais, humanas e técnicas para que os estudantes possam receber em tempo útil respostas às suas dúvidas e dificuldades de natureza institucional, académica, administrativa ou extracurricular. O modelo pedagógico de Fernandes-Marcos [26] é um modelo pedagógico virtual de carácter geral que procura proporcionar princípios e linhas mestras para o planeamento,

organização e implementação de oferta educativa de nível universitário administrável online e híbrido.

IV. DAS NARRATIVAS PESSOAIS À PROMOÇÃO DA SUSTENTABILIDADE NA APRENDIZAGEM ONLINE

As narrativas digitais pessoais têm demonstrado ser ferramentas poderosas e versáteis no contexto do ensino online, oferecendo novas perspetivas para a construção de identidades e a preservação cultural em ambientes virtuais. Através da sua capacidade de envolver os estudantes de forma emocional e interativa, estas narrativas tornam-se particularmente eficazes na transmissão de conhecimento e no reforço da literacia mediática, promovendo uma participação ativa no processo de aprendizagem. Ao colocar o indivíduo e a sua história no centro do processo de aprendizagem, abrem-se novos caminhos para uma educação mais inclusiva, sustentável e adaptada às realidades culturais e tecnológicas contemporâneas.

A preservação da diversidade cultural nas plataformas de ensino online surge como um dos grandes desafios e oportunidades na educação digital contemporânea. As narrativas digitais pessoais desempenham um papel fundamental neste contexto, permitindo que vozes diversas e, muitas vezes, marginalizadas, se façam ouvir em ambientes educativos virtuais. Ao partilhar experiências culturais por meio de histórias de vida, as narrativas digitais não só enriquecem o processo de aprendizagem, mas também fortalecem a identidade cultural e promovem a sustentabilidade cultural em ambientes globais de e-learning.

Uma das principais vantagens das plataformas de ensino online é a capacidade de conectar estudantes de diferentes regiões do mundo, possibilitando a troca de experiências culturais. No entanto, o processo de globalização do ensino online pode, por vezes, resultar numa homogeneização de conteúdos e práticas, relegando culturas e línguas minoritárias para segundo plano. As tecnologias digitais possuem um grande potencial para democratizar a produção de conteúdos, mas para tal é necessária uma inclusão deliberada de diferentes vozes e perspetivas no ambiente virtual.

Valorizar as narrativas pessoais pode ser, como se verificou durante a pandemia, uma forma de reforçar a resiliência dos projetos. Devido às restrições de deslocação impostas aos alunos, muitos deles sentiram a necessidade de recorrer a extensivamente a plataformas online de *stock footage.* Muitos não podiam deslocar-se aos locais de filmagem por terem de ficar em casa em quarentena, ou por haver restrições de deslocamento dentro das cidades ou para fora das cidades ou mesmo porque os locais que pretendiam filmar se encontravam fechados ou desertos. Outro problema de alguns alunos era o acesso a material de filmagem profissional por não se poderem deslocar à universidade. Se por um lado fazia sentido dar alguma flexibilidade aos alunos muitos em situações de ansiedade elevada por outro lado fez sentido também apelar a produções mais centradas na realidade próximas aos alunos. Isso pode ser promovido logo na definição dos briefings com projetos mais identitários ou com sugestões práticas de os alunos se centrarem no contexto dos seus bairros ou recorrerem a materiais de arquivo pessoais.



Fig. 7 Frame de projeto audiovisual de alunos de marketing e publicidade do IADE (2021) [36].

Um dos temas explorados para um projeto de audiovisual foi o desperdício alimentar, sendo os alunos encorajados a explorar como o tema se relaciona com os próprios alunos ou com as realidades mais próximas dos contextos das comunidades locais.

O uso das narrativas digitais pessoais permite contornar parte desse risco, ao oferecer uma plataforma para que indivíduos de diferentes culturas possam partilhar as suas histórias e preservar as suas tradições. Projetos como o *Mostra Goiás* e o *Conta.Me* demonstram como o uso de narrativas audiovisuais pode contribuir para a valorização e disseminação de culturas locais, promovendo a inclusão cultural em contextos educacionais online. Através da criação de vídeos curtos e documentários, produzidos com ferramentas acessíveis como smartphones e computadores pessoais, os membros de comunidades locais podem documentar e partilhar a sua herança cultural, preservando-a para futuras gerações.

Contudo, a preservação da diversidade cultural no ensino online enfrenta desafios significativos. A padronização das plataformas e o uso predominante

de línguas dominantes, como o inglês, podem dificultar o acesso e a participação de comunidades linguísticas minoritárias. Neste sentido, a flexibilidade das plataformas de ensino deve ser utilizada para permitir a criação de conteúdos em múltiplos idiomas e formatos, assegurando que a diversidade cultural seja verdadeiramente representada. Ferramentas como legendas automáticas e traduções em tempo real são exemplos de tecnologias que podem ser usadas para facilitar o acesso a conteúdos educacionais em diferentes línguas.

Além disso, é essencial que os currículos e programas pedagógicos nas plataformas de ensino online sejam desenhados de forma inclusiva, permitindo que os estudantes contribuam com as suas próprias narrativas e perspetivas culturais. Ao integrar narrativas digitais pessoais no processo educativo, os docentes podem promover uma aprendizagem mais envolvente e contextualizada, que valorize a experiência individual de cada estudante e fomente o respeito pela diversidade cultural. O poder das narrativas pessoais reside na sua capacidade de criar empatia e compreensão mútua, fatores essenciais para a construção de um ambiente de aprendizagem inclusivo.

Apresentar exemplos como o de *Life in a Day 2020* ou o anúncio da *taurus* já enunciados são formas de promover empatia e encorajar a produção de formas narrativas próximas ou semelhantes.

Por fim, a implementação de tecnologias emergentes, como a realidade virtual (VR) e a realidade aumentada (AR), pode abrir novas possibilidades para a preservação cultural em ambientes de e-learning. Estas tecnologias permitem a criação de experiências imersivas, nas quais os estudantes podem interagir com artefactos culturais digitalizados ou participar virtualmente em eventos culturais, proporcionando uma vivência mais profunda e significativa das tradições culturais. Ao combinar o poder das narrativas digitais com essas tecnologias, o ensino online pode não só preservar, mas também revitalizar a diversidade cultural em escala global.

Em suma, a preservação da diversidade cultural nas plataformas de ensino online é tanto um desafio quanto uma oportunidade. As narrativas digitais pessoais emergem como uma ferramenta poderosa para alcançar esse objetivo, permitindo que as histórias e tradições culturais sejam partilhadas e preservadas em ambientes virtuais. Para que essa preservação seja eficaz, é necessário um esforço coordenado de adaptação das plataformas, dos currículos e das práticas pedagógicas, assegurando que a diversidade cultural seja valorizada e integrada no processo de aprendizagem online.

V. DAS CONCLUSÕES

As narrativas digitais pessoais emergem como uma ferramenta inovadora no ensino online, promovendo a interação cultural e permitindo que as histórias individuais sejam integradas num contexto educativo global.

Neste artigo analisamos o impacto das narrativas digitais pessoais em ambientes de e-learning, com ênfase no seu contributo para a sustentabilidade cultural e a promoção de metodologias pedagógicas mais inclusivas e diversificadas. Através de uma revisão da literatura e da análise de artefactos, analisamos a importância das narrativas pessoais no ensino e aprendizagem online, destacando o seu potencial para fomentar a interação cultural, a preservação do património imaterial e a construção de identidades, visando trazer para discussão o papel central que as narrativas podem desempenhar na transformação do ensino superior online, promovendo uma aprendizagem mais eficaz e adaptada às realidades contemporâneas.

Da discussão final concluímos que a preservação da diversidade cultural nas plataformas de ensino online é tanto um desafio quanto uma oportunidade. As narrativas digitais pessoais emergem como uma ferramenta poderosa para alcançar esse objetivo, permitindo que as histórias e tradições culturais sejam partilhadas e preservadas em ambientes virtuais, respeitando os valores éticos, as diferentes sensibilidades e as diferenças culturais. Trata-se de um processo em contínua construção que requer uma análise crítica e integradora dos múltiplos desafios, cenários e soluções que se colocam na contemporaneidade do ensino e aprendizagem online quando se confronta com a diversidade cultural e a necessidade premente da correspondente preservação da sustentabilidade cultural como parte integrante do próprio modelo pedagógico e dos correspondentes processos de ensino e aprendizagem online.

É preciso salientar que uma prática pedagógica responsável é fundamental para que os estudantes desenvolvam uma atitude participativa, mas sustentável e ética. Neste sentido, o desenvolvimento das narrativas audiovisuais pessoais e a sua partilha é

promovido realçando que a produção e o consumo de media digitais têm também impactos ambientais, nos recursos energéticos e no lixo eletrónico produzido, requerem a implementação de medidas de proteção de dados, meios de armazenamento e transmissão seguros por forma a proteger a privacidade dos participantes e prevenir violações de dados.

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REFERÊNCIAS

[1] K. Soini and J. Dessein, "Culture-Sustainability Relation: Towards a Conceptual Framework," *Sustainability*, vol. 8, no. 2, pp. 167, 2016, doi: 10.3390/su8020167.

[2] J. Clammer, "Culture and Sustainability," in *The Palgrave Handbook of Global Sustainability*, Palgrave Macmillan, Cham, 2021, doi: 10.1007/978-3-030-38948-2_174-1.

[3] R. Barthes, "Introducción al análisis estructural de relatos," in *Análisis estructural del relato*, R. Barthes et al., Eds. México: Red de Jonas, 1990.

[4] D. P. McAdam, "Personal narratives and the Life Story," in *Handbook of Personality: Theory and Research*, 3rd ed., R. W. Robins and L. A. Pervin, Eds. New York: Guilford Press, 2008, pp. 242-262.

[5] P. Ricoeur, *Temps et Récit*. Paris: Seuil, 1985.

[6] P. Crowley, "Paul Ricœur: The Concept of Narrative Identity, the Trace of Autobiography," *Paragraph*, vol. 26, no. 3, pp. 1-12, 2003.

[7] P. Ricoeur, *La mémoire, l'histoire, l'oubli*. Paris: Seuil, 1991.

[8] C. Geertz, *The Interpretation of Cultures: Selected Essays*. New York: Basic Books, 1973.

[9] J. Lambert, *Digital Storytelling: Capturing Lives, Creating Community*. London and New York: Routledge, 2013.

[10] A. Brailas, "Digital Storytelling in the Classroom: How to Tell Students to Tell a Story," *Int. J. Teach. Case Studies*, vol. 8, no. 1, pp. 16-28, 2017, doi: 10.1504/IJTCS.2017.084407.

[11] A. Fernandes-Marcos, S. Pereira, and R. A. Ferreira, "A narrativa pessoal audiovisual: instrumento de afirmação social e de diversidade cultural no contexto do desenvolvimento humano sustentável," in *Cinema Negro – Uma revisão crítica das linguagens*, C. Prudente and R. de Almeida, Eds. São Paulo: Universidade de São Paulo, 2023, pp. 422-436, ISBN: 978-65-87047-40-9.

[12] A. Fernandes-Marcos and S. Pereira, Eds., *Conta.me*. Macao: University of Saint Joseph, 2024, ISBN: 9798329811346.

[13] V. Teixeira César, "Audiovisual and Media Literacy to Promote Local Cultures," *Commun. Technol. Dev.*, vol. 6, 2018, Available: https://journals.openedition.org/ctd/607.

[14] Storycenter, "Vital Voices: Stories by Emerging Women Leaders from Around the Globe," Storycenter, 2024. Available: Vital Voices: Stories by Emerging Women Leaders from Around the Globe — STORYCENTER.

[15] UNICEF South Africa, "Young Voices," YouTube, 2024. Available: https://www.youtube.com.

[16] R. Scott and K. Macdonald, *Life in a Day* [Documentary], Scott Free Productions, National Geographic Films, 2011. Available: https://www.slashfilm.com/513564/life-day-ridley-scottproduced-doc-beauty-day-sundance-review/.

[17] The Guardian, "Life in a Day 2020 Review – Ambitious, Bizarre, and Hugely Exasperating," *The Guardian*, 2021. Available: https://www.theguardian.com/film/2021/feb/01/life-in-a-day-2020-review-kevin-macdonald.

[18] The Guardian, "Life in a Day: Around the World in 80,000 Clips," *The Guardian*, 2011. Available: https://www.theguardian.com/film/2011/jun/07/life-in-a-day-macdonald.

[19] Taurus, "Taurus Homemade Video," 2020. Available: https://youtu.be/OGcumPKBp-s.

[20] Korsakow Institute, "Korsakow, True Narration Is Nonlinear," 2024. Available: Korsakow Institute – To Get a Better Understanding of Reality.

[21] Mozilla Hubs, "Mozilla Hubs," 2022. Available: https://support.mozilla.org/en-US/kb/end-support-mozilla-hubs.

[22] Inanimate Alice, "Inanimate Alice," 2024. Available: Alice Inanimada - Alice Inanimada (inanimatealice.com).

[23] D. A. Kolb, *Experiential Learning: Experience as the Source of Learning and Development*. Englewood Cliffs, NJ: Prentice-Hall, 1984.

[24] United Nations Sustainable Development Group, "Policy Brief: Education During COVID-19 and Beyond," United Nations, 2022. Available: https://www.un.org/development/desa/dspd/wp-content/uploads/sites/22/2020/08/sg_policy_brief_covid-19_and_education_august_2020.pdf.

[25] A. R. Masalinova, M. A. Khvatova, L. S. Chikileva, E. P. Zvyagintseva, V. V. Stepanova, and M. V. Melnik, "Distance Learning in Higher Education During Covid-19," *Front. Educ.*, vol. 7, p. 822958, 2022, doi: 10.3389/feduc.2022.822958.

[26] A. Pereira, A. Mendes, L. Morgado, L. Amante, and J. Bidarra, "Um Modelo Pedagógico Virtual para o Ensino Superior: O Modelo da Universidade Aberta de Portugal," Universidade Aberta, 2007. Available: Repositório Aberto: Modelo pedagógico virtual da Universidade Aberta: para uma universidade do futuro.

[27] E. Carvalho and A. Marcos, "O Ensino e Aprendizagem da Programação de Computadores no Ensino a Distância: Uma Proposta de Instanciação do Modelo Pedagógico Virtual da Universidade Aberta," in P. Dias, D. Moreira, and A. Quintas-Mendes, Eds., *Práticas e Cenários de Inovação em Educação Online*, Lisboa: Universidade Aberta, 2016, ISBN: 978-972-674-786-4, pp. 189-219. Available: http://hdl.handle.net/10400.2/5552.

[28] C. Hodges, S. Moore, B. Lockee, T. Trust, and A. Bond, "The Difference Between Emergency Remote Teaching and Online Learning," *Educause Review*, vol. 27, 2020. Available: https://er.educause.edu/articles/2020/3/the-difference-between-emergency-remote-teaching-and-online-learning.

[29] T. Anderson, "The Pandemic Pushes Universities Online. The Big Question Is What Happens Next," *The Conversation*, 2020. Available: https://theconversation.com/pandemic-pushes-universities-online-what-happens-next-143040.

[30] A. Bozkurt and R. C. Sharma, "Emergency Remote Teaching in a Time of Global Crisis Due to the COVID-19 Pandemic," *Asian J. Dist. Educ.*, vol. 15, no. 1, pp. 1-6, 2020, doi: 10.5281/zenodo.3778083.

[31] G. Marioni, H. van't Land, and T. Jensen, "Global Survey Report: The Impact of COVID-19 on Higher Education Around the World," International Association of Universities, 2020. Available: https://www.iau-aiu.net/IMG/pdf/iau_covid19_and_he_survey_report_final_may_2020.pdf.

[32] A. Alghambi, "COVID-19 Mandated Self-Directed Distance Learning: Experiences of Saudi Female Postgraduate Students," *J. Univ. Teach. Learn. Pract.*, vol. 18, p. 014, 2021, doi: 10.53761/1.18.3.14.

[33] United Nations Sustainable Development Group, "Policy Brief: Education During COVID-19 and Beyond," United Nations, 2022. Available: https://www.un.org/development/desa/dspd/wp-content/uploads/sites/22/2020/08/sg_policy_brief_covid-19_and_education_august_2020.pdf.

[34] A. R. Masalinova, M. A. Khvatova, L. S. Chikileva, E. P. Zvyagintseva, V. V. Stepanova, and M. V. Melnik, "Distance Learning in Higher Education During Covid-19," *Front. Educ.*, vol. 7, p. 822958, 2022, doi: 10.3389/feduc.2022.822958.

[35] Interaction Design Foundation, "What Is Learning Experience Design," Interaction Design Foundation - IxDF, 2016. Available: https://www.interaction-design.org/literature/topics/learning-experience-design.

[36] IPAM, "Universidade Europeia, IADE e IPAM Inovam Modelo Acadêmico," 2020. Available: https://www.ipam.pt/noticias/universidade-europeia-iade-e-ipam-inovam-modelo-academico/.

[37] Universidade Europeia, "Cursos Online," 2024. Available: https://www.europeia.pt/cursos-online/.

MultipliCity, a case study in generative AI-assisted immersive illustration workflow

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Abstract— It is timely to consider the possibilities of new workflows to integrate generative AI with illustration in ways that do not displace the enjoyable visual-centered aspects of the illustrator's work. We consider this problem in the special case of immersive drawing and illustrate it in the case of MultipliCity, an installation exploring and representing the interplay between myth and reality in urban environments, specifically focusing on Venice.

Keywords—generative AI, equirectangular panoramas, illustration, virtual reality, drawing

I. INTRODUCTION

It is likely that illustrators will be compelled to integrate AI into their workflow somehow. A worst-case scenario would be replacing handmade drawing with textual prompting as a main skill. Illustration is a visual art that involves visual thinking, and we would like it to remain so. Our great concern is ensuring this integration is done in a way that enhances rather than replaces the discipline of handmade drawing and painting. Artists must cooperate with engineers to guide the tools in a desirable direction. In this paper, we explore this idea in our own specialty of illustration, which is particularly technical and carries its specific characteristics: that of immersive illustration using spherical perspectives and VR panoramas.

II. NEW HYBRID WORKFLOWS IN ILLUSTRATION

A. The purpose of illustration

Illustration has always walked on a tightrope – on the one hand it is a commercial artform, bounded by tight deadlines and external requirements for profitability; on the other it has always been a work of passion and creativity and one of the great expressive avenues for the human skills of drawing and painting. One can view illustration as a job aiming to create consumption images. This is strictly correct. But we might as well take the viewpoint that illustration's main point of interest is that it is a commercial vehicle that finances one of the worthwhile endeavors of the human spirit – in this view, the main thing produced is not illustrations, but illustrators. Drawing can be seen as a mode of thinking supported by a skill set developed and transmitted by multiple generations on a chain akin to a genetic lineage. In this view, illustrators are not just commercial makers of pictures – they are the bearers of one of the torches of the human spirit, and the existence of this knowledge and this mode of thought is something that enriches us all, even those who do not partake in it directly but only infer its existence from the enjoyment of the products it creates. In this view, we take pleasure in illustrations not just because they look pretty but because it pleases us to know that other humans – like us – exert their abilities to the utmost in a way that makes us proud of being human, just as we ourselves may dignify our humanity by expressing it in some other creative way, being engineering, science, chess playing or sports. Let us put it this way: the value of the Renaissance is not that it produced Brunelleschi's dome but that it produced Brunelleschi. And our pleasure in visiting the dome is not that it has such splendid structural properties but that it reassures us of our value as humans, even if we ourselves are no Brunelleschi.

So, in the case of illustration – as in fact in many other such human activities - there is a delicate balance between the legitimate needs of the commercial activities that finance the artist and the preservation of the deeper aspects of the art form. The insertion of AI-generated imagery – like many technologies before, photography, for instance - risks breaking this delicate balance. Drawing may be

replaced by textual prompting as a main creative tool of illustration – and this may happen whether or not the AI imagery is better than the human-generated one; all it takes is that it is judged good enough by the clients and publishers so that whatever originality and creativity is lost is deemed compensated well enough by speed and convenience. This may happen by sheer market force, even if not desired explicitly by any specific client or publisher. One can easily imagine a scenario where drawing can no longer compete in terms of speed and convenience with text prompting and gets replaced with it, even if the generated imagery never reaches the same quality level as the best human illustration. The number of images created would certainly not decrease; quite the opposite; one expects imagery to multiply to the point of a market glut, but how much poorer the experience of creating them is! Prompting is mainly a verbal, not visual, activity, and what a poor verbal activity usually is! It is mostly very poor, disjointed prose, a guessing game with no intrinsic beauty, but is strictly goal-oriented. The promise of AI that it would allow for natural conversation instead of programming may be true in LLMs, but is not the usual experience of AI image generation. Textual prompts are like blind probing for the hidden knobs inside a black box. They are often filled with ugly pseudo-technical terms of doubtful effect, like so many dark incantations. Take this gem of anti-poetry by an AI prompter using Midjourney [1]:

maze, Narrow, steep staircase, Old Building, Floating buildings, Urban, City rain, art by Miyazaki and Ian McQue and Akihiko Yoshida and Katsuya Terada, colorful, trending on artstation, gorgeous, ultra-detailed, realistic, 8k, octane render, hyper-detailed, cinematic

It is hard to see an improvement in the human condition when instead of taking classes in drawing – or 3D modeling, or even programming – one takes instead classes on "prompt engineering", which is to say, on begging the machine for favors, especially when the "techniques" involved are not stable nor translatable nor deep nor developed enough to be called either an art or a science (it is hardly clear whether some common tokens such as "50mm lens, 8k, hyper-detailed" are effective or just cargo cult superstitions).

III. IMMERSIVE ILLUSTRATION

Immersive art has a long history that we will not recap here, from the 19th-century panoramas to VR (see, for instance, [2], [3]). We will only refer to the special case of the more recent type of immersive illustration done with the help of spherical perspective drawing. This is a drawing discipline that has hijacked the tools of spherical photography. Spherical photography stitches several photos to cover a full "360" view from a fixed spatial point. They usually store the stitching as an equirectangular projection that carries all the visual information. This image can then cover a virtual sphere to allow immersive visualization of the photographic content in VR or on a screen. Immersive illustrations work by drawing directly onto the equirectangular projection. Then, the drawing, just like a spherical photograph, can be visualized in VR. Of course, this requires the artist to know how to draw while considering the peculiar perspective deformations that the equirectangular projection causes. This has been formalized into a specific type of perspective called spherical perspective [4]. Recently, not only equirectangular [5] but also azimuthal equidistant [6] and cubical perspective [7] have been formalized and can now be learned as technical drawing methods. However, most artists just draw using fixed grids and other ad-hoc methods or just by their intuitive knowledge of the perspective's geometry.

A. The effects of AI on Immersive Illustration

The pressure to integrate AI is felt in immersive illustration, and the authors have experienced it personally. The first author is an experienced professional illustrator working in this field for many years ([8], [9]) and the second author has been deeply involved in this formalization of spherical perspective drawing as well as in the development of immersive drawing software. Both authors are enthusiastic about the potential of AI. Still, they are concerned that their field – currently based on a foundation of handmade technical drawing – will be rendered not obsolete but less interesting by relegating the artist to the position of prompter and art director, thereby not robbing him of the job exactly (the main worry in the art field today) but making that job less satisfying by pushing it far from its visual foundations.

There are several ways in which AI can render immersive illustration less interesting, the main ones being:

1. By negating the use of drawing, relegating the artist to a cycle of textual prompting

and evaluating AI proposals, more an art director than an artist.

2. By negating the need for perspective knowledge through interfaces that do not require or profit from it.

Point 2 sounds strange to outsiders. There have been considerable efforts in software interfaces to eliminate the need for perspective knowledge [10], [11]. However, for many immersive illustrators, understanding the perspective is both interesting and leads to its form of visual expression [12], [13].

The installation described in the present work is a first exploratory step in a program – to be implemented as a Ph.D. dissertation by the first author under the second author's supervision – on how to go a different way: how to develop artistic workflows that integrate AI techniques to enhance rather than replace the art of handmade drawing in the specific context of immersive illustration.

B. Current platforms for Immersive Illustration

The installation described ahead uses Skybox AI, a generative AI from Blockade Labs that specializes in generating equirectangular panoramas. Let us describe the tools currently available to the immersive artist in the generative AI field to explain our platform choice.

A 360° illustrated environment has a higher complexity than a normal image: rules of composition have to be concerned with object disposition around the viewer, details are usually numerous, and the resolution must be larger than a normal image because in the process of re-projecting a spherical image onto a screen, the viewer watches only a small part of the image at a time, and each such part must have enough resolution to fill the screen with adequate detail. Thus, combined with a specific spherical projection format in which those illustrations must be done to work properly (usually the equirectangular projection), this limits the number of Generative AIs up to the task.

Dall-E can be used to create an immersive image by generating six views (one for each cube face of a cube map) with six text prompts, assembling and patching utilizing a combination of inpainting techniques and exporting the portion of the image through a panoramic patching software (Pano2VR). Kevin Holer explains the process in detail [14].

nVidia GauGAN 360 [15] [16] is a highly intuitive tool to help artists create virtual worlds from scratch. It converts scribbles into realistic spherical panoramas, allowing users to draw their segmentation maps and manipulate the scene on an equirectangular or cube map image, updated in real time. Each drawn area is labeled with material labels like sand, sky, sea or snow rendered in the generated output. However, there was no way to integrate this interface with detailed handmade drawings as a prompt, and the results were too painterly for our purposes; we wished for a more drawing-like look for both input and output.

Midjourney can generate panoramic seamless images by using a text prompt and setting the following parameters: "2:1 aspect ratio", the same ratio of an equirectangular image, and "tile," to get seamless images for a tiling pattern.

The generation of an equirectangular image in *Stable Diffusion* was done with Deforum on Google Colab. The only parameter that can be set for panoramas is the aspect ratio 2:1.

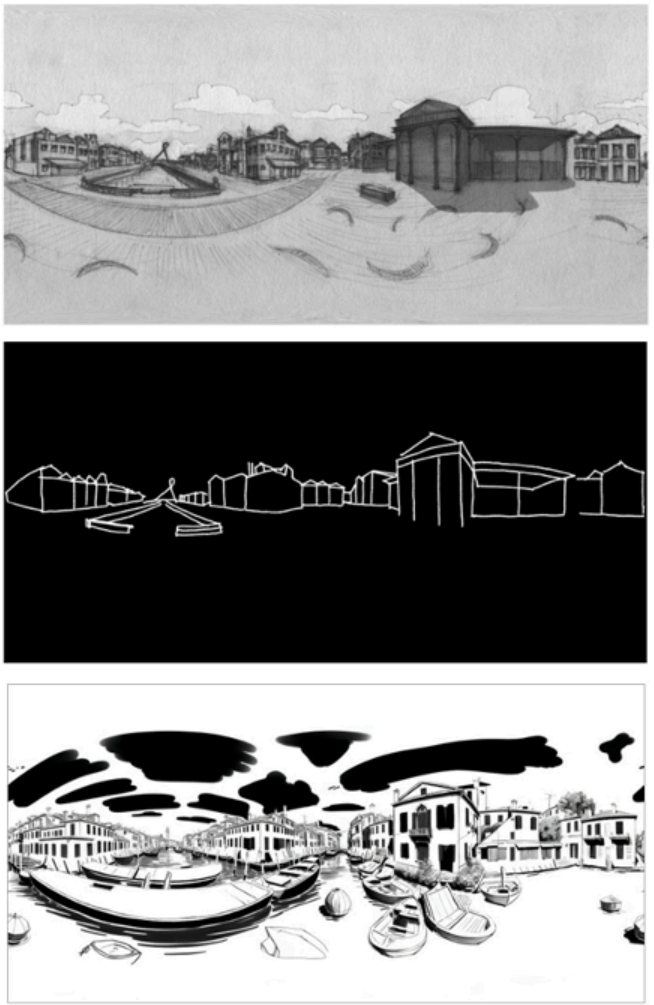


Fig. 1. Top: Equirectangular drawing of Praça do Peixe in Aveiro, Portugal. Center: Control image traced from the original drawing. Bottom: The image was generated from the control image, and a text prompt was given by the Skybox AI from Blockade Labs. All illustrations in this paper are © Chiara Masiero Sgrinzatto.

Both models fail to solve the spherical geometry: it happens that the horizon is not in the vertical center of the image, or that the distorted areas at the zenith and nadir are not rendered at all, or are rendered in another projection, or the tiling fails. The generated image is 1024px wide for Stable Diffusion and 1500px wide for Midjourney, and it needs to be processed through an upscale to be viewed as a VR panorama at a sufficient resolution on a modern screen. The control over the composition is mostly non-existent, although, in Midjourney, it is possible to highlight and change some areas of the image during the generation process.

By contrast, *Skybox* by Blockade Labs [10] is a model based on Stable Diffusion but specially trained for generating spherical images [17], capable of generating 8k equirectangular scenes from text prompts with various styles. It also creates depth maps of the generated panorama.

It is possible to enhance the generation by drawing directly on the tridimensional space in the web app or by adding a *control image* when using the API service. This last aspect made it possible to integrate visual prompting suitably to our purposes.

The API version of Skybox Blockade Labs was used for the installation to ensure reliability in the spherical geometry, the high resolution of the generated image, and the possibility of using handmade drawings to influence the composition. Explaining the spherical drawings done during the sketching campaign through the control image feature was possible. The drawings were stylized, obtaining a white sketch on a black background fed to the model as a visual prompt and textual. Access through the API, mediated by Node.js, was another strong point, as it allowed for programmatic variations and systematic tests in prompt and control image variation.

IV. MULTIPLICITY

A. Overview

MULTIPLICITY is a phygital immersive installation in which hand-drawn 360° panoramas and generative AI are key elements in exploring and representing the enigmatic interplay between myth and reality in urban environments, specifically focusing on Venice.

Places, content, and narratives are combined to create a circular, complex relationship between these elements. Pairs of hand-drawn spherical panoramas establish identification and correspondence between specific locations in Venice and their analogs in a series of parallel cities. The AI imagines the "invisible" third layer, where the machine's interpretation of the mythical environment is given and combined with the artist's one. The AI takes the role of a working partner in a dialogue rather than a replacement for the artist.

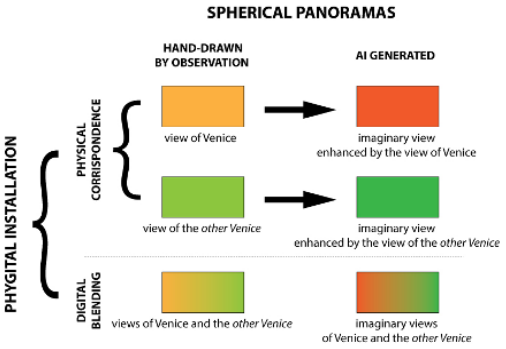


Fig. 2. Workflow diagram.

The installation includes a series of paper-printed so-called *triptychs*. The name refers to the three-pronged workflow that generates them, not to the number of pictures; in fact, each "triptych" consists of four spherical pictures displayed through mini-domes, each consisting of: 1. a view from Venice, 2. a corresponding view from another city (recognized as another Venice), 3. two AI-generated panoramas obtained from the two hand drawn views by a cross-interaction that will be described ahead. All four panoramas have a QR code leading to the corresponding virtual world content. Visitors are invited to walk through the mini-domes, stop, and observe each of them and their cross-correspondence. They can then enter the virtual layer through their smart devices to complete the experience.

B. Concept of the exhibition: Mythical cities

Across History, a number of cities have acquired a powerful mythological allure that turned them into "eternal cities." They have become icons of the past, a pride of the present, and a simulacrum of themselves in the future. Mythical cities can bewitch the visitor and impress themselves powerfully in his eyes and heart. One of the most famous among them is Venice. When observing Venice, different mythological layers can be identified.

Venice is a myth for its physical dimension, for the water which overcomes land, its little calli, its bridges and gorgeous buildings, and its nature as a dual city – the one in the air and the one reflected in the water; and still yet for its History and that of its people, for the will of Doges that made it to resist over time as a water city, for its majestic identity, its story of harbors

and travels and far away markets, its decay and today's gentrification. And finally, it is a Myth because of the narrative it created for itself or others created about it in Literature, Music, Painting, Theatre, Video Games, Cinema, and even Science.

The power of mythic cities is so strong that the ones who visit that place start to wear an unconscious new pair of glasses. This is why they can still see Venice in Amsterdam, Aveiro, Stockholm, and hundreds of other places worldwide.

MultipliCity aims to investigate how this extraordinary inspiration takes place, how places can influence inhabitants or visitors, and how these, conversely, develop a different view, perception, and interaction in other places. In the game of perspectives this research considers, one further layer is added: the Artist dialogues with the Observer and the Machine. In an extreme contemporary provocation, the artist asks the AI to open a third eye to provide an additional glance and interpretation of Venice-the-Myth.

C. Technologies, Techniques, and Workflow

In *MultipliCity*, the artist combines 360° hand-drawn immersive panoramas with generative AI algorithms to explore and depict the interaction between myth and reality, merging and creating a dynamic relationship between places and their stories.

The correspondence of specific places in Venice and a series of parallel cities is represented in pairs of hand-made equirectangular drawings. The artist represents real locations through on-site drawing, a panoramic post-production process, and little adjustments in the composition when urban elements of daily life disturb the view.

The AI generation process is enhanced with hand-made sketches with data about Venice and the other Venices worldwide. The prompt considers the description of the hand-made panorama representing Venice and the corresponding one concerning the other locations.

The exhibition comprises triptychs (as mentioned above, sets of 4 paired pictures). The elementary operation at the basis of the triptych creation is an interaction between the human artist and a generative AI, in this case, the Skybox AI by Blockade Labs. The process is as follows (refer to Figure 1):

1) The artist begins by making a handmade equirectangular drawing on location (Figure 1 - top).

2) The artist traces the original drawing to make a schematic "control image" (Figure 1 - center), that is, a white-on-black linear interpretation of the panoramic drawing that keeps only the main structural lines, as judged by the intentions and purposes of the artist.



Fig. 3. An alternative control image for the drawing of Figure 1.

3) The control image is fed into Skybox AI via its API and a text prompt, generating a new image (Figure 1 - bottom).

This process results in a pair of related images – a handmade drawing and an AI-generated image – in a way that is deeply mediated by drawing (Figure 2). The original drawing, of course, preserves the main features of traditional illustration –it is entirely under the control of the artist, who not only draws but *chooses*, for choice is the main conventional illustration activity; the illustrator doesn't draw what is merely seen, but must choose what to emphasize, what delete, what to stress, resulting in a plethora of major and minor adjustments in the composition, elimination of extraneous elements, and so on, for compositional and general artistic effect.

This process of choice is again present in the second step when the control image is "traced." The control image is a black and white picture (white lines on a black background), sized at 2048x1024 pixels, to be fed along with the text prompt into the API of the Blockade Labs Skybox AI as a control image – a visual prompt. Here, too, there is an ample avenue of choice for the artist. One does not simply trace the main lines of a drawing, and one *decides* which lines are the main lines. There are many choices of "main lines" that one could make as well as the level of detail with which they are drawn, from the simple lines of Figure 1 (center) to the sketchy lines of the alternative control image of Figure 2. One can change details at will, remove or emphasize elements; one could even simply invert the brightness of the original sketch and supply the whole original picture as a control image. The possibilities here are a whole territory in themselves.

Having established this main process, the workflow for the creation of the images in each triptych is a variation as follows:

1. The artist scouts one of the Venices, chooses a location, performs a handmade drawing of an equirectangular image from on-site observation, and races the stylized control image of the panoramic drawing. Further, the artist writes a textual prompt describing the location of the first drawing.

2. The artist finds a corresponding location in the (original) City of Venice and once more draws a panorama on location, draws its sketch map, and describes the location as a text prompt.

3A. The control image of the Venice location and the text prompt of the other location are fed into the AI to generate a new panorama that mixes the two.

3B. The control image of the other Venice location and the text prompt of the Venice location is fed into the AI to generate a new panorama that mixes the two.

In this way, a triptych of interactions is established between the pictures of the two locations crossmatched with their prompts, between the cities themselves, and between the artist and the AI. In this interaction, the practice of drawing is essential for communication. For this reason, the textual prompt has been kept deliberately simple. For instance, in the drawing of

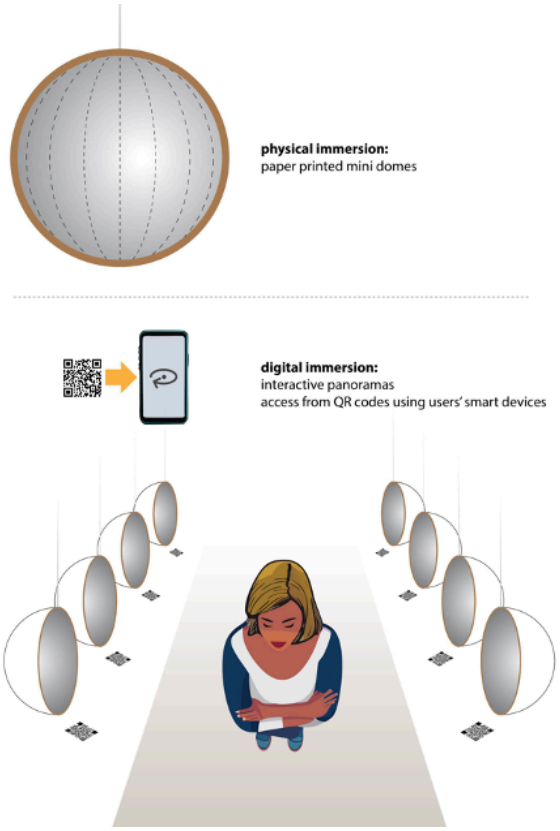


Fig. 4. Top: Images are displayed in hemispheres. QR codes link to the VR view. Bottom: Arrangement of the hemispheres.

Praça do Peixe in Aveiro (Figure 1), the corresponding prompt is simply "a view of Aveiro," which was cross-matched with a picture of Venice whose prompt was simply "a view of Venice." Much more than the prompt, the interaction was dominated by the drawing process and the choices it entails.

Once the triptych images are created following the above process, they are not presented directly as an exhibition of equirectangular drawings or VR panoramas. Instead, they are presented as a physical/digital hybrid arrangement of anamorphic mini-domes with QR codes linking to the VR views (Figure 4). Each picture is made into a hemispherical anamorphosis. That is, it is made to cover the inside of the physical hemisphere like the VR pictures cover the inside of virtual spheres. An ideal observer in the center of such a sphere would have the illusion of seeing the real environment. Since the hemispheres are small and the user is not located at the center, there will be some perception of visual deformation. However, the observer still has the sensation of seeing a very natural wide-angle view of the location.

The artist builds the hemispheres as mini-domes using embroidery tambourine instruments and the paper origami technique. The equirectangular images are converted into an interrupted sinusoidal projection

[18], printed, laser-cut to ensure a perfect shape, and assembled into mini-domes to achieve an anamorphic illusion of a wide semi-panoramic view (Figure 5 - top).

The mini-domes are then assembled on both sides of a corridor. Visitors are invited to walk through the hanging domes, finding the possible points of connection between the corresponding pairs of immersive environments. (Figure 4, Figure 5).

The QR codes provide the installation's virtual dimension. All panoramas are available for fully immersive view in virtual form, reachable through the QR codes on each hemisphere, and can be explored by visitors with their smartphones or tablets. Virtual environments enable the visitor to see the full panorama that is only partially visible in the physical hemispheres.

D. Exhibition Venue and Contents

MultipliCity was publicly displayed in the collective exhibition *Circuitos* in the context of the XI Doctoral Retreat in Digital Media Art of the Doctorate in Digital Media Art, a joint degree of Aberta University and Algarve University, in Portugal. The exhibition occurred from 16 to 19 July 2024 at a temporary gallery space at Aberta University in Lisbon (Figure 5).

The installation was placed at the intersection of two spaces - the auditorium foyer and the bar, where the space narrows slightly to form a hallway that facilitates the experience.

Four pairs of spherical drawings were exhibited, corresponding to the following pairs of locations:

1) Venezia. Via Garibaldi – Aveiro. Praça do Peixe.
2) Venezia. Piazzetta San Marco – New York City. Madison Square Gardens.
3) Venezia. Calle Larga San Giacomo dell'Orio – Amsterdam. Oudezijds Voorburgwal.
4) Venezia. Giudecca, Molino Stucky – Stockholm. Södermalm, Münchenbryggeriet.

The exhibition concept can be implemented in many ways and with varying numbers and locations. The choice above was influenced by the exhibition venue's spatial characteristics and the aircraft transportation portability constraints.

The archive of material that the exhibition produced is collected in a virtual tour, accessible online via computer, tablet, smartphone, and HMDs [12].

V. TOWARDS A HYBRID WORKFLOW FOR IMMERSIVE ILLUSTRATION

MultipliCity represents a first step towards investigating hybrid human-AI workflows in immersive illustration through artistic practice. It was created in the context of a Ph.D. thesis plan in Digital Media Arts to be developed by the first author under the supervision of the second. In future work, we intend to investigate the possibility of a fruitful interaction with AI. What would that entail?

In terms of technology, we would desire to use open-source tools. This is not only for cost reasons – after all, digital illustrators have used commercial tools at great cost, even for marginal performance



Fig. 5. MultipliCity installation at the *Circuitos* exhibition, held at Aberta University, Lisbon, 16 to 19 July 2024.

benefits – but also because of a special need to control both configurations and the user's data. This poses problems as the current best model, although it can be accessed through a convenient API is not open source and cannot be subject to the desired changes or customizations. Also, the requirements for training such a model from scratch are beyond the abilities of the individual artist, at least as done in this case. However, it would be interesting to see how far one can go with relatively low-budget options such as DreamBooth [19] Low-Rank Adaptation (LoRA) or the more recent Weight-Decomposed Low-Rank Adaptation (DoRA)[20], which brings the promise of bridging the gap to full fine-tuning at greater efficiency. As we write this paper, a new open-source generative AI is available – 360PanoImage (See [21], [22]) based on Stable Diffusion, and might be a worthy alternative or a starting point to be refined further.

More than technology, we are concerned with objectives. It is easy to be led by the nose and forget what one's purpose is, instead adapting to whatever is available. We must remember that our purpose is to preserve drawing, rather than textual prompting, as the main activity of the illustrator.

This may require *more* (but different) text prompting. A big limitation of Skybox and all the other panorama generators is that the "discussion" with the AI does not resemble the conversation with an assistant artist. One simply feeds prompts and gets results. It does not have the nuance found with LLMs such as ChatGPT, the sense of easy back and forth. One might look forward to a general-purpose LLM that can draw – interacting through elaborate conversation rather than the more propitiatory, one-sided prompts that are the usual interaction with diffusion models. The latest version of ChatGPT already does that upon request, but the output is Dall-E panoramas, which, for now, are lacking in quality.

In general terms, one would wish that AI would take up the drudgery and leave us more time for the creative aspects, while the direction has been the exact opposite lately. It will do us no good to have surplus production of images if our new job is in the lithium mines or, less dramatically, if it is a drudgery of bad prose.

The most significant negatives of AI for our field are, on the one hand, the removal of drawing from center stage and, on the other, the removal of the discipline of perspective itself.

It is desirable that the interface is both heavily drawing-based and understands the language of spherical perspective with its characteristic constructions, special notions such as antipodal vanishing points, and its symmetry groups. Then, communication could motivate and use the illustrator's

perspective knowledge and ability to communicate visually.

AI could help with the undesirable aspects of panorama drawing, such as handling extreme deformations near the zenith and nadir or covering surfaces with textures, which must suffer deformations that are very difficult to attain by hand. Here, annotations such as in GauGAN 360 might be the direction to follow.

AI could be the most help outside the confines of image generation itself. A big hindrance to equirectangular drawing is the hassle of scanning and preparing the drawing to be seen in VR – a trivial but time-consuming task. Image recognition and computer vision are already used to simplify that process (see [23], [24]), but more general AI might make it much more seamless.

AI will inevitably have a strong impact on the lives of illustrators, and panoramic illustrators in particular. Blind market forces alone will not be concerned with whether the coming changes are beneficial or not to illustration as a human activity, but only with production efficiencies. It is up to illustrators and aligned technologists to ensure that whatever workflows arise treat them like more than machine operators. We hope the work we are starting will contribute in some small measure to a desirable outcome.

VI. FURTHER DEVELOPMENTS

Future developments, materials, and media will be deposited on the personal websites of the authors ([25], [26]).

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REFERENCES

[1] B. Shadow, "Midjourney prompt examples," Oct. 18 2024. [Online]. Available: https://www.blueshadow.art/midjourney-prompt-commands/

[2] O. Grau, "Into the Belly of the Image: Historical Aspects of Virtual Reality," Leonardo, vol. 32, no. 5, pp. 365–371, Oct. 1999, doi: 10.1162/002409499553587.

[3] O. Grau, Virtual Art: from illusion to immersion, Leonardo, MIT Press, 2003.

[4] A. B. Araújo, "Spherical Perspective," in Handbook of the Mathematics of the Arts and Sciences, B. Sriraman, Ed., Cham: Springer International Publishing, 2021, pp. 527–587, doi: 10.1007/978-3-319-57072-3_100.

[5] A. B. Araújo, "Drawing equirectangular VR panoramas with ruler, compass, and protractor," Journal of Science and Technology of the Arts, vol. 10, no. 1, pp. 2–15, 2018, doi: 10.7559/citarj.v10i1.471.

[6] A. B. Araújo, "Ruler, compass, and nail: constructing a total spherical perspective," Journal of Mathematics and the Arts, vol. 12, no. 2–3, pp. 144–169, 2018, doi: 10.1080/17513472.2018.1469378.

[7] A. B. Araújo, L. F. Olivero, and A. Rossi, "A Descriptive Geometry Construction of VR panoramas in Cubical Spherical Perspective," diségno, no. 6, pp. 35–46, Jun. 2020, doi: https://doi.org/10.26375/disegno.6.2020.06.

[8] C. Sgrinzatto, "Venice Original: A spherical illustration of an imaginary environment," in Artech 2021, Aveiro: ACM, 2021, pp. 1–4.

[9] C. Masiero Sgrinzatto, "2000 Eyes: Spherical View of La Fenice di Venezia," in ArtsIT, Interactivity and Game Creation, A. L. Brooks, Ed., Lecture Notes of the Institute for Computer Sciences, Social Informatics and Telecommunications Engineering, Cham: Springer Nature Switzerland, 2023, pp. 22–35, doi: 10.1007/978-3-031-28993-4_2.

[10] A. Kihlström, "Design tools for sketching of dome productions in virtual reality," 2018.

[11] D. Tran Luciani and J. Lundberg, "Enabling Designers to Sketch Immersive Fulldome Presentations," in Proceedings of the 2016 CHI Conference Extended Abstracts on Human Factors in Computing Systems - CHI EA '16, San Jose, California, USA: ACM Press, 2016, pp. 1490–1496, doi: 10.1145/2851581.2892343.

[12] G. Michel, "L'oeil, au Centre de la Sphere Visuelle," Boletim da Aproged, no. 30, pp. 3–14, 2013.

[13] A. B. Araújo, L. F. Olivero, and S. Antinozzi, "HIMmaterial: Exploring new hybrid media for immersive drawing and collage," in Proceedings of the 9th International Conference on Digital and Interactive Arts, Braga Portugal: ACM, Oct. 2019, pp. 1–4, doi: 10.1145/3359852.3359950.

[14] K. Holer, "Creating spherographs with AI," Jan. 20, 2024. [Online]. Available: https://www.360-drawing.com/creating-spherographs-with-ai

[15] "GauGAN Turns Doodles into Stunning, Realistic Landscapes | NVIDIA Blog," Oct. 25, 2024. [Online]. Available: https://blogs.nvidia.com/blog/gaugan-photorealistic-landscapes-nvidia-research/

[16] T. Park, M.-Y. Liu, T.-C. Wang, and J.-Y. Zhu, "Semantic Image Synthesis with Spatially-Adaptive Normalization," Nov. 05, 2019, arXiv: arXiv:1903.07291. [Online]. Available: http://arxiv.org/abs/1903.07291

[17] G. B. M. Stan et al., "LDM3D: Latent Diffusion Model for 3D," 2023, arXiv, doi: 10.48550/ARXIV.2305.10853.

[18] L. Bugayevskiy and J. Snyder, Map Projections - A Reference Manual, Taylor & Francis, 1995.

[19] N. Ruiz, Y. Li, V. Jampani, Y. Pritch, M. Rubinstein, and K. Aberman, "DreamBooth: Fine Tuning Text-to-Image Diffusion Models for Subject-Driven Generation," Mar. 15, 2023, arXiv: arXiv:2208.12242. [Online]. Available: http://arxiv.org/abs/2208.12242

[20] S.-Y. Liu et al., "DoRA: Weight-Decomposed Low-Rank Adaptation," Jul. 09, 2024, arXiv: arXiv:2402.09353. [Online]. Available: http://arxiv.org/abs/2402.09353

[21] "360PanoImage web interface," Oct. 25, 2024. [Online]. Available: https://huggingface.co/spaces/gokaygokay/360PanoImage

[22] "360PanoImage github page," [Online]. Available: https://github.com/ArcherFMY/SD-T2I-360PanoImage/

[23] L. F. Olivero and A. B. Araújo, "Desiderata for a Performative Hybrid Immersive Drawing Platform," i-com, vol. 21, no. 1, pp. 33–53, Apr. 2022, doi: 10.1515/icom-2022-0009.

[24] L. F. Olivero, "Spheri v1: A body tracking artefact to interact with spherical perspective drawings made on-the-fly," in Proceedings of the 11th International Conference on Digital and Interactive Arts, ARTECH '23, New York, NY, USA: Association for Computing Machinery, Apr. 2024, pp. 1–9, doi: 10.1145/3632776.3632824.

[25] "Personal website of Chiara Masiero Sgrinzatto," Jan. 29, 2024. [Online]. Available: https://www.chiaramasierosgrinzatto.com/

[26] "Personal website of António Bandeira Araújo," Nov. 29, 2024. [Online]. Available: https://www.araujoab.com/

EXPLORING PORTUGUESE TILES (AZULEJOS): Revealing Macau's Cultural Heritage through Embroidery Artefacts and an Augmented Reality Experience

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Abstract—Macau's Portuguese tiles, known as azulejos, are historical evidence of Portuguese and Chinese mixed culture. This study focuses on Macau's azulejos' cultural relevance and significance to reveal the city's cultural legacy. By the comprehensive analysis of this study, a prototype of an embroidery artifact integrated with the Augmented Reality (AR) experience is developed to enhance Macau residents' deeper understanding of the precious azulejos.

The study employs a variety of approaches, including literature studies, interviews, questionnaires, photo collections, and prototype building. Azulejos are endangered due to their historical significance, relationship to Macau and Portuguese history, lack of conservation work, and limited documentation. To preserve and ensure the sustainable development of Macau's azulejos, we plan and construct a physical artifact that combines textile fabrication processes with AR experiences. The study investigates the panel's design technique, integrating features retrieved from actual tiles to create a new textile fabric panel. Furthermore, embroidery techniques and machine use are examined. These methodologies offer vibrant and innovative ways to appreciate and explore the stunning azulejos. By combining traditional cultural heritage with contemporary techniques, this research aims to bridge the gap between the past and present, providing novel means to engage with and safeguard Macau's rich cultural heritage embodied in azulejos.

Keywords—augmented reality, azulejos in Macau, embroidery, textile fabrication, digital preservation, sustainable development

I. INTRODUCTION

A. Background

After more than four hundred years of Portuguese colonial history, Macau stands out from its distinctive status as a mixture of Portuguese and Chinese cultures, creating unparalleled traditions and customs. In Macau, azulejos do not merely embellish architecture, churches, and streets; this stunning blue and white pattern is also incorporated into the decoration of various restaurants, furnishings, fashion, and souvenirs, symbolizing Macau's cultural and artistic identity. These cultural artifacts, inherited from the Portuguese colonial period, are inextricably connected with Macau's rich history, art, and culture.

Followed by the global norms of cultural preservation, the Macau government is devoted to enhancing the conservation awareness of this cultural artifact. The Cultural Affairs Bureau[1] conducted the Cultural Heritage Protection Law[2] in 2019 to promote the idea that intangible cultural heritage must be protected and shared, while the manufacturing and painting of azulejos was registered in the Inventory of Intangible Cultural Heritage[3] in 2000. The government, academic organizations, and associations continuously promote this traditional handicraft by organizing lectures, workshops, and exhibitions, and they try to pass on this manufacturing technique to the new generation and the community.

However, the precious azulejo artifacts gradually succumb to the impacts of rain and sunshine, with a shortage of local azulejo artists, restoration specialists, printed documentation, and systematic conservation efforts. The lack of resources and expertise poses a significant challenge to preserving these valuable assets for the community. Along with globalization and urbanization development, it is crucial to revitalize the cultural legacy with novel approaches to maintain the city's identity and facilitate sustainability.

B. Motivation

In the vibrant context of Macau, azulejos serve as poignant symbols of the region's rich cultural heritage. Despite their significance, the endeavors to preserve these tiles remain rare and constrained. Currently, only government institutions and the Casa de Portugal em Macau association are continuously committed to passing on the legacy of this traditional craft to the public. Also, Macau needs more artisans who specialize in the conventional manufacturing techniques essential for creating and maintaining azulejos in Macau.

Preserving this cultural heritage is the same as safeguarding Macau's unique identity, particularly in its role as a prominent tourist destination. Spreading this invaluable treasure to the broader public is crucial in fostering a deeper connection with Macau's history and traditions. Utilizing cutting-edge technology presents an innovative approach to cultivating people's interest and appreciation for these precious artifacts.

C. Research Objectives

Given the significant deterioration of azulejos in Macau, the primary objective of this research is to revitalize and promote Macau's azulejos through exploring the exploration of cultural preservation using transformative azulejos artwork and innovative technologies. Additionally, this research seeks to uncover the cultural importance of azulejos and examine the digital preservation methods for Macau's azulejos. Through a comprehensive analysis of azulejos, photo collection, and digitalization, the project will result in a fabric panel prototype integrated with augmented reality experiences that showcase a fresh and captivating perspective on Macau's azulejos, as well as contribute to the further digital preservation of Macau's azulejos. It not only preserves traditional artwork via sustainable materials, but it also encourages participation and contact with the target audience. It enhances people's awareness of preserving the cultural legacy of azulejos and facilitates a novel way of cultural preservation.

II. LITERATURE REVIEW

A. Value and Appreciation of Azulejo

1) Azulejo Tiles' Cultural Importance

Azulejos are derived from Arabic, meaning "small polished stones." It is made of ceramic and fired at a high temperature to produce a glaze result. Muslims first developed ceramic tiles in the 13th century. After high usage and evolution in many European countries over centuries, the mass-glazed tiles were manufactured and widely used in Portugal. Their usage was much higher than in other European countries in the 17th century [1]. It is mainly used to decorate walls and vaults in churches, monasteries, and the palaces of nobility [2]. Inspired by Chinese porcelains, blue-and-white azulejos gradually became popular in the 17th century. Encountered by the strong earthquake in Lisbon in 1755, the Portuguese widely applied ceramic tiles to reconstruct the significant parts of the destroyed city. Subsequently, the art of azulejos peaked in the 18th century, making the Portuguese become the Age of Masters in azulejos. The contemporary style of azulejos, infiltrated with individuality and modern art, is still widely employed in architecture in Portugal.

Azulejo is a valuable asset of Portugal as it is not only for decorative purposes but also for its historical and cultural significance. People usually decorate these tiles with natural objects, mythological tales, religious imagery, and historical scenes. It indicates that, in each period, Portugal's social, mental, and artistic evolution and the country's significant transformations often assumed more of a spatial, architectural character than a merely decorative one [3]. It is valuable for its aesthetic value and innate function of being adorned with vital historical architecture and depicting historical facts, cultural motifs, or religious themes. It gradually became representative of Portugal and played an essential role in art. In today's society, the azulejos stand out for their cultural value as they mark the aesthetics of art and depict important historical moments; therefore, it is often regarded as one of the national arts of Portugal.

2) Azulejos Historical and Artistic Value in Macau

Macau stands out for its deep-rooted Portuguese and Chinese culture, and azulejo's historical and artistic value is beyond all doubt. It is not hard to find Portuguese azulejos on street signs, churches, and building walls in Macau, mostly remnants of the Portuguese colonial period. The mutual dependency - architecture/the azulejos and the azulejos/architecture - proved the true essence of the azulejos resides in its intimate relation with architecture [3]. Some historical architectures adorned with azulejos tiles in Macau have been registered on the World Heritage list. It embraces high appreciation value thanks to the sophisticated manufacturing techniques resulting in its durability and exquisite craftsmanship, as well as its innate function of featuring narratives.

TABLE I. CLASSIFICATION OF THE FUNCTIONS OF MACAU'S AZULEJOS BY THE RESEARCH (PHOTOS TAKE BY WONG, 2023-2024).

FUNCTIONS	DESCRIPTIONS	EXAMPLES
Signage	Azulejos serve as road signs, door plates, and text depictions to indicate specific messages.	  1. The Pousada de São Tiago Hotel 2. Travessa do Conde
Decorative	Azulejos are used to decorate architecture, churches, and streets, enhancing the aesthetic appeal.	  1. Red Cross Mansion 2. Macau Fisherman's Wharf
Storytelling	Azulejos depict the historical facts, cultural motifs or religious themes that depict a culture's specific history, ideas, beliefs, and livelihood.	  1. Macau International Airport 2. IAM Building
Preservation (protection)	Ceramic tiles can protect the wall from moisture and humidity.	  1. IAM Building 2. The Macau Portuguese School
Ornamentation	Beyond being used to cover walls, azulejos also stand as ornamental elements. The patterns and the design of azulejos are used to create aesthetic appeal in various applications, such as products, fashion, furniture, virtual design, and digital arts.	  1. Pousada de Coloane 2. The Pousada de São Tiago Hotel

In Macau, most of the azulejos were created in the Portuguese colonial period, while some symbolized China-Portuguese relations. In particular, the IAM building (former Leal Senado Building) - was Macau's first municipal chamber, initially built in 1784; it contains classical azulejos decorative walls and the azulejos painting depicting the former IAM Buildings and the old scene of Macau. The well-known British artist George Chinnery painted plenty of old scenes of Macau in the 19th century on azulejos tiles, which established fruitful value in terms of historical changes and artistic value in the period without photography. Subsequently, the contemporary azulejos has evolved into not only a decorative one but also a combination of contemporary symbolic significance and aesthetic, employing traditional techniques and materials; a good example is the vast panel of azulejo in The Macau International Airport created by Portuguese painter Eduardo Nery. Those azulejos in Macau perform multiple functions, particularly in decoration, narratives, and showcasing social characteristics, which significantly contribute to the historical and cultural values of different periods in Macau. The author has classified the functions of Macau's azulejos in a table, which includes indicators, decorative, storytelling, preservation (protection), and ornamentation (see Table 1).

However, the situation of azulejos in Macau overcomes other issues; the bulk of valuable tiles progressively succumb to the impacts of rain and sunshine and the shortage of local azulejos artists, restoration specialists, and printed documents. Even though the manufacturing and painting of azulejos was registered into Macau's intangible cultural heritage in 2000, and government and institutions are dedicated to promoting this handicraft by organizing workshops and exhibitions, the conservation efforts in Macau still need to be improved.

B. Digital Innovation in Cultural Heritage

1) Digital Preservation and Access to Cultural Artifacts

An artifact is an ornament, tool, or other object made by a human, especially historically or culturally interesting[4]. Incomplete technologies limited the early conservation and restoration works. Today, digital preservation has become a crucial tool in many countries to facilitate the communication of cultural heritage and artifacts to visitors. The accessibility and sustainability of digitalization are beneficial to public engagement.

Regarding public engagement in showcasing an artifact, the two primary considerations are the application of digital technology in artifact restoration and the communication between artifacts and users. Firstly, digital preservation is one of the fields of archaeology. The mission of archaeologists is to capture information, such as excavation diaries, discovered records, photographs, archaeological drawings, and video recordings of the archaeological site [4]. This research will focus on photographs and digitalization to present cultural artifacts. Secondly, digital preservation aims to inherit a specific cultural identity generation by generation. The interactivity and engagement could be reinforced by applying digital technology to present cultural artifacts. For example, the physical qualities of an object have been conveyed to visitors via haptic devices and extremely faithful reproductions or through "open drawer" displays where visitors physically reveal parts of an exhibit, making the gesture meaningful in the discovery process [5].

Digital preservation is crucial to safeguard the legacy and preserve. As per the United Nations Sustainable Development Goal 11 (SDG), 'make cities

and human settlements inclusive, safe, resilient and sustainable' is a global responsibility. Digital preservation protects a city's cultural character while promoting inclusive and sustainable urbanization. Sustainable preservation approaches of digitizing and using novel technologies show a city's history, ensuring its documentation and long-term preservation and improving efficiency and effectiveness. This is the global commitment to promote sustainable cities and communities by safeguarding cultural assets and encouraging cultural tourism.

2) Sustainability and Innovation in Cultural Heritage

The idea of sustainability was first adopted in the new mandate by IUCN in 1969, and it is suggested that it was possible to achieve economic growth and industrialization [6]. This idea has been acknowledged in the field of economic development; however, this idea has been emerging in the field of art and culture in recent decades. Cultural heritage drives sustainable growth and serves as a basis for sustainability as it reveals the civilization of individuals and communities.

Measurement and analysis must be taken throughout the information's life cycle to preserve digital heritage. Preserving digital heritage begins with designing reliable systems that produce authentic and stable digital objects (UNESCO article 5, 2003). When working on a specific project regarding the preservation of cultural heritage, it is essential to consider the sustainable future, meaning that the project is beneficial to future study and assessment and avoid falling into the situation "when the project is over, everything is over [7]". Accessibility and durability are the two decisive sustainability factors regarding a cultural heritage project, such as materials, venue, environmental impact, digitalization, etc. Meaningful projects for cultural preservation must be considered sustainable development.

C. Interaction Design in Panel Display and Augmented Reality

1) Uses of Augmented Reality

AR has served as a powerful tool, thanks to the ubiquitous smartphones in today's society, bringing virtual elements to the natural environment quickly with users' smartphones, particularly in exploring cultural legacy. According to the survey done by Tan in 2021, which aims to understand the general public's understanding of AR, VR, and its application and prospects in museums, the result shows that the vast majority of users have high acceptance and are willing to try interactive exhibits and virtual exhibits, despite that most people have only experienced not many types of related equipment [8].

There are three types of AR in terms of triggers: marker-based AR, markerless-based AR, and location-based AR. Marker-based AR uses a designated actual image (AR marker) to trigger the AR experience, while markerless AR can be used without a marker. Location-based AR uses GPS to trigger AR experiences, usually outdoors and on a larger scale. In our prototype design, a marker-based AR will trigger several virtual objects. The goal is to integrate these virtual elements with real-world objects, enhancing virtual communication and overall user experience.

2) UX Design Principles for Physical Panel Integrated with AR

To design a physical panel integrated with AR, it is crucial to prioritize the user experience (UX) principles that ensure the concept and message of the prototype are well-delivered to the users the users are highly engaged and have a great user experience. UX design also involves acquiring and integrating a product, including branding, design, usability, and function[5]. This design prototype will go through the UX design process to ensure the outcome provides an excellent experience for the users.

3) Design User-Centred Approaches to Encourage Audience Engagement and Learning

In addition to the contexts expressed by designers, user experience should always employ a user-centered approach, meaning that carefully considering the adaptability and accessibility needs of the users, as there may be users' physical and environmental limitations that impact their interaction with the design product. As such, it is essential to conduct thorough testing throughout the design and development process to ensure the final design meets the diverse needs of the target users. Figure 1 shows the user-centered work process in which UX designers are the users' advocates and keep users' needs at the center of all design and development efforts[5].

In the design process of AR, injecting virtual elements into interactivity and operability as much as possible means that users will be more willing to explore the augmented environment constructed by the designers, thereby enhancing the user's sense of pleasure in using the product [8]. To drive human-computer interaction, augmented reality experiences are offered to interpret the meaning and

significance of the azulejos, especially the abstract forms often depicted in azulejos. This immersive experience will encompass animations, sounds, interactive buttons, and informative details. Through these interactive designs, users will gain a deeper understanding and appreciation of the prototype, engaging in contextual interpretation and storytelling.

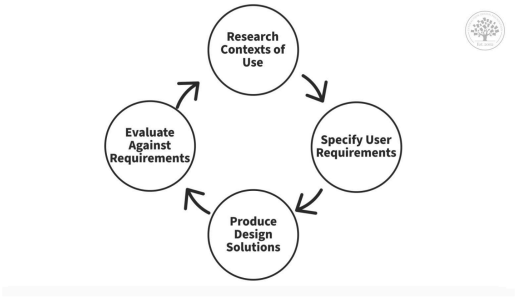


Fig. 1. The user-centered work process.[6]

D. Techniques on Embroidery

Textile materials employed in close contact with the human body engender an interaction between the characteristics of the material and the human senses [9]. Some artists recontextualize tradition and culture with textile works in today's innovative art and design. The Portuguese artist Joana Vasconcelos, known for her textile handicraft and sculptural artwork, explores distinct themes through stunning handicrafts and fabric materials in contemporary art. It allows audiences to interact with the fabrics by touching the silhouette and feeling the shape, offering a compelling engagement.

Embroidery is a traditional non-photorealistic art form that involves stitching threads of various colors into a base fabric to create an image [10]. Embroidery is a timeless artistic form practiced for thousands of years using decorative patterns stitched onto clothing, accessories, furniture, and even standalone works. Many different types of embroidery machines are available, from home use to commercial and industrial machines. This research will focus on the computer-controlled embroidery machine and its techniques. These advanced machines enable the interpretation of digital graphics and customized designs into physical embroidery pieces facilitated by computer software and programming.

III. RESEARCH METHODOLOGY AND DATA COLLECTION

This research employed a mixed-method approach to evaluate the mentioned research questions from different perspectives. The primary target audience is comprised of Macau's residents who are interested in azulejos. The study commenced with qualitative research, involving traditional research on Macau's azulejos, interviews, and fieldwork to gather fundamental information and photographic resources. Simultaneously, a quantitative survey questionnaire assessed people's interest in and familiarity with Macau's azulejos and their views on preserving azulejos integrated with innovative technologies.

Drawing on the findings and data observations, an experimental prototype was developed to explore a novel approach to preserving Macau's azulejos and to accomplish the research objectives. The prototype will undergo usability testing to refine it further and collect feedback from testers.

By combining qualitative and quantitative methodologies, the research provides a comprehensive understanding of the significance of azulejos in Macau and explores innovative ways to preserve and showcase these artifacts.

A. Research Survey of Macau Residents

An online survey was launched to Macau residents to gauge their understanding, interest, and perceptions of azulejos. The survey includes questions on their familiarity with azulejos, their views on integrating azulejos with AR, and their opinions on interactive art featuring azulejos.

The result shows that despite the prevalence of azulejos in Macau, many respondents are only vaguely aware of them. While they express interest in azulejos and acknowledge their cultural significance, many lack familiarity with their history and deeper meanings. Respondents are more familiar with azulejos patterns than panels depicting historical scenes. This finding underscores the importance of our prototyping efforts to enhance users' understanding of the historical context.

Respondents expressed a positive attitude toward adopting innovative AR and interactive art technologies. AR has the potential to enhance real-world experiences and provide significant benefits when used effectively. However, their primary concern is the malfunctioning of AR systems, an issue they have encountered with existing market offerings.

Additionally, respondents highlighted the issue of the loss of historical resources, which are constantly evolving and at risk of being forgotten. These

technologies could effectively engage the younger generation and spark interest in history and culture. Furthermore, they proposed the creation of a digital database to document each piece of azulejos, which could serve as a valuable resource for researchers.

B. Interview with Scholar

To better understand the current development of azulejos and to collect academic recommendations on the preservation and sustainability of azulejos, we invited a visiting academic from the University of Saint Joseph, Professor Francisco Vizeu Pinheiro, who specializes in architecture, sustainability, and heritage. Professor Francisco researches the History and heritage of Macau and its regional influence and sustainability. He has a license in architecture from the University of Lisbon, Portugal, and he specializes in azulejos and its relations with architecture and heritage. His perspectives could be highly referenced and representative of the academic point of view on azulejos preservation and sustainable development.

In the interview questions, we conducted five main topics that are related to the research focus, including the Macau government's scheme in azulejos preservation, insights into the revitalization of azulejos, comparisons of preservation work in Portugal and Macau, the challenges of azulejos conservation work, and public education in raising awareness of azulejos preservation. He has given valuable insight that could shed light on our research.

Professor Francisco emphasized the importance of understanding the Portuguese azulejos production techniques, which led to a longer lifespan for the tiles. Some azulejos in Macau did not follow the Portuguese manufacturing process - first to cook the ceramics, then to paint them, then cook them again - often only lasting a shorter time than the original process. He suggested that these techniques could be taught as permanent courses, similar to the music school at the Macau Conservatory. After all, this specialized process differs from the production of traditional Chinese ceramics.

Professor Francisco stated that the Macau government and institutions should take a case-by-case approach to conservation efforts. Some azulejos, such as those in the IAM Building, are in good condition despite being placed indoors, while others, like the exterior wall of the Dr Sun Yat-Sen Municipal Park, are deteriorating rapidly.

Additionally, Professor Francisco highlighted the presence of fake azulejos, like the one recently added at the cathedral square near the garbage room, depicting the Iec Long firework factory. This theme is not related to the history or tradition of the place. One of the characteristics of azulejos is that placing azulejo panels in public spaces should be meaningful and connected to the location, as this aligns with the essence of azulejos. This is an essential insight that we should consider when developing our prototype.

C. Fieldwork

A comprehensive photographic documentation process is integral to the research methodology, aimed at accurately cataloging all the azulejo tiles in Macau for design prototyping and further studies. Conducting fieldwork for photo collection circumvents the authority and copyright issues associated with online sources. This collection also establishes a digital database, ensuring long-term access and usability for academic research.

During the fieldwork, the majority of azulejos are publicly accessible, while certain azulejos are located within private premises, and a few of them are permanently dismantled. Moreover, the azulejo panels installed on the exterior walls of the Dr Sun Yat-Sen Municipal Park have suffered significant deterioration and damage over the years due to prolonged exposure to rain and sunshine (as shown in Figure 2). Due to these environmental factors, many tiles have gradually become detached and flaked off. These 16 large azulejo panels, installed in 1993 and depict historical maps of Macau, have received no restoration work for over 30 years, exacerbating their deterioration. The fact that azulejos depict historical scenes contributes to its cultural value. Some panels in Macau are based on paintings that significantly represent Macau. One of the panels depicting the A-Ma Temple installed on the exterior wall of the Dr. Sun Yat-Sen Municipal Park was originally from the artwork created by the artist Auguste Borget, who vividly recorded the A-Ma Temple in different angles in 1838 (see Figure 3.). As shown in Figure 4, the panels located at Travessa do Meio originated from George Chinnery's sketch. Those original sketches are precious to Macau as they depicted the old city's scenes. Those azulejos are said to have been painted by locals rather than by Portuguese sources [11]. Despite the azulejos' painters being unknown, it is noticeable that they have different painting styles and brushwork from the originals.

Except for the azulejos, which have a long history in Macau, these tiles are now used to decorate the newly built facilities and architecture that serve as the iconic elements representing Macau, and these tiles can be found in hotels in Macau. These newly installed tiles can be found adorning casinos, hotels, restaurants, and even electricity boxes (see Figure 5), seamlessly integrating into Macau's daily life. The azulejos have become tangible evidence and a representation of the city's mixed culture of Portuguese and Chinese influences.



Fig. 2. These panels suffered from severe deterioration (photos taken by Wong, 2023-2024).

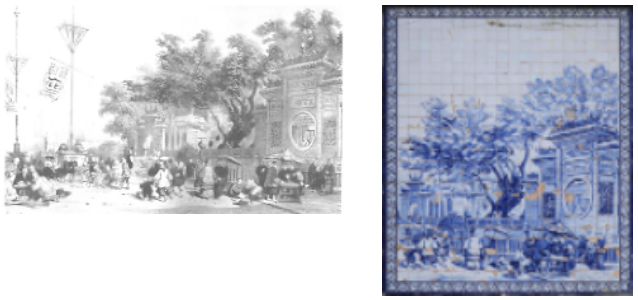


Fig. 3. Original Auguste Borges's sketch[7] (1838) and the azulejos panel of Plaza in front of A-Ma Temple (photos taken by Wong, 2023-2024).

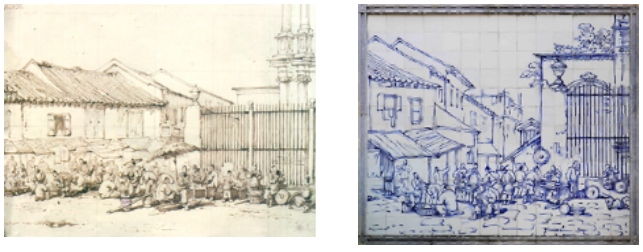


Fig. 4. Original George Chinnery's sketch[8] and the azulejo panel of 'Street Restaurant Outside S. Domingos' dating from 1840 (photos taken by Wong, 2023-2024).



Fig. 5. Electricity boxes adorned with azulejos (photos taken by Wong, 2023-2024).

IV. DESIGN OF THE PROTOTYPE

A. Prototyping Innovation

To advance this research, we developed a prototype as an engaging platform for preserving azulejos using cutting-edge technology while encouraging active participation. Drawing from insights gathered through the literature review and survey results, this prototype is designed to collect data and inform future developments in the field.

The prototype features a transformative azulejos panel made from fabric materials, integrated with augmented reality experiences, and disseminated through multiple channels. It offers users an interactive journey to explore Macau's azulejos in a novel way, blending tangible and intangible elements seamlessly. Figure 6. illustrates the relationship diagram, depicting user interaction with the prototype, while Figure 7. showcases a visual mock-up of user engagement.

The user experience begins with visual and tactile interaction with the fabric panel. Adjacent to the panel, a poster displays project details and includes QR codes linking to the AR experiences. By scanning the QR codes with their devices, users can explore virtual elements and access practical information related to the panel. These virtual components create connections to the panel's website, bridging the physical and digital realms of azulejos.

B. Process of Prototype Design

Figure 8. provides a flowchart of the prototype design process, including the software and hardware used. The process began with a field study of Macau's azulejos, followed by photo collection and editing. The prototype's initial step involved creating a panel design based on a motif from Macau's azulejos. The

photographs were converted into vector graphics to facilitate the subsequent embroidery processes. The fabric pieces were then quilted to form a large patchwork integrated with augmented reality experiences. The AR elements were linked to dissemination channels, bridging the physical panel with the digital world.

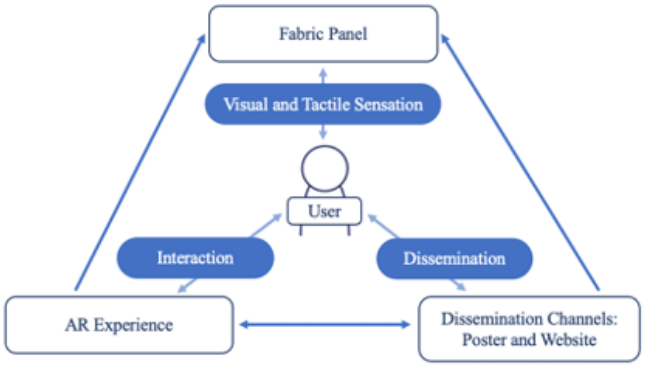


Fig. 6. Relationship Diagram of User and Prototype (Wong, 2023-2024).

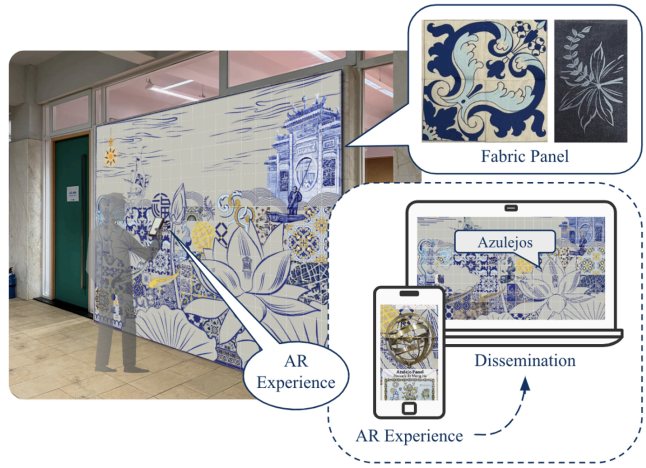


Fig. 7. Visual mock-up when users interact with the prototype[9] (Wong, 2023-2024).

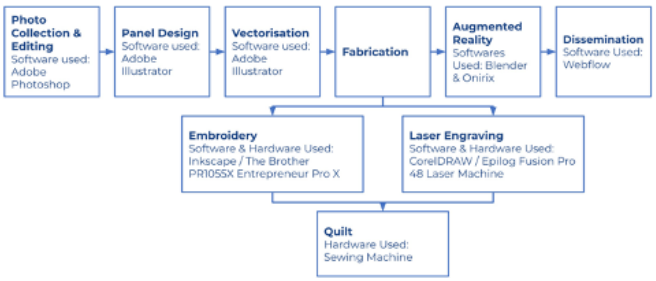


Fig. 8. Flowchart of the prototype design process (Wong, 2023-2024).

C. Interface Design of Innovative Panel

Drawing inspiration from the natural characteristics of azulejos—square-shaped and narrative—a patchwork composed of 357 individual fabric pieces, each silhouette extracted from tiles in Macau offers a novel visual representation of a symbolic motif of Macau. As shown in Figure 9, the design features Macau's city flower, the lotus, along with the A-Ma Temple, and a Portuguese caravel, symbolizing the historic moment when the Portuguese landed near the A-Ma Temple, shaping Macau into the remarkable historical city it is today.

The design approach for the fabric panel utilized the concept of collage, a fine art technique that assembles various fragments into a cohesive artwork through adhesive means. However, each piece in this design is meticulously arranged in neat squares reminiscent of azulejos. As Shields [12] suggests, collaged elements lead double lives, balancing their original identities and new roles in the poetic ensemble. Each fabric piece, derived from actual tiles in Macau, contributes to a new visual composition. This fabric panel prototype is a reinterpretation of Macau's azulejos, aimed at raising awareness of this cultural legacy. By breathing new life into these traditional tiles, the design draws attention to their historical significance.



Fig. 9. Digital Design of the Fabric Panel (Wong, 2023-2024).

Cubuk [13] noted that azulejo tiles were often cut into 14 x 14 cm squares for specific purposes. Meanwhile, the azulejo tiles were traditionally cut into 14 x 14 cm squares and 15.2 x 15.2 cm in the IAM Building. In line with this tradition, the fabric panel we intend to create will incorporate individual fabric pieces, each measuring 14 x 14 cm. These pieces will be quilted together to form a large fabric panel of 294

cm in width and 238 cm in height, consisting of 21 rows and 17 columns of fabric pieces.



Fig. 10. The Brother PR1055X Entrepreneur Pro X and the graphic embroidered.



Fig. 11. From photographing and digitalization to embroidery.[10]

D. Embroidery Techniques and Quilting

The Brother PR1055X Entrepreneur Pro X embroidery machine was used for all tile embroidery work, as shown in Figure 10. This 10-needle machine features auto-threading and operates at speeds of up to 1,000 stitches per minute. The time required to embroider a single fabric piece ranged from 30 to 70 minutes under the speed of 800 stitches per minute, depending on the complexity of the patterns. Colors traditionally found in azulejos, such as cobalt blue and yellow, were used, with dark blue, light blue, and yellow chosen for the embroidery on a beige base fabric. Figure 11. shows the process from photographing and digitalization to embroidery.

Linen fabric was chosen as the base to minimize stretch, and the non-woven polyester fabric was used for stabilization. This adjustment proved successful, as the final pieces maintained proper alignment. Given that the trim lines at 14.2 x 14.2 cm are embroidered on each fabric piece, the quilting process involves aligning each piece with these markers to ensure precision (see Figure 12).

Despite encountering challenges due to the thickness of the fabric, leading to slight misalignments on the edges of each piece during quilting with the sewing machine, the final panel presents a good outcome. The vibrant color combinations–featuring colors of blue, light blue, yellow, and others–stand out, capturing the vibrant color palette typical of azulejos tiles.



Fig. 12. The quilted fabric panel.

E. Augmented Reality Design

To advance this investigation, the project aims to leverage cutting-edge technology to enhance the appreciation and promotion of azulejos. By creating dynamic 2D and 3D animations within an AR experience, the project offers a compelling platform for exploring these artistic treasures and ensuring their legacy endures. The prototype will seamlessly integrate selected azulejos motifs into the AR experience, encouraging immersive interaction and exploring their fascinating interpretations.

The research survey revealed that many respondents lack awareness of azulejos' history and deeper meanings. AR technology can address this knowledge gap by virtualizing images through various elements such as video, text, sound, and animation [14]. By presenting virtual objects via AR devices, users can engage with and better understand the motifs and origins of azulejos.

To elaborate the AR prototype, three elements with significant symbolic meaning were chosen for integration with AR: an armillary sphere, the Chinese character 'FU (福)' (happiness), and the polychrome pattern 'flower vases'. The armillary sphere, a navigational tool used by Portuguese navigators, has been the symbol of Portugal since the reign of King Manuel I and is placed on the Portuguese flag. It depicts the time when the Portuguese arrived at the

port of Macau and symbolizes Macau as a cultural crossroads. Besides, the Chinese character '福' (happiness) is found in the vast panel in The Macau International Airport created by Portuguese azulejos painter Eduardo Nery. The large panel depicted the nautical and aviation scenes in Macau and Portuguese and Chinese religions, myths, and cultures, revealing the historical significance of the connections between Portuguese and Chinese. In addition to the symbolic objects, the iconic floral motif of replica flower vases is extracted from the IAM Building, which are decorative objects commonly adorned in palaces and convents [12]. By incorporating these AR experiences, we aim to draw users' attention to delving into and discovering these precious artifacts.

1) Animation Design

The purpose of creating animations is to virtualize the hand-drawn elements found in azulejos and enhance user engagement. Each AR experience consists of two animations: a dynamic virtual object and an accompanying pop-up name tag. All animations are created within Blender[11] and Procreate[12].

In the context of the armillary sphere, a dynamic 3D model is brought to life, with the spinning animation set to loop continuously to capture attention (see Figure 13).

During the animations, each object is accompanied by a pop-up name card revealing the original panel and its corresponding description (see Figure 16). Considering the user-centered approach that recognizes the impact of excessive text on user experience, each name card features only one to two concise sentences of description. Additional information will be available on the designated website for those seeking a more in-depth understanding.

In the subsequent AR animation, the motion graphics effect is employed to transition the Chinese character '福' into its regular script form, highlighting the original character (see Figure 14). The same effects are tailored to the floral motif pattern, emphasizing the elegance of flowers and enhancing the appreciation for repeating patterns (Figure 15).

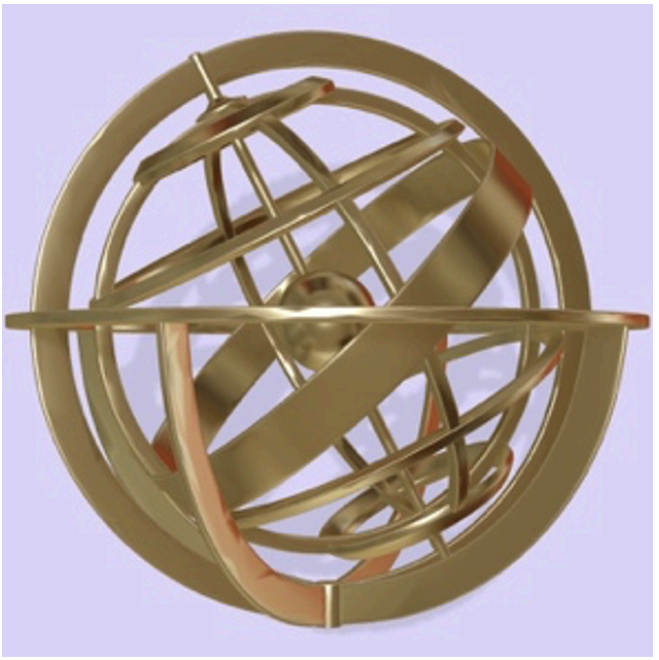


Fig. 13. Spinning animations of the armillary sphere.[13]

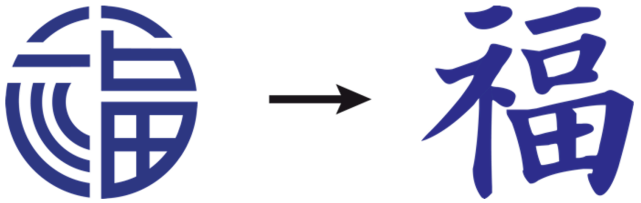


Fig. 14. Motion graphics effect for the Chinese character '福 (Fu)'.

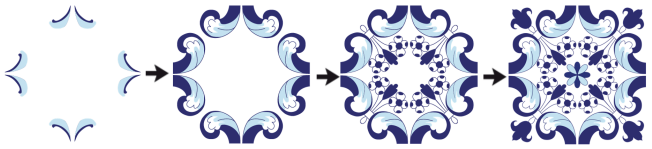


Fig. 15. Motion graphics emphasize the flowers' elegance.



Fig. 16. Name cards of the armillary sphere, the Chinese character '福 (Fu)', and the polychrome pattern.

2) AR Experience Creation

AR experiences are created using Adobe Aero[14]. The AR markers are the images of the embroidered fabric pieces of the 'FU,' armillary sphere, and flower polychrome pattern (Figure 17). These markers are configured to trigger corresponding virtual elements such as animated objects, name cards, descriptive titles, and interactive buttons.

Interactions enrich the user experience in AR experience. For the armillary sphere AR experience, the 3D animation of the armillary sphere is automatically displayed on the scene load. By tapping on it, users can trigger a descriptive title, an animated name card, and a 'more info' button (see Figure 19). Since the name card offers only a brief informative description, users can tap the 'more info' button to access a URL directing to a web browser with a more in-depth introduction to the original azulejos panel. The AR creations of the 'FU' and flower polychrome pattern are the same approach. Figure 18. shows the QR codes link to the AR experience.

Anchoring AR markers has to be reached through trial and error. During the process, we faced challenges where issues with light and shadow could cause anchoring failures due to the irregular surface of the fabric not being flat or smooth. The ambient lighting conditions at the installation site of the panel are a crucial factor that requires careful consideration. Given that the panel is situated outdoors, we conducted tests with the AR markers at various times to capture optimal photos for their effectiveness.

These animations and AR experiences recreate traditional art forms in a digital object, enhance user engagement, and foster a deeper understanding and admiration for the depicted cultural symbols.



Fig. 17. The AR markers of the 'FU', armillary sphere, and flower polychrome pattern in Adobe Aero.



Fig. 18. QR codes link to the AR experience, from the 'FU' and the armillary sphere to the flower polychrome pattern.



Fig. 19. AR experience of the armillary sphere in Adobe Aero.

F. Dissemination

The design prototype is named 'Stitched-in Blue and White.' It is disseminated through a poster and a website, acting as an essential connection between users and the fabric panel. These mediums ensure users understand the project's concept, purpose, and detailed information.

This logo of 'Stitched-in Blue and White' (see Figure 20) serves as a branding element across the poster and website, establishing a visual identity for the project. The poster and fabric panel visually represent the project's brand. It features QR codes that access AR experiences and direct users to the project's website. The poster delivers a brief overview of the fabric panel's title and name and the project's concept and visually engages viewers to encourage their active participation. Developed using Webflow, the website's responsive design ensures seamless functionality across various devices (see Figure 21).



Fig. 20. Logo of the panel 'Stitched-in Blue and White'.



Fig. 21. The website page of 'Fu' and the armillary sphere are displayed in portrait orientation on the phone.

In conclusion, the dissemination strategy for this project integrates multiple mediums such as panel branding, AR experiences, a project logo, a dedicated website, and interactive posters with QR codes to enhance accessibility and engagement with the appreciation and stories behind the stunning azulejo tiles. The cohesive visual identity ensures that users can easily explore and interact with the project across various platforms and devices, fostering a comprehensive and user-friendly dissemination of the research outcomes. This is the URL of the website: https://hazels-dapper-site-3f54b5.webflow.io

V. CONCLUSION AND FURTHER WORK

While azulejos are considered national assets of Portugal, the azulejos in Macau stand out for their uniqueness, embracing the symbolic meaning of the place where they are found. These stunning tiles, as tangible assets, embody their diverse function in artistic and architectural significance, while their intangible value contributes to Macau's sustainable development and the city's image in tourism. Therefore, it is important to safeguard these endangered assets, particularly concerning the deterioration of Macau's azulejos.

Urbanization and globalization gradually penetrate and threaten the preservation of a city's traditions. To commit to the United Nations' SDGs of safeguarding the legacy, this study focuses on the digital preservation of Macau's azulejos, employing several methodologies. We conducted an in-depth analysis of azulejos in Macau and collected photographs of Macau's azulejos. We established a physical artifact- a transformative panel- in a novel way with the integration of AR experience while showcasing the actual images of Macau's azulejos and the motif related to the city's traditions. This innovative approach aims to promote azulejos and revitalize these treasures, contributing to sustainable development and ensuring a bright future for azulejos.

During the design process of the prototyping development, we explored the related works and corresponding approaches appropriate for our prototype. We investigated a user-centered approach to our prototype design that facilitated user engagement. Throughout the engagement in the design prototype, users can appreciate the beauty of azulejos and understand the in-depth stories and meanings of this cultural legacy.

To accomplish this project does not mean merely finishing the study. The relevant future work could entail an open-source project containing all the

photographs of azulejos in Macau and their introductions, similar to what the Portuguese government and institutions are doing. Furthermore, AR experiences can be utilized in educational-oriented or art-oriented projects or integrated with existing initiatives to enhance public engagement and ensure the sustainable development of azulejos.

Cultural preservation and sustainable development are ongoing works. Revitalizing cultural heritage through the integration of cutting-edge technology stands as the primary approach to safeguarding a city, a settlement, a culture, an architecture, or customs. This is the global norm to protect our civilization on Earth.

REFERENCES

[1] Saporiti, T. (1998). Azulejos portugueses: Padrões do século XX: XX century patterns = Portuguese ceramic. Publimpressores, Artes Gráficas.

[2] Baule, A. (2017). Shape Universality Classes in the Random Sequential Adsorption of Nonspherical Particles. Physical Review Letters, 119(2), 028003. https://doi.org/10.1103/PhysRevLett.119.028003

[3] Lévai, C. (Ed.). (2006). Europe and the world in European historiography. PLUS-Pisa University Press.

[4] Zhou, M., Geng, G., & Wu, Z. (2012). Digital preservation technology for cultural heritage. Higher Education Press ; Springer.

[5] Petrelli, D., Ciolfi, L., Van Dijk, D., Hornecker, E., Not, E., & Schmidt, A. (2013). Integrating material and digital: A new way for cultural heritage. Interactions, 20(4), 58–63. https://doi.org/10.1145/2486227.2486239

[6] Adams, W. M. (2006). The Future of Sustainability: Re-Thinking Environment and Development in the Twenty-First Century. The World Conservation Union. http://cmsdata.iucn.org/downloads/iucn_future_of_sustainability.pdf

[7] Steckiewicz, M. (2017) Effective policies for durable and self-sustainable projects in the cultural heritage sector. INTERREG Europe application form. Typescript.

[8] Tan, S. (2020). Virtual experience in augmented exhibition. Virtual technology application in real museums and its impact on exhibition spaces [Doctoral Thesis, Politecnico di Milano]. https://hdl.handle.net/10589/171010

[9] Zhezhova, S., Jordeva, S., Golomeova-Longurova, S., Dimitrijeva-Kuzmanoska, V., & Dimova, T. (2019). Tactile properties of fabrics. Tekstilna Industrija, 67(2), 4–10. https://doi.org/10.5937/tekstind1902004Z

[10] Xinling, C., Mccool, M., Kitamoto, A., & Mann, S. (2012). Embroidery modeling and rendering. In Proceedings—Graphics Interface (p. 139).

[11] Alexandre Pais, Andre Lui ; creative director and photography by Carol Kwok ; translated by Cultural Commercial Communication Co Limited - 澳門葡國瓷磚 / by Alexandre Pais & 呂澤强 ; 創意總監及攝影郭倩齊 ; 翻譯三思文商傳訊有限公司. (with Pais, A. N., 呂澤强, & 郭倩齊). (2015). Azulejos em Macau = Portuguese tiles in Macau (Di 1 ban). Asia One Books ; Chinese Cultural Industries Promotion Association.

[12] Shields, J. (2014). Collage and Architecture (0 ed.). Routledge. https://doi.org/10.4324/9781315883199

[13] Cubuk, G. (2023). Azulejos as an architectural element within the scope of design and conservation. Cultural Heritage and Science, 4(1), 40–48. https://doi.org/10.58598/cuhes.1279872

[14] Flavián, C., Ibáñez-Sánchez, S., & Orús, C. (2019). The impact of virtual, augmented, and mixed reality technologies on the customer experience. Journal of Business Research, 100, 547–560. https://doi.org/10.1016/j.jbusres.2018.10.050

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[1] https://www.icm.gov.mo/en

[2] https://images.io.gov.mo/bo/i/2013/36/lei-11-2013.pdf

[3] https://www.culturalheritage.mo/en/detail/102318

[4]https://www.collinsdictionary.com/dictionary/english/artefact#:~:text=Word%20forms%3A%20artefacts&text=An%20artefact%20is%20an%20ornament,is%20historically%20or%20culturally%20interesting.

[5] https://www.interaction-design.org/literature/topics/ux-design#:~:text=User%20experience%20(UX)%20design%20is,%2C%20design%2C%20usability%20and%20function.

[6] https://www.interaction-design.org/literature/topics/ux-design#ux_design_is_user-centered-4

[7]https://www.macaudata.mo/macaubook/book111/html/15501.htm

[8]https://www.icm.gov.mo/rc/viewer/30007/1515

[9] The location is the University of Saint Joseph in Macau.

[10] Methodology based on the project - VISUAL IDENTITY 1.0 - VISUAL IDENTITY: PATTERNS AND TEXTURES IN THE CITY OF MACAU (TERRITORY) and VISUAL IDENTITY 2.0 - PATTERNS AND TEXTURES IN MACAU CITY (REIMAGINED).

[11] https://www.blender.org/

[12] https://procreate.com/

[13] Source of 3D model: https://free3d.com/3d-model/armillary-sphere-v2--103480.html; Animation and material are built by Wong.

[14] https://www.adobe.com/products/aero.html

Shared literacies in technological, artistic practice: New sensitizations, critical thinking, ancestry and multiculturalism

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Abstract—This manuscript intends to discuss how epistemological interfaces between art, technology, and the humanities can be established through shared transdisciplinary practices based on Multiplatform Shared Literacies (MSL). In addition to elucidating this issue from endo-aesthetic, participatory action-research, and diversivist perspectives, it seeks to bring to light how this method has proved capable of promoting critical reflection creatively based on different types of knowledge, new technological sensitivities, and traditional practices alike. In terms of the cases covered here, "The Wishing Tree" (2012 - 2024) was the one that started this methodological construction. "Hoshi Akari: Beyond the Southern Cross," "Technoresistances, new sensitizations and critical thinking," and "Hi-tech + Low-tech: technological Art and Multiculturalism" are applications of these already structured practices that took place in postgraduate programs in the multi- and transdisciplinary field.

Keywords - multiplatform shared literacies, art and technology, education through art, new sensitizations, diversifies

I. INTRODUCTION AND CONTEXT

I don't know if art has a mission, but if it has, I would not like it to be anything but offering someone the opportunity to formulate new questions about the here and now of their existence. (Graciela Sacco)

The historical-conceptual subtopics discussed below are the basis for the formatting of a transdisciplinary and multicultural action-research method that we call Shared Multidimensional Literacies (SML), acquired during twelve years of artistic, technological, and cultural sharing actions carried out so far in 14 countries on four different continents. Based on the detection and construction of critical thinking from other worldviews, its nature has also found ample justification in the face of the social, technological, environmental, and climatic transformations that planetary humanity has undergone, especially in the 20th and 21st centuries.

In parallel to our shared actions around the world, we have also observed in our surroundings how the exponential increase in media disinformation (Tiburi, 2019) (1), as well as the increasing automation of human thinking through artificial intelligence tools, has affected the way we think, produce, communicate and act in everyday life. Also, issues related to the Anthropocene, such as the disregard for climate change expressed in the criminal fires in the rainforests, the ongoing practices of extermination of the Amazonian peoples, as well as the denial of science, strongly expressed during the Covid-19 pandemic, have made us realize the urgency of building and rescuing systemic perspectives. (Vasconcellos, 2003; Giannetti, 2006) (2)(3), critical (Freire, 1965 and 1967) (4)(5), and multicultural (Jagodzinski, 1999) (6) perspectives in all instances of pedagogical, social, and cultural literacy, as well as the extent to which our actions have met these demands.

A. Decolonizing single dominant thoughts and methods: rescuing critical worldviews from a Latin American perspective

Thoughts and worldviews of a critical nature are based on a) self-knowledge developed from an awareness of our family, local, generational, cultural, and intellectual contexts, b) apprehensions of facts, and c) principles and/or theorems that have been demonstrated, proven and/or remembered (Freire, 1967; Hooks, 2021) (7). Pragmatic, technical, and/or rhetorical approaches without any kind of contextualization have made individuals, collective,s and societies very vulnerable to discursive strategies of single thoughts, repetitive diffusions (especially in the media), (mis)information and intimidation, which at any given time and in any given moment seek to stifle anything that deviates from "pre-established" norms (Appadurai, 1996; Forestier, 2000; Lander et al. 2005; Martins, 2020) (8)(9)(10)(11).

Antonio Bispo dos Santos (1959 - 2023)(12), a Quilombola writer and freethinker, brought us an emancipatory, anti-standardizing cosmovisionary perspective based on the principle of a diverse universality to confront cosmophobic perspectives. His work "A terra dá, a terra quer" (The land gives, the land wants) struck us because of the similarity of its content with the cosmovisionary diversity accumulated in all our experiences

and sharing. In it, Bispo offers an incisive critique of the "standardizing" process of the concept of "culture" and distinguishes it from art based on people's different ways of being, acting, and living.

> *Os colonialistas dizem que não temos cultura quando não nos comportamos do jeito deles. Quem não sabe tocar piano ou não sabe o que é música erudita, quem nunca frequentou um teatro, quem não frequenta o cinema, para eles não tem cultura. Para nós, quem não sabe dançar e cantar no batuque, quem não sabe fazer uma comida, quem não se emociona com a cantiga de um pássaro, não tem um modo agradável de viver.* (Bispo dos Santos, 2023, p. 23)[8]

He also gave the term "humanist" to those who disregard diversity as a characteristic of the cosmos, ultimately leading people to think singly. For him, "while society is made up of equals, community is made up of diversity" (ibid., p. 29).

> *Nós somos os diversais, os cosmológicos, os naturais, os humanos. (…) Eu não sou humano, sou quilombola. Sou lavrador, pescador, sou um ente do cosmos. Os humanos são eurocristãos monoteístas. Eles têm medo do cosmos. A cosmofobia é a grande doença da humanidade.* (Ib.)[2]

B. The transdisciplinarity of education and literacy through artistic practices

Bispo's critical worldview aligns with Latin American intellectuals who focused primarily on literacy and education through the arts, including Paulo Freire, Ramón Cabrera Salort, and Ana Mae Barbosa. Freire already evoked the need for a critical education for the lower classes, without which the most oppressed will desire to rise to the dominant classes to become the oppressors themselves (Freire, 1965). His literacy method consists of first using everyday words for the students, contextualizing the words and their syllables, and leading them to situate themselves based on their geographical, socio-economic, and cultural conditions (Freire, 1967).

Ramón Cabrera Salort, for his part, advocates a multicultural education that goes beyond the pragmatic and technical education practiced in the vast majority of schools on the planet. This pragmatism lies in the fact that these schools set out to teach "a set of 'useful things' that must be learned through a set of subjects" (Cabrera Salort, 2017. p. 284).

> *¿Que ligazón tienen estas cosas con la vida? ¿En qué medida estas nos son necesarias y han de transformarnos de mente y corazón? ¿Como estas cosas útiles podrían saberse mejor, si parten de mis intereses y encarnan en lo dos otros, modifican nuestra realidad a par que me modifican?* (Ib)[3]

Salort also exemplifies how the teaching of Art History, as in other fields of knowledge, could be demonstrated in a way that would revive shared experiences between teachers and students in the field of "innovation, change, rupture, indiscipline and conflict" (Cabrera Salort, 2022)(13).

Ana Mae Barbosa proposes a "triangular approach" to art education based on three pillars: first, the teaching of artistic practice; second, the understanding of the work in the field of its meaning, based on people's contact with and appreciation of it; and third, the contextualization of the work in its time, space, and authorship. She attributes "contextualization" to the meaning of "awareness" (Barbosa, 2022)(14).

> *Contextualizar é estabelecer relações. Neste sentido, a contextualização no processo de ensino-aprendizagem é a porta aberta para a interdisciplinaridade. A redução da contextualização à história é um preconceito modernista. é através da contextualização que se pode praticar a educação na direção da multidisciplinaridade e da ecologia, valores curriculares que definem a pedagogia pós-moderna* (Barbosa, 1998, p. 38).(15)[4]

II. MULTIDIMENSIONAL SHARED LITERACIES IN ACTION RESEARCH FIELD

Concerning workshops for the production of artistic and pedagogical audiovisual content, we agree with Mário Kaplún's critique, which advocates a "different kind of communication: participatory, problematizing, personalizing, interpellating" (Kaplún, 1998) (16).

> *Generalmente, los que acuden a nuestros Talleres de Comunicación Educativa llegan esperando sobre todo técnicas. Piensan que si sus producciones y mensajes no logran «llegar» eficazmente a sus públicos es sólo por su desconocimiento de los recursos instrumentales.* (Kaplún, 1998, pp. 12-13)[5]

Usually, when training actions that include any type of media technology content, participants usually expect pragmatic and instructional teaching. The absence of humanities and subjectivization in curricula and training in the fields of technicity (Wilson, 2015; Medina Ramirez, 2022) not only generates this type of outlook but also, from a broader perspective, promotes a disconnection between the individual and their environment and their ecosystemic constitution.

This also applies to artistic practice, whereby the focus is on developing manual, bodily, and strategic skills (Juul, 2005)(19), as well as fostering "some cultural sensitivity" (Barbosa, 2005, p. 99)(20). Although, within the context of a Western capitalist system, art becomes an autonomous entity detached from ritualization, commodified, and separated from life (MartinBarbero, 1997, p. 67), it does not become a commodity. (21) It continues to serve as a conduit for meanings that cannot be conveyed through other forms of communication, such as discursive and scientific

[8] The colonialists say that we don't have culture when we don't don't know how to make food, who isn't moved by the song of a behave in their way. Those who can't play the piano or don't know bird, don't have a pleasant way of life. (Bispo dos Santos, 2023, what classical music is, those who have never been to the theater,[p. 23)] those who don't go to the cinema have no culture. For us, anyone who doesn't know how to dance and sing in a batuque, who

language (Barbosa, 2005). Additionally, it facilitates a "conversation of souls," moving from the individual to the collective and being shared (Bispo dos Santos, 2023, p. 23).

In this context, Ana Medina Ramirez (2022) puts forth a playful approach to incorporating available materials and technologies in artistic practice, viewing them as significant creative resources.

> (…) *un taller de arte necesariamente es un acercamiento a técnicas artísticas considerando que lo importante es el proceso creativo. Cada vez que se introduzca un material al taller, deben realizarse ejercicios de exploración para conocer sus posibilidades.* (Medina Ramirez, 2022, p. 29)

A. Methodological basis

It would be erroneous to view SML as a means of supplanting any existing academic or instructional curriculum or the historical.

[2] We are the diversals, the cosmological, the natural, the human. (...) I'm not human; I'm Quilombola. I'm a farmer, a fisherman, an entity of the cosmos. Humans are monotheistic Euro-Christians. They are afraid of the cosmos. Cosmophobia is humanity's great illness. (Ib.)

[3] What is the connection between these things and life? To what extent are they necessary for us, and must they transform our minds and hearts? How can these valuable things be better known if they start from my interests and incarnate in others, modifying our reality as they modify me? (Ib).

[4] To contextualize is to establish relationships. In this sense, contextualization in the teaching-learning process is the open door to interdisciplinarity. Reducing contextualization to history is a modernist prejudice. Through contextualization, education can be practiced in the direction of multidisciplinarity and ecology, curricular values that define postmodern pedagogy.

[5] Generally, those who come to our Educational Communication Workshops arrive expecting above all techniques. They think that if their productions and messages fail to "reach" their audiences effectively, they only lack knowledge of instrumental resources (Kaplún, 1998, pp. 12-13).

And contemporary achievements of scientific research within the context of its established methodologies. In essence, it represents a cross-cutting revisiting of empirical and qualitative methods to foster sharing, listening, and approaches in the procedural, sensitive, conceptual, and critical spheres (Vasconcellos, 2002; Rey, 2002; Bardin, 2011; Fortin and Gosselin, 2014; Cabrera Salort, 2016).(22)(23)(24)(25)

- *Individual and collective reflections and proposals in testimonies, debates, and conversation circles:* Based on the pre-established provocations, all parties must analyze their experiences in the context of (multi)cultural plurality. Reflections are encouraged and developed through the active listening of guest commentary during and after the exhibitions. The analyses of the actions and works should respond to how the content studied is apprehended, understood, and critically (re)interpreted creatively, expressed by the guests from their diverse repertoires and cultural matrices.

- *Systemic artistic practices:* This understanding and application implies getting to know and, in many cases, inducing the participants - spectators - observers to act and play a leading role alongside a given artistic artifact in a symbiotic way, both in the creation and construction of the artistic work and, within the contextual possibilities, in the interactive human-artifact relationship (Giannetti, 2006, pp. 175-200). During the exhibition, the intuitive, creative, bodily, and strategic resourcefulness of the participants and guests in front of the constructed work will show the degree of "intimacy" acquired with the interactive sensitization (haptic and/or touchless movement) experienced.

- *Observation:* How each workshop participant (regardless of any previous specific artistic ability) concentrates and is proactive in the face of the challenges set for and during the construction of the piece, as well as their interaction and ethics towards others, must be observed horizontally between all of them, with the intention of understanding and learning different attitudes, performances, and assertiveness, without developing any prior value judgments. In this way, the knowledge of the effects of affective and intellectual immersion is also observed, as well as the interaction with the piece during and at the end of its construction.

- *Analysis of the works created:* the works created should be studied based on their sensitive and reflective impact (Bardin, 2011)(21) on the participants and the audience present and should have the following key parameters: a) the understanding expressed about the different and possible roles of artistic practice in the construction of knowledge; b) the behavioral impacts possibly triggered by the technological interactive processes; c) the degree of curiosity and interest aroused about adding elements of ancestral knowledge to complement or counter scientific methods or the very understanding of the concept of "modernity"; d) the willingness expressed to multiply critical-creative actions from multidisciplinary and multiplatform artistic practices.

III. CASE STUDIES

The procedural sharing structure has promoted the intersection of the participants' repertoires and the joint

construction of knowledge and reflection. Over time, these events have added an essential multicultural dimension through the sum of different critical and behavioral polysemies observed in the productions and exhibitions (Ibid). The series of workshops "The Wishing Tree" (Teles et al., 2013; Teles and De, 2017; Pitman, 2018; Leão, 2018, Paiva, 2019; Teles, 2019, 2020, 2022a and 2022b)(26)(27)(28)(29)(30)(31)(32)(33)(34) held in different countries and continents over the last twelve years was the main trigger for the conception and construction of this method under discussion here, which has also been experimented in postgraduate programs in the fields of education, political science and multidisciplinary global studies at academic institutions in Japan, England and Macau, China.

As SML encompasses not only the sharing of ideas and worldviews but also technological ones, one of the significant challenges associated with this method is its implementation in a module of the Master's degree course in Symbolic Production and Sociocultural Mediation, which is scheduled to take place at the Faculty of Visual Arts of the University of Arts (ISA) in Havana, Cuba, during the first semester of 2025. If, on the one hand, this is a university dedicated to teaching arts and media communication in a country where critical thinking has been cultivated in the population since primary and secondary school, on the other hand, the international economic embargo suffered for decades has led to a significant technological shortage, both in terms of acquiring components at a low cost and in terms of maintaining them.

A.. "The Wishing Tree" (2012 - 2024)

"The Wishing Tree" artistic workshop was never a particularly large-scale project. Conversely, the workshops were conducted individually, with no predetermined framework for subsequent events. As the results were disseminated through academic articles, lectures, conferences, exhibitions, and social media, new invitations were extended for further events. To date, the workshops have been held in 13 countries.[1]. They were initially conceived in partnership with US-based Indian researcher Mousumi De to introduce low-cost technologies to the endo-aesthetic experience (Giannetti, 2006; Teles, 2009) and integrate recycling practices into the teaching and practice of art education in primary and secondary school classrooms. However, new topics and discussion areas emerged as the project progressed, enhancing its potential in shared training.

The project was initially inspired by Japanese folklore surrounding Tanabata (Kawanam, 2013) and Indian folklore about the Kalpavriksha tree (Pande, 2019), about trees with the power to grant people's wishes. By the conclusion of the inaugural workshop, it became evident that the tree sculpture, constructed using discarded objects, represented the fulfillment of wishes. This underscored the possibility of fostering ecological and anti-consumerist learning through artistic endeavors, particularly in light of its alignment with the epistemology of Educommunication (Teles et al., 2013; Teles & De, 2017). As the workshops were conducted in educational institutions, community centers, and indigenous villages, the local participants expressed a series of polysemies. These emphasized sharing knowledge and creative actions and the trans and multiculturalism inherent in them (Teles, 2018, 2019, and 2022).

Moreover, some pieces have been exhibited in museums and cultural centers for the general public (Teles, 2017). One such piece was produced in collaboration with the Pataxó-Hãhãhãe indigenous community in Milagrosa Village, Bahia, Brazil. This project, titled "Indigenous Electronic Art," involved ten artists from diverse backgrounds, including Brazilian nationals, who were selected to create works that integrated electronic artifacts with local crafts and worldviews in various indigenous communities in Northeast Brazil in July 2018. (Pitman, 2018 and 2019; Teles, 2019, p. 37). In the subsequent month, the resulting works were exhibited for two months at the Museum of Modern Art in Salvador. The following year, the AEI project was bestowed with an Honorable Mention in the STARTS Prize'19 – Innovation at the nexus of Science, Technology, and the ARTS, at CiberArts 2019. An event sponsored by Ars Electronica - Art, Technology, and Society, which showcased a selection of notable works, included "The Wishing Tree Hãhãhãe," a piece we had the opportunity to contribute (Leopoldseder et al., 2019, pp. 200-201).

B. Hoshi Akari - beyond the southern cross (University of Kumamoto, Japan, 2019)

In 2016, the city of Kumamoto in Japan was struck by one of the most powerful earthquakes in recent history, resulting in hundreds of fatalities, thousands of injuries, and a significant number of individuals becoming homeless (Smart and Grierson, 2016). Many historic edifices and monuments were destroyed, and the water quality in the city's rivers, which are renowned for their purity and clarity, was adversely affected. For several weeks, the city was deprived of electricity, necessitating lamps for illumination during the night.

Subsequently, Dr. Kyoko Akaky, a professor at Kumamoto University, conducted an annual "Hoshi Akari" workshop with her students from the Postgraduate Education course, during which they recalled the tragedy. In the workshop, the students commemorate the victims of the disaster, create artistic handmade lamps, and underscore the brilliance of the stars and the Milky Way, which were reflected in the rivers due to the lack of lighting in the city, as well as the innumerable minor points of light produced by people's lamps.

When she heard about the "The Wishing Tree" workshop, inspired by the Tanabata legend, which also alludes to the shining of the stars, Dr. Akaki invited us to take part in her classes and add the elements used in it at the beginning of July 2019, during the last week of the Japanese celebration of the Tanabata festival (Tanabata

Matsuri). She studied Brazil's culture, fauna, and flora at this event. She observed that the Brazilian flag included some of the stars and constellations of the southern hemisphere, which were not visible from Japan. She named that year's edition "Hoshi Akari - beyond the Southern Cross" in homage to the sharing between the Japanese and Brazilian symbols used in it.

With the participation of approximately seventy students, an installation was produced utilizing recycled materials, interactive music, audio recordings of the student's wishes, and animations based on the individual pieces constructed and historic buildings photographed (KTV, 2019). In this way, the integration and sharing that took place between different schools, cultures, and areas of knowledge, in the context of debate and symbolic conjunction, revealed a method of self-knowledge and historical knowledge that is informed by a profound respect for the present, as well as the ancient and recent past, and a respectful engagement with the culture and knowledge of others.

C. Technoresistances, New Sensitizations, and Critical Thoughts (University of Leeds, United Kingdom, 2024)

During our research trip held in 2023 and 2024 at the University of Leeds, at the School of Languages, Cultures and Societies of the Faculty of Arts, Humanities and Cultures, under the supervision of Prof. Dr. Thea Pitman, after a lecture held at the Camões Centre for Portuguese Language Studies, we were invited by Prof. Dr. Anna Grimaldi to hold a multi- and transdisciplinary workshop at the School of Politics and International Studies of the Faculty of Social Sciences of the same university. Based on interdisciplinary and multicultural pedagogical practices, this workshop was held with the aim of "improving the student experience through collaborative, decolonial, and arts-based pedagogies" (Grimaldi, 2023)(41). Students from the Institutes of Political Science, History, and Final Arts attended.

Our interactive sculpture "Evil is not the Metal," previously exhibited in Brazil and Portugal, was used as the material basis for this workshop. Composed of a wooden structure wrapped in crumpled cardboard with gold foil veins, it contained a haptic sensory interface that connected to the veins (inputs) and also to speakers and six LED strips, one of which filled the interior of a hollow structure similar to a crystalline outcrop, Another on the same surface illuminated six small steel wire sculptures in the shape of trees from below, and four more "flowed" from the top of the same outcrop to the ground (outputs) with animation.

In their natural state, the LED stripes flowing from the top displayed an animation of smooth movements in shades of blue reminiscent of flowing rivers. The LED on the surface illuminated the small trees in green, while the one inside the outcrop flashed in multicolored dots in shades of purple and white. Simultaneously, the sounds of the natural environment, including the sounds of water, monkeys, and birds, were played back in the context of the interior of the Amazon rainforest. Upon contact with the golden veins, the lighting exhibited a notable alteration in its behavior. Simultaneously extinguishing the LED within the outcrop, the LED on the surface rapidly flashed in red. In contrast, the four LEDs emerging from the top began to emit a crimson, orange, and yellow glow. Each instance of contact with the gold veins resulted in a distinct auditory stimulus, evocative of assaults on the natural environment and the indigenous peoples of the Amazon.

The participants were tasked with reworking the sound design in the gold veins based on their conceptions of the sounds they heard when the word "gold" came to mind. This prompted a reflection on and debate about the nature, importance, benefits, and environmental impact of mineral extraction processes and the damage they cause to the environment, health, and lives of the people involved. This was done based on their worldview. Additionally, the participants were required to interpret and share the representation of their ideas expressed through their chosen and collected sound clusters.

> While the installation generated fantastic interactions and awareness of gold mining in Brazil, the workshops provided students with a unique experience. Students could harness their diverse skills and knowledge and practice decolonial thinking by connecting with one another's cultural and situational life experiences. They also developed an understanding of how cultural and artistic production, as a political act, can be used to represent, transmit, and even catalyze political ideas and practices through interacting with various audiences. (Grimaldi, 2023)

D. Hi-tech + Low-tech: Technological Art and Multiculturalism (University of Saint Joseph, Macao, 2024)

This seminar-workshop was driven to the Global Studies Doctoral Program's students and teachers and aimed to debate the power of creative artistic-technological literacies in the inter and transdisciplinary research context. During the lecture, we were able, for the first time, to present a broadly structured concept of MSL as a set of knowledge sharing (given and received) through different skills and worldviews from the aesthetic, affective, empirical, laboral, cultural, social, and epistemological dimensions. Concerning its definition, applicability and transdisciplinary methodological potential, we have explained some of the dimensions of art education and education through art for the construction of critical thinking and research defended by Ramón Cabrera (2017 and 2023), as well as the diasporic Quilombola cosmovision of Bispo dos Santos, and the critique stemming from the capitalization of elements of nature by Ailton Krenak (2022)(41) and Davi Kopenawa (Limulja, 2022)(42). We also present the case studies in detail in this article, with which we have built this methodological proposal.

Before we started the lecture, we asked the participants to draw freely on a blank sheet of paper the research they were doing for their doctorate in the program. We noticed the initial surprise expressed, albeit silently, by many participants. After the lecture, we asked each of them to explain to their colleagues the content of their drawings

and how they presented their ongoing research. We could see how much this simple activity could make them think less descriptively and more interpretively about their work and the impact of their final opinions on them. One of the course participants, Ph.D. student Wai Ling Cheung, Principal of Mateus Ricci School in Macau, invited us to hold The Wishing Tree workshop at her school. The workshop took place in the last weeks of November, and the exhibition opened on December 3.

IV. FINAL CONSIDERATIONS

Artistic practice need not be limited to people with a particular artistic gift. Nor does its final product have to be a work of art in the curatorial sense. It is the moments of abstraction that they provoke and, consequently, a different way of trying to represent a given subject, objects of research and analysis, that are important when they are used to broaden the spectrum of reflection and analysis. On the other hand, the exchange of ideas, thoughts, actions, objects, and technologies is spontaneous and should not require any counterpart. It acquires a multidimensional organic fluidity of its own accord.

These statements can be seen in the actions and literature that have built up this method over the last two decades. To date, more than twenty institutions in fourteen different countries have adopted and embodied CLM. Higher education institutions, primary and secondary schools, cultural centers, and Indigenous villages, each in their ay and space-time, have shown us the breadth and diversity of possible formats for achieving shared literacy through creative processes. Although local, momentary, and minor in scale, the transcultural and multicultural intellectual and affective effects have finally shown us the power and the necessity of cultivating critical thinking based on different worldviews, thus promoting tremendous respect and tolerance among unequal people.

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REFERENCES

[1] M. Tiburi. (2019). *Delírio do Poder: Psicopoder e loucura coletiva na era da desinformação*. Rio de Janeiro: Ed. Record.

[2] M. Vasconcellos. (2002) *Pensamento sistêmico: o novo paradigma para a ciência*. Campinas: Ed. Papirus.

[3] C. Giannetti. (2006). *Estética Digital: sintopias da arte, a ciência e a tecnologia*. Belo Horizonte: C/Arte.

[4] P Freire. (1965). *Pedagogia do oprimido*. São Paulo: Ed. Paz e Terra.

[5] P. Freire.. (1967). *Educação para a liberdade*. São Paulo: Ed. Paz e Terra.

[6] J. Jagodzinski. (1999). Thinking Through /Difference/ in Art Education Contexts: Working the Third Space and Beyond. In: MASSON, R.; BOUGHTON, D. (eds.), *Beyond Multicultural Art Education: International Perspectives*.

[7] B. Hooks. (2021). *Ensinando pensamento crítico*. São Paulo. Ed. Elefante.

[8] A. Appadurai (1996). *Modernity at Large: the cultural dimension of globalization*. London / Minnesota: University of Minnesota.

[9] V. Forestier. (2000). *Uma estranha ditadura*. São Paulo, Ed. Terramar.

[10] E. Lander. et al. (2005) A colonialidade do saber: eurocentrismo e ciências sociais. Perspectivas latino-americanas. Buenos Aires: CLACSO.

[11] M. T. Martins. (2020). *A arte de trazer a vida pelas mãos*. In: ALVES C. e ALVES A. *Epistemologias e metodologias negras decoloniais e antirracistas*. Pensamento Negro Decolonial collection.

[12] A. Bispo dos Santos (2023) *A terra dá, a terra quer.* São Paulo: Ubu Editora.

[13] R. C. Salort. (2022) *Educación por el Arte, sentido de lo propio y actualidad (en pos del arte de mañana).* In: *Congreso Grietas Y Provocaciones Para Educación en Artes.* InSEA. Available at https://www.youtube.com/watch?v=qh8KvVK9iB4 accessed in September 2024.

[14] R. C. Salort (2022). *Decolonialismo y transformación. Paulo Freire y el Arte/Educación en Brasil*. In: *Congreso Grietas y Provocaciones para la Educación* em Artes. Cusco: Insea2022.

[15] A. M. Barbosa, (1998). *Tópicos Utópicos*. Belo Horizonte: C/Arte.

[16] M. Kaplun (1998). *Una pedagogía de la comunicación*. Madrid: Ediciones de la Torre.

[17] C. Wilson. et All. (2013). UNESCO - Alfabetização midiática e informacional: currículo para formação de professores. Brasília: UNESCO, / UFTM.

[18] A. M. Ramirez. (2022). *Bases para un taller de arte y juego: desarrollo del juego y del arte en la niñez*. Nuevo León: Universidad Autónoma de Nuevo León.

[19] J. Juul. (2005). Half-real: video games between actual rules and fictional worlds. Cambridge: MIT Press,

[20] A. M. Barbosa et Al. (2005). *Artes Visuais: da exposição à sala de aula*. São Paulo: Edusp.

[21] Martin-Barbero. (1997) *Dos meios às mediações*. Rio de Janeiro, UFRJ.

[22] P. Rey (2002). Por uma abordagem metodológica da pesquisa em artes visuais. In BRITES, B; TESSLER, E. (Org.) *O meio como ponto zero: metodologia da pesquisa em artes plásticas*. Porto Alegre: E. Universidade/UFRGS.

[23] L. Bardin.(2011). *Análise de conteúdo*. São Paulo: Edições 70.

[24] S. Fortin; P. Gosselin (2014). *Considerações metodológicas para a pesquisa em arte no meio acadêmico*. ARJ - Art Research Journal, [S.l.], v. 1, n. 1, p. 1-17, Maio 2014. ISSN 2357-9978. Available from: https://periodicos.ufrn.br/artresearchjournal/article/view/5256/4314 accessed in October 2024.

[25] R. C. Salort (2016). *Indagaciones sobre arte y educación*. Monterrey, Universidad Autónoma de Nuevo León.

[26] P. C. Teles et Al. (3013). *Technological migration and recycling process in the "Wishing Tree" Workshop: multicultural media literacy and protagonism*. In: ARDIÓN, M. e IMMACOLATA, M. Libro de Actas. XIII Congreso Internacional Ibercom Santiago de Compostela: IBERCOM, AssIBERCOM, AGACOM.

[27] P. C. Teles. And DE, M. (2017). Protagonismo, Reciclagem e Novas Sensibilizações em Oficinas Internacionais de Arte Tecnológica. In: SOARES, I. et all (Orgs.) *Educomunicação e suas áreas de intervenção: novos paradigmas para um diálogo intercultural.* 1ed. São Paulo: ABPEducom, 2017, v. , p. 637-645.

[28] T. Pitman. (2018). *Earthing Electronic Art: An Ecocritical Review of the Exhibition AEI Arte Eletrônica Indígena, Museum of Modern Art, Salvador da Bahia*, Brazil, Aug-2 Sept-2, 2018. New York: ACI.

[29] L. Leão. (2018.) O diálogo, o desenho e o texto: reflexões sobre a pesquisa em processos de criação. In: #17.ART • 17o Encontro Internacional de Arte e Tecnologia • 2018. ISSN: 2238-0272.

[30] A. S. Paiva. (2019). *A ancestralidade hi-tech dos povos originários*. In: Revista ABCA no. 50.

[31] P. C. Teles. (2019). *Arte tecnológica processual sem toques: experiências endoestéticas sob perspectivas transculturais*. In: ARTECH 2019 - Proceedings of 1te 9th, International Conference on Digital and Interactive Arts. Nova York: ACM.

[32] P. C. Teles. (2018). "Hi-Tech + Low-Tech": Aesthetic Reframing Processes Through Brazilian-Nigerian Art Literacy. In: SIMÃO, E.; SOARES, C. (Eds.) *Trends, Experiences, and Perspectives in Immersive Multimedia and Augmented Reality.*

[33] P. C. Teles. (2022)b. The multicultural and transdisciplinary construction of anticonsumerism critical thoughts: the multisensory diversity of the artistic installation series "The Wishing Tree." In: ISEA2022 Barcelona, International Symposium on Electronic Art Proceedings, pp. 599 - 607. https://doi .org/10.7238/ISEA2022.Proceedings. ISBN 978-84-08-47459-2.

[34] P. C. Teles. (2020). *Floresta dos Desejos - Documenta 2012 - 2019*. Available from:https://youtu.be/TprxO0rlgmE accessed on October 2024.

[35] S. Kawanam (2013). *Tanabata Matsuri - Festival das Estrelas*. www.japaoemfoco.com.br available from: https://www.japaoemfoco.com/tanabata-matsuri-festival-das-estrelas. Accessed on October, 2024.

[36] A. Pande. (2019). Kalpavriksha - The boon-bestowing tree of life, In: Times now news.com. Available from https://www.timesnownews.com/columns/article/kalpavriksha-theboon-bestowing-tree-of-life/440285 accessed in October 2024.

[37] T. Pitman. (2019). *Indigenous new media arts: narrative threads and future imaginaries*. In: Rev. Transmotion, Vol 5, no. 1.

[38] H. Leopoldseder Ett Al. (Ed.). (2019). CyberArts 2019. Berlin, Hatje Cantz Verlag GmbH.

[39] SR Smart; J. Grierson. (2016). *Japan hit a second powerful earthquake*. The Guardian, 16 de abril de 2016. Available at: https://www.theguardian.com/world/2016/apr/16/japan-hit-by-secondpowerful-earthquake-with-fears-of-more-to-come accessed on March 3rd, 2024.

[40] Kumamoto TV (2019) The Wishing Tree. (Video file in the author's possession).

[41] A. Grimaldi. (2024). Transdisciplinary Decolonial Conversations as Pedagogy. Leeds: University of Leeds. Available at: https://ctis.leeds.ac.uk/transdisciplinary-decolonial-conversations-as pedagogy/ accessed in September 2024.

[42] A. Krenak (2022). *O futuro Ancestra*l. São Paulo, Cia. Das Letras.

[43] H. Limulja (2022). *O desejo dos outros: uma etnografia dos sonhos yanomami*. São Paulo: Ubu Ed.

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[1] Brazil (2012, 2015, 2018), Portugal (2012), Germany (2014), Namibia (2018), India (2019), Cuba (2023), Vietnam (2024), Greece (2014), New Zealand (2015), Nigeria (2016), Nepal (2017), Macao, SAR China (2024).

Ab Ob Sub Ject

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Abstract—This article focuses on the conceptual and technical process of developing three interactive video arts of an artivist nature focused on self-reflection on perspective using techniques such as critical flow and embodiment, with the aim of addressing mainly human-animal relationships. In addition to present the current state of an artifact under construction, it is expected that this exploratory record can contribute as a possible model of how the creation of interactive video arts can fit into a research process based on artistic practice.

Resumo—Este artigo foca-se no processo conceptual e técnico de desenvolvimento de três videoartes interativas de cariz artivista focadas na auto-reflexão sobre a perspetiva utilizando técnicas como critical flow e embodiment, com o objetivo de abordar relações humano-animais. Além de apresentar o estado atual de um artefacto artístico em construção, espera-se que este registo exploratório possa contribuir como um possível modelo de como a criação de videoartes interativas podem se enquadrar num processo de investigação baseada em prática artística.

Palavras-chave—arte digital, videoarte, pesquisa baseada na prática artistica, relações animal-humano, human-animal studies, abjeto, feminismo, flow, embodiment, modelos 3D , head tracking, inteligência artificial

I. INTRODUÇÃO

O presente artigo tem como tema a relação intra e inter animais (humanos e os outros), e como objeto de estudo a construção de empatia e o reconhecimento do outro através da utilização de arte digital, mais concretamente através da apresentação/construção de videoartes [1] interativas que estimulem a criação de narrativas individuais. Este tema, liga-se com o campo interdisciplinar dos estudos humano-animais, que analisam as relações humanos e animais. Por essa via tem potencial para cruzar vários campos como psicologia, sociologia, antropologia, teologia, ciência política, economia, história, estudos pós-coloniais, pós humanismo e estudos feministas. Em termos artísticos apresenta o processo de criação conceptual e técnico de uma obra de pós cinema, uma videoarte digital que, através de cruzamento entre texto, som, vídeo, computação gráfica, inteligência artificial e interatividade pretende dotar o espetador de reflexões sobre os média atuais, do seu papel na criação (e destruição) de significados e do seu lugar como consumidor mediático.

O caso de estudo é a videoarte interativa *(Ab/Sub/Ob)ject*, apresentado nas XVIII Jornadas CIAC (Centro de investigação em Artes e Comunicação) e desenvolvida no contexto da disciplina de Média Arte Digital (MAD) do Doutoramento em Média-Arte Digital da Universidade do Algarve e Universidade Aberta. A videoarte passou por três iterações no decurso do seu desenvolvimento, sendo que poderão vir a existir outras no futuro.

A primeira iteração, uma videoarte interativa controlada pela orientação cabeça - "o olhar" - do espetador onde este escolhe se quer ver um filme de publicidade ou um filme de imagens captadas por ativistas relativos a uma marca de leite, partiu do cruzamento entre conceitos relativos a arte e arte digital (de autores como Martin Heidegger, Arlindo Machado, Walter Benjamin, Marshall McLuhan, Priscila Arantes, Lúcia Santaella, entre outros) com questões relacionadas com direitos dos animais, tendo como base o livro "A Vaca Que Não Ri" [2].

O livro "Imagens Apesar de Tudo" [3] esteve na base da segunda evolução da videoarte, em que a escolha deixa de ser sobre imagens de animais, para ser sobre campos de concentração nazis, onde a escolha do espetador incide sobre um filme de propaganda nazi, onde os campos de concentração são apresentados como lugares agradáveis, ou sobre imagens reais captadas aquando da libertação dos judeus.

A terceira e atual versão foi baseada no conceito de abjeto, que se interseta entre os conceitos

psicanalíticos de sujeito e objeto, conceito esse que no livro "*Powers of Horror*" [4], é usado para explorar as dinâmicas de desejo, exclusão e identidade. O animal (ou animalidade), assim como tudo o que ameaça a ordem, regras e identidades dos sujeitos é confinado a um lugar sem definição, longe do olhar. Nesta terceira iteração, a quantidade de filmes para os quais o espetador escolhe olhar (ou não) é mais abrangente incluindo temas relacionado com ameaças à ordem social como gênero, cor, religião, espécie, deficiência física, estatuto social, preferência sexual, assim como abjeção relacionada à ordem do próprio individuo, como o cadáver e dejetos corporais. O título desta terceira videoarte interativa (e que serve como título para este artigo) é *"Ab/Ob/Sub/Ject"*. Ao desconstruir a palavra em "ab", "sub", "ob" e "ject", o o título propõe uma reflexão crítica sobre as dinamicas de exclusão (ab ject) e o papel do objeto (ob ject) na experiência subjetiva (sub ject) como catalisadoras das dinâmicas de desejo, exclusão e identidade.

II. PROBLEMÁTICAS E QUESTÕES

O processo de criação das três iterações levanta problemas e questões de várias ordens:

A. De que forma ou com que critérios (interface, mecânica e eventos, estímulos visuais e auditivos, como realizar uma montagem que permite a construção de uma narrativa simultaneamente livre mas orientada) se pode construir uma videoarte interativa que sirva como mecanismo de autoanálise e autorreflexão baseado em conceitos psicanalíticos?

B. Como será possível relacionar tópicos à primeira vista não relacionados como o conceito de abjeto um conceito relacionado com sensação de horror e vómito que ocorre aquando de uma ameaça de significado pela distinção entre o eu e o outro (animal humano ou não) e direitos dos animais?

C. Em que medida a discriminação por sexo, género, raça, cor ou origem étnica ou social, características genéticas, língua, religião ou convicções, opiniões políticas ou outras, pertença a uma minoria nacional, riqueza, nascimento, deficiência, idade ou orientação sexual se podem relacionar ou não com questões de especismo [5] discriminação por espécie e através dessa ligação auxiliar a construção de empatia com animais?

D. No âmbito de interfaces, até que ponto a utilização do olhar como input poderá ajudar o espetador, ao ativamente ter de decidir para onde e o como olha (e para onde e como desvia o olhar), a ter maior consciência que o mesmo tema pode ser percecionado de formas diferentes por ele mediante a forma como é apresentado mediaticamente?

III. METODOLOGIA E OBJETIVOS

Será utilizada metodologia de *"art-practice as research"* [6], investigação baseada na prática artística, pois o processo criativo de experimentação e criação do artefacto artístico é utilizado como meio de gerar conhecimento e entendimentos relevantes para os temas em questão, assim como para tomada de decisões de desenho e conceção do mesmo artefacto.

Para Candy e Edmonds [7] a investigação baseada na prática artística é caracterizada por, além de se focar na criação de algo novo - o artefacto - também incide na forma como o processo dessa criação resulta na transformação de ideias, que por sua vez pode originar novos trabalhos. O objetivo normalmente não é atingir a "perfeição" nas criações, mas sim que estas resultem em algo realmente novo em termos de conhecimento. A prática e investigação são interdependentes e complementares. Questões de investigação surgem do processo de prática e vice-versa.

A auto-etnografia [8] também é utilizada na escolha de conteúdos e associação de temas. O projeto é baseado em ideias pessoais do investigador sobre os temas e significados culturais, políticos e sociais abordados e sobre si mesmo. E serve ao autor como mecanismo de autoaprendizagem teórica e reflexão.

A fenomenologia hermenêutica [9] também faz parte das metodologias abordadas porque procura-se, através de um filme interativo controlado com o olhar do utilizador, criar um espaço de diálogo e reinterpretação de outros vídeos, promover novos olhares sobre o mundo, e consequentemente novos significados.

Procurar-se-á explorar o processo de criação de um filme interativo que sirva como espaço liminar abstrato de estranheza onde o espetador possa:

- refletir sobre a sua relação simbólica com os outros e consigo mesmo (perigosa e segura)
- refletir sobre o seu próprio olhar
- contactar com médias diferentes concebidos para públicos diferentes com critério diferente de algoritmo de Youtube
- através de *sense of embodiment* [10] aproximar-se do que está a ver como algo normalmente externo, estimulando um exercício de perspetivismo

IV. ENQUADRAMENTO

A. Quadro Teorico e Conceptual sobre o Objeto de Estudo

As várias iterações da videoarte interativa *(Ab/Sub/Ob)ject* foram desenvolvidas para estudar como a média-arte digital pode servir de mecanismo de (re)enquadramento do "outro", primeiramente orientado ao animal não-humano, mas cujas semelhanças e relações com outros tipos de discriminação entre humanos se foram tornando mais presentes e inevitáveis ao longo das várias iterações.

Pode-se entender videoarte como uma forma de expressão artística que utiliza o vídeo como meio primário de comunicação artística. Centra-se na criação de obras que exploram diferentes áreas e aspetos da arte como o tempo, o espaço e o movimento através de meios visuais e auditivos. A videoarte tem características como multimédia e interatividade, gestão e manipulação do tempo, espaço e movimento, narrativa flexível, que permite inovação e experimentação [1] comparativamente com formas mais tradicionais de vídeo como o cinema. Utilizar-se-á estas características da videoarte como mecanismo de exploração de novas poéticas que facilitem jogar com a perspetiva do participante para o por no lugar do "outro".

A hierarquização e valorização desse "outro" é tema de debate desde tempos imemoriais. E, mais fundamentalmente, antes de se olhar para o outro como valorizável e com posicionamento hierárquico, é em primeiro lugar considerar o outro referenciável, o que por si é outro problema.

A titulo de exemplo, Platão referiu que, dentro dos animais humanos, as mulheres, escravos e crianças são dignos de valor (assim como são os animais não humanos), no entanto inferiores ao homem adulto, a quem apelidou de cidadão politico [13]. Já outro pensador, René Descartes, caminha no sentido de uma uniformidade entre humanos, menciona uma existência de alma por todos, independente e mais importante que corpo. Embora apenas implicitamente, essa perspetiva da alma permite a valorização independentemente de raça, género ou outras características físicas. No entanto, essa alma existe em animais da espécie humana exclusivamente. Animais fora da espécie humana não possuem alma, não sentem dor e são vistos como autómatos biológicos. Embora possam manifestar comportamentos que se assemelham a respostas a dor, são para Descartes apenas reações mecânicas [14].

Vários tipos de preconceitos têm vindo a ser nomeados ao longo da história, à medida que diferentes formas de discriminação têm sido reconhecidas e estudadas. Racismo, sexismo, homofobia, antissemitismo, islamofobia, transfobia, capacitismo e classismo são alguns exemplos de termos usados para nomear diferentes tipos de preconceitos ao longo do tempo. O preconceito de animais humanos para animais não humanos foi cunhado por Richard Ryder em 1970 com o nome especismo [5].

Peter Singer define o termo da seguinte forma: "O especismo, na sua forma primeira e mais importante, é um preconceito ou tendenciosíssimo a favor dos interesses dos membros da nossa própria espécie e contra os interesses dos membros de outras espécies, unicamente com base na espécie" [15].

Frequentemente quando surge um termo ou movimento que desafia normas sociais ou propõe novas ideias, também surgem movimentos contrários, muitas vezes em reação direta a ele, podendo também chamar a atenção para alguns problemas que esses movimentos podem trazer.

Cascais, em "A Bioarte na Encruzilhada da Arte, da Ciência e da Ética", refere que na Alemanha nazi houve uma tentativa de restabelecer e reconfigurar limites. Considera que, paralelamente à diminuição do humano, em forma de desprezo pela civilização, por parte dos nazis houve uma elevação, ao mesmo tempo, do amor pelos animais e uma ecologia profunda. Nesta análise, o autor considera a possibilidade de que os direitos dos animais podem resvalar para "o totalitarismo biocêntrico que culmina com o nazismo". Esta forma de correlacionar o que o autor chama de "conceção romântica de

homem-natureza" com o nazismo e totalitarismo, um argumento comum e recorrente [16] é um argumento comum utilizado com vista a desvalorizar o movimento dos animais, aqui apresentado de uma forma académica e intelectualizada. No entanto, esta inter-relação pode também incentivar o descartar da importância de rever e refletir sobre os limites éticos da nossa relação com a animais e a natureza. Não fica totalmente claro se, ao querer lançar a reflexão, não existe alguma intenção do autor em marcar esse ponto, mas, assumindo que a valorização que o animal humano dá à sua relação com a natureza é inversamente proporcional à valorização que o homem dá à sua relação com o próprio homem, é possível, como contraponto, e novamente simplificando, referir sociedades que não respeitam direitos humanos como a China, e cuja relação com a natureza também é na mesma direção. Recorrendo a dados do mais recente *Animal Protection Index* [17] (que classifica os países de acordo com as suas politicas e leis de bem estar animal), os seis países com a nota mais elevada atribuía no *ranking*, B , foram Áustria, Dinamarca, Holanda, Suécia, Suíça e Reino Unido. Esses mesmos países receberam também notas elevadas no ranking de liberdades civis do mais recente *Human Rights Index* [18] De notar que Suécia e Dinamarca em ambos os *rankings* receberam as cotações mais elevadas Poder-se-á dizer que estes dados *per se* beneficiariam de um maior aprofundamento, mas não parecem indicar uma incompatibilização de um melhor relacionamento homem-homem coexistente com um melhor relacionamento homem-animal (os outros). O que poderia talvez ser dito sobre a argumentação dada relacionado a Alemanha nazi e a sua ideologia ecológica implicar menos direitos humanos, é que parece ser possível que uma coisa não implique a outra nem diretamente, nem inversamente.

Segundo Fonseca [2], na contemporaneidade a matança maciça de animais é, simultaneamente, mais intensificada e mais recôndita que nunca. Um curioso consumidor, ou mesmo um investigador que não atue alinhado com os interesses do agronegócio, muito dificilmente poderá entrar num matadouro. Lá dentro, num dia normal de trabalho, sensações como pena, horror, desgosto, choque, repugnância, entre outras, são facilmente experienciáveis. Mas a manutenção do atual status quo do sistema de exploração de animais para fins alimentares estará dependente do impedimento de que estas sensações sejam experienciadas pelos consumidores. É um "mundo fechado" — dizia um proprietário de um outro matadouro — provavelmente porque existe uma noção de que a manutenção das práticas de consumo depende da omissão das práticas de maneio e de abate a que os animais estão sujeitos. Ou seja, será conveniente, para o setor exploratório, que o desconhecimento, desinteresse e a indiferença dos consumidores se mantenham em relação aos animais. Para o efeito, será fundamental que os animais continuem a ser concebidos pelos consumidores enquanto "referenciais ausentes" (e.g.: "carne", "bitoques", "chouriços", "presunto", etc.), e que se evitem cogitações sobre os processos a que estão sujeitos durante a sua vida e morte.

De forma a pensar nos animais não humanos de uma forma mais ética, Singer sugere que para uma visão mais evoluída da problemática dos direitos animais se caminhe no sentido de (1) deixar de considerar a vida humana sacro santa e de (2) deixar de considerar a vida animal como irrelevante [15] .

Também poderá ser útil ter em consideração a área de estudo emergente *Human-Animal Studies* [19] que se relaciona com as relações animais humanos e os outros, com a premissa que todos os animais tem valor por si e não como utilitário referente a outro animal – consiste em 4 "movimentos" que também se pretende trabalhar nestes artefactos:

1. Elevar o animal não humano – mostrar que o animal não humano é capaz de comunicação, sentimentos e empatia comportamentos humanos

2. "Diminuir" o ser humano – mostrar que certas características consideradas normalmente exclusivamente "animais" e não humanas são também humanas. Entre elas o facto de o ser humano ser irracional e emocional. A teoria actor-rede [20] também elimina a exclusividade do humano como agente actante no meio, não só incluindo outros animais mas também plantas e máquinas

3. Esbater distinções – trata-se de principalmente por olhar para a noção de espécie como uma linha discreta e bem definida e passar a vê-la como algo híbrido [21], num sentido mais quimérico (por exemplo temos outros animais e microrganismos dentro de nós).

4. Colocar a questão – baseado na teoria da alteridade de Levinas, em que temos um abismo grande que é a base da ética que é nunca poderemos conhecer totalmente o outro [22]. Levinas dá enfase ao rosto do outro ser visto adequadamente.

Estes quatro movimentos incluem "diminuir o humano" e "elevar o animal". Será que este movimento se aproxima do movimento que Cascais se refere como uma deshumanização violenta do humano por parte dos nazis em prol dos animais? Ou será que são movimentos que por acaso ocorreram de forma simétrica (segundo o autor) mas que os seus mecanismos de de atribuição/remoção de referências e valores são semelhantes?

Para analisar o caso dos nazis e a discriminação entre humanos e a sua relação mediática, recorrendo livro de Georges Didi-Huberman - "Imagens apesar de tudo" [3] - onde autor analisa as únicas 4 imagens obtidas dentro de um campo de concentração nazi, bem como o facto de que todos os outros registos eram ocultados pelo regime Nazi, assim como a forma como depois de virem a público, faz notar que as imagens que ilustram essa realidade são muitas vezes rejeitadas e até consideradas ofensivas. Afirma:

> Permanecendo atento à lição de Georges Bataille, com efeito -Auschwitz como questionamento do inseparável, do semelhante, da «imagem do homem» em geral-, descobre-se que, aquém e além do seu sentido político óbvio, as quatro fotografias de Alex nos situam perante uma vertigem, perante um drama da imagem humana enquanto tal.[3]

O facto de existir uma resistência a "olhar" para o que faz o humano confrontar-se com os seus limites e a sua imagem divina/pura/imaculada/sacrossanta também tem sido alvo de estudo. Apoiada nas teorias de Lacan e Freud, Julia Kristeva explorou o conceito de abjeção no livro "Powers of Horror: An Essay on Abjection" [4]. O abjeto começa quando o significado colapsa. Existe algures entre o conceito de objeto e sujeito e representa elementos tabu do eu que vivem num espaço ambíguo. Partes da identidade que foram rejeitadas - abjetadas. O que causa abjeção não é a sujidade, mas sim o que perturba identidade, sistemas e ordem. Tudo o que não respeita limites, posições e regras O intermédio, o ambíguo, o composto. Como o abjeto vive fora da ordem simbólica, enfrentá-lo é uma experiência traumática. O abjeto costuma estar associado com a ideia do "estranho". Um cadáver posiciona-se fora da ordem simbólica e cria abjeção pela sua estranheza, mas ao mesmo tempo familiaridade, cria ambiguidade. Isso ocorre por nos lembrar da materialidade do corpo humano e da vida.

> "The abject confronts us, on the one hand, with those fragile states where man strays on the territories of animal. Thus, by way of abjection, primitive societies have marked out a precise area of their culture in order to remove it from the threatening world of animals or animalism, which were imagined as representatives of sex and murder." [4]

Ao abjetar algo, esse algo não se torna nem sujeito nem objeto, simplesmente é rejeitado e a sua existência não é reconhecida, desaparece, deixa de ser visível.

Para explorar o tema da perceção do outro e das estratégias de manipulação através da arte digital, este estudo recorre a autores cujas teorias fornecem uma base filosófica e comunicacional robusta para a análise e construção de artefactos artísticos.

Heidegger, na sua análise sobre a tecnologia e a essência da tecnologia [23], refere que a essência da tecnologia consiste em enquadrar (*Gestell*) o mundo, trazer à presença, tornar visível o que reside na verdade (*Alêtheia*), usando e sendo usada pela física moderna, revelando e ordenando o real como reserva estanque (*Bestand*). A capacidade de questionar a verdade é ameaçada porque opera-se dentro de enquadramento que por si, "fecha".

Mas, por outro lado, Heidegger afirma que ao nos apercebemos desse perigo, ao questionar a sua existência, (algo que é da competência da arte), isso pode será uma forma de aceder um caminho para a revelação da "salvação".

Pensadores, académicos e teóricos acabam por tecer elaborações relacionadas com essa capacidade de abrir e fechar de arte e tecnologia.

Embora a arte possa "tornar visível" o que não é, George Duhamel, manifesta preocupação com a forma como o advento do Cinema, e as suas inovações tecnológicas que lhe atribuem qualidades cinéticas, também trazem riscos para a contemplação e introspeção:

> Já não posso pensar o que quero pensar. As imagens em movimento tomaram o lugar dos meus pensamentos. [24]

Mesmo sendo assim, assumindo que poderá ser dito que as massas só apreciam arte como entretenimento, desprovida de caracter contemplativo e que se está a caminhar no sentido de a arte perder esse caracter, Walter Benjamin também reconhece que isso pode ser visto de outra forma: como uma forma de mobilizar as massas para a arte usando a

distração como chamariz, como forma de atrair publico para a arte.

> ... as tarefas que são apresentadas ao aparelho de percepção humana em épocas de mudança histórica, não podem ser resolvidas por meios apenas visuais, ou seja, da contemplação. Elas só são dominadas gradualmente, pelo hábito, após a aproximação da receção táctil. [25]

A expressão "o meio é a mensagem" [26] relaciona-se com a importância que o meio de comunicação tem para o conteúdo. Consequentemente, o surgimento de um novo meio de comunicação implica uma "recalibragem" dos mecanismos de perceção para o poderem interpretar.

> A ideia de que o ser humano é um ser intermediário faz parte da tradição grega de que somos herdeiros, mas que, com algumas excepções, tendeu a ser esquecida com o advento da modernidade, quando o sujeito passou a ser visto como um fim em si próprio. A crítica da técnica e da modernidade, em McLuhan, ao contrário, implica que o conteúdo da mensagem é irremediavelmente modelado pelo meio pelo qual a mensagem é difundida. Tal afirmação pode ser exemplificada na situação em que se olha a paisagem que se abre para além da janela. Neste instante, somos, na verdade, inconscientes do facto de que o vidro, apesar da transparência, confere particularidades ópticas a todas as cenas que gostamos de imaginar serem objecto de contemplação directa. [27]

Relativamente às formas "clássicas" de consumo de médias como o cinema, Lúcia Santella [28], refere que existe um movimento de convergência de medias anteriormente separadas que introduzem uma relação interativa entre o utilizador e o texto híbrido. Refere que "as midias digitais estão sendo celebradas por sua capacidade de gerar sentidos voláteis e polissêmicos que envolvem a participação ativa do usuário".

A média-arte digital é uma forma de arte que também resulta da convergência de medias anteriormente separadas e interatividade. Pedro Veiga propõe a seguinte definição:

> A méd̀ia¬-arte digital é̀ toda a forma de arte que nã̀o pode ser idealizada e/ou materializada e/ou exibida sem a utilização de tecnologias digitais, e cujo conteúdo e apreciação estética e cognitiva variam em função do tempo.[29]

Essas potencialidades da convergência de medias juntamente com interatividade como forma de reenquadrar o mundo, recalibrar mecanismos de perceção, juntamente com uma critica aos riscos de contemplação e introspeção, servirá de base para o desenvolvimento das videoartes que irão abordar relação humano-animais e humano-humano em contextos mediáticos atuais e segundo perspetivas de autores referidos anteriormente.

B. Obras de Referência e Exemplos

Além da base teórica, alguns trabalhos de média-arte digital que serviram como inspiração/gatilho para os filmes interativos descritos neste texto foram:

Filme *Neblina* [30], em que o utilizador mediante posicionamento do cursor do rato computacional, interage com um filme em andamento e decide como construir a narrativa e o que ver, ao poder trocar de cena mediante a posição do cursor.

Através da imersão na narrativa interativa, espera-se um efeito de espelho onde espetador projeta a sua própria identidade no protagonista da ação, tornando-se um espetador-protagonista. [30]

Filme *Speciesism | Ageism | Racism* [31], onde são geradas faces que "remixam" idade, cor, género e espécie.

> SAR generates sequences of masks from photos of people and animals without bias, imbued meaning or particular intent, leaving all interpretations and assumptions to the audience. […] Conceptually, SAR thrives in the intersectionality of postcolonial theory, feminist and anti-discrimination studies, as well as animal rights movements, policies and practices. By stripping away the ability to consistently identify species, age, race, gender or sexual orientation, the artwork allows for a disruptive aesthetic appreciation, which confronts the ideology and politics of group superiority.

A utilização da face como elemento artístico, facilitadora do cruzamento entre várias formas de discriminação como forma de promover a dissolução de categorizações será também abordada mais à frente na secção referente ao processo de criação dos filmes interativos.

Filme *Alentejo – Sonho Lucido 2022* [32]. Neste filme interativo, o utilizador também determina o progresso do filme, utilizando interfaces intocáveis [33] os movimentos da mão, por via de um sensor Leap Motion, para controlar o progresso do filme.

> *Alentejo — Sonho Lúcido 2022* is a cyberperformance in which I manipulate the content behind me with the gestures of my hand. It represents the idea of a lucid dream, about a journey to the Alentejo. The projection behind me is the dream, and I am the dreamer changing the visuals (or scenes) in real time. [32]

Performance *[IN]MarImmersive Waves* [34], onde o performer de marimba controla com o seu corpo um sistema de arte generativa utilizando inteligência artificial e uma webcam como sensor.

> Inspirado num dos elementos da natureza mais preciosos à vida humana, a água, o nome *[IN]Maŕmmersive Waves* resulta de uma fusão entre as palavras Marimba e Immersive. Trata-se de um artefato no qual faço parte integrante enquanto performer, com inclusão de arte generativa em tempo real ativada através de movimento. [34]

Simulador *Virtual Mirror* [35], visualizador de realidade virtual dos resultados de um scan facial em 3D. O utilizador, utilizando um capacete de realidade virtual, olha para um reflexo de uma réplica 3D da sua (ou outra) cabeça. Este software foi construído com objetivo de testar os resultados de um projeto de investigação em decurso na altura relacionado com a capacidade de se realizar uma captura em 3D da cara e também investigar o *sense of embodiment* [10] provocado ao utilizador ao ver um reflexo seu (ou de outro) em 3D.

Algumas experiências à volta do conceito de *embodiment* apresentaram resultados que poderão sugerir na empatia e altruísmo:

1. *Embodiment* de pessoas brancas em corpos negros reduziu o racismo implícito [36]
2. *Embodiment* homens no corpo de uma mulher vítima de assédio sexual resultou numa tendência reduzida para prejudicar as mulheres [37]
3. *Embodiment* como Sigmund Freud pode estimular um dialogo interior para abordar problemas de saúde mental [38]

Os videojogos da saga *NieR*, da produtora *Square-Enix* e com direção criativa de *Yoko Taro*, contem elementos que são usados como forma de colocar o jogador num estado de autocritica sobre os seus atos. Como afirma Damian Savchev na sua tese sobre esses jogos e as missões presentes no jogo:

> The quests in the game end quite unhappily. This can further serve an antiviolence rhetoric by framing the player as an unethical entity, as opposed to a hero who battles an antagonist in a situation in which the player never really questions the results of their own actions from a questline structure. [...] The approach seen in NieR seems to be one of attempting to critique players through their enjoyment of the combat, mainly by means of dialogue. [39]

Neste sentido, através da imersão e interatividade que é fornecida pelas missões de um videojogo - uma forma de média-arte - é possível enquadrar o publico para o fazer refletir de forma critica sobre os seus atos, de formas únicas que outras formas de arte sem interatividade não permitem.

C. Abordagem Conceptual Tecnológica

Existem alguns princípios que podem auxiliar a construção de um artefacto multimédia em termos do que irá provocar no utilizador.

É comum considerar-se o conceito de *flow* [11] como associado ao quão apelativo um videojogo é [40].

Segundo Csikszentmihalyi as condições para o *flow* incluem:

- encontrar desafios ou oportunidades para a ação que estendam, mas não excedam excessivamente as habilidades existentes;
- ter objetivos claros próximos e feedback imediato sobre os progressos realizados.

Sob essas condições, a experiência se desenrola perfeitamente a cada momento e entra-se num estado subjetivo com as seguintes características:

- concentração intensa e focada no momento presente;
- fusão entre ação e consciência;
- perda de autoconsciência reflexiva (ou seja, perda de consciência de si mesmo como um ator social);
- sensação de que se está no controle de suas ações; isto é, uma sensação de que se pode, em princípio, lidar com a situação porque sabe como responder a tudo o que pode acontecer;
- distorção da experiência temporal (tipicamente a sensação de que o tempo passou mais rápido do que o normal);
- experiência da atividade como intrinsecamente gratificante, de tal forma que muitas vezes o objetivo final é apenas uma desculpa para o processo.

Posteriormente verificou-se que esta fenomenologia é notavelmente semelhante em diferentes contextos de lazer e trabalho, independentemente da cultura, idade, gênero e diferença de classe. [41]

Embora *flow* se traduza num estado em que o sujeito experiência prazer e foco no que está a fazer, também existem críticas acerca do estado.

Braxton Soderman aponta que o facto do estado de *flow* ser baseado na ordem e regras pode ser problemático pois pode contribuir para a alienação do sujeito como um estado ideal. Afirma que, ao abstrair o sujeito das problemáticas da realidade isso

acaba por reduzir a autoconsciência crítica por colocar o sujeito num estado de foco em objetivos limitados:

> ...while flow privileges the idea of growth of self and an expansion of the powers and skills of the self, it also reduces the number of moments where critical evaluation and reflection can occur. [...] If the growth of the self is a key component of flow theory, then the reduction of critical consciousness is its ideological flipside. [12]

Assim como Duhamel, Soderman põem evidencia a questão dos "riscos para a contemplação e introspeção" que um novo "média" abarca, neste caso os videojogos em vez do cinema. O que Heidegger afirma ser o "caminho para a salvação".

No entanto, Soderman afirma que é possível ter-se o que chama de *critical flow*, formas de utilizar flow para estimular o pensamento critico e o autoquestionamento.

Reforçando o potencial para re-significação através da média-arte digital, relativamente à interação do sujeito interator com novas médias, Arlindo Machado observa, por exemplo, que os "computadores estão afetando profundamente as relações de intersubjetividade e de sociabilidade dos homens, assim como a própria natureza do "eu" e da sua relação com o outro.".

> Alguns analistas do ciberespaço têm sugerido, por exemplo, que os computadores conectados em rede, ao colocar também em conexão os seus usuários e permitir que cada um deles se distribua dentro dessa rede, estão afetando profundamente as relações de intersubjetividade e de sociabilidade dos homens, assim como a própria natureza do "eu" e da sua relação com o outro. [42]

Acerca da intersubjetividade e sociabilidade trazidas pelos computadores e pelas tecnologias sejam referidas por Arlindo Machado, Priscila Arantes defende que não só ocorre esse abalo na intersubjetividade, derivado dos meios digitais, mas esse abalo é a parte de maior importância dessa hibridização que ocorre nas artes digitais.

Ampliar a noção de interface para outros domínios, além dos aparatos estritamente informáticos, nos permite, assim, repensar também as relações sujeito/obra da produção estética na era digital. Sobre este aspeto seria interessante resgatar Edmond Couchot, que, a partir da noção de interface, assinala a constituição de uma nova forma de subjetividade na contemporaneidade:

> "De todas as hibridações em direção às quais o numérico se inclina - afirma o autor - a mais violenta e decisiva é a hibridação do sujeito e da máquina, através da interface. Violenta porque ela projeta o sujeito - tanto o autor da obra quanto o espectador, o artista quanto o amador de arte - em uma situação nova, em que ele é intimado insistentemente a redefinir-se. (...) A aparelhagem numérica do sujeito perturba, com efeito, novamente as relações entre o EU e o NÓS, mas de uma maneira que se configura sem comum medida com o que já conhecemos".

Seja através de trabalhos artísticos que empregam avatares e que potencializam uma espécie de duplicação do sujeito, seja através de criações compartilhadas em rede, "o sujeito trespassado pela interface", ou o sujeito "*interfaceado*", como nomeia Couchot, é um sujeito que é intimado a redefinir-se continuamente: um sujeito em trânsito, para quem a relação entre o Eu e o Nós é colocada o tempo todo à prova.

Parafraseando Couchot, poderíamos dizer que, assim como o "sujeito trespassado pela interface é, de agora em diante, muito mais trajeto do que sujeito", a obra interfaceada é muito menos objeto acabado, e mais criação que se manifesta em processo a partir de suas interfaces, seja com o interator, seja dentro do próprio sistema computacional. [43]

O que reforça o papel do observador na re-significação do sujeito e a sua relação com outro.

Dentro da base teórica e conceptual apresentada nesta secção, dar-se-á o desenvolvimento das três iterações do filme *(Ab/Sub/Ob)ject.*

V. DESENVOLVIMENTO DAS VIDEO-ARTES

A. Storyboard

Partindo da premissa inicial da disciplina de Média-Arte Digital de criar um artefacto com algo relacionado com vídeo e media-arte digital e o interesse do autor em abordar a temática dos direitos dos animais nos média assim como o tema do abjeto, foi desenvolvido um storyboard (simultaneamente *user flow* e *mockup*) com um conceito de videoarte interativa (Fig. 1).

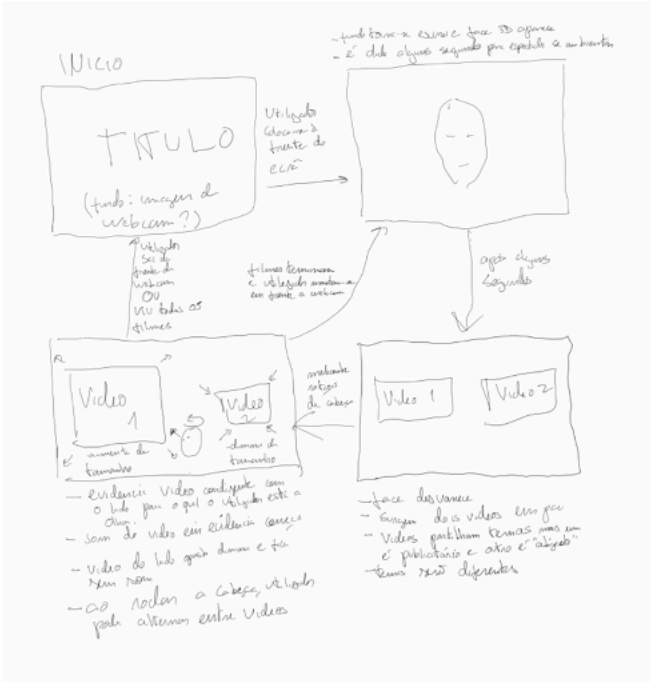


Fig. 1 - Esboço com storyboard/userflow da vídeo-arte interativa.

Este storyboard inicial ilustra o funcionamento e aparência de uma videoarte interativa que deverá estar a correr num ecrã com algum tipo de dispositivo computacional juntamente com uma webcam ou outro tipo de dispositivo que detete a presença e movimentação da cabeça do espetador, assim como capte a sua imagem. São apresentados 3 ecrãs que são os 3 estados fundamentais da aplicação (sendo que os 2 ecrãs inferiores são o mesmo estado, presentes como 2 no storyboard de forma a representar o funcionamento de um dos ecrãs).

Os 3 estados/ecrãs são:

1. Ecrã de título créditos –. No storyboard apresentado os elementos presentes neste ecrã são o título e a imagem captada de webcam (sendo que este elemento está apresentado com um ponto de interrogação pois seria uma hipótese a explorar)
2. Ecrã com face do espetador (espelho) – este ecrã terá um fundo escuro e uma cabeça tridimensional controlada pelo espetador surge, sendo um ecrã de ambientação introdutório para a mecânica de ambientação com a cabeça
3. Ecrã com vídeos – este ecrã contém 2 vídeos. Os 2 vídeos partilham temas, mas um é publicitário e outro é relacionado com o tema do abjeto. É indicado que os temas serão diferentes. Mediante a rotação da cabeça para olhar para a esquerda ou direita do ecrã, o vídeo do lado respetivo à direção para que o utilizador olha é colocado em evidencia aumentando o tamanho, e o vídeo do lado oposto diminui e perde o som. Ao rodar a cabeça o espetador pode alternar entre os dois vídeos.

Estes estados/ecrãs são ativados/desativados mediante as seguintes ações/gatilhos:

a) Inicio da aplicação – ao iniciar a aplicação será iniciado o ecrã 1

b) No ecrã 1 um utilizador é detetado – aplicação transita para o ecrã 2

c) No ecrã 2 utilizador mantém-se detetável durante alguns segundos – transição para ecrã 3

d) No ecrã 3 utilizador termina de visualizar os filmes todos e mantem-se em frente à webcam– no esboço inicial está presente uma dupla transição neste caso (o que consiste uma incoerência pois seria logicamente impossível transitar para dois ecrãs diferentes em simultâneo). Essa transição seria tanto para o ecrã 1 como para o ecrã 2. Esta transição acabou por ser ignorada e não ser utilizada em nenhuma das iterações da videoarte interativa, conforme será descrito mais à frente.

e) No ecrã 2 ou 3 caso deixe de ser detetada a presença do utilizador, a videoarte retorna ao ecrã 2

B. Controlo

Como referido, o controlo é realizado através da rotação da cabeça do utilizador (Fig. 2).

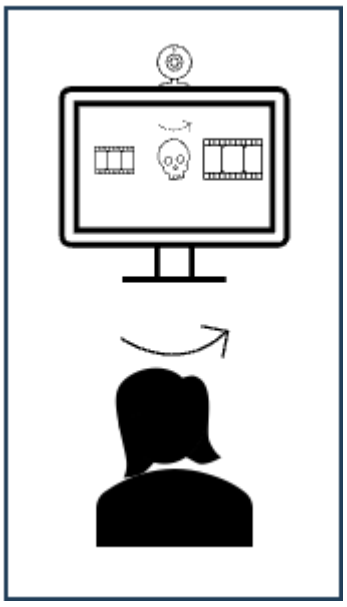


Fig. 2 - Rider esquemático que representa o espetador a interagir com a aplicação usando a cabeça como controlo.

O desenho da videoarte interativa com controlo pela rotação da cabeça tem dois objetivos principais:

1. servir como metáfora para um olhar subconsciente e tornar essa escolha mais consciente para o utilizador
2. permitir um sistema de controlo intuitivo, simples e inovador, que possa com isso, "prender" o utilizador. Através do princípio de *flow* usado no desenvolvimento de aplicações interativas, em que a experiência ótima é conseguida através de um equilíbrio entre dificuldade e desafio acessível. Pretende-se que o controlo usando a cabeça providencie um sistema de controlo fácil ao utilizador, que será contrabalançado com os temas e escolhas mais difíceis que o utilizador terá a possibilidade de fazer.

O primeiro passo no desenvolvimento da aplicação foi a implementação do sistema de controlo utilizando a cabeça, que foi reutilizado nas várias iterações da videoarte interativa.

Utilizou-se uma webcam em conjunto com o software de inteligência artificial *Mediapipe* que, através de um input de vídeo, estima em tempo real posições de um conjunto de pontos da face (Fig. 3).

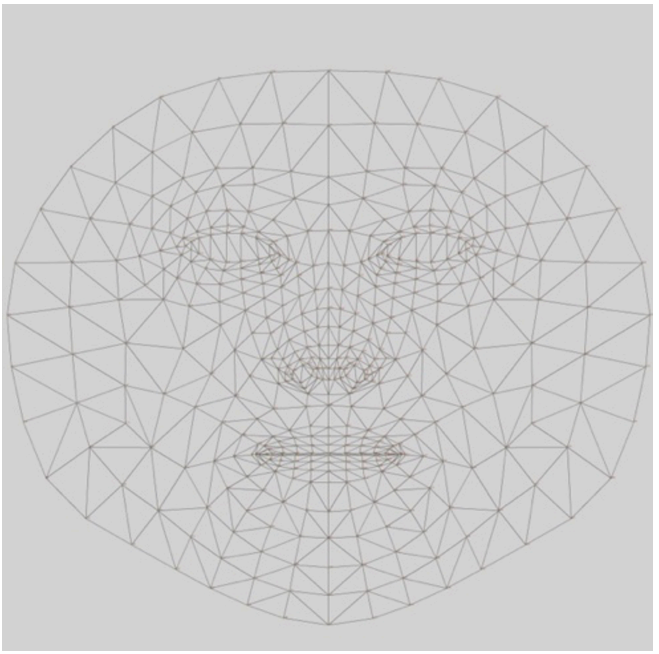


Fig. 3 - Diagrama com os pontos providenciados pelo modelo de face tracking TensorFlow. Imagem detalhada na página web da documentação.
https://github.com/tensorflow/tfjs-models/blob/master/face-landmarks-detection/README.md#keypoint-diagram

Cada ponto tem um índice numérico.

Para cálculo da rotação da cabeça foram escolhidos os pontos 10, 152, 234 e 454, que correspondem aos extremos superiores e laterais da face, quando de frente para a camara (Fig. 4).



Fig. 4 - Identificação dos 4 pontos (dos providenciados pelo facetracking) utilizados para calculo da rotação de cabeça (pontos 10, 152, 234 e 454). A imagem foi capturada com a permissão explícita da pessoa retratada.

Relacionando distâncias e ângulos entre os 4 pontos acima são estimadas as rotações (com um certo grau de erro, mas suficientemente precisas para o objetivo deste projeto) num eixo tridimensional XYZ da cabeça à volta do pescoço. Essas rotações são

depois mapeadas a determinadas ações que controlam a videoarte interativa (Tabela 1).

TABELA I - MAPEAMENTO DE CONTROLO

Relação entre eixos de rotação de cabeça e controlo mapeado de acordo com o estado da terceira video-arte		
Eixo(s) de rotação	*Estado da video-arte*	*Controlo mapeado*
Y	Em qualquer estado	Alternar entre videos ou espelho
X	Espelho	Cor da imagem no espelho Alternar entre palavra "*abject*", "*subject*" ou "*object*" sobreposta à imagem de webcam da participante
XY	Espelho	Rotação da imagem no espelho
Y	Video	Velocidade e posição do vídeo atual e som respetivo
XYZ	Video	Controlo de modelo 3D

Conforme referido anteriormente, o olhar para os lados para selecionar o vídeo tem como intenção uma metáfora para "escolher para onde olhamos", e o olhar para cima e abaixo é uma metáfora para o conceito de "olhar-nos de cima abaixo", expressão que se relaciona com a forma como julgamos as pessoas, atribuindo-lhes certos significados.

A ilusão de pertença a um corpo virtual espelhado é possível quando existe uma sincronia entra as ações motoras do participante e os movimentos do avatar visto na imagem espelhada, segundo Gonzalez-Franco et al. [44] . Embora o estudo referido tenha sido efetuado com sistemas de realidade virtual, os autores afirmam ser possível também com um uma projeção num ecrã (Figura 5).

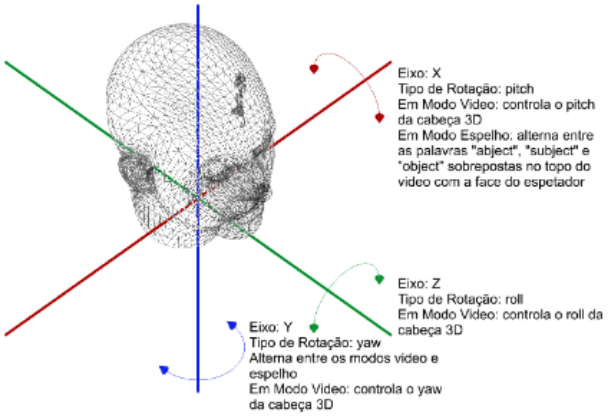


Fig. 5 - Esquema indicativo de que eixos da cabeça controlam a aplicação.

A presença da sua face ou de um modelo 3D, serve como forma de transmitir ao utilizador qual é referencial de controlo, uma forma de facilitar a aprendizagem do sistema controlo da aplicação, colocando em evidencia a importância da sua cabeça ou a de um avatar 3d, estimulando movimentos de uma cabeça reativa aos seus movimentos, podendo em tempo real e de forma explicita verificar que o seu movimento de cabeça tem impacto no controlo da aplicação e nos vídeos.

C. Ferramenta de desenvolvimento e plataforma de visualização

As três versões da videoarte interativa foram desenvolvidas no software cables.gl [45], plataforma de criação de arte computacional. O sistema cables.gl caracteriza-se por ser um ambiente de programação visual (Fig.6), baseado em nós, para criação de conteúdos multimédia digitais que podem ser executados por defeito num browser de internet, mas com a possibilidade de execução offline. Permite também a criação de novos nós, utilizando a linguagem de programação *Javascript*.

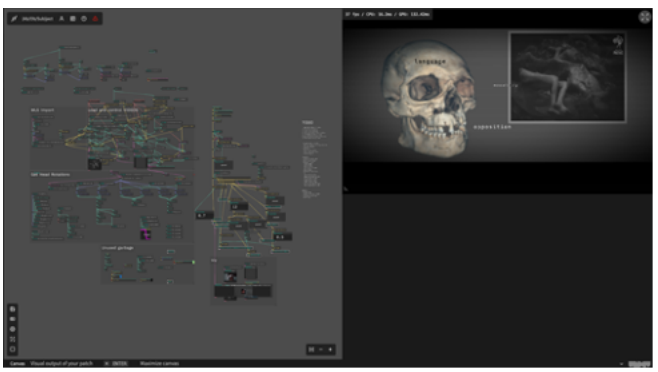


Fig. 6 - Captura de ecrã da estrutura do projeto no seu estado à data da escrita deste texto, dentro do software cables.gl.

D. As videoartes interativas

I. *Primeira iteração:* Após o desenho do esquema apresentado na subsecção anterior, foi implementada uma primeira versão da videoarte. Nesta primeira iteração, apenas o ecrã/estado 3 do storyboard foi implementado, com o tema duas distintas representações associadas a um produto de origem animal (não-humano): na publicidade e em imagens captadas por ativistas. A rotação da cabeça do espetador usado como controlo de qual vídeo deve ser dado enfase e assim servir de metáfora para o olhar e o seu desvio relativamente a questões de produção e maus-tratos animais.

No centro de cada estado na Fig. 7, é possível ver uma representação puramente 3d da orientação da face do espetador, detetada pela aplicação.

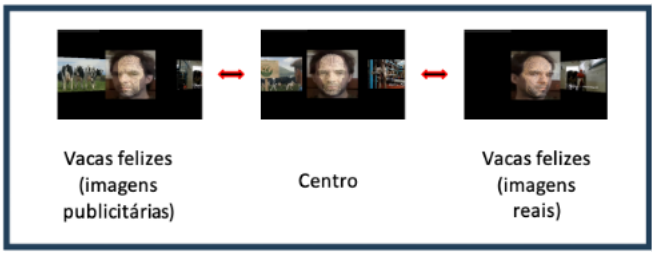


Fig. 7 - Captura da primeira videoarte no editor cables.gl. Três estados discretos possíveis.

Os vídeos escolhidos para a primeira videoarte interativa são relativos a campanha comercial "Vacas Felizes", sendo uma inspiração inicial o livro do sociólogo Rui Pedro Fonseca "A Vaca que não ri", uma alusão à marca "A Vaca que ri", que aborda fenómenos relacionados com a normalização da exploração animal, sendo que alguns deles se relacionam com a mitificação e ocultação da exploração de animais (os outros, não humanos) pela publicidade que a retrata, neste caso, como algo "inocente", "positivo" e até "divertido" para os animais.

Embora a inspiração seja a marca "A vaca que ri", os vídeos utilizados na videoarte dizem respeito a uma campanha da marca Terra Nostra chamada de "Vacas felizes dos Açores". Ambos os vídeos foram retirados da plataforma Youtube. Um vídeo é um anúncio da campanha em questão, onde vacas e humanos aparecem felizes a cantar e em campos, sendo que o outro vídeo consiste em filmagens nos açores das instalações onde lhes eram retirados o leite. Ambos os vídeos contem a música presente na publicidade.

II. *Segunda iteração:* Nesta versão, inspirada no livro "Imagens apesar de tudo" de Georges Didi-Hubermman onde o autor reflete nas 4 únicas imagens retiradas dentro de campos de concentração nazi (em funcionamento) e na dificuldade, oposições e complicações existentes associadas à sua divulgação e reconhecimento. A partir da inspiração nesse tema e, como se trata também de uma forma de selecionar o olhar, foram alterados os filmes. A publicidade sobre vacas felizes dos Açores foi trocada por um vídeo de propaganda da era nazi onde surgiam campos de concentração como locais onde judeus viviam alegremente com boas condições de vida. O vídeo sobre as condições reais das vacas felizes dos Açores foi trocado por um vídeo com as condições reais com que foram encontrados os prisioneiros judeus no campo de concentração nazi de Auschwitz (Fig. 8).

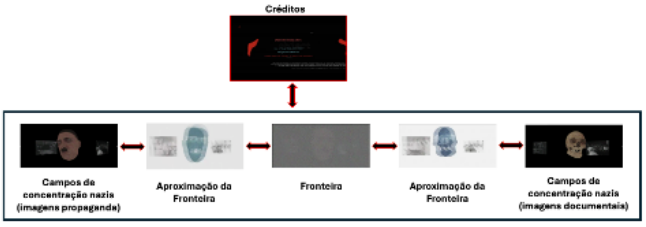


Fig. 8 - Vários estados discretos e contínuos da segunda iteração da videoarte interativa.

Além da alteração dos filmes, o "espelho" também funciona de forma diferente. A imagem em vídeo do espetador no centro foi também trocada por modelos 3d de cabeças que servem como avatares que replicam os movimentos do espetador. Mediante o filme que se está a visualizar, o avatar é alterado para simbolizar a perspetiva de quem vê. Quando o foco é o vídeo de propaganda nazi, o espetador passa a ter como avatar Adolf Hitler, simbolizando uma perspetiva nazificada. Quando o foco é o vídeo documentário jornalístico com as condições chocantes dos campos de concentração nazi, o espetador passa a ter como avatar uma caveira danificada, simbolizando o ponto de vista dos judeus que foram mortos.

Acrescentando a dimensão de não só o espetador se ver, mas ver-se como outro, pretende-se usar o

conceito de *embodiment* para jogar com a perspetiva do espetador, que se pode ver tanto como judeu morto ou nazi, servindo para ver-se tanto como potencial vítima, assim como potencial opressor e dessa forma, criar um espaço para estimular reflexão sobre si mesmo.

Para a troca entre ambos os avatares, foi adicionado um efeito visual. Quando se aproxima a alteração de avatares, quanto mais o espetador orienta a cabeça para o centro do video, as cores tornam-se o seu negativo e a imagem separa-se, surgindo um ruido visual que ofusca toda a imagem. Quando o espetador começa a rodar a cabeça numa orientação que não centrada, a imagem reaparece, com o avatar do "lado" do ecrã correspondente. A implementação deste efeito pretende emular a perda de sinal e re-sintonização de um canal de televisão analógico. Serve como metáfora para as forma como, dependendo de como se olha para algo, procede-se a "re-sintonizar o olhar".

III. *Terceira iteração:* A terceira iteração da videoarte interativa foi inspirada no livro *Powers of Horror* de Julia Kristeva..

Esta iteração é composta por 2 estados principais, o estado "créditos" e o estado "em interação". O estado "em interação" tem sub-estados.

Quando não existe deteção de espetador em frente à webcam é apresentado o ecrã de créditos, onde consta o título da obra, a autoria e uma citação relativa ao abjeto, tema desta terceira iteração da videoarte interativa.

Quando é detetado a presença de espetador em frente ao dispositivo de captura de imagem utilizado (neste caso, webcam), transita-se para o estado de interação, onde o espetador interage com a videoarte interativa.

Neste estado o espetador controla a aplicação com o movimento da sua cabeça. Como nas iterações anteriores, rodando a cabeça tanto para o lado esquerdo como direito é apresentada um filme, desta vez com vários temas relacionados com o abjeto e olhando para o centro, o utilizador visualiza-se a si mesmo, num modo que se irá denominar de "espelho".

A transição entre modo espelho e modo vídeo é animada para simular a sintonização de um canal de televisão (Fig.9).

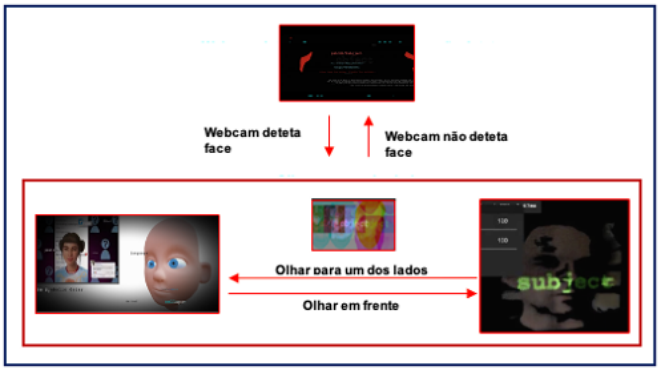


Fig. 9 - Ilustração de como a deteção e movimentação da cabeça do espetador controla a aplicação e permite alternar entre os seus diferentes estados

E. Temas da terceira iteração

Nesta iteração explorou-se vários temas reconhecidos como alvo de abjeção, sublimação purificação[46], tanto por Kristeva como por outros autores:

- O monstruoso feminino [47]
- O animal abjeto [48] e "*disneyficado*" [49]
- Corpo, sexo, homossexualidade e transexualidade [50]
- Religião [4]
- Parto [4] e aborto [51]
- Fezes e outros elementos corporais expelidos [4]
- Pureza da imagem digital e erro informático como forma de abjeção [52], abjeção em videojogos [53], [54] e em inteligência e vida artificial [55]
- Sem abrigo [56], [57]
- Politica [56]
- Corpos com deficiências [57]
- Sublimação [58], [59] e utilização de cartoons em publicidade de cigarros [60]

F. Componentes da terceira iteração

A terceira iteração é a mais completa e complexa das três e pode ser dividida em estados que compõem uma forma única do espetador se ver ao espelho, enquanto consume vídeos de Youtube enquadrados numa interface visual desconfortável, confusa e pouco familiar, ao contrário da interface do Youtube, amplamente difundido e cuja intuitividade é

praticamente natural para grande parte dos utilizadores atualmente. Erros e outras falhas de funcionamento não foram ativamente resolvidas tanto por falta de tempo como também porque a existência de falhas é algo inerente à realidade, sendo que normalmente as plataformas de consumo digital buscam a perfeição de forma a conseguir manter o utilizador preso. Com isso pretende-se criar uma sensação de "abjeção digital".

Os estados são

I. *O Outro (abjeto/objeto): estado em que o espetador entra ao rodar a cabeça para um dos lados. É composto por:*

a) *Video:* Videos retirados do site Youtube (na sua maioria), sendo que houve uma tentativa de fazer pesquisas independentes utilizando um Youtube com recomendaçoes relacionadas ou baseadas no historico do utilizador desátivadas, para evitar algum tipo de tendencia mesmo alternando entre temas, para evitar apresentar conteudos vindos de uma *bolha*.

b) *Modelo 3D:* Por cada video existe um modelo 3D associado. A escolha do modelo 3d foi subjectiva mas houve uma tentativa de obter modelos relacionados com o tema do video. Os movimentos do modelo, que pode ser uma face e corpo animado (de animais humanos e os outros) ou objeto. Estes estão no geral replicam de alguma maneira os movimentos da cabeça do participante. Os objetivos desta presença são vários. Em primeiro lugar, sendo Kristeva, algo que fazemos quando abjetamos, sublimamos ou simplesmente olhamos para algo, separamo-nos de nós mesmos.

II. *Espelho:* A imagem do espetador no centro serve como espelho para manter o utilizador mais consciente que ele está também presente nas escolhas que faz. O ato de olhar para o outro pode ser um ato de empatia ou distanciamento, em que nos colocamos mais ou menos no lugar do outro. A presença da imagem do espetador junto das imagens que se pretendem ser o foco da escolha tem o objetivo de aproximar mais o participante do outro, metaforicamente e literalmente. Tem assim um objetivo em termos simbólicos, proporcionar ao espetador a confrontação de si mesmo, o seu próprio ego, enquanto escolhe para onde olhar, algo que normalmente o faz com uma certa distancia de si mesmo como "observador".

Pertende-se assim manter o utilizador perto do que está a ver, do "outro". Na sua imagem, o espetador tem sempre a presença de uma etiqueta em cima da sua própria imagem. Mediante o movimento vertical da cabeça, o utilizador olha-se "de cima a baixo" e mediante o ângulo vê sob si uma de três palavras: "abject", "subject" ou "object", sendo que a sua imagem também muda de côr mediante o ângulo, assim como o texto. Pouco perceptivel é que a imagem do utilizador é um gráfico de barras em 3D visto de cima, servindo também como metáfora para a sua multidimensionalidade.

III. *Fronteira:* ao alternar entre estado um estado intermédio surge que é aqui chamado de fronteira e que é o espaço *in-between* em que vários estados se cruzam.

IV. *Créditos:* Caso o espetador esteja ausente ou não detetado pela *webcam,* será apresentado um ecrã com créditos

A figura 10 ilustra varios sub-estados da videoarte interativa mais detalhadamente.

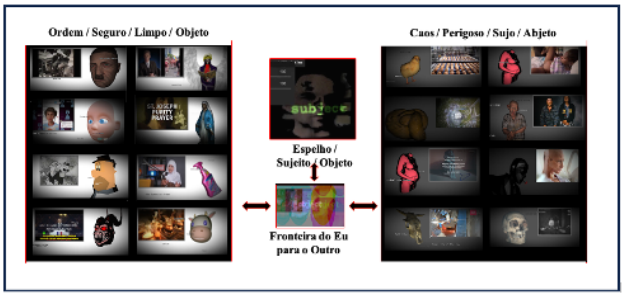


Fig. 10 – Estados e estrutura simbólica da terceira vídeo arte interativa. O espetador alterna entre um modo em que vê o "outro" (em forma de vídeos e modelos 3d) e se vê a si mesmo, sendo que os seus movimentos afetam sempre esse "outro" (controla o vídeo e som, assim como o modelo 3d).

G. Utilização de som e texto

Além da interatividade, do vídeo e do 3D, em todos os estados da videoarte, tentou-se utilizar o som e texto de forma metafórica.

Relativamente ao som usou-se a diminuição de *pitch* dos vídeos caso o espetador esteja no ecrã "espelho" de forma a simbolizar o momento em que se vê a si como um momento que o "outro" está ausente quando o ego se faz presente. A distribuição de canais esquerdo direito mediante o vídeo esteja no lado esquerdo ou direito do ecrã tem o intuito transmitir uma sensação de incompletude da informação que está a receber em dado vídeo para onde rodou a sua cabeça. Mantendo presente que embora tenha decidido não olhar para determinado video, ele não deixa de existir.

Inspirado no jogo Silver Case[61], de Suda51, em todos os ecrãs há a presença de texto com palavras retiradas de um texto sobre abjeção de um website dedicado a Julia Kristeva. Estas palavras surgem aleatoriamente em várias posições do ecrã e tem o objetivo de adicionar uma camada de informação extra relacionada com o tema do abjeto. Embora as palavras sejam relacionadas com o conceito, são deixadas sem explicação deixando a interpretação para o utilizador. Exemplos de palavras usadas: *"narcissism", "homogenic", "animal", "impure", "transcendent", "order", "losing (body) control", "rules", "outside religion", "disgust", "primal repression", "sublime", "urine", "ambiguous", "chaos", "opposition", "trauma", "sex and murder", "the corpse".*

VI. CONCLUSÃO

Apresentou-se neste artigo o registo do processo de desenvolvimento de três videoartes interativas que também podem ser vistam como três iterações de uma obra em construção.

De momento, as videoartes serviram principalmente como processo reflexivo, exploratório e experimental para o autor, como etapa precedente de futuras investigações decorrentes das aqui apresentadas.

A investigação baseada na prática artística assente na criação das videoartes interativas, promoveu aprendizagens interdisciplinares e multidimensionais com dimensões críticas, processuais e transformativas. Além de aprendizagem tecnológica, este projeto contribuiu para novos entendimentos de caráter epistemológico sobre temáticas como psicanálise, média-arte digital, estudos humanos-animais, psicologia da experiência digital, entre outras.

Relativamente às questões e problemáticas levantadas na secção 2, procurou-se criar um sistema interativo que permite ao espetador criar a sua própria narrativa com recurso a conteúdos vídeo existentes, conjugado com um controlo através do próprio corpo. Usando a direção e o movimento da sua cabeça o participante escolhe os conteúdos que quer ver. Usou-se conceitos de psicanalise referidos anteriormente para selecionar os conteúdos e os estados da aplicação a apresentar como escolha ao espetador.

Procurou-se relacionar entre o conceito de abjeto e relações entre humanos e animais através da seleção de conteúdos visuais relacionados com práticas exploratórias de animais não humanos por humanos que poderão provocar sensações associadas com o abjeto como pena, horror, desgosto, choque e repugnância. Por esse motivo mantem-se esses processos recônditos e num "mundo fechado", de forma a excluir a experienciação dessas sensações pelos potenciais consumidores dos produtos resultantes dessa exploração.
Similarmente, segundo o conceito do abjeto, o que ameaça a ordem é excluído para formar o sujeito.

O conceito de abjeto é usado recorrentemente no meio académico para caracterizar vários tipos de discriminação, exclusão e opressão. Recorrendo a essas referencias, mas sem pressupostos de ligações diretas entre os tipos de discriminação, selecionou-se conteúdos relacionados a esses tipos de exclusões de forma a criar uma videoarte interativa que estimule livremente a reflexão de quem o use, embora com um tema em comum.

A utilização do olhar como controlo de vídeo, som, texto e modelos 3D tem o objetivo de criar uma experiência psicológica imersiva com estímulos multimodais.

O sistema de controlo usando a cabeça foi também pensado como forma intuitiva de interagir da videoarte e, sendo uma forma de controlo digital pouco convencional, espera-se estimular o interesse, fascínio e curiosidade do espetador pelo sistema de controlo, proporcionando uma experiencia "divertida", complementando-a com conteúdos eventualmente desconfortáveis, com o intuito de tenta criar uma experiencia equilibrada entre diversão e desafio com cariz critico (*critical flow*) , em cujo o movimento explicito da cabeça e o olhar psicológico para o "outro" estão em sincronia.

Carece ainda de experimentação por parte de outros espetadores para validar se os critérios usados para construir as videoartes interativas proporcionam a experiência imersiva desejada. Nesse sentido, no futuro, será relevante um trabalho etnográfico sobre os impactos e interpretações da obra.

Numa apresentação publica do desenvolvimento do trabalho, surgiu uma questão relacionada sobre se o trabalho não poderia ter interpretações inversas ao pretendido. De facto, existem indícios que o uso de *embodiment* pode também provocar sentimentos mais negativos relativamente a um outro ou servir para o classificar como vitima [36] . Estudar quais melhores e piores formas de enquadrar o outro num contexto de *embodiment* para aumentar a empatia pode ser algo a ter em conta numa próxima iteração.

Também foi sugerido usar um sistema de análise de comportamentos do utilizador para medir como se comportam os espetadores ao experienciar a videoarte, no geral e em cada ecrã.

No estado atual, o "motor" desenvolvido para as videoartes permite também personalizar vídeos, modelos 3d, textos de forma a explorar outros temas ou perspetivas dos mesmos.

Existe também a ideia de numa próxima iteração realizar melhorias técnicas como performance geral, utilização de sensores mais precisos que uma webcam, utilização de modelos com melhores animações, utilização de realidade virtual, entre outros.

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REFERÊNCIAS

[1] TAI, 'Characteristics of video art: the new form of artistic expression', TAI ARTS. Accessed: Oct. 14, 2024. [Online]. Available: https://taiarts.com/en/blog/characteristics-of-video-art/

[2] R. P. Fonseca, *A Vaca que Não Ri*. Livros Horizonte, 2018.

[3] G. Didi-Huberman, *Images in spite of all: Four photographs from Auschwitz*. University of Chicago Press, 2012.

[4] J. Kristeva, *Powers of horror: An essay on abjection*. Columbia University Press, 1984.

[5] R. D. Ryder, 'Experiments on Animals', *Em Animals, Men and Morals*, 1971.

[6] G. Sullivan, *Art practice as research: Inquiry in visual arts*, 2.a. SAGE Publications, 2010.

[7] L. Candy and E. Edmonds, 'Practice-based research in the creative arts: Foundations and futures from the front line'. 2018.

[8] C. Ellis and A. P. Bochner, 'Autoethnography, personal narrative, reflexivity: Researcher as subject'. 2000.

[9] M. Manen, *Writing in the dark: Phenomenological studies in interpretive inquiry*. Left Coast Press, 2003.

[10] K. Kilteni, R. Groten, and M. Slater, 'The sense of Embodiment in virtual reality', vol. 21, no. 4. pp. 373–387, 2012. doi: 10.1162/pres_a_00124.

[11] M. Csikszentmihalyi, *Flow*. HarperCollins, 1991.

[12] B. Soderman, *Against flow: Video games and the flowing subject*. MIT Press, 2021.

[13] Platão, *A República*, 15th ed. Fundação Calouste Gulbenkian, 2017.

[14] R. Descartes, *Discurso do método*, 3rd ed. Martins Fontes, 2001.

[15] P. Singer, *Libertação Animal, Hoje*. 2024.

[16] 'Opinion | Don't Put Hitler Among the Vegetarians', *The New York Times*, Sep. 21, 1991. Accessed: Oct. 20, 2024. [Online]. Available: https://www.nytimes.com/1991/09/21/opinion/l-don-t-put-hitler-among-the-vegetarians-800991.html

[17] 'World Animal Protection | Animal Protection Index'. Accessed: Oct. 20, 2024. [Online]. Available: https://api.worldanimalprotection.org/#

[18] 'Human rights index', Our World in Data. Accessed: Oct. 20, 2024. [Online]. Available: https://ourworldindata.org/grapher/human-rights-index-vdem

[19] K. Shapiro, 'Human-animal studies: Remembering the past, celebrating the present, troubling the future.', *Society & Animals: Journal of Human-Animal Studies*, vol. 28, no. 7, pp. 797–833, 2020, doi: 10.1163/15685306-BJA10029.

[20] B. Latour, *Reassembling the social: An introduction to actor-network theory*. Oxford University.

[21] D. Haraway, *When species meet*. University of Minnesota Press.

[22] E. Levinas and A. Lingis, *Totality and infinity*. Duquesne University. doi: 10.1007/978-94-009-9342-6.

[23] M. Heidegger, *Ensaios e conferências*. 2012.

[24] G. Duhamel, 'Scènes de la vie future'. 1930.

[25] W. Benjamin, *A Obra de Arte na era da sua reprodutibilidade técnica (G*. L&PM Editores, 2013.

[26] M. McLuhan, 'The medium is the message', *Em Understanding*, 1964.

[27] J. C. V. Sá, *A Crítica da Técnica e da Modernidade em Heidegger e McLuhan*. Interacções: Revista Do Instituto Superior de Serviço Social de Coimbra, 2001.

[28] L. Santaella, *Culturas e artes do pós-humano: da cultura das mídias à cibercultura*. São Paulo: Paulus, 2008.

[29] P. A. Veiga, 'O museu de tudo em qualquer parte: Arte e cultura digital: interferir e curar', *Grácio Editor*, 2020, [Online]. Available: https://repositorioaberto.uab.pt/handle/10400.2/11265

[30] B. M. Silva, 'Neblina: notas sobre o projeto "Os caminhos que se bifurcam"', *Texto digital*, vol. 9, no. 2, 2013, doi: 10.5007/1807-9288.2013v9n2p3.

[31] P. A. Veiga, 'Speciesism | Ageism | Racism. Atas de AVANCA | CINEMA 2020 Conferência Internacional de Cinema - Arte, Tecnologia', *Comunicação*, vol. 11, 2020.

[32] A. Perfeito, 'Alentejo - Sonho Lúcido 2022'. 2022. [Online]. Available: https://anaperfeito.com/Alentejo-Sonho-Lucido-2022

[33] A. Perfeito and B. M. Silva, 'Cinema ao Vivo: Compor Narrativas Lineares através das Interfaces Intocáveis e dos Movimentos Corporais dos Performers', in *Em ARTECH 2023: Digital Creation Processes-Proceedings of the 11th International Conference on Digital and Interactive Arts*, 2023.

[34] V. Ramalho, '[IN]MarImmersive Waves'. 2022. [Online]. Available: https://dmad.ciac.pt/vasco-ramalho/

[35] R. d'Orey, X. Alvarez, and T. Vieira, 'Virtual Mirror'. 2014. [Online]. Available: https://www.youtube.com/watch?v=zocDPDvzWOM

[36] T. C. Peck, S. Seinfeld, S. M. Aglioti, and M. Slater, 'Putting yourself in the skin of a black avatar reduces implicit racial bias.', *Conscious Cogn*, vol. 22, no. 3, pp. 779–787, Sep. 2013, doi: 10.1016/j.concog.2013.04.016.

[37] S. Neyret *et al.*, 'An Embodied Perspective as a Victim of Sexual Harassment in Virtual Reality Reduces Action Conformity in a Later Milgram Obedience Scenario', *Scientific Reports*, vol. 10, no. 1, p. 6207, Apr. 2020, doi: 10.1038/s41598-020-62932-w.

[38] M. Slater *et al.*, 'An experimental study of a virtual reality counselling paradigm using embodied self-dialogue', *Scientific Reports*, vol. 9, no. 1, p. 10903, Jul. 2019, doi: 10.1038/s41598-019-46877-3.

[39] D. R. Savchev, 'Do you accept defeat? Is it all pointless? Give up here? Em Anti-violence Rhetoric in the NieR Series Within a Japanese Context'. 2022.

[40] J. Chen, 'Flow in games (and everything else', *Communications of the ACM*, vol. 50, no. 4, pp. 31–34, 2007, doi: 10.1145/1232743.1232769.

[41] M. Csikszentmihalyi, *Flow: The psychology of optimal experience*. HarperCollins, 1990.

[42] A. Machado, *Arte e mídia: aproximações e distinções*. E-compós, 2007.

[43] P. Arantes, 'Arte e mídia no Brasil: perspectivas da estética digital', vol. 3, no. 6. pp. 52–65, 2005. doi: 10.1590/s1678-53202005000200004.

[44] M. Gonzalez-Franco, D. Perez-Marcos, B. Spanlang, and M. Slater, 'The contribution of real-time mirror reflections of motor actions on virtual body ownership in an immersive virtual environment', presented at the IEEE Virtual Reality, Apr. 2010, pp. 111–114. doi: 10.1109/VR.2010.5444805.

[45] 'About', cables. Accessed: Oct. 25, 2024. [Online]. Available: https://cables.gl/about

[46] M. Douglas, 'Purity and Danger: An Analysis of Concepts of Pollution and Taboo', Routledge & CRC Press. Accessed: Oct. 21, 2024. [Online]. Available: https://www.routledge.com/Purity-and-Danger-An-Analysis-of-Concepts-of-Pollution-and-Taboo/Douglas/p/book/9780415289955

[47] B. Creed, 'Horror and the Monstrous-Feminine: An Imaginary Abjection', Accessed: Oct. 21, 2024. [Online]. Available: https://www.academia.edu/47188889/Horror_and_the_Monstrous_Feminine_An_Imaginary_Abjection

[48] B. Creed and J. Hoorn, 'Animals, art, abjection: Powers of Horror in Art and Visual Culture', 2016, pp. 90–104. doi: 10.7228/manchester/9780719096280.003.0006.

[49] R. R. Stanton, *The Disneyfication Of Animals Book*. Accessed: Oct. 21, 2024. [Online]. Available: https://www.indigo.ca/en-ca/the-disneyfication-of-animals/9783030493189.html

[50] J. Butler, *Bodies That Matter: On the Discursive Limits of Sex*. London: Routledge, 2011. doi: 10.4324/9780203828274.

[51] R. Rizq, 'States of Abjection', *http://dx.doi.org/10.1177/0170840613477640*, May 2013, doi: 10.1177/0170840613477640.

[52] K. Kriss, 'Dirty data: the impact of diminishing materiality and the close-up on abject and corporeal representation in computer generated imagery.', Thesis, UNSW Sydney. Accessed: Oct. 21, 2024. [Online]. Available: https://unsworks.unsw.edu.au/entities/publication/4eae8eca-5ce1-4dc1-bda1-f2a2a3c6c293

[53] C. Bronsema, 'Finding the Abject in Video Games', Accessed: Oct. 21, 2024. [Online]. Available: https://www.academia.edu/34659567/Finding_the_Abject_in_Video_Games

[54] R. R. Ramirez, 'Your Abjection is in Another Castle: Julia Kristeva, Gamer Theory, and Identities-in-Différance'.

[55] A. Bradley, 'The Abject in the Technological Other', *Theses : Honours*, Jan. 2004, [Online]. Available: https://ro.ecu.edu.au/theses_hons/1002

[56] *Abjection Incorporated: Mediating the Politics of Pleasure and Violence*. Duke University Press, 2020. doi: 10.2307/j.ctv11313th.

[57] I. Tyler, 'Revolting Subjects', Bloomsbury. Accessed: Oct. 21, 2024. [Online]. Available: https://www.bloomsbury.com/uk/revolting-subjects-9781350360761/

[58] R. Klein, *Cigarettes Are Sublime*. 1993. Accessed: Oct. 21, 2024. [Online]. Available: https://www.dukeupress.edu/cigarettes-are-sublime

[59] H. Keane, 'Cigarettes are No Longer Sublime', *Australian Humanities Review*, no. 57, 2014.

[60] D. Sa and B. D, 'Cartoon characters as tobacco warning labels', *PubMed*, Accessed: Oct. 21, 2024. [Online]. Available: https://pubmed.ncbi.nlm.nih.gov/11115308/

[61] G. Suda, *The Silver Case*. (1999). Grasshopper Manufacture.

Bridging Cultural Gaps in AI Art: Hypernetworks Conditioning for Contemporary Chinese Abstract Acrylic Painting Generation

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Abstract—The proliferation of AI-generated art has highlighted significant biases in current text-to-image models, which are predominantly trained on Western styles. Consequently, these models, including state-of-the-art systems such as Stable Diffusion and DALL-E, struggle to accurately represent non-Western art forms, limiting their cultural applicability and artistic diversity. This gap is particularly evident in Chinese abstract acrylic painting, where unique stylistic elements such as brushstrokes, texture, and composition are often misrepresented or overlooked.

To address this limitation, we propose a novel framework that integrates hypernetworks conditioning into diffusion models, enabling them to capture the distinct visual characteristics of Chinese abstract acrylic paintings. Our approach utilizes subjective image captioning through the BLIP (Bootstrapped Language-Image Pretraining) module to generate culturally sensitive text-image pairs, which serve as inputs for the hypernetworks. By training the hypernetworks on the author's acrylic paintings, which are inspired by the contemporary Chinese abstract style, this method enhances the diffusion model's ability to modulate latent space encodings in alignment with the artist's unique style. Evaluation across various keyword-based and abstract prompts demonstrates a significant improvement in producing culturally authentic outputs, preserving the stylistic integrity and expressive quality of this unique fusion of traditional and modern Chinese art.

These results suggest that incorporating subjective captioning and hypernetworks conditioning can bridge the current cultural gaps in AI art generation, paving the way for more inclusive and representative AI systems that better capture the diversity of global artistic traditions and innovations.

Keywords—Diffusion Models, Hypernetworks, Chinese Abstract Acrylic Painting, Image Generation, Subjective Captioning, Cultural Representation, Text-Image Alignment

I. INTRODUCTION

AI-generated art has experienced tremendous growth in recent years, with systems like Stable Diffusion and DALL-E enabling users to create complex images with simple text prompts. These models have broadened the scope of artistic expression, making image generation more accessible to creators of all skill levels. However, there are significant limitations in how AI models represent diverse cultures, often perpetuating biases present in training data [1].

A. Context and Motivation

Despite the remarkable capabilities of these models, challenges remain in accurately representing diverse cultural art styles. AI-generated art is predominantly trained on datasets that largely reflect Western art forms, leading to an underrepresentation of non-Western artistic traditions. This bias limits the artistic scope of AI models and raises broader concerns about cultural representation and inclusivity in AI.

A particularly striking example of this underrepresentation is Chinese abstract acrylic painting, a unique form of art that blends traditional Chinese ink painting with modern abstract techniques using acrylic paint. This art style is characterized by fluid brushstrokes, layered textures, and symbolic compositions integral to its visual language. These subtleties, however, are often misinterpreted or completely lost by mainstream AI art models due to inherent biases in their training datasets and the limitations of text prompts to convey complex, culturally specific artistic nuances. As a result, AI-generated images of Chinese abstract acrylic

paintings frequently fail to capture the authentic stylistic elements that define this rich artistic tradition.

B. Problem Statement

Current text-to-image models, including cutting-edge diffusion models like Stable Diffusion 1.5/2.1 and DALL-E 3, struggle to capture the nuanced style of Chinese abstract acrylic paintings. This limitation stems from two key factors. First, the dataset biases in these models favor photographic images or Western artistic traditions, which do not adequately represent this art style's expressive and symbolic nature. Second, text prompts alone cannot convey the intricate stylistic details that define these paintings, such as specific brushstroke techniques, texture, and abstract composition [2]. Without culturally relevant data and a more sophisticated approach to encoding these visual characteristics, current AI systems are ill-equipped to generate faithful representations of this art style.

C. Contributions

To address these challenges, we introduce a novel method that integrates subjective captioning with hypernetworks conditioning into diffusion models, enhancing their ability to represent Chinese abstract acrylic painting authentically. Our approach leverages Bootstrapped Language-Image Pretraining (BLIP) [3] to modify or replace its generated captions with culturally relevant captions that align with the visual traits of this art form. These captions augment the text-image alignment, enabling hypernetworks to condition the diffusion model's latent space more effectively. A latent space is a hidden, compressed, or abstract representation of data that helps understand or generate new instances of that data [4].

By training on a dataset of Chinese abstract acrylic painting, our method successfully captures the unique aesthetic traits of this art form, including its brushstroke style, texture, and abstract symbolic composition. This framework addresses the underrepresentation of non-Western art in AI-generated images and improves the overall diversity and inclusivity of AI art systems.

II. RELATED WORK

A. Hypernetworks in Generative Art

Hypernetworks have emerged as a powerful method to enhance the adaptability of neural networks, especially for generative tasks. In the context of image generation, hypernetworks generate weights for the main network based on inputs, allowing for flexible weight adjustment during training or inference. This ability suits them to handle complex, style-based tasks in image generation, such as adapting to different cultural art forms. Research by Chauhan et al. (2023) presents an overview of how hypernetworks improve model flexibility, reduce training complexity, and enable more dynamic architectures. The application of hypernetworks in generative tasks like image synthesis has shown promising results, particularly in cross-domain image editing, where hypernetworks help realign model weights to achieve detailed attribute changes across diverse domains [5]. In text-to-image generation, hypernetworks have been applied to modulate visual-text encodings, enhancing the transfer of stylistic traits from reference images into the generated outputs [6]. However, generating culturally nuanced art styles like Chinese abstract acrylic painting remains challenging. Without subjective captioning, tools like BLIP or DeepBooru struggle to comprehend stylized elements in such a painting style fully. Automatic captioning often fails to reflect these highly stylized paintings' unique content and form and restore their semantic meanings, leading to suboptimal alignment between the text prompt and the visual output.

B. Style Transfer and LoRA Fine-Tuning

Style transfer, a technique where the style of one image is applied to another, has seen significant advancements through internal and external learning mechanisms. An internal-external learning method for artistic style transfer, which utilizes individual style images and a large-scale style dataset to enhance the quality of stylized outputs significantly, was introduced [7]. To further improve efficiency, the LoRA (Low-Rank Adaptation) fine-tuning technique has been applied in style transfer, enabling models to adapt to specific artistic styles with minimal parameter adjustments[8]. This technique avoids large-scale retraining by fine-tuning only a small set of weights, making it computationally efficient for generating specific styles without compromising fidelity. Using only image-based transfer methods can generate visually similar images within the style. Still, when text is introduced—such as a prompt like "an Amazon jungle in Chinese abstract acrylic painting style"—the generated result often struggles to retain the integrity of the target style, leading to compromised outputs.

C. Cultural Representation in AI Art

The lack of cultural diversity in AI-generated art has become a pressing issue, as mainstream vision-language models are predominantly trained on Western-centric datasets, leading to biased outputs that fail to represent non-Western artistic traditions[8]. In generative art, integrating culturally enriched datasets, combined with methods like hypernetworks, allows models to better align with non-Western styles. For example, the HyperEditor framework utilizes hypernetworks to reassign weights in StyleGAN's generator, enabling cross-domain style editing and authentic attribute manipulation across a range of cultural art styles[5]. By employing these techniques, models can better capture and generate art forms like Chinese block-prints, contributing to a more inclusive representation of global artistic traditions.

III. METHODOLOGY

Our approach centers on maintaining strict consistency across key hypernetworks training parameters, including the number and quality of training images, training steps, epochs, learning rate, base model, neural network structure, and activation functions[9]. However, a critical distinction lies in our handling of captioning. Rather than relying solely on automatically generated captions from BLIP (Bootstrapped Language-Image Pretraining), we implement subjective adjustments to these captions shown in Fig.1 to ensure greater cultural sensitivity and accuracy in depicting Chinese abstract acrylic painting.

A. Data Collection

The dataset comprises high-resolution scans of the author's Chinese abstract acrylic paintings, characterized by their expressive brushstrokes, intricate color dynamics, and abstract representations of natural phenomena such as snow-capped mountains, waterfalls, and ocean landscapes. These images embody essential artistic features such as textured line work, layered color application, and dynamic composition, which are fundamental to the aesthetic of Chinese abstract acrylic art. The dataset includes diverse themes to ensure the model captures the full range of these stylistic nuances, each emphasizing different aspects of form, texture, and color. This diversity is critical for training the model to generalize effectively and produce culturally authentic outputs reflective of this unique art style.

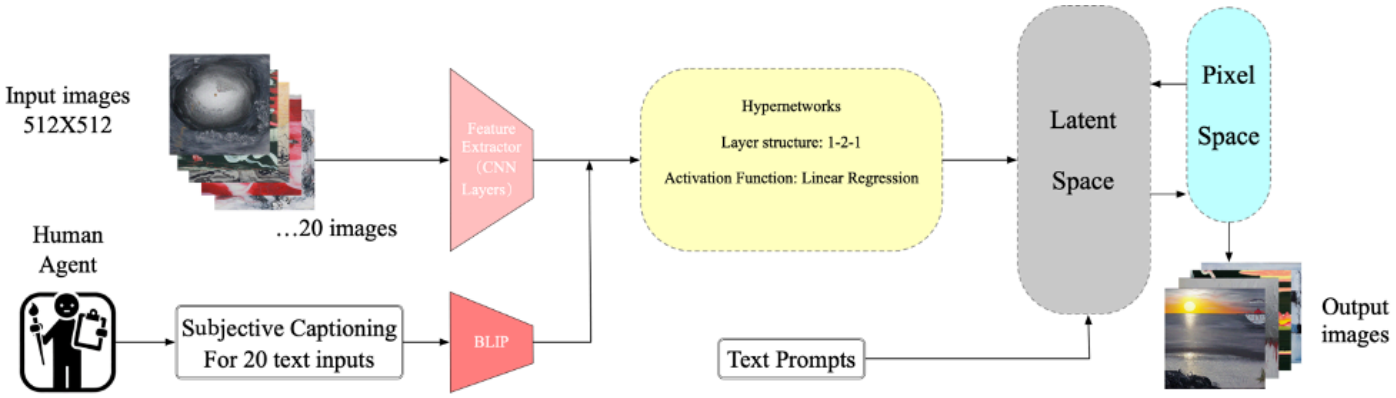


Fig. 1. Subjective captioning in hypernetworks conditioning

B. Subjective Captioning

A central component of our methodology is subjective captioning, which enhances text-image alignment and facilitates the model's understanding of the cultural and stylistic elements inherent in Chinese abstract acrylic painting. In general, automatic captioning models like BLIP often fail to capture the nuanced details and cultural depth of highly stylized art forms, leading to misaligned or superficial representations. To mitigate this, we use BLIP to generate initial captions and refine them manually, incorporating artistic descriptions provided by the artist.

For example, where BLIP might generate a generic caption such as "a painting of a mountain scene," we refine it to "Chinese abstract acrylic painting featuring delicate brushstrokes and ethereal light, symbolizing the flow of energy in a snow-capped mountain landscape." This process integrates subjective stylistic annotations, bridging the gap between the visual content and the deeper cultural and artistic context. By including content descriptions and stylistic details,

the captions more accurately reflect the underlying artistic intent and help the model align text prompts with culturally specific visual features. This manual refinement enriches the contextual information provided to the model, allowing for more precise and culturally sensitive image generation.

C. Hypernetwork Design

The hypernetwork acts as a style-conditioning module within the diffusion model, dynamically adjusting the weights of the primary network based on the stylistic cues drawn from the input data. This enables the model to reproduce the unique artistic qualities of Chinese abstract acrylic painting with high fidelity. The architecture of the hypernetwork is designed to generate style-conditioned weights for the diffusion model, aligning the output with the intricate brushwork, layered textures, and abstract compositions characteristic of this art form.

The hypernetwork modifies the latent space of the diffusion model, capturing subtle visual details such as brushstroke direction, texture depth, and compositional balance. This ensures that the model can adapt to various abstract prompts while preserving the cultural integrity and stylistic nuances of Chinese abstract acrylic painting. By conditioning the model's latent space on these visual and cultural cues, the hypernetwork enhances the model's ability to generate images that authentically reflect the distinctive features of this artistic style.

D. Training Process

The training process integrates multiple latent spaces—text inputs, visual data, and stylistic cues generated by the hypernetworks—into a unified representation that informs the diffusion model's image synthesis. For this study, we utilized the "v1-5-pruned-emaonly" as the base model, with the hypernetworks following a 1-2-1 architecture and a learning rate set to 0.00005. The model has trained over 2000 dynamic steps, with intermediate image generations and hypernetworks checkpoints saved every 100 steps to facilitate the iterative evaluation of generation quality.

Each training step fine-tuned the alignment between the visual characteristics of the generated images and the text prompts, ensuring that the model's outputs consistently reflect the abstract content and the stylistic nuances inherent in Chinese abstract acrylic paintings. This multi-stage training process allows the model to continuously refine its generative capabilities, progressively enhancing its ability to produce culturally authentic and artistically faithful images.

To achieve the highest quality in the generated images, we employed a dual loss strategy combining perceptual style loss and GAN (Generative Adversarial Network) loss [10]. The loss of perceptual style ensures that high-level content and stylistic elements—such as the dynamic flow of brushstrokes, textural contrasts, and the interplay of light and shadow—are accurately captured and aligned with the reference paintings. This loss function compares the high-level features of the generated image with the reference artwork, guiding the model toward stylistic fidelity.

On the other hand, the GAN loss promotes the realism of the generated images, ensuring that they are visually indistinguishable from the original paintings. The adversarial component forces the model to produce outputs that adhere to the aesthetic principles of Chinese abstract acrylic painting and exhibit a level of detail and texture that enhances their artistic authenticity. The combination of these two loss functions enables the model to generate images that not only retain the aesthetic qualities of the source material but also exhibit a heightened level of artistic precision and cultural accuracy.

IV. EXPERIMENTS AND EVALUATION

A. Training Progress Evaluation (Per 100 Steps)

To closely monitor the generative quality and progression during training, we evaluate images generated by the model at every 100-step interval. The generated images are compared with the original artwork to assess how well the model captures and evolves the key stylistic features such as brushstroke techniques, color composition, and textural layering.

This evaluation focuses on:

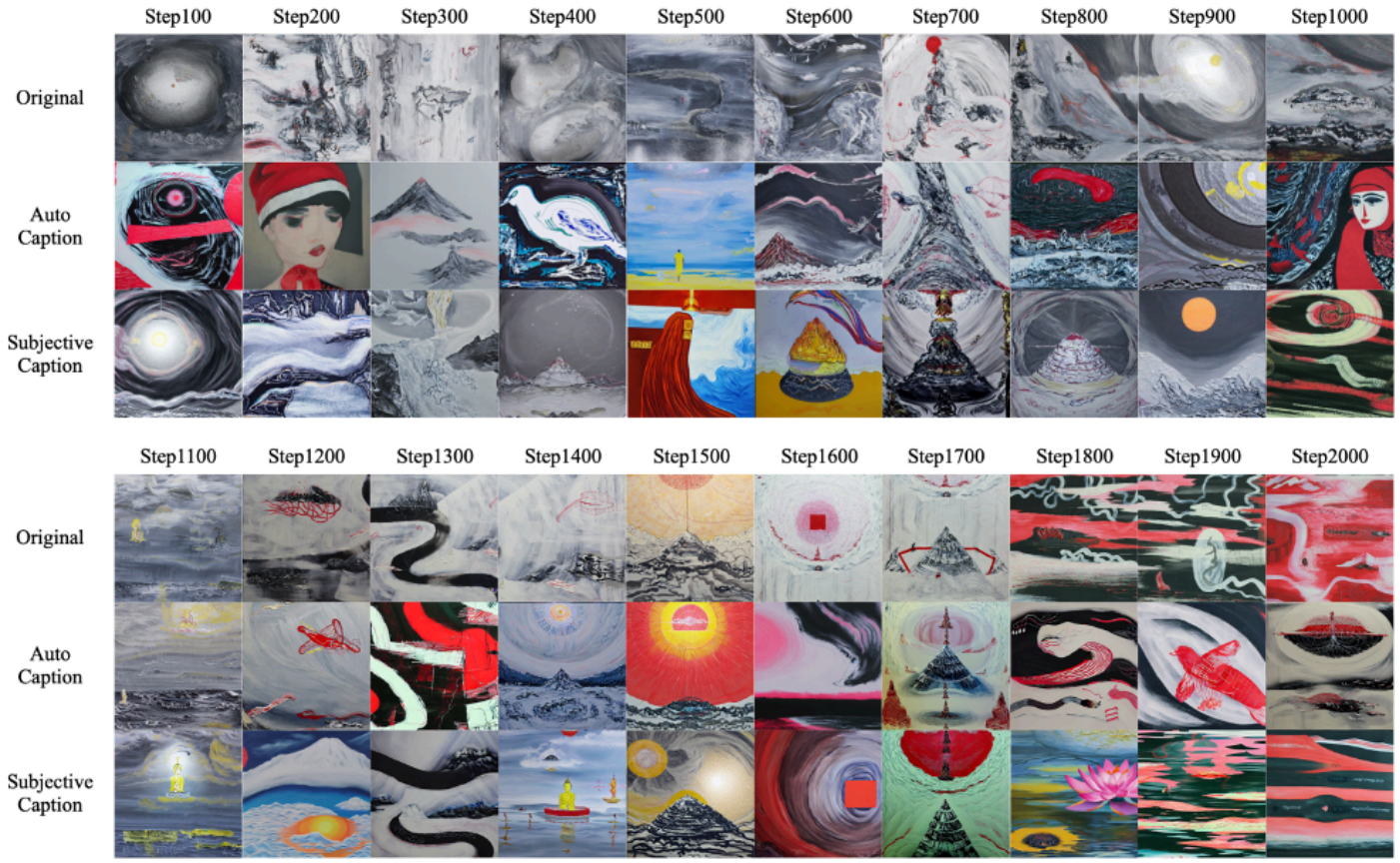


Fig. 2. Demonstration of training results from auto-captioned and subjectively captioned hypernetworks, along with the corresponding training materials

- Stylistic Accuracy: Whether the model progressively improves in reproducing the original works' unique brushstroke styles and abstract forms.
- Visual Fidelity: The level of detail, texture, and composition present in the generated images as training progresses, ensuring alignment with the original paintings.

The results, as shown in Fig.2, indicate that at steps 200, 500, 400, 1000, and 1900, the hypernetworks, using automatic captions, generated images that were highly irrelevant to the original paintings and introduced new content, such as a female portrait and a bird. In contrast, while the hypernetworks with subjective captions also produced some irrelevant images at steps 500, 600, 1200, and 1800, they did not introduce entirely new content, maintaining a closer alignment with the original thematic elements of the artwork.

B. Abstract and Concrete Prompt Evaluation

The model's ability to manage both abstract and concrete prompts is assessed using the following inputs:

- "A pink dream"
- "Sunset by the seashore"
- "Flowing energy in a snowy mountain landscape"
- "Abstract expression of creative digital intelligence"

These prompts represent a spectrum of conceptual and visual complexity, testing the model's flexibility in adapting Chinese abstract acrylic painting techniques to different thematic contexts. The generation results are shown in the Fig.3.

The first two prompts, "A pink dream" and "Sunset by the seashore," are concrete yet imaginative descriptions. They allow us to observe how well the model preserves stylistic features like brushstroke flow and color dynamics in generating familiar, visually interpretable scenes. By grounding the evaluation in concrete imagery, we can compare generated outputs against more well-defined landscape or dreamlike representation expectations.

In contrast, "Flowing Energy in a Snowy Mountain Landscape" and "Abstract Expression of Creative

Digital Intelligence" introduce more abstract concepts. These prompts push the model to interpret symbolic or non-literal themes while maintaining the core stylistic elements of Chinese abstract acrylic painting, such as fluid motion, layered textures, and expressive composition. This part of the evaluation allows us to explore whether the model can preserve the underlying artistic principles when faced with more interpretative or conceptual challenges.

Key Metrics:

- Interpretative Fidelity: This metric assesses how effectively the model retains core stylistic elements, such as brushstroke quality and abstract compositions while translating the abstract concepts into visual form. It measures the balance between artistic creativity and adherence to the foundational style.
- Artistic Expression: This metric evaluates the generated images' ability to convey symbolic, emotional, and expressive qualities consistent with the traditional and modern fusion seen in Chinese abstract acrylic painting. It examines how well the outputs reflect the depth and intent of the original artistic techniques when applied to diverse conceptual themes.

TABLE I. RESULTS OF COSINE SIMILARITY AT DIFFERENT TRAINING STEPS FOR STYLE CONSISTENCY

Step Interval (Compared Image)	Average Cosine Similarity (Original Image)	Average Cosine Similarity (Auto-Caption)	Average Cosine Similarity (Subjective-Caption)
100	0.85	0.82	0.88
200	0.84	0.81	0.87
300	0.82	0.79	0.85
400	0.80	0.78	0.84
…	…	…	…
2000	0.74	0.70	0.78
Average	0.78	0.74	0.82

Using this prompt mix, we can better understand the model's versatility and capacity to maintain stylistic integrity across both concrete and abstract visual themes. In analyzing the results by human judgment, images generated by hypernetworks with subjective captioning are considered to own better quality, details, and artistic value.

C. Style Consistency and Similarity Evaluation

For the style consistency evaluation, we systematically compared the images generated at each step with all other images generated during the Training Progress Evaluation by auto-captioned and subjective captioned hypernetworks. This method allowed us to track the stylistic evolution of the model over the training process. Specifically, the image generated at step 100 was compared with images generated from steps 200 to 2000, calculating the average cosine similarity to measure stylistic consistency. This process was repeated for each subsequent step, providing a comprehensive analysis of the model's stylistic retention as training progressed. Additionally, we introduced a benchmark data group using original training images to represent the style consistency of Contemporary Chinese Abstract Acrylic Painting, following a similar comparison method [11].

1) Evaluation Process:

a) Image Comparison: At each step interval (e.g., 100, 200, ..., 2000), we calculated the cosine similarity between the selected image and all other images generated at the remaining steps. This approach provided a detailed view of the model's stylistic drift or convergence over training iterations.

b) Feature Extraction with ResNet50: ResNet50 extracts feature vectors from each image to capture high-level stylistic elements, such as brushstrokes, textures, and compositional structure [12]. This deep learning model is known for its ability to discern intricate artistic nuances, providing a robust basis for our style analysis.

c) Average Consistency Measurement: We calculate the cosine similarity between the selected image and all others for each step, then compute the average similarity score across these comparisons. This average score represents how consistently the model retains stylistic elements as training progresses. A higher average cosine similarity indicates better stylistic consistency over time.

2) Key Metrics:

Style Consistency (Average Cosine Similarity): The average cosine similarity score reflects the model's ability to preserve stylistic features across the training process. A higher average score suggests that the

model maintains consistent stylistic elements, which is crucial for generating art with a coherent style.

3) Statistical Significance:

To ensure the statistical significance of our findings, we performed multiple-group comparisons, analyzing the mean, standard error, and standard deviation of the cosine similarity scores across different steps and conditions. This analysis allowed us to identify any significant differences in style consistency between the auto-captioned and subjective captioned hypernetworks [13].

D. Style Similarity Evaluation

For style similarity, we compare each image generated during the Abstract and Concrete Prompt Evaluation by four different prompts with the original 20 artworks to evaluate how well the model captures the stylistic essence of Chinese abstract acrylic paintings. This evaluation is performed using VGG-16.

1) Evaluation Process:

a) Feature Extraction with VGG-16: We utilize VGG-16, a model known for capturing both low-level details (edges, textures) and high-level abstractions (style, composition), to extract feature vectors from the generated images and the original paintings[14].

b) Similarity Measurement: We compute the cosine similarity between the feature vectors of the generated images and the original paintings by calculating its average value. This evaluates how closely the model's generated outputs align with the stylistic characteristics of the original artworks.

2) Metrics:

Style Similarity: In Table II, High similarity scores indicate that the model has successfully captured and reproduced the stylistic essence of the original paintings, demonstrating its ability to generate culturally and artistically accurate outputs[13].

3) Statistical Analysis:

To substantiate our findings, we conducted a comprehensive statistical analysis, including the computation of the average, standard deviation, and standard error of the cosine similarity scores. This analysis provided insights into the model's performance across different prompts and its ability to replicate the stylistic nuances of the original artworks.

4) Result:

The images generated by the hypernetwork trained with subjective captioning demonstrated moderately higher style consistency and greater similarity to the original artworks than those generated with automatic captioning. This result underscores the importance of subjective captioning in enhancing the model's ability to capture and reproduce the stylistic essence of Chinese abstract acrylic paintings.

V. DISCUSSION

A. Effectiveness of Subjective Captioning

The introduction of subjective captioning in our framework plays a pivotal role in enhancing the correspondence between text prompts and the generated visual outputs. Unlike automatic captioning methods, which often provide generic or overly literal descriptions, subjective captioning allows for the infusion of nuanced cultural and artistic details. This enrichment enables the model to understand better and reflect the complexities of Chinese abstract acrylic painting, particularly in terms of the fluidity of brushstrokes, the layering of colors, and the symbolic nature of composition. By manually adjusting the captions based on the artist's interpretations of the works, we bridge the gap between culturally specific visual elements and the AI model's language-based understanding.

TABLE II. RESULTS OF COSINE SIMILARITY FROM 4 PROMPTS FOR STYLE SIMILARITY

Prompt (Compared Image)	Average Cosine Similarity (Base Model)	Average Cosine Similarity (Auto-Caption)	Average Cosine Similarity (Subjective-Caption)
"A pink dream"	0.35	0.70	0.80
"Sunset by the seashore"	0.40	0.65	0.83
"Flowing energy in a snowy mountain landscape"	0.73	0.81	0.85
"Abstract expression of creative digital intelligence"	0.60	0.78	0.84
Average	0.48	0.74	0.83

Subjective captioning ensures that important cultural motifs, such as the interpretation of natural phenomena or the symbolic use of space in abstract

Chinese painting, are not lost in translation during the generative process. This method enables the model to align more closely with the cultural context of the artwork, making the generated images not only visually accurate but also culturally resonant. The inclusion of stylistic annotations in the captions, such as descriptions of brushstroke techniques or the abstract representation of landscapes, results in outputs that better capture the intended emotional and symbolic depth of the original works.



Fig. 3. Demonstration of results from auto-captioned and subjectively captioned hypernetworks using prompts

B. Limitations and Challenges

Despite the success of subjective captioning and hypernetworks conditioning, several limitations remain. One of the primary challenges is data scarcity. High-quality datasets that accurately represent non-Western art forms, such as Chinese abstract acrylic painting, are limited. This scarcity can hinder the training process, reducing the model's ability to generalize across different themes or styles within the same cultural tradition. Moreover, while effective in generating culturally authentic outputs, the reliance on artist-specific datasets may limit the model's ability to represent broader stylistic variations within the genre.

Another challenge lies in the inherent biases of base models like Stable Diffusion, which are often trained predominantly on Western-centric datasets. These biases can persist even with hypernetworks modulation, potentially leading to subtle misrepresentations of non-Western styles. Fine-tuning hypernetworks for niche art forms remains complex, particularly when a predominantly Western aesthetic has preconditioned the base model's latent space. The fine-tuning process requires high-quality data and careful optimization of hyperparameters to ensure that the model captures the intricate stylistic details without overfitting specific datasets or losing the ability to generalize across prompts.

Additionally, subjective captioning requires a certain understanding of the artworks to accurately describe their cultural and stylistic elements. This manual work from human agents may introduce inconsistencies or misinterpretations if they lack a deep knowledge of the artistic tradition. Ideally, the artist should be involved in the captioning process to ensure that the descriptions truly capture the intent and nuances of the artwork. This approach would help preserve the authenticity and cultural integrity of the generated images.

C. Ethical Considerations

In addressing the ethical implications of our work, we acknowledge several key areas of concern. The issue of authorship and ownership in AI-generated art is complex, and we ensure that the artist's role in the creative process, particularly through subjective

captioning, is recognized and respected[15]. We are mindful of the potential impact on human creativity, aiming to use AI as a collaborative tool that enhances rather than replaces human artistic input[16]. The originality and authenticity of AI-generated works are paramount, and our framework is designed to produce outputs that are true to the artist's unique style and cultural heritage[17]. We also recognize the importance of cultural sensitivity and representation, striving to reduce biases and ensure diverse art forms are accurately and respectfully portrayed. The economic and professional implications for artists are considered, with our approach positioning AI as a creative enhancement rather than a replacement. Transparency and disclosure are upheld, with all AI-assisted works clearly labeled and the artist's contributions acknowledged[18]. Moral agency remains a human responsibility, and we ensure that our development and use of AI respect cultural sensitivities and artistic integrity. Lastly, we consider the social impact of AI-generated art, committing to using AI to promote cultural diversity and artistic expression and to contribute positively to social change.

VI. CONCLUSION

This paper presents a novel framework for bridging cultural gaps in AI-generated art, focusing on contemporary Chinese abstract acrylic painting as a case study. By integrating subjective captioning with hypernetworks conditioning, we enhance the model's ability to generate culturally authentic and stylistically faithful representations of contemporary Chinese abstract art. The subjective captioning process enriches the text-image correspondence, ensuring that the model accurately reflects the nuanced details and cultural significance embedded in the art form. Our results show a marked improvement in the model's ability to produce outputs that align with the stylistic integrity and expressive quality of contemporary Chinese abstract acrylic painting, paving the way for more inclusive and representative AI systems.

A. Future Work

Looking forward, there are several avenues for extending this research. One potential direction is to apply this framework to other underrepresented art forms, such as Indigenous or African art, which also lack representation in mainstream AI models. Future models can further bridge the cultural gaps in AI-generated art by expanding the dataset to include more diverse art forms. Additionally, there is potential for exploring interactive AI art tools, where users can guide the model's generation process in real-time, adjusting stylistic parameters or providing direct feedback to the hypernetworks. This interactive approach could foster a more dynamic relationship between artists and AI systems, enhancing creativity and broadening the scope of artistic expression facilitated by AI. Finally, incorporating multi-modal inputs such as sound or motion data could expand the capabilities of AI in generating multimedia art forms, opening up new possibilities for creative expression across various artistic domains.

B. Generative Artwork

In a contemporary Chinese abstract style, this digital artwork shown in Fig.4 was generated using Stable Diffusion with hypernetworks conditioning trained through the subjective captioning method, using the prompt "Creative Digital Intelligence."



Fig. 4. Creative Digital Intelligence.

REFERENCES

[1] Bhatt, H., et al, "An Extensive Analysis of AI-Generative Art Algorithms," in 2024 IEEE International Conference on Information Technology, Electronics and Intelligent Communication Systems (ICITEICS), 2024, pp. 1–6.

[2] M. McCormack, "Is Writing Prompts Really Making Art?" in Artificial Intelligence in Music, Sound, Art, and Design, 2023, pp. 196–211.

[3] Li, J., et al, "Blip: Bootstrapping language-image pre-training for unified vision-language understanding and generation," in International Conference on machine learning, 2022, pp. 12888–12900.

[4] Mikolov, T., et al. *Efficient Estimation of Word Representations in Vector Space*. arXiv preprint arXiv:1301.3781, 2013.

[5] Zhang, H., et al, "HyperEditor: Achieving Both Authenticity and Cross-Domain Capability in Image Editing via Hypernetworks," in Proceedings of the AAAI Conference on Artificial Intelligence, 2024, pp. 7051–7059.

[6] Yuan, X., et al. "Text-to-image generation via implicit visual guidance and hypernetworks," in arXiv preprint arXiv:2208.08493, 2022.

[7] Chen, H., et al. "Artistic style transfer with internal-external learning and contrastive learning," in Advances in Neural Information Processing Systems, vol. 34, pp. 26561–26573, 2021.

[8] Smith, B., et al. "Balancing the picture: Debiasing vision-language datasets with synthetic contrast sets," in arXiv preprint arXiv:2305.15407, 2023.

[9] Chauhan, V., et al. "A brief review of hypernetworks in deep learning," in Artificial Intelligence Review, vol. 57, no. 9, pp. 1–29, 2024.

[10] Hanjun Li. " 2. Combining CycleGAN and perceptual loss for image style transfer: Double training process," in Applied and Computational Engineering, 2024.

[11] Zhang, Yihua, et al. "Unlearncanvas: A stylized image dataset to benchmark machine unlearning for diffusion models." *arXiv preprint arXiv:2402.11846*,2024.

[12] Kang Xu. " 1. Automated Artist Identification Using Deep Learning and Transfer Learning Techniques," in Science and technology of engineering, chemistry and environmental protection, 2024.

[13] David Issa Mattos Chapter 6 Multiple-group comparison | Online Appendix for: Statistical Models for the Analysis of Optimization Algorithms with Benchmark Functions.2023. Retrieved from https://davidissamattos.github.io/statscomp/multiple-group-comparison.html

[14] A. V. Bruns, et al. " 4. Deep network representation of art style similarity judgment," in Journal of Vision, 2023.

[15] Jiang, Harry H., et al. "AI Art and its Impact on Artists." Proceedings of the 2023 AAAI/ACM Conference on AI, Ethics, and Society. 2023.

[16] Park, S. The work of art in the age of generative AI: aura, liberation, and democratization. *AI & Soc*,2024. https://doi.org/10.1007/s00146-024-01948-6

[17] Wang, Yifei. "Artificial Creativity-Ethical Reflections on AI's Role in Artistic Endeavors." *Authorea Preprints*,2023.

[18] Piskopani, et al. "Responsible AI and the arts: The ethical and legal implications of AI in the arts and creative industries." *Proceedings of the First International Symposium on Trustworthy Autonomous Systems*. 2023.

Narrative Environments in Digital Art

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Abstract—This research project presents both an investigatory process that maps a theoretical framework and a practical experiment aimed at creating a digital artifact whose result explores the potential of typography as a form of visual and aesthetic expression within contemporary artistic discourse. One objective is the exploration of dynamic and interactive digital typography, while the second objective deals with the relevance of the imagistic qualities of typography in immersive digital environments. The purpose is to explore a new form of materiality and a new vehicle for mediating the reading experience. For our analysis, we used a selection of poems from Sophia de Mello Breyner Andresen to question: how can contemporary digital art approaches promote a different reading experience and transform the emotional perception of a poem? To answer this question, we conducted a methodology that combines art practice-based research articulated with interpretative phenomenology, literature review, case studies, artistic references analysis, visual research, focus groups, and user-centered research. That process's data collection and insights helped create a typographic installation prototype to collect new data and conduct testing experiments.

Keywords—Digital Typography, Digital Media Art, Digital Narrative Environments, Typographic Interactive Installation

I. INTRODUCTION

The emergence of digital technology has introduced new possibilities for new art approaches, reshaping communication and text-based manifestations in the creative field. Digital technology has expanded typography's expressiveness, functionality, and usability, opening a new chapter in exploring artistic expression materiality characterized by typographic elements. The analysis of relevant contributions of typography in art and how contemporary typography-based art has evolved under the influence of digital media significantly impacted the theoretical framework for our practical-artistic project. At its core, the project is contextualized in a problem that leads to the following research hypothesis: a contemporary approach to digital media art, exploring kinetic and interactive typography as a means of visual and aesthetic expression, promotes a different reading experience, and transforming the emotional perception of a poem. To test this hypothesis, we created a digital and interactive installation using a selection of poems from the poetic corpus of Sophia de Mello Breyner Andresen (1919-2004), one of the most important Portuguese poets of the 20th century. The installation allows users to interact with imagistic-based typographic compositions of the poems, stimulating on-site individual interpretations. The objective aims to provide an unconventional reading experience, enhancing perception, acquiring meaning or sentiment, and emotional engagement with poems through the mediative process.

II. BRIEF THEORETICAL FRAMEWORK

At the beginning of the 20th century, typographic experiments of European artistic avant-garde movements, such as Futurism, Dadaism, Russian Constructivism, and Surrealism, challenged the established graphic text-based conventions. The exploration and relationship between the visuality of the written word and its meaning and the new materialities of typography expression in experimental films and artistic installations were disruptive, new, and pleasurable. Marinetti's *Manifesto del Futurismo* 1909 broke from conservative literary traditions to promote a new poetic and typographic revolution celebrating speed and modernity [1][2]. His concept of *parole in libertà* freed words from syntax and grammar and allowed expressive and visual text arrangements [3]. Marinetti's graphic experiments significantly influenced other futurist artists, marking a general moment in other avant-garde movements, such as Russian constructivism and Dadaism, or artists such as Guillaume Apollinaire. The quest for innovative ways

to visualize words turned the page into an experimental space, breaking away from the horizontal, linear constraints of traditional typography established by movable type [2].

A new phase of this typographic revolution was opened with the advent of cinema. In the 1920s, various artistic movements, fascinated by the new creative possibilities of kineticism, produced influential works in experimental film and the use of moving typography. In 1924, Marcel Duchamp, Marc Allégret, and Man Ray began to work on the film "Anémic Cinéma" (Fig. 3) in Man Ray's studio [4]. This short, published in 1926, is considered a key reference in the history of experimental film and kinetic typography because of the use of repetitive sounds and composition of words that suggested sensorial pulsating activity. Additionally, some artists began exploring new forms of featuring typography in installation artworks with innovative spatial and materiality approaches.

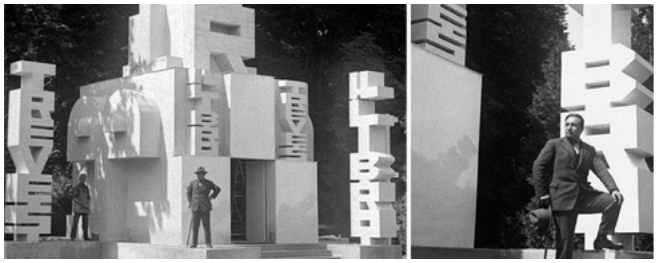


Fig. 1. *The bolted Book*, Fortunato Depero, 1927.

The Italian futurist artist Fortunato Depero created one of the first examples of modern typographic installation. For the 1927 *Biennale Internazionale delle Arti Decorative in Monza*, Depero designed a Book Pavilion for publishers *Bestetti Treves Tumminelli*, known as "The bolted Book" (Fig. 2) built entirely out of giant block letters [5]. The pavilion represented a new stage for avant-garde typography and marked the beginning of typographic installation.

The expressiveness of aesthetics of European avant-garde movements had repercussions in neo-avant-garde approaches in the 1950s and 1960s. One of the most notable examples is expressed in Concrete Poetry, which significantly influenced the postmodernism movements, such as the New Wave Typography, Fluxus Art, and Experimental Poetry. Gradually, emerging languages from computer technology were introduced. From the early 1970s till the 1980s, postmodern typography and typographic installations emerged in designers and artists like Sheila de Bretteville, Stephen Doyle, Barbara Kruger, and Jenny Holzer.

Digital technology has expanded typography's expressiveness, functionality, and usability. Digitalization brought the facility to manipulate letters – shape, color, motion – and enabled the integration of interactive behaviors and generative forms [6]. This transition greatly expanded into the liberation from the limitations of printed typography and printed books, once the primary medium for the written word, which nowadays faces fierce competition with digital interfaces. This paradigm shift enabled the creation of new materialities and digital environments, allowing text narrative to transcend and expand beyond the physical limitations of the printed book.

Discussing materiality in digital art means recognizing that every act of artistic expression needs a medium to be realized. Authors like Marshall McLuhan, Harold Innis, Hans Ulrich Gumbrecht, and Lev Manovich emphasize the role of media technologies in reshaping cultural thought. McLuhan, for instance, argues that the medium is the message, suggesting that materiality profoundly impacts how we understand and process information. Media actively shapes our perception and mindset, not mainly through their content but primarily through their material and technical properties [7].

Digital installations transform the user's relationship with the written language by enabling interaction and incorporating the user's physical presence into the experience. The traditional notion of reading and contemplation is set aside as the audience's presence becomes integral to the work. The artwork emerges from the interaction between the installed elements, the space they occupy, and the user [8]. That sense of "presence" emphasizes the importance of sensorial experience, materiality, and spatial aspects that define how users experience meaning or perception. According to [9, p. 78, it] is the "interface that creates its unique materiality and the unique user experience." Changing the interface, even slightly, can significantly alter the work's meaning, experience, or impact.

Among the earliest digital installations exploring typography are, The Legible City" (1989) by Jeffrey Shaw, "Stream of Consciousness: An Interactive Poetic Garden" (1997) by David Small and Tom White (Fig. 2)), and "Text Rain" (1999) by Camille Utterback and Romy Achituv, which stand out as reference works. "The Legible City" transformed urban landscapes into typographic environments, allowing users to navigate through virtual cities constructed entirely of words by pedaling a stationary bike. "Text Rain" uses interactive technology to let participants "catch" falling letters

from a poem with their bodies, creating a connection between physical presence and textual materiality. "Stream of Consciousness: An Interactive Poetic Garden" consists of a minor, two-meter-square garden with water streaming down a series of cascades into a pool. It "is a fountain of Words" [10, p.1], projected onto the water and floating like leaves in a continuous cycle, being drawn into a drain and pumped back to the start. The user's presence goes beyond mere contemplation to assume the role of a transforming agent/ of an agent of change: visitors can control the word´s movement, causing them to multiply or block their flow [10].



Fig. 2. Stream of Consciousness: An Interactive Poetic Garden, David Small and Tom White (project direction: John Maeda), 1997.

III. METHODOLOGICAL FRAMEWORK

The methodological framework is partially guided by a creative process that involves the adoption of practice-based research [12, 13], specifically a/r/tography [14] and a/r/cography [15]. These two approaches advocate research methods substantiating artistic writing and production through a continuous flow of questions. It aims to foster rhizomatic and generative research by questioning and distancing from established postulates. By questioning and distancing from established postulates, it seeks to foster rhizomatic and generative research, leading to new and diverse understandings of an artistic subject, thereby contributing to the creation and dissemination of knowledge. The acquisition of new knowledge is, in part, through artistic practice - the creative act, from the initial concept to its execution and exhibition - and the results of that practice [12, 13], in a constant dialectic of doing and thinking, integrating aesthetic-conceptual processes, technological development, and experimentation [11]:

a) Aesthetic-conceptual process: this research approach is guided by conceptual and aesthetic issues that emerge from the gradual maturation of the initial idea to the act of materializing the artistic installation. Reference [11] points out that aesthetic mediation is one of the central activities of the creative process in digital art. Aesthetic mediation is part of every phase of artistic creation [15], while the artist is also in constant aesthetic appreciation of his creative process.

b) Technological development: for obvious reasons, the history of digital art has been shaped as much as the history of science and technology as by art-historical influences [16]. In other words, digital art is intrinsically linked to the development of digital technology. Therefore, our artistic project will integrate emerging digital technologies and develop innovative techniques. This phase is linked to the functional development of the installation experience. It also engages in constant dialectic with a critical analysis focused on 1) the functional aspects and tangible effects of digital technology on artistic practice, 2) the objects used in the artwork, and 3) interactivity. Overall, it examines the practical implications of digital technology in modeling materiality, how digital tools are employed, and how their performative, interactive, or other contact-based usage influences and shapes user behavior, knowledge acquisition, and the reading experience. In this phase, the main objective is to optimize user interactivity with visual elements.

c) Experimentation: digital media art is an interdisciplinary field that combines art and technology, often integrating methodologies and theories from computational science, which can be classified as an experimental research project. The artist's role shifts from creating contemplative objects to engaging in experimental processes that explore dynamic systems of interaction, making art a form of research into the possibilities of technology. Experimentation is central to our methodological framework, focusing on visual experimentation, technological exploration, tools, and digital production methods, enabling the artistic installation to evolve innovatively. Through experimentation, hypotheses will be tested, generating results that will be analyzed to gain insights that, according to [15], allow the concept to be confirmed or adjusted.

As in [13], the artistic practice is theorized as research, with an interpretive phenomenological approach from the perspective of personal interpretation of phenomena. In our research, this approach will be developed with an ethnographic component aimed at collecting data from the audience, including contributions from focus groups with experts (artists, designers, teachers, researchers, and students in these fields). We will also conduct user-centered research to question the key concept, using usability tests to collect contributions to

optimize our digital installation project. Complementarily, we will use standard methodologies such as literature review, case study analysis, visual research, and the specific analysis of the poet's body of work, focused on the poems' key concepts that align with the installation's purpose.

IV. INSTALLATION CONCEPT

A. Aesthetic-conceptual process

Sophia de Mello Breyner Andresen's poetry, as in [17, pp. 21–22], frequently explores the metaphor of time in various ways: the "time of memory," where she revisits the happy moments of her childhood; the "time of the revolt," depicting a historical period in which there was no room for freedom; and the "pure, ancient, and primordial time" exploring the idea of an era that precedes modernity, marked by an almost untouched purity, a deep connection with nature, the mythical world, and the culture of the classical period, where values such as harmony, beauty, and justice were central.

For the installation's concept, we were inspired by the metaphor of the "time of revolt" theme, using the textuality material of the poe, "Data,"" published in Sophia de Mello Breyner Andresen's book, "Livro Sexto" (1962) [18] which reads as (authors' translation):

> Time of loneliness and uncertainty
> Time of fear and time of betrayal
> Time of injustice and vileness
> Time of denial
> Time of cowardice and time of anger
> Time of masquerade and lies
> Time of slavery
> Time of conniving without record
> Time of silence and gag
> The time when blood has no trace
> Time of threat

In this poem, the word "time" is used to replace the forbidden word "Regime" (dictatorial and fascist), as a code that was recognized and used by all Portuguese poets of that time. Having the "narrative" and semantic content of this poem as a reference, the artistic installation explores the metaphor of time in different and complementary ways. On one hand, it reflects how the fight for freedom persists through time. This perspective aims to provide a critical and comparative reflection on past and present forms of dictatorship and oppression, using the metaphor of time to connect these experiences. As [19] states, today, the digitalization of social life and the crisis of democracy are leading society towards a "digital dictatorship" system, in which algorithms and AI control social, economic, and political processes by monitoring and analyzing our actions. In this context, "Big data" manipulates information, creating a regime of surveillance that endangers individual freedom under an authoritarian structure.

On the other hand, but in a complementary way, our installation invites the audience to reflect on the impact of technology on our perception of time. Its concept seeks to depict the disruption between human perceptual time and the time of the technological era — those of algorithms and machines. While humans need time to process and interpret information, which is named in this paper "humane time," the inhumane supersonic speed and pace of the algorithmic age information bombardment are drastically different. From this perspective, the time required for reading and reflection — essential for critical thinking that defines our human cognitive characteristics — is under threat. The emotional disconnection with textual meaning resulting from this modern accelerated life may exacerbate this loss, diminishing our capacity to feel and think deeply. Moreover, this new technological time reprograms our abilities and skills of observation, introducing a new way of interpreting a world partially led by us but partially overtaken by machines.

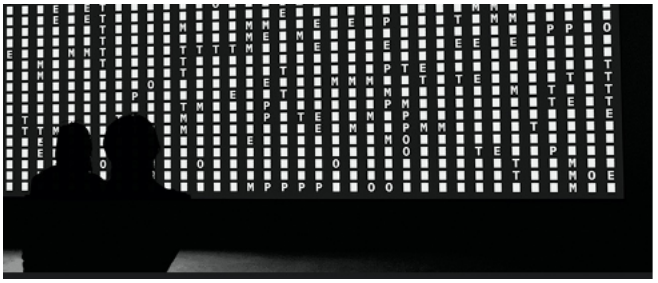


Fig. 3. Frame of a cine-imagistic interpretation (does not yet match the final aesthetic result) of the poem "Data" by Sophia de Mello Breyner Andresen.

The choice of our installation aesthetic harmonizes the time theme concept with different cine-imagistic (kinetic and visual) approaches related to time. The dynamics and speed of the typographic composition will change based on the audience's behavior. Texts on the experience will accelerate or decelerate amid a constant flow of digital stimuli. Words or sentences may move slowly but gradually speed up to the point of becoming illegible, reflecting how technological time can surpass human perception. The opposite also happens — texts will slow down and become more readable over time, translating the need for "humane time" in contrast to the machine's speed. Some text compositions will appear as if rendered in real-time by

an algorithm, contrasting with the human desire for immediate and fluid reading. Other typographic solutions from modular elements (small blocks, lines) are periodically reorganized. This modular aesthetic symbolizes the fragmented time of the algorithmic era. The installation also employs the "glitch" effect to create a digital interference aesthetic, reflecting the failures of technology. It uses imagery (symbols or characters) reminiscent of digital processing simulation, such as binary coding, programming, clock interfaces, or digital displays, sometimes distorted or erratic, blended with legible text. This disruptive duality of the "technological time" (represented by code) and the "humane time" (represented by legible text) infers a coexistence but on different frequencies.

The aesthetic process was developed by visual experimentation, using an on-linear, iterative, and adaptable matrix based on four key phases. 1) Static Visual Concept: in this phase, static vocabulary is developed, including color palettes, typography, layouts, and other essential graphic components. — Tools: Moodboards; sketches; graphic design software. 2) Dynamic Visual Concept: This phase involves adding dynamics to the static graphic elements and creating animations and transitions that interact passively with the audience. — Tools: Animation and video editing software. 3) Interactive Visual Concept: This phase focuses on developing visual solutions for audience interaction. — Tools: Development and coding tools; AR/VR platforms. 4) Spatial Visual Concept: This phase addresses the spatial design and the arrangement of the installation environment, considering how the audience will physically engage with the artwork. It includes the layout, the flow of space, and how the physical context enhances the immersive and interactive experience. — Tools: 3D design software.

B. Technological development

The installation occupies an interior space, with white side surfaces used as screens to project the poem compositions. Through the audience's interactive behavior, these compositions will switch between different imagistic interpretations in motion. Creative code solutions from *Processing* language are used to generate imagistic poems. Motion sensors, specifically *Kinects*, are installed to monitor the public's movements. The *Kinects* will detect visitors' silhouettes through body tracking, creating an interactive area where contact with the typographic composition changes the pre-coded micro and macro typographic parameters. To make the experience more immersive, a sound environment will interact with the typographic composition. The sound also has an action-reaction function or behavioral feedback (a response indicating that the action affected the system). The sound setup was developed using a granular synthesizer in Max MSP, which allows a previously defined sample to be manipulated in different sound parameters: grain, pitch, and playback speed, among others. The values of the previous variables which determine the sound parameters are set by monitoring the user's position about the x (horizontal), y (vertical), and z (depth) axes of the installation space, incorporated in Max MSP through the Open Sound Control (OSC) protocol.

V. CONCLUSION

Sophia de Mello Breyner Andresen had an extraordinary ability to capture and convey visual images, creating a sensory experience through words. Her poetry is rich in 'lived' and detailed images that evoke sensations, landscapes, places, and moments in an almost pictorial way. By exploring the imagistic nature of typography in our artistic installation, we aim to recreate this ability to evoke images and senses through letters and words in innovative technological materialities. Using different micro and macro typographic solutions, as well as interactive and kinetic behaviors, the installation aims to transform the text into visual digital 'landscapes' that interrogate the sensations described by the poet. The installation is an aesthetic exercise investigating how form and typographic structure can convey meaning and emotion, just like poetry. Typography, often seen merely as a means of textual communication, is elevated to a visual art form with its *poiesis*. By combining these two dimensions – the textual and the visual –we aim to create an immersive experience that allows the user to feel the words even before understanding them in literary terms. Conceptually, the installation simultaneously presents a metaphor of time and a "paradox": a poem that reflects our "humane time" to think, write, and confess the states of our souls while at the same time revealing itself to be increasingly fragmented and interrupted by the speed of "technological time," reflecting our ongoing struggle to pause this time that refuses to stop.

We believe this experience might contribute to the creation of knowledge at various levels: one, by exploring how a typographic approach using kinetic and interactive behaviors can change the perception generic attributed to static text; secondly, by examining how this can influence the interpretation of traditional poetic works, enhancing the pleasure and

satisfaction of engaging with poems through new media approaches. The research also analyses the importance of immersive environments in shaping new materiality and promoting literary literacy through innovative reading experiences.

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REFERENCES

[1] A. Bartram, "Futurist Typography and Liberated Text". New Haven, CT: Yale University Press, 2005.

[2] H. Spencer, "Pioneros de la Tipografía Moderna". Barcelona: Ediciones G. Gili, 1996.

[3] J. Drucker, "The Visible Word: Experimental Typography and Modern Art, 1909-1923". Chicago, IL: The University of Chicago Press, 1997.

[4] B. Scheffer, C. Stenzer, P. Weibel, and S. Zehle, Eds., "Typemotion: Type as Image in Motion". Berlin: Hatje Cantz, 2015.

[5] S. Heller and M. Ilic, "*Lettering Large: Art and Design of Monumental Typography."* New York: The Monacelli Press, 2013.

[6] B. Brownie, "Transforming Type". New York: Bloomsbury Academic, 2015.

[7] K. Littau, "Translation and the materialities of communication," Translation Studies, vol. 9, no. 1, pp. 82–96, 2015. Available: https://doi.org/10.1080/14781700.2015.1063449

[8] P. Arantes, *"@arte e mídia: perspectivas da estética digital"*. São Paulo: Editora Senac, 2005.

[9] L. Manovich, *"The Language of New Media"*. Cambridge: MIT Press, 2001.

[10] S. Small, *"Interactive Poetic Garden: A Digital Ecosystem of Text."* Cambridge: MIT Media Lab, 1998.

[11] A. F. Marcos, "Artefacto computacional: elemento central na prática artística em arte e cultura digital," *Revista Lusófona de Estudos Culturais*, vol. 4, no. 1, pp. 129-147, 2017.

[12] L. Candy and E. Edmonds, *"Practice-Based Research in the Creative Arts: Foundations and Futures from the Front Line"*. 2018.

[13] Sullivan, "Chap04 - Art Practice as Research: Inquiry in Visual Arts," in *Art Practice as Research: Inquiry in Visual Arts*, SAGE Publications, 2009, pp. 94-120.

[14] R. L. Irwin, "Becoming a/r/tography," Studies in Art Education, vol. 54, pp. 198-215, 2013. Available: https://doi.org/10.1080/00393541.2013.11518894

[15] P. A. Veiga, "O Museu de Tudo em Qualquer Parte – Arte e Cultura Digital: Interferir e Curar". Faro, Portugal: Grácio Editor, CIAC, 2020.

[16] C. Paul, "Digital Art", 4th ed. London: Thames & Hudson, 2023.

[17] H. Malheiro, "O Enigma de Sophia: Da Sombra à Claridade". Lisbon: Oficina do Livro, 2008

[18] S. Andresen, "Livro Sexto". Lisbon: Assírio & Alvim, 2014.

[19] G. Howes and J. G. D. Howes, "Democracia digital e a ditadura dos dados," *Aurora. Revista de Arte, Mídia e Política*, vol. 16, no. 46, pp. 114–120, 2023. https://doi.org/10.23925/1982-6672.2023v16i46p114-12

Graus de interação em obras de média-arte digital
Interactional levels on digital media artworks

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Abstract—This article sought to present a way of categorizing the interactional level of digital media art with the public. The artworks are rated based on their level of interaction with the audience through digital resources. Although this approach was developed based on the analysis of ten digitally mediated dance works, with video as the primary technical support, it is proposed here to expand its use in classifying other types of non-performative digital media artworks. Four interactional levels were found: level 1, also called 'one-way artifact'; level 2, also called 'public engagement artifact'; level 3, also called 'digital manipulation artifact'; and level 4, also called 'interactive differential artifact.' This categorization aims to recognize aspects of the public's interaction with the artwork based on the digital resources used. It does not intend to attribute hierarchical value between artistic choices and results. Thus, it is intended to suggest its use in research and teaching environments to introduce formal mechanisms for analyzing and classifying this type of artifact and allow artists/creators to become aware of their variations and possibilities.

Keywords—Interactional level; Digital media art.

Resumo—Este artigo visa apresentar uma forma de categorizar obras de média-arte digital a partir do nível de interação com o público que a obra oferece. Embora esta abordagem tenha sido elaborada a partir da análise de dez obras de dança com mediação digital, tendo o vídeo como matéria principal, propõe-se aqui a expansão da sua utilização na classificação de outros tipos de obras de média-arte digital, não performativas. São propostos, e justificados, quatro graus de interação: grau 1 – artefatos de via única; grau 2 – artefato de engajamento público; grau 3 – artefato de manipulação digital; e grau 4 – artefato de diferencial interativo. Esta categorização pretende reconhecer aspectos da interação do público com a obra, a partir dos recursos digitais utilizados. Não pretende atribuir valor hierárquico entre as diferentes escolhas e resultados artísticos. Pretende-se, assim, sugerir a sua utilização em ambientes de investigação e ensino, de maneira a introduzir mecanismos formais de análise e classificação deste tipo de artefato, bem como permitir que os artistas/criadores possam tomar consciência das variações e possibilidades ao seu dispor.

Palavras-chave—Graus de interação; média-arte digital.

CONTEXTUALIZAÇÃO

O presente trabalho sobre a categorização em graus de interação emergiu durante a seleção e análise de obras de dança com mediação digital, cujo mote poético envolvesse a subversão da gravidade. A partir deste filtro, foram encontrados múltiplos de exemplos, todos ancorados no audiovisual. O vídeo do corpo em movimento é a matéria prima de todos os trabalhos analisados. Esta realidade – vídeos que poderiam ter sido gravados com recursos analógicos – trouxe à tona a questão do pertencimento desta amostra ao campo da média-arte digital. Embora todas as obras tenham sido realizadas com recursos audiovisuais digitais, a sua utilização parece atender mais à conveniência do acesso aos recursos audiovisuais embutidos em dispositivos digitais ao alcance da mão, como smartphones, do que a uma demanda poética ligada ao mundo digital.

A dúvida sobre o pertencimento de obras audiovisuais digitais ao ecossistema da média-arte digital vinha sendo alimentada pela equivocada ideia de que só seria legítimo considerar pertencentes ao campo da média-arte digital as obras que fizessem valer aspectos do universo digital ausentes no mundo analógico. Como algumas obras da amostra selecionada poderiam, hipotéticamente, ter sido feitas com recursos analógicos, a pergunta emergente era: o simples fato destes vídeos terem sido gravados, editados e exibidos com recursos digitais é suficiente

para categorizar estas obras no campo da média-arte digital? Sucede que a definição de média-arte digital é ampla e inclusiva. No entendimento que defendemos, toda a forma de arte que for idealizada e/ou materializada e/ou exibida com tecnologias digitais, numa apreciação que decorre num período de tempo (e.g. todas as formas de performances, músicas e audiovisual) pertencem ao campo da média-arte digital [1]. Ao confrontar a pergunta com o adequado parâmetro de validação, desfez-se o equívoco, já que o conceito de média-arte digital é o resultado da evolução de movimentos estéticos e artísticos e também da constante evolução tecnológica e científica dos últimos cem anos, portanto abrangente e em transformação [2]. Dito isto, mesmo quando o único recurso digital utilizado na obra é audiovisual, esta ainda pertence ao conjunto da média-arte digital.

Entretanto, uma vez reconhecida a pertinência deste conjunto, impunha-se outra questão: o que diferencia então a obra audiovisual que pode ser exibida no cinema, daquela que não pode, como uma videoinstalação? E ainda, encontrando mais sutilezas nas diferenças: o que diferencia a exibição de uma obra audiovisual numa sala de cinema da sua exibição em redes sociais? Diferentes plataformas digitais funcionam como palco, no caso das obras de dança analisadas. Os recursos digitais estão proporcionando novos palcos e novas formas de existência para obras de dança. Conforme observa o artista, investigador e professor [3], "pelo facto desta prática [de média-arte digital] se situar maioritariamente fora dos anteriores circuitos artísticos – museus e galerias – também ela fomenta o surgimento de novos espaços e formas de fruição e exibição" [3].

Ao longo do percurso investigativo o novelo de questões levou ao reconhecimento do uso de recursos digitais nas formas de interação da obra com o público. Foi para reconhecer e compreender as sutis diferenças numa amostra de dez obras muito similares, que a categorização em graus de interação emergiu. O principal objetivo deste artigo é dar a conhecer a possibilidade de categorização no que se propõe designar como "graus de interação", na qual diferencia-se maior ou menor uso de recursos digitais. Porém a amostra analisada aqui será alargada para além do escopo da dança originalmente estudado.

Mas, o que diferencia os vários tipos de interação? Uma das chaves de diferenciação está nos recursos digitais utilizados pelos artistas. As escolhas sobre a interação do público com a obra determinam diferenças no tipo de recurso digital a ser utilizado, no suporte da obra e nas formas de exibição e fruição. A exibição de um vídeo digital de dança numa sala de cinema é diferente da exibição da mesma obra em redes sociais. Uma obra que envolva algum nível de manipulação das suas peças digitais pelo público demandará programação específica, assim como uma obra na qual a intervenção do público seja imprescindível para que esta seja acionada. A diferença está no grau de interação que a obra permite, mediada pelos contextos digitais, daí a atribuição de graus em números e a nomenclatura explicativa de cada grau.

II. CONDICIONANTES DA INTERAÇÃO

Durante a análise das obras estudadas foram identificadas e caracterizadas algumas condições dadas pelos recursos digitais que ofereciam maior ou menor interação. O desvendar destas condições levou à compreensão de algumas diferenças, que colocam os recursos digitais como condicionantes da realização das obras e das possibilidades de interação. As principais condições, dadas pelos recursos digitais, encontradas nas obras analisadas foram: captação, edição e exibição audiovisual; interação social; manipulação da obra; existência da obra.

Recursos digitais como condição para captação, edição e exibição audiovisual

Neste caso os principais recursos utilizados pelos artistas são câmeras, programas de edição audiovisual e projetores. A utilização destes recursos digitais não parece ocorrer por interesse específico na investigação das potencialidades proporcionadas pelo universo digital; o seu uso parece responder às circunstâncias atuais de facilidade de acesso aos dispositivos digitais, como uma espécie de conveniência digital. Trata-se de escolha sim, porém menos pelas características poéticas e estéticas específicas do digital – ainda que estas possam ser aproveitadas – e mais pela logística. Entretanto, a hipótese de uma obra ter o potencial de realização sem recursos digitais não significa que ela seria efetivamente realizada e atendendo ao número de obras que o faz, é possível assumir a probabilidade de que não o seria. Vale dizer que o amplo uso dos recursos digitais pela sua conveniência, nos tempos atuais, engrandece, barateia e facilita a produção e a vida de artistas; permite a ampliação de experiências e inovações e ajuda a formar o campo da média-arte digital em toda a sua diversidade. Quando os recursos digitais funcionam unicamente como condição de captação, edição e exibição audiovisual, as obras

resultantes corresponderão a 'obras de via única', ou grau 1.

Recursos digitais como condição para interação Social

Neste caso, além do uso para captação, edição e exibição audiovisual, o principal recurso utilizado pelos artistas são redes sociais, o que implica também no uso da internet, sem a qual não existiriam as plataformas de interação social. Alguns artistas têm feito destas plataformas digitais o seu palco. Diferente do uso da rede social para anunciar a obra, mobilizando o público a comparecer ao local do evento performativo, alguns artistas escolhem compartilhar os seus processos em forma de postagens abertas nas redes, à espera de interação do público através de comentários e opiniões. Para fazer da rede social o seu espaço prioritário de exibição pública, é necessário seguir a tendência valorizada pelos algoritmos, portanto as postagens costumam ser curtas, de fácil disseminação e provocativas o suficiente para o engajamento. Este novo palco artístico permite maior porosidade do processo criativo, possibilitando o acompanhamento do desenvolvimento da poética do artista em postagens de experimentos inacabados e trechos de ensaios. Quando os recursos digitais funcionam como condição de interação social, as obras resultantes corresponderão a 'obras de engajamento público', ou grau 2.

Recursos digitais como condição para manipulação digital

Neste caso, para que haja interação do público com a obra, é necessário algum nível de programação. Para viabilizar a manipulação da obra pelo público, o uso de recursos digitais avança para competências menos intuitivas, que envolvem linguagens de programação. São utilizadas plataformas de programação ou mesmo são criados programas (softwares) específicos para a realização da obra. Ligação à internet certamente é requerida no processo de programação e pode ser necessária durante o funcionamento da obra. Quando os recursos digitais funcionam como condição de manipulação digital, as obras resultantes corresponderão a 'obras de manipulação digital', ou grau 3.

Recursos digitais como condição para existência da obra

Neste caso, tal qual na condição anterior, é necessária a utilização de alguma plataforma de programação. Entretanto, diferente da condição anterior, será necessário ainda algum recurso digital de acionamento da obra. Via de regra, uma ligação à internet será necessária para o perfeito funcionamento da obra. Acionadores de diferentes tipos podem ser utilizados: sensores de presença, de som, de peso; QR codes ou botões físicos que necessariamente serão acionados pela interação do público com a obra. Sem o ato voluntário ou involuntário do público, a obra não se realiza, não funciona como produto audiovisual independente, pois depende da ativação do público para revelar-se ao público. Quando os recursos digitais funcionam como condição de existência, as obras resultantes corresponderão a 'obras de diferencial interativo', ou grau 4.

Todas estas condições dadas pelos recursos digitais (de produção audiovisual, de exibição preferencial em redes sociais, de interferência na obra e de interação como condição de existência) informam sobre escolhas dos artistas na forma que se relacionam com o público e com os recursos digitais, ou seja, informam os graus de interação possíveis entre artista, obra e público.

III. GRAUS DE INTERAÇÃO

Tomando como inspiração a ideia de comunicação com maior ou menor grau de mediação [4]: 'um-todos'; 'um-um'; 'todos-todos'; e, tendo sido devidamente apresentadas as relações entre os recursos digitais e as possibilidades de interação que estes condicionam, prosseguimos para a apresentação das quatro categorias de interação artistas/artefatos/público, graduadas da seguinte maneira:

Grau 1: Artefato de via única

Será aquele artefato de média-arte digital, ou seja, idealizado, materializado e/ou exibido através do uso de recursos digitais [1], que, estabelece com o público a relação tradicional de um para todos, dos média clássicos [4]. O artefato é entregue para apreciação sem que a produção ou exibição preveja hipóteses de interação entre público e obra, nem entre público e artista. O artefato de via única é aquele cujos recursos digitais são utilizados para captação, edição e/ou exibição audiovisual. Embora híbrida entre as artes do cinema e do vídeo e as média-arte digitais, a categoria artefato de via única pode ser considerada uma mais valia para a produção artística da média-arte digital, conforme já argumentado antes.

Grau 2: Artefato de engajamento público

Será aquele artefato de média-arte digital que faz das plataformas digitais interativas o seu palco. Esta forma de exibição busca interação do público com os artistas em forma de comentários em redes sociais. A obra ainda é ofertada ao público em formato audiovisual, como algo a ser apreciado, no entanto o seu compartilhamento em redes sociais propicia mais interações, na medida em que é possível sondar o impacto causado no público nas muitas etapas, ângulos e perspectivas compartilhadas, proporcionando interação e engajamento com a obra e com o artista. O artefato de engajamento público é aquele cujo principal recurso digital utilizado é a interação através das redes sociais, com o uso da internet.

Grau 3: Artefato de manipulação digital

Será aquele artefato de média-arte digital que utiliza recursos digitais para a interação do público com a obra através de alguma linguagem de programação. No caso destes artefatos, a possibilidade de interação do público é diretamente com a obra, através de alguma forma de manipulação, algo mais próximo da ideia de jogo. Estes artefatos podem ainda funcionar parcialmente como produtos audiovisuais, porém este modo de usufruto será apenas parcial, já que seu potencial se realiza com a interação. O seu compartilhamento em redes sociais não será possível, exceto em vídeos de bastidores, ou vídeos demonstrativos do seu funcionamento. O artefato de manipulação digital é aquele cujos recursos digitais viabilizam formas de interação com a própria obra, através de linguagem de programação, mas ao mesmo tempo mantém alguma possibilidade de existência quando não há interação.

Grau 4: Artefato de diferencial interativo

Será aquele artefato de média-arte digital que só se realiza ao ser acionado pela interação – voluntária ou involuntária – do público. É o artefato que não teria qualquer hipótese de existir sem os recursos digitais, ou seja, são artefatos possíveis apenas a partir da última década do século vinte e mais intensamente a partir do século vinte e um. A principal e mais marcante característica deste grau é a necessidade de interação do público com a obra para a sua realização. O artefato de diferencial interativo é aquele cujos recursos digitais viabilizam formas de interação com a própria obra, através de botões, códigos QR ou outros tipos de sensores. Requerem camadas de linguagem de programação e, embora possa haver um espaço reservado ou até objetos visíveis no local onde estão exibidos, eles não podem ser apreciados sem a devida interação.

IV. EXEMPLO DE OBRA PARA CADA CATEGORIA

Na tabela 1 estão listadas as obras que servirão de exemplo para cada uma das categorias:

Tabela 1 - Identificação dos artefatos pelo título, ano e artista criador

Título	Ano	Artista
Anima [5]	2019	Thom Yorke
AMA [6]	2012	Julie Gautier
[o][p][r][e][s][s][ã][o] [7]	2022	Alexandre Martins
[Des]montagem [8]	2022	Cristina Cavalcanti

No quadro 2, vê-se a distribuição das obras pelo grau de interação que oferecem:

TABELA 2 - IDENTIFICAÇÃO DOS ARTEFATOS PELO GRAU DE INTERAÇÃO

Artefato de via única	Artefato de engajamento público	Artefato de manipulação digital	Artefato de diferencial interativo
Grau 1	Grau 2	Grau 3	Grau 4
Anima	Ama	[o][p][r][e][s][s][ã][o]	[Des]montagem

A seguir, uma breve descrição de cada obra, com destaque para as especificidades dos graus 3 e 4.

Anima - Artefatos de via única – grau 1

Anima [5] é um curta metragem realizado pelo músico Thom Yorke, disponível em plataformas de streaming por assinatura, que serve como exemplo de artefato de via única, grau 1 de interação, assim como serviria de exemplo qualquer vídeo realizado por meios digitais, transmitido por meios de massa nos moldes descritos por [4] como 'um-todos' (rádio, tv, streaming de assinatura paga ou cinema). Oferecer apenas um exemplo para esta categoria parece pouco, já que esta é a mais abundante dentro do que chamamos média-arte digital, que envolve idealização, materialização e/ou exibição através do uso de recursos digitais [1]. Entretanto listar exemplos seria impossível, justamente por esta categoria abarcar basicamente toda a produção audiovisual e musical realizada e veiculada no século vinte e um, considerando que os recursos digitais se tornaram ferramentas praticamente onipresentes seja na produção musical e audiovisual, seja na veiculação das mesmas.

AMA - Artefato de engajamento público – grau 2

AMA [6] é uma videodança realizada pela artista Julie Gautier, produzida com câmera digital e difundida pelo youtube. Tal qual a categoria dos

artefatos de via única, é imensa a amostra de artefatos de engajamento público. Toda a arte postada em redes sociais atende ao critério de pertencimento ao campo da média-arte digital. Considerando que o tempo de horas postadas no youtube conta-se aos milhares de anos, oferecer apenas um exemplo pode parecer pouco. Entretanto, para os fins de descrever uma nova forma de classificação, um único exemplo resulta suficiente.

[o][p][r][e][s][s][ã][o] - Artefato de manipulação digital – grau 3

[o][p][r][e][s][s][ã][o] [7] é uma obra de vídeo interativa. Uma camada de texto foi adicionada a um clip de vídeo em stop motion, através do processing[1]. Este vídeo, assemelhado a um GIF[2], acessível online[3], agora composto por caracteres alfabéticos irreconhecíveis, por estarem muito comprimidos, é exibido em loop, até que uma perturbação venha a ocorrer pela captação de sons do microfone do computador de quem interage com a obra, que está programado para funcionar como um sensor de som. O som captado pelo microfone do computador faz com que os caracteres que formam o vídeo aumentem de tamanho, deformando a imagem e tornando legíveis os caracteres. Quanto maior o volume do som, maiores se tornam os caracteres, que expressam a palavra 'opressão'. Atualmente a camada de texto do vídeo está formada por ideogramas chineses. Entretanto, diversos idiomas podem formar esta camada textual, que é exibida no próprio site do software processing, o que permite que qualquer pessoa curiosa reutilize ou modifique aquela sequencia algorítmica na construção de uma outra obra, ou na alteração do idioma que forma o vídeo, dentre outras possibilidades de intervenção [9].

A obra [o][p][r][e][s][s][ã][o] teve um desdobramento em vídeo, a partir da gravação da interação do próprio artista com a obra, como uma espécie de demonstração do efeito da interação sonora, porém gravado. Este vídeo tornou-se uma obra em si, embora obviamente conectada à primeira, inclusive com o mesmo nome. Neste caso, o vídeo homônimo é uma obra de grau 2, pela impossibilidade de interação direta, e não de grau 3, como é o vídeo interativo [o][p][r][e][s][s][ã][o].

[Des]montagem - Artefato de diferencial interativo – grau 4.

A obra [Des]montagem [8], exibida na exposição Rizoma, em Loulé, Portugal é uma instalação interativa. Um sensor arduíno detecta a presença de público no local e provoca o disparo de fumaça, que funciona como tela para a projeção de fotos de mulheres torturadas durante a ditadura empresarial-militar no Brasil (1964-1985). As imagens são acompanhadas de áudios dos perpetradores, negando ou atenuando a sua ação criminosa [10]. Antes de entrar, o público vê apenas uma carta escrita à mão, exibida numa tela de ipad. Ao entrar na sala, a fumaça, a projeção das fotos e o áudio são acionados. O que permite a existência da obra é a presença do público na sala.

V. REFLEXÕES FINAIS

Com os exemplos trazidos neste artigo, pretendemos demonstrar que as quatro categorias emergentes, antes aplicáveis apenas a obras de dança com mediação digital, funcionam também na diferenciação dos graus de interação do público com outras obras de média-arte digital.

Cada grau permite um certo tipo de interação, que vai se intensificando, de acordo com as escolhas artísticas e o aprofundamento no uso de recursos digitais. As obras de grau 1 oferecem tanta interação quanto é possível ter, sendo audiência de cinema, tv ou rádio. As de grau 2 oferecem interação entre humanos, que compartilham opiniões sobre a obra. As de graus 3 e 4 oferecem interação direta do público com a obra, através de manipulação. Nos casos das obras situadas nestas categorias, desfrutar plenamente destas significa não apenas apreciar o efeito imagético que elas possam ter, mas intervir diretamente na sua forma, aparência e existência. As obras de manipulação digital e de diferencial interativo permitem, em alguma medida, que o público tome decisões sobre elas, adicionando uma dimensão lúdica, próxima à ideia de jogo. O grau 4 de interação permite maior afastamento dos recursos audiovisuais, algo a ser explorado em futuros artigos. O grau de interação da obra com o público vai determinar o suporte tecnológico necessário para a disponibilização da obra.

Acreditamos que a classificação em categorias reconhecíveis de interação pode vir a enriquecer o campo da média-arte digital, na medida em que explicita características específicas das formas de produção artística neste universo, ainda não nomeadas. Esta categoria pode ser utilizada em ambientes de investigação e ensino, de maneira a introduzir mecanismos formais de análise e classificação deste tipo de artefato. Na medida em que permite o reconhecimento objetivo de diferentes formas de interação das obras com o público, esta

categorização pode favorecer a reflexão sobre critérios curatoriais no âmbito da média-arte digital, bem como permitir que os artistas/criadores possam tomar consciência das variações e possibilidades ao seu dispor.

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REFERÊNCIAS

[1] P. Alves da Veiga, O Museu de Tudo em Qualquer Parte: arte ecultura digital – inter-ferir e curar. Grácio Editora, 2020, p. 30.

[2] P. Alves da Veiga, J. Bidarra, and A. Araújo, "Média-Arte Digital – Ampliando Conceitos," ROTURA – Revista de Comunicação, Cultura e Artes, vol. 3, no. 1, Prefácio, 2023.

[3] P. Alves da Veiga, Experiência e atenção: Construção e constrição de ecossistemas de média-arte digital (Repositório Aberto) [Ph.D. dissertation, Universidade Aberta/Universidade do Algarve], 2018.

[4] P. Lévy, O que é o virtual?, 1st ed., vol. 3. Quarteto Editora, 2001.

[5] T. Yorke and P. Anderson, Directors, Anima [Musical short film]. Netflix, 2019. Available: https://www.netflix.com/title/81110498.

[6] J. Gautier, Director, AMA - Julie Gautier [Dance performance]. Sep. 1, 2022. Available: https://www.youtube.com/watch?v=EdDupIljyjE.

[7] A. Martins, [O][p][r][e][s][s][ã][o] [Online interactive video]. Available: https://editor.p5js.org/alexandremartins1891/sketches/BK5Bg8mFk.

[8] C. Cavalcanti, [Des]montagem [Interactive installation], 2023.

[9] A. Martins and B. Mendes da Silva, "Palavra-Imagem-Movimento: Subsídios da tipografia para o discurso artístico moderno e contemporâneo," ROTURA – Revista de Comunicação, Cultura e Artes, vol. 3, no. 1, pp. 58–73, 2023.

[10] C. Cavalcanti, Director, [Des]montagem [YouTube video]. Jun. 18, 2023. Available: https://www.youtube.com/watch?v=HGHtK6xy3JE.

[1] https://editor.p5js.org/

[2] GIF: Graphics Interchange Format (Formato de Intercâmbio Gráfico)

[3] https://editor.p5js.org/alexandremartins1891/sketches/BK5Bg8mFk

18-Full-Paper

spectral spaces: from 19th-century stereoscopy to 21st-century generative IA

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Abstract—This paper explores the creative process behind the development of the artifact spectral spaces, a video art installation that combines 19th-century stereoscopic technology with generative artificial intelligence (AI). The work evolved from an ongoing investigation into how AI models can collaborate with human artists to co-create abstract imagery that can be integrated into video art artifacts. Drawing inspiration from early visual technologies and contemporary digital systems, the artifact juxtaposes past and future through an immersive, interactive experience. By analyzing the conceptual framework, visual aesthetics, technical aspects, and audience interaction, this study underscores AI's potential to create perceptually engaging experiences in video art while offering insights into the role of materiality and perception in contemporary media practices.

Keywords—generative AI, abstract imagery, video art, visual perception, stereoscopy, binocular rivalry

I. INTRODUCTION

spectral spaces emerge from an ongoing research project to study the potential creative contributions of generative artificial intelligence (AI) models based on text instructions, such as Midjourney, in the human-machine co-creation of abstract images suitable for video art artifacts. It was presented at the 11th Doctoral Retreat in Digital Media Arts, organized by Universidade Aberta and Universidade do Algarve. The exhibition provided the opportunity to assess the overall aesthetic quality of the work by observing audience reactions and collecting feedback on their experience.

The artwork references the origins of photography and the moving image, drawing inspiration from 19th-century stereoscopy. It was conceived as an anachronistic device that evokes the past via a stereoscopic viewing element. At the same time, the present is experienced through peering, and the future—or a conceptualization of it—is projected through synthetic moving images displayed on a screen positioned inside the device. The visual experience is accompanied by an immersive soundscape that enhances the perception of layered temporality and deepens the viewer's engagement.

Central to the conceptual framework is the act of peering, which serves not only as a medium through which the spectator navigates the distinct temporal dimensions embedded in the work—the past, the present, and a speculative future—but also as a trigger for visual interaction. This requirement sparks curiosity while simultaneously creating a sense of expectation and the need for discovery. Integrating a physical element in a closed box equipped with a stereoscopic viewer through which the user peers and speakers are positioned at ear level (Fig. 1) aims to enhance immersion by providing a more individual, exclusive, and self-aware interactive experience. At the same time, it promotes the return of materiality by restoring tangibility to the digital. In doing so, the viewer becomes more engaged, and the device gains a sense of familiarity.

In this artistic creation, the exotic views typical of 19th-century stereoscopic images—traditionally composed as diptychs—are replaced by enigmatic structures and spaces with apparent depth imagined by AI. This technology may emerge as one of the most influential innovations of the 21st century [1]. These AI-generated visuals maintain the diptych format but are transposed into sequences of moving images that flow at a slow, barely perceptible rhythm on a screen. Although sharing formal affinities, the images differ from one another in ways that result in the dissimilar stimulation of each eye—that is, each eye receives different visual information—triggering the phenomenon of binocular rivalry. In conjunction with the stereoscopic depth effect, this rivalry creates

floating, unstable images with spectral characteristics that open up new observation spaces. The uncanny sensation provoked by these unpredictable fluctuations in visual awareness contrasts with the familiarity conveyed by the physical element, which alludes to a time when the mechanics of technical objects were still within the grasp of ordinary human understanding.



Fig. 1. A viewer engaging with the spectral spaces artifact (source: authors).

II. VISUAL AND CONCEPTUAL REFERENCES

A. The act of peering: Marcel Duchamp's Étant Donnes

Marcel Duchamp's Étant Donnés is a complex and multifaceted installation with layers of meaning that merit in-depth analysis. However, the focus here will be limited to peering through the two peepholes pierced in the wooden door and its consequences for the viewer's full appreciation of the artwork.

The three-dimensional tableau that constitutes the visual component of the installation is visible only through those peepholes from a single, fixed vantage point [2]. By restricting and controlling the conditions under which the work is perceived— limiting access to a single spectator—Duchamp exerts a subtle yet profound influence over perception. The viewer must recognize that seeing is not a passive act but one shaped by both the observer and the observation conditions. In this forced one-on-one interaction, the subjectivity of perception is emphasized, as the piece's impact lies precisely in the viewing act [3].

When conceiving spectral spaces, one of the primary questions the authors considered was how to engage the audience and prompt visual interaction while rejecting a purely passive contemplation stance. This was accomplished by "hiding" the visual elements inside an attractive and mysterious device explicitly designed to provoke curiosity. Through this mechanism, the act of peering, drawn from Duchamp's work, is transformed into interpreting as the viewer tries to process the disparate imagery.

A central aspect of the artifact is its demand for a quasi-isolation state, an almost total immersion achieved by allowing only one viewer to peer through the lenses. This fosters an intensely personal interaction that encourages more prolonged engagement and highlights the subjective nature of vision. The resulting intimate involvement is in clear opposition to the communal nature of typical art viewing, which is usually open and shared with multiple spectators. Under such conditions, individual interpretation may be subtly influenced by the presence of others. However, forcing a controlled, private viewing mode triggers a moment of introspection, compelling the spectator to focus on his perception and comprehension of the visual experience.

The mechanics of the installation, which make the moving images available exclusively through the lenses, transform the act of peering into an intentional process, thereby reinforcing the viewer's awareness of his role as an active observer, shifting from a passive recipient to a participant in the construction of the work's full significance. Aligning with Duchamp's assertion that "the creative act is not performed by the artist alone" [2, p. 388], the spectator becomes a crucial component in the realization of meaning, underscoring the notion that the artwork is an active, dynamic process co-created by both artist and audience.

B. Regaining materiality: Andy Lomas's Digital Chemotaxis

The central object of Andy Lomas's Digital Chemotaxis interactive installation presented at Goldsmiths College [4] is a 19th-century multiview stereoscope. Although there is no indication that the video element is three-dimensional, to experience the artwork fully, the spectator must sit and lean forward to peer through the lenses of the stereoscope, which is placed on a table. The stereoscope is the only way to access the video, fostering a direct, personal connection.

This configuration imposes specific physical and sensory constraints, distinguishing it from more passive modes of engaging with digital media, such as

viewing a screen from a distance. In addition to observing the object, the viewer also actively experiences it, enhancing the constitutive role of this interaction in fully recognizing the work's aesthetic value.

Lomas's installation was pivotal in shaping the concept of spectral spaces, which, as previously mentioned, centers on the act of peering. When reflecting on the aesthetic experience of the spectator, particular attention was given to how the images should be presented, emphasizing the importance of integrating something tangible to complement the visuals. The physical element provides the artifact with its interactive nature but also counters the limitations of presenting images solely through a screen, which would otherwise diminish the sensory depth and complexity of the work. By regaining materiality and granting the public an active role, the artifact deepens the involvement and heightens the sense of presence, ultimately leading to a more immersive and interactive experience.

Once a cutting-edge technology, the stereoscope is now an antique technical object recontextualized within a contemporary digital installation. It shapes the viewer's engagement through bits of materiality and historical significance while also serving as a mediator to the digital artwork and influencing how it is perceived. This dual function creates a unique experience that places the viewer within a continuum of technological development, marked by the transition from the analog, mechanical nature of the stereoscope to the intangible, non-material forms of the post-digital age. This generates a dialogue between past and present that challenges the spectator to reconcile the tactile, material qualities of the device with the immateriality of digital processes.

C. Media consumption and other features: August Fuhrmann's Kaiserpanorama

Once regarded as tools for individual or specialized use, certain visual technologies gained widespread public appeal and became central to mass communication [5]. This transformation allowed large audiences to access and engage with images simultaneously as optical devices evolved into mediums capable of reaching broader audiences.

One prominent example is August Fuhrmann's Kaiserpanorama. Nonetheless, although the machine's design was inherently social—intended for group use—the viewing process remained private, as each spectator perceived the images independently through separate eyepieces. Multiple viewers could gather in a public setting to use the device, yet each interacted personally with the visual material. This combination of collective presence and individualized experience likely contributed to the Kaiserpanorama's cultural significance in the 19th century.

This interplay between shared and private fruition was central to the design of spectral spaces, which sought to replicate and reinforce the notion of isolated viewing within a public context. The installation demonstrates how technology can mediate the balance between collective and individual dynamics by facilitating solitary engagement within an open exhibition space.

Another feature of the Kaiserparonama that influenced the conceptualization of the artifact includes its ability to transport viewers to different places—capitalizing on their interest in novel visual experiences—while creating immersive illusions. In spectral spaces, this is achieved by AI-generated abstract imagery that takes advantage of the visual phenomena of spectroscopy and binocular rivalry. In both devices, the mechanisms responsible for the evolving sequences of images are concealed, rendering the technology invisible to the observer and thus enhancing the overall illusionistic outcome.

Fuhrmann also demonstrated early concerns for user experience in his design. Recognizing that discomfort could disrupt the viewing experience, he incorporated a cushion to allow spectators to rest their arms [5]. This attention to both the visual experience and the physical well-being of the viewer was applied to the layout of the installation spectral spaces (Fig. 2). When viewers remain in a fixed position for extended periods, and physical strain can negatively affect their interaction with the installation. To address this, design features such as seating or support structures were incorporated to alleviate discomfort, minimizing the physical demands of engaging with the artwork and allowing for a deeper, more prolonged immersion in the experience.

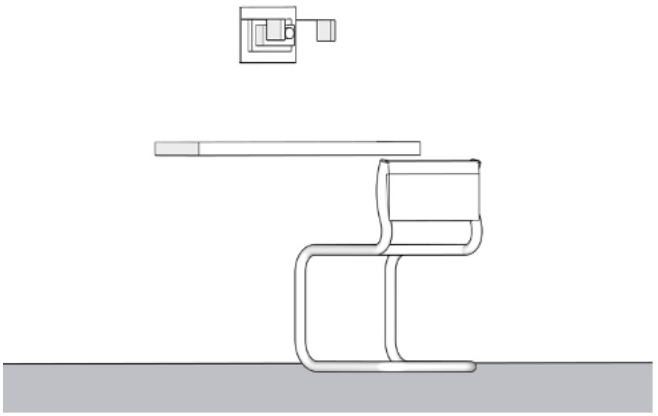


Fig. 2. Layout design of the spectral spaces installation (source: authors).

III. TECHNICAL CONCEPTS

A. AI-generated imaging

The images utilized in producing the artifact's visual component are part of a study [6] to analyze how generative AI models, such as Midjourney, interpret and process natural language instructions that subjectively represent the intersection between abstraction and moving images. An inherently experimental methodology was essential for this analysis, allowing possibilities and discoveries to arise from deep engagement in practice and observation. By examining the outputs, a recurrence of abstract structures with apparent depth was observed, subsequently informing conceptual and technical choices made during the artifact's construction.

Exploring text-to-image AI models involves multiple iterative stages in which numerous images are generated, requiring a thorough curation similar to a photographer's editing workflow, where several steps are undertaken to ensure the final series aligns with a specific creative vision [7]. During this phase, the visual representations were selected based on defined criteria, including their suitability for stereoscopic viewing, binocular rivalry, and ability to function effectively as part of a sequence.

Although the AI model provided the initial visual foundation, the authors played an essential role in defining the final composition by meticulously establishing the relationships between the images, determining the nature of the movement, and integrating the accompanying sound, ensuring a cohesive and immersive outcome.

B. Stereoscopy

Stereoscopic machines, once revolutionary in visual technology, facilitated early immersive experiences by leveraging the principles of binocular vision. This form of vision relies on the slight disparity between the images captured by each eye, allowing the brain to synthesize a perception of depth and thereby simulate a three-dimensional viewing perspective that mirrors the biological processes of human vision [8].

The wooden structure of the spectral spaces viewer was constructed using the optical elements of a 19th-century stereoscopic box (Fig. 3), with the original viewing distances preserved to ensure the proper functioning of the mechanism. In this system, two images are positioned side by side in diptychs, specifically designed to be viewed simultaneously through the device, ensuring that when properly aligned, they produce a three-dimensional effect [5]. Within this visual illusion, some aspects of the images appear to emerge autonomously, transcending the boundaries of the surface or threatening to tip forward out of the frame.

Similar to traditional stereoscopic photography, stereoscopic video presents two distinct views of a scene, corresponding to the left and right eyes of the viewer, creating a similar effect [8]. In the spectral spaces artifact, this arrangement enables a more captivating visual experience, drawing the spectator's attention to what is being seen and the act of seeing itself. Peering through the viewer and the mental construction it generates causes the observer to become visually detached from the surrounding context [9]. Consequently, the immediate environment is removed from the visual field and consciousness, inviting extended engagement and contemplation as the spectator explores the illusion of depth and movement within the images.



Fig. 3. 19th-century stereoscopic box used as a reference for the design of the spectral spaces artifact. (source: Wikimedia Commons).

C. Binocular Rivalry

The video composition created for the artifact spectral spaces combines stereoscopic depth and the visual phenomenon of binocular rivalry, within which dissimilar images are presented to both eyes simultaneously, leading to competing perceptual experiences. This effect is typically achieved using a stereoscopic device, which enables the presentation of distinct stimuli to each eye, creating the necessary conditions for the phenomenon [10].

Despite the extensive scientific literature on the topic, the mechanisms underlying binocular rivalry have not yet been fully elucidated [11]. According to experimental studies conducted by Carmel et al. [12], when the brain is presented with conflicting visual information, it does not combine the two images into a unified three-dimensional perception. Instead, it

alternates between them, with periods of dominance—when one image is visible—and suppression—when the other image is pushed into the background—occurring over time. However, suppression is not always absolute. This means that even when one image dominates in conscious perception, parts of the suppressed image may still be faintly or partially visible. Depending on the combination of images, the transitions between the dominant and suppressed images can be gradual and slow. As a result, a significant portion of the viewing time is spent in mixed phases, where elements of both images are partially visible, with the nature of these phases uniquely shaped by each observer's visual processing capacities [12].

From the observations made during the development of the video and feedback gathered from viewers who interacted with the artifact during its exhibition, it is evident that neither image is entirely suppressed. Instead, a competition emerges between the dominant and suppressed visual representations, with elements appearing to float in space away from the "pictorial surface" of the screen due to the combined depth effect of stereoscopy, producing an unstable, fluctuating spectral image that never fully materializes.

These dynamics affect viewers' visual perception in diverse ways, making it challenging to articulate the transformations that occur during binocular rivalry, as they happen spontaneously and are unpredictable [13]. Although the phenomenon is natural and easily observable [14], describing the interplay of dominance, suppression, and fleeting mixed phases in precise terms can be difficult due to the abstract aspects of these concepts. Furthermore, the differences in how each individual perceives the rivalry add another layer of complexity to conveying it accurately.

A key factor in producing the video was the thorough selection, combination, and sequencing of AI-generated visual representations, as referenced in Section III-B. This process was designed to maximize the potential of each phenomenon—stereoscopic vision and binocular rivalry. The approach followed an iterative experimental method, exploring multiple options; some proved effective, while others were abandoned. The final composition was based on the assumption that only images with an illusion of depth were appropriate for stereoscopic viewing. Images similar in formal terms enabled incomplete suppression in rivalry, thereby creating perceptual variety. The sequence movement was intentionally subtle to allow the brain time to adjust.

IV. FINAL CONSIDERATIONS

The audience is invited to engage with the artifact's inherent anachronism by interacting with the stereoscopic box, a tangible antique object through which they access a futuristic vision composed of AI-generated, abstract moving images. This convergence of past and future—where the traditional is juxtaposed with the modern and the familiar with the unfamiliar—underscores the importance of materiality as a mediator of visual experience in the post-digital era. Furthermore, it enriches the sensory dimension and confronts the spectator with notions of transformation and technological innovation.

The act of peering, in this context, functions as a dynamic and interactive element of the experience, becoming a subject for analysis and comprehension. The spectator's innate capacity to process visual rivalry is fundamental to perceiving the representations displayed by the device, which means that visual cognition is challenged by engaging with the artifact. As a result, the viewer becomes aware that perception is not an inherently natural process but can be constructed and manipulated. The optical device generates artificial and enhanced perspectives that the observer would not experience otherwise, establishing specific conditions that guide the viewer's vision in a particular manner. This process prompts reflection on how the senses—particularly sight—and our understanding of reality are mediated and shaped by technological apparatuses.

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REFERENCES

[1] J.-M. Aguado-García, S. Alonso-Muñoz, R. González-Sánchez, and C. De-Pablos-Heredero, "How is Is AI being applied in higher education? Examining the state-of-the-art," INTED proceedings, Mar. 2024, doi:10.21125/inted.2024.0492.

[2] C. Tomkins, Duchamp: a biography. London: Chatto & Windus, 1996.

[3] A. d'Harnoncourt and W. Hopps, "Etant Donnés: 1° la chute d'eau, 2° le gaz d'éclairage: Reflections on a New Work by Marcel Duchamp," Philadelphia Museum of Art Bulletin, vol. 64, no. 299/300, pp. 6–58, 1969, doi:10.2307/3795242.

[4] A. Lomas, "Andy Lomas - Digital Chemotaxis," Andy Lomas, 2023.

https://www.andylomas.com/digitalChemotaxis.html (accessed Sep. 22, 2024).

[5] V. Peselmann, "Enacting public perception in the late 19th century. The Kaiserpanorama," Figurationen, vol. 17, no. 2, pp. 70–88, Dec. 2016, doi:10.7788/figurationen-2016-0208.

[6] M. Amorim, B. Mendes da Silva, "Generative AI in the co-creation of abstract images: composing a video art essay," presented at the Digicom – 8th International Conference on Design and Digital Communication, Nov. 2024.

[7] J. Oppenlaender, "The Creativity of Text-to-Image Generation," in 25th International Academic Mindtrek Conference, 2022, pp. 192–202. doi:10.1145/3569219.3569352

[8] M. R. Pickering, "Stereoscopic and multi-view video coding," in Academic Press Library in Signal Processing. Image and video compression and multimedia, D. R. Bull, M. Wu, R. Chellappa, and S. Theodoridis, Eds., Elsevier, 2014, pp. 119-153.

[9] V. dos Reis, "Rapto, imersão e presença: um estudo sobre a fotografia estereoscópica de Francisco Afonso Chaves (1857-1926)," in A terceira imagem: a fotografia esteresocópica em Portugal, V. Flores, Ed., Lisboa: Documenta, 2016, pp. 103–109.

[10] R. Blake and R. P. O'Shea, "Binocular Rivalry," in Reference Module in Neuroscience and Biobehavioral Psychology, Elsevier, 2017. Available: https://www.sciencedirect.com/referencework/9780128093245/neuroscience-and-biobehavioral-psychology

[11] J. W. Brascamp, P. C. Klink, and W. J. M. Levelt, "The 'laws' of binocular rivalry: 50 years of Levelt's propositions," Vision Research, vol. 109, Part A, pp. 20–37, Apr. 2015, doi:10.1016/j.visres.2015.02.019.

[12] D. Carmel, M. Arcaro, S. Kastner, and U. Hasson, "How to Create and Use Binocular Rivalry," Journal of Visualized Experiments, no. 45, Nov. 2010, doi: https://doi.org/10.3791/2030.

[13] R. Blake, "The Perceptual Magic of Binocular Rivalry," Current Directions in Psychological Science, vol. 31, no. 2, pp. 139–146, Mar. 2022, doi:10.1177/09637214211057564.

[14] N. Wade, "On the Art of Binocular Rivalry," i-Perception, vol. 12, no. 6, pp. 1–23, Nov. 2021, doi:10.1177/20416695211

SHORT PAPERS

1-Short-Paper

Endless Moments: Generative music in the browser

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Abstract—Endless Moments is an immersive, real-time audiovisual experience. Its generative audio system produces harmonious, polyphonic synth sounds with a subtle rhythmic pulse. The visual component features a dynamic field of algorithmically generated textures and shapes. Inspired by diverse cultural influences, the ambient soundscape blends Western harmonies with rhythmic techniques from various cultures. The audio and visuals interact as agents within a coded environment, gently pulsing and synchronizing harmoniously. This generative work is part of a series by the authors, created using JavaScript, SVG, and Web Audio APIs for a seamless, real-time web-based experience.

Keywords—generative, music, media, art, algorithmic

I. CONCEPT

"Endless Moments" is a captivating generative artwork that harmonizes real-time visuals and polyphonic soundscapes into an immersive experience. Drawing from minimalist music, global rhythmic traditions, and Color Field painting, it blends dynamic textures with evolving melodies to create a sense of timeless flow. The synchronized interaction between its visual and auditory elements offers viewers a meditative journey, celebrating the fusion of cultural inspiration and algorithmic artistry.

As a generative digital media work, it blends temporal audiovisual elements with subtle stochastic variations to create an ever-changing and deeply familiar job. The synchronization of audio and visual events with real-time computing processes, combined with the evocative musical and visual motifs, offers an immersive experience that resonates with audiences on multiple levels.

The digital generative work embodies an inherent duality, seamlessly blending the fleeting with the timeless. This fusion creates a sense of ongoing evolution that remains deeply rooted in familiarity.

Aesthetically, the musical motifs in Endless Moments resonate with echoes from Western musical traditions yet are influenced by rhythmic elements from other cultures, bridging historical influences and contemporary multicultural expression. The polyphonic musical textures are accompanied by abstract, textured visual elements that evolve with the music, guiding the audience through a journey that transcends time.



Fig. 1. Still Image from Endless Moments.

II. MUSICAL INFLUENCES

Endless Moments draws inspiration from the evolving minimalist compositions of pioneers like Terry Riley and Steve Reich. These composers are renowned for their innovative use of repeating phrases that overlap, shift phases, and evolve, creating dynamic and emergent textures.

At the core of Endless Moments are algorithmic processes designed to generate musical phrases and their transformations. This approach results in a continually evolving musical landscape that balances on the edge of chaos and coherence. The generative processes influence many musical attributes, including harmonic structure, phrase lengths, part balance, and medium-term structure. An intricate balance between

these elements is designed so the music is foregrounded and the work remains engaging and coherent.

The piece embodies the essence of minimalist music and algorithmic aesthetics, where simplicity and complexity coexist. While seemingly simple, the repeating phrases interact in complex ways to produce a rich tapestry of sound. As these phrases overlap and change phase, new patterns and textures emerge, creating a sense of movement and evolution within the music.

The algorithmic nature of Endless Moments is largely deterministic, thanks to using a seeded pseudo-random number generator, ensuring that each performance is similar. However, its constant evolution means that an individual viewer's experience at a particular moment is unique in an exhibition space where the work is continually running. Variability is guided by the underlying generative processes designed to maintain a coherent musical structure. The result is a familiar and ever-changing piece, inviting listeners to experience the music in new ways with each hearing.

Many musical cultures incorporate repeating elements that contribute to their unique soundscapes. For instance, African music is renowned for its intricate polyrhythmic patterns, where multiple rhythms are played simultaneously, creating a complex and engaging auditory experience [1]. Similarly, Middle Eastern music often features heterophony, a texture where multiple performers play simultaneous variations of a single melodic line, adding richness and depth to the music [2]. The Gamelan music of Indonesia also exemplifies this with its layered, interlocking patterns [3]. Along with these as influences, the rhythmic embellishments in Endless Moments draw inspiration from the pitched percussive patterns found in traditional Indian drum performances [4]. These embellishments add a layer of rhythmic sophistication and cultural richness to the composition.

By integrating these varied rhythmic influences, Endless Moments creates a tapestry of sound that is both globally inspired and uniquely its own. The interplay of these elements results in a piece that is rhythmically intricate and continually evolving, much like the musical traditions it draws from. This fusion of Western harmonic structures and global rhythmic practices enhances the piece's complexity and pays homage to the rich musical heritage of different cultures.

III. VISUAL INFLUENCES

The visual inspiration for Endless Moments is rooted in the Colour Field painting techniques that emerged in the 1940s, pioneered by artists such as Mark Rothko, Barnett Newman, and Clyfford Still [5]. These artists embraced a form of visual abstraction that deliberately eschewed any suggestion of figuration, focusing instead on the emotional resonance of color and form. Their work is characterized by large expanses of textured color that create a sense of depth and intensity, inviting viewers to immerse themselves in the visual experience.

The expressive power of the color field style is most impactful when presented at a large scale, enveloping the viewer and fully allowing them to appreciate the subtle variations and interactions of color. This immersive quality is a key element in the visual design of Endless Moments. The piece employs a digital color field technique that is subtly animated, with layers of related colors creating a sense of depth and richness, as shown in Figure 1. This digital approach allows for a dynamic visual experience that evolves, much like the music itself.

Adding to this visual tapestry are transient, rrandomizedtextural forms that appear and disappear synchronically with the music. Combining these visual elements with the music creates a cohesive, immersive environment where sound and sight are intricately linked.

This approach allows Endless Moments to provide a subtle yet immersive visual experience that does not distract audiences from the intricate minimal music of the work.

IV. APPROACHES TO GENERATIVE DESIGN

Endless Moments is a rule-based, algorithmic work that continues the authors' long-term exploration of algorithmic music and art. In an era where machine learning processes dominate the landscape of generative media, one might question the relevance and value of rule-based approaches. However, the authors believe that the human crafting of algorithmic processes holds significant value, even as machine learning models make algorithmic generative processes more accessible to many.

In Endless Moments, the rule-based algorithms are crafted with a deep understanding of musical and artistic principles, allowing for a nuanced and intentional creative process. The value of rule-based work lies in its ability to reflect the artist's unique perspective and innovative choices. Each algorithm is

a carefully constructed set of rules that guide the generative process, resulting in a work that is both structured and dynamic. This approach allows for a high degree of variability and unpredictability, ensuring that each iteration of Endless Moments is unique while still adhering to the authors' overarching vision.

This method contrasts with machine learning models, which often rely on vast amounts of data and complex neural networks to generate content. While machine learning can produce impressive and innovative results, the handcrafted nature of rule-based algorithms offers a different kind of creative control and intimacy.

The authors view these approaches as complementary, much like how hand-cut lithographic printing continues to exist alongside laser printing. Both rule-based and learning-based methods involve crafting code to express creative intentions, but with hand-coded algorithms like those used in Endless Moments, the authorial voice seems closer to the surface. This proximity allows for a more direct and personal expression of the artist's vision, as the artist's rules and structures are meticulously designed and implemented.

Understanding cultural context is essential to all artistic practice. Artistic expression is deeply intertwined with the values, history, and social norms of the culture from which it emerges. This complexity poses a significant challenge for fully autonomous creative AI systems, which often lack the nuanced understanding to navigate and interpret cultural subtleties effectively. As a result, co-creative processes—where humans and AI collaborate—and hand-coded digital media works are likely to remain central to generative media for artistic purposes [6]. These approaches leverage human intuition, cultural knowledge, and emotional insight, ensuring the creative output is technically impressive, culturally relevant, and emotionally engaging.

Endless Moments exemplifies the enduring value of rule-based, algorithmic art in the age of machine learning. Combining the precision and intentionality of handcrafted algorithms with the dynamic and evolving nature of generative processes offers a rich and engaging experience that highlights the complementary strengths of both approaches.

V. TECHNICAL CONSIDERATIONS

Endless Moments is a real-time artwork designed to run seamlessly in a web browser. It leverages the standard features of modern web browsers, including JavaScript, the Web Audio API, and Scalable Vector Graphics (SVG). The work exemplifies the artistry of technical efficiency, harnessing the full potential of modern web browsers through a seamless integration of built-in programming interfaces. Every aspect of the music and visuals is meticulously crafted without relying on third-party libraries, showcasing the authors' commitment to creative independence. The streamlined source code, remarkably compact at just 56 kilobytes, reflects a balance between technical efficiency and artistic expression, highlighting the elegance of simplicity in generative art.

Attention to web browser diversity and device variability, scalability, and accessibility reflects an artistic preference for accessibility. The work transcends technical constraints by ensuring seamless functionality across diverse hardware, inviting a broad audience to engage with its immersive generative experience. This thoughtful design underscores the creators' dedication to blending technological adaptability with artistic integrity.

As with any creative medium, the web browser as a platform has its affordances and constraints. The rich media programming infrastructure of web browsers provides a robust foundation for creating dynamic and interactive works. However, the development process needed to consider Endless Moments' performance and output, allowing for the variability of different devices that might run the job. For instance, scalability to different screen sizes and maintaining efficient operation and high audio quality across various systems require careful attention.

It is best presented at scale to fully appreciate the subtle nuances of Endless Moments and experience the work in its most immersive form. This means displaying the visuals on a large monitor or projecting them onto a wall, coupled with a full-range sound system that offers a wide stereo field. Such a setup allows the intricate details of the visual and auditory elements to be fully appreciated by the audience.

VI. CONCLUSION

Endless Moments explores browser-based generative art, combining algorithmic processes with human creativity to produce a dynamic and engaging piece. The work offers an immersive experience that continuously evolves by incorporating diverse musical and visual influences. The minimalist musical techniques and global rhythmic patterns, paired with

color field-inspired visually evocative elements, are designed to create a harmonious blend of sound and sight.

The rule-based, algorithmic approach ensures that each iteration of Endless Moments is unique while maintaining a coherent structure that reflects the artists' vision. This handcrafted method highlights the value of intentional design in generative art, offering a personal touch in an era dominated by artificial generation. Endless Moments invites audiences to experience its evolving nature, providing a fresh and captivating experience with each encounter.

REFERENCES

[1] S. Arom, "Time structure in the music of Central Africa: Periodicity, meter, rhythm, and polyrhythmic," Leonardo, vol. 22, no. 1, pp. 91–99, 1989.

[2] R. Jankowsky, "Music of the Middle East and North Africa," in Excursions in World Music, T. Rommen and B. Nettl, Eds., Routledge, 2020, pp. 56–93.

[3] H. Spiller and E. A. Clendinning, Focus: Gamelan Music of Indonesia. Routledge, 2022.

[4] J. Salamon, S. Gulati, and X. Serra, "A multi-pitch approach to tonic identification in Indian classical music," in Proceedings of the 13th International Society for Music Information Retrieval Conference, F. Gouyon, P. Herrera, L. Martins, and M. Müller, Eds., Porto, Portugal: International Society for Music Information Retrieval (ISMIR), 2012.

[5] K. Wilkin and C. Belz, Color as a field: American painting, 1950-1975. Yale University Press, 2007.

[6] P. Galanter, "Artificial intelligence and problems in generative art theory," in Proceedings of EVA London 2019, BCS Learning & Development, 2019.

The Faro Museum poster collection II: a virtual exhibition

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Abstract—The present article is a follow-up to a previous paper presented at ARTECH 2023 in Faro, which described the early stages of development of a virtual exhibition regarding Italian movie posters from the beginning of the 20th century. This work stems from a collaboration between CIAC - Research Center for Arts & Communication and the Museum of Faro, which intends to study, enrich, and disseminate a singular collection of 330 posters that belonged to the Portuguese scenographer and artist Joaquim António Viegas. After its initial presentation at ARTECH, the same exhibition has now been concluded and inaugurated simultaneously with its physical counterpart in the Municipal Museum of Faro in November of 2024. This paper describes some of the steps taken after the presentation of the prototype's demo at ARTECH's conference. Besides describing the later stage of this creative process, we also propose to present the final artifact, i.e., a 3D virtual exhibition that features 20 rare Italian movie posters from the early 1900s. With this initiative, we hope to demonstrate the opportunities of using digital technologies to preserve and promote local cultural heritages and memories.

Keywords—virtual exhibition, 3d models, movie posters, digital media arts, artificial intelligence

I. INTRODUCTION

During the 11th International Conference on Digital and Interactive Arts - ARTECH 2023, which took place in Faro, Portugal, a group of members from the Research Center for Arts & Communication (CIAC) showcased a video demonstration regarding a prototype for a virtual exhibition [1]. This project aimed to create an extension for a physical exhibit displaying a set of Italian movie posters from the early 20th century, which took place at the Municipal Museum of Faro between November and December of 2024. This project is one of many initiatives born from a cooperation between CIAC and the Museum of Faro to study, promote, and enrich a collection of rare posters that once belonged to Joaquim António Viegas, a Portuguese artist and collector. Viegas was a painter and scenographer who worked in various Portuguese entertainment venues, such as the Chiado Terrasse in Lisbon or the High-Life Hall in Oporto, during the first decades of the 1900s. During this period, he collected hundreds of posters, which would later come into the possession of the Museum of Faro. Nowadays, this cultural institution holds 330 items, categorized into three groups: a) Cinema, b) Circus and Variety Shows, and c) Commercial Advertisements.

To disseminate this legacy, the museum partnered with CIAC, leading to an exhibition in 2021 that showed 33 French movie posters from 1907 to 1914 [2]. To further this collaboration, the two entities planned a second presentation, this time focused on Italian cinema (Fig. 1). During early talks regarding the limitations of displaying some of the posters due to conservation issues, the idea of creating a second exhibit, entirely digital, was proposed. This would open new possibilities for promoting this legacy. Not only would it allow us to show otherwise inaccessible objects to the public, but it could also manifest a more practical method of demonstrating additional materials related to the posters, e.g., videos of some of the movies in the expo. We decided to move forward with the double exhibition format for these reasons.



Fig. 1. *L'Emigrante* (1915), directed by Febo Mari. Poster illustration by Leopoldo Metlicovitz (*Source: Museum of Faro*).

II. VIRTUAL MUSEUMS AND EXHIBITIONS

Museums are evolving beyond displaying and preserving cultural objects, focusing on new communication and engagement forms with the public. To attract visitors to return, museums are creating new strategies that often involve dynamic and flexible exhibits, sometimes powered by digital mechanisms like virtual museums [3].

The role of the curator is equally changing and expanding. They must ensure scientific accuracy and quality of digital content, effective communication, and the integration of innovative technologies into the museum's projects to enhance interactivity and visitor experience [3, 4].

Meanwhile, the role of digital apps, such as interactive virtual exhibitions, is steadily increasing in museums. They offer new modes of engagement with the public: these spaces often include immersive 3D simulations where content, interactive features, and accessibility are equally important. They could function as pedagogical tools and provide access to otherwise inaccessible materials [5].

Even though a virtual experience might not fully replicate a physical one, it offers unique opportunities, like easy access to cultural content, personalized exploration, connectivity with external resources, and the ability to present delicate objects, reducing the risk of damage. They allow museums to enhance communication strategies by offering new ways to experience cultural heritage.

III. DEVELOPING THE EXHIBITION

Building from these concepts and premise, a team of researchers with expertise in museum curation, digital media art, and programming began the production of a virtual exhibit that would present 20 rare Italian movie posters - nine more than its physical counterpart - complemented by textual, aural and videographic information.

The first steps, described in more detail in the previous article [1], entailed the 3D scanning of the museum's rooms set up to receive the 2024 exhibition. This fieldwork was done with the help of cameras equipped with LiDAR sensors and mobile apps like Polycam or Luma AI. This enabled us to develop different 3D models of these spaces that would later be populated by the posters' images (Fig. 2).



Fig. 2. 3D rendering of the exhibition rooms and adjacent corridor. The scan was taken with cameras equipped with LiDAR sensors and a Polycam app (*Source: authors*).

After this initial fieldwork, the group began a 3D model development process based on experimentation and testing different tools. Partially inspired by the 2022 ARTeFACTo digital exhibition [6], created on Kulla, and other similar websites that allow the user to create virtual tours and exhibits, like OnCyber [7], the team started by uploading the museum's scans on the Unity platform, a tool that allows for more flexibility and experimentation with different concepts and designs in a 3D environment - when compared with the abovementioned programs (Fig. 3).



Fig. 3. 3D rendering made with Unity of one of the museum's rooms, complemented by various posters (foreground) and a screen playing a movie (background) (*Source: authors*).

At the same time, we experimented with the museum's scans in Cables.gl [8], a visual programming environment that focuses on creating interactive 3D

graphics, animations, and web experiences. Around the time our team previewed the project at ARTECH 2023, with a video demonstration showcasing the different production stages that occurred until then, we opted to move the entirety of operations to Cables.gl due to the member's experience with this second program.

After the transition from the Unity engine to Cables.gl, the team designed a workflow based on some key objectives: a) use the 3D models of the museum rooms to create a quasi-replica of the physical exhibit; b) fill the 3D models with 20 Italian cinema posters selected by the curators, some of which were exclusive to the digital mode; c) complement the images with textual information about the posters; d) complement the images with the respective movies (when possible); f) define how the information would be presented to the public; and g) add interactive features.

With one version of the models uploaded to Cables, we began working on the visual and audio features of the exhibit to create an immersive digital experience [9]. To address potential breaks in immersion caused by visual imperfections in the 3D scans/models, our first decision was to develop methods for alternating between photorealistic and abstract shading of the museum's 3D mesh [10] (Fig. 4).

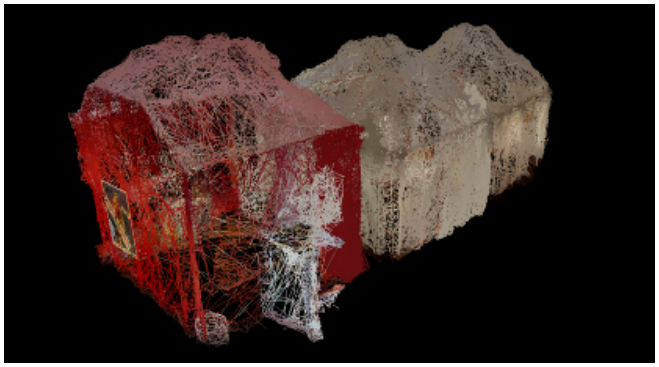


Fig. 4. 3D abstract rendering of the exhibit rooms (*Source: authors*).

The next step was to position the images of the posters in the 3D space and edit them. As for the positions, most of them follow the same logic as museum exhibits of this kind, i.e., fixed on the room's walls. Nevertheless, a few of them were positioned in what would be the entrance/middle of the rooms.

The next stage was to define how the user would experience and interact with the information. The concept was to create a camera that would flow through the posters with the click of a button. For this, it was essential to define camera movements and fixed positions. As for the movement, the camera is controlled by the positions of the posters: they dictate how the camera makes the transitions - pans/dollies/tilts - between images.

Regarding the fixed positions, the screen is divided between a poster in the center and a text in the left. In some cases, there is a video in the middle, with the images occupying the right side of the screen (Fig. 5). It is also common to see other (more faded) posters in the background or adjacent to the currently focused figure.

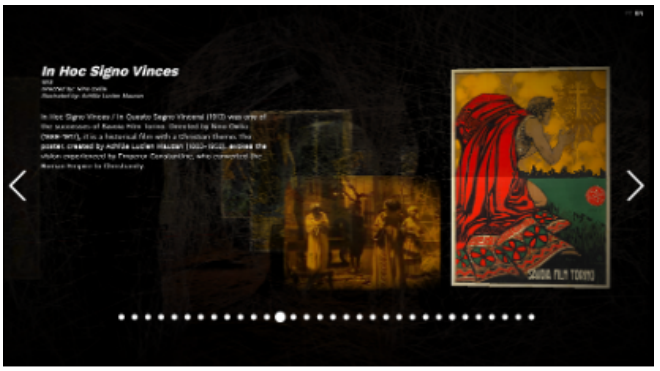


Fig. 5. Screen organization when viewing a poster with video (*Source: authors*).

In this view mode, the museum model is set to an abstract, wireframe render of the 3D mesh. This state is composed mostly of negative space, where the walls, ground, and ceiling become less prominent, and the posters and texts take center stage. This black void enhanced the immersion factor and granted more focus to the posters [11].

Besides information related to each poster, various other texts were produced that help contextualize this exhibition, i.e., about the museum's collection, the early years of Italian cinema, its movie posters, and their illustrators. This information was presented using a different logic. Instead of the camera moving just between transitions and then fixed when viewing the images, the screen constantly flows through the exhibit space and the other faded posters. When we transition to these texts, the model changes its visual configuration, morphing from a mesh of lines to a more photorealistic and detailed composition (Fig. 6).

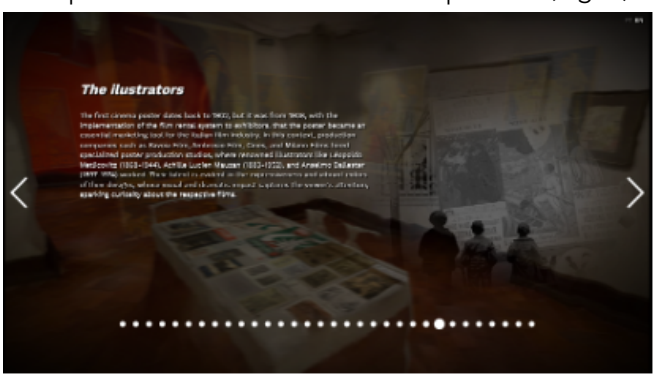


Fig. 6. Screen view during exhibition-texts mode (*Source: authors*).

Regarding the interaction features, most of them concern the movement through the exhibit space: the user can move between posters in different forms: a) by clicking on the left/right arrows on the screen; b) by clicking on the left/right keyboard buttons; and c) by clicking on the navigation buttons on the lower section of the screen. This left/right interaction mimics how the exhibition flows between images. The other form of interaction pertains to selecting and expanding the pictures or videos, which happens by clicking on these media types.

Furthermore, because the exhibit presented two incomplete posters, there was also a conversation about reimagining and recreating these art pieces with the help of image synthesizers that use artificial intelligence. The program used for this was Stable Diffusion - Automatic 1111 version. By using the 'outpainting/inpainting' techniques and the prompts "Ancient Rome, Roman people, Roman architecture, Roman columns, Roman statues," we were able to recreate a lower portion of the two posters (Fig. 7), showing new iterations of the missing part in small intervals.



Fig. 7. Reimagination of the missing section of one of the posters of *Gli ultimi giorni di Pompei*, 1913 (*Source: authors*).

Finally, since the public can access the virtual exhibition in the museum through their smartphones, a second version was designed for mobile devices and, specifically, portrait mode. Since the format and dimensions are quite different from the desktop view, most of the work was concentrated on repositioning and redimensioning the diverse media of the exhibit (Fig. 8). Another difference concerned the mode of interaction, i.e., swiping - movement - and clicking on the screen - expanding images and videos.

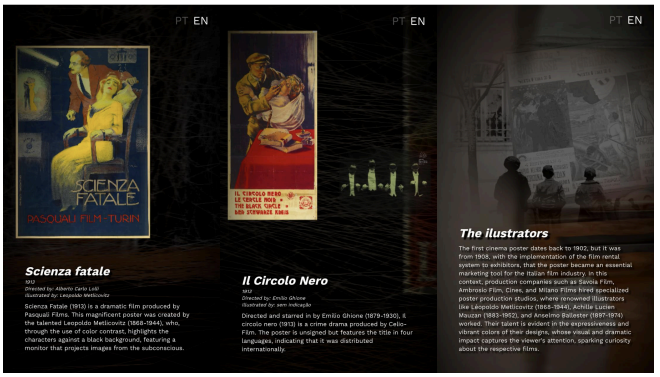


Fig. 8. Multiple exhibit configurations in portrait/mobile mode (*Source: authors*).

IV. INSTALLATION

Because of this project's artistic and cultural importance for the museum and CIAC, and considering its virtual and remote nature, we aim to disseminate this exhibition in different places and settings. For this reason, we propose to present this digital exhibit [12] at the 2024 ARTeFACTo conference. To access this experience, the user will just need a computer or a tablet with internet access (Fig. 9). A QR code might complement the display, encouraging people to try it on their mobile phones. Finally, headphones could also be presented with the laptop/tablet since a soundscape accompanies the exhibit. The exhibit was created in both English and Portuguese.

Fig. 9. Schematic with the installation configuration (*Source: authors*).

V. FINAL CONSIDERATIONS

Donated in 1990, the Museum of Faro's poster collection includes rare and unique posters. The cinema collection represents a significant sample of poster art from the early 20th century. It serves as a valuable testament to the role of this medium in the rise of cinema as a cultural industry.

Through this virtual exhibition, we aim to offer a cultural, artistic, and educational experience by providing materials that cannot be presented at the museum due to space limitations and conservation issues. The project aims to allow people to know this important period of cinema's history and discover posters that deserve to be artistically and culturally recognized without needing to go to Faro physically.

Finally, presenting in the conference's context will provide CIAC's team with a valuable opportunity for discussions and feedback from academic peers, digital media artists, and other professionals who focus on technologies and content related to virtual visits and 3D simulations. These contributions will be essential

to developing future strategies and methodologies, testing different tools, solidifying the foundation of a project we hope to expand, and creating future exhibits centered around this unique legacy.

ACKNOWLEDGMENTS

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REFERENCES

[1] R. d'Orey, J. Carrega, B. M. da Silva, and A. Martins, "The Faro Museum poster collection: Demo of a prototype for a digital exhibit," in *Proceedings of the 11th International Conference on Digital and Interactive Arts (ARTECH '23)*. New York, NY, USA: Association for Computing Machinery, 2024, Article 17, pp. 1–5. Available: https://dl.acm.org/doi/10.1145/3632776.3632779.

[2] Agência Lusa, "Museu Municipal de Faro mostra 33 cartazes raros de cinema francês," *Observador*, Jul. 30, 2021. Available: https://observador.pt/2021/07/30/museu-municipal-de-faro-mostra-33-cartazes-raros-de-cinema-frances/.

[3] S. Pescarin, "Museums and virtual museums in Europe: Reaching expectations," *Ricerca Scientifica e Tecnologie dell'Informazione*, vol. 4, no. 4, pp. 131–140, 2014.

[4] C. Ciurea, A. Zamfiroiu, and A. Grosu, "Implementing mobile virtual exhibition to increase cultural heritage visibility," *Informatica Economică*, vol. 18, no. 2, pp. 24–31, 2014.

[5] G. Dumitrescu, F. G. Filip, A. Ioniță, and C. Lepădatu, "Open source Eminescu's manuscripts: A digitization experiment," *Studies in Informatics and Control*, vol. 19, no. 1, pp. 79–84, 2010.

[6] F. Martins de Abreu and S. Ka Man, "ARTeFACTo2022Macao - Virtual Exhibition," kuula, 2022. Available: https://kuula.co/share/N2CZx/collection/79DjN?logo=0&info=0&fs=1&vr=1&sd=1&initload=0&thumbs=1.

[7] OnCyber, "V1 Feed," 2024. Available: https://oncyber.io/feed.

[8] Cables.gl, "Made with Cables," 2024. Available: https://cables.gl/made-with-cables/.

[9] J. Vidyarthi, *Sonic Cradle: Evoking mindfulness through "immersive" interaction design* [M.Sc. thesis], Simon Fraser University, Surrey, Canada, 2012.

[10] G. Gonçalves, H. Coelho, P. Monteiro, M. Melo, and M. Bessa, "Systematic review of comparative studies of the impact of realism in immersive virtual experiences," *ACM Computing Surveys*, vol. 55, no. 6, pp. 1–36, May 2022, doi: 10.1145/3533377.

[11] J. Vidyarthi, B. E. Riecke, and D. Gromala, "Sonic Cradle: Designing for an immersive experience of meditation by connecting respiration to music," in *Proceedings of the Designing Interactive Systems Conference*, New York, NY, USA: Association for Computing Machinery, 2012, pp. 408–417, doi: 10.1145/2317956.2318017.

[12] A. Martins and R. d'Orey, "A Ascensão do Cinema Italiano na Coleção de Cartazes do Museu de Faro," *SOLIDsolutions*, 2024. Available: https://solidsolutionsdev.github.io/CartazesCinemaItalianoMuseuFaro/.

Violência de gênero na videoinstalação Intrusa[s] / Gender violence in the videoart Intruder[s]

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Abstract—This paper presents Intrusa[s], a video installation that reflects gender-based violence in sports. The artwork features an archival image that serves as a trigger, leading to a video accessed through Augmented Reality (AR). The video was created using free stock footage sourced from online platforms. Artificial Intelligence (AI) was employed to evoke a video game aesthetic, emphasizing the objectification of the female body. Additionally, AI-generated hands were manually inserted frame by frame. The work is inspired by the story of Kathrine Switzer, the first woman to run the Boston Marathon in 1967 officially. Her participation sparked violent outrage from race organizers, who attempted to remove her from the event forcibly. This moment symbolizes one of many examples of gender-based violence present in sports. The installation addresses not only this historical event but all situations in which women were accused of invading spaces deemed exclusively male and had their bodies invaded by male hands, whether in the world of sports, at work, or in everyday life.

Keywords—Women in sport; Sport; Gender violence; Equality; Media art; Artificial Intelligence; Video installation.

Resumo—Este artigo apresenta a obra Intrusa[s], uma videoinstalação que reflete sobre a violência de gênero no esporte. A obra utiliza uma imagem de arquivo como gatilho, conduzindo a um vídeo acessado por meio de Realidade Aumentada (RA). O vídeo foi produzido com imagens gratuitas de bancos de dados disponíveis na internet, e a Inteligência Artificial (IA) foi empregada para criar uma estética de videogame, destacando a objetificação do corpo feminino. Por fim, mãos, também geradas por IA, foram inseridas quadro a quadro. É uma obra inspirada na história de Kathrine Switzer, a primeira mulher a correr oficialmente a Maratona de Boston, em 1967. O fato provocou a ira dos organizadores da corrida, que tentaram expulsá-la de forma bastante violenta. É uma, entre muitas imagens de violência de gênero que podem ser vistas no esporte. A instalação reflete não apenas esse evento histórico, mas todos aqueles em que mulheres foram acusadas de invadir locais considerados exclusivamente masculinos e tiveram seus corpos invadidos por mãos masculinas, seja no mundo do esporte, no trabalho ou na vida cotidiana.

Palavras-chave—Mulheres no esporte; Esporte; Violência de gênero; Igualdade; Media-arte; Inteligência Artificial; Videionstalação.

I. INTRODUÇÃO

A obra de videoinstalação *Intrusa[s]* apresenta uma imagem de arquivo que funciona como gatilho para um vídeo, por meio de Realidade Aumentada (RA). No vídeo, uma mulher corre pelas ruas de uma cidade. Mas seu esforço é em vão, pois ela parece não sair do lugar. Apenas mais tarde é que se compreende o boicote que ela está sofrendo. Uma mão gigante aparece. É uma mão masculina, que dá ordens. Depois surge outra, desta vez tentando impedir que a mulher siga seu percurso. Em seguida, mais uma, que tenta tocá-la e, por último vê-se uma mão ameaçadora, violenta.

A imagem documental, que pode ser vista na Figura 1, é de Kathrine Switzer, a primeira mulher a correr oficialmente a maratona de Boston, em 1967. A atleta se inscreveu usando apenas as iniciais de seu nome, o que confundiu os organizadores, que não perceberam se tratar de uma mulher.



Fig. 1. Kathrine Switzer na Maratona de Boston (Captura de Tela). Fonte: www.kathrineswitzer.com.

Na época, não era proibida a participação feminina na maratona, mas havia a crença de que elas eram

muito frágeis para suportar correr os 42.195 metros. Portanto, a presença de uma maratonista do gênero feminino era inimaginável. Ao se dar conta de que havia uma mulher na pista, o diretor da corrida, Jock Semple, tentou expulsá-la, proferindo frases como: "Saia da minha corrida e me dê esses números". Ela chegou a ser questionada: "Você é uma sufragista?" "O que você está tentando provar?" Ela respondeu: "Eu só estava tentando correr" [1].

A fotografia da atleta sendo empurrada é extremamente violenta. É uma dentre tantas imagens de violência de gênero que podem ser vistas no esporte. Felizmente, ela não cedeu e continuou a correr, conseguindo concluir a prova em 4 horas e 20 minutos. Pode-se imaginar seu estado emocional durante e depois da corrida. Switzer tornou-se comentadora televisiva e segue na luta pela igualdade de género. Em 2015, lançou a fundação *261 Fearless.*

Em 1972, foi criada e oficializada a categoria feminina na Maratona de Boston. Em 1974, Switzer venceu a Maratona de Nova York, com o tempo de 3h07min29s. Em 1975, ficou em segundo lugar na Maratona de Boston, com 2h51min37s. Em 2018, 11.628 mulheres concluíram a referida maratona [2].

O corpo feminino visto como objeto, disponível para ser tocado, manipulado por mãos masculinas, vai além das pistas de corrida. No universo do esporte, têm vindo à tona inúmeros relatos de assédio, o que por muitos anos foi normalizado. *Intrusa[s]* reflete não apenas este evento, mas todos aqueles em que mulheres foram acusadas de invadir lugares considerados exclusivamente masculinos e que, por esta ou qualquer outra justificativa, tiveram seus corpos invadidos por mãos masculinas, seja no mundo do esporte, no trabalho ou na vida cotidiana.

II. INTRUSA[S]

O título provoca ao indicar o duplo sentido, colocando a palavra no singular e o *s* entre colchetes, indicando o plural. Quem é a intrusa? As mulher, ao tentar ocupar um lugar totalmente dominado pelos homens? Ou intrusas são as mãos que invadem seu espaço e seu corpo? A palavra remete também a títulos de filmes de terror, nos quais a imagem feminina é bastante estereotipada e onde muitas vezes se vê a exploração de seus corpos. Há uma inspiração na estética de *videogame*, com o intuito de reforçar a objetificação do corpo feminino, muitas vezes visto como uma peça que serve ao jogo, à mercê das mãos que tudo podem. Neste sentido, se aproxima de uma machinima, termo que surge da combinação das palavras em inglês machine (máquina, referindo-se a computadores e jogos), animation (animação) e cinema. É um tipo de produção audiovisual realizada por meio da captura de imagens em tempo real em ambientes 3D, utilizando a tecnologia de jogos eletrônicos. Pode também referir-se ao modo de produção ou ao produto que resulta de novos sistemas, a partir da hibridização entre diferentes mídias, integrando elementos e procedimentos característicos dos jogos eletrônicos e do cinema em um diálogo criativo [3]. Machinima é, conceitualmente, tanto um filme feito a partir de jogo eletrônico, quanto um processo de produção. Ainda, pode ser pensado como um novo produto, que nasce dos sistemas híbridos e complexos e propicia novas poéticas, convergindo para a estética da interatividade, incorporação e imersão, palavras-chave que tornam visível a articulação dos sujeitos com as linguagens das máquinas.

III. INVESTIGAÇÃO

[Des]montagem. Arte, arquivo e medias digitais é uma pesquisa baseada na prática artística [6] que se debruça sobre os conceitos de arquivo e de montagem. A montagem de imagens permite o encontro entre diferentes temporalidades, desvelando as relações entre estas. Por seus elementos intrínsecos, como a possibilidade de múltiplas combinações, de interatividade e de imersão, a media-arte digital é adequada para essas provocações. Benjamin [4] sugere que o sentido das ideias está intrinsecamente ligado à sua posição em uma determinada configuração, tornando inevitável a associação da montagem à dialética.

Nesta videoinstalação, a montagem é entendida como procedimento crítico, ao associar uma imagem de arquivo, imagens de uma mulher correndo pelas ruas e imagens geradas por IA. As imagens ganham novas camadas de significado a partir da videocolagem e da presença da imagem documental.

IV. REFERÊNCIAS

A. Fotomontagem

Gênero que se consolidou na década de 1920, com o movimento dadaísta, a fotomontagem consiste em justapor duas ou mais imagens fotográficas em um mesmo plano visual, provocando uma fusão semântica. Uma das precursoras no uso desta técnica foi Hannah Höch, cujas obras questionavam os padrões estéticos da época e a posição da mulher na

sociedade, como pode ser visto na Figura 2. Em 1930, desenvolveu uma série onde descontextualizava imagens de obras de museus etnográficos, adicionando fotografias de modelos europeias. Desta forma, satirizava os padrões de beleza, negava a pureza da raça e questionava o corpo feminino objetificado e erotizado.

A técnica de fotomontagem foi amplamente utilizada por artistas soviéticos de vanguarda, num primeiro momento em cartazes e ilustrações, capas de revistas e livros. Depois foi usada para propaganda do Partido Comunista, como reporta Fabris [5]. O grupo, cujos principais expoentes são Rodchenko, Klutsis e El Lissitzky, fazia experimentos bastante diferentes daqueles realizados pelos artistas do ocidente. Klutsis, que atribuía a si próprio o pioneirismo na fotomontagem, foi quem separou a técnica em dois tipos primordiais: a formal e a militante. Rodchenko criava a partir de fotografias próprias de caráter documental e buscava fazer com que a arte tivesse uma função social.



Fig. 2. Sem título, de Hannah Höch, 1930. Museu Etnográfico.
Fonte: www.guardian.com

B. Mãos

A pesquisa procurou compreender a representação das mãos nas artes.

> A iconografia da mão ocupa um forte lugar simbólico em várias culturas de diferentes lugares. A mão exprime as ideias de atividade, ao mesmo tempo que as de poder e de dominação. A mesma palavra em hebreu, *iad*, significa ao mesmo tempo mão e poder. A mão da justiça foi, na Idade Média, a insígnia da monarquia francesa. A mão esquerda de Deus é tradicionalmente associada com a justiça e a mão direita com a misericórdia [6].

As mãos gigantes reforçam a violência da situação retratada. O filme *A Mão (Ruka)*, de Jirí Trnka [6], foi uma obra de referência. No filme, um oleiro que produz vasos na própria casa vê uma mão invadir seu espaço e lhe dar ordens, uma crítica contundente do autor ao regime totalitário em que vivia, na Tchecoslováquia de 1965, como ilustra a Figura 3. No começo, a mão oferece dinheiro e presentes, mas aos poucos vai se tornando violenta. Outra obra que representa as mãos de forma desproporcional é o espetáculo de dança *Por um Fio (Sur un Fil)*, de Claire Théault e Anthony Figueiredo [7]. Neste caso, representam os pensamentos e emoções. A luta contra as sombras do passado.

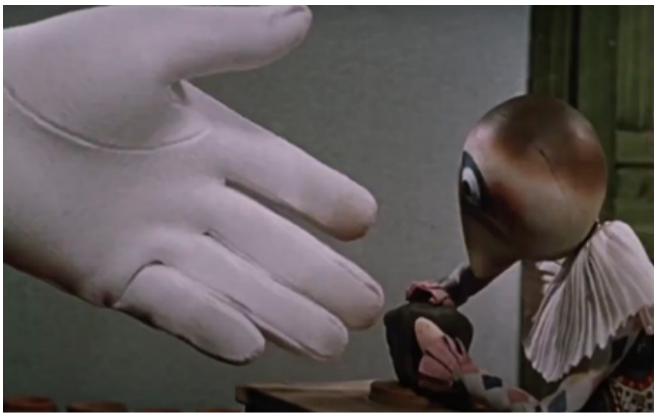


Fig. 3. The Hand, de Jirí Trnka.
Fonte: https://cinemaemcena.com.br

V. TECNOLOGIAS UTILIZADAS

A imagem de arquivo de Kathrine Switzer funciona como um gatilho para o vídeo, disponível no *Youtube*, através do dispositivos móveis, por meio do aplicativo de RA *Artivive*. O vídeo foi produzido com imagens gratuitas do *Pexels,* disponível gratuitamente na internet. A IA do aplicativo *Wondershare* foi usada para trazer a estética de *videogame*. Posteriormente, foi feita a montagem e a finalização, com a inserção das mãos, geradas também por IA, com o *Generative Fill*, ferramenta do *Photoshop*. Foram aplicadas manualmente, quadro a quadro, com o uso do *Premiere Rush*. A trilha sonora foi produzida com ruídos, vozes e risadas, também de bancos de sons gratuitos.

No espaço expositivo, são necessários:

- acesso à internet
- parede ou suporte vertical branco, no qual possa ser afixada a fotografia
- 01 plinto com aproximadamente 0.80m X 0.40m X 0.40m.

Os equipamentos são:

- 01 ou 02 tablets (para permitir que mais pessoas possam fruir simultaneamente)
- 01 alto-falante *bluetooth* com alimentação de a/c, aproximadamente 20W de potência.

A Figura 4 mostra um esquema da instalação e as Figuras 5,6 e 7 mostram capturas de tela do vídeo que a compõe.



Fig. 4. Esquema da videoinstalação *Intrusa[s].*

Em exposições virtuais, sugere-se que a fotografia documental fique disponível na página. Ao clicar na imagem, o visitante é direcionado para vídeo.



Fig. 5. Videoinstalação *Intrusa[s].* (Captura de Tela).



Fig. 6. Videoinstalação *Intrusa[s].* (Captura de Tela).



Fig. 7. Videoinstalação *Intrusa[s].* (Captura de Tela).

VI. METODOLOGIAS

A criação seguiu um percurso a/r/cográfico, metodologia já presente em trabalhos anteriores, no âmbito da pesquisa *[Des]montagem. Arte, arquivo e medias digitais*, em processo no Doutoramento em Media-arte Digital (DMAD), na Universidade do Algarve (UAlg). A investigação pretende compreender como a montagem pode provocar novos pontos de vista ao mudar elementos de lugar e criar diferentes associações. O uso de imagens de arquivo também está presente neste estudo.

É uma Investigação Baseada na Prática Artística [6], na qual criação e pesquisa caminham juntas e se retroalimentam e tem como método a a/r/cografia [8], abordagem que se apropria da metáfora do arco, no sentido de que em um processo criativo os desvios são desejáveis e preferíveis à linha reta, permitindo uma maior abrangência. O artista assume também as posições de investigador e de comunicador. Pode-se entender este conjunto de arcos como um rizoma, em constante transformação. As diferentes fases no processo se consolidam no diálogo entre a pesquisa e a realização da obra.

O trabalho foi acompanhado pelo Laboratório de Investigação e Criação Partilhada – Cinema e Outras Imagens em Movimento, um projeto de Renata Ferraz, do Labcom - Comunicação e Artes / iA* Unidade de Investigação em Artes, sediado na Universidade da Beira Interior (UBI). Um espaço de diálogo entre artistas e investigadores.

Todo o percurso está registrado em um Diário Digital de Bordo (DDB), hospedado em um *blog* [9]. Cada entrada no diário contém textos que refletem o pensamento e as ideias artísticas desenvolvidas, esboços, desenhos, planos, imagens, vídeos e autocríticas. O DDB pode e deve ser revisitado como forma de compreender os próprios caminhos. Encontra-se disponível para fruição do público e deve sempre ser disponibilizado no momento das exposições através de um código QR na folha de sala.

VII. CONSIDERAÇÕES FINAIS

Esta videoinstalação foi criada especialmente para a exposição *Mulheres no Desporto: Pioneirismo, Desafios, Inspiração, Igualdade,* que ocorreu no Museu Nacional do Desporto, nas *Instalações Interpretativas do Jamor*, em Lisboa, sob a curadoria de Jorge Santos. A exposição traça a trajetória feminina no esporte, apresentando mulheres que desafiaram estereótipos de gênero [10]. Foi também exposta na *18.ª Conferência do Conselho da Europa dos Ministros do Desporto*, que teve lugar em outubro de 2024 na Alfândega do Porto, um evento organizado em parceria com o governo português. Será exibida em dezembro de 2024 na exposição *#Em Meio 16*, no *#23.ART* - Encontro Internacional de Arte e Tecnologia, no Instituto Politécnico do Porto.

Os vídeos originais têm licença de uso gratuito e sem restrições quanto a edições. Segundo a plataforma, não é necessário mencionar a fonte nem dar crédito, mas, por respeito aos artistas, o nome do estúdio que realizou os vídeos será sempre creditado. Os meios e tecnologias propostos podem ser atualizados ou adaptados às necessidades de cada espaço.

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REFERÊNCIAS

[1] K. Switzer, *Kathrine Switzer: First Woman to Enter the Boston Marathon*, (May 15, 2012). [Video file]. Available: https://www.youtube.com/watch?v=fOGXvBAmTsY

[2] P. Lopes, "Kathrine Switzer foi a primeira norte-americana a correr oficialmente em Boston," *Ativo*, 2018. [Online]. Available: https://www.ativo.com/corrida-de-rua/papo-de-corida/kathrine-switzer-historia-da-corrida/.

[3] M. Gregolin, "O machinima e arte na era digital," *Travessias*, vol. 2, no. 1, 2008.

[4] W. Benjamin, *Origem do drama barroco alemão*. São Paulo, SP, Brasil: Brasiliense, 1984.

[5] A. Fabris, "Entre arte e propaganda: fotografia e fotomontagem na vanguarda soviética," *An. Mus. Paul. História e Cult. Mater.*, vol. 13, pp. 99–132, Jun.2005, doi: 10.1590/S0101-47142005000100004.

[6] R. R. Silva, "A mão como símbolo político nas artes gráficas e visuais," *Ícone*, vol. 18, no. 1, p. 41, Jan. 2020, doi: 10.34176/icone.v18i1.238038.

[7] J. Trnka, *The Hand (Ruka).*, (2003). Accessed: Jul. 27,2024.[Video file]. Available: https://www.youtube.com/watch?v=tyAVc5nAil0.

[8] "Let's work together | Claire et Antho (Perspective Live)," *Claire et Antho*. Accessed: Jul. 27, 2024. [Online]. Available: https://www.claireetanthoperspective.com/why-do you-need-us-for.

[9] P. A. da Veiga, "A/r/cografia – A Criatividade Investigada na Investigação Criativa," *Investigação-Experimentação-Criação: em Arte-Ciência-Tecnologia*, vol. 1, pp. 51–74, 2020.

[10] C. Cavalcanti, "Cristina Cavalcanti." [Online]. Available: https://www.cristinacavalcanti.com/post/pensamentos.

[11] "Intrusa[s]," *ipdj-museudesporto*. Accessed: Nov. 27, 2024. [Online]. Available: https://museudesporto.ipdj.gov.pt/-/exhib-womeninsport_mediaart_intruders.

right to copy & *memórias em movimento*: textual, visual, and dynamic collages using PowerPoint

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Abstract—This short paper delves into the creation process of the right to copy and memórias em movimento (memories in motion), two digital artworks that converge text, image, and movement, integrated into a PhD art project. Furthermore, it describes the reframing of the popular presentation software Microsoft PowerPoint for creative and artistic purposes.

Keywords—text, typography, audiovisual artworks, digital media-arts, PowerPoint

I. INTRODUCTION

The following paper stems from a PhD project that involves studying and producing artworks that combine text, image, and movement in audiovisual and digital environments. Furthermore, in a period when emergent AI technologies are exponentially increasing, integrating many creative fields, such as the arts, we also propose an alternative approach to creative and artistic processes by using conventional digital tools that, while commonly used, are often overlooked when it comes to their creative potential.

The art created in this context uses accessible and easy-to-learn tools that are not directly related to the artistic and audiovisual fields, such as Microsoft Word, that is repurposed to create stop motion animations [1], or, as we will discuss in this paper, presentation software like PowerPoint, to produce typographic, aural and videographic collages by using its interface as the mise-en-scène for multiple dynamic presentations.

The pieces outlined in this paper embed text as a core element, serving not only as a visual feature but as a kinetic aspect that introduces meanings and interpretive potentials.

II. TEXT AS VISUAL AND DYNAMIC EXPRESSION

The written word can often be overshadowed in visual and audiovisual artworks, where images, movement, and sound tend to dominate. However, there is significant creative potential in incorporating text into these mediums. As stated by Uyan Dur, "The most effective use of writing in both a linguistic context and as a visual expression has been within the scope of conceptual art, and this has brought new discourses and perspectives to the art" [2, p.219]. Rather than being a static or purely functional element, text can become a powerful visual and conceptual tool. For instance, Marcel Duchamp's film *Anémic Cinéma* (1926) places text at the heart of the work: words are not just read; they are visualized and experienced through motion, creating new aesthetic and semantic dimensions (Fig.1). Contemporary artists and filmmakers, such as Jenny Holzer with her large-scale text installations or kinetic typography in digital design, continue to explore how the written word can interact with visual and auditory elements to provoke thought, evoke emotions, or communicate in innovative ways.

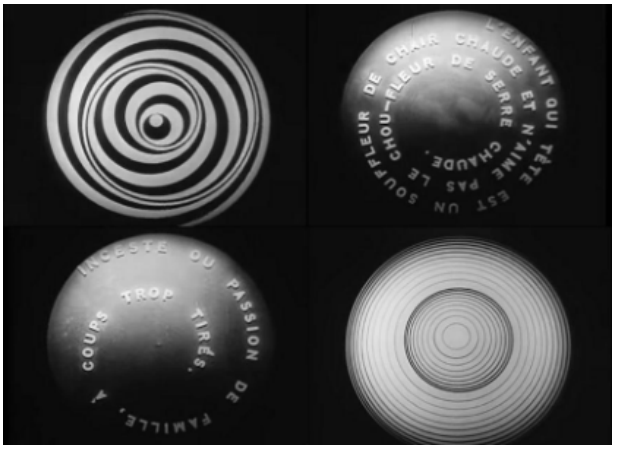


Fig. 1. Duchamp's geometrical and textual Rotoreliefs from *Anémic Cinéma* (Source: Marcel Duchamp, 1926).

Another illustrative example can be seen in digital poetry, which incorporates graphic, visual, and aural components into texts. Some creations explore the plurality of readings that the digital medium allows, enabling greater freedom to establish intertextual relationships through sound and movement [3]. *Sweet Old Etcetera* (2006), by Alison Clifford, operates in this intertextual vein: this digital project attributes movement, forms, and sounds to the poetry of E. E. Cummings, generating new readings and relationships between the different elements that compose the poems (Fig. 2).

In essence, technological innovations bring about functional transformations and profoundly affect art through these evolutions in media. Computational systems allow words to be represented in new ways, creating an ecosystem that enhances the production of artistic works that explore the dynamism and interactivity of typography. Since its inception, the use of written words has changed, and the various techniques at our disposal for producing it have a considerable impact on its appropriation for artistic purposes. Text is more than a supplementary element; it can be central to artistic expression, enriching visual and audiovisual experiences with deeper layers of meaning and interaction.



Fig. 2. *Sweet Old Etcetera* (Source: Alison Clifford, 2006).

III. RIGHT TO COPY

Integrated into a PhD art project that searches for quasi-symbiotic relationships between different verbo-visual dimensions, many works produced in this context try to form mutual bonds between its different materials: e.g., the dynamic properties can perfect the conceptual meaning of textual bodies. However, for this new work, the idea that intrigued us was, in a certain sense, the opposite. When image and word do not combine idyllically. When one hinders or stands in the way of the other.

This premise would lead to the creation of the *right to copy*. This work appropriated stock images that are still embedded with digital and textual watermarks. Would it be possible to compose a poetic object from this dissonance by not omitting this infamous dynamic between word and image?

Another aspect of this work involved adopting accessible digital tools to create typographic audiovisual works. For these reasons, the *right to copy* employed, among other devices, the program Microsoft PowerPoint (PPT) to *create* six short clips. The premise was to use its presentation slides as a scenario for different animations that involved textual, visual, aural, and moving elements.

As for the creative process, it started with gathering distinct source materials to test different concepts. On the one hand, stock photos were gathered from image banks like Adobe Stock or Dreamstime (Fig. 3). These figures would serve as the background for multiple animated scenes. On the other hand, six of Eadweard Muybridge's experiments with motion photography were collected (Fig. 4), which provided the kinetic elements of each scene.

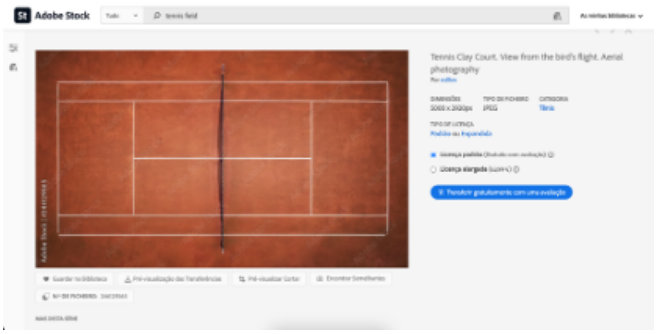


Fig. 3. Example of "Tennis Field" figure gathered from a stock image website (Source: Adobe Stock Photo).

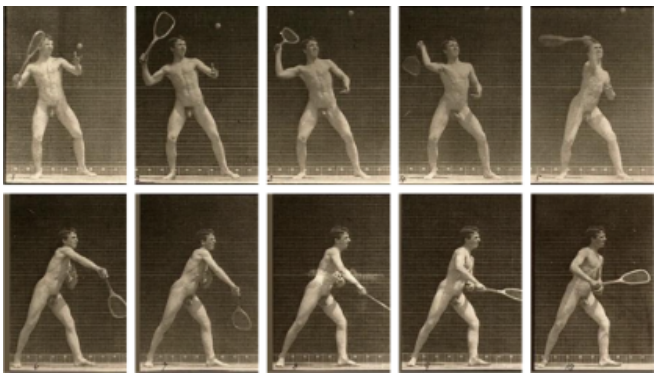


Fig. 4. *Animal Locomotion. Plate 294. Lawn tennis, serving* (Source: Eadweard Muybridge, 1887).

Not only do these pre-cinematic examples manifest a relevant link to a couple of dimensions explored in this project, i.e., image and movement, but they also bring forward another interesting quality to this work, which is, in a certain way, antagonistic to the characteristics of the figures selected for the background. Due to their antiquity and following the copyright laws of the United States of America - the

country of origin of these images - Muybridge's photos are in the public domain. Because of this, an interesting ideological confrontation was created, juxtaposing stock photos that have copyright restrictions with Muybridge's images, which are free to use.

To reinforce this idea, another layer was created on top of the motion studies. This was achieved by producing a textual filter on each frame of Muybridge's compositions. For example, in the sequence where a man serves a tennis ball (Fig.5), each image went through an editing process where the different color segments became typographic elements (Fig. 6). As for the characters themselves, the letters/words chosen were associated with the names of the companies which own the various stock image banks (Fig. 6). By digitally branding these images with letters, what was once free, is now restricted again.

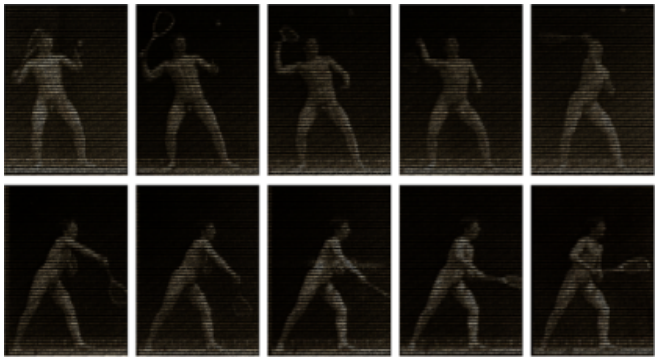


Fig. 5. *Animal Locomotion. Plate 294. Lawn tennis, serving* converted into a text-image replica (Source: authors).



Fig. 6. Detail of *Plate 294. Lawn tennis, serving* covered with the words "Getty images" (Source: authors).

Back to the PPT, the program where the multiple stock images and Muybridge's experiments were uploaded, new ideas could be tested and implemented. The following stages involved playing with the different features of this software to edit and compose six animated scenes (Fig. 7): a) multiply images and edit them, changing their positions, sizes, colors, shadows, or other inherent properties; b) loop the animated images/videos; c) animate the video screens across the slides; d) add sounds and music; e) (de)synchronize the animations and audios; and f) time the transition between slides.



Fig. 7. All six slides/animations from *right to copy* produced using PowerPoint (Source: authors).

In multiple PPT slides, six short animated scenes were created: two men playing tennis in a court, appropriated from *Animal Locomotion, Plate 294*; the famous dancing couple, *Plate 197*; a group of boys playing leapfrog, *Plate 168*; a galloping buffalo, *Plate 700*; a woman bringing a cup of tea to another, *Plate 451*; and four horses racing each other, *Plate 626*. All these videos were combined with stock figures that would (re)contextualize the original images.

This mixture of elements created a playful collage of textual figures and animations that interlace multiple concepts related to the connections between words and images or with what is fair use or not in the digital, creative, and artistic paradigms. In the end, each scene resulted in a small video, although this work was also developed to be played like a PPT presentation with all six scenes being reproduced in a single looped sequence.

IV. MEMÓRIAS
EM MOVIMENTO

After the creative success of the *right to copy*, there was an incentive to keep experimenting with similar concepts: a) the use of PPT slides and functionalities to create animated scenes; b) the use of Muybridge's vast and impressive catalog, since much of it was left to explore; c) the convergence of figurative images with typographic materials.

At the same time, integrated into this PhD project, a parallel study was being developed that delved into a collection of manuscripts from a local figure who wrote extensively about the art of cinema and the moving image.

In 2021, the estate of Fernando Gonçalves Lavrador (1928-2005), an engineer by profession who spent much of their time writing and theorizing about

the seventh art, was donated to Cine-Clube de Avanca (Film Club of Avanca), Portugal. Thus, this institution became responsible for studying, organizing, and promoting the memories and works of this prominent figure in Portuguese culture. His estate is vast, consisting of essays and books authored by him, a personal collection of monographs, film magazines, newspaper clippings, and many other objects related to film.

To disseminate this valuable body of works - currently unavailable to the public -, an artistic project was proposed which will result in several digital and audiovisual works that will bring together, once more, the written word and visual and dynamic elements, providing an immersive and thematically relevant experience about this significant personality.

Regarding the materials for the new production, they are composed mainly of Lavrador's manuscripts, which consist of theoretical essays and oral presentations about cinema, poems, and personal and social chronicles.

This new artistic venture started precisely by using some of the same strategies, methodologies, and tools from *right to copy*. This choice happened due to the new synergies that could emerge from the convergence of Muybridge's pre-cinematic experiments and the written works of Fernando Lavrador. This author endeavored in the moving image as well. These coincidences prompted a new production, a natural evolution of sorts, entitled *memórias em movimento* (*memories in motion*), centered around the elements discussed in this paper. One big difference happened in converting Muybridge's images into textual-imagetic compositions. Instead of covering the images with brand names, the original and unseen handwritten texts of Fernando Lavrador were used.

Once again, six animated sequences have been produced. Regarding the motion experiments, we chose plates *7, Walking*; *33, Walking and carrying a 14.lb basket in hand, hands raised*; *91, Ascending stairs*; *164, Jumping and pole-vaulting*; *219, Stooping, lifting a broom and sweeping*; *344, Striking a blow with right hand*; *386, Miner Using a Pick; 416, Toilet, putting on dress* [4] (Fig. 8).



Fig. 8. Examples of Muybridge's motion experiments appropriated for *memórias em movimento* (Source: Eadweard Muybridge, 1887).

As for the words/texts that would merge with the images, they entailed two small essays: "Do Fenómeno Fílmico à Emoção Cinematográfica" ("From Film Phenomenon to Cinematic Emotion") and "A Mulher e o Cinema" ("Women and Cinema"); another essay (untitled) about the confrontation between cinema as art and as industry; an introduction to Polanski's *Repulsion*; a manuscript for a lecture about the characteristics of National Cinemas; and finally, an incomplete text entitled "Cinema de Amadores, Cinema Independente e Cineclubismo" ("Amateur Cinema, Independent Cinema and Film Clubs").

These materials created and manipulated new text-image compositions in PowerPoint, using previously mentioned techniques and later in DaVinci Resolve, to give new levels of dynamism and interaction between the different slides/animated scenes (Fig. 9).

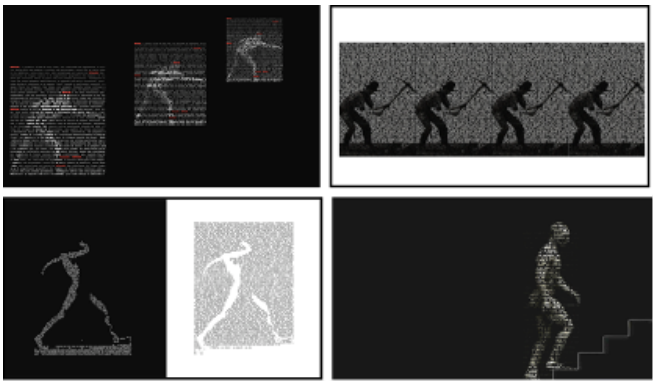


Fig. 9 Four slides/animations from *memórias em movimento* (Source: authors).

To develop the aural dimension of this work, we took inspiration from one of Lavrador's texts, which mentions several French composers, including Claude Debussy. The soundtrack is the 1905 orchestral composition *La Mer, trois esquisses symphoniques, L. 109: II. Jeux de vagues*. The musical piece and the textual images flow together, culminating in a harmonious audiovisual collage.

V. INSTALLATION

Regarding the installation setup for both works, they have been produced to run continuously on PowerPoint in presentation mode. *Right to copy* and *memórias em movimento* are also available to watch in video format [5, 6]. In a gallery/museum setting, the presentations can be experienced with a projection on a wall or with an LCD screen and by using either a .mov/.mp4 or .ppt file. Both works have soundtracks, so it would be advisable to complement the projection with audio speakers or headphones (Fig. 10).

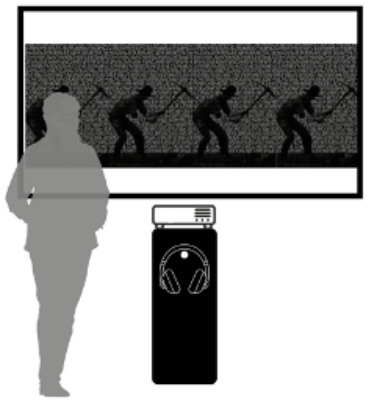


Fig. 10. Schematic for the installation (Source: authors).

VI. FINAL CONSIDERATIONS

*memórias em movimento n*ot only continues the work initiated with the *right to copy*, but it also serves as an intertextual testament and homage to the moving image: from Muybridge's groundbreaking early experiments with a motion to the insightful writings of Fernando Gonçalves Lavrador. Lavrador's contributions to film theory and culture are brought into a new light, merging past and present in a visual and conceptual artistic form.

Moreover, the repurposing of PowerPoint in the creative process highlights the potential of technology, transforming a functional software into an innovative space for artistic expression, where text and imagery converge in unexpected ways.

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REFERENCES

[1] A. Martins and A. Gavina, "Como se constrói uma casa," Vimeo, 2022. Available: https://vimeo.com/764465418.

[2] B. İ. Uyan Dur, "Virtual reality art and immersive experimental typography," Electronic Journal of New Media, vol. 5, no. 3, pp. 219–233, 2017. doi: 10.17932/IAU.EJNM.25480200.2021/ejnm_v5i3002.

[3] A. Neitzel and J. Bridon, "Poesia digital: Reflexões em curso," Literatura y Lingüística, no. 27, pp. 111–133, 2013.

[4] E. Muybridge, Muybridge's Complete Human and Animal Locomotion: All 781 Plates from the 1887 Animal Locomotion, New York, NY, USA: Dover Publications, 1979.

[5] A. Martins, "Right to copy collection," YouTube, 2023. Available: https://youtu.be/Zmd62YZnJ6Y.

[6] A. Martins and A. Gavina, "Memórias em movimento," YouTube, 2024. Available: https://youtu.be/Rx-UAKVftLE.

Development of an untouchable interactivity system for the live cinema performance: SSL2020

Desenvolvimento de um sistema de interatividade intocável para a performance de live cinema: SSL2020

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Abstract—This article reports the creation process of an untouchable interactivity system for the SSL2020 live cinema performance. This system allows the performer to interact live with the audio and visual elements of the artwork and manipulate the film's narrative through body movements. A computer peripheral that detects hand gestures, visual programming software for creating the project, and an intermediate interface that acts as a digital controller were used. Combining these technologies forms a system that doesn't need to directly touch the objects to function during the performance.

Keywords—live cinema, interactive narrative, hand tracking, visual programming

Resumo—O presente artigo relata o processo de criação de um sistema de interatividade intocável para a performance de live cinema SSL2020. Esse sistema possibilita a performer de interagir ao vivo com os elementos áudio e visuais da obra, assim como de manipular a narrativa do filme, através dos movimentos corporais. Utilizou-se um periférico computacional que deteta os gestos das mãos, um software de programação visual para a criação do projeto, e uma interface intermédia que atua como um controlador digital. O conjunto destas tecnologias forma um sistema que não necessita de toque direto nos objetos para funcionar durante a performance.

Palavras-chaves—live cinema, narrariva interativa, rastreamento de mãos, programação visual

I. INTRODUÇÃO

SSL2020[1] é uma produção artística e de investigação em desenvolvimento, iniciada em fevereiro de 2020, com o apoio financeiro de instituições governamentais. A obra já foi apresentada ao público em formato *online* e presencial, em espetáculos ao vivo, e em eventos culturais ou científicos[2].

Trata-se de uma *performance* de género *live cinema* [1] [2], com características da média-arte digital, cuja projeção é um filme narrativo, com estruturas semelhantes às do cinema: a narrativa divide-se em três atos, o I (preparação), o II (confronto), e o ato III (resolução) [3] [4].

Tecnicamente, SSL2020 é um filme, com uma *performer* posicionada em frente da projeção, a simular a ideia de um sonho lúcido, *i.e.*, um sonho que é possível de ser manipulado pelo sonhador, consciente do seu estado mental [5]. Em SSL2020 o filme representa o sonho, e a *performer* representa a sonhadora.

A temática da narrativa baseia-se na aldeia Safara, no Alentejo em Portugal. A sonhadora/*performer* encontra-se no momento presente numa casa local (ato I), no segundo ato apercebe-se que está dentro de um sonho, e no terceiro ato ela viaja para um tempo passado.

Nos espetáculos, a autora projeta e manipula elementos audiovisuais referentes ao local retratado (a aldeia): fotografias analógicas e *samples* de paisagens sonoras — enquanto toca música eletrónica e escrita em tempo real. Os elementos audiovisuais estão agrupados por capítulos (ou atos da narrativa) dentro do *software* de programação visual *Isadora*[3], e ao vivo, a *performer* recorre a controladores MIDI[4] ou ao teclado do computador para modificá-los e editá-los. No entanto, em 2024, pretendeu-se recorrer a sistemas de interatividade intocável [6] — ou sistemas computacionais que detetam os movimentos corporais do ser-humano, sem a necessidade de toque direto no material.

Anteriormente, já havia sido testado o controlador *Leap Motion*[5] para esse propósito, contundo, não

existia forma de detetar o aparelho no *Isadora*, pelo que foi necessário encontrar uma *interface* intermediária (*GECO*[6]), esta atua como se fosse um controlador MIDI, mas digital.

Neste artigo, descreve-se o processo de criação de um sistema tecnológico e artístico, que permite à *performer*, manipular a narrativa, as fotografias analógicas e as paisagens sonoras, através dos movimentos das mãos. Apresentam-se as seguintes questões iniciais de investigação: é possível manipular, através dos movimentos corporais, elementos sonoros, visuais e narrativos, num espetáculo de *live cinema*? Que sistema computacional é funcional para este propósito? Expõe-se a hipótese inicial que é possível existir essa manipulação, se utilizarmos uma *interface* digital e um periférico (*GECO* e *Leap Motion*), no qual juntos atuam como um controlador MIDI, mas sem a necessidade de toque direto nos objetos.

II. METODOLOGIA

A metodologia de investigação neste artigo, é baseada na prática artística, porque é uma investigação original empreendida para obter novos conhecimentos, por meio da prática de um sistema artístico e tecnológico, e dos resultados dessa prática [7].

Os autores criativos (tanto os estudantes, como amadores ou profissionais), conseguem perceber como funciona a criatividade e fazem as escolhas que fazem nos seus processos criativos, através da observação e/ou textos analíticos posteriores à prática [8]. Nas artes criativas, incluindo na média arte-digital, a ênfase está no processo criativo e nas obras que são geradas: o artefacto desempenha um papel vital nas novas compreensões sobre a prática que surgem — nesse sentido, prática e pesquisa atuam juntas de forma a gerar novos conhecimentos, que podem ser compartilhados e analisados [7].

Utiliza-se também neste artigo, como metodologia de investigação, a filosofia do interpretativismo, por apresentar-se as verdades e os conhecimentos como subjetivos, cultural e historicamente situados, baseados nas experiências das pessoas em questão, e na sua compreensão das mesmas [9].

Por fim, recorre-se às teorias da hermenêutica, sendo associada à interpretação dos textos ou documentos — neste caso, aos estudos citados ao longo do texto — e aos seus significados profundos e subjetivos [9].

III. PROCESSO DE CRIAÇÃO

Procede-se nos seguintes textos o relato do processo de criação do novo sistema computacional de interatividade intocável, com o intuito de ser utilizado nas *performances* de SSL2020. O processo dividiu-se em ter etapas: preparação (referente à investigação dos materiais que se pretende utilizar), implementação (criação e desenvolvimento do sistema) e por fim o teste (uma simulação do espetáculo, com a utilização do novo artefacto).

A. Preparação

Inicialmente, fez-se uma pesquisa sobre a *interface* a utilizar, mais especificamente, sobre o seu modo de operar e em que situações e por quem costuma ser utilizado.

> Quais as possibilidades quando o nosso próprio corpo humano, se tornar uma *interface*? O que pode acontecer se existirem aparelhos, capazes de traduzir e transmitir diretamente o que nós fazemos com o nosso corpo, e extrair informação e expressão disso?" [10]

Como já referido na introdução, uma *interface* intermédia é necessária, para conseguir a conexão entre o aparelho que deteta os movimentos das mãos (*Leap Motion*), e o *software* onde o projeto está alojado (*Isadora*). O sistema escolhido foi *GECO* — uma *interface* multidimensional, que identifica os movimentos das mãos no *Leap Motion*, esses movimentos podem ser configurados e programados, e as informações são enviadas para outros *softwares*, através de sinais MIDI [10].

GECO é denominado pelo seu autor (Bevin) por "*software* de música", e o próprio refere que este permite expressar áudio através dos gestos das mãos [10]. No entanto, Bevin [10], ao experimentar o *GECO* e o *Leap Motion* numa palestra, alega que ainda não descobriu como este sistema poderá exatamente funcionar para tocar música em palcos, e que é tão recente quem nem existe ainda vocabulários.

No *website* do *software*, estão demonstrações de vários músicos que já utilizaram o *Leap Motion* e o *GECO*, conectados a outros DAW[7] [11]. É possível entender que estes músicos utilizam os gestos das mãos para diferentes propósitos, como modificar efeitos, trocar de *samples*, aumentar e baixar volumes. No entanto, não é totalmente percetível o que cada gesto está a fazer, não tão percetível como um instrumento musical quando se toca numa corda ou bateria.

Na pesquisa não foram encontrados exemplos onde se utilizasse este sistema para interagir com

narrativas e visuais, apenas com música, pelo que não existirá nenhuma semelhança ou exemplo do que se vai desenvolver para SSL2020.

B. Implementação

A implementação consiste em dois focos principais: criação de novos *patchs*[8] no *Isadora*, e programação de gestos das mãos específicos para ações distintas.

Inicialmente, desenvolveram-se soluções para "tocar" os *samples* sonoros e as fotografias analógicas, individualmente, e a surgir de forma aleatória — na versão anterior, o que se tocava em cada capítulo eram *slideshows* de fotografias e faixas com *samples* sonoros, pelo que não existia uma aleatoriedade dos elementos, e os espetáculos não diferiam uns dos outros.

Para esses propósitos, criaram-se dois *patchs* novos — um para as fotografias e outro para os *samples* (ver figura 1) — onde se utiliza um ator denominado por *Shuffle,* este atua como se fosse um baralho de cartas, quando se tira uma, essa fica de fora, e o processo continua, retirando sempre valores de forma aleatória. Os valores selecionados correspondem ao número do ficheiro dentro de uma pasta pré-definida — neste caso, são as pastas onde se encontram as fotografias e os *samples* correspondentes a cada capítulo.

Desta forma, existe aleatoriedade e improvisação ao vivo — dos elementos áudio e visuais — mas persiste uma continuidade na narrativa, porque os elementos só mudam dentro de cada capítulo ou *scene* [9], *i.e.*, os atos da narrativa apresentam uma linearidade.

Como forma de atribuir gestos corporais para modificar aleatoriamente os *samples* e as fotografias, escolheu-se a presença da mão esquerda aberta para as imagens, e a presença da mão direita aberta para os sons (ver figura 2).

No *patch* do *Isadora*, utiliza-se o ator *Control Watcher* para receber sinais por MIDI (ver figura 1), e no *GECO* (ver figura 2) atribuí-se um número de canal para cada gesto: para modificar as imagens é o *channel 2* e para os sons é o *channel 3.*

Ao experimentar os gestos surgiu um problema, quando se coloca uma mão no *Leap Moption*, o ator *Control Watcher* dispara a funcionalidade do *trigger* várias vezes, e muda várias fotografias e sons de seguida, não havendo assim um controlo real e exato para modificar os elementos, com o gesto das mãos.

Encontrou-se a solução no ator *Multi Blocker* (ver figura 1), com esta funcionalidade, atribuí-se um tempo para bloquear a passagem de um *trigger in* para o *out*, portanto, quando se coloca a mão esquerda, só passado 2 segundos é possível mudar para a próxima fotografia — dá tempo para colocar e retirar a mão — e quando se coloca a mão direita, só passado 10 segundos é possível modificar para o próximo som.

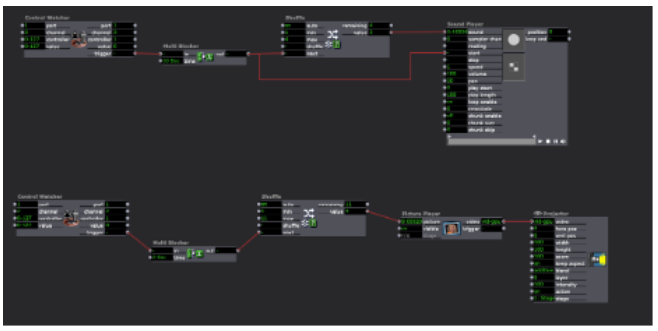


Fig. 1. *Patchs* para trocar imagens e sons *(software Isadora).*

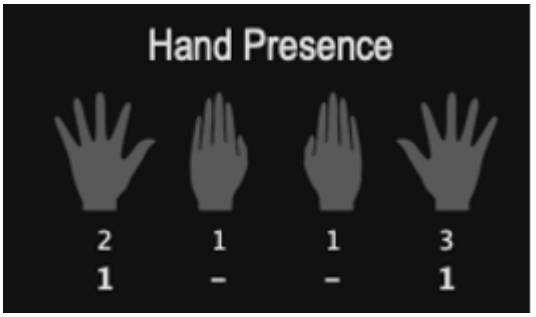


Fig. 2. Gestos para trocar imagens e sons (*interface GECO*).

Na *scene* 2 do projeto — que representa o segundo ato da narrativa, quando a *performer* se apercebe que está a sonhar — em vez de fotografias analógicas, existem duas esferas previamente animadas no *Adobe After Effects*, originárias de duas das fotografias analógicas utilizadas no primeiro ato, denominadas por *Esfera_A* e *Esfera_B*. Nas versões anteriores, estas já eram modificadas com o *Leap Motion,* quando se colocava uma mão, surgia a primeira esfera, quando se colocavam as duas, surgia a segunda. No entanto, para esta versão, decide-se atribuir mais movimento para alternar entre ambas as imagens.

Criou-se dois *patchs*, um para cada esfera (ver figura 3), onde o valor ativado pelo movimento da mão, corresponde à intensidade do aparecimento de cada imagem.

Atribuí-se a posição do gesto (*up and down*) da mão esquerda fechada para o aparecimento da *Esfera_B* e a posição do gesto da mão direita fechada para a *Esfera_A* (ver figura 4). Desta forma, ao vivo,

existe um movimento entre as duas mãos, no qual o resultado final é percetível ao espetador.

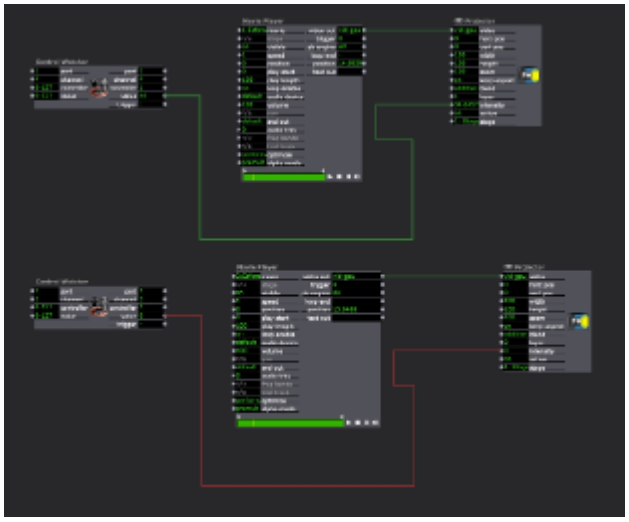


Fig. 3. *Patchs* para alternar entre imagens *(software Isadora).*



Fig. 4. Gestos para alternar entre imagens (*interface GECO*).

Relativamente à mudança de *scenes* (ou atos da narrativa), atribuí-se os gestos das duas mãos fechadas, a moverem-se para a frente e para trás, como mostra a figura 5.



Fig. 5. Gestos para mudar de *scenes* (ou atos) - (*interface GECO*).

Esta ação teve o mesmo problema dos *patchs* para modificar as imagens e os sons, o ator *Control Watcher* é ativado várias vezes quando deteta duas mãos, portanto, utilizou-se também o *Multi Blocker,* para que durante 20 segundos só muda uma vez de cena, assim dá tempo para concluir o *fade out*.

Outra questão foi o facto de quando estamos a utilizar as mãos na mesma *scene*, para outra funcionalidade — por exemplo, para alternar entre as esferas — as cenas mudam também. Apesar de este sistema com o *Leap Motion* e *GECO* reconhecer e permitir programar vários tipos de gestos diferentes, os canais ativam todos só pelo facto de detetar a presença das mãos, não é tão exato como um controlador MIDI, com botões e *knobs*, onde cada toque em locais diferentes no objeto, ativam funcionalidades diferentes, de forma rigorosa.

Encontrou-se uma solução, com os atores *Toggle* e *Gate* (figura 6), no qual se criou uma forma para ativar e desativar a funcionalidade da mudança de cenas, com a tecla "a" do teclado. Como mostra a figura 6, quando o sinal no ator *Gate* está verde, significa que é possível mudar de *scene*, quando está vermelho, significa que a ação está bloqueada.



Fig. 6. *Patchs* para mudar de *scenes* (ou atos) - *(software Isadora).*

Com estes *patchs* e gestos está tudo a funcionar, no entanto, para mudar de cenas é necessário sempre carregar no teclado antes de fazer os movimentos.

C. Teste

Realizou-se um teste das novas funcionalidades relatadas neste artigo[10]. Não se utilizou os restantes elementos da *performance* (escrita de textos em tempo real e música eletrónica), para conseguir ter uma perceção mais imersiva e exata do novo sistema de interatividade intocável.

Observou-se que nesta versão da *performance* e com este novo sistema, conseguiu-se atingir os seguintes resultados:

- Mais movimentos dinâmicos e gestos intocáveis por parte da *performer*;
- Aleatoriedade na ordem dos elementos áudio e visuais, o que torna cada espetáculo diferente um do outro;
- Mudança dos atos da narrativa através de movimentos corporais.

Contundo, entende-se que este sistema *(Leap Motion, GEGO* e *Isadora)* não permite utilizar cada gesto de forma tão exata como um controlador MIDI, as mãos são sempre detetadas e as funcionalidades são todas ativadas, independentemente dos gestos que se programou.

IV. CONCLUSÃO

O processo criativo do sistema de interatividade intocável para a *performance* de *live cinema* SSL2020, foi repartido em três partes: preparação, implementação e teste.

Na preparação investigou-se o novo *software* utilizado *GECO*, criado pelo seu autor em 2013, com o propósito de tocar música através dos movimentos das mãos. No entanto, o autor refere que não existe ainda vocabulário para descrever esta forma de *performance*. Não foram encontradas obras onde este sistema fosse utilizado para *performances* com projeções visuais e com narrativas.

Na implementação foram desenvolvidos novos *patchs* e programaram-se os gestos para as ações pretendidas: manipulação individual e aleatória das fotografias analógicas e dos *samples* sonoros, e para a mudança dos atos da narrativa. Contundo, o facto de o *Leap Motion* ser muito sensível a detetar as mãos, muitas vezes os gestos pré-programados não são reconhecidos e o resultado é confundido. No entanto, foram encontradas soluções através de "atores" no *Isadora*, para que cada gesto só ative a funcionalidade pretendida.

Realizou-se um teste do novo sistema e tudo funciona como pretendido. Concluí-se que poderão existir outro género de tecnologias mais atuais, que possam ser mais precisas e exatas, e permitirem ter mais movimentos ao vivo, e ainda outras funcionalidades através dos gestos das mãos.

ACKNOWLEDGMENTS

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REFERÊNCIAS

[1] Makela, M. (2008). The Practices of Live Cinema. Proceedings of the ARTECH 2008, 4th International Conference on Digital Arts, 7-8 November, Portuguese Catholic University, Porto. pp. 83-91. http://hdl.handle.net/10400.2/1973

[2] Menotti, A. (2015). Live Cinema. In Carvalho, A., & Lund, C. (Eds.), The Audiovisual Breakthrough. (pp. 85-107). Contemporary media art e.V. http://www.ephemeral-expanded.net/audiovisualbreakthrough/

[3] Silva, B. (2021). Comunicação audiovisual: o comboio do amor. (Edição 1). Coleção Humanitas, Centro de Investigação em Artes e Comunicação.

[4] Field, S. (2005). The foundations of screenwriting. (Delta trade paperback revised edition). Bantam Dell, United States.

[5] LA Berge, S., Rheingold, H. (1990). Exploring the worlds of Lucid Dreaming. United States: Ballantine Books.

[6] Perfeito, A., & Silva, B. (2023). Cinema ao Vivo: Compor narrativas lineares através das interfaces intocáveis e dos movimentos corporais dos performers. In ARTECH 2023: Digital Creation Processes-Proceedings of the 11th International Conference on Digital and Interactive Arts, pp. 49-55. http://hdl.handle.net/10400.1/20198

[7] Candy, L., & Edmonds, E. (2018). Practice-based research in the creative arts: Foundations and futures from the front line. Leonardo, 51(1), pp. 63–69. https://doi.org/10.1162/leon_a_01471

[8] Skains, R. (2018). Creative Practice as Research: Discourse on Methodology, Media Practice and Education, 19(1), pp. 82-97. https://doi.org/10.1080/14682753.2017.1362175

[9] Ryan, G. (2018). Introduction to positivism, interpretivism and critical theory. Nurse Researcher, 25(4), pp. 41–49. https://oro.open.ac.uk/49591/17/49591ORO.pdf

[10] Bevin, G. [Geert Bevin]. (2013, junho 28). Leap Motion & GECO - Tech overview (GeekOut 2013 Keynote Excerpt). [Video]. Youtube. https://www.youtube.com/watch?v=KnpHXTpbV-M&list=PLHBN1EA TIE1QWXqo5zfLe77q0cRDTEeuc

[11] Uwyn. (2013, abril 28). Geco showcase - Multi-dimensional MIDI expression through hand gestures. https://uwyn.com/geco/showcase

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[1] SSL2020 é a sigla de *Safara — Sonho Lúcido 2020*

[2] https://anaperfeito.com/Safara-Lucid-Dream-2020

[3] https://troikatronix.com

[4] Sigla para o termo inglês *Musical Instrument Digital Interface*

[5] https://www.ultraleap.com/leap-motion-controller-overview/

[6] https://uwyn.com/geco/

[7] Sigla para o termo inglês *Digital Audio Workstation*.

[8] *Patch* é o termo no *Isadora* para denominar um conjunto de ligações (ou *nodes*), para executar uma determinada funcionalidade num projeto.

[9] *Scene* é o termo no *Isadora* que atua como separador. Neste projeto, corresponde aos capítulos da história, no sentindo em que cada *scene* reúne os elementos áudio e visuais correspondentes a cada ato (ato 1, ato 2 e ato 3).

[10] https://youtu.be/NAs4UnnKSNo

There is no truth / just sensual objects

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Abstract—In the series of works, There is no truth / just sensual objects. The object—stone—is explored through three different forms of representation. The original stone functions as an object independent of cognition, while the print and virtual representation of the 3D model illustrate sensual images dependent on the properties of the perceiving subject. These representations reveal the filters imposed on the object through registration, simultaneously showcasing the illusions that the human eye imposes on the perception of the real object.

The use of touch as a tool for discovering the truth about the object emphasizes the sense-making role of the body. In analyzing the tension between different representations, the work refers to the postulates of new materialism, emphasizing matter's capacity to determine and cause actions. By combining nature with technology, the piece creates a metaphor for extended reality—a contemporary realm where virtuality blends with matter.

Keywords—visual cognition, new materialism, 3D scan, 3D print, Object-oriented ontology

I. INTRODUCTION

In the series *There is no truth / just sensual objects*; the object—stone—is presented through three forms of representation. The original stone illustrates an object independent of cognition. The print serves as an image filtered through technology—registration independent of human cognitive properties and stripped of qualities projected onto the object by the human eye and acquired knowledge [1]. The virtual representation—a 3D model in a digital frame—appears objective and cold yet inaccessible. The comparison of material forms reveals properties projected by the human mind onto the object. In a self-centered act of perception, qualities such as color provide information leading to eye-based conclusions, which may be misleading. A fundamental example from image theory illustrates this phenomenon: light and dark colors create non-existent optical spatial relationships, exaggerating depth contrast between illuminated and shadowed areas [2].

The search for truth about the object shifts to the sense of touch—the hand tracing the stone examines its structure. One sense becomes a frame of reference for another, prompting doubt and questioning the already-formed mental image. The process of perception transforms into a critical analysis of gathered data. Each representation highlights the influence of the perceiving subject, demonstrating how the image of an object changes depending on the observer's cognitive properties. Technology is both an indicator of the limitations of human perception and a tool that broadens the scope of what can be perceived [3].

The installation explores the essence of the object, which remains unchanged despite being captured in different forms of representation. At the same time, *there is no truth / just sensual objects* engage in a symbiotic relationship with technology, demonstrating its role in enhancing human abilities and extending the body's limitations.

II. EVERYDAY LIFE, OBJECTS

In everyday life, objects retreat from the spectrum of a subject's attentive perception. Referring to Heidegger's ideas, entities exist in the human world as what he calls equipment, meaning they are responsible for certain tasks. They become readable forms, perceived as tools or sensory artifacts [4]. When spotting an object, the mind searches for its mental picture to define its function and character. As a result, objects are not fully perceived but glanced at to ensure the efficient functioning of human activity. While crossing the street, the color of traffic lights is perceived, but the detailed features of the lamp—such as the degree of metal corrosion or the way light moves across its surface—tend to be neglected.

According to Heidegger, objects exist primarily as tools within this framework [5].

Reflecting on an object through different materials or recording methods frees it from the human-determined realm. The common phrase "It looks good on camera" suggests that recording highlights advantages while concealing weaknesses in an object's appearance. What becomes significant is the cognitive process of the camera operator. Their relationship with the object extends through the data gathered using a tool that broadens perception. Rather than acting as a magic wand that transforms reality, technology is an additional perspective that enriches the picture [6].

Stones are collected based on visual complexity and intuitive appeal. Working with them over time reveals their features, structures, and the history that has shaped them. Photography is a means of documentation, keeping track of the objectified collection. The camera captures a stone's features differently from the human eye. The eye adapts to changing lighting or contrast rapidly, allowing brightness and darkness to be perceived almost simultaneously. The only adjustment required is the imperceptible blink that enables the pupil to regulate light intake. In contrast, a camera's aperture remains fixed, capturing brightness with a consistent reference point rather than one that shifts dynamically [7].

Grounding Heidegger's thoughts in object-oriented ontology, Graham Harman distinguishes between the sensory object—a form accessible through perception—and the tangible form, the actual object-as-it-is, which is never fully attainable in knowledge. He emphasizes that both ways of seeing—tools-in-use and things—are shaped by human beings. However, the stone existed before humans shaped it into a tool, which will continue to exist even when it disappears from the perceptual horizon. Because of this, objects do not necessarily require a subject for their existence; therefore, the subject should not be included in the acknowledgment of their reality [8].

Limiting the existence of objects—whether animals, resources, flora, or tools—to only their connection to humans has led to severe consequences, shaping the environment into a catastrophe. These consequences stem from neglecting a broader perspective and lacking awareness of the limitations of human knowledge. Things exist outside human references and create networks of mutual interconnectivity.

The human body limits perception, restricting access to features beyond its capabilities. Technology enables the collection of data otherwise inaccessible without specialized apparatus. For example, while the human eye cannot perceive infrared (IR) or ultraviolet (UV) light, these wavelengths are integral to everyday life and specialized fields. X-rays reveal the body's inner structures, radio waves enable communication, and IR satellite images assist in weather prediction, among many other applications. Uncovering hidden realms begins once perceptual limitations are extended, fueling itself like a snowball. However, it is not reality that changes—it is the vision of the world. Phenomena such as global warming and solar radiation have become apparent—not invented—through these expanded technological lenses.

Following this path of extending knowledge through different lenses of perception, a 3D scanner became the following exploration tool. The assumption was that this technology would allow for an objective examination of the stone's form. Previous camera-based records were expanded by adding depth. However, the scanner operated differently than the logic of human perception. Initially, it seemed that gathering final models and then checking their accuracy through comparison would be a straightforward approach. However, this process (merging) proved misleading for the scanner and resulted in glitches. More precise scans required an ongoing scanning process with pauses to change perspectives. These pauses had to occur when many characteristic and defining features were visible, ensuring they remained identifiable even after shifting perspectives. This helped prevent the scanner from losing track.

Another divergence between human vision and the scanner's function involved darkness and shadows. It was assumed that some parts might be covered in shadow during scanning and that adjusting the perspective later would reveal these areas. However, darkness was misleading for the scanner—rather than labeling shaded areas as unknown, it lost track and began to glitch.

This collaboration with recording technology prompted a deeper questioning of perception, revealing unconscious, intuitive mechanisms. More importantly, it exposed how naturally human ways of

seeing are projected onto mechanical tools. With the 3D scan displayed on a computer screen, the accuracy of the scan was examined by framing the stone's features within a focused area and checking them in the virtual representation. Some features became noticeable only after appearing on the screen, prompting verification through touch, as vision alone proved misleading.

The virtual representation required movement and rotation to appear as a spatial object. Printing the models allowed for examining the correlation between each version's features. The printing process introduced its characteristics to the stone's form. The lines created by the nozzle—the printer's resolution—became visible. These formations resembled isometric lines on geographical maps, acting as guidelines to navigate the stone's depth. Their presence was unexpected. Once again, in an assumption of control, the machine was viewed merely as an executor of human will—a transparent agent carrying out an idea. The silent implementer of materialization had been overlooked. Matter, often seen as lifeless and subordinate, revealed its creative qualities throughout the process of shaping *There is no truth / just sensual objects*.

The tension between the three representations of the object demonstrates the impact of material on the image of things. Agentive and independent matter forms one of the tenets of the new materialism movement. Its proponents argue that there is no ideal creative subject whose intention governs the created work. Matter organizes itself from the ground up and possesses its agency (vitalism), engaging in a dialogue with the creator when they meet.

Using technology as a recorder relies on non-human properties of perception, constructing an alternative version of the sensory object whose features, like those of the original, point to the essence of the stone. The digital frame acts as a portal to a virtual representation. Dialogue with tangible objects highlights the properties of the material in which the object manifests. For the viewer, the stone in three iterations encourages an exploration of the essence of this object. It also prompts a closer examination of everyday, common objects. Unfamiliar perspectives on one's surroundings lead to a deeper view of what is around us, as seeing differently is seeing anew.

Where does the stone come from? The phrase "cold as stone" is often used to describe someone unemotional, yet the form of the stone itself tells a story with honesty and clarity. Environmental forces smooth areas that have broken away from the whole or mark them sharply, with jagged edges testifying to the rupturing forces of pressure or temperature. The shimmering surface reveals the minerals it comprises. The grain size indicates the cooling process of lava, while the smoother texture of certain forms shows the sedimentation of minerals forming sedimentary rocks. The stone bears witness to Earth's formative forces.

In common perception, nature appears as an idyllic space untouched by human activity. Following the ideas of T. Morton, the creator of *Dark Ecology*, such a definition aligns more with naive illusions that romanticize reality than with truth. Morton encourages viewing post-industrial spaces as a new kind of nature, accepting the impact of human activity on environmental change, and taking responsibility for the consequences of development. By merging nature with technology, a synergy between these two worlds emerges. Combining cybernetic properties with familiar reality creates a threshold between what is known—and what is yet to come.

III. THE ARTWORK



Fig. 1 Installation – there is no truth, just sensual objects, frame, object 1, object 2, text (in Polish), 2022.

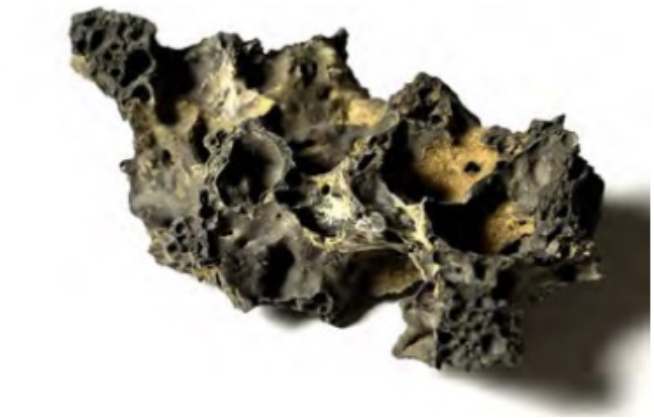


Fig. 2 Installation – there is no truth, just sensual objects - detail - object 1 - found stone (slag), 2022.



Fig. 3 Installation – there is no truth, just sensual objects - detail - object 2 - printed model, 2022.

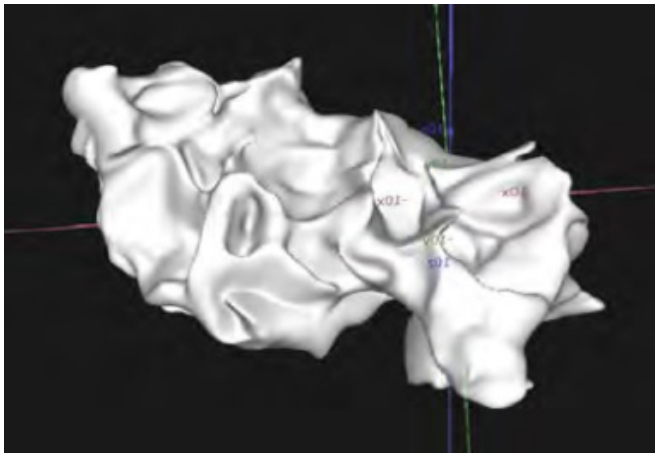


Fig. 4 Installation – there is no truth, just sensual objects - detail - object 3 - virtual model, 2022.



Fig. 5 Installation – there is no truth, just sensual objects: The Monolith, overview: digital frame, object 1, object 2, photographic triptych, 2024.



Fig. 6 Installation – there is no truth, just sensual objects: The Monolith, detail: digital frame, object 1, object 2, 2024.



Fig. 7 Installation – there is no truth, just sensual objects: The Monolith, detail: photographic triptych (of the stone), 2024.

REFERENCES

[1] R. Arnheim, Art and Visual Perception. Berkeley, CA, USA: Univ. of California Press, 1974.

[2] B. K. Bergen, Louder than Words: The New Science of How the Mind Makes Meaning. New York, NY, USA: Basic Books, 2012.

[3] M. Gołaszewska, Aesthetics of Modernity. Warsaw, Poland: Wydawnictwo Naukowe PWN, 1984.

[4] E. Gombrich, Art and Illusion. London, U.K.: Phaidon Press, 2009.

[5] N. Goodman, Ways of Worldmaking. Indianapolis, IN, USA: Hackett Publishing, 1978.

[6] M. Heidegger, Being and Time. Albany, NY, USA: State University of New York Press, 1996.

[7] J. Gibson, The Ecological Approach to Visual Perception. Boston, MA, USA: Houghton Mifflin, 1979.

[8] G. Harman, Object-Oriented Ontology. London, U.K.: Pelican Books, 2018.

[9] Ł. Guzek, The Art of Installation. Gdańsk, Poland: Słowo/Obraz Terytoria, 2014.

[10] R. Ingarden, Studies on Aesthetics. Warsaw, Poland: Polish Scientific Publishers PWN, 1973.

[11] R. Kluszczyński, Interactive Art. Warsaw, Poland: Wydawnictwa Akademickie i Profesjonalne, 2010.

[12] B. O'Doherty, Inside the White Cube. Berkeley, CA, USA: Univ. of California Press, 1986.

[13] M. Ostrowicki, Aesthetics of Virtuality. Kraków, Poland: Universitas, 2005.

[14] R. Pfaller, Interpassivity: The Aesthetics of Delegated Enjoyment. Edinburgh, U.K.: Edinburgh Univ. Press, 2017.

[15] L. Wiesing, Artificial Presence. Stanford, CA, USA: Stanford Univ. Press, 2010.

[16] J. Gierasimiuk, "Sociology of scientific knowledge of Ludwik Fleck," Quarterly Journal of History of Science and Technology, vol. 26, no. 3, pp. 533–548, 1981.

[17] B. Latour, "Visualization and cognition: Drawing things together," Knowledge and Society: Studies in the Sociology of Culture Past and Present, vol. 6, pp. 1–40, Jai Press, 1986.

[18] K. Lipka, "Intentional object in the context of the creative process," Art and Philosophy, vol. 40, no. 2, 2021.

[19] A. Ogonowska, "Society of the spectacle: Precursors and their contemporary intellectual heritage," Future. World - Europe - Poland, no. 1, 2012.

[20] R. Shusterman, "Thinking through the body," Journal of Aesthetic Education, vol. 40, no. 1, Spring 2006.

[21] R. Shusterman, "On the end and purpose of aesthetic experience," Theory Literature-Culture, no. 1, 2006.

[22] P. Sznajder, "Dialogical dimension of Hans-Georg Gadamer's philosophy of art," Studies in the History of Philosophy [Online], vol. 13, no. 2, pp. 101–117. [Accessed: Apr. 7, 2024].

Hands - Reimaginando as Tradições Artesanais e a Expressão Urbana

Hands - Reimagining Craft Traditions and Urban Expression

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Abstract—This paper proposes an artifact that embodies the duality between the virtualization of the artwork and the tangibility of urban craft traditions. "Hands" is part of a series of artifacts that reinterpret textile craft traditions within the contemporary urban context, aligning with a post-digital aesthetic approach. By leveraging rematerialization and the digital's capacity to preserve and amplify intangible heritage, this work seeks to foster a dialogue between tradition and innovation, emphasizing the significance of textile art as a medium for cultural reflection and preservation in the post-digital environment.

Keywords—Artistic Creation, Post-Digital, Rematerialisation, Textile Art, Multisensory Interaction

Resumo — Este artigo propõe um artefacto que incorpora a dualidade entre a virtualização da obra de arte e a tangibilidade das tradições artesanais urbanas. "Hands" faz parte de uma série de artefactos que reinterpretam as tradições do artesanato têxtil no contexto urbano contemporâneo, alinhando com uma abordagem estética pós-digital. Ao tirar partido da rematerialização e da capacidade do digital para preservar e amplificar o património imaterial, esta obra procura promover um diálogo entre tradição e inovação, sublinhando a importância da arte têxtil como meio de reflexão e preservação cultural no ambiente pós-digital.

Palavras-Chave—Criação Artística, Pós-Digital, Rematerialização, Arte Têxtil, Interação Multisensorial

I. INTRODUÇÃO

"Hands-an homage to textile craft traditions" constitui-se como uma série de objetos artísticos em que coexistem artefactos no seu formato tangível e virtual. Aqui propomo-nos a apresentar 2 artefactos anteriormente expostos no festival de arte urbana *48 Stunden Neukölln*, em Berlim em 2024.

As mãos são o elemento central da obra, pelo seu poder expressivo e comunicativo, pela sua associação direta aos saberes tradicionais. Nestes artefactos as mãos convidam os espectadores, que, silenciosas, estas mãos atraem através do ruído dos padrões estampados, pela expressão dos gestos e pela composição.

Em uma aproximação a uma estética pós-digital, em que as fronteiras entre o analógico físico tangível e o digital se tornam porosas, este projeto propõe uma reflexão sobre o contributo que o processo da virtualização dos processos criativos das artes mais tradicionais pode contribuir para a sensibilização da urgência de salvaguardar esse mesmo património imaterial, sem abandonar a sua essência física e cultural. O artefacto aqui apresentado pretende interrogar as relações entre tradição e tecnologia, re-imaginando os gestos e padrões têxteis que caracterizam as práticas artesanais no ambiente urbano contemporâneo. Ao transformar o silêncio e o som das tradições em estímulos visuais e táteis, "Hands" conecta os espectadores com o ruído simbólico e as nuances das práticas criativas artesanais, reintroduzindo a importância da experiência sensorial no meio digital.

Esse diálogo entre a virtualização e a tangibilidade dos materiais tradicionais ressoa com o conceito de rematerialização, em que o digital não apenas replica, mas também amplifica a presença física e cultural do objeto. Através da interação entre os artefactos virtuais e físicos, a série explora como o espaço digital pode ser um agente de preservação e inovação, salvaguardando o patrimônio imaterial enquanto desafia o espectador a reavaliar a estética, a função e a presença dos objetos na sua forma material e virtual.

II. CONTEXTUALIZAÇÃO TEÓRICA

A. A rematerialização numa aproximação à estética pós-digital

Numa perspetiva da estética pós-digital, o conceito de rematerialização dos artefactos de cariz artístico surgem como resposta ao excesso de intangibilidade promovido pelas práticas artísticas digitais contemporâneas [1].Esta rematerialização, longe de rejeitar o digital, utiliza-o como um ponto de partida para reintroduzir a fisicalidade e a tangibilidade nos processos artísticos. Para alguns autores como Bishop [2], o regresso ao material na arte representa uma tentativa de recentrar a experiência sensorial e as interações táteis, que muitas vezes se perdem na experiência mediada pelo ecrã. Este movimento de retorno à materialidade responde, assim, a uma necessidade contemporânea de ressignificar o digital através da integração de elementos físicos e sensoriais.

A estética pós-digital, conforme explorado por Cramer [3], é caracterizada pela transição da visão puramente digital para uma prática híbrida, onde a materialidade e o digital coexistem de forma dinâmica e interdependente. Este novo paradigma sugere uma estética que recusa os limites impostos pela imaterialidade digital (ou mesmo a ausência de limites físicos), promovendo a reintrodução de características táteis e físicas na produção artística, explorando texturas, volumes e a tridimensionalidade, que desafiam a bidimensionalidade da tela. A rematerialização dos artefactos de cariz artístico pode, assim, ser vista como uma resposta crítica e evolutiva da prática artística pós-digital, visando superar a limitação experiencial da arte mediada apenas pelo virtual [4].

Este fenómeno é particularmente evidente nas práticas artísticas contemporâneas que envolvem arte têxtil e média-arte digital onde a materialidade do suporte se cruza com a tecnologia. Nesta linha, Hansen [11] explora como a tecnologia, ao contrário de desmaterializar o objeto, pode acentuar a sua presença física, tornando-o um artefacto estendido. Na arte têxtil, a rematerialização pode atingir uma expressão particular, onde o toque e a textura do tecido são revalorizados, não como meros suportes, mas como partes essenciais da obra, possibilitando novas experiências táteis e hápticas.

O recurso à recriação de materiais que apelam ao toque e à curiosidade sensorial do público, mesmo quando a obra é apresentada no seu formato virtual, despertam a vontade do publico em conhecer a obra na sua vertente tangível, procurando sentir e explorar a fisicalidade da peça, criando uma relação envolvente entre o público e o objeto artístico.

As texturas e superfícies apelam ao toque, o artefacto desafia o observador a experienciar a obra de forma multissensorial, permitindo-lhe transcender a simples observação visual para um nível de fruição tátil e emocional. Este processo reforça a conexão entre o espectador e a obra, estimulando uma resposta afetiva e, em simultâneo, crítica, onde o público é incentivado a refletir sobre a própria natureza do digital e do físico, interagindo com os limites de ambos [5].

Simultaneamente, a intangibilidade do meio digital amplia as possibilidades de participação, colaboração e partilha nas redes sociais, tornando a obra num evento coletivo e interativo. Através da mediação digital, o público não só interage diretamente com a peça como partilha a experiência online, promovendo a obra numa esfera pública mais ampla. As redes sociais, ao possibilitarem a documentação e a divulgação destas experiências, transformam a fruição individual numa discussão global, onde múltiplos espectadores podem reinterpretar e influenciar o significado da obra, e promovendo uma democratização da experiência artística, onde a participação ativa do público se torna uma extensão essencial da obra, expandindo as suas potencialidades através da interação sensorial e do diálogo social alargado.

Assim, o diálogo entre rematerialização e estética pós-digital não é apenas um retorno nostálgico ao físico, mas sim uma tentativa de criar um espaço híbrido onde a tecnologia dos medias digitais e a materialidade se reforçam mutuamente. Este diálogo ressignifica o papel do digital na arte contemporânea e expande as possibilidades de interação sensorial, oferecendo ao espectador uma experiência complexa que integra o melhor dos dois mundos [6], [7].

B. A arte têxtil num contexto pós-digital

Utilizando o termo arte têxtil para nos referirmos especificamente a objetos com propósitos artísticos, produzidos em materiais têxteis (físicos ou simulados na sua versão digital).

O surgimento da arte têxtil no panorama da arte contemporânea floresceu com a estética pós-digital. Os artefactos pós-digitais questionam e obrigam-nos a repensar a forma como a moda e os têxteis são expostos nas galerias/museus, o seu lugar enquanto objeto artístico e a interação entre este e o público. Em muitos casos, são objetos de desejo que se tornam agentes de indução do pensamento crítico. Os objetos de arte têxtil pós-digital são artefactos com intenções artísticas e não apenas comerciais ou de marketing.

A maioria destes artefactos tem suportes materiais (esculturas têxteis, instalações artísticas, ou outros), mas cada vez mais são complementados (em parte ou na totalidade) por rematerializações digitais/virtuais [8].

A arte têxtil, mais do que feita de artefactos expostos para apreciação passiva do seu discurso estético visual, tem tendido também para os artefactos que apelam ao toque, olfato e manuseamento dos materiais, visando uma imersão multissensorial na obra. Quando se deixa impregnar pelo digital, a arte têxtil apresenta-se com uma estética usualmente pós-digital, aportando ainda dimensões da experiência sensorial imediata e efémera, uma forma de hipermoda [9].

Seguindo a linha de pensamento de Catherine Dormor [10], o têxtil pode ser visto como um material, um conceito, uma linguagem ou uma metáfora. A reflexão acerca da relação entre a teoria e a prática artística têxtil implica, simultaneamente, considerar a materialidade e a expressividade do têxtil enquanto matéria, mas também a linguagem suscitada pelo têxtil.

III. TRABALHOS E EXPOSIÇÕES ANTERIORES

Os autores deste artigo têm vindo a desenvolver vários trabalhos e reflexões acerca da materialização das tradições têxteis sob uma perspetiva pós-digital. São exemplos disso: *Demora-te* (apresentada em 2015 na Artech em Óbidos), *Ecoações* (apresentada em 2015 na XVIII Bienal de Arte Contemporânea de Vila Nova de Cerveira), *Al-Andaluz Têxtil* (apresentado em 2017 na XIX Bienal de Arte Contemporânea de Vila Nova de Cerveira).

"Hands - an homage to textile craft traditions", nasceu na sequência da instalação "*Entre tecidos*" apresentada em 2021, na abertura do Ciclo de Exposições INVITRO, em Mértola, Portugal

Em "*Entre Tecidos*", a instalação toma como ponto de partida os padrões tradicionais da tecelagem e a influência representação do padrão. A tela é explodida, de onde saem fios e cordas que se expandem pelo espaço cénico da instalação, de forma a remeter para as urdiduras dos teares e simultaneamente as cordas das tradições fluviais, de onde eram estabelecidos os contactos e as trocas comerciais e culturais com o mediterrâneo. No espaço cénico, existem duas esculturas têxteis com cerca de 1 m, que remetem para as mãos a agarrar e a separar os fios. Um vídeo é projetado nas superfícies da tela, que consiste numa animação acerca dos motivos da tecelagem, (re)materializando a instalação física no ecrã.

Neste espaço, o espectador pode precorrer e visualizar de perto os elementos que compõem a instalação, de forma livre, não havendo regras pré-estabelecidas. Pretende-se também que para além da experiência háptica e interativa do espectador dentro da instalação, exista também uma experiência partilhável pelos espectadores nas redes sociais, dando assim uma continuidade à instalação.

O primeiro artefacto desta série "Hands" é um painel têxtil (veja-se figura 1), exposto, pela primeira vez na exposição coletiva *Bodyspaces* - CANVAS INTERNATIONAL ART FAIR 2023 em Veneza, no Palazzo Albrizzi-Capello, com organização de ITSLIQUID GROUP.



Fig. 1: Aspeto do Painel Têxtil da série "Hands".

Este painel é composto por 18 mãos e braços confecionados em tecidos de algodão branco com 2 padrões diferentes: um estampado característico dos tecidos tradicionais de "chita" portugueses, e um estampado de capulanas africanas, para mostrar a diversidade das artes têxteis.

O espectador é convidado a tocar o painel, descobri-lo através do tato e unir as mãos às mãos da obra.

Todos os elementos do painel são feitos de materiais têxteis, pelo que são maleáveis sem perder a forma inicial

Posteriormente, em 2024, o painel foi também exposto na galeria *The House of Smalls*, em Edimburgo.

IV. DESCRIÇÃO DO ARTEFACTO PROPOSTO

Artefacto 1: escultura com movimento



Fig. 2: Vista geral da escultura 3d do Artefacto 1 proposto.

O artefacto (veja-se figura 2) é composto por 18 mãos/braços, com 9 movimentos diferentes, cada par de braços têm uma textura própria em materiais diferentes, sendo na sua maioria materiais têxteis, com cores radiantes e alegres.

O artefacto é esculpido e apresentado em 3d de forma a ser instalado em qualquer sala de exposição virtual (na impossibilidade poderão ser expostas fotografias do artefacto) e em realidade aumentada através da aplicação *Adobe Aero*, possibilitando a interação do utilizador e a posterior partilha da obra.

A escultura, na sua aplicação de realidade aumentada, tem som ambiente e um movimento giratório, veja-se o exemplo através do *qr-code* disponibilizado na figura 3.

Fig 3: *Qr-Code* para acesso ao vídeo da Realidade Aumentada do Artefacto 1.

Artefacto 2: painel sonoro



Fig 4: Vista geral da escultura 3d do Artefacto 2 proposto.

O segundo artefacto (veja-se figura 4) é composto por 8 mãos, modeladas em 3d, simulando materiais têxteis.

O artefacto, quando acedido na aplicação de realidade aumentada *Adobe Aero*, é interativo, com efeitos diferentes em cada mão. Foram selecionados 8 sons diferentes associados às tradições têxteis e às atividades e saberes associados: 3 sons da produção dos tecidos em teares tradicionais (o som do bater do pente, da passagem da laçadeira e do mexer dos pedais), 2 sons do rasgar do tecido, 2 sons de máquinas de costura em funcionamento e 1 som das agulhas de feltragem. Estes sons na sua maioria foram capturados nos locais ao decorrer das atividades têxteis e em alguns casos recorreu-se a bibliotecas de sons já existentes

Na aplicação de realidade aumentada os sons estão ligados a cada objeto (a cada mão), são acionados individualmente pelo utilizador ao tocar a primeira vez no objeto ligado, e ao tocar a segunda vez desliga esse som, assim possibilitando que possa combinar vários sons ou ouvir individualmente.

O objetivo dos autores com esta interação na obra, é que o utilizador descubra o objeto, repare em maior pormenor ao tocar e descobrir as diferenças de materiais e o som de cada mão e simultaneamente despertar o desejo por conhecer mais sobre as tradições têxteis representadas visualmente e sonoramente.

Incorporar sons e texturas nos artefatos de arte têxtil enriquece a experiência do fruidor, proporcionando uma interação sensorial mais profunda e envolvente, o que vem permitir ainda a ligação emocional e cultural mais significativa com a obra. Além disso, a inclusão de sons e texturas pode

evocar memórias e emoções, tornando a experiência artística mais pessoal e imersiva.

REFERÊNCIAS

[1] C. Paul, Digital Art. London: Thames & Hudson, 2015.

[2] C. Bishop, Artificial Hells: Participatory Art and the Politics of Spectatorship. London: Verso, 2012.

[3] F. Cramer, "What Is 'Post-digital'?". Berry, D. M., & Dieter, M. (Eds.), Postdigital Aesthetics: Art, Computation, and Design (pp. 12-26). London: Palgrave Macmillan, 2015.

[4] S. Pereira, A, Fernandes-Marcos, "Post-Digital Fashion: The Evolution and Creation Cycle." ZoneModa Journal, 11(1), 71–89, 2021https://doi.org/10.6092/issn.2611-0563/13121

[5] L. U. Marks, Touch: Sensuous Theory and Multisensory Media. Minneapolis: University of Minnesota Press, 2002.

[6] S. O'Sullivan, Art Encounters Deleuze and Guattari: Thought beyond Representation. London: Palgrave Macmillan, 2006.

[7] O. Grau, Virtual Art: From Illusion to Immersion. Cambridge, MA: MIT Press, 2003.

[8] A. Fernandes-Marcos, S. Pereira, "Post-digital textile aesthetics: a critical reflection on the process of digital re-materialization of artifacts," ARTeFACTo- Third International Conference on Digital Creation in Arts, Media and Technology, 2022.

[9] G. Lipovetsky, "Da leveza. Para uma civilização do ligeiro", Lisboa: Edições 70, 2016.

[10] C. Dormor, "A Philosophy of Textile," 1st Bloomsbury Publishing, 2020. Available at: https://www.perlego.com/book/2035523/a-philosophy-of textile-pdf

[11] M. B. N. Hansen, Bodies in Code: Interfaces with Digital Media. New York: Routledge, 2006.

Interactive Places: Exploring Visual Systems and Storytelling through Immersive Experiences Abstract

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Abstract—Interactive Places is a project encompassing a set of parallel stories with affective awareness, which has been experienced in recent years in Hong Kong and Macau. This project explores the interplay between design, storytelling, and cultural anthropology, and this project draws on the insights of Pink (2013), who emphasizes the importance of visual methods in ethnographic research. Her work, Doing Visual Ethnography, provides a foundation for understanding how visual representations can enrich narratives and enhance cultural understanding. The project underscores the significance of user-centered design in creating immersive experiences that resonate with visitors. As Norman (2013) argues in The Design of Everyday Things, prioritizing the needs and perspectives of users is essential for effective design. This approach fosters a deeper emotional connection between the audience and the presented narratives. By aligning the design with the visitors' experiences, the project cultivates a more engaging and meaningful interaction with the sociocultural contexts of Macau and Hong Kong.

Moreover, this work aims to transport visitors into an immersive and sensory experience where each photographic moment reveals narratives about people, cities, and objects. The role of storytelling as a fundamental component in cultural anthropology is emphasized, highlighting its significance in shaping cultural understanding and transmitting knowledge across generations (Babcock, 2004) and how narratives inform social dynamics and identity within communities. A particular focus on Portuguese heritage provides a deeper exploration of visual representations, making the information more memorable and engaging.

The methodology of this project combines ethnographic research with documentary observation, collecting visual data without preconceived notions about social interactions. An open-minded approach, characterized by curiosity and a willingness to absorb the unknown, is essential. This data collection centers on the local societies of Macau and Hong Kong, allowing the collected stories to illuminate individuals' customs and social dynamics. The immersive experience is enhanced through augmented reality (AR), where each photograph is synchronized with an interactive video. This video provides a location map of the photo's location, enriching the understanding of the sociocultural context.

*The project's results highlight how visual representations and ethnographic research create new experiences that reflect individual perceptions and collective sharing. The images, objects, and forms acquire sociocultural meanings, transforming these representations into vehicles for cultural identity affirmation. *Interactive Places* offers a visual narrative and invites visitors to reflect on the interconnection between design and sociology, emphasizing the crucial role these stories play in forming collective and cultural consciousness.*

Keywords—Storytelling; Ethnographic Research; Immersive Experience; Cultural Anthropology; Cultural Heritage

I. INTRODUCTION

Interactive Places represents a confluence of storytelling, cultural exploration, and technological innovation. It delves into the parallel narratives of individuals and communities in Hong Kong and Macau, highlighting their unique experiences while fostering a deeper understanding of cultural heritage. By integrating photography, augmented reality, and ethnographic research, the project aims to create an immersive environment that emotionally and intellectually engages visitors. This paper discusses the project's foundations, methodology, and outcomes, illuminating how visual systems can convey complex cultural narratives.





Figure 1 and Figure 2 | Contrasts between Hong Kong Barbour with the Star Ferry, on the left and the right a traditional shop in Macau. These images reflect the diverse visual narratives of modernity and heritage that shape these interconnected communities.

II. METHODOLOGY

The methodology employed in Interactive Places is multifaceted, combining ethnographic and documentary observations as a qualitative research method.

Ethnography allows for a deep interpretation of a community's cultural and social dynamics (Geertz, 1973). The project emphasizes a curiosity-driven approach, where I immerse in the local context without preconceived notions. This openness facilitates authentic engagement with the communities of Macau and Hong Kong.

1. Ethnographic Observation:

Ethnography serves as the main approach of this research process, allowing for a deep understanding of this study's cultural nuances and social dynamics. It involved studying people and cultures through immersive observation and my participation in their daily lives. The focus was on understanding the community's beliefs, behaviors, rituals, and social dynamics from an insider's perspective, capturing the richness and complexity of human experience. As part of the outcomes of ethnographic observation, a holistic understanding of cultural practices, meanings, and social structures was achieved, which in turn aids in the detailed interpretation of the way of life of the studied community.

2. Documentary Observation:

Alongside ethnographic methods, documentary observation as a research method provides a systematic collection and analysis of visual artifacts - photographs and videos. Primarily, the focus is on capturing and analyzing the existing materials to get insights into the cultural phenomena by offering a sensory layer to the research. Emphasizing the documentation of observable aspects of culture rather than participant interaction. Moreover, documenting everyday life and rituals through a structured analysis of the collected artifacts provides valuable insights into cultural trends, historical contexts, and societal issues that result in visual narratives or comparative analyses. In summary, while ethnographic research prioritizes immersive engagement and participants' subjective experiences to achieve a deep understanding of cultural meanings and practices, documentary observation focuses on analyzing existing visual or textual materials to extract insights about culture without necessitating direct interaction with participants, and when employed together. These methods complement one another to create a richer understanding of cultural contexts.

3. Augmented Reality Integration:

The project integrates augmented reality to enhance the immersive experience, with each photograph not only paired with an interactive video but also layered with parallel narratives that offer multiple perspectives and depths of meaning. This layering invites viewers to experience a series of stories that run concurrently, capturing the diversity and complexity of life in each scene. Each photograph is paired with an interactive video that offers additional context and narrative depth.

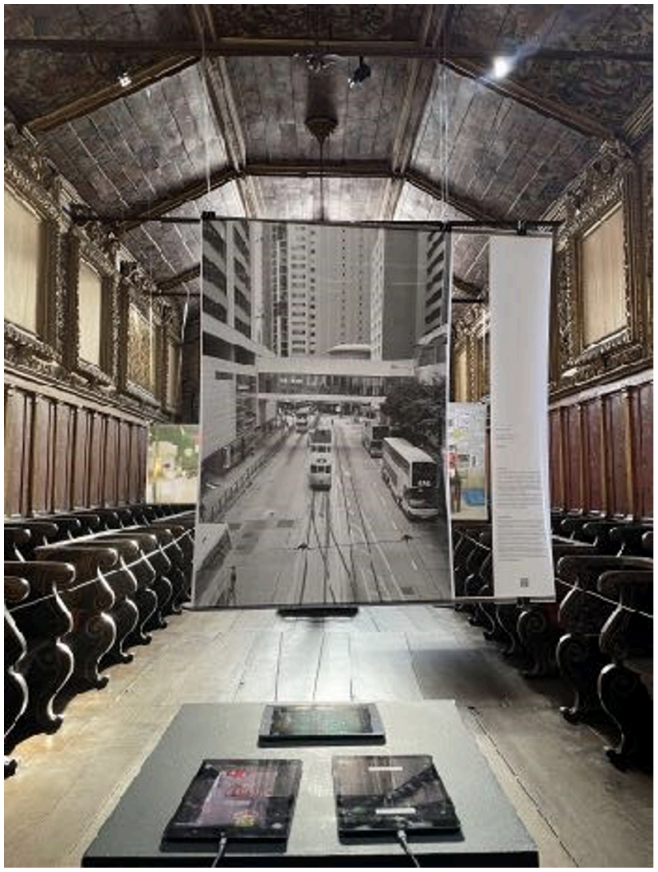






Fig. 3, Fig. 4, and Fig. 5: The immersive exhibition displaying cultural heritage artifacts, illustrating the connections between photos and the videos (AR) | CRIATECH 2022 - Aveiro - Portugal.

III. RESULTS

The results of Interactive Places demonstrate the power of visual representation in conveying complex cultural narratives. Integrating ethnographic research with visual storytelling creates new experiences that resonate with visitors on multiple levels.

1. Cultural Identity Affirmation

The project reveals how visual representations of people, objects, and places acquire sociocultural meanings. These images serve as vehicles for affirming cultural identity, allowing visitors to connect with the heritage of Hong Kong and Macau. The focus on Portuguese heritage provides an additional layer of significance, highlighting this cultural narrative's historical ties and contemporary relevance.

2. Collective Experience

The immersive nature of the project fosters a collective experience among visitors. Individuals reflect on their perceptions and share insights by engaging with the narratives presented through photographs and augmented reality, creating a dialogue about cultural diversity and shared experiences.

3. Interconnection of Design and Sociology

The project illustrates the interplay between design and sociology, showcasing how design can be utilized to communicate sociocultural contexts. The visual systems employed in Interactive Places enhance the storytelling aspect and invite visitors to consider the broader implications of cultural representation and identity formation.

IV. CONCLUSION

Interactive Places serves as a testament to the potential of immersive experiences in bridging design, storytelling, and cultural anthropology, demonstrating how thoughtfully crafted visual systems can convey complex sociocultural narratives and identities. By employing ethnographic research, augmented reality, and storytelling, the project creates a unique space for exploration and understanding. Moreover, *Interactive Places* is a powerful tool for documenting, preserving, and reinterpreting cultural contexts, bridging personal and collective memories. The project invites visitors to engage with deeper questions about cultural representation and identity formation through visual storytelling and ethnographic insight, encouraging reflection on their identities within a broader sociocultural landscape.

Moreover, this paper emphasizes integrating storytelling and design to foster a deeper appreciation of cultural heritage. Through exploring visual systems and immersive experiences, Interactive Places encourages a collective consciousness that values cultural diversity and promotes understanding among individuals and communities.

REFERENCES

[1] Babcock, B. A. (2004). The Role of Storytelling in Cultural Anthropology. Anthropology & Education Quarterly, 35(3), 290-308

[2] Geertz, C. (1973). The Interpretation of Cultures. New York: Basic Books.

[3] Norman, D. A. (2013). The Design of Everyday Things: Revised and Expanded Edition. New York: Basic Books.

[4] Pink, S. (2013). Doing Visual Ethnography.London: Sage Publications

Virtual Journey through an Immersive Interactive Environment: A Sensory Exploration of an Artistic Space Modeled by Dynamic Painting and Emotional Music by Domingos Mateus

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Abstract—This study explores the sensory impact of a virtual journey through an immersive, interactive environment inspired by the artistic work of Domingos Mateus. It addresses how sensory experiences in virtual spaces, using dynamic visual and auditory stimuli, can enhance emotional engagement and spatial awareness. This study aims to investigate the effectiveness of combining dynamic painting and emotionally resonant music within an interactive, digital environment, aiming to evoke a deeper connection between viewers and artistic content. A multi-sensory museum was implemented, blending interactive visual components (dynamic painting) with a custom musical score designed to elicit emotional responses. Participants navigated the virtual environment using VR equipment, creating a fully immersive experience. Sensory responses were monitored using real-time biofeedback to gauge emotional engagement and presence. Findings suggest combining interactive visual art and music significantly enhances users' emotional engagement and immersive experience. Participants reported heightened spatial presence, with biofeedback data indicating increased emotional arousal during key moments. This sensory approach is potentially used in therapeutic and educational settings, where emotional and sensory stimulation are beneficial. The study underscores the power of immersive environments in enhancing the user's connection to artistic expressions and fostering memorable experiences.

Keywords—Artistic Space, Virtual Reality, Interactive Environments, Biofeedback, Aesthetic Emotions

I. INTRODUCTION

In recent years, immersive virtual environments have transformed how individuals experience art, allowing audiences to engage with visual and auditory stimuli in a highly interactive and sensorial manner [1]. This study, "Virtual Journey through an Immersive Interactive Environment: A Sensory Exploration of an Artistic Space Modelled by Dynamic Painting and Emotional Music by Domingos Mateus," situates itself at the intersection of art, technology, and emotional engagement, exploring how digital, multi-sensory experiences can deepen the viewer's connection to artistic expressions. This work is significant as it addresses the growing interest in how immersive technologies can enhance user engagement and emotional resonance in artistic spaces and therapeutic and educational contexts [2] [3].

The primary purpose of this research is to explore the emotional and sensory impact of combining dynamic, interactive visuals with emotionally evocative music in a virtual multi-sensory museum. By immersing participants in a space that blends Domingos Mateus's [4] dynamic painting techniques with custom music, the study aims to understand how sensory elements influence perception, emotional engagement, and spatial presence [5]. The principal conclusions indicate that multi-sensory experiences, particularly when integrated with visual art and music,

can significantly enhance emotional arousal, presence, and user satisfaction, demonstrating the potential for these environments to create profound, memorable interactions in digital and physical artistic spaces [6] [7].

II. MATERIALS AND METHODS

This study was conducted using a Virtual Reality (VR) system designed to simulate an interactive, immersive environment inspired by the artistic work of Domingos Mateus. The environment incorporated two primary sensory elements: dynamic painting and a custom musical score, both developed to reflect Mateus's artistic themes.

A. Dynamic Painting and Music Composition

The visual component consisted of dynamic digital paintings modeled after Domingos Mateus's art style. These paintings were adapted to evolve in real time in response to the user's choice. The music from the Portuguese Guitar [8] has been selected for this study, including emotionally evocative arrangements that shifted dynamically with the user's exploration, heightening the emotional and aesthetic experience.

B. Materials

The VR system was developed in Unity [9]. The virtual museum can be experienced using a high-resolution headset (such as Quest 3, Quest Pro, or HTC Vive), spatial audio headphones, and motion controllers, enabling full sensory engagement and interaction.

III. AESTHETIC EMOTIONS IN ARTISTIC ARTIFACTS

Aesthetic emotions, from the combination of dynamic painting and music, play a crucial role in promoting positive emotional states within an immersive environment [10]. Dynamic painting, which evolves in real-time and responds to user interaction, creates a visual experience that feels personalized and deeply engaging, drawing viewers into the artwork itself [11]. When paired with evocative music, this fusion amplifies the emotional impact, as auditory cues guide the user's mood and reinforce the emotional tone set by the visuals. Depending on the music's rhythm and melody, the experience can evoke a range of emotions, such as calmness, nostalgia, and joy, enhancing the immersive quality of the interaction.

This synergy of visual and auditory stimuli intensifies the user's emotional engagement and sense of presence, making it easier to induce positive mental states. The harmonious interaction of these elements creates an "emotional landscape," where each shift in sound or change in the painting stimulates profound emotional responses. As a result, this aesthetic approach can reduce stress and anxiety, making it a powerful tool in therapeutic contexts, where the goal is to promote well-being and create a meaningful emotional connection with both the art and oneself.

The Portuguese guitar is an iconic instrument with a unique sound, allowing for a diverse tonal range that complements Fado's melancholic, vibrant, and expressive nature. The singular sonority of the Portuguese guitar gives it an instantly recognizable voice, embodying the spirit of Portuguese musical heritage.

Virtual reality can be a powerful tool for promoting positive emotional states, particularly for bedridden individuals or those with limited mobility, significantly impacting their mental well-being. For individuals confined to beds or wheelchairs or with reduced mobility, VR can alleviate feelings of isolation and monotony, providing a source of engagement and mental stimulation.

These VR experiences are designed to evoke positive emotions, reducing stress and anxiety by enabling participants to relax in peaceful settings that stimulate calm and contentment. This interaction with a virtual environment can also help regulate mood, support relaxation, and improve cognitive focus, which are essential components of mental well-being [12].

The effective incorporation of Aesthetic Emotions ed into 360-degree narratives in immersive environments by carefully blending visual, auditory, and interactive elements transports participants to positive emotional levels.

Aesthetic emotions, such as awe, nostalgia, tranquillity, and wonder, are triggered by experiences that engage the senses and the imagination, making them particularly powerful in VR storytelling. In a 360-degree environment, these emotions can be evoked through meticulously crafted settings, dynamic interactions, and sensory details.

IV. THE VIRTUAL MUSEUM

The physical layout of the virtual museum is designed to immerse visitors in a multi-dimensional exploration of art.

Upon entering, users find themselves in a vast, open virtual space reminiscent of a cozy gallery, with ceilings and softly lit walls that highlight the artworks

without overwhelming them. The environment is carefully crafted to evoke a sense of tranquillity and focus, using neutral, subtle colors for the interior to direct attention to the vibrant digital displays of art (Fig. 1).



Fig. 1. Physical layout of the virtual museum.

The floor reflects the patterns used by the "Portuguese sidewalk," which combines the white of limestone and the black of basalt, rocks used to decorate the noblest spaces of the towns and cities of Portugal since the beginning of the 19th century.

On the walls of the gallery are discreetly represented symbols of Portuguese history and cultural heritage, representing the age of the discoveries, honoring authors such as Luís de Camões and Fernando Pessoa, the most significant monuments and patterns representative of history and people, such as the famous tile panels, and the Heart of Viana which is a jewel that was part of the relics of Portuguese families and carries the legacy of beauty, values and feelings from generation to generation.

Evoking the spirit of the Portuguese guitar, an instrument that Domingos Mateus uses so well, the gallery is decorated with elements that reflect the symbolism of the Portuguese cultural patrimony. Symbolism, representing the oldest and most striking traditions, aims to highlight the identity and belonging the artist expresses through his painting and music.

The virtual museum has an organic garden that represents natural elements and reflects freedom of thought and emotions (Fig. 2).



Fig. 2. An organic garden is seen from the inside.

A. Dynamic Painting and Music Composition

The participant can walk through the corridors freely, choosing his path freely, or guided by the visual stimuli the works of art throw. When contemplating the work of art, the participant is invited to interact with it. The traditional painting transforms and resizes, occupying almost the entire field of the participant's vision and transporting the participant to his interior. Before the participant can contemplate the painting, it will appear dynamically, undergoing transformations that the movements of the hands of the participant may influence. The dynamic process of creating images highlights details that would go unnoticed by a static observation, and the participant is no longer just an observer but an adjunct in making the final image (Fig.3).



Fig. 3. Interactive 3D Dinamig painting.

Each painting of the author is associated with a song that reflects the mental state associated with the underlying message. The music can reflect different states, from the nostalgia of a landscape to the traditionalism of costumes and characters, through the state of restlessness expressed by the "Ballad of the Tortosendo," where the feelings oscillate between the provisional definitive and the definitively provisional (Fig. 4).



Fig. 4. The author, Domingos Mateus, performs the "Ballad of the Tortosendo."

The participant can travel from work to work of art, experiencing different emotional states provided by the interaction between dynamic painting and music the author performs.

The chosen route and duration of the trip is a choice of each participant, making each experience customizable and personal, turning it into a unique and memorable moment.

V. CONCLUSION

This study demonstrates the powerful potential of immersive virtual environments in enhancing sensory and emotional engagement with art. By combining dynamic painting and evocative music, as modeled by Domingos Mateus, the virtual journey designed in this research offered participants a unique multi-sensory experience that significantly heightened emotional arousal, spatial presence, and personal connection to the artwork. The findings underscore that integrating visual and auditory elements within an interactive environment can deepen users' emotional responses and provide a more impactful artistic experience.

The concept of Emotional Aesthetics is central to these results, which serve as a vector for inducing mental states associated with mental health and well-being. Through carefully crafted sensory stimulation, Emotional Aesthetics fosters mental states that promote relaxation, introspection, and emotional resilience. By exploring these effects, this study shows how immersive environments can transcend traditional art appreciation, opening possibilities for therapeutic applications where emotional and sensory engagement contributes to well-being.

Incorporating aesthetic emotions in immersive environments enriches the narrative and deepens the viewer's psychological involvement. By allowing participants to become emotionally invested in the story, VR narratives can create memorable and impactful experiences beyond traditional storytelling. This approach to designing VR content has applications in mental well-being, therapeutic practices, and entertainment, where aesthetic emotions are integral to achieving a transformative and lasting impact.

These results hold promising implications for using immersive environments in artistic, therapeutic, and educational settings, where emotional and sensory stimulation can be pivotal. By fostering deeper connections to artistic expressions, this approach can expand the boundaries of traditional art appreciation and open new pathways for engaging audiences in digital spaces. Future research may focus on optimizing sensory components, exploring additional senses such as touch or scent, and assessing long-term effects on emotional and cognitive responses.

ACKNOWLEDGMENT

We want to express our deepest gratitude to Domingos Mateus for his profound artistic legacy and multidimensional contributions to music, painting, and writing. His work not only enriches each of these fields individually but also serves as a powerful source of inspiration for interdisciplinary projects that explore new dimensions of artistic expression. Domingos Mateus's creative vision and dedication continue to inspire innovative approaches to sensory and emotional engagement, as reflected in this study.

REFERENCES

[1] P. Veloso Gomes, V. J. Sá, A. Marques, J. Donga, A. Correia, and J. P. Loureiro, "Creating Emotions Through Digital Media Art: Building Empathy in Immersive Environments," in *Multidisciplinary Perspectives on New Media Art*, IGI Global, 2020, pp. 142–160. Doi: 10.4018/978-1-7998-3669-8.ch007.

[2] J. Ma, D. Zhao, N. Xu, and J. Yang, "The effectiveness of immersive virtual reality (VR) based mindfulness training on improvement mental-health in adults: A narrative systematic review," *EXPLORE*, vol. 19, no. 3, pp. 310–318, May 2023, doi:10.1016/j.explore.2022.08.001.

[3] G. Li Pira, B. Aquilini, A. Davoli, S. Grandi, and C. Ruini, "The Use of Virtual Reality Interventions to Promote Positive Mental Health: Systematic Literature Review", *JMIR mental health*, vol. 10, p.e44998, Jul. 2023, doi: 10.2196/44998.

[4] "CPS / Artistas/ Domingos Mateus." Accessed: Oct. 25, 2024. [Online]. Available: https://www.cps.pt/pt/artistas/domingos-mateus

[5] P. Larsson, D. Västfjäll, P. Olsson, and M. Kleiner, "When what you hear is what you see: Presence and auditory-visual integration in virtual environments," *Proceedings of Presence 2007*, p. 11-18. ISBN: 10-09792217-1-4. Jan. 2007.

[6] F. de A. Ramires, "VR Exhibitions: Enhancing the Feeling of Immersion through Interactive Virtual Reality in Art," Bachelors Creative Technology, University of Twente, Netherlands, Jul. 2023. Available https://purl.utwente.nl/essays/96873.

[7] M. Melo, G. Gonçalves, P. Monteiro, H. Coelho, J. Vasconcelos-Raposo, and M. Bessa, "Do Multisensory Stimuli Benefit the Virtual Reality Experience? A Systematic Review", *IEEE Trans. Vis. Comput. Graph.*, vol. 28, no. 2, pp. 1428–1442, Feb. 2022, doi: 10.1109/TVCG.2020.3010088.

[8] N. J. dos S. A. Cristo, "The Portuguese Guitar: History and Transformation of an Instrument Associated with Fado," 2014, Accessed: Oct.25, 2024. [Online]. Available: https://yorkspace.library.yorku.ca/bitstream/handle/10315/27635/etd-1404923854.zip?sequence=4

[9] "Unity Real-Time Development Platform | 3D, 2D, VR & AR Engine," Unity. Accessed: Oct. 25, 2024. [Online]. Available: https://unity.com

[10] M. Pizzolante, E. Sarcinella, F. Borghesi, S. Bartolotta, A. Gaggioli, and A. Chirico, "'Being immersed in Aesthetic Emotions': Comparing immersive Vs. Non-immersive VR in aesthetic emotions elicitation", presented at the Annual Review of CyberTherapy and Telemedicine, Jan. 2023. Available: https://psycnet.apa.org/record/2024-58782-020.

[11] S. Du, T. Ge, J. Pei, J. Wang, C. Yin, and Y. Zhu, "Panoramic Fluid Painting," in *2019 IEEE Conference on Virtual Reality and 3D User Interfaces (VR)*, Mar. 2019, pp. 904–905. doi: 10.1109/VR.2019.8798200.

[12] S. H. M. Chan, L. Qiu, G. Esposito, K. P. Mai, K.-P. Tam, and J. Cui, "Nature in virtual reality improves mood and reduces stress: evidence from young adults and senior citizens", *Virtual Reality*, vol. 27, no. 4, pp. 3285–3300, Dec. 2023, doi: 10.1007/s10055-021-00604-4.

VR Center for Cultural Heritage Presentation: Old Bosnian Town of Dubrovnik and Kopošići Stećak Necropolis

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Abstract—The Virtual Center for Cultural Heritage Presentation focuses on showcasing artifacts from the Old Bosnian Town of Dubrovnik (Sarajevo Canton, Ilijaš) and the Kopošići stećak necropolis, utilizing modern Head-Mounted Display (HMD) technology. This virtual reality platform offers visitors a unique experience of exploring and studying this significant historic site (a National Monument of Bosnia and Herzegovina). The digital reconstruction of the necropolis allows users to investigate the details of each stećak and accompanying artifacts, enabling them to navigate the space in real-time. The Virtual Center provides educational content highlighting the cultural significance of the stećci, its history, and its symbolism. Realistic graphics, narrative elements, and sound further enrich the overall experience. This innovative approach allows a wide audience, regardless of physical distance, to interactively experience and study the cultural heritage of this National Monument.

Keywords—Virtual technologies, digital replica experience, national monument, innovative pedagogy, cultural heritage digitization.



Link: VR experience - screen recording (2D) of the walkthrough: https://vimeo.com/999081682?share=copy

I. VR VISITOR CENTER, WHY?

The prototype of a Virtual Reality (VR) center for cultural heritage presentation was developed to create an experimental model for presenting cultural heritage artifacts, their digital three-dimensional replicas (digital twins), and showcasing them within a virtual 3D space that mimics the appearance of a modern museum exhibition. This prototype aims to test the spatial arrangement and how information about artifacts is presented and to test narrative forms and guidance through the exhibition using an audio guide. The project and creation of the prototype aimed to explore different methods for creating digital replicas of artifacts and archaeological findings that have been uncovered and cataloged during recent years of archaeological work at Kopošići and the Old Bosnian town of Dubrovnik.

Additionally, this VR experience aims to propose a model for publishing and suggest the production of a platform that would enable the publication and presentation of Bosnia and Herzegovina's cultural heritage and historical monuments in a new format for domestic, regional, and international audiences alike.
Existing platforms like Side-Quest or META Quest AppLab, which provide access to VR experiences and projects, can allow easy access to VR content for both expert and general audiences. This would offer insight into locations and objects (artifacts) and provide guided tours or the possibility of free exploration and review of the digital archives of archaeological findings.

1.1. Creative and Expert Team / Old Bosnian Dubrovnik Foundation

A small number of collaborators were involved in the project's realization. The development of the VR spatial concept, its content, visual-aesthetic elements, and technical production was led and executed accordingly.

In close consultation and coordination with the Art Council of the Old Bosnian Dubrovnik Foundation and Mr. Perica Mijatović, the key initiator and moderator of all the Foundation's activities related to promoting this National Monument, the presentation format for the VR project was agreed upon as part of the major interactive exhibition organized at the City Gallery Collegium Artisticum in Sarajevo in May 2023.

The archaeological artifacts were selected in consultation with Prof. Dr. Edin Bujak, one of the leading researchers of Kopošići/Dubrovnik over the past 10 years. Based on my experience from previous VR projects (Stećak 3D for the Mak Dizdar Foundation and Wadi Al Helo, and ReImagine Al Hamra for Shorooq and AUS/CAAD), I decided to simplify the structure of the VR experience from a technical standpoint as much as possible.
Collaborating on the creation of digital content were young assistants Mak and Ema Filipović, who helped with sound design and the materials used for ambient presentation in the VR center.

II. TECHNOLOGY AND THE CREATION PROCESS OF DIGITAL CONTENT

2.1. Digital Reconstruction and Interactive Content

The primary technical requirement for creating the VR center was the creation of 3D models of the location and stećaks. In 2019, during my first visit to Kopošići and the Old Bosnian town of Dubrovnik, I conducted a series of photographic recordings of the broader location and detailed images of the necropolis and the town. This photographic material allowed the digital reconstruction of various conservation and restoration phases of the town's structures. A notable project is producing a short documentary-artistic film about the site, following the town through the four seasons.
At the same time, a team from Global Digital Heritage (GDH) visited Kopošići and conducted a photogrammetric reconstruction of the main group of stećaks. Their work has been published on the SketchFab platform and is freely accessible.
Another focus in creating the content for this VR center was scanning artifacts discovered during various archaeological phases and digs led by teams under Prof. Dr. Edin Bujak of the Faculty of Philosophy, University of Sarajevo, from 2016 to 2023.

2.2. UNITY 3D Software Platform for Integrating and Creating a Virtual Reality Experience (VR) – Meta Quest 2 HMD

Modern virtual reality technology uses VR headsets (Head-Mounted Display - HMD) devices to create a unique user experience. These devices allow visitors to move through the Starobosanski Dubrovnik visitor center and the Kopošići stećak necropolis in real time. The virtual reconstruction with realistic graphics and sound elements enables interaction with architectural and archaeological details that would otherwise be difficult for the general public to access.
The user of this new VR visitor center can move around the experience using a teleportation system (a

direct jump to a location chosen using VR controllers) by pressing the GRIP button on the Meta controller or by walking freely.
Interaction and activation of narrative segments are enabled through the use of the META Quest controllers and the TRIGGER button.

The visitor center is structured into five zones:

Zone 01:

The starting point focuses on familiarizing visitors with the context of the city. It provides insight into photographic materials showcasing the broader context of the city, its suburbs and town, and the spaces where the town functioned.

Zone 02:

This zone establishes the context and broader space around the Kopošići necropolis and Dubrovnik. Dioramas, reduced-scale models of the necropolis and the town, are located in the central part of the VR center. Visitors can activate audio content (medieval music compositions or narrative elements) by pressing a button, providing context and analysis of the 3D models. This zone also presents the beautiful stećak from the necropolis at Očevlje near Dubrovnik.

Zone 03:

This area represents an archaeological trench next to the eastern wall of the town, providing a similar experience to visiting a trench during ongoing archaeological work. The sound plays an essential role here, creating a re-creation of the excavation visit using spatially positioned sound effects. Each space has its specific narrative introduction in the form of narration.

Zone 04 - Brocade Cloak:

On the way to the terrace, visitors pass by one of the most significant finds from the

Kopošići necropolis – a brocade cloak discovered beneath the stećak of Mirko Radojević. Reconstructed by a specialist team from the National Museum of Bosnia and Herzegovina, the digital replica of this cloak allows visitors to explore its intricate design without risking damage to the fragile original.

Zone 05 - Terrace - Life-size replicas of artifacts (1:1):

The terrace features life-size replicas (1:1 scale) of the artifacts, allowing visitors to walk through the Kopošići necropolis and see the most significant stećaks. Behind the stećaks, three artifacts are displayed: metal tools and arrowheads, pottery, and jewelry and decorative items.
When exiting onto the terrace, users experience the natural surroundings of Dubrovnik through a panoramic 360-degree photographic view.

IV. EXHIBITION / EDUCATION

Educational and Pedagogical Approach

Organized by the Old Bosnian Dubrovnik Foundation and through the tremendous effort and work of Mr. Perica Mijatović, an independent researcher and key initiator of many activities related to the care and promotion of this national monument, a large interactive exhibition titled "Old Towns of Bosnia and Herzegovina, with Dubrovnik Among Them" was held in May 2023 at the City Gallery Collegium Artisticum in Sarajevo. One of the primary elements of this exhibition, in addition to the 40 panels on old towns prepared by ICOMOS Bosnia and Herzegovina with support from UNESCO Bosnia and Herzegovina, allowed visitors to use VR devices to visit the VR visitor center and take a virtual walk through the *stećak* necropolis.

This digital replica of the necropolis and the objects found during archaeological research and fieldwork was entirely based on digital reconstruction using photogrammetry, providing a realistic portrayal of the *stećaks* and artifacts.
The virtual center not only allows for the presentation of cultural heritage but also serves as an educational platform for spreading knowledge about the historical and cultural aspects of *stećaks* and the Old Bosnian town of Dubrovnik. Visitors can learn about the historical context and symbolism through narrative and visual elements. This approach is an innovative tool for museums, universities, and other educational institutions looking to enhance pedagogical practices in fields like art history, archaeology, and other related humanities disciplines.

Integrating digital information through narration, visual content, and three-dimensional interactive spaces has become essential in modern educational and research environments. By digitizing *stećaks* and other archaeological sites, we enable the preservation and promotion of this unique segment of cultural heritage. The publication of scientific papers and the results of archaeological research using VR platforms allows broad access to locations that are otherwise geographically hard to reach. In contrast, innovative pedagogical methods using VR technology offer a new way of learning and researching.

V. CONCLUSION

This prototype of a VR center for cultural heritage presentation represents an important step toward preserving and promoting the rich historical heritage of Bosnia and Herzegovina. It is essential to coordinate activities in creating a joint platform that allows the continuous publication of new content related to stećaks as part of the shared cultural heritage recognized by UNESCO as a world cultural heritage.

By combining education with research and interactive entertainment elements, this platform opens new possibilities for academic research and the popularization of cultural monuments among the wider public, contributing to the preservation of cultural goods for future generations.

Before we view the video walkthrough of the Dubrovnik/Kopošići VR center, I would like to quote Rebecca Rouse and Evan Barba from their work.

Designing for New Media:

"We live and create at a critical moment when virtual reality (VR) is no longer exclusively available to leading academic institutions, specialized research centers, or companies that develop its technology. The recent boom and mass production of various VR-equipped devices has allowed a growing community of engineers, technologists, artists, experience designers (gamification and simulations), museologists, and cultural heritage preservationists, as well as educators and students, to use the VR platform and thereby create new experiences." [RoBar17]

REFERENCES

[1] R. Rouse and E. Barba, "Design for Emerging Media: How MR Designers Think About Storytelling, Process, and Defining the Field," in *Interactive Storytelling: 10th International Conference on Interactive Digital Storytelling, ICIDS 2017*, Funchal, Madeira, Portugal: Springer International Publishing, 2017, p. 245.

[2] M. Danks, M. Goodchild, K. Rodriguez-Echavarria, D. B. Arnold, and R. Griffiths, "Interactive Storytelling and Gaming Environments for Museums: The Interactive Storytelling Exhibition Project," in *Technologies for E-Learning and Digital Entertainment (Edutainment 2007)*, K. Hui et al., Eds. Berlin, Heidelberg: Springer, 2007, vol. 4469, pp. [insert page numbers if available].

[3] M. Charlier, "Interface and Interaction Design," in *Designing Connected Products: UX for the Consumer Internet of Things*, C. Rowland, E. Goodman, M. Charlier, A. Light, and A. Lui, Eds. Sebastopol, CA: O'Reilly Media, 2015, p. 298.

[4] H. Jenkins, "Transmedia Storytelling 101." Available: http://www.henryjenkins.org/2007/03/transmedia_storytelling_101.html. Accessed: Mar. 4, 2019.

[5] J. Bucher, *Storytelling for Virtual Reality: Methods and Principles for Crafting Immersive Narratives*, Ch. 4, "Storytelling Principles for Immersive Space," Taylor & Francis Group, 2017. Available: http://ebookcentral.proquest.com/lib/ausebooks/detail.action?docID=4906521. Accessed: Jan. 24, 2023.

[6] GDH and Association for the Digitization and Informatisation of Cultural Heritage (DIGI.BA), "Stećak Medieval Bosnian Tombstone at Koposici." Available: https://sketchfab.com/3d-models/stecak-medieval-bosnian-tombstone-at-koposici97f8f23015c54c2384e7613f178d14c4. Accessed: Oct. 18, 2024.

"Agreement. Energycorn": A Ceramic Installation Glazed Using Corn Biomass Waste

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Abstract—"Agreement. Energycorn" is a large-scale ceramic installation that interrogates industrial agriculture's environmental and philosophical implications by using corn biomass waste as a primary material for glaze. The project reflects on the global significance of maize, the second most cultivated crop worldwide, and its role in biofuel production.

Keywords—Ceramic installation, Corn biomass waste

I. INTRODUCTION

Energycorn, an adaptation of South American maize for European conditions, has been bred specifically for its biomass yield, nearly double that of conventional grain corn. This installation explores the transformation of this hybrid corn, cultivated for bioethanol, biogas, electricity, and heat, into art, prompting a broader reflection on sustainability, globalization, and ecological interdependence.

The installation features slip-cast and hand-built earthenware sculptures made from traditional industrial ceramics techniques, emphasizing the fusion of natural and industrial elements. The ceramic forms are glazed using ash derived from the incineration of corn plant waste—leaves, stalks, and roots—produced during energy maize cultivation. When these organic materials are burned and combined with lime and sand, they form a distinctive ceramic glaze. The ash, rich in absorbed elements such as metals, reflects the agricultural processes that influenced the plant's growth, including fungicides, herbicides, and insecticides. These chemical residues are visually manifested in the glaze as striking brown, green, and red hues, created during oxidation firing at temperatures exceeding 1100°C.

The towering ceramic columns, some reaching up to 2.3 meters in height with circumferences up to 80 cm, are designed to symbolize the mechanized transformation of natural processes in industrial agriculture. The physicality of the corn plants, cast into the ceramic forms, echoes the environmental cost of monoculture farming and the depletion of the soil's living ecosystem. The late sowing of maize and heavy machinery for monoculture disrupt the intricate soil balance, leaving it vulnerable to erosion from wind and water. Lime and mineral fertilizers are introduced to sustain crop yields, and herbicides are used to eliminate competing plants, emphasizing the tension between human manipulation and ecological health.



Fig. 1. Agreement_Energycorn_Exhibition_Wiew2 - Luse-Linda-Mais.



Fig. 2. Energycorn - Luse-Linda-Mais-©Michael-Maritsch.

By incorporating waste material from an industrial process into art, Agreement. Energycorn raises fundamental questions about humanity's relationship with nature and the long-term sustainability of current food production practices. The ashes from corn biomass serve as a symbolic narrative tool, representing agriculture's destructive yet regenerative cycle. The work encourages viewers to reflect on the environmental, ethical, and societal implications of industrial farming. It highlights the complex, often exploitative, relationship between technological innovation and ecological balance, urging contemplation of whether modern agricultural practices can coexist with the need for environmental preservation.

Ultimately, Agreement. Energycorn reflects globalization, food production, and the interconnectedness of human and environmental systems. Transforming agricultural waste into art prompts deeper consideration of how industrial agriculture reshapes landscapes and cultural and ecological values. The installation becomes a platform for dialogue, challenging audiences to consider how technological advances can either support or hinder ecological balance in an increasingly industrialized world.

REFERENCES

[1] L. Luse, "Agreement. Energycorn," *Website*, 2024. [Online]. Available: https://en.lindaluse.com/vereinbarung-energiemais

[2] "Sustainable ceramics: How eco-friendly pottery is shaping modern design," *Vocal Media*, 2024. [Online]. Available: https://vocal.media/art/sustainable-ceramics-how-eco-friendly-pottery-is-shaping-modern-design

[3] J.-C. Rebière, "Les cendres végétales, matières premières des verres et des émaux: un exemple, les cendres de végétaux utilisées par Fr. D. de Montmolin," *Verre*, vol. 16, no. 2, pp. 43–50, 2010. [Online]. Available: https://www.researchgate.net/publication/47864359.

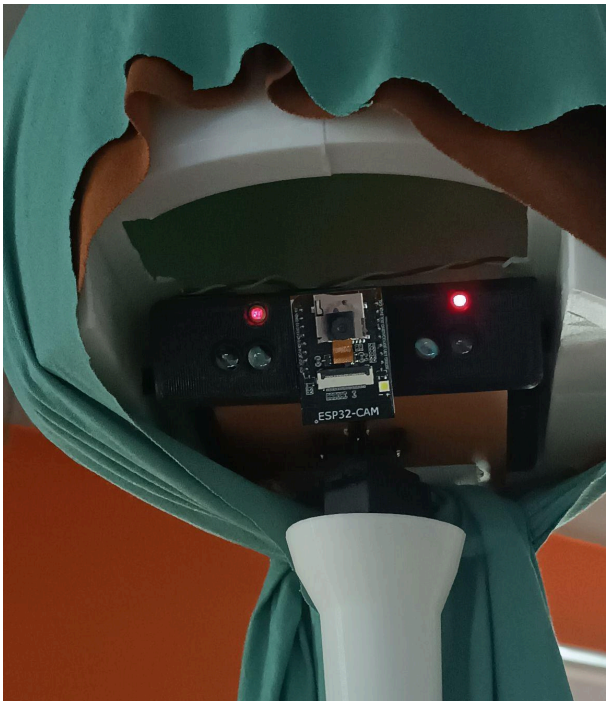
[4] E. Pacelli, "3D printed ceramics: Eat food waste to reduce, reuse, and recycle," *Ceramic Tech Today*, 2024. [Online]. Available: https://ceramics.org/ceramic-tech-today/3d-printed-ceramics-eat-food-waste-to-reduce-reuse-and-recycle

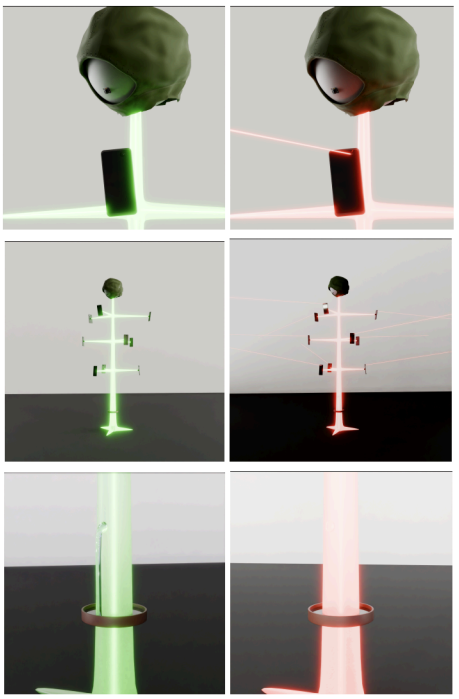
ARTIST TALKS

The Forest ... Looks at you!

Paulo Cesar Teles || Brazil

Interactive Artwork (Artefact)





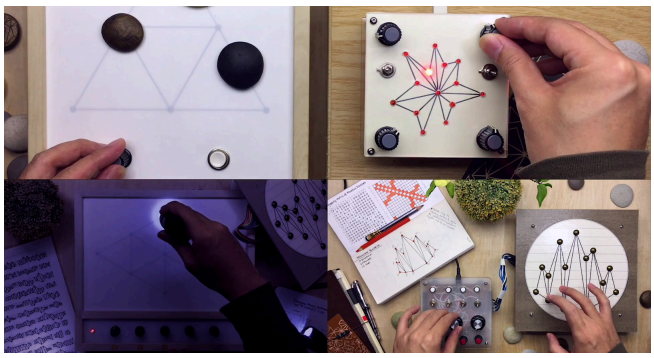
ARTISTS || Paulo Cesar Teles, Juliano Prado, Matheus Hencklein Ponte, Gabriel Paparotti, Elida Antunes, Moon Cheung Yin Yan.

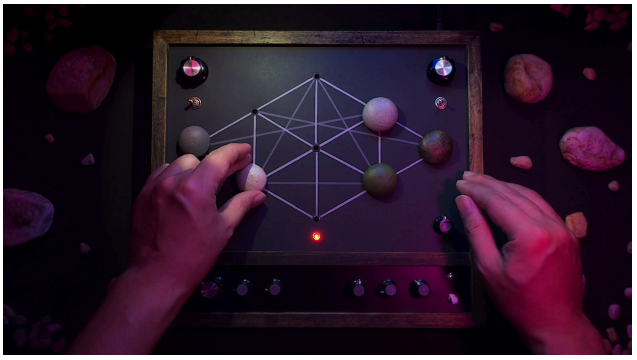
Group ARTME (Art, Technology and Emerging Media), University of Campinas, Brazil, University of Saint Joseph, Macao.

DESCRIPTION || "The Forest ... Look at you!" is an interactive, translucent, self-illuminating, and robotic sculpture that, through the spatial detection of people and faces using proximity sensors and a facial recognition camera, seeks to relive an unusual experience that took place during an immersion in the Amazon rainforest. In the deep rainforest, the shaman Edson Baré showed us a copaiba tree where he extracted sap from its stem. He also warned us not to look at the top. Otherwise, it stops leaking sap. This artwork evokes the paradoxical "offensive" and "defensive" nature expressed in the "vigilance" concept in the context of the needs and dangers that permeate our nature and urban ecosystems in the human and non-human dimension of the act of observing.

The Tahigami Music Project

Datu Arellano || Philippines
Music/Sound Instrument (Artefact)





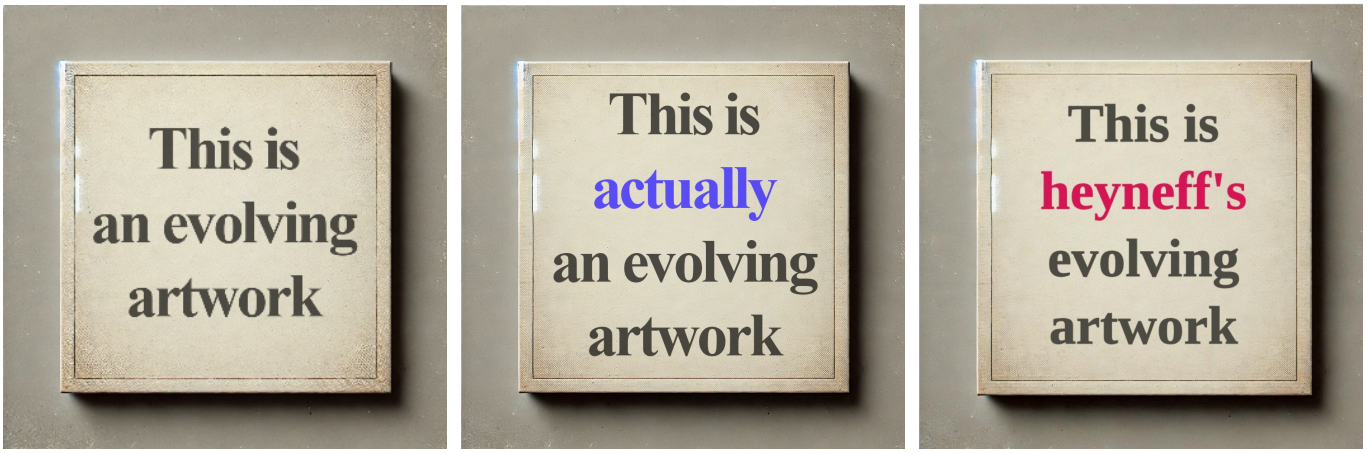
ARTISTS || Datu Arellano
https://datuarellano.com

DESCRIPTION || "The Forest ... Look at you!" is an interactive, translucent, self-illuminating, and robotic sculpture that, through the spatial detection of people and faces using proximity sensors and a facial recognition camera, seeks to relive an unusual experience that took place during an immersion in the Amazon rainforest. In the deep rainforest, the shaman Edson Baré showed us a copaiba tree where he extracted sap from its stem. He also warned us not to look at the top. Otherwise, it stops leaking sap. This artwork evokes the paradoxical "offensive" and "defensive" nature expressed in the "vigilance" concept in the context of the needs and dangers that permeate our nature and urban ecosystems in the human and non-human dimension of the act of observing.

This is an evolving artwork

Artist Daniel Filipe Farinha || Portugal - Macau

Interactive Artwork (Artefact)



ARTIST || Daniel Filipe Farinha (MAT LAB)
https://teia.art/ktorn
https://teia.art/objkt/856725

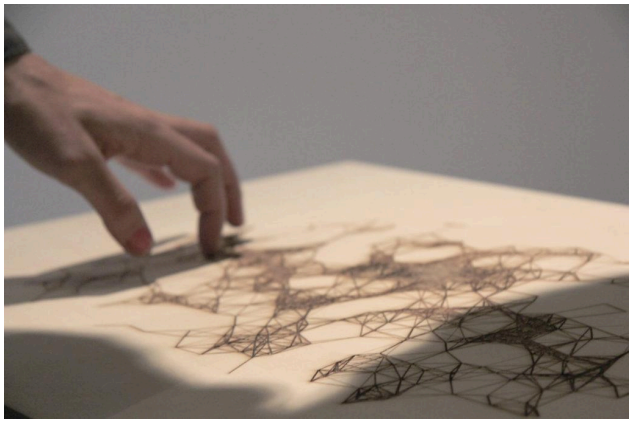
DESCRIPTION || This experimental code-based artwork, minted as an NFT in the TEIA marketplace on Tezos, challenges the notion that NFTs must be immutable at the code-base level once minted. Instead, it uses the computer network to contact a smart contract on the blockchain. It returns the URL of the latest version of the artwork's codebase, allowing the artist to upload new versions of the code over time. The smart contract also keeps track of the full version history of the artwork, allowing anyone to browse the history of the artwork's evolution.

In the latest version, v3, artwork randomly displays the name of one of its collectors each day. It contacts the blockchain to retrieve the list of collectors and uses the hash of the first Tezos block of that day (UTC timezone) as the random seed.

Tangible Scores:
instruments, notation, and the hand

Enrique Tomás Calderon || Spain - Austria

Tangible Artwork (Artefact)





ARTISTS || Enrique Tomás Calderon (TAM LAB)
https://tamlab.kunstuni-linz.at/team/enrique-tomas
Video Trailer: https://vimeo.com/322733700
https://tamlab.kunstuni-linz.at/projects/tangible-scores

DESCRIPTION || In which ways is it possible to embody musical intention into musical instruments? 'Tangible Scores' is a live electronic performance with paper tangible interfaces whose embossed profile has been inspired by certain sound gestures. Through the 'action of the hand' a machine learning system recognizes tactile patterns and enables real-time manipulation of musical information. A generative lighting system augments the paper's physical materiality and inscribes a visual narrative inspiring a musical form. This work shows us how much our body is the main actor enabling the 'moment of transition' between artistic intentions and perceived sonic outcomes. The result of this physical encounter is a live performance where sound, light and

ABSTRACTS

The Cycle of Life and Decay

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ABSTRACT

The Cycle of Life and Decay is about the condition surrounding all living things (and arguably our universe): All things are bound to a never-ending cycle of life, growth, and decay. Unlike our general human perception (which generates illusions that the life we surround and create for ourselves is/will be stable), nothing is permanent, and everything is bound to change. Life and death, suffering and tranquillity, and ever-changing states of consciousness are what is stable. This continuous process of creation, growth, and destruction of matter works as a solution for the problem of heat death through entropy, allowing a universe that is eternal without a beginning or end. In Buddhist belief, Samsara is the endless cycle of life, death, and suffering (which all living souls are part of and will be part of until they manage to free themselves from it). This piece attempts to find a parallel between these two notions (the cycle bounding living things and the cycle that considers our universe) to create a sonic farewell to 'Şampiyon Melekler' (two Cypriot volleyball teams (high school girls-boys) that went to Turkey in February 2023 to compete in the finals and lost their lives due to their hotel collapsing because of the 7.8 Earthquake) wishing that they found liberation from this cycle in which they are no longer experiencing suffering but only tranquillity.

The piece explores a novel hybridity concept/method (that belongs to the author/composer of the piece) called 'Cannibalistic Hybrid'. Two metal-ballad songs were composed to be deconstructed and used as the main material driving the piece. The cannibalistic hybrid in this piece contains two genres: electroacoustic (being the subsidiary genre that is only used for its techniques) and metal (being the dominant genre in which it is used as the main material). The subsidiary genre starts 'eating' the dominant genre's material in many levels and dimensions throughout the piece.

Artwork:
https://drive.google.com/file/d/1kW3LLIMSr-ZPY2dRDSYwLFnpmpeEMiuV/view?usp=sharing

The piece is stereo/fixed-media. It is intended to be performed through a live diffusion performance through multiple arrays of speakers (in which the performer alters the level of each speaker regarding the changes happening in the piece to create an immersive sonic environment).

Keywords—Electroacoustic, Acousmatic, Metal, Hybrid Music, Genres, Sound Art

REFERENCES

[1] Abell, C. (2015, April). II—Genre, Interpretation and Evaluation. In Proceedings of the Aristotelian Society (Hardback) (Vol. 115, No. 1pt1, pp. 25-40).

[2] Adkins, M., Scott, R., & Tremblay, P. A. (2016). Post-Acousmatic Practice: Re-evaluating Schaeffer's heritage. Organised Sound, 21(2), 106–116.

[3] Ahlkvist, J. A. (1999). Music and cultural analysis in the classroom: Introducing sociology through heavy metal. Teaching Sociology, 126-144.

[4] Duff, D. (2014). Wordsworth's" Prospectus": the genre. The Wordsworth Circle, 45(2), 178-184.,

[5] Emmerson, S. (1986). The Language of Electroacoustic Music. London: The Macmillan Press Ltd.

[6] Emmerson, S. (2007). 'Where next? New music, new musicology'. EMS : Electroacoustic Music Studies Network.

[7] Fabbri, F. (2012). Genre theories and their applications in the historical and analytical study of popular music: a commentary on my publications (Doctoral dissertation, University of Huddersfield)

[8] Friconnet, G. (2022). Establishing a taxonomy of metal subgenres based on quantitative musical and thematic features. Metal Music Studies, 8(2), 183-203.

[9] Akiyama, M. (2010). Transparent listening: Soundscape composition's objects of study. RACAR: revue d'art canadienne/Canadian Art Review, 35(1), 54-62.

[10] Allen, M. (2013). Against 'hybridity'in genre studies: blending as an alternative approach to generic experimentation. Trespassing Journal, 2, 3-21.

Ideological Distortion

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ABSTRACT

Ideological Distortion is a piece that explores the dark side of today's media, the dilution of ideologies, and the constant bombardment of confusion. It invites the listener to reflect on the issues and feel the horror and hate that is constantly imposed on society whether we individuals are lucid about it or not.

Artwork:
https://drive.google.com/file/d/1jOvgkX1nxBre6RnULUTpILLJHpFGME8c/view?usp=sharing

The piece is stereo/fixed-media. It is intended to be performed through a live diffusion performance through multiple arrays of speakers (in which the performer alters the level of each speaker regarding the changes happening in the piece to create an immersive sonic environment). The piece followed a rather standard methodology for composing acousmatic music:

1- Come up with/pick a theme/artistic goal (in this piece's case creating a political/ piece about the dark side of media)

2- Start gathering/recording different sound materials (that might or might not be related to the picked theme)

3- Manipulate sources

4- Put the different manipulated sources into groups

5- Start making connections and hierarchies

6- Repeat steps 2, 3, 4, and 5, not in a numerical order but in an order that would suit the piece

7- Start making connections between different small-scale compositional statements

8- Put the attention to the overall form

The piece also used several methods in terms of building the piece to handle CPU shortage when working with a high degree of sound sources. The main idea is to process the material through many instances in a feedback loop, sometimes using the same or different software/manipulations and utilizing/committing only to the final material. This feedback loop idea was also used when managing the workflow in the DAW project file through mixing the materials (in an electroacoustic context) for composing the piece: the project migration happened numerous times through bouncing down and moving into the following project file to be able to keep building sound materials into the composition.

Keywords—Electroacoustic, Acousmatic, Sound Art

REFERENCES

[1] Moore, A. (2015). Sonic Art: An Introduction to Electroacoustic Music Composition. New York: Routledge. Roads, C. (2015). Composing Electronic Music: A New Aesthetic. New York: Oxford University Press.

[2] Schaeffer, P. (1952). A la recherche d'une musique concrète. Paris: du Seuil. Schaeffer, P. (1966). Traité des objets musicaux. Paris: du Seuil.

[3] Ahlkvist, J. A. (1999). Music and cultural analysis in the classroom: Introducing sociology through heavy metal. Teaching Sociology, 126-144.

[4] Schaeffer, P. (2012). In search of concrete music by Pierre Schaeffer; translated by Christine North and John Dack. Berkley and Los Angeles: University of California Press.

[5] Schaeffer, P. (2017). Treatise on Musical Objects: An Essay across Disciplines; translated by Christine North and John Dack. Oakland: University of California Press.

[6] Smalley, D. (1986). "Spectro-morphology and Structuring Processes." In, S. Emmerson, ed., The Language of Electroacoustic Music. Basingstoke: Macmillan Press, pp. 61-93. Smalley, D. (1991). "Spatial experience in Electro-Acoustic Music". In, L'Espace du Son II. Ohain: Musiques et Researches, pp. 121-124. Chapter Two 36

[7] Smalley, D. (1996). 'The Listening Imagination: Listening in the Electroacoustic Era'. In Contemporary Music Review, Vol. 13 (2), pp. 77-107.

[8] Smalley, D. (1997). "Spectromorphology: Explaining Sound Shapes". In, Organised Sound, Vol. 2 (2), pp. 107–126.

[9] Smalley, D. (2007). "Space-form and the acousmatic image." In, Organised Sound, Vol. 12 (1), pp. 35-58.

Grains of Temporality: Methods for Eclecticism and Polystylism in Hybrid Music Composition

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ABSTRACT

Musical hybridity and critical methods developed for hybridizing electroacoustic and metal music (as part of the presenter's Ph.D. research). These methods are formed to build a blueprint for hybrid composers (ultimately not only specific to metal and electroacoustic but for other genres as well that combines spectromorphological focused music with harmony and rhythm-based music since this type of hybridity requires a unique set of challenges and complexities). Hybridity in music is a well-established and vibrant contemporary scholarly topic. Even though the current literature provides many useful terms and strategies regarding different types of hybrids, the methods for building hybrids are rare. This abstract specifically focuses on the piece 'Grains of Temporality' and discusses the fruitful and problematic methods for composing the polystylistic and eclectic hybrid between electroacoustic music and metal. Different excerpts from the piece will be played when discussing the techniques and methodologies. We will briefly discuss different types of hybridity (transformational hybrid, eclecticism, polystylism, and so on), genre and its notions (their problems, their significance, and their contemporary uses), and the notion of fluidity when approaching the hybridity in music to set the context. As technology increases at a rapid rate and postmodern conditions only grow stronger as lines get blurry, hybridity has been more than a prominent musical power to embrace this current condition and reflect through what is considered music and art in the 21st century (and challenge the notions of high art and low art).

Artwork:
https://drive.google.com/file/d/1LB8RYk3FlfXDUETn2ZG-5YZ6tP8c-7K7/view?usp=sharing

Keywords—Electroacoustic, Acousmatic, Metal, Hybrid Music, Genres, Sound Art

REFERENCES

[1] Abell, C. (2015, April). II—Genre, Interpretation, and Evaluation. In Proceedings of the Aristotelian Society (Hardback) (Vol. 115, No. 1pt1, pp. 25-40).

[2] Adkins, M., Scott, R., & Tremblay, P. A. (2016). Post-Acousmatic Practice: Re-evaluating Schaeffer's heritage. Organized Sound, 21(2), 106–116.

[3] Ahlkvist, J. A. (1999). Music and cultural analysis in the classroom: Introducing sociology through heavy metal. Teaching Sociology, 126-144.

[4] Duff, D. (2014). Wordsworth's" Prospectus": the genre. The Wordsworth Circle, 45(2), 178-184.,

[5] Emmerson, S. (1986). The Language of Electroacoustic Music. London: The Macmillan Press Ltd.

[6] Emmerson, S. (2007). 'Where next? New music, new musicology'. EMS: Electroacoustic Music Studies Network.

[7] Fabbri, F. (2012). Genre theories and their applications in the historical and analytical study of popular music: a commentary on my publications (Doctoral dissertation, University of Huddersfield)

[8] Friconnet, G. (2022). Establishing a taxonomy of metal subgenres based on quantitative musical and thematic features. Metal Music Studies, 8(2), 183-203.

[9] Akiyama, M. (2010). Transparent listening: Soundscape composition's objects of study. RACAR: revue d'art canadienne/Canadian Art Review, 35(1), 54-62.

[10] Allen, M. (2013). Against 'hybridity in genre studies: blending as an alternative approach to generic experimentation. Trespassing Journal, 2, 3-21.