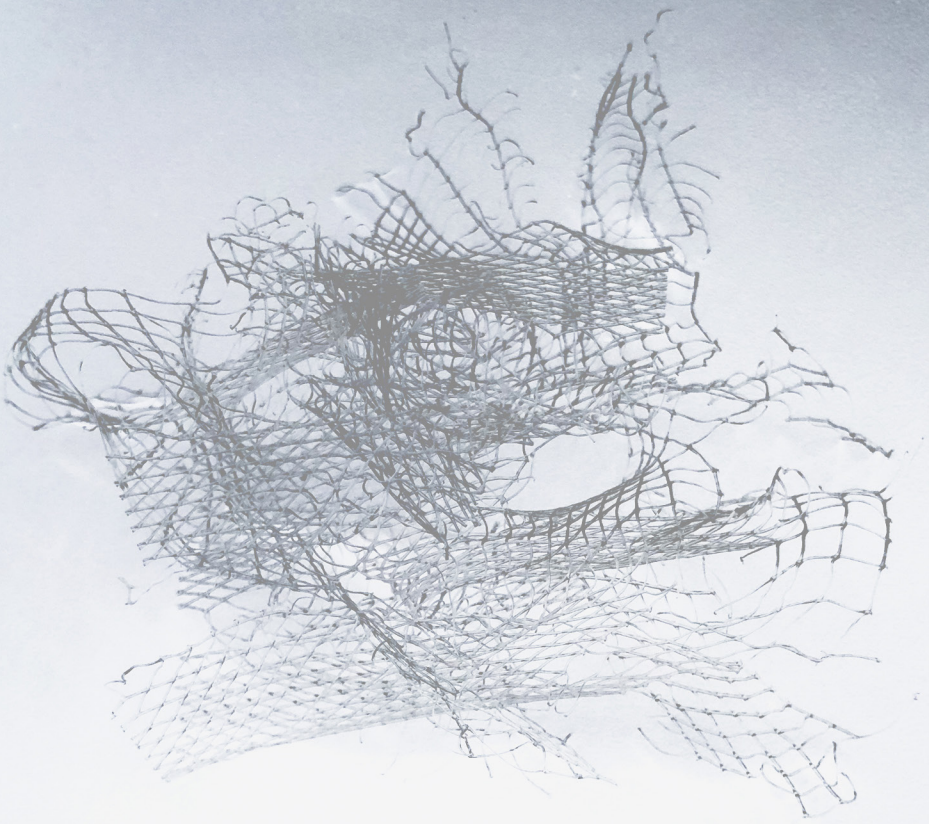

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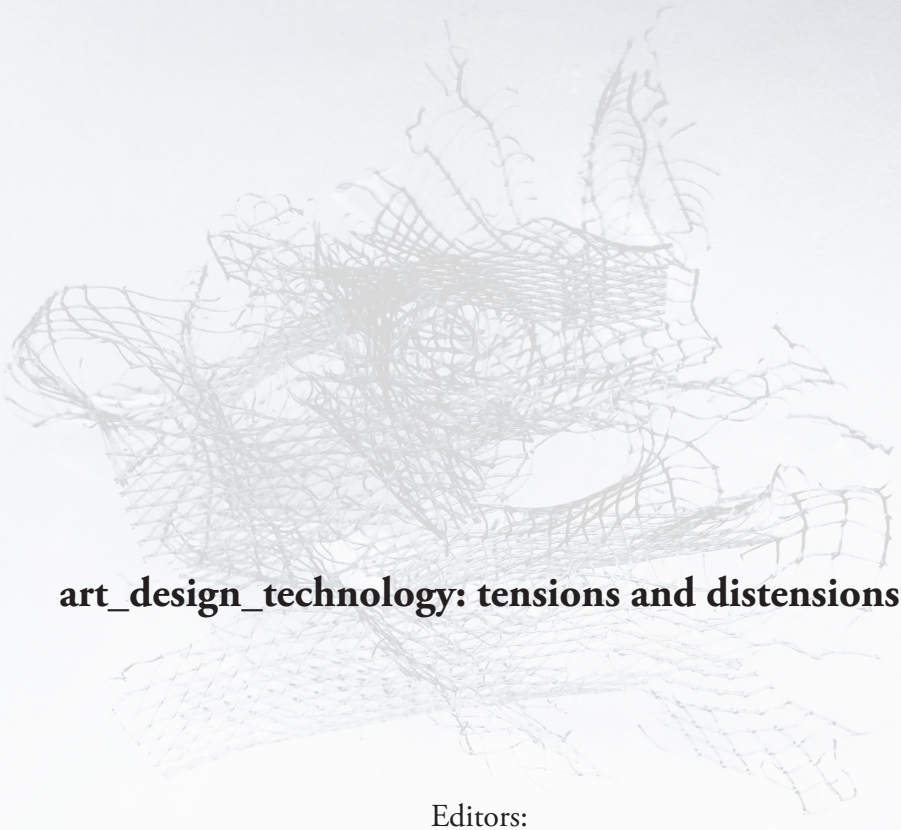

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Editors:
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SUMMARY

PRESENTATION

This book is yet another outcome of the activities of the Art, Design and Digital Media Group (GP_ADMD), affiliated with ECA-USP and CNPq. It stems from the intention to make public the research developed by its active members between 2024 and 2025, while also fostering connections with other researchers and content that, directly or indirectly, intersect with art, design, and digital media.

The original proposal envisioned that each GP_ADMD member would invite an external researcher to participate in the publication, encouraging research networks and potential academic exchanges. Over the nearly two years dedicated to the book's production, through persistence and dedication, we succeeded in gathering eight chapters written by researchers from different regions of Brazil and abroad. As the title of this publication suggests, the texts weave together tensions and resolutions enabled by the interplay of themes related to art, design, and technology.

By inviting researchers external to GP_ADMD, we primarily aimed to recover transversal approaches that, although not directly developed within the group, remain relevant to contemporary debates across art, design, and digital media.

One of the main challenges of this publication was producing it as a bilingual edition — in Portuguese and English — which also reflects our second goal: to broaden the dissemination of the knowledge produced here by weaving networks across other linguistic and cultural contexts.

The first chapter, titled *Curatorial Counter-Narratives: Approaches and Contaminations in Contemporary Art Exhibitions*, authored by Ananda Carvalho, offers reflections on curating within the field of contemporary art. The text analyzes exhibitions that take shape as counter-narratives — curatorial discursive constructions that offer alternatives to traditional models and are marked by a more plural character.

Belinda Dunstan and Priscila Guerra, authors of the second chapter, *Listening to Materials: Dialogue between Digital and Analogue Practices in Designing Social Robots*, explore the proposal of "engaging materials and their qualities as active participants in the design process." This proposition is considered an interdisciplinary methodological strategy to be applied in the development of social robot morphologies. The chapter analyzes two case studies: the first concerning the design of a social robot morphology; and the second, developed in an undergraduate educational context, exploring movement qualities in social robots. By bringing the approach of listening to materials — so central to art and design — into the field of social robotics, the article offers an innovative set of methodological tools and opens new research avenues in the area.

The third chapter, *The Slowdown of Catastrophe: Performative Framing in the Work Erupulsões*, authored by Eduardo Mondelli, presents the creative process of the video *Erupulsões* (2022), produced by the author and exhibited at the 22nd Sesc Videobrasil Biennial. The chapter proposes an aesthetic and psychoanalytic investigation of the work, articulating the concepts of the sublime and sublimation.

In the fourth chapter, *Being – the Path of Subjectivation*, Eduardo Salvino discusses the dangers of predictive algorithm models, which conceal mechanisms of digital control and surveillance, undermining individual rights and rapidly eroding democracy itself. In counterpoint to the informational architecture of algorithms, the text presents examples of aesthetic interventions that generate both tension and release in the monitoring of personal data traces.

The fifth chapter, *Drawing Board to Facilitate Artistic Practice for Visually Impaired Individuals: Conceptual Project Development Process*, was conceived by Elizabeth Romani, Denise Dantas, and Paulo Henrique Lima da Rocha. They emphasize the importance of the full and equal participation of people with disabilities in social life. The chapter advocates a more inclusive educational approach, promoting greater autonomy for students with visual impairments through the integration of assistive technologies in learning processes.

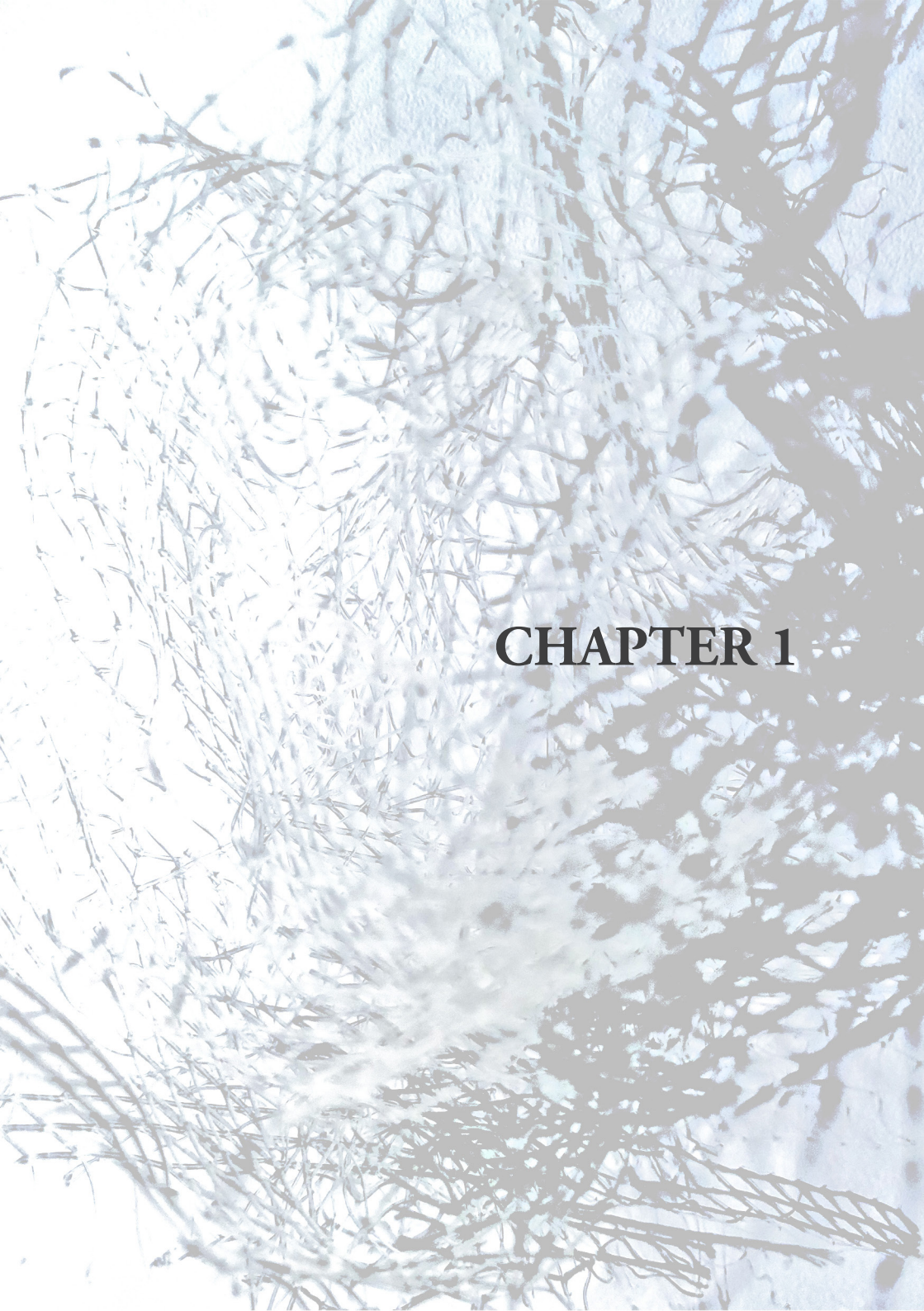
Larissa Macêdo, author of the sixth chapter, *Artistic and Curatorial Practices on Social Media: Algorithms and Crossroads*, critically reflects on the curatorial black and Brazilian practices shared on social media in the early 2020s. Drawing on the concept of "crossroads" developed by Leda Maria Martins, the chapter contributes to the deconstruction of universalizing logics, advancing an understanding of social media as ambiguous communicational environments capable of destabilizing hegemonic processes in contemporary visual art. The author presents examples in which the performative character and the processes of co-curation and algorithmic co-creation established online challenge the hegemonic biases present in these spaces.

The seventh chapter, titled *Form against Function: Preto Matheus and the Poetic (Pseudo)illegibility of the Letter* by Miguel de Ávila Duarte, explores how the artistic work of Preto Matheus — a trained designer who uses the grid as a creative tool — prioritizes the playful act of letter deciphering over conventional rules of legibility. The chapter discusses the subordinating tradition between typefaces and text, as well as historical relationships between constructive art movements and design. Ultimately, the author designates Preto Matheus's work under the category of *monstrutivism*.

Monica Tavares, Juliana Henno, and Chi-Nan Pai author the eighth and final chapter, *3D Scanning, Parametric Design, and Digital Fabrication in the Context of Assistive Product Development*. Highlighting the technological potential of 3D scanning, parametric design, and digital fabrication, the chapter explores how these tools can foster the development of assistive products. Finally, it presents a case study showing how personalization significantly boosts user self-confidence while reducing the social stigma associated with disability.

Thus, we invite readers to begin this journey with the confidence that the texts presented here will contribute to the expansion of critical repertoires and serve as powerful conceptual frictions.

Monica Tavares, Juliana Henno and Priscila Guerra



CHAPTER 1

CURATORIAL COUNTER-NARRATIVES: APPROACHES AND CONTAMINATIONS IN CONTEMPORARY ART EXHIBITIONS

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Abstract

This chapter reflects on the curation of art exhibitions as a possibility to articulate counter-narratives. It analyses how curatorial discourses gain materiality in the exhibition design through approaches and contaminations of artistic propositions. These issues are discussed through examples of selected aspects from four exhibitions: *O Rio do Samba: Resistência e Revolução* (The Rio of Samba: Resistance and Revolution), *Museu de Arte do Rio*, 2018, *Um defeito de cor* [A Defect in Color], *Museu de Arte do Rio*, 2022, *À Nordeste* [To the Northeast], *Sesc 24 de Maio*, 2019, and *Dos Brasis* [Of Many Brazils], *Sesc Belenzinho*, 2023. Finally, in dialogue with Claire Bishop, the non-neutrality of curatorial discourses and the plurality of contemporary art display methods are interrogated.

1. Curatorial counter-narrative and art history

Between 2016 and 2017, I participated in the research team for *A História da _rte* [The History of _rt], which compiled quantitative data on artists mentioned in eleven books used in undergraduate Visual Arts courses in Brazil, such as Ernst H. Gombrich's *The Story of Art* and Giulio C. Argan's *Arte Moderna* [Modern Art]. The aim was to "measure the exclusionary landscape of official Art History studied in the country by gathering and cross-referencing basic information on the artists

included" (Moreschi, 2017 [our translation]). After data collection, this research reveals that, of the 2,443 artists mentioned in the books, only 215 are women, and 22 are Black, with only 2 being Black women (Moreschi, 2017). Arriving at this alarming realization calls for rethinking the art system. Reaching this alarming conclusion implies rethinking the art system. With so many absences, it is necessary to reflect on exhibition and curatorial practices. This chapter seeks to map procedures that address the multiplicity of contemporary art display modes, considering that curatorship serves as a tool for constructing narratives, historical record, and in establishing relationships with audiences (Carvalho & Cordeiro, 2022, pp. 134–135).

It can be considered that the work of art is understood within the social field, hence the need to understand how art history can be constructed through exhibitions. From this perspective, other authors also affirm that:

> Exhibitions have become the medium through which most art becomes know. [...] Exhibitions are the primary site of exchange in the political economy of art, where signification is constructed, maintained and occasionally deconstructed. Part spectacle, part socio-historical event, part structuring device, exhibitions – especially exhibitions of contemporary art – establish and administer the cultural meaning of art (Greenberg et al., 1996, p. 2).

From this perspective, the urgency to discuss the potentialities of an exhibition emerges. How are narratives and exhibition discourses organized? What are the dialogues or gaps that curatorship has questioned in the visual arts? In response to the figures from the project *A História da _rte* [The History of _rt], it is noted how Fabiana Lopes (2016, p. 40, emphasis mine) develops the idea of counter-narrative based on the analysis of Afro-descendant artistic production:

> It reveals itself as a site of dialogue with art history—a narrative in its own right—that suggests the incorporation

> of other narratives formed by non-Western traditions into the official discourse: personal and collective histories and memories, ways of seeing, perceiving, and experiencing reality, filtered through African traditions, Indigenous traditions, and both popular and scholarly languages, which are engaged with one another in a continuous and dynamic movement that fosters new possibilities.

From this understanding of counter-narrative, how are curatorial actions established? How can the pluralities of artistic productions be revealed? How can relationships be created between the works, their spatial organization, and the opportunities for engagement with the public? The following section delves into four examples of curatorial practices that construct counter-narratives, which materialize in the exhibition design through processes that blend proximities and contaminations of artistic productions.

2. Approaches and contaminations

2.1. Some Historical Cases

To provide historical context for this reflection, one can recall the exhibition *A Mão do Povo Brasileiro* [The Hand of the Brazilian People], held in 1969 for the inauguration of MASP [Museum of Art of São Paulo] on Avenida Paulista. Conceived by Lina Bo Bardi, in collaboration with Pietro Maria Bardi, Glauber Rocha, and Martim Gonçalves, the exhibition compiled research and developments from exhibitions that the architect had previously organized between 1959 and 1965. It encompassed a complex array of artistic productions such as "Northeastern ex-votos, the figureheads and prows of boats from the São Francisco River, Candomblé objects, and the garments of orixás" (Menezes, 2022, p. 704 [our translation]) . The curatorial gesture gained visibility as Lina Bo Bardi's selections entered "the museum space for the first time through her exhibitions, gaining relevance through their recurring presence" (Menezes, 2022, p. 704 [our translation]) . According to anthropologist

Ilana Seltzer Goldstein (as cited in Paiva, 2022, p. 56), these practices were named "'artification' by the French sociologist Roberta Shapiro, referring to objects previously not considered artistic by Western culture that subsequently began to be exhibited in art museums".

This process of *artification* would gain a bit more space in exhibition venues only years later, as in the case of another emblematic exhibition, *A Mão Afro-Brasileira* [The Afro-Brazilian Hand], curated by Emanoel Araújo at MAM-SP in 1988. Another example of this, was the creation of the Museu Afro Brasil [Afro Brazil Museum], inaugurated in 2004, also conceived by Araújo. It is noteworthy that this institution presents "a [...] exhibition design of juxtapositions and agglutinations, [...] mixing art, culture, and other forms of material economy" (Oliveira, 2023, p. 113 [our translation]). This exhibition procedure will be discussed next through recent exhibitions. Emerson Dionísio de Oliveira (2023, p. 107) also presents the concept of "'trans-historicity' to make visible how distinct artistic practices, a priori, are brought together to symbolically perpetuate narrative strategies of art history in institutionally recognized museological settings".

From another perspective, one can also recall the 24th São Paulo Biennial, organized by curator Paulo Herkenhoff and associate curator Adriano Pedrosa, under the curatorial theme of anthropophagy. The idea of contamination, materialized as a curatorial procedure, became one of the main actions of this Biennial edition by fostering relationships between Brazilian art history and world art history—or, more precisely, the traditional universal history that encompasses North America and Europe. In this way, the curators sought "to establish a dialogical gesture, by including a strong piece by a Brazilian artist in the room of a European or North American artist" (Herkenhoff, 2008, p. 36 [our translation]). For example, one can cite the exhibition of works by Lygia Clark and Mira Schendel alongside those of Eva Hesse and Louise Bourgeois; the display of the sculpture/object *TaCaPe* by Brazilian artist Tunga, in the 16th-century room; and the insertion of *Trouxa* [Fool], a conceptual work by Artur Barrio, a Portuguese artist based in Brazil, in the Francis Bacon room.

Many exhibitions curated by Herkenhoff explored a display approach of contaminations, manifested in a wide diversity and complexity of works occupying exhibition spaces, denying the neutrality and sterility of the white cube[1]. Among other exhibitions, *Contrapensamento selvagem* [Counter-Savage Mind] stands out, curated by Cayo Honorato, Clarissa Diniz, Orlando Maneschy, and Paulo Herkenhoff, held at Itaú Cultural in São Paulo in 2011. In an interview with Canal Contemporâneo, Diniz (quoted in Canal, 2011) emphasized that the proposal sought "to conceive the space as a collaborative gathering between the artists, where the exhibition environment would allow them to contamine one another." [our translation]. This approach became even more recurrent in exhibitions held at the Museu de Arte do Rio (MAR) [Museum of Art of Rio de Janeiro], an institution that Herkenhoff helped establish, directed, and curated from its opening in 2013 until 2016.

2.2. Approaches between Visual Culture, Documents, Texts, and Artworks

In recent years, a reflection on the polyphony of art, which includes visual culture, has gained prominence in exhibitions at MAR [Museum of Art of Rio], especially those curated by Marcelo Campos.

> Today, in focusing on the mechanisms of art, the significant divisions between popular and high culture or between formalist and contextual art should no longer compete for a supposed class-based elevation of an artwork's quality.
>
> There are many pressing issues to address. [...] What is now required is the presence, participation, and expansion of the previously marginalized groups within biennials, exhibitions, and the official art system. [...] if the museum is, as James Clifford suggests, a "contact zone," then it will be necessary for material culture to be explicit, opening

1. See Carvalho, A. (2019).

> itself up to analysis and engaging in a live and performative interaction with the public, no longer enthroned solely by specialists, but rather meant to foster listening among the groups from whom these pieces were originally taken and appropriated.
>
> More than entertainment and selfies, Afro-Brazilian art deal with the potential to create heritage bonds with objects and stories that need to be brought back into the world, reinterpreted by Brazilian and global society (Campos, 2018, pp. 77-78 [our translation]).

In an interview with the Plataforma de Curadoria [Curatorship Platform], Marcelo Campos (2019) exemplifies this approach through the curation of the exhibition *O Rio do Samba: Resistência e Reinvenção* [The Rio of Samba: Resistance and Reinvention] (Museum of Art of Rio, 2018). In the production process of this exhibit, Campos (2019 [our translation]) highlights that "a photocopied document was more important than a Di Cavalcanti. I learned to see samba without it being interpreted solely through modern art". The curator emphasizes, "we were telling the story of Black people, the story of samba artists. So, we sought documents. It was a curatorship where we took a tiny photograph from a book, enlarged it, framed it, and hung it on the wall" (Campos, 2019 [our translation]). With this gesture, Campos underscores the strategy of creating connections between artistic propositions and visual culture. In this way, "[...] it defetishizes objects by continually juxtaposing works of art with documentary materials, copies, and reconstructions" (Bishop, 2013, p. 59).

The proposal of contaminations among artworks, documents, and other images of visual culture is a recurring theme in exhibitions produced at MAR, beyond *O Rio do Samba*. In *Um Defeito de Cor* (2022), alongside approximately 400 works in diverse languages by over 100 Brazilian and African artists, most of whom are women, the exhibition includes texts inspired by the characters and historical events cited in the book, documentary photographs, newspaper clippings, posters, etc. (Figures 1 and 2).

Figures 1 and 2
Views of the exhibition Um defeito de cor (Museu de Arte do Rio).

Source: Photo by Ananda Carvalho.

This exhibition is based on the eponymous book in which Ana Maria Gonçalves uses a fictional narrative to tell the story of Kehinde, a Black woman who was enslaved and later freed. Her journey begins with her capture as a child in Benin, continues through Bahia, Maranhão, Rio de Janeiro, and São Paulo, and concludes with her return to Africa as an adult. In this narrative, the author—who was also a co-curator of the exhibition—reworks and shares with the reader a comprehensive account of slavery in Brazil. In its adaptation for the exhibition, this objective remains, further expanding reflections on the issues addressed.

Another recurring practice in the Museum of Art of Rio exhibitions is to invite various people to share curation, rather than limiting it to the idea of a universal curator as the sole holder of knowledge. For context, in addition to *Um defeito de cor*, three examples are cited. The curatorial team for *Dja Guata Porã* (2017) included Sandra Benites, an anthropologist and Guarani Nhandeva Indigenous curator, Professor José Ribamar Bessa, a specialist in the Indigenous history of Rio de Janeiro, as well as Clarissa Diniz (then MAR's content manager) and Spanish curator Pablo Lafuente. For *O Rio do Samba*, the curatorial project was shared by Marcelo Campos and Clarissa Diniz with Nei Lopes, "samba

man" (Campos, 2019): an expert in the field, composer, singer, samba musician, and researcher of Afro-Brazilian culture. For *Casa Carioca* (2020), Marcelo Campos Campos shared co-curatorship with Joice Berth (an architect and urban planner who develops a critical racial and feminist perspective), among other exhibitions.

Returning to *Um defeito de cor* [A Defect in Color], the exhibition layout is organized as an "installational structure" (Heráclito, 2022). In the MAR setup[2], the exhibition occupied two rooms on one floor of the museum, guiding certain paths and offering a circular walking experience through "walls" of fabric and translucent structures (Figure 3). "The exhibition feels like a large circle, a continuous movement. You can turn around through the chapters" (Heráclito, 2022 [our translation]). Besides the images, numerous informative texts fill the space, introducing characters from the book who, in some way, embody diverse presences in the construction of history. They also contextualize historical events and the ten themes or nuclei of the exhibition, which rework each of the book's ten chapters: slavery, struggles and revolts of the Black movement, religion and ancestor worship, female leadership, labor and entrepreneurship, African diaspora, transatlantic slave trade, contemporary Africa, systemic racism, and violence.

2. After its showing at MAR, *Um defeito de cor* was exhibited at the National Museum of Afro-Brazilian Culture in Salvador (November 6, 2023, to March 31, 2024) and at Sesc Pinheiros in São Paulo (April 24 to December 1, 2024).

Figure 3
View of the exhibition Um defeito de cor (Museu de Arte do Rio, 2022)

Source: Photo by Ananda Carvalho.

The cumulative exhibition design has become a recurring approach at MAR to highlight plural perspectives. Next, we will observe how this accumulation procedure is discussed in two other exhibitions: *À Nordeste* and *Dos Brasis* (held at other cultural centers in São Paulo). Among others, Marcelo Campos—chief curator of MAR since 2018—and Clarissa Diniz—content manager at MAR from 2013 to 2018—are part of the curatorial teams of the exhibitions analyzed below.

2.3. Contaminations and Presences in the Exhibition Space

In 2019, *À Nordeste*, held at Sesc 24 de Maio and curated by Clarissa Diniz, Bitu Cassundé, and Marcelo Campos, highlighted the responsibility of bringing diverse, activist, and inclusive perspectives to the circuit and history of Brazilian art. With the aim of developing counter-narratives, the exhibition was based on a proposition by Ceará-born artist Yuri Firmeza to showcase artistic productions that were not focused on the Rio de Janeiro–São Paulo axis. A key feature of the exhibition was its approach to bringing together productions and creating a horizontalization of practices developed in the Northeast of the country or, even when created by artists from other places, challenging the imaginary about the region from a transhistorical perspective.

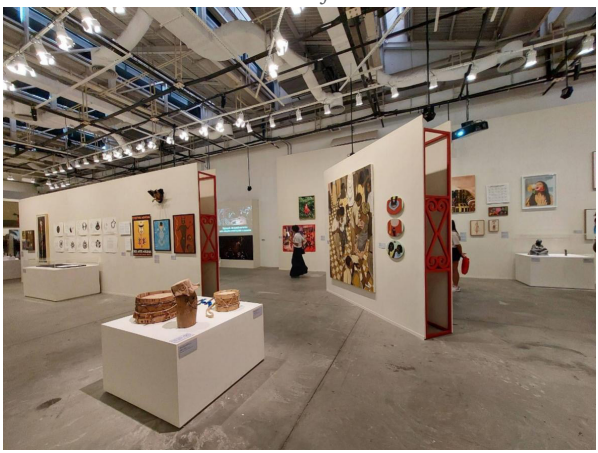
À Nordeste presented 250 works that filled the exhibition space from floor to ceiling. The layout, which led the audience through a sort of labyrinth, offered non-linear and plural readings of the curatorial proposal. With works addressing themes that were once marginalized, the exhibition made no distinction between modern and contemporary or popular and erudite. To mention just one example, there was *Memelito*, a video installation displaying a selection of memes shared on social media by the group *Saquinho de Lixo*.

This exhibition is remembered for various reasons, including the discussions it sparked in *Revista ARTE!Brasileiros*, which included critical texts by Aracy Amaral and Tadeu Chiarelli, as well as responses from the curators and the artist Yuri Firmeza. The first text published, written by Amaral (2019), points out a negative experience with the "cumulative display" [our translation], the blend of different artistic languages, and the absence of renowned names. The critique opens and closes by stating that "Curating is not an easy task to conceive" [our translation], asserting that the exhibition would serve as an example of what not to do. In the curators' response, we find justifications for a curatorial practice that constructs counter-narratives, as exemplified by other cases mentioned in this chapter.

> It should be emphasized that, in the proposed curatorial project, other forms of visibility — social, political — were equally prioritized. If they cause discomfort due to their asymmetrical coexistence within the exhibition space, they do so out of an ethical-aesthetic concern to avoid simulating, through art, pacifying, framed, aseptic existences: ones that neutralize the violence of the worlds and lives of their creators. [...] If what was sought could not be located, at the very least, it must be suspected that what is at stake here are other trajectories, other intentions, other desires, other protagonisms, other urgencies, other artists, other representations of the Northeast (Campos, Cassundé and Diniz, 2019 [our translation]).

The discussion continued with the publication of a text by Tadeu Chiarelli (2019) under the title *Apesar de montagem confusa*, *À Nordeste aponta para questões urgentes* (Despite a Confusing Layout, À Nordeste Points to Urgent Issues). These issues are summarized at the end of the text as "about Brazilian society, about the art we produce, and, just as importantly, about how to adequately balance the desire to break with traditional curatorial work while maintaining the intelligibility of what is intended to be presented to the public" (Chiarelli, 2019 [our translation]). Finally, Yuri Firmeza (2019) wrote the text entitled "Muvuca", adding another layer of reflections on the history and system of Brazilian art.

Figure 4
Exhibition view of Dos Brasis.



Source: Photo by Ananda Carvalho. Sesc Belenzinho, São Paulo, 2023.

Further reflecting on the proposition of counter-narratives and exhibition design, we can observe *Dos Brasis* (Figure 4), curated by Igor Simões in collaboration with associate curators Marcelo Campos and Lorraine Mendes, presented at *Sesc Belenzinho* in 2023. The exhibition, the outcome of a research project funded by Sesc across the country, focuses on the production of Black artists beyond White-Brazilian art (Simões, Mendes, Campos, 2023, p. 10). At the 1st International Congress on

Afro-Diasporic Studies, Simões[3], commented, "We wanted displays packed with works as a kind of curatorial manifesto to declare that this production does not end with what is in the exhibition. This production is a tiny fraction of the 57% of the Brazilian population" [our translation]. This premise is further emphasized in the exhibition catalog:

> The works presented in Dos Brasis shatter any attempt to confine[4] (and this term is not used here innocently) Black artistic production to a single, generalized perspective. On the contrary, the over 240 artists, spanning from the 18th to the 21st century, who form this densely packed exhibition, are an unequivocal demonstration of the various paths chosen in expressions that unite singularity and dialogue with a wide array of artistic traditions, whether Black… or White (Simões, 2023, p. 25 [our translation]).

To give visibility to all this production, the curators developed methods and strategies that materialize the theoretical propositions of counter-narratives:

> [...] the premise of a narrative that would adopt chronology, style, or any other notion directly aligned with the groupings of Eurocentric canonical histories was also not an option. Instead, we conceived and worked with the idea of constellations: encounters, proximities, and distances between different propositions that at times produce dissonances, revealing their particularities and possible connections (Simões, Mendes, Campos, 2023, p. 11 [our translation]).

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3. Simões's remarks were presented on the panel "Art Theories and Histories" at the 1st International Congress on Afro-Diasporic Studies at Sesc RJ, held on December 11-12, 2023, in the Fecomércio RJ Headquarters Auditorium. The talk is also available at: https://www.youtube.com/watch?v=aSAFbPPp7Io. Accessed on: March 7, 2024.

4. In the original Portuguese: "tentativa de aprisionamento".

The idea of constellations can be identified as another recurring method in contemporary art exhibitions. It seeks to highlight pluralities and abandon the creation of authoritarian and universalizing relationships. Regarding the exhibition *Dos Brasis*, this author informally heard from a specialized audience that, although the exhibition highlights the number of artists involved, the conceptual connections between the works were not deeply explored. From this perspective, could it be said that the unprecedented presence of these artists is already fostering the construction of critical thinking?

Figure 5
View of the Dos Brasis

Source: Photo by Ananda Carvalho. Sesc Belenzinho, São Paulo, 2023.

The space hosting *Dos Brasis* has great potential. *Sesc Belenzinho* is a cultural center that attracts a broad audience who come for the swimming pool, sports activities, workshops, and other programs not primarily aimed at visiting the exhibition, but who encounter it along the way. Children can be seen playing among the artworks, fostering different ways of experiencing the exhibition (Figure 5). In this sense, it is possible to reflect on how the exhibition, with its large number of works by Black artists, indeed enables encounters and recognitions with an art form that still lacks a recurring presence in major museums.

3. Final considerations

in response to the urgent demand for a revision of history and the art system from a plural perspective, this chapter presents some possible answers through discursive constructions materialized in the exhibition designs of *O Rio do Samba: Resistência e Revolução*, *Um Defeito de Cor*, *À Nordeste*, and *Dos Brasis*. From the perspective of approaches and contaminatios, plural points of view are crafted. The exhibition practices break away from the traditional "white cube," a modern art exhibition model. This model has become established in contemporary art due to its supposed neutrality, given the absence of elements distracting from the artwork. However, no model is truly neutral. And if the structure of the white cube has become a tradition, an exhibition "canon," perhaps it is worth discussing how the encounter between artistic propositions and the audience can be experienced in a non-authoritarian way.

The design of the exhibitions mentioned here consolidates a procedure of accumulation or the creation of labyrinths. For some, this approach is interpreted as a positive perspective of plurality. Others see it as a mess that hinders the experience — as in the criticisms by Aracy Amaral and Tadeu Chiarelli regarding *À Nordeste*. It may be necessary to emphasize the possibilities of divergences in a creative but respectful way. And thus: "It suggests a spectator no longer focused on the auratic contemplation of individual works, but one who is aware of being presented with arguments and positions to read or contest" (Bishop, 2013, p. 59)

To add another perspective, we can consider another text, titled *Information Overload*, in which Claire Bishop (2023), mentioned above, discusses the "archival turn" in research-based art exhibitions. Bishop analyzes various stages in the setup of these exhibitions to draw connections with digital culture, the production of knowledge across multiple screens, and online reading. In the first phase, evident since the 1960s but gaining momentum in the 1990s — even before the internet became widespread — "[...] this aversion to authorial mastery was a response not just to poststructuralism but also to feminist and postcolonial theory, which

variously critiqued linear history as evolutionary, univocal, masculinist, and imperial" (Bishop, 2023). In subsequent phases, especially over the last two decades, artists have sought to structure their work between skimming and sampling, acknowledging shifts in information reception shaped by internet experiences.

Although Bishop (2023) addresses a specific language—installations derived from research-based art — a parallel can be drawn to think about exhibition reception and setup more broadly. The author expresses a critical stance toward accumulation/saturation displays, arguing that "Such exhibitions seem to demand a kind of reading that is no longer pleasurable or innovative or liberating but echoes the all-too-routine experience of connecting the dots as we search the Web, frantically trying to synthesize a morass of conflicting opinions" (Bishop, 2023). She emphasizes, "My point is that the craft of assembling language, and how it is presented, needs to transcend quotidian communicational efficiency. Text is never neutral but is shaped by the mode of its delivery" (Bishop, 2023).

In other words, curatorial processes shape both what and how artistic propositions are shared. In the exhibitions discussed here, the relationships between artworks and spaces establish narratives that can function as counter-narratives. Many works are on display, inviting open-ended interpretations and experiences, while the accumulation/saturation model reinforces the existence of a substantial, vibrant body of work that deserves exhibition space, as argued by Igor Simões in *Dos Brasis*.

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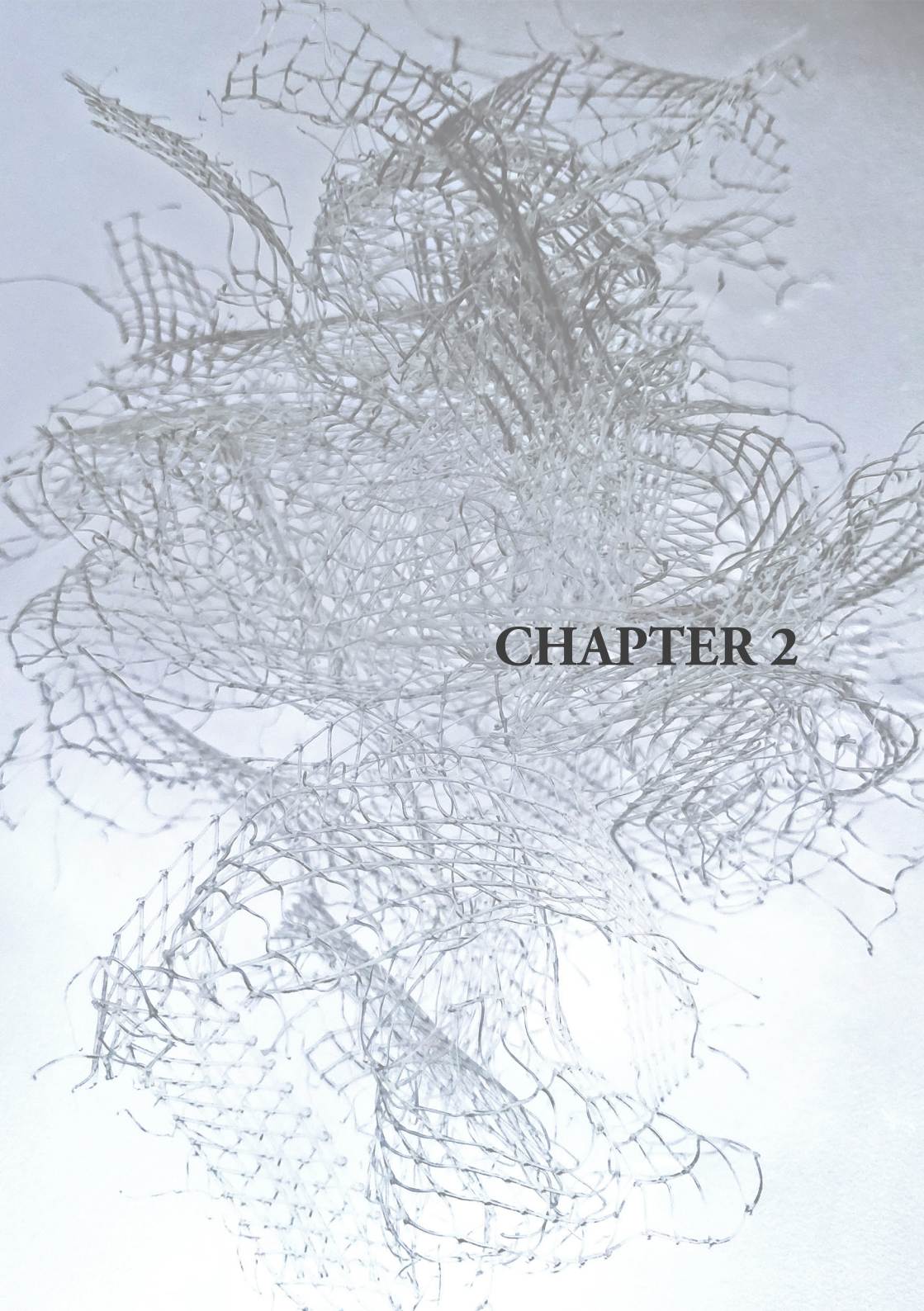

CHAPTER 2

LISTENING TO MATERIALS: DIALOGUE BETWEEN DIGITAL AND ANALOGUE PRACTICES IN DESIGNING SOCIAL ROBOTS

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Abstract

This chapter explores the methodology of 'listening to materials', derived from artistic practices, as a cross-disciplinary approach that can be applied to the development of social robot morphologies. Analysis of contemporary art case studies reveals how artists have led this practice of listening, noticing, learning from and responding to various mediums to inform and shape their work. This chapter examines the application of the method in two scenarios. The first involves the design of a social robot morphology in practice-based research and the second focuses on an educational setting, where the development of both morphology and affective movement for social robots is considered. It is proposed that 'listening to materials' in a deliberate and purposeful manner, traversing the realms of the analogue and digital, provides a range of dynamic and generative design possibilities, resulting in distinctive morphologies. Additionally, this process offers a means of circumventing the conventional forms and movements often predetermined by design software and electronic hardware, thereby reclaiming the mark of the maker, the expression of affect, and the role of intention in the development of this social technology.

1. Introduction

1.1. Listening

The act of listening, as distinct from hearing, denotes not just audibility but attention, perception and understanding. The act of listening to materials might be understood literally, as discussed extensively by sonic arts scholar Caleb Kelly (2022), or metaphorically, as it is employed in this chapter, to describe the engaged act of looking, touching, noticing, understanding and acting upon the nature of materials, to further a design. In both instances, both the literal and metaphorical, "It involves the whole body as a source of understanding"* (Tan, 2021, p. 247)[1]. Listening to materials entails an active dialogue between the maker (artist, designer, student, researcher and others) and the material they have chosen to work with. In this dialogue, the maker may intuit that a certain material may be appropriate for the project, but as they work, they continue to *listen* or learn from the material, and adjust their design or plan, rather than forcing the material to behave in a way not fully suited to the qualities inherent to it. By way of illustration, while working with a material, it may bend, twist or crumple, suggesting certain forms or finishes the artist had not previously considered. Throughout an iterative process, a designer may engage with various materials, and if open to the dialogue of listening and responding to those materials, the design exploration and the subsequent development of the work can be largely material-led.

If working between the analogue and digital, both the hardware and software involved in these processes may inform the development of the work beyond the unidirectional manufacturing of the original design. For example, moving from analogue to digital, a maker may notice glitched changes in a 3D scanned sculpture, as a result of the process of digitization, and rather than edit the model, they may take inspiration

1. *Here, Tan is specifically describing the practice of deaf artist Christine Sun Kim.

from these changes and alter their design. Later when the model is 3D printed, new textural qualities may emerge, and this may be viewed as new information to further inform the work, rather than a process by-product to be removed.

Within this chapter, two case studies are presented: one involving practice-based research by a doctoral candidate and another conducted within an undergraduate educational setting. In both cases, the act of listening to materials is employed in the development of social robot morphologies. In the case study of practice-based research, the act of listening to materials is part of the process of shaping, texturing, and painting the social robot. Within the educational setting, the nature of the prototyping materials is also capitalised upon to inform the design of the robot's movement, and even character development. This methodological approach sits in opposition to the majority of contemporary technology development, particularly in the field of social robotics, where morphological forms are largely responsive to the mechanical and technological requirements of the robot's function. Alternatively, the form may be designed within a 3D modelling program, carrying the mark of the program's tools, and is then directly manufactured in the chosen material. Any dialogue in the development of the robot usually comes in the form of user feedback, where the robot's form may then be altered digitally, and re-manufactured, in a unidirectional manner.

Designing a robot's morphology based on standardised hardware, or through a unidirectional process—sketch to 3-D model to manufacture—can lead to a number of pitfalls. Firstly, the robot's design may resemble that of many others, as evidenced for example by the large number of humanoid social robots developed on a standardised platform (see:

Quori[2], Snackbot[3], ARI[4], Olivia[5]). All of these robots move and operate in a very similar manner, despite being designed for a wide variety of applications. Secondly, without alternative sources of inspiration, social robot designers may resort to one of a narrow range of morphological typologies, such as the human replica, the futuristic machine, or the cute companion, all of which carry different problematic implications, as described by Dunstan and Hoffman (2023). Further issues present within the practice of contemporary social robot morphology design are explored in section 1.3 of this introduction.

The methodology of involving materials and their qualities as an active participant in the design process may contribute to the development of social robot morphologies in several ways, which are illustrated within this chapter. Design materials and processes may yield unexpected outcomes, contributing to innovative forms, and helping designers avoid mimicking problematic morphological typologies. As a result of this process, there may be greater visual congruence between the morphological form of the robot and the material it is constructed from, as the latter can actively inform the former. Additionally, the morphology of the robot may be more expressive, even in a stagnant position, and may add character and interest to the robot. Listening to materials while designing a robot's movement capabilities can inspire movement generation and reduce the overuse of electronic components. This approach can also facilitate the dissolution of the barriers between analogue and digital practices, once they are employed to adapt to the materiality of robots, thereby promoting dialogue between them.

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2. Quori, designed by the Immersive Kinematics La: https://www.immersivekinematics.com/quori/. Accessed on: May 2, 2025.

3. Snackbot developed at Carnegie Mellon University: https://www.cs.cmu.edu/~snackbot/about-public.html. Accessed on: May 2, 2025.

4. ARI developed by PAL Robotics: https://pal-robotics.com/robot/ari/. Accessed on: May 2, 2025.

5. Olivia developed by A*STAR Social Robotics Lab: https://research.a-star.edu.sg/articles/highlights/robot-olivias-lessons-in-tool-mastery/. Accessed on: May 2, 2025.

In the first section of this chapter, the artist and PhD student Priscila D. Guerra describes the creative process for developing the morphology of the social robot 安 [ān] (2022-2024) within the context of the research entitled *Movement and human-artificial creature interaction: new approaches*. She presents the act of listening to materials in the dialogue between digital and analogue practices, related to three aspects: form, texture and painting. Moreover, the title of the social robot is also an act of listening, as the name was chosen for its proximity to the formal and conceptual characteristics of the artwork. The Chinese symbol 安 means "calm", "quiet"[6], and visually resembles the design of Guerra's social robot.

In the second section of this chapter, Dr Belinda J. Dunstan, researcher and educator from the University of New South Wales details teaching methodologies used in her undergraduate course, *BENV2522 Social Robotics*, to support students in the design and development of social robots. In this section, Dunstan describes how students are encouraged to respond to materials, capitalising on their qualities to inform both the morphology and movement of the robots they design. The described methodology is then shown in application to another interaction course, where students design interactive architectural façades, in the course entitled *CODE2230 Human-Machine Interaction*.

While the practice of listening to materials to inform the development of social robot bodies is a new methodological approach in the field of social robotics, this is a well-worn approach within the fields of art and design. The following section explores the practices of artists who engage in the methodology of listening to materials and provides examples of the many ways that responding to the nature of materials can form a dialogue in the production of creative work.

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6. Pronunciation of the symbol 安: [ān]. Glasgow: HarperCollins Publishers. https://www.collinsdictionary.com/dictionary/chinese-english/%E5%AE%89. Accessed on: May 2, 2025.

1.2. In Dialogue with Materials

The aforementioned practice of listening to materials is not a novel phenomenon in the artistic field. It can be observed in the creative process of contemporary artists who have explored the qualities of the materials they have used to create their works.

Artist Richard Serra was a post-minimalist American artist renowned for his large-scale abstract sculptures. Serra investigated the characteristics of materials and modelled them in accordance with their own specifications and in a manner that enhanced their intrinsic qualities. He was particularly interested in the characteristics of "industrial materials and the physical properties of the chosen media" (Tate, 2024). The 1967 work *To Lift*, made with vulcanised rubber, explored the elasticity of this material and its slightly molten appearance. The work was part of a series of pieces created in the 1960s in which the artist sought to combine certain verbs, including "to tie", "to bend", "to curve" and "to splash", with the materials used, thus integrating the creative process with the final outcome (The Museum of Modern Art, 2024). In the case of the work *To Lift*, Serra followed the action of "lifting" and transformed vulcanised rubber into a sculptural form through experimentation. This position of listening to the materials is demonstrated in the artist's receptive and careful approach to the singularities of the bodies and materials within the creative process.

Another practitioner engaged in listening to materials is American artist Jon Isherwood. This artist selects stone as the material to explore in his work, also using digital fabrication technologies to accentuate its plastic characteristics. Isherwood's process involves studying marble and concrete blocks, analysing their veins, their tonal differences, before designing grooves to accentuate the materials' qualities. With regard to this research, Gelber (2003) states that:

> Instead of making minimal marks on the surface of the stone in order to create an abstract persona, the CNC pieces have rows of lines covering almost their entire surface. The

> lines the machine carves into the stone follow the stone's form and accentuate the roundness and bulginess. These bloated forms undermine our expectations of the medium. Isherwood carefully chooses the rocks he uses and makes sure the veins in the stone appear in places that will increase the drama and beauty of the whole.

Isherwood began the process of listening to materials at an early age, when he encountered the work of Henry Moore and experienced the tangible presence, mass and body of his works occupying the space. After working with steel and concrete, Isherwood encountered stone and became interested in the plastic possibilities this material offered. His experiments with stone led him to work with the surface of the material, creating textures, marks and grooves. Rocks are mineral formations that show, through impressions and traces, the narrative of the relationship between the elements and the environment. In this sense, the artist's interferences with the material reinforce its own compositional process.

Nevertheless, Isherwood's creative process is not limited to manual operations; it also encompasses the control and precision provided by CNC technologies. Consequently, in addition to the artist's manual, intuitive and variable gestures when digging the furrows in the stones, there are the controlled, more precise and predictable movements provided by the computer.

Regarding the analogue and digital process of creating his artwork, Isherwood proceeds as follows (Gelber, 2003):

> I first produce a large group of plaster molded and carved forms. Successful forms are digitally scanned and transferred to the computer as three-dimensional files. The use and modification of tool path, scaling and morphing programs, allows for manipulation and intervention. This is an intervention that is monitored on the screen. I make printouts of the forms and paste up full size images to measure scale.

> Simultaneously, I am selecting rock in consideration of the form. At this point it is very much a dialogue between the scale that the material projects out and my imposed requirements of color, veining composition and stone type. After this I go back to the computer and make the final decisions with regard to what the size and angle of the milling tool should be.
>
> The selected block of stone is placed on the lathe or milling machine. First cuts are made with a diamond saw which is digitally fed information from the computer files as to where and where not to cut. The sculpture slowly starts to emerge. The process is interactive in that you can stop the machine, rewrite the program, and change the form.
>
> When the milling is complete the blank or beginning of the sculpture is removed, and my hand work begins. Over a period of time I work the surfaces by cutting, carving, drilling and polishing them until the sculpture is complete. On some occasions the sculpture is placed back on the mill to carve openings using newly written programs. In essence the original plaster forms are from my hand, the stone blanks, which are produced by the CNC machine, act as new starting points for my hands and eyes to act on.

The creative process described above may be considered to commence with a project that is, to some extent, defined in format. This project then engages in a dialogue with the tangible characteristics of the material, informing it according to its contours, colours and textures. In this way, the artist's interventions are not executed in a rigid and unyielding manner, but rather in a dynamic and iterative process that engages in a back-and-forth dialogue between the design of the impressions to be left on the material, its inherent characteristics, and any modifications based on the outcomes of digital and analogue processes.

Likewise, the combination of morphological design and tangible and plastic characteristics of materiality in the design of social robots is proposed. The specific interplay between analogue and digital practices

in Isherwood's constructions can be applied in the context of social robot design. The enhancement of digital fabrication can be achieved through the incorporation of manual processes, which can then be integrated back into the digital fabrication process. This iterative cycle continues until the materials are better suited to their qualities and characteristics. In this sense, it is possible to envisage a robotic design that is attentive to the particularities of this reciprocal process.

1.3. Materials Informing Social Robot Design

The development of social nonhuman bodies is one in which researchers cannot afford to adopt a passive or uninformed role. In her article "*Robots in Society, Society in Robots*" (2010), Selma Šabanović identified that the design of social robots had been primarily developed in a unidirectional, technologically-determinist manner, where technology is developed in a linear fashion and society fulfils a passive role by accepting and adapting to the results of technical innovation. Here Šabanović is specifically calling for more critical engagement and a greater incorporation of social and cultural meaning-making into the design of social robots, in light of the impact that interaction with robots has in shaping the societies they participate in. Šabanović describes this as a *mutual shaping*, or co-production between robots and society. Building on this, it is argued herein that the physical design of social robot bodies is often overshadowed by a focus on their technological capabilities, and yet it contributes significantly to the social and cultural impact of robotic technologies.

Dunstan and Hoffman (2023) have argued that the phenomenon of unconscious unidirectional design is particularly problematic when it comes to the morphological design of social robot bodies, as roboticists often select a typology without awareness of the historical cultural trajectories of artefact design that precede it, and these typologies, later shape the reception, treatment and influence of the robot. Dunstan and Hoffman have posited that popular social robot morphology typologies categorised as the Human Replica, the Futuristic Machine, and the Cute

Companion each carry problematic cultural implications, and require a more knowing and critical use. The present research extends this discussion further to a more granular level, arguing for a more conscious engagement with not only typologies, but also processes and materials, to encourage a conscious mutual shaping between the materials and the prototype, between designer and the designed.

The popular image of a robot is one built using electronic components and artificial materials such as metal and plastic. This stereotypical image remains prevalent within real robotics research, reinforcing homogenising aesthetic issues, and perpetuating projects where characteristics of hardness, resistance, strength and efficiency are tied to the figure of the robot, distancing them from organicity. Listening to materials can promote a return to qualities such as ephemerality, malleability and tangibility in robotic design. Such qualities look to assist robots to navigate a natural world, full of soft bodies, to safely co-exist and communicate with organic social beings, and to move with biologically inspired forms of locomotion, for ever increasing applications. Encouragingly, a more conscious and adaptive use of materials is already emerging within the field of social robotics, as evidenced by developments in soft robotics. The term 'soft robotics' is defined by Rus and Tolley (2015, p. 467) as: "Systems that are capable of autonomous behaviour, and that are primarily composed of materi¬als with moduli in the range of that of soft biological materials".

Soft robotics employs biodegradable organic materials in accordance with one of the objectives of developing machines that are more akin to humans and reducing the potential for harm and damage they may cause (Majidi, 2014). Additionally, it seeks to investigate the intricacies of movement and the morphological possibilities afforded by these novel materials, reflecting a primary focus of the present research. Exploring the potential of soft materials in robot design and human-machine interaction has been the focus of much of the research in soft robotics. This research suggests considering materials such as gels, fluids, and elastomers and their

inherent qualities, including elasticity, bending, and deformation (Majidi, 2014). This approach could facilitate the development of a wider range of unconventional, adaptable, and emerging robot behaviours:

> Soft robots provide an opportunity to bridge the gap between machines and people. In contrast to hard-bodied robots, soft robots have bodies made out of intrinsically soft and/or extensible mate¬rials (for example, silicone rubbers) that can deform and absorb much of the energy arising from a collision. These robots have a continuously deformable structure with muscle-like actuation that emulates biologi¬cal systems and results in a relatively large number of degrees of freedom compared with their hard-bodied counterparts (Rus & Tolley, 2015, p. 467).

In this context, the work of Christiansen, Rafsanjani and Jørgensen (2023) is illustrative of the exploration of soft materials in robot design. The authors present pertinent considerations for the biomorphic design of soft personal robots and propose an integrated approach to the visual, tactile and behavioural aspects of robotic design. Similarly, applications of listening to materials in robotic design projects in academic environments will be presented in the following sections.

2. Listening to the social robot 安, a practice-based approach

This section will present an analysis of the morphological design process of the artwork 安 (2022-2024), a social robot created by Guerra as part of the development of her doctoral thesis. The analysis presented in this chapter will propose approximations between the way of listening to materials that is evident in contemporary artists such as Richard Serra and Jon Isherwood, as discussed in the previous section, and the morphological design of social robots. It also presents alternative solutions to the anthropocentric approach to the design of social robots, with the objective of proposing a deviation from the current trends. The design process of 安 has been analysed by reviewing and reflecting on the path

taken to create the artwork, and is divided into three sections covering the aspects of shape, texture and painting. The analysis is conducted in a descriptive and reflective manner, discussing the relevance of the act of listening to materials for the morphological design of social robots, as well as the plastic, methodological and conceptual choices in the development of 安.

The creative process has been presented in three parts due to its didactic nature and, above all, due to the complementary relationship established between the analogue and digital phases of creation. The aim of this research is to make a contribution to the field of robotic design, presenting a model of the design process that takes particular account of the specific characteristics of the materials and the artist-work interaction in the development of robots.

2.1. 安 and its Formal Aspects

This section presents the research work conducted by Guerra (2022-2024) as part of her doctorate at PPGAV-ECA-USP[7]. The research was conducted in partnership with UNSW Sydney, Australia, at the Creative Robotics Laboratory, funded by CAPES-PrInt[8]. Guerra's research focuses on the development of a social robot named 安. The subtlety of its movement is a central aspect of the robot's design, as it forms an essential basis for human-machine interaction. This subtlety is investigated to encourage questions in the interactors about the vitality and animation of 安, as well as to stimulate the perception of the interactors regarding movement. Such circumstances encourage curiosity and can prompt interaction.

7. Postgraduate Program in Visual Arts at the School of Communications and Arts at the University of São Paulo.

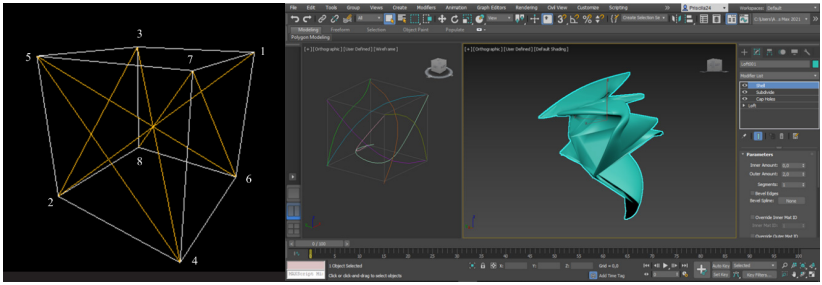
8. Process number 88887.695175/2022-00.

The morphology of the social robot was designed in such a way as to translate traces of movement into a three-dimensional format. In order to achieve this, the work of Laban, a Hungarian dancer and choreographer, was referenced, who established scales of movement for study by dance professionals. The diagonal scale of movement, which is based on the hexahedron's (cube) shape, was selected with the intention of establishing specific connections between points in space through the body. The configuration of the social robot was generated using the Loft command in the 3Ds Max program, based on the numerical sequence of the trajectory of the movements performed on the scale (see Figure 1). The resulting model was subsequently produced via 3D printing.

Laban's development of movement scales is related to his system for representing human movement, which consisted of a notation called Labanotation, used mainly in dance. This system of representation enables the ordering and classification of human movements in a generalised manner (Laban, 1978).

In light of Laban's notational system, the proposal for the format of 安 represents an effort to concretize the trace of a set of systematized human movements in a physical and tangible manner. The proposal thus suggests the visible and physical materialisation of the path of movement through the dancer's body in a synthetic way, namely, condensed into a single three-dimensional form. The objective of the morphological creation proposal for 安 was to initiate a process of generalisation and systematisation of human movements, with the ultimate goal of synthesising these movements into a unified model. In this context, it can be proposed that the digital modelling process of the work is based on the principles of generalisation, both in terms of concept and form.

Figure 1
Laban's diagonal scale and its reproduction in the 3Ds Max programme, and application of the Loft command. Screenshot.



Source: Priscila Duarte Guerra, 2021.

This generalising stage of the work's morphology was linked to the physical conditions of 3D printing, including print settings, gravity, material properties such as strength, density, flexibility, melting temperature and physical environmental characteristics such as ambient temperature, humidity conditions and ventilation. Two 3D-printed prototypes were produced in order to achieve the final model of the social robot. The initial prototype, produced using black PLA, exhibited a substantial weight and a surface marred by irregularities, including gaps and unfilled parts. The second, final model, printed on white PLA, exhibited a lighter weight and a predominantly uniform surface. The lightness and uniformity of the final printed model became distinctive features of the morphology of 安, which were subsequently refined through analogue modelling techniques.

Following the completion of the 3D printing process, the surface was sanded in order to accentuate the underlying structure of the piece, rather than highlighting the distinctive textures associated with the 3D printing technique. The objective was to minimise any potential association between the interacting subject and 安 and the manufacturing process of the social robot, thereby emphasising the fact that it had been 3D printed. Furthermore, by treating the surface to make it uniform, the subsequent colouring and lighting stages were rendered suitable for the purpose of creating ambiguity in the perception of its movement.

During the sanding stage, a discernible tactile interaction was observed between the artist and the robot's body. The sanding process integrated and formatted the morphological design of the social robot according to the movement and friction of the artist's body, utilising the sandpaper as a medium. The artist's movements were translated into the robot's shape, thereby extending her own body into the machine of the robot. Consequently, the interaction between the artist and the artwork has resulted in a mutual conformation. The direct contact between the artist's and the robot's bodies through the sandpaper has resulted in the modelling of the surface of the work, leaving marks of this interaction on the material. These include fingerprints and pressure applied with the fingers and palms of the hands. Concurrently, the surface of the artist's body was also modified, exhibiting a more even texture to the hands.

2.2. 安 and Aspects Related to Texture

To gain further insight into the topic of material deposition in 3D printing, it is possible to examine not only the formal aspects but also the texture by comparing digital and analogue media. An example of this is Fused Deposition Modelling (FDM), which produces objects with a layered characteristic due to the construction process. The distinctive layered quality of the additive process is a hallmark of digital fabrication. Consequently, the observer is able to discern the digital manufacturing process that was employed in the creation of the piece and highlight this fact. However, this can detract from the relationship between the piece's formal characteristics. It was found to be crucial to strike a balance between emphasising the medium and the work itself.

Furthermore, this texture provides a tangible representation of the mechanical actions of the 3D printer during the fabrication of the robot's morphology, thereby formalising manufacturing concepts that are unique to 3D printing. The mechanical movements are therefore executed in accordance with the principles of efficiency, speed and precision embedded in the 3D printer's programming (G-Code).

To differentiate the morphological characteristics of the project from those typically attributed to the construction of robots by humans, the process of creating textures in the work 安 was complemented by an analogue and artisanal process of reworking its texture. Consequently, the act of sanding the sculpture fosters a more direct and immediate connection between the artist and the social robot, facilitating the creation of emotional bonds and leaving marks and traces of interaction on both entities. The sanding process serves to reinforce the emphasis on the tactile experience of creating the social robot.

Moreover, sanding eliminates the mechanical imprints of texture intrinsic to 3D printing, which espouses a logic of functionality embedded within the medium. In this instance, the removal of the 3D printed layers is attributable to the friction generated during the sanding process. Consequently, the texture of 安 is constituted by the marks and traces of the process of removing layered structures that represent functional concepts printed in its digital fabrication.

This process not only emphasizes the tactile experience of creating the social robot but also invites us to consider another important aspect: the respect for the contours of the social robot during the sanding stage. This is in the sense that its shape is emphasised in comparison with its 3D-printed texture. The formation of layers through the additive process is contingent upon the positioning of the piece on the printing surface and the influence of gravity. Therefore, the layers are not necessarily aligned with the contours of the piece, but rather with the objective of an efficient printing process, which entails the avoidance of the typical errors associated with 3D printing, such as the presence of flaws, the formation of inhomogeneous layers, and the necessity for supports to hold the pieces due to gravity influencing the 3D printing process.

The slicing software employed in the digital manufacture of parts via the FDM process features a configuration structure for printing parameters that is designed to achieve specific practical objectives. These include the production of uniform, resistant, and consistent parts. This is exemplified

by the Ultimaker Cura[9] programme, wherein the print settings encompass layer height, infill, printing and build plate temperature, as well as gravitational support for the pieces. It is noteworthy that software such as Ultimaker Cura are used in diverse contexts, and therefore do not inherently incorporate aesthetic considerations into their operational logic. It thus falls upon the artists themselves to adapt these programs to align with their specific interests.

In the context of 安, characteristics that are typically regarded as errors were deemed irrelevant for incorporation into the project. This was because the digitally designed and modelled shape was identified as a key quality within the morphological design proposal for the artwork.

The digital manufacturing traces that had been added to the structure of the social robot were removed, thereby minimising the presence of irrelevant information related to notions of efficiency, precision, and speed that were specific to the means of manufacture. This approach enabled a return to the contours and shapes of 安, thereby respecting its morphology.

The importance of surface smoothness was highlighted, a characteristic that was emphasized in the morphological design of 安 in its digital model, which was transformed into a physical model through the additive 3D printing process. To achieve this result in the physical version, it was necessary to sand the piece and apply layers of spray putty to rectify imperfections, resulting in a uniform surface. The sanding process was interspersed with layers of the spray filler. The colours of the layers (spray filler in yellow, pink and grey) differed due to the various stages of attempting to achieve surface homogeneity (see Figure 2).

9. Ultimaker Cura developed by Ultimaker: https://ultimaker.com/software/ultimaker-cura/. Accessed on: May 2, 2025.

Figure 2
Images of the piece with layers of spray putty applied and revealed by the sanding process.

Source: Priscila Duarte Guerra, 2023.

The process of sanding the piece revealed the various layers of application, thus enabling the visualisation of the 'epidermis' of the social robot. The layers applied subsequent to the 3D printing process became visible, akin to a fingerprint that identifies and particularises the work.

The texturing evinces a progression from general to specific, particularly with respect to the formal structure of the digitally modelled piece based on a scale of movement created by Laban, which is physically realised through a functional logic inherent in the programming of 3D printers. However, in body-to-body interaction with the artist, the subject 安 acquires marks and traces of this interaction that particularise it.

2.3. 安 and Aspects Related to Painting

The third stage of 安's morphological design was the application of paint. Once the shape had been modelled and the surface and texture had been worked on, the painting stage commenced.

A digital simulation of the work's lighting and colouring effects was conducted using the 3Ds Max software. A variety of colours and metallic effects were tested on the piece, and the one that best served as a basis for the physical version was selected. The selected hue was a champagne colour with a slight rosiness, which was due to its visual effects and its relation to luminosity. Accordingly, the model that most closely approximates the golden colour was selected, as it plays a pivotal role in the social robot's design.

A study was undertaken to ascertain the most efficacious techniques for the physical creation of 安, with a view to achieving a comparable effect to that of the digital simulation. Casting techniques and plating with metals such as copper and bronze were considered, but were deemed unfeasible due to the production costs and the weight of the final product. Consequently, 3D printing was re-evaluated as the most suitable method for producing the final version of 安. This version was produced using white PLA filament and coated with rose gold and gold metallic spray paints. Prior to the final application, a series of tests were conducted on PLA-printed plates with the objective of determining the number of layers required for each colour. During the testing phase, it was observed that an iridescent effect was produced as a result of uneven application, which could potentially enhance the ambiguity in the perception of the subtle movement of 安 (see Figure 3).

A relational analysis of the two means of morphological construction of the social robot (digital and analogue) reveals that in a digital process, metallic materials were used in the robot's design based on mathematical models integrated into the program that simulates physical contexts and phenomena. This environment allows for the prediction of the object's luminous, reflective, and chromatic characteristics. A comprehensive investigation was undertaken to ascertain the optimal physical technical solutions that would facilitate the realisation of this objective. However, the generalisation did not take into account the influence of random factors in physical reality, which may have affected the outcome. One illustrative example of this can be observed in the analogue experimentation with metallic spray paints, which were employed to bring the physical effects closer to the simulated digital effects. From this experimentation, it became evident that an iridescent effect was a fundamental attribute to be included in the morphological design of the social robot, with the intention of particularising it.

Figure 3
From left to right: digital painting simulations; two images of the piece with layers of spray paint of different colours; final piece with the iridescent effect.

Source: Priscila Duarte Guerra, 2023.

This section (Figure 3) presents three moments in the creation of the work 安, with a particular focus on the compositional aspects of its shape, texture, and painting. It elucidates the integration of digital and analogue practices in the development of this composition. The aim is to demonstrate the preliminary digital phase of generalisation, which enables the abstractions and simulations inherent to the work. However, these are interlinked with the subsequent analogue, manual and personalised stage, which is conducted directly on the work itself. It can be observed that the process of creating 安 proceeded from a more general to a more specific approach, from an abstract to a concrete representation. These two approaches were not mutually exclusive; rather, they were complementary. This study presents empirical evidence that the act of listening to materials can perform a pivotal role in the morphological design of social robots.

3. Social robot morphology and movement design in an education context

The approaches and examples described in this section stem from undergraduate courses offered at the University of New South Wales (UNSW) Sydney, by the School of Built Environment. The former is designated *BENV2522 Social Robotics*, and is the first social robotics

undergraduate course offered in Australia. The latter is designated *CODE2230 Human-Machine Interaction*, and applies social robotics concepts to the context of the built environment.

3.1. Designing Robots with Movement in Mind

Affective, efficient and long-term human-robot interaction requires the interactions between robots and humans to go beyond the rudimentary display of basic emotions towards something more fluid, natural and meaningful. As highlighted earlier in this chapter, the morphology of a social robot must also be carefully considered, to avoid cognitive dissonance due to misplaced user expectations, and to avoid unintentionally engaging with historical lineages of particular typological aesthetics, and their cultural implications. While many of the world's leading universities now have social robotics research labs, at time of writing, social robotics education at the undergraduate level is still in its relative infancy, globally. The content of the present course has therefore been developed in close dialogue with contemporary social robotics research and engages with the issues currently being navigated by social roboticists, including that of morphology design, and meaningful movement.

In 2014, Guy Hoffman and Wendy Ju published a paper entitled, *Designing Robots with Movement in Mind*, where they proposed a range of methodologies for approaching the design of a social robot that promotes the value of movement in robotic communication, emphasising human sensitivity to physical movement and spatiotemporal affordances. As highlighted by Hoffman and Ju (2014), traditionally, roboticists have considered the movement needs and the morphology of a robot as separate design issues to be addressed, with the aesthetic morphology goals sometimes being predetermined, and then augmented to fit around existing hardware parameters. Conversely, the pragmatic and physical movement needs of a robot's system may be prioritised, with the morphology being considered in an ad-hoc manner. In both approaches, the expressive quality of the movement is not considered, and can lead

to crude and awkward movements as well as a mismatch between the appearance and movement of a robot. Hoffman and Ju advocate for the expressive movement capabilities of a robot to be explored in the early stages of its development, and in conjunction with "both the visual and pragmatic requirements of the robot (2014, p. 93)". To this end, the authors describe the application of many techniques for movement-centric design, drawn from Hoffman and Ju's (2014) work, including 3D Animation Gesture Sketches, Skeleton Prototyping, Wizard of Oz, Video Prototyping and Interactive DoF (degrees of freedom) Exploration.

The approach of prioritising early-stage prototyping towards the development of affective movement and the concurrent development of a robot's morphology, informs both the theoretical approach and assessment scaffolding of the course *BENV2522 Social Robotics*. Within the course, Hoffman and Ju's (2014) approach is paired with the methodology of listening and responding to materials at each of the prototyping stages, to inform the design development of the robot and its movement capabilities.

3.2. Movement Matters

The premise of the course is to explore affective bodily movement as a method for robots to communicate with humans. While technology groups such as XBOX and Apple have been embracing human gesture as a natural way for humans to communicate with technology, little work has been done in social robotics to capitalise on human sensitivity to motion as a way for robots to communicate more effectively with humans. In social robotics, where robots are expected to communicate emotional concepts or intention for action in response to social applications, roboticists are often resorting to communication methods such as expressive facial features, including mechanically articulated features[10] or on-screen[11]. Other avenues

10. Lütkebohle, I. et al. (2010).

11. Gockley, R. et al. (2005).

for communication include movement and path planning[12], lighting patterns[13], sound[14] and proximity[15]. However, anyone who has been woken by an alarm clock or alerted to a door being left ajar, understands that loud beeping and flashing LEDs are far from a comfortable or natural way to be communicated with. Hoffman and Ju emphasise movement as a powerfully expressive medium, detailing that regardless of an object's appearance, humans are highly sensitive to movement and even abstract motion, where "humans readily recognize, classify, and attribute intention even to purely abstract moving shapes" (2014, p. 93).

Bodily expression and gesture are internationally shared methods of communication, and can form a powerful and democratising approach to interacting with a social robot, where no prior technical knowledge or skills are needed to understand the robot's expression or intent. Employed as a primary mode of communication, bodily movement opens up participation in human-robot interaction to groups often marginalised by contemporary technologies, including children, the elderly, those with disabilities, as well as those lacking the literacy or capability to interact verbally or the dexterity for a touchscreen.

In designing a social robot, focusing on expressive bodily movement, particularly that generated in dialogue with existing qualities of a chosen material, allows for iterations of design development and mechanical optimisation to take place before any electronic components are introduced. This method fosters a more sustainable and lean approach to the use of electronics and encourages mechanical elegance and simplicity in design. The following sections detail the iterative stages that form the scaffolded approach and assessment task structure of BENV2522, towards the development of interactive social robots.

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12. Sharma, M. et al. (2013).

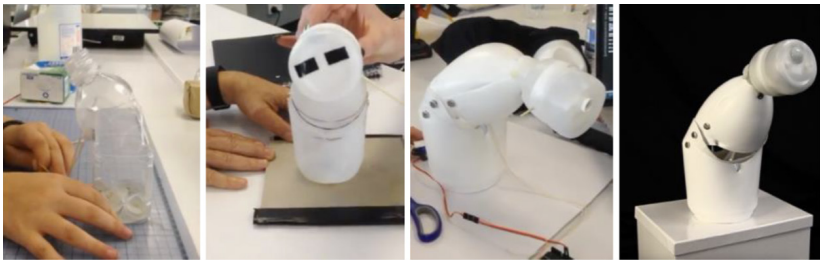
13. Jacobsson, M. et al. (2007).

14. Marynowsky, W. et al. (2023).

15. Velonaki, M. et al. (2005).

3.3. Milk Bottle Robot Bodies

Figure 4
A student develops an autonomous social robot through sequential prototyping, beginning with puppeteering a plastic bottle.



Source: Author's own photographs.

Images from popular fiction in Hollywood films and Japanese anime have contributed to the establishment of a ubiquitous image of what robots ought to look like, which is distinct and can be difficult to deviate from. To dismantle this image and allow students to focus primarily on the development of expressive movement, students are asked to develop a social robot from a plastic milk bottle. This readily available and recycled object has a body form that is easy to cut, shape and augment, and is hollow, allowing strings, wires and other mechanical elements to be hidden inside. Milk bottles are also typically made from high-density polyethylene (HDPE) plastic, which is robust and will bend, flex and return to shape many times, actively informing the movement of the robot (see Figure 4). To develop their robots, students engage in a series of iterative stages of prototyping, incorporating Hoffman and Ju's (2014) techniques for movement centric design.

3.3.1. Documenting Affective Movement

To first recognise and understand the qualities of affective movement, as distinct from movement for movement's sake, students are asked to document examples of movement in the world that they find interesting, captivating, or affective for any reason. These short videos are added to

a personal blog, where students are asked to reflect on the qualities of the movement they have observed. Student-documented examples have included running water, kinetic artworks, butterflies and birds, and even the loose corner of a shade cloth flapping in the wind. Through reflection, students note the qualities they will later attempt to embed within the movement of their robots, such as slow and deliberate movement, intention, rhythm, care, fluid and dynamic motion, variation in speed and pacing, or subtle and understated movement. Observing movement that is not directly related to human bodily expression but is still affective or emotive can be helpful for students to begin to de-couple intentional and emotional movement from the human form and facial features, to be more readily applied to an abstract form.

3.3.2. 3D Animated Gesture Studies

Hoffman and Ju (2014) describe how the use of 3D animation studies can be used to explore the expressive capabilities of a robot free from any mechanical concerns, and to arrive at an effective DoF setup. Additionally, an animation study can be used to encourage students to distil and simplify the movement qualities they have documented through video into a physical two-dimensional plane. This stage can aid students in dissecting what the individual components and stages of the movement may be, for example, if the movement is linear or looping, and what the resting position may be.

3.3.3. Puppeteered Skeleton Prototype (Wizard of Oz + DoF Exploration)

The puppeteered skeleton prototype challenges students to physically and mechanically explore, select and optimise expressive bodily movement for their robot, without the use of any electronic components. This stage allows for the deliberate design of unique affective movement and degrees of freedom, free from the recognizable swing-arcs of widely available electronic components such as servo motors. Students use multiple-action linkages (MALS) to economise complex and linked movements into as fewer linear or rotational inputs as possible.

Students begin with a milk bottle for their robot body, and then must cut, glue, bend and shape the plastic to arrive at a new morphology, and to plan expressive movements. In this process, they encounter the qualities of the HDPE plastic and are encouraged to 'listen' to the way the plastic moves, to notice the inherent spring and return qualities of the bottle, which can give instruction to the movements they are designing. Students use split pins, small nuts and bolts, zip ties, rubber bands and interlocking components to support bending, twisting, lifting and rotating movements, and then animate the movement with strings and skewers. When they discover that the robot requires body elements for expression beyond the initial milk bottle, they add additional pieces from other bottles, fabricate additional parts, or use recycled parts such as the joints from a plastic articulated snake. Throughout the design process, the students return to their planned applications and move the robot through the interaction scenario to determine what needs to be expressed.

The aim of this stage is to be able to fully puppeteer the desired movements of the robot body, using string and skewers, to streamline the final stage of attaching the electronics. Students are encouraged to reduce all movement down to as fewer liner or rotational inputs as possible, to ease the attachment of electronic components.

3.3.4. Plugging it all in

Once the robot body design is complete and the desired movements have been mechanically optimised, the students attach one or two servo motors to drive the MALS, and the speed and movement of the motors are set on an Arduino board. It is important that the electronics are introduced as the final stage, as for students, this can often be where the dialogue with material prototyping ends. Additionally, allowing the majority of the design process to take place prior to the application of electronics builds confidence in students from disciplines outside of STEM, and opens participation in the design of social robots to those who may initially lack knowledge in electronics and coding. This

series of methods has been effective in producing a wide range of robot morphologies and movements, with student cohorts comprised from eleven disparate disciplines.

3.4. Human-Machine Interaction: Listening to materials when designing interactive robotic architectural façades

The methodology described above can also be used in application to designing other interactive robotic and social systems, such as a responsive architectural façade. In the course Human-Machine Interaction, students are asked to design an architectural façade that responds to users of the space and can communicate information through movement that is engaging and affective.

Undergraduate Computational Design students are often highly skilled in computer-aided and parametric design but can be less confident in real-world hand-modelling and materiality. The aim of this course is for students who are designing computationally for architecture to encounter the real-world elements that evade digital design, including materials, weight, friction and gravity, and to become attuned to the opportunities and limitations of these elements. Additionally, the course introduces the notion of movement as something that can be intentional and highly communicative in architecture, not just in service of functionality or entertainment.

Following the same steps described in the Social Robotics course, computational design students observe and document movements in short videos and then translate the selected movements into animated sketches, extracting the movement qualities they wish to integrate into their responsive façades (Figure 5).

Figure 5
Screenshots of video stills: A student stirs tissue paper with a straw in a vase of water, observing the movement and play of light (video prototyping). The student then sketches the movement in a brief animation gesture study.

Source: Screenshots of a student's work in the *Human-Machine Interaction* course.

Figure 6
Screenshots of video stills: A student physically puppeteers the material and mechanical movements of the skeleton prototype before adding the electronic components in her design for an interactive architectural façade.

Source: Photographs of a student's work in the *Human-Machine Interaction* course.

Following the documentation and animation stages, the students then explored material and mechanical solutions through the puppeteered prototyping methodology. Figure 6 shows a student exploring multiple fabrics to listen to and understand the qualities of the materials, and to allow the material to inform how it should fold and move. In the first image the silk material folded into many smooth and small folds as it spiraled inwards. The organza material in the second image held its form, and the tensile quality of the material suggested that it could simply be scrunched instead of stitched or folded, and it would move in a captivating way. Drawing on the observations captured in Figure 5, the student chose a white translucent organza material similar in appearance to the tissue paper, to allow for a play of light on the surface when the façade is moving.

As a final step, the student attached a hidden linear actuator to drive the umbrella-like mechanisms, allowing the tessellated fabric pods to slowly move and bend in the light, forming an interactive façade.

4. Final considerations

The practice of 'listening to materials', once solely the domain of artists and craftspeople, comprises a methodological approach for use in the design of social robots. Understood as the conscious act of looking, touching, noticing and acting upon the nature of materials, in both physical and digital forms, this methodology can continually inform the use of materials within a design process, in an on-going dialogue with the maker. Viewed as a granular practice of co-production, the qualities of prototyping materials can encourage a conscious mutual shaping between a social technology and its social maker.

Within this chapter, we have illustrated the application of this approach in both the research and educational context. Within the research context, attentively listening to materials can foster an empathetic approach to robot design, aligning with the material's qualities, and corresponding to the traces and marks left by the interaction between the designer and

the design. This approach not only nurtures creativity but also promotes morphological diversity, transitioning from a perspective that emphasises the functional aspects of robots to one that also values their form. This orientation enables a more holistic view of robot design, embracing the complementarity of various aspects—ranging from general to specific, abstract to concrete, and analogue to digital processes.

Within the educational context, the approach of responding to the given qualities of materials can aid students in shaping new morphological robot forms that subvert traditional typologies and help to avoid the cultural and historical implications associated with the unconscious adoption of popular 'robotic' aesthetics. This approach can concurrently suggest potential for interaction, resulting in planned movement that is more affective, engaging, mechanically elegant and controlled. Encouraging students to prototype through material-driven stages of puppeteering movement and developing morphology can reduce the use of and reliance upon electronic components and increase the access and confidence of students from diverse disciplinary backgrounds to engage in technology development. Additionally, this focus on materials helps students to understand materials in greater depth, and how they can be used without forcing them to behave in ways that are counter to their inherent qualities.

While this chapter contains detailed, pragmatic steps for applying the method of listening to materials within the context of social robotics, this concept can be adopted more broadly in the development of various designs, particularly in social technologies, as demonstrated in interactive architecture. In social robotics, this methodology offers a valuable tool for addressing complex design challenges.

For instance, in the realm of aesthetics, listening to materials in visual design promotes the particularization and integration of inherent material qualities, contrasting with the standardization and mismatch often seen between form and material. This approach encourages the use of innovative, adaptable, and sustainable materials, as highlighted by advancements in soft robotics.

Moreover, in mechanical design, this approach presents alternatives to the use of conventional electronic and metallic components, enabling the creation of malleable structures that function in a fluid and integrated manner. Ultimately, listening to materials in designing both the morphology and movement of social robots fosters a more experimental and engaging design process, resulting in outcomes that are more affective, varied, and intentional.

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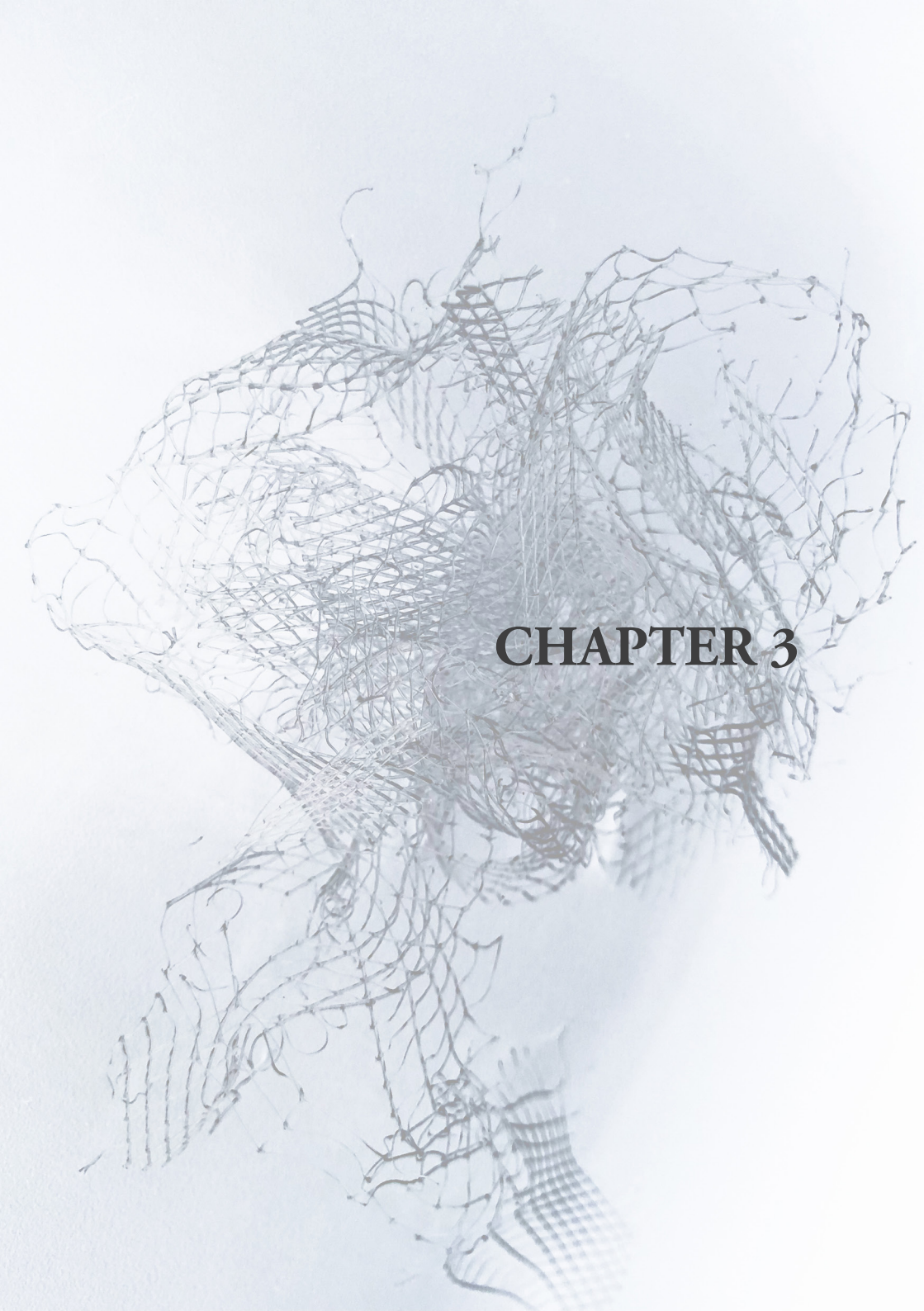

CHAPTER 3

THE SLOWDOWN OF CATASTROPHE: PERFORMATIVE FRAMING IN THE WORK *ERUPULSÕES*

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Abstract

This chapter presents the creative process behind the video *Erupulsões* [*Driveruptions*, 2022] by artist Eduardo Montelli, exhibited at the 22nd Sesc Videobrasil Biennial, drawing connections between the concepts of "performative framing" and "slowing down catastrophe". Created during the COVID-19 pandemic, the work blends different media to narrate personal childhood memories and poetic reflections on the ambivalent desires of contemporary subjects. Throughout the text, in dialogue with the analysis of the video *Erupulsões* (2022), aesthetic and psychoanalytic questions related to the concepts of the sublime and sublimation are addressed.

1. Performative framing as an art practice

"I freed myself, easily and effortlessly" (Euripides, 2017).

"The instinctual transformation on which our aptitude for culture is based can be undone by life's interferences" (Freud, 2010).

"It is precisely because a living being can die that it is necessary to care for it so that it can live" (Butler, 2009).

In this chapter, the term performative framing (Montelli, 2021) refers to both the production of multiple inscriptions of ourselves and the objects generated in this process. This practice encompasses physical or virtual records that must be constantly maintained, organized, and presented to authorities capable of legitimizing them. Such inscriptions are not merely constative descriptions of of any given identity but instead performatively establish the social existence of a particular subject.

The legitimacy of performative framings depends on their alignment with the recognition norms prevalent in the society in which they are inserted: there are criteria for identity evaluation, approval, and rejection that may vary across time and space. For example, the recognition of an individual as an artist, as well as their symbolic or market value relies—not only on the production of art but also—on maintaining a direct, complex, and simultaneous relationship with field agents and the public, mediated through inscriptions such as portfolios, personal websites, projects, and, especially today, social media profiles.

Assuming that, in principle, performative frameworks serve as a means of conforming to certain norms and criteria of social recognition, in my doctoral thesis (Montelli, 2021), I sought to identify the dominant performative framework model in the context where I live and work as an artist. I observed that this model stems from the intricate logics of biopolitical control, spectacle, and neoliberal rationality that dominate contemporary society.

In dialogue with Gilbert Durand's mythanalysis (1983), I pointed out that this context reflects the rise of the Greco-Roman myth of "The Abduction of Ganymede." Through the analysis of images of this myth created over centuries, I observed the circulation and transformation of a specific fantasy: being desirable and subservient to a sovereign power as a means of earning a higher, more beautiful, enlightened, and eternal form of life. I referred to this fantasy as *Ganymedic*, recognizing it as a dominant model of performative framing today (Montelli, 2021):

> The Ganymedic framing is guided by the growing use of technological mediatisation devices that spectacularize life while intensifying surveillance and control over human activities. Above all, the Ganymedic framing enforces individual conformity to subjectivity patterns aligned with capitalism's advancements (Montelli, 2021, p.169).

We must note that performative framing is a biopolitical technique used to conform individuals to a dominant ideal of subjectivity. However, considering the argument of philosopher Paul B. Preciado about the possibility of transforming "technologies of normalization" into spaces of creation (2011, pp. 11-20), we recognize a creative potential in the practice of performative framing. The social injunction to produce multiple inscriptions to unify the self into a normative identity (Bourdieu, 1998) leaves gaps open for experimenting with deviant uses of norms.

"Framing the framing", critically reflecting on its means, cultivating the complexity of life and everything that overflows normative frameworks (Butler, 2015, p. 25). Could this be a deviant way of using dominant performative framing techniques? Philosopher Yuk Hui complements this issue by relating the idea of "reframing the framing" to "technodiversity" (2020, p. 123), a concept he developed to indicate the need for a multiplication of thoughts on technique as a measure to go beyond capitalist logic. I agree with these ideas, and what interests me, as an artist and researcher, is a type of thinking about technique that is not only carried out through theory but also through poetic practice.

I believe that performative framing can be considered a work of art that is "theoretically informed and practically realizable" (Hui, 2016, p. 252), capable of investigating its own means of production while using them. This definition is important because it helps to clarify the meaning of the term "artwork" that I am using here: a way of observing, evaluating, experimenting and not conforming to the norms of recognition in force in a neoliberal society marked by spectacular and media-driven biopolitical control, norms that I summarize as the Ganymedean model of performative framing.

2. Performative framing in the work *erupulsões*

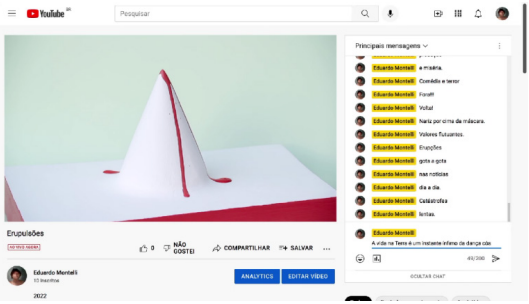
In my artwork, rather than attempting to propose an alternative identity model to such Ganymedic norms, I make framings as a way of thinking about and from the dominant framing techniques (Montelli, 2022), primarily investigating relationships between contemporary subjects and their means of communication. In this chapter, I will address the creation process and the result of the work *Erupulsões* (2022), first exhibited at the 22nd Sesc Videobrasil Biennial[1]. This work was created during the COVID-19 pandemic and mixes different media to narrate personal childhood memories and poetic reflections on the ambivalence of human desires.

In *Erupulsões*, a screen simulates the YouTube platform interface, imitating a live stream format. In the image, we see a minimalist miniature of a volcano—a white plaster cone[2] onto which red paint drops are poured, gradually mimicking the effect of an eruption. Alongside the action's recording, in the chat section, a text is written and published by the subject broadcasting the live, as if *Erupulsões* viewers occupied the author's point of view.

1. Link to the work *Erupulsões*: https://www.youtube.com/watch?v=g7kMarIpbTc (Last accessed in December 2024).

2. The formal procedure of creating the object refers to Paul Cézanne's famous thought: "Everything in nature takes its form from the sphere, the cone, and the cylinder. One must learn to paint using these simple forms, and then one can do whatever one likes" (Bernard, 2009, p.24).

Figure 1
Erupulsões



Source: Video frame by Eduardo Montelli, (2022)

Erupulsões (2022) considers and experiments with YouTube usage, understanding this platform as a dominant performative framing technique today, especially during the pandemic (Perez et al., 2022). Therefore, this artwork can be an example of "framing the framing" in the sense previously elaborated. Another type of framing addressed in the work concerns contemporary subjects' relationships with images and information about potentially traumatic events.

The idea of live streaming a volcano image arose from observing media coverage of a series of volcanic eruptions happening simultaneously worldwide in 2021, amid the pandemic context. These news, seen together, highlight a certain ambivalence between attraction and danger, catastrophe and spectacle. They also reveal a series of new recording practices supported by cameras and other high-quality technological equipment, capable of framing such events from unusual and impressive distances and angles.

Figure 2
News Eruption

Source: Digital artwork by Eduardo Montelli (2024)

The complexity of human sensations in the face of events revealing nature's destructive power, as well as our ambivalent ability to aesthetically enjoy them, is not new. At least since the 1st century AD (Longino, 2015), there has been a certain pleasure derived from perceiving extreme and radical situations, a sensation termed "sublime." One of the philosophers who most contributed to this thought was Immanuel Kant, especially in his work *Critique of the Power of Judgment*:

> Boldly suspended rocks above us, seemingly threatening, heavy clouds accumulating in the sky and advancing with lightning and thunder, volcanoes in their entirely destructive violence, hurricanes with the devastation they leave behind, the boundless ocean in fury, the high waterfall of a mighty river, etc., reduce our capacity to resist, compared to their power, to an insignificant smallness. But the vision we have of them will be all the more attractive, the more fearsome they are, only if we are in safety; and with pleasure, we call these objects sublime, for they elevate the soul's strength above its usual average and allow us to discover a resistance capability of an entirely different kind, which gives us courage to compare ourselves to all-powerful nature (Kant, 2016, p.158).

Although the notion of the *sublime* is ancient, we can say that some elements of the present bring a sense of novelty to it. Never before have we had as much access as we do today to so many tragic events and impressive recordings of these events in real time. This is due to simultaneous advances in Anthropocene crises and technologies for producing and circulating images globally—or even cosmically, considering images of black holes and other extraterrestrial phenomena already captured.

Besides the news about volcanoes in 2021, we can cite an example of a beautiful image made by NASA satellites, showing from a safe distance—as Kant conditions—the effects of the floods in Rio Grande do Sul in 2024[3]. This is just one of many cases in which catastrophic events are viewed from an external perspective: it is as if we were observing Jupiter's giant vortices, not the planet we ourselves inhabit.

Another type of image circulating in contemporary times, and which served as inspiration for the creation of *Erupulsões*, is the so-called "oddly satisfying videos," which accumulate millions of views and likes on social media. Journalist Emily Matchar, in an article published in The New York Times in 2019[4], defines these videos as follows:

> These videos are compilations of physical objects being manipulated in certain highly specific ways: melted, smoothed, extruded, carved, sliced, dissolved. Frosting piped fluidly over a layer cake. Molten glass slowly ballooning from the tip of a blowpipe. [...]
>
> What makes Oddly Satisfying so oddly satisfying? While the videos have yet to become the subject of major scientific inquiry, there are some theories. It may have to do with

3. Link to view the photograph on the NASA Ocean Biology Processing Group website: https://oceancolor.gsfc.nasa.gov/gallery/793/ (Last accessed in September 2024).

4. The article entitled Finding What's 'Oddly Satisfying' on the Internet" is available on "The New York Times website via the link www.nytimes.com/2019/02/22/opinion/sunday/oddly-satisfying-videos-internet.html (Last accessed in May 2024).

> symmetry, patterns and repetition, which our brains seem to find inherently pleasing. It may have to do with a sense of "flow" — the state of being completely absorbed in an experience. Or it may be related to the "autonomous sensory meridian response," or A.S.M.R., the phenomenon of deriving a pleasurably tingly sensation from certain auditory stimuli, like tapping or whispering or crinkling.

The video featured in *Erupulsões* was created in dialogue with the aesthetics of the oddly satisfying. Centralized framing, close-ups, the simplified form of the volcano, the reduced color palette, the clarity, the silence, the slow rhythm of the droplets, the complementarity between green and red, and the repetitive action of a hand using an eyedropper that always appears in the same spot are formal choices designed to convey a sensation of meditative relaxation akin to ASMR—or irritation and anxiety, depending on the viewer's taste. All of this contrasts with the common imagery we have of an explosive volcanic eruption.

I would like to highlight another layer of meaning regarding the formal choices of the performative framing explored in *Erupulsões* (2022), which is the text displayed in the chat area of the screen. This text was created in 2021 as a way to articulate some ideas, memories, and feelings that were troubling me at that time, using the method of free association writing. It's worth noting that this period was marked by the anxieties of the pandemic and the news of the eruption of the *Cumbre Vieja* volcano, considered the longest in the past 500 years, lasting over 80 days. Below is the first version of the text, slightly different from what was published in the video:

> "Are there volcanoes here?" I asked the teacher fearfully during a school lesson. One of the oldest memories I carry is the relief I felt with her negative response. "I live in a country... blessed by God," sang the song that always made me think of the absence of volcanoes in Brazil. The lava-filled science fair models in American movie scenes also caught my attention. There are no volcanoes here, I thought

proudly. Years earlier, I was startled by the roar of fighter jets seen from the daycare playground on September 7th. "It's war stuff!", a classmate answered when I asked what was happening. From that day on, I became terrified of planes flying overhead, afraid to be outdoors, only feeling safe indoors. The psychologist asked me to draw a helicopter, and after finishing the best drawing I could, she asked why I wasn't afraid of it. "Because it's not real," I stated. Imagination is not reality. Over time, I came to accept that we weren't at war like on TV, and no bombs would ever fall on us while we played in the garden.

What luck! Here, there are no wars, no dinosaurs, no Godzilla, King Kong, or dictatorship. Everything is in the past; everything is fiction. Soap operas. Teen dramas. Sunday variety shows. I cried myself to sleep the day the Mamonas Assassinas' plane crashed (a Brazilian rock and satirical music band). I ran away when schoolmates opened photos of the band's mutilated bodies on the classroom computer. "Assustador (Scary)" was the website's name. The images of dead people made my legs shake and left me breathless. "How can they like seeing this?" I wondered, feeling I was wrong. Fearful! Coward! Faggot! Growing up and learning. About the dark side of ourselves. The beauty of nature's destructive force. The sublime. The pleasure in transgressing boundaries. Hubris, temperance. A society of excesses and restrictions, connections and isolations, closeness and distance, production and misery, comedy and terror. Out! Back! Nose above the mask. Floating values. Eruptions, drop by drop, in the news, day by day. Slow catastrophes. Life on Earth is but a fleeting moment in the cosmic dance. The Moon moves slightly farther away each year. One day, the Sun will explode. Tomorrow, my alarm will ring earlier for medical tests. I need to lower my cholesterol. My friend's baby is six months old, and I haven't visited yet. I just remembered a meme. Should I download TikTok? Did that drawing cure my fear? Can art save us? Are there no volcanoes here?

I consider "life story" as a kind of performative framing, understanding it as an institution of self-unification (Bourdieu, 1998, p.186) tied to a social injunction to archive one's life (Artières, 1998, p.11). In this sense, I view the use of my life experiences as a way to artistically experiment with this type of framing while exploring possibilities for creation beyond normative identification. The text in *Erupulsões* is part of this investigation. It mixes biographical elements with reflections on the culture in which this biography is inscribed. The way this content is presented in the work explores the language of self-referential writing, blending meanings through the interplay of words, images, and the video interface, creating ambiguity regarding the artistic genre in question.

Researcher Philippe Lejeune (2014, pp. 29-30) defines the autobiographical genre as a narrative written in the first or second person, in prose or poetry, focusing on the true life story of the writer. According to the author, unlike the autobiographical novel, autobiography is not a guessing game with the reader, as it assumes an established identity. For it to be recognized as autobiography, the writing must present an alignment of identity between the author, narrator, and character. This requires establishing an "autobiographical pact" with the reader through paratextual elements[5]. In the case of *Erupulsões*, the presence of the name Eduardo Montelli in the video images can be seen as a proposal for this pact.

Another type of writing relevant to understanding the form of *Erupulsões*' text is autofiction, a term first used on the back cover of *Fils*, written by Serge Doubrovsky in 1977. There, the author questions the genre of his text, noting that it does not fit the canonical definitions of autobiography elaborated by Lejeune. Ultimately, defines his book as: "Fiction of events and real facts. If you like, autofictions. Autofiction, for entrusting the language of an adventure to the adventure of language, distancing itself from the common sense and syntax of the novel" (Doubrovsky, 1977).

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5. Gérard Genette (2009) define como "paratextos" todos os elementos que acompanham um texto e que auxiliam em sua identificação: títulos, intertítulos, notas, nomes, prefácios, posfácios, epígrafes e até mesmo materiais publicitários ou outras publicações que façam referência ao texto em questão.

The idea of using the term "autofiction" as an alternative to the generic definition of "autobiography" does not aim to emphasize a sense of falsification or fabrication but refers to a notion of narrative perlaboration of the self, close to the processes of psychoanalysis. It highlights that any attempt to restore lived experiences through language, with the aim of sharing them with others, is always a form of invention, creation—in other words, fiction—even when the intention is to "tell the truth" (Noronha, 2010, pp. 252–253). Autofiction exposes the rift between the empirical self and the verbal self, revealing self-representation as necessarily monstrous, fragmented, and dispersed, whereas autobiography tends toward the monumentalization of subjects (Nascimento, 2017).

The text of *Erupulsões* transitions between the genres mentioned above, bringing characteristics that can interact with both. While there is an "autobiographical pact" established through the video's paratexts, we can also notice an "adventure of language" in how the words are presented to readers-viewers. The stream-of-consciousness writing does not appear finalized, as in book pages or even video subtitles. We see the text being written and published from the perspective of a commentator seemingly watching the live stream. The name of the user who writes the comments is the same as that of the channel owner broadcasting the stream and also the author of the work, as indicated in the exhibit caption. We could define *Erupulsões* as an autobiographical or autofictional digital soliloquy. A writing-performance that brings various paratextual elements into dialogue, including the relationship between the image of dripping ink and the messages accompanying it in the chat.

It is also worth considering what meanings the presentation of a "digital soliloquy" suggests. Of Latin etymological origin, the word soliloquy [soliloquium] expresses the act of "talking to oneself"—literally composed of sōlus (alone) and loquor (to speak). Using the chat section of a live stream as a space to "talk to oneself" evokes an idea of solitude. This idea is reinforced by the fact that the "speech" comes from the same person promoting the broadcast.

Although it may connote terms like flop and low profile[6], the solitude addressed in *Erupulsões* seeks to discuss the feeling that, fundamentally, all social media users are always talking to themselves. Everyone seems more concerned with exposing and validating their own opinions and ways of life. In general, the comment sections of all sites are filled with repetitive compliments, prefabricated emojis, clichés, jokes, insults, threats, trolling, spam, empty arguments, among other pseudo-dialogical talk. There is little interest in listening to the other, understanding them, and sharing experiences with them. Perhaps, in this way, we are trying to protect ourselves, avoiding being truly affected by experiences. We watch everything happen, but from a distance, as with satellite images—detached, out of harm's way, anesthetized, without suffering. "There are no volcanoes here. [...] How lucky!"

Figure 3
We're lucky

Source: Digital art by Eduardo Montelli (2024)

6. *Flop* is a popular term used on social media to describe projects that haven't achieved the desired success, such as films with low box office, music videos with few views, music albums that don't sell, etc. *Low profile*, on the other hand, describes people who use social media in a discreet way and have no intention of communicating with a large audience.

This is one facet of virtual networks and the performative framing practices they guide, which shows that rather than expanding intersubjective communication and the inventive potential of subjectivation processes, the internet often promotes alienation and isolation. Finally, regarding the human capacity to dialogue and share transformative experiences, this fact reveals a potentially catastrophic dimension of technological advancements—apparently as wonderful and terrifying as erupting volcanoes.

3. Performative framing as the slowing of catastrophe

Something curious happens when we look up at the sky and see an airplane. We know these means of transport are extremely fast, yet we have the impression that they move slowly. Without delving into complex explanations of parallax physics, we can simply understand that the distance or the angle of observation can alter the observer's perception of the speed or actual location of an object. Scale changes caused by shifts in perspective also occur. The sun, for instance, with its 1,392,700 km diameter, sometimes seems like a small point of light that could fit between our fingers.

Beyond this difference in spatial-temporal positioning, we should consider the mental processes that influence and modify the perception of reality's objects. Once again, I invite Kant to help think through this issue:

> Nothing in nature could be given that could not, no matter how great we deemed it, be reduced to something infinitely small when considered in another comparative relation; and conversely, nothing would be so small that it could not, in comparison with smaller measures, expand through the imagination to the grandeur of a world. Telescopes, in the first case, and microscopes, in the second, have provided us with rich material for making these observations (Kant, 2016, p.146 [our translation])

In Kantian thought, the role of the imagination faculty is fundamental in the aesthetic experience. For the philosopher, it is not the phenomena themselves that produce the pleasure of the sublime but the perception by the contemplating subject of their own mental capacity: it is their "mode of thinking that introduces sublimity into the representation of nature," provoking "satisfaction with the expansion of the imagination itself" (Kant, pp.143 and 146 [our translation]).

> It is precisely because there is, in our imagination, an effort to advance toward the infinite, and in our reason, at the same time, a claim to absolute totality [...], that the inadequacy of our faculty to estimate the greatness of things in the sensible world [...] awakens the feeling of a supersensible faculty within us. It is the use that the faculty of judgment makes [...] in favor of this latter feeling, and not the object of the senses, that is absolutely great, while, in comparison, any other use is small. Thus, what should be called sublime is the spiritual disposition arising from a certain representation that engages the reflective faculty of judgment, and not the object itself. [...] The sublime is that which, by the mere fact of being thinkable, demonstrates a faculty of the mind that surpasses any measure of the senses (Kant, 2016, pp. 146-147).

The sublimity would lie in the human mind insofar as, through it, we consider ourselves superior to the forces of nature, capable of going beyond its sensible reality—bearing in mind that this only happens "if we find ourselves safe" (Kant, 2016, p. 158). The sublime, therefore, seems to be an effect of the subject's positional difference in relation to the observed object, stemming from a spatial-temporal and/or imaginary displacement. In other words, maintaining a safe distance allows one to derive pleasure from a grand and persistent volcanic eruption, a pleasure particularly tempered by the self-awareness of the ability to enjoy something that can destroy us—but does not. This sublimating,

aesthetically pleasurable, and supposedly safe perspective is conceived by Kant in the direct relationship between the subject and the phenomena of nature[7]. But now, let us seek to relate it to imagetic representations.

Aristotle argues that poetic creation is a natural phenomenon stemming from the human mimetic capacity. The tendency toward imitation can already be observed in, being responsible for an acquisition of knowledge superior to that of other animals. Beyond stimulating learning processes, the Greek philosopher asserts that imitation is a natural source of pleasure. Evidence of this is the fact that certain things that cause discomfort when seen in reality become pleasing when "represented in very perfect images such as [...] the reproductions of the most repugnant [...] corpses." Aristotle states that Greek tragedy is a type of imitation that, through "pity and fear, brings the purification of such passions" (Aristotle, pp. 42 and 48 [our translation]). Nietzsche offers a similar analysis when he says that only art can transform "disgusting thoughts about the horror and absurdity of existence into representations with which it is possible to live: these are the sublime, as the artistic domestication of the horrific" (Nietzsche, 1995, p. 56 [our translation]).

We note that "purification" and "sublime" are related concepts. Fear, disgust, anger, and other sensations considered unpleasant are transformed into sources of pleasure through an internal, mental process in Kant's case, or an external, poetic process in Aristotle and Nietzsche. These are shifts in perspective. For our purposes here, it is relevant to consider these concepts as they overflow between interior and exterior, between subjects and objects, as I do not intend to decide between one or the other to anchor my arguments. I aim, therefore, to move away from a binary logic. My proposal is to focus on the perspectival plasticity of the perception of sensations, of aesthetic experience, as it traverses the ideas of these three authors.

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7. It is worth noting that Kant also argues about the human capacity to control their "internal nature" through their mental faculties. The Kantian sublime, therefore, arises from the experience of individuals who position themselves as superior to the phenomena of both external and internal nature.

This aesthetic plasticity, rooted in differences in perspective, however harmless it may seem, is a phenomenon that provokes significant effects on how perception is assessed and experienced. It may induce a certain numbness in observers regarding their reality, a desensitization that prevents them from being truly affected by the experience. For instance, believing that a fast-moving object is moving slowly risks being struck by it before any chance of evasion. Similarly, perceiving a tragic event as merely an image contemplated from a distance obscures the trail of destruction it leaves in "real life."

Today, the accelerating flood of disaster images, whether natural or not, creates conditions in which these events are followed as though they were not concrete realities. News broadcast on television or the internet is perceived as tragic scenes in the Aristotelian sense of "Poetics"—theatrical. We feel compassion and fear, but at the same time, we find ourselves safe, purified: "we are lucky not to suffer from it." The horror of human experience is domesticated. Sublime, perhaps, but also perverse and alienating. The pathos is always that of the other, always foreign, distant. On Instagram, for example, posts about people affected by wars, those losing rights, possessions, or being subjected to violence, that is, truly suffering from the realities of life, appear interspersed with photographs and videos of parties, travels, restaurants, pets, and other content that conveys safety and joy.

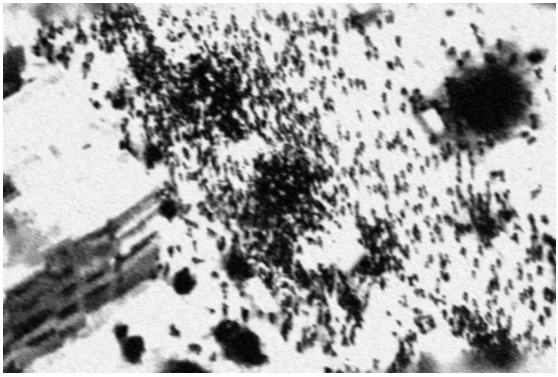
Here, it is worth quoting Paul Virilio's words in *Aesthetics of Disappearance*, a book in which the author analyzes the subjective side effects brought about by the technological transformations of recent centuries:

> Our contemporaries have become characters afflicted by a flypaper-like memory, to which an indiscriminate heap of useless facts adheres, leading them to be judged inferior to computer screens, where information sticks at full speed—a memory deemed to lack gaps, failures, or absences. [...] The violence of speed dominates the technical world (Virilio, 2015, pp. 39 and 103 [our translation]).

Technologies for the production and circulation of images are designed and used in a way that makes it very easy to feel and think that we are distant and safe. There is no time for shock, at least as long as we are not the subjects of real suffering. The high speed at which events appear and disappear in feeds fosters a sense that no transformative action, whether individual or collective, is necessary because everything will pass and return to how it was before: "soon we'll be back to normal," someone might comment on a "tragic" post. However, lives, relationships, and connections are threatened by the accelerated rhythms that dominate this social dynamic oriented by digital media. "Submitting to this arrangement becomes almost irresistible due to the fear of social and economic failure—fear of being left behind, of being considered outdated" (Crary, 2016, p. 54 [our translation]).

Thus, we note that the alterations in perception caused by shifts in perspective occur not only through distancing but also through differences in speed. It is necessary to recognize that these phenomena are not merely physical but also psychic. Moreover, they involve notions of power and generate changes in social reality. "Observing from a distance" and "acceleration" are capacities acquired and progressively enhanced by technical advances, but they stem from a destructive and dominating impulse that accompanies the trajectory of certain human projects—colonialism, capitalism, transhumanism, among others. These relationships between distance, speed, and domination are ancient ideas: "the fastest uses others as if they were standing still," said Plato (2014, p. 63 [our translation]). However, here we consider such ideas as illusions, fantasies, or even delusions that ignore, minimize, or deny their real catastrophic effects.

Figure 4
Abstração sobre mundo [Abstraction About the World]



Source: Digital Art by Eduardo Montelli (2024)

As we have seen earlier, in discussing the choice of a volcanic eruption as a central image and the use of a chat tool to present a digital soliloquy, the work *Erupulsões* seeks to address the unease generated by the desensitization encouraged by contemporary communication technologies. Aerial images and the affective disconnection of hyperconnected users in virtual networks represent an illusionary safe distance, engaging with questions of the sublime and the purification of passions. YouTube appears as a digital stage where even the most repugnant images and dialogues are consumed as if they were scenes from a Greek tragedy. The video explores the ambivalent nature of these phenomena, which are simultaneously sources of pleasure and displeasure. In this context, the title *Erupulsões* references Freud's psychoanalytic concept of the drive, always laden with tensions:

> I concluded that, in addition to the instinct [drive] to preserve living matter and to combine it into increasingly larger units, there must also be another, opposing one, which seeks to dissolve these units and return them to their primal inorganic state. [...] Alongside Eros [life drive], a death instinct [drive]. [...] We may suspect that the two types of instincts rarely—perhaps never—appear in isolation but are instead fused in highly variable proportions (Freud, 2010, pp. 85–86 [our translation])

Freud synthesized the variety of impulses driving human existence as life and death drives, reflecting tensions between love and hate, activity and passivity, self and other. In his clinical observations, he identified four possible outcomes for drives: reversal to their opposite (e.g., love or hate), redirection to the self (e.g., activity or passivity), repression (resulting in psychopathological symptoms), and sublimation, considered "a fate imposed by civilization" (Freud, 2010, p. 60 [our translation]).

Freud primarily described artistic activity and intellectual inquiry as activities of sublimation:

> The drive is sublimated insofar as it is directed toward [...] socially valued objects. [...] The term sublimation [...] evokes the word sublime, particularly in the fine arts to denote creations suggesting grandeur and elevation, and the word sublimation as used in chemistry to describe a process by which a substance transitions directly from solid to gas (Laplanche & Pontalis, 1991, p. 495 [our translation])

The Brazilian psychoanalyst Perci Schiavon proposes understanding the drive as a practice. Thus, the "experience one can have of it" is the most important aspect, as it represents "the measure of our relationship with the unconscious, that is, with the truth of our being" (Schiavon, 2012, p.17-18 [our translation]). The drive "is what it is insofar as it is exercised," and the more it is exercised, the more it is expressed (Schiavon, 2012, p.156 [our translation]). In this conception, sublimation – understood as practice, "sublime-action," ethics, and aesthetics – is considered "the original destiny of the drive," "its active aspect" (Schiavon, 2012, p.46 and 130 [our translation]). However, Schiavon emphasizes that the exercise of the drive does not occur naturally: it may or may not occur.

Schiavon diverges from Freud, who recognized the death drive as a primal tendency—a desire to return to the inanimate—in perpetual tension with the excitations of the life drive. For the Brazilian psychoanalyst, there is only one drive: the life drive, which must be exercised each time

as a sublime-action in varying degrees and intensities. The drive can be labeled a death drive only when, contaminated by repressive forces, its energy is not exercised and fails to achieve its "sublimatory, real form" (Schiavon, 2012, p. 208 [our translation]).

> We call the death drive the abrupt or gradual abandonment of active perspectives, the diminishment or abstention from the drive's exercise. The term 'drive' of death persists only because it still refers to the same force [...] merely distanced from or approaching (as we might describe a focal point). If analytical ethics consists in the practice of the drive, the death drive is the purest expression of ethical desertion. [...] Gradually or abruptly, the drive's force ceases to be exercised and is severed from what it could do. In its place, we see what we call the death drive (Schiavon, 2012, p. 182, 235 [our translation])

In the solitary voice of *Erupulsões*, there is a reflection on the ambivalence of fear and fascination regarding violent events such as wars, accidents, climate disasters, natural phenomena, pandemics, and so forth. This reflection sketches an analysis of these tensions, shifting between "self" and "other" and society at large, navigating the micro and macro in search of something that seems to permeate all these layers. The flows of drive magma? Curiously, Freud himself compared the movements and transformations of drives to volcanoes:

"We can decompose the life of each drive into singular waves [...] which relate to each other much like successive lava eruptions." (Freud, 2014, p. 45 [our translation])

Ultimately, we reach the final (conscious) dimension of the performative framework elaborated in the creation of *Erupulsões*: its nature as a destination of the drive, an exercise of the drive's force. This creative process—in all its stages, from the idealization and construction of the sculpture to the recording of the action, poetic writing, video editing, and the writing of

this chapter—was developed during a period of forced social isolation, marked by individual and collective uncertainties and insecurities. It can be seen as a way of confronting the unease of the context.

I see the performative framing of *Erupulsões* as an exercise in "slowing catastrophe"—an attempt to process what I experienced and observed in such a confusing and ambivalent way. At the same time, I was safe, isolated, yet always at risk of contamination. A rapid eruption of news, information, and the most varied and contradictory opinions. But I must emphasize that I speak of "slowing," not "deceleration." Rather than seeking a return to a "normal" pace to comprehend the catastrophic events of daily life, it is about seeking a slower perception through artistic practice—a slow-motion framing that reveals and examines details perhaps obscured by eyes expanded by advanced observation techniques of the modern era.

4. Conclusion

The catastrophic events we observe through images are not distant from us; rather, we are immersed in them, even if we do not suffer their immediate effects. There is no safe distance, nor can we surpass them through increased speed. Freud, troubled by the outbreak of World War I, understood that the progress of civilization (a modern colonial ideal) was built upon the denial of death, grounded in the unconscious desire for eternal life. This death-denying culture creates conditions in which life (especially the lives of others) is treated as disposable, replaceable, and commodified:

> Should we not admit that with our cultural attitude toward death, we are psychologically living beyond our means, once again, and step back to acknowledge the truth? Would it not be better to give death its rightful place in reality and in our thoughts, and bring to light our unconscious attitude toward it, which we have so carefully repressed until now? (Freud, 2010, p. 246 [our translation])

Judith Butler engages with Freud's concerns, stating that "there should be a recognition of precariousness as a shared condition of human life. [...] Since life is precarious, it must be preserved." (Butler, 2015, p. 30, 57 [our translation]). In this context, "slowing catastrophe" becomes a form of care, an attention to the fragility of the human condition, considering the complexity of its ambivalent desires.

I think of slowing, not sublimation, as I wish to move away from the term "sublime," laden as it is with ideals of elevation, detachment, purification, and the loss of solidity. Not sublimation, but artistic work: an "eruption into the social field" (Guattari, 2024, p. 24 [our translation]) through shared artistic practice. Perhaps this eruption signals a new approach to naming the destinations of the drive. *Erupulsões*, each time, expands the territories of exercise and nourishes life with its fertilizing ashes.

Figure 5
Destinations of the Drive

Source: Digital Art by Eduardo Montelli (2024)

The erupulsões involve the pleasure and anguish of perceiving the multiple dimensions of one's ability to grasp lived reality. However, Kantian ideas of superiority and separation associated with this aesthetic experience hold no interest here. On the contrary, the focus lies on bringing subjects and phenomena closer to the sensory world, uncovering their inalienable points of contact and connection. Even though our mental faculties and

techniques may simulate overcoming the limits imposed by external and internal nature, we remain bound by the organic existence of our bodies and our earth. Would it not be better to use the grandeur of imagination to devise ways to preserve life in its diverse entirety, rather than accelerate catastrophes? Shouldn't we acknowledge that what is truly necessary is to process and surpass the limits of a civilizational ideal that denies death, anchored in the unconscious fantasy of eternal life?

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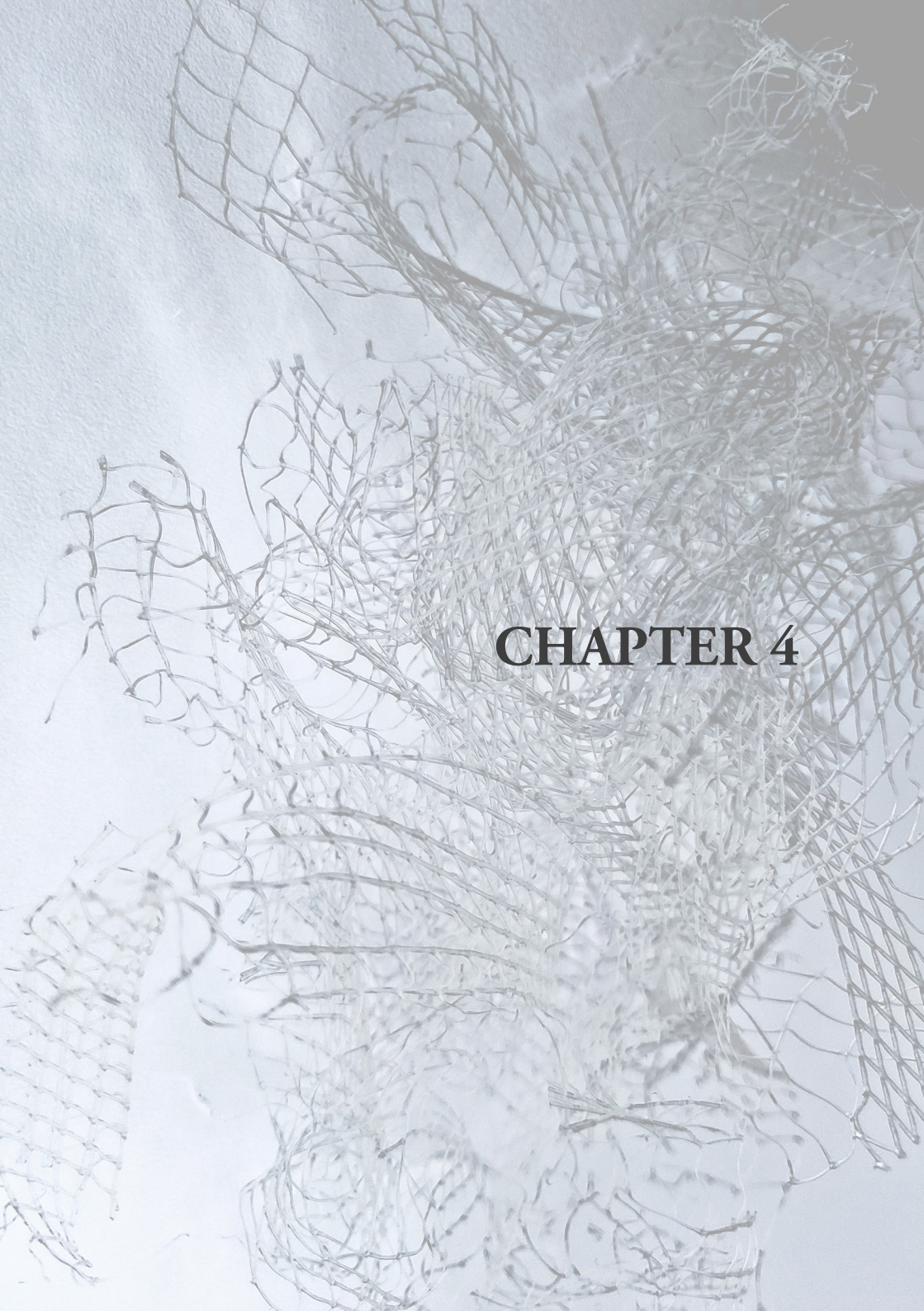

CHAPTER 4

BEING – THE PATH OF SUBJECTIVATION

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Abstract

This study explores the dangers posed to democracy and society by current models of predictive algorithms that trace patterns and sustain surveillance and control. These algorithms, within the context of data colonialism exercised by Big Techs, foster a capitalistic subjectivity in today's on- and offline universes. However, resistance exists. This chapter also examines the aesthetic interventions *Tor* (2021) and *Go Rando* (2017), which utilize digital interfaces and browser extensions, challenging a dystopian late capitalism that, we believe, already attempts to appropriate sleep.

1. Introduction

> *A virtual ecology is necessary here as a complement to the ecologies of what already exists. The machinic entities traversing these different registers of actualized worlds and incorporeal universes are a two-faced Janus*
> (Guattari, 1992, p. 139 [our translation]).

This study examines the dangers to democracy and society presented by algorithmic models (O'Neil, 2020), which to some extent support "data colonialism" (Couldry & Mejías, 2019) through projects designed to control our lives. This concept relates to Big Other (Zuboff, 2018), a found in the realm of the Google search enterprise, which analyzes, mines, and extracts available online data, inaugurating a market form rooted in informational and surveillance capitalism.

The mentioned data become the foundation for "prediction" (Bruno, 2013), that is, to demand future changes in the state of online platform users, also reshaping social space. That said, we posit counterpoints—disruptions such as those observed in aesthetic interventions designed as digital interfaces.

The first of these noises is the 2021 intervention named *Tor* (Bruno, 2013), a collaborative, mediated, and activist-oriented initiative involving coding to circumvent online surveillance and monitoring. The second, from 2017, is *Go Rando* (Grosser, 2017), a Facebook browser extension that creates a sense of estrangement for users of this digital social network.

Its emojis (symbols like "angry," "sad," or "wow") are used to generate an emotional profile as feedback for friends and are also, through predictive algorithms, elements of surveillance and control. Now, with *Go Rando*, these emojis are realigned to create more balanced profiles. The disruption generated presents a user profile that is less genuine, deceiving the algorithms of Meta Platforms (the current name of Facebook). These browser extensions, to some extent, challenge a dystopian "late capitalism" (Crary, 2014), which, we believe, is already attempting to appropriate sleep.

2. Model

The mathematician Cathy O'Neil (2020), in her research discussing the dangers of algorithms to democracy and society, clarifies the term by presenting distinct scenarios, some offline, characterized as models. According to O'Neil (2020, pp. 30–34), the purpose of an algorithmic model is to establish itself in various contexts and circumstances, seeking the ideal combination.

These models must be continuously updated and adjusted, as they involve variables and unpredictability. Thus, when compared to a recipe, every measurable relationship between each combined component of the recipe is included, from the ingredients and preparation time to the people who consumed the food.

Regarding the findings of O'Neil's research (2020, p. 35), Sack (2019, pp. 85–86) clarifies that only the most crucial details are included in algorithms, much like recipes, and these are based on the assumption of an almost ubiquitous context of existing hardware and software: programming languages, operating systems, protocols, and networks.

Recipes and algorithms, as explained by the aforementioned researchers, are equally imprecise and context-dependent. In both cases, no matter how detailed the instructions, something will always be missing in the end. Similar to a "decision tree" (2023)[1], an illustration or diagram of an algorithm, it outlines the minimum number of questions that must be answered to evaluate the likelihood of making a correct decision. As a method, it allows the operation to address the problem in a structured and systematic way to arrive at a logical conclusion.

O'Neil (2020, pp. 30–35) explains that the inputs for the algorithm in her analogy of a family recipe are the possible information she has about her family, as well as the ingredients, energy, time, and willingness. The outputs would be something akin to what she herself cooks and her method. Updates and adjustments, which involve calculating relevant facts and actions derived from observations for the model's success, make it what statisticians call a "dynamic model."

Ideally, O'Neil suggests, the model should be refined over time by testing it daily, incorporating data about what is bought and cooked, and noting the reactions of those involved. For clarity, this optimization of the algorithm would include parameters or constraints such as cooking time and the exclusion or inclusion of ingredients.

It is assumed that the algorithm in question can handle only one task, possibly functioning like an ignorant machine with enormous blind spots—reflecting the judgment and priorities of its creators—since

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1. Figure 1 – Decision tree. GFBioinfo (2023). http://web.tecnico.ulisboa.pt/ana.freitas/bioinformatics.ath.cx/bioinformatics.ath.cx/indexf23d.html?id=199. Accessed on: June 1, 2023.

no model can fully capture the complexities of the real world, such as the nuances and noise of human communication in which important information might be omitted.

In contrast to the recipe algorithm, O'Neil (2020, pp. 8–24) presents several toxic and biased models that are increasingly prevalent in daily life, which she calls "Weapons of Math Destruction (WMDs)." These are mostly harmful models that encode human prejudices, errors, and biases into the software systems that are increasingly managing people's lives. The mechanisms of these models are opaque and invisible to everyone except their creators: mathematicians and computer scientists. Their decisions, even when flawed or harmful, are beyond challenge. These black boxes sentence and punish the poor and marginalized in society while further enriching the wealthy, who can still be judged by people, whereas the masses are judged by machines.

It is relevant, therefore, to cite as a second model—an antithesis to the recipe algorithm—another that is not formatted in software. Considered by O'Neil (2020, pp. 38–40) as a WMD, it is the LSI-R (Level of Service Inventory – Revised), an algorithmic model designed in the 1990s to detect criminal recidivism and used in various regions of the United States. The LSI-R was seen as a partial yet efficient tool in the criminal justice system, helping non-dangerous offenders receive lighter sentences. However, as will be discussed, the model's design reflects a racist and discriminatory framework rooted in the U.S. judicial and prison systems, where factors such as race and social status are central to determining sentences—often unjust—despite claims by authorities of aiming for impartiality. This WMD, another algorithm masking human bias with technology, includes a lengthy questionnaire for detainees to complete.

According to O'Neil (2020, pp. 40-43), these include questions about prior convictions, which are linked to the risk of recidivism, as well as related questions, such as the involvement of others in the crime in question and the role of alcohol and drugs. Clearly, there is a tendency to penalize young Black individuals from marginalized areas, many of whom

are stopped by the police dozens of times without having done anything wrong. Many teenagers may have consumed alcohol before the legal age or been caught with a joint in their pocket, but wealthy white youth, in contrast, are rarely penalized for the same behaviors when confronted by law enforcement. As a result, there is a disproportionate number between non-white individuals stopped by police and the Black community, even among those who are innocent.

It is important to understand that in a harmful algorithm that surveils and condemns individuals, their relationships, and their traces, there exists a configurable taxonomy, as it is relational and constructed with scale and opacity. To some extent, it provides approximate answers depending on the context or subject matter. Theorists Nick Couldry and Ulises A. Mejías (2019, pp. 183-184) warn about the paradox of the "datafication" of information and note that courts around the world have begun to adopt algorithmic processing, delegating much of the power to regulate violations of autonomy to commercial platforms with dangerous practices and normative consequences for the legal system itself. There remains, however, a deep paradox that both Julie Cohen and Mireille Hildebrandt note: "[...] that practices of data colonialism are potentially eroding the very notion of the rational, reflexive, law-respecting human subject on which the legitimacy of law itself depends." (Cohen, 2018, as cited in Couldry & Mejías, 2019, p. 183 [our translation]).

3. Relationship

More and more internet users suspect that Google's search engine, the most widely used in the world, extracts and uses their data for a wide variety of purposes. In many cases, suspicions also fall on the digital assistants embedded in smartphones, whether through audio capture or user-entered data, both performed by users themselves (it is also worth mentioning the potential surveillance carried out by the front-facing cameras of smartphones).

According to O'Neil (2020, p. 12), this company is a leader in the use and refinement of algorithmic models, applying statistics and monitoring thousands of variables, with researchers continuously running tests.

For instance, they might change the color of the letters in a single ad (from blue to red), display each version to 10 million people, and record which one garners more clicks. O'Neil (2020, p. 21) states that when statistical systems are designed to find customers or manipulate desperate debtors, the increasing revenues of such companies seem to indicate they are on the right path. Profits ultimately serve as substitutes or approximate indicators of truth – the proxy of the software.

It is important to note the role of metadata, which are data that describe other data, and that algorithms tend to serve as the foundation of a new social order. Evidence of this can be observed in the emerging logic of hegemonic accumulation within today's interconnected spaces, where data extraction and appropriation replace the production of goods. This creates concentrations of power and poses threats to core values such as freedom and privacy.

This social order is illuminated by sociologist Shoshana Zuboff (2018, p. 18-33) in her discussion of the prospects for an information-based civilization. Zuboff coins the term Big Other and highlights the aforementioned search startup, Google, which, using not-so-legitimate mechanisms, has pioneered the analysis, mining, extraction, and commodification of online data. This has resulted in the creation of new markets for behavior prediction and actions concerning the future, as will be explored later. Google has become the largest and most successful Big Data company by owning the most visited website and, therefore, having access to the largest amount of data exhaust—streams of user data that serve as raw material for analysis and the continuous production of algorithms, advertising segmentation, and subsequent auction-based sales.

Google has inaugurated a market form derived from informational capitalism, identified by Zuboff as "surveillance capitalism," which the sociologist also refers to as Big Data. This form monetizes data acquired through surveillance. It is understood that, to some extent, everything tends to become commodities rapidly, aligning with contemporary consumption practices. Everything comes to have a price, encompassing both the tangible and the symbolic: sports, culture, music, food, natural resources, places, violence, body parts, sex, traditions, education, religion, and even emotions. Through databases and the corresponding appropriation of information analyzed by algorithms, commodification processes reshape everyday life and social relationships, ultimately leading to the redefinition of "human qualities" and the depoliticization of individuals' relationships with the dynamics of social change.

Data colonialism, as Couldry and Mejías (2019, pp. 32–33) term capitalism in its phase of expansion, imposes data extraction infrastructures directly into the fabric of life, with the risk of fundamentally distorting human experience by invading the self's domain. This domain, as will be discussed later, underpins values such as autonomy and freedom in all their forms. Theorists draw attention to the term "surveillance capitalism" from Shoshana Zuboff (2018), arguing that this, like other terms—such as informational capitalism, communicative capitalism, platform capitalism, or even digital capitalism—has not fundamentally altered the meaning or purpose of capitalism. It remains what it has always been: the systematic organization of life to maximize financial value, resulting in the concentration of power and wealth in the hands of a very few.

Zuboff (2018, p. 58) defines surveillance capitalism as an institutionalized logic of accumulation based on the rapid consolidation of institutionalized facts—spanning data brokers, data analysis, data mining, professional specializations, unimaginable cash flows, powerful network effects, state collaboration, material hyper-scale resources, and unprecedented concentrations of informational power. This has resulted in a pervasive sense of inevitability. In this new regime, the global architecture of

computer-mediated interaction transforms electronic text into an intelligent global organism, which she terms the Big Other.

Paraphrasing Couldry and Mejías (2019, p. 32–33), contemporary societies are marked by the increasing importance of information circulation and processing. This accelerated circulation, combined with data and information extraction, has profoundly impacted business management, labor organization, and the integration of social life into the economy. The novelty is not so much the surveillance itself but rather the networks of social relationships in which user data have significantly expanded the ways human life is appropriated to organize the economic and social order as a whole. Surveillance is situated within this context but is insufficient alone to define the current state of capitalism.

There is a lack of configuration of the subject for data extraction, as what matters for extraction is the data itself, not the individual per se. This process of extraction, stratification, and subsequent mining also targets clusters and groups. Big Data is an extraction project based on formal indifference to the populations it involves; in other words, internet users and interactors serve both as the sources of data extraction and the end targets of what that data produces. Examples include continuous feedback mechanisms, such as suggestions for books, places visited, or even likes on a social media platform. This project signals the transformation of contemporary society and economy, characterized by a lack of clarity in the distinctions between social and institutional divisions and the roles of individuals as users, clients, and citizens.

4. Prediction

Building on Zuboff's observations mentioned earlier, we turn to theorists Couldry and Mejías (2019, p. 18), who assert that data captured by computers—universal machines capable of performing unlimited operations to model any aspect of the world that can be modeled—constitutes a form of translation. This translation represents the actions of these machines in a language that allows those actions to be processed according to their "grammar" for information storage.

In discussing digital surveillance, Professor Fernanda Bruno (2013, pp. 177–178) proposes a "cartography of actions" of users in digital networks, mapping their paths as a basis for behavioral modulation. Within these actions, one can implicitly observe algorithmic models shaping their future paths. These maps, created from traces and vestiges of a range of communicational and/or expressive actions, have cognitive, political, and subjective implications. They function as a sociotechnical device composed of a diverse and distributed taxonomic machine that monitors, classifies, and predicts our modes of life. This device incorporates mechanisms of monitoring, classification, and prediction, which embed themselves in participatory flows while simultaneously intervening in them.

This proactive performativity, derived from user traces—whether left in text messages, phone calls, digital network interactions, or search engines—enables the companies monitoring these activities to archive, classify, and individualize them. As Bruno (2013, p. 171) notes, each of us now sees distinct outcomes based on our presumed preferences, shaped by past navigation and interactions. Thus, the results we encounter on Google Search are no longer those determined by the PageRank algorithm, which previously ranked internet pages based on the number of links pointing to them.

Supporting the points discussed earlier, Zeynep Tufekci (2011, p. 217) argues that algorithms making decisions raise the same range of issues as humans do when making decisions: transparency, accountability, discrimination, error, and so forth. Increasingly, computing is being used to make, or assist in making, gatekeeping decisions beyond online platforms. Many companies, for instance, are turning to algorithms to make hiring, firing, or other employment decisions. Federal laws often apply to these decisions such as prohibitions against discrimination based on race, gender, disability, family size, or other protected categories in cases of hiring, lending, or housing. Nevertheless, algorithmic decision-making creates opportunities for such discrimination to resurface, even when not explicitly targeted by the algorithms themselves.

For over a decade, Google's search engine has turned the computer interface into a kind of one-way mirror, reflecting users' interests while algorithms "observe" their clicks. The "filter bubble" (Pariser, 2011), which also applies to platforms like Facebook and YouTube, results in personalized content selections based on browsing history, age, gender, location, and other user data. By selecting topics of greatest interest to the web browser, including articles and posts that align with the user's opinions, the algorithm creates a comforting bubble. The primary goal is to keep users engaged for as long as possible, effectively left to their own devices. Meanwhile, personalization filters act as a form of invisible self-propaganda, reinforcing users' existing ideas, amplifying familiarity, and alienating them from the unfamiliar. In an era where shared information is the basis of shared experience, the filter bubble becomes a centrifugal force, driving people apart.

This distancing from differences and closeness to similarity not only shapes how people think but also creates a collective bubble that denies other possible perspectives. Consequently, individuals tend to isolate themselves within communities, pages, and friendships with those who think like them and share their values—particularly political-ideological ones—resulting in echo chambers. This confinement undermines democratic action by making citizens indifferent to differing viewpoints, fostering conditions for polarization. Serendipity, the act of discovering unexpected but valuable things, is left aside, reducing opportunities for encounters that spark creativity through the convergence of ideas from diverse disciplines and cultures.

Currently, there is a profiler, combined with a gatekeeper, implemented through a specific software model to meticulously map behaviors and identify user profiles with extreme precision. This process generates a network map where the paths taken reflect the users' presumed preferences, projected by algorithms that monitor and analyze their clicks and browsing patterns.

Bruno (2013, p. 169-170) asserts that this network map, or profiler, facilitates advanced calculations of profiles that influence the realm of potential actions and choices of Web users. It provides projections that aim to stimulate or inhibit behavior, either to encourage specific individuals or groups in their choices, or for marketing or targeted advertising, as well as for various services, including preventive security actions or risk calculations.

5. Noise

Drawing on Bruno's words (2013, pp. 171–172), it is crucial to problematize, or even challenge—whether through activism or aesthetic-poetic proposals—the less explicit face of personal trace monitoring and its proactive effects. The researcher notes that small initiatives are emerging, such as the development of browsers and applications designed to bypass user tracking on the internet. These aim to regulate or debate the social, subjective, economic, and political implications of monitoring, data mining, and profiling. Bruno highlights the *Tor* network (2021), a system composed of tools that enable browsing, publishing content, exchanging messages, and more. It uses a data packet system that resembles a winding, difficult-to-follow path and periodically erases users' footprints to mislead potential trackers.

Rather than following a direct origin-destination route, the data packets used by users on the *Tor* network (Bruno, 2013, p. 172) take unpredictable paths through different servers, obscuring their journey so that no observer, at any point along the route, can determine the data's origin or destination. Conceived in the 1990s in response to the lack of security on the early Web due to tracking and surveillance, the *Tor Project* (2021)[2] became a nonprofit organization in 2006. David Goldschlag, Mike Reed, and Paul Syverson of the U.S. Naval Research Laboratory

2. Figure 2 – The Tor Project. Torproject (2021). https://blog.torproject.org/cooking-onions-names-your-onions/. Accessed on: January 10, 2023.

(NRL) asked whether it was possible to create internet connections that wouldn't reveal who was communicating with whom, even under network surveillance. This led to the creation of *Tor Onions* (2021), a system of layered connections, as suggested by its name, where no central hub exists, enabling data traffic through multiple servers. These data packets are encrypted and coded during their journey, offering users maximum privacy.

The *Tor Onions* Project, designed as a decentralized network, required operation by entities with diverse interests and trust assumptions. The software was released as open-source to maximize transparency and decentralization, leading to an increase in voluntary nodes (servers or connection points within the *Tor* network that relay data to ensure user anonymity and privacy) by the end of 2003. Most of these nodes were located in the United States, with one additional node in Germany. By circumventing and debating censorship and government control, the *Tor Project* began to gain popularity among activists and tech-savvy users concerned with privacy. However, it remained challenging for those with less technical knowledge to use. Consequently, from 2005 onwards, tools beyond the *Tor* proxy began to be developed, including the *Tor* Browser in 2008.

Participants in the project discuss a variety of routines related to the network and its platforms in blogs and chats, often using user-generated names—such as "*Cooking with Onions*" (2017), a resource aimed at improving the network's services. Despite the *Tor* project's (2021)[3] collaborative, activist-driven nature and use of coding to circumvent surveillance and monitoring on the Web, its purpose is neither to provide artistic critique nor to target algorithms for debate. This underscores the importance of aesthetic-poetic proposals that challenge networks by making critical statements about their extreme appropriation by large

3. Figure 3 – *The Tor Project*. Torproject (2021). https://blog.torproject.org/cooking-onions-names-your-onions/. Accessed on: January 10, 2023.

corporations. These corporations monetize the networks, appropriating, above all, user data. Today, art continues to use established media and platforms but advances by critically addressing the flow of capital into the informational space.

Again, paraphrasing Bruno (2013, p. 171), each of us now sees a distinct result tailored to our presumed preferences based on past browsing and interactions, based on past browsing and interactions. If we turn our attention to the guardian algorithms, the "gatekeepers" (Tufekci, 2015, pp. 209–212), these invisible agents adjust content for users in a basic and individualized way and significantly alter key aspects of traditional gatekeeping concerning visibility, information, asymmetry, and the public's ability to perceive results of editorial work.

In one example, using only "Facebook Likes" (Tufekci, 2015, p. 210–211), researchers were able to reliably model latent traits of 58,000 volunteers, including characteristics such as sexual orientation, ethnicity, religion, political beliefs, personality traits, drug use, and more. In one case, researchers were able to accurately determine whether a Facebook user was gay, even when this characteristic was not explicitly indicated in his profile. The conclusions of Zeynep Tufekci (2015, p. 211) should be emphasized with regard to these machines armed with our data, both online and offline, because increasingly these gatekeepers can find out things about us like never before, and without explanation in law, politics and even basic public awareness.

According to Zeynep Tufekci (2015, p. 212), through algotrhythmic manipulation and based on its posts, Facebook is able to induce mood swings in its users. Advertisers have exploited this capability, targeting specific consumers individually rather than broad demographic categories, often preying on vulnerable users. Facebook, as an algorithm-driven, parameterized platform, has become a frequent subject of aesthetic and poetic critiques. In what follows, we will analyze some artistic interventions that explore artificial intelligences and the routine actions of their users, not only on Facebook, but on different platforms, in order to problematize the image-sound universe present in the digital sphere.

To this end, it is appropriate to follow *Go Rando* by multimedia artist and designer Ben Grosser (2017) who questions the problematic nature of reactions, as seen on the promotional page for his web browser extension. *Go Rando* introduces noise into Facebook's social network, where users interact with emojis such as "angry," "sad," or "wow", used to build emotional profiles on Facebook. Predictive algorithms that already determine consumption profiles can, in this context, lead to increased surveillance, placement on watchlists, more targeted advertising, emotional manipulation, and so on, as observed on other platforms like those operated by Google. Grosser explains that whenever a user clicks "Like," *Go Rando* randomly selects one of seven "reactions" on their behalf. Consequently, Facebook's algorithms perceive the user as someone whose emotions are "balanced" — for instance, someone who feels "angry" as often as "haha" or "sad" as often as "loving". Thus, the social network cannot discern the genuineness of the user's reaction.

This browser extension (Figure 4, above)[4], created for Facebook (2017) by Ben Grosser (Pardes, 2022), serves as a tool for "demetrication" removing metrics and quantification of social approval devices in social networks. Grosser and other companies have also developed similar tools for other social media platforms. Browser extensions (García, 2023), to some extent, contribute to user well-being on these networks by alleviating the constant concern about the number of likes received. In certain cases, users themselves, aided by these extensions, can even choose to hide likes and reactions on their timeline. This makes users less dependent on numbers, rendering them less significant in the context of digital social network interactions.

The irony and ambivalence in *Go Rando* guide its proposal, critiquing the intersection of interaction and friendliness, social engagement, and prediction. This interface adopts a satirical tone, playing with the

4. Figure 4 – *Go Rando*. Grosser (2017). https://bengrosser.com/projects/go-rando/. Accessed on: September 15, 2022.

taxonomic construction of the profiler. According to Grosser (2021), his intention is to propose interactions, machines, and systems that make the unfamiliar familiar, revealing how software prescribes behavior and, consequently, changes who we are and how users deal with the cultural, social, and political effects of such software. The artist's work examines, among other issues, how the positioning and counting of friends by an interface interferes with conceptions of friendship and who benefits from the emotional responses generated by users intuited by a software system - algorithmic parameterization, in other words.

According to Grosser (2017), it is increasingly evident that Facebook likes, on a platform that shapes the social world with its billions of users, not only inform friends about what the user interacted with today but also influence what the user will see in the future on this social network: "The individualities projected by the profiles do not focus so much on the consciousnesses that sustain the action; they take a step forward and directly target the action itself" (Bruno, 2013, p. 174 [our translation]). The platform uses the "like" activity to target ads, decide which posts appear in a user's news feed, and manipulate their emotions as part of its own studies on human behavior. It also shares user data with other companies and government agencies, amplifying surveillance and algorithmic decision-making – a platform that, in the words of Couldry and Mejías (2019, p. 26 [our translation]), "produces the social for capital." If a user's preferences have already been widely shared, what would be the harm in selecting a different reaction or emoji, such as "angry" or "sad," instead of "like"? The "like" was a multifunctional signifier that could mean many things and was, therefore, harder to interpret algorithmically, states Grosser (2017). While Facebook's "reactions" reduce the complexity of human emotion — as seen with the ubiquitous "like" emoji — they are compelling enough to encourage algorithmic analyses of mood, whose questionable precision will nonetheless be used to generate an emotional profile for each social network member. When these reactions are combined with other data available to corporations and state agencies, the potential for misuse becomes significant, the artist emphasizes.

For example, paraphrasing Grosser (2017), emotional profiles could impact someone's economic future. Amazon might use their reactions to inform dynamic pricing; banks might view "sad" or "angry" customers as higher credit risks for loans; a future employer might interpret a "sad" profile as a signal to negotiate a lower salary or dismiss a candidate altogether. These reflections echo the warnings of Zuboff:

> Material requirements and highly specialized knowledge separate subjective meaning from objective outcomes. [...] This examination of Varian's combination of data, extraction, and analysis suggests some key features of the new logic of accumulation associated with big data, spearheaded by Google. First, revenues depend on data assets appropriated through ubiquitous automated operations. These operations constitute a new class of assets: surveillance assets. Critics of surveillance capitalism might characterize such assets as "stolen goods" or "contraband" insofar as they were taken rather than given and do not produce [...] the necessary reciprocities. The valued culture of social production in the individual networked sphere relies on the very tools that are now the primary vehicles for the surveillance-based appropriation of the most lucrative data exhausts. These surveillance assets attract significant investments that might be called surveillance capital (Zuboff as cited in Varian, 2010, p. 1–10; Zuboff, 2018, p. 40–41 [our translation])[5]

The addition of Facebook reactions to these systems will lead to further (and questionable) analyses of mood, potentially using someone's feelings as partial justification for surveillance, imprisonment, and more. This becomes evident as every "angry," "sad," or "wow" reaction we post is integrated into predictive algorithms – data that could result in increased surveillance, placement on watchlists, or even denial of entry at a country's border, reiterates Grosser (2017).

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5. Varian, H. (2010) and Varian, H. (2014).

Why *Go Rando*? Addressing this question posed at the end of the project's presentation page, Ben Grosser (2017) promptly responds that the intervention adopts the strategy of obfuscation to disrupt Facebook's increasingly refined data collection practices. The artist suggests that, while unlikely, if everyone started using *Go Rando* tomorrow, it could have widespread collective effects against corporate and governmental emotional profiling. However, regardless of this possibility, Grosser asserts that the tool provides individual benefits to any user by disrupting Facebook's news feed algorithm, thus dulling the "filter bubble" effect. This allows users to resist emotional manipulation attempts and confuse both corporate and governmental surveillance.

Fernanda Bruno (2013, p. 174-175) states that user actions on networks, which are currently characterized by their lack of hierarchical organization, are continually shaped by a logic inherent to the set of social practices. Control is exercised in a partnership regime, adhering to an ethic of shared responsibilities and risks, self-regulation, and self-management — one of autonomy, initiative, self-improvement, and continuous choice. Additionally, the predictive-performative nature of profiles aligns with a culture of performance and operates within it as both a technology for empowering individual choices and a technology of control. Entrepreneurship in private and public life becomes the norm, and performance emerges as a model of style and success for individual existence, as exemplified by ride-sharing apps and other platforms based on evaluation and optimization. The proactive nature of algorithmic knowledge derived from personal data traces is crucial to its effects on power and control.

The sale of customers to advertisers by marketing agents and the provision of profiles of suspects, criminals, or potential victims to security agencies by surveillance agents are part of this system. Bruno (2013, p. 176) further argues that this is compounded by the proactive normativity present in online networks, which is often integrated into personalized informational and cognitive interfaces, as exemplified by the "filter bubble" created by Google's search engine.

Hence, the importance of questioning such monitoring and control devices for personal traces lies in interrogating the forms of resistance that may emerge from this power regime. This regime is founded on knowledge and types of intervention that do not necessarily involve identification procedures as seen in disciplinary surveillance techniques but rather limit, through other means, the possible field of action, choice, and experience of individuals.

Finally, Grosser states that *Go Rando* (2017) appropriates the reduced scale of choices. Paraphrasing one of Grosser's remarks (2017), it would be interesting to witness inappropriate reactions from our friends in the future, as this could contribute to the battle between individual freedom and the corporate-state Big Data machine, which seeks to use our data against us.

Thus, reflecting on the performativity of web users and drawing analogies to the conditions affecting the mood states of such profiles, it is fitting to draw on the research of professor, art critic, and essayist Jonathan Crary (2014, p. 74). Crary argues that many forms of enduring and multivalent social exchange have been reshaped into habitual sequences of solicitation and response. Simultaneously, the range of what constitutes a response has become stereotyped and, in many cases, reduced to a small catalog of possible gestures or choices. As your bank account and friendships can now be managed through identical mechanical operations and gestures, there is an increasing homogenization of what used to be entirely unrelated areas of experience. Given the infinity of content accessible 24/7, there will always be something online more striking than anything in one's immediate real-world circumstances, in real-time situations, or in daily life.

This predictive weapon — the algorithm — and these WMD (Weapons of Math Destruction O'Neil, 2020) are also tools of "data colonialism," a practice of extracting, mining, and selling internet users' information for various purposes, primarily carried out by major corporations. Couldry and Mejías (2019, pp. 17-18) argue that the development of

"data colonialism" expands externally through geography and internally through the social sphere, masked by the rational framework of capitalism's expansion. Its unnoticed proliferation, along with its projects to control our lives, ways of knowing, means of production, and political participation, foreshadows the creation of a new global social order. This order must be challenged through examples of interventions like *Tor* (2013) and *Go Rando* (2017), as previously discussed.

Couldry and Mejías (2019, p. 24) express a desire for a heart recorder that can accurately distinguish between a heartbeat and other bodily signals, emphasizing that data collection, information gathering, and discrimination are not inherently harmful. The problem lies in the application of this discrimination—data-based categorizations—within connective structures in an already segregative and exclusionary system. The authors point out that, over time, the capitalization of labor through work relationships has led to a highly unequal distribution of profits. Similarly, they argue, the capitalization of life through data relationships is likely to introduce new forms of inequality into human existence.

An exchange must be facilitated through the meticulous removal of barriers to the flow of data within and between platforms; perfection, they assert, is partly an achievement of algorithm-based software that enables platforms to produce "the social" for "capital" (Couldry and Mejías, 2019, p. 26). Facebook serves as an example—a successful yet ambiguous interface that shapes the behavior and actions of its billions of users.

Paraphrasing Cathy O'Neil (2020, p. 21-24), poorly designed mathematical models now micro-manage the economy, advertising, and penal systems. These WMD (Weapons of Math Destruction) are opaque, unaccountable, and operate on a massive scale to organize, target, or "optimize" millions of individuals. By conflating their results with concrete reality, many create destructive feedback loops—harming citizens, rendering them collateral damage, and discarding them, thus

perpetuating injustices and affecting them at critical life junctures: accessing higher education, securing employment, obtaining loans, and receiving sentencing in the judicial system. These areas of life are increasingly controlled by secret algorithms that impose arbitrary punishments—this is the grim world of Big Data.

Hacking aims to liberate the functionalities of devices from the institutional logics in which they are embedded and redistribute these devices into alternative configurations for new purposes. This approach is particularly relevant for exploring the aesthetic-poetic problematizations and the activist bias of the propositions in question. In the market sphere, these enclosed logics are those of accumulation, as highlighted by Zuboff (2018, pp. 56-57).

According to the sociologist, Google, through algorithmic prediction, projects past virtual behavior onto future real-world behavior via database analysis, thereby reconfiguring marketing and advertising. As a result, Google and similar companies have learned to obscure their operations, choosing to invade unprotected individual and social domains until they face opposition. In the meantime, these corporations leverage their economic power to cheaply defend what they have already seized. In this way, surveillance assets are accumulated, attracting significant surveillance capital while producing new and notable policies and social relations.

In contrast to the sardonic humor of *Go Rando*, for Big Data (Zuboff, 2018, pp. 31-32), nothing is trivial or ephemeral—everything can be captured, from actions to discourses: Facebook likes, Google searches, emails, texts, photos, music, videos, locations, communication patterns, every click, page view, and more. These data are appropriated, abstracted, aggregated, analyzed, packaged, and sold endlessly. These data streams have been labeled by technologists as "data exhaust," often dismissed as waste. Google stands out once again, as its status as the most visited search engine makes it rich in monetizable, non-claimable waste.

Zuboff (2018, pp. 40-41) explains that Big Data serves as the business benchmark for most companies and startups, where routine value estimates rely on user attention more than revenue to project the profitability of surveillance assets, considered "stolen" or "smuggled goods" as they were taken rather than willingly provided. "[...] The relentless financialization of previously autonomous social spheres continues unchecked. Sleep remains the only lasting 'natural condition' that capitalism has yet to eliminate" (Crary, 2014, p. 91 [our translation]).

6. Mold

In an era of easy 3D scans and iris recognition by mobile device companies, the contemporary struggle centers on the attention economy, warns essayist Jonathan Crary (2014, p. 84-86) in his discussion of contemporary capitalism and the end of sleep. Crary examines how this endless non-time blurs any separation between an intensified, omnipresent consumerism. Paying close attention to the role of the human eye, the professor describes the continuous management of individual attention and the compromise of perception within the mandatory routines of contemporary technological culture.

Crary notes that in today's control environments, the term "eyes" repositions human vision as a motor activity that can be subjected to external directives or stimuli. The eye becomes an intermediary element in a circuit whose outcome is always a motor response of the body to electronic solicitation. The goal is to refine the ability to locate eye movements within targeted locations or points of interest, thereby maximizing monetization opportunities and enabling the continuous accumulation of user data. Companies like Google and others now compete to dominate what remains of everyday life and its elusive anonymity.

To understand the user and their uninterrupted connection to the internet, Crary explains:

> One of the goals of Google, Facebook, and other companies [...] is to normalize and render indispensable, as Deleuze outlined, the idea of a continuous interface—not literally perfect, but a relatively uninterrupted engagement with illuminated screens of various kinds that incessantly demand interest or response. Of course, there are intervals, but not intervals where any sort of counter-project or flow of thought might be nurtured and sustained. As opportunities for electronic transactions of all kinds become ubiquitous, no vestige remains of what used to be daily life, outside the reach of corporate intrusion. An attention economy dissolves the separation between personal and professional, between entertainment and information, all overlaid with an obligatory communication functionality that is inherently and inescapably 24/7 (Crary, 2014, p. 85 [our translation]).

Drawing from sociologist Shoshana Zuboff's research (2018, pp. 43-45), we see that Big Other is an architecture, a ubiquitous institutional network regime that records, modifies, and commodifies daily experience, shaping it. This power no longer aligns with ownership of property or production means but rather extends to everything—from household appliances to human bodies, from communication to thought—all to establish new pathways for monetization and profit. Consider Google itself (Zuboff, 2018, p. 27), with its investments in machine learning, drones, nanoparticles patrolling bodies for signs of disease, sensors, and internet-connected devices designed to create a new intelligent infrastructure for bodies and objects. "Unlike the centralized power of mass society, there is no escape from Big Other. There is nowhere to be where the Other is not present" (Zuboff, 2018, p. 44).

Underpinning the concept of surveillance capitalism, Zuboff (2018, pp. 45-46) argues that power is no longer tied to the ownership of production means but rather to the ownership of behavioral modification means, echoing observations by other theorists mentioned in this chapter. In this new form of power, contracts and the rule of law are supplanted by the rewards and punishments of a new type of invisible hand.

Big Other is sovereign, and it directs the population toward its compliance regime based on rewards and punishments, privately administered in contrast to contracts and the rule of law, sustained by a unilateral redistribution of rights. In the absence of legitimate authority and free from sanctions, Big Other can be described or understood as an automated top-down coup, as Zuboff asserts (2018, p. 49). Reality is subjugated to the market and money, reborn as behavior; it undergoes the same type of fictitious metamorphosis as people, nature, and exchange have. According to Zuboff (2018, p. 56), reality emerges as the fourth dominant characteristic of market dynamics in the 21st century, stemming from the new logic of accumulation within surveillance capitalism.

Regarding corporate surveillance, the constant monitoring of every thought and action by external forces changes the power dynamics in which we exist, transforming a supposed order of individuals into a collection of living entities connected to an external system (Couldry & Mejías, 2019, p. 164). Autonomy is not a form of aggressively individualistic self-governance, but rather refers to socially grounded integrity without which we cannot recognize ourselves or others as similar to ourselves. The target of surveillance is not the entire person, but rather an assembly of duplicated data that probabilistically identifies a real individual, as Couldry and Mejías (2019, p. 155) assert, even though the real individual is bound by discriminatory actions taken based on the data collected, as O'Neil (2020) has already pointed out regarding information about the individual and/or group.

Couldry and Mejías (2019, pp. 155-156) insist on the term "surveillance," even though they acknowledge that its meaning originates from historical forms of tracking that are very different from those of today. Surveillance and control—such as data capture—share something in common when it comes to freedom, and that something is the invasion of the basic space of the self in the name of external power. The minimum integrity of the self is the limitation that constitutes the self as self, a space whose horizon is action and imagination. This limitation is often experienced

in the defense of a minimum physical control around the body, but this can be invaded by acts of power that harass and monitor it, the theorists reiterate.

As these configurations are added to the algorithmic action traversing time and space, how is the self shaped? For possible answers, we will follow Couldry and Mejías (2019, pp. 153-173), who draw on Friedrich Hegel's writings about the space of the self, considering tools to challenge data colonialism in relation to autonomy and freedom. According to them,

> Hegel describes this space as both external and internal, like a circle that never-endingly turns in on itself. This, he says, is what makes "the free will . . . truly infinite, for it is not just a possibility, a predisposition; its external existence is its inwardness, its own self" (Hegel, 1921, p. 22, as cited in Couldry & Mejías, 2019, p. 156)[6].

According to Couldry and Mejías (2019, p. 167), Hegel could never have imagined that this minimal integrity would be routinely threatened, let alone by the broad system of property relations on which capitalism is based and whose surveillance has been persistently modulating the behavior of the individual, damaging the external sphere of freedom—the defining space of the subject. "For Hegel, the defining space of the subject is the reflective relationship with oneself, with the right to subjectivity and the development of free will; a free and self-sufficient life in which 'nothing from the outside, nothing that is not me, determines my actions'" (Hegel, 1921, p. 22, as cited in Couldry & Mejías, 2019, p. 156 [our translation]). The philosopher emphasizes that the individual lives a life that is not free from external constraints; it is a life lived through mediations experienced in the other.

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6. Hegel, G. (1921).

Philosopher Enrique Dussel (2000, p. 158, as cited in Couldry & Mejías, 2019, p. 157)[7] expands upon Hegel's social concept of freedom. Dussel argues that a person's substance, with all its uniqueness and its own indeterminacy, stems from a history and a culture; a being that is responsibly determined and free, always situated beyond the horizon of totality. The defense of the minimum integrity of the self exposes contradictions within the very (individualistic) version of freedom capitalism, while simultaneously providing a basis to defend the social values that help the individual think beyond this notion and beyond data colonialism.

Today, data relations involve systems that insinuate themselves into the needs, desires, and other choices of the self. The data infrastructure upon which the self-tracker depends to enhance itself contains concerning elements and dynamics because they are arbitrary, driven by objectives that are external to this infrastructure, and operate in ways that remain opaque, and therefore can never be reflexively integrated into their goals, conclude Couldry and Mejías (2019, p. 170). According to Couldry and Mejías (2019, p. 184), none of the ideals desired in today's societies—democratic status, freedom, and health—make sense without reference to an autonomous self, a self that must be rescued from data colonialism using all available resources, all political and philosophical means.

7. Conclusion

It is necessary to cause disruptions in the "data colonialism," "surveillance capitalism," and "24/7," within which the algorithm resides. We must understand the algorithm to attempt to oppose the issues surrounding the terms mentioned, even if initially this seems ineffective. One must consider a counterpoint to this exponential machine informational architecture. We must try to challenge this power asymmetry and allow

7. Dussel, E. (2000).

ourselves to practice a truly democratic principle. In their reflections, Couldry and Mejías (2019, p. 199) assert that, to find a force greater than human life, "dataism" affirms the strength of information processing or algorithmic power, which seems to know human life better than humans can know themselves. This ideology, however, clashes with a much older vision of how human life should be, an ecological view of life itself, whatever its limits, restrictions, and deficiencies. Life is an area of open and growing connection, even when forms of human power attempt to control it.

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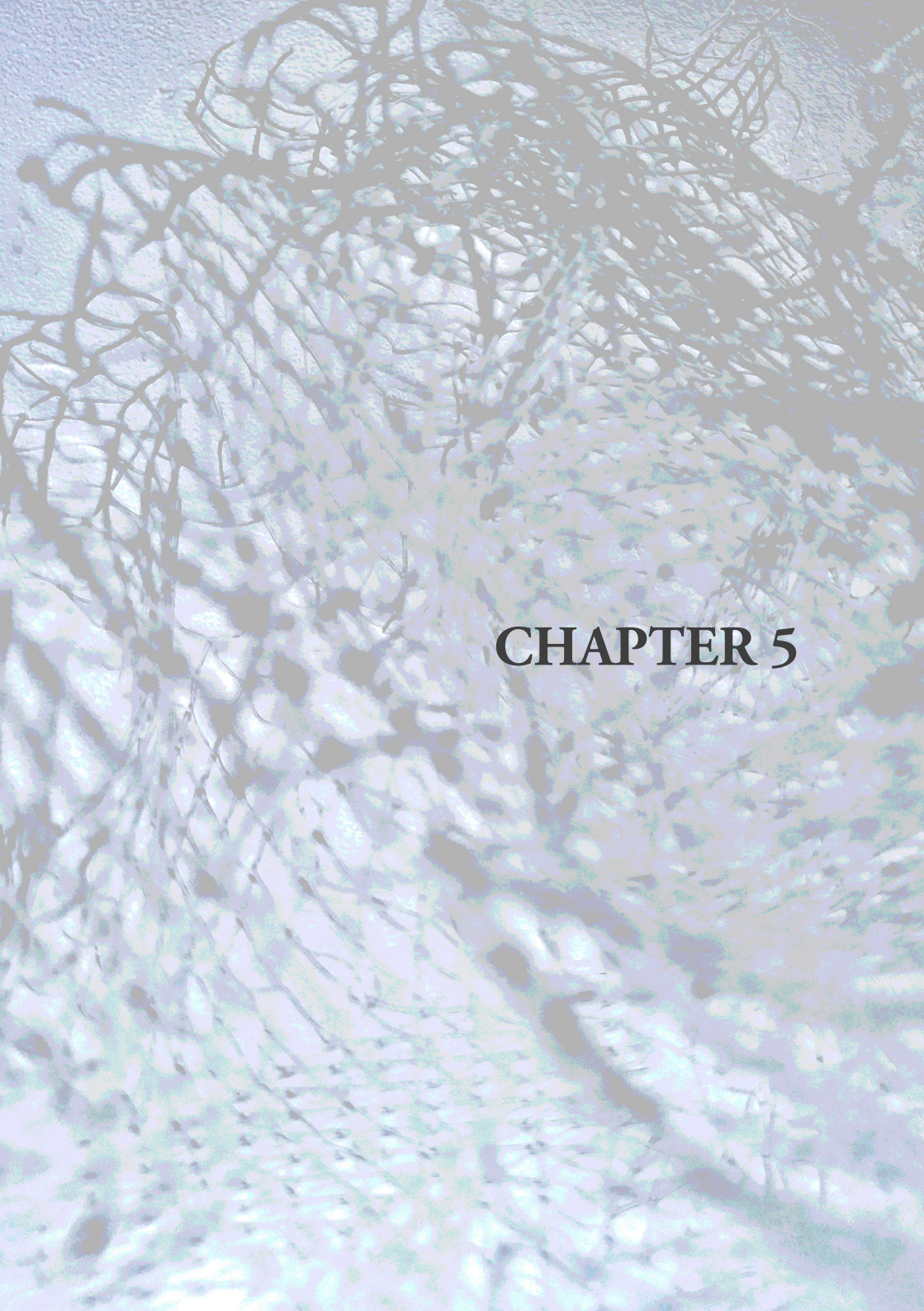

CHAPTER 5

DRAWING BOARD TO FACILITATE ARTISTIC PRACTICE FOR VISUALLY IMPAIRED INDIVIDUALS: CONCEPTUAL PROJECT DEVELOPMENT PROCESS

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Abstract

This study addresses the rights of visually impaired individuals and their autonomy within the school context through the use of Assistive Technology products. The chapter aims to present the development process of a conceptual project to assist visually impaired individuals, particularly the blind, during art classes. The drawing board project seeks to improve a product typically created by teachers working in inclusive school resource rooms or Pedagogical Support Centers. To this end, the methodological procedures of Bonsiepe et al. (1984) were adopted, integrating an approach to develop a technological solution tailored to the specific needs of visually impaired students. The study aims to contribute to the design field by discussing methods and products that facilitate the education of visually impaired students.

1. Introduction

This study presents the creation of a drawing board aimed at assisting the teaching of drawing to visually impaired individuals. The purpose of the board is to facilitate the execution of tasks proposed during drawing classes more effectively, promoting the inclusion of students with specific needs. This initiative seeks to stimulate the act of drawing, thereby broadening the artistic repertoire of these students.

This research is socially relevant as, according to the 2010 Census (IBGE, 2012), approximately 3.5% of the Brazilian population self-identifies as having significant difficulty seeing or being completely unable to see, totaling 6,562,910 individuals at the time, with this number expected to grow. Temporini and Kara-José (2004) highlight several factors contributing to the increase in the visually impaired population, including increased life expectancy, a lack of specialized services, limited access to ophthalmological care, economic difficulties, and insufficient educational efforts to promote preventive behaviors. It is therefore essential to better integrate these individuals, equipping them to be self-sufficient, strengthening the ideal of citizenship, and reducing barriers to accessing quality healthcare.

In Brazil, numerous public agencies and philanthropic organizations provide support to individuals with special needs, fostering their inclusion in society. The Benjamin Constant Institute (IBC) in Rio de Janeiro, under the Ministry of Education, aims to provide effective pedagogical resources to improve these individuals' quality of life and support the development of essential skills and knowledge. The *Dorina Nowill Foundation for the Blind and Laramara – Brazilian Association for Assistance to the Visually Impaired*, both in São Paulo, also work to promote autonomy and inclusion, offering psychological and social support, in addition to specialized services. The Pedagogical Support Centers, affiliated with state governments and located in municipalities with higher population densities, produce, adapt, and provide a variety of materials for pedagogical purposes and daily assistance to blind or

visually impaired individuals (Loch, 2008). These centers offer services such as guidance, training, and capacity-building, as well as support in various aspects of life, including employment, leisure, and culture.

The Statute of the Person with Disabilities (EPD), in accordance with the Brazilian Inclusion Law (LBI) No. 13,146 (Brazil, 2015), Article 27, IV, guarantees the right to education, stating:

> Education is a right of persons with disabilities, ensured through an inclusive educational system at all levels and lifelong learning, to achieve the maximum possible development of their physical, sensory, intellectual, and social talents and abilities, according to their characteristics, interests, and learning needs [our translation].

However, unfortunately, the Brazilian reality does not align with these regulations, as the country's educational system lacks the necessary infrastructure, trained professionals, and sufficient educational materials to fully ensure the rights established in the Statute of the Person with Disabilities (EPD). The absence of these elements hinders the enforcement of the rights guaranteed to people with disabilities, preventing them from fully benefiting from the educational and professional development opportunities to which they are legally entitled. Therefore, it is essential to implement effective measures to enable individuals with disabilities to exercise their rights.

Disabilities can be debilitating, often causing frustration when individuals rely on others to perform routine tasks. This dependency, compounded by the social stigma frequently associated with disability, negatively impacts their quality of life, reinforcing emotional and social barriers that must be overcome. A key factor in addressing this issue is focusing on the autonomy of these individuals, which can manifest in daily activities, leisure, emotional well-being, education, professional life, and more (Marchi, 2019; Aciem & Mazzotta, 2013). In advocating for the autonomy of visually impaired students in the classroom as a pathway

to improving quality of life, this chapter aims to discuss the process of creating a product that integrates and enhances the tools used by visually impaired students during drawing activities.

2. Contextualization of drawing education and visually impaired students

According to the National Education Guidelines and Framework Law (LDB) — Law 9394/96, paragraph 2, the teaching of Arts is a mandatory curricular component at various levels of basic education, aiming to promote the cultural development of students. (Brazil, 1996) Therefore, visually impaired individuals have the right to participate in art classes and to access the images presented in teaching materials.

Santos and Cavalcante (2022) emphasize that tactile drawing is a fundamental exercise for the development of blind students. It is through these tactile stimuli that blind students engage in haptic reading. In this way, they develop greater sensitivity in their fingers and acquire new symbols, contributing to the enhancement of reading skills and artistic expression, while also broadening their reflection, imagination, and sensitivity. The authors also argue that blind students have the same learning potential as sighted students, as this disability does not limit their ability to learn. Piekas (2015) highlights that this skill should be taught to blind children as early as possible to facilitate learning and improve their understanding of images and tactile drawing interpretation.

However, a portion of blind or visually impaired children, adolescents, and adults is still excluded from drawing education. This is partly due to society's disbelief in the ability of visually impaired individuals to understand drawings and communicate through them. Such attitudes hinder the debate on inclusion and equal opportunities. It does not mean that blind or visually impaired individuals cannot identify raised flat figures, but rather that they are not exposed to tactile drawings as frequently as sighted individuals are exposed to conventional drawings (Santos & Cavalcante, 2022)

The importance of teaching drawing to visually impaired individuals is undeniable for their personal development. The skills acquired through drawing education help students identify and create images, expanding their communicative, informational, and artistic repertoire. However, this possibility can only be realized through the expansion of low-cost Assistive Technology (AT) resources and products. This way, they can be more widely distributed in schools and pedagogical support centers, enabling a growing number of students to develop these skills. (Laramara, 2020; Santos & Cavalcante, 2022; Piekas, 2015)

In addition to AT resources, various tools such as 3D printers, 3D pens, and embossing machines support drawing education for visually impaired individuals (Santos & Cavalcante, 2022). Nonetheless, these tools are often inaccessible due to their high cost, which is particularly challenging for most Brazilian schools that lack financial resources or budget autonomy. As a result, low-cost tools are frequently used in public schools and pedagogical support centers. These tools are often improvised solutions or adaptations of existing products.

Laramara (2020)—the Brazilian Association for Assistance to the Visually Impaired—offers an example of such adaptations, teaching a technique for creating materials that facilitate the drawing process for blind children using everyday items. The materials include:

(1) ballpoint pens or thick-tipped pencil;
(2)mesh boards or pieces of mosquito netting, T-shirts, dishcloths, sackcloth, jute, cotton fabric, EVA foam, felt, interfacing, among others;
(3) Notebook paper, plain white paper, or even scrap paper;
(4) A horizontal support, such as a hand-held drawing board, a table, cardboard, or a wooden panel.

The technique involves securing a piece of textured material (e.g., mosquito netting, EVA foam) to the support with adhesive tape or weights. A sheet of paper, preferably A4 sulfite paper with a weight of 40 g/m², is then placed on top. Using a thick-tipped pencil or ballpoint pen,

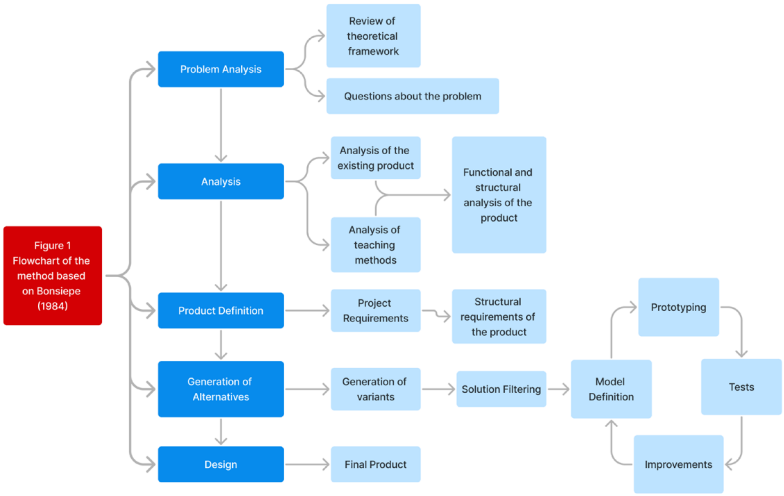
drawings are created on the paper with enough pressure to leave a tactile impression on the back of the sheet without piercing it. A variation of this technique involves using thumbtacks to create holes that form shapes. In this way, students can feel the lines or marks they have made on the back of the sheet (Laramara, 2020).

Despite advancements in technology over the years, access to AT resources and products remains far from ideal. Widespread use of AT continues to face barriers such as the lack of professional training and, above all, the high cost of producing these products. According to the World Intellectual Property Organization (WIPO)—a UN agency—it is estimated that over one million people globally require access to assistive technologies, a figure expected to double in the next decade due to population aging. However, only one in ten people currently have access to these technologies (Correio Brasiliense, 2021). This project aims to address this gap by developing low-cost AT products, which could reduce the exclusion of visually impaired students from disciplinary environments.

3. Methods

This project adopted the methodological framework developed by Bonsiepe et al. (1984), designed to facilitate the design process by guiding professionals through defined phases and stages while offering specific techniques and approaches for each stage. However, adjustments were made to better suit the development of the proposed artifact. The process was divided into micro and macro stages to more effectively address the project's specific needs. This involved implementing five phases, with minor adjustments within each phase (Figure 1).

Figure 1
Flowchart of the method based on Bonsiepe et al. (1984)



Source: Created by the authors (2023)

3.1. Problematization

The problematization phase aims to deepen the understanding of the problem through the critical analysis of aspects related to its resolution. According to Bonsiepe et al. (1984), this phase involves formulating essential questions, such as "What?", "Why?", and "How?", to identify the needs of the product to be developed.

To address these questions, a literature review was conducted, considering the contributions of Neto (2015) and Piekas (2015). The understanding of the importance of the full inclusion of visually impaired individuals in society and its potential benefits for the community as a whole was also a central aspect considered in this phase. This is supported by several authors, including Gil (2000), Nogueira (2009), Brumer, Pavei, and Mocelin (2004), among others, who emphasize the relevance of this topic.

In addition to the literature review, an interview was conducted with professionals from the Pedagogical Support Center for Assistance to People with Visual Impairments (CAP) located in Natal, RN. The interview involved two CAP/RN teachers: Participant A, a geography graduate with a specialization in educational technologies and distance education, and Participant B, a pedagogy graduate with a specialization in Special Education. Both participants contributed to clarifying issues and concepts related to visual impairment based on their personal experiences.

Participant A, who is congenitally blind, and Participant B, who became blind later in life, addressed questions on the subject, drawing on their expertise and sharing personal accounts. These ranged from the importance of haptic development in children with visual impairments to the financial challenges associated with assistive technology (AT) resources and products designed for teaching visually impaired individuals. The insights gathered from this interview were essential for a more comprehensive understanding of the subject, contributing to the identification of the problem this project aims to address.

To organize the data collected from the theoretical framework and interviews, the Problem Analysis tool (Table 1) proposed by Baxter (2000) was employed. This tool involves formulating a series of pertinent questions about the problem to deepen its understanding and examine its inherent aspects. In addition to the questions proposed by Bonsiepe et al. (1984), the analysis included inquiries such as: "What exactly is the problem you want to solve?" and "Why does this problem exist?" (Baxter, 2000).

Table 1
Problem Analysis

What problem does the product aim to solve?	Lack of materials designed for teaching drawing to visually impaired individuals.
	Reducing the exclusion of blind students in art classes within inclusive schools.
Who is the target audience?	Blind or visually impaired students.

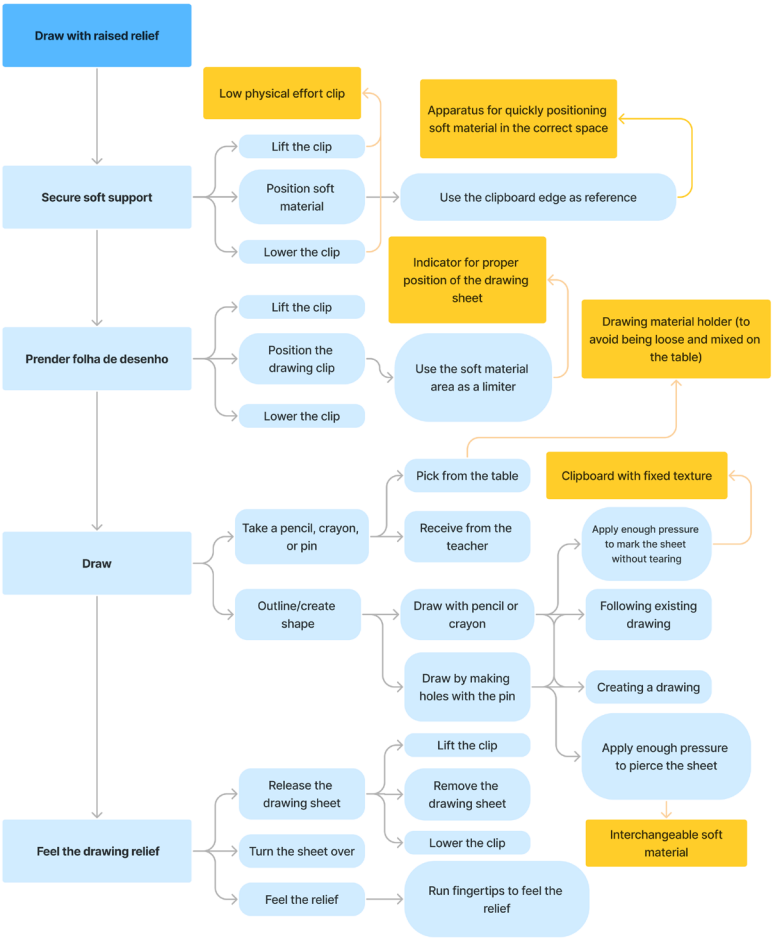
Why create this product?	Mitigate the stigma that visually impaired individuals cannot participate in art classes.
	Promote full participation of visually impaired students in drawing activities.
	Encourage the development of AT products to foster equal opportunities.
	Stimulate autonomous drawing practices.
How is it expected to achieve this?	Investigate methods and techniques for teaching drawing to blind and visually impaired students.
	Evaluate similar products.
	Study the needs of blind students and art teachers working in inclusive schools or pedagogical support centers.
	Develop a product that facilitates the drawing process for blind and visually impaired students.
What are the potential obstacles?	High production costs (materials and technology involved).
	Improper handling of the product.
What is expected from the product?	Reproduction with low complexity and low-cost materials.
	Address the needs of users and teachers.
	Promote inclusion in the classroom.
	Be versatile for use by diverse audiences.

3.2. Analysis

According to Bonsiepe et al. (1984), the analysis stage aims to understand the functionality of the product by examining existing products that perform similar functions, observing how the target audience interacts with these products, or identifying how they solve the problem without specific resources. This approach seeks to extract essential information regarding the product's use and problem resolution, enabling the identification of strengths and weaknesses. These insights are used to enhance or generate new ideas to optimize the performance of the new product (Bonsiepe et al., 1984; Celuppi and Meirelles, 2018).

To achieve this, existing drawing techniques for people with visual impairments were investigated. The functional analysis tool was employed to understand how the student performs the task. The research highlighted the work of Neto (2015) and Piekas (2015). Both researchers describe the use of a drawing board as a tool. On the board, a soft material such as EVA foam, fabric, or nylon mesh is affixed, over which a letter-size paper sheet is placed for drawing. When the paper is flipped, the drawing appears in relief due to the deformation of the paper, allowing tactile reading of the drawing. After the analysis (Figure 2), points of interest were identified, particularly the need to create a support for drawing materials so that art students can organize them more conveniently, facilitating identification and use of these materials.

Figure 2
Functional Analysis Diagram Completed



Source: Made by the authors (2023)

After the functional analysis, an evaluation of the structures used to address the problem was conducted. Structural analysis was performed (Table 2) based on the results of the functional analysis. This process aimed to identify the structures present in the materials involved and subsequently determine which ones require improvement, removal, or inclusion in the product.

Table 2
Structural Analysis Framework

Existing Structures	**Desired Structures**
Clip	Clip
Soft support (EVA foam)	Drawing board inclination
Drawing board	Adjustable drawing board inclination
	Interchangeable EVA foam support
	Drawing board with positioning markers: with and without EVA foam.
	Support for drawing materials.

The analyzed drawing technique relies on improvised materials to meet user needs, resulting in a limited number of structures and, consequently, restricted functionality. There is a lack of added features that simplify tasks or provide the user with additional usage options. In this context, the need to introduce new structures into the product was identified, such as support for the soft material (EVA foam). This support benefits visually impaired students by facilitating the replacement of damaged materials and the positioning of the material as a backing for the drawing sheet. This saves time and eliminates the need for extra materials, such as tape, to secure the backing. Other suggested features include storage for drawing materials, positioning markers for the drawing sheet, and an adjustable inclination for the drawing board.

3.3. Problem Definition

Bonsiepe et al. (1984) highlights that the problem definition phase focuses on organizing project requirements to structure and prioritize prob-

lems, giving due importance to the most pressing issues to be resolved. This phase guides the main objectives of the product throughout the project. In this project, keywords were used to construct project requirements (Table 3) and subsequently classify each objective as necessary, desirable, or optional.

Table 3
Systematization of Project Requirements

Requirements	**Objectives**	**Classification**
Practicality	Lightweight	Necessary
	Clear usage	Necessary
	Portable	Necessary
Aesthetics	Good finishing	Necessary
	Rounded edges	Optional
	Raised textures	Optional
	Few colors	Desirable
Functionality	Replaceable material for creating raised relief	Necessary
	Support for other drawing materials	Necessary
	Interchangeable parts	Necessary
	Easy sheet fixation and positioning	Necessary
Ergonomics	Appropriate dimensions	Necessary
	Easy to transport	Desirable
	Adjustable inclination	Desirable
	Horizontal inclination	Desirable
	Vertical inclination	Optional
	Good stability on support surface	Necessary
Production	Low cost	Necessary
	Easy to manufacture	Necessary
Materials	Low cost	Necessary
	Easy to source	Necessary
	Easy to clean	Desirable
	Water-resistant	Optional

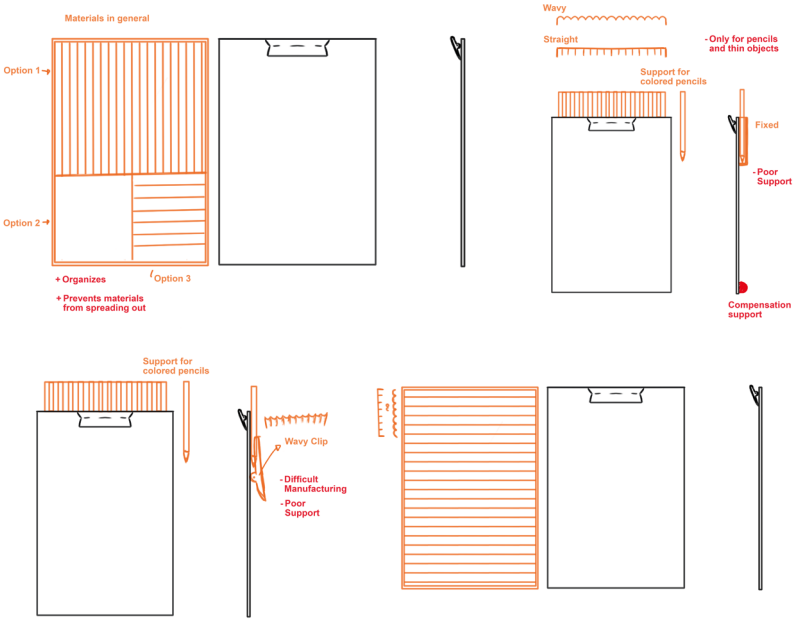
Accessibility	Tactile information to indicate sheet positioning	Necessary
	Color contrast	Desirable

3.4. Generation of Alternatives

The requirements served as guidelines for the stage of generating alternatives. This stage is responsible for the conception of possible solutions to the proposed problem, including the generation of various options to select the one that best meets the presented needs. This approach is an adaptation of the morphological matrix tool, in which the options for different parts of the product are systematized and later combined to form variants. In this case, the same principle was applied, but in a more flexible manner, by sketching these solutions and analyzing, during the development process, which options integrate most effectively with each other to reach an acceptable solution.

Based on the desirable structures for the product identified in the analysis stage (Table 3), sketches were created for each of these structures to identify variations in form and use. The structures considered for the generation of alternatives are: (1) Support for drawing materials; (2) Structure for the tilt of the drawing board; (3) Indicator for positioning the drawing sheet; and (4) Support for the EVA sheet. While developing alternatives for the drawing materials support (Figure 3), it was established as a requirement that the support allows students to organize colored pencils, crayons, markers, and other similar materials in a practical and accessible way, facilitating their use during activities. Commonly, these materials are placed on the drawing table or any support surface, where they can mix with other items, making it difficult for visually impaired students to identify them. Additionally, there is the risk of these materials falling off the support surface, causing damage or loss.

Figure 3
Sketches of the Structure of the Materials Support.



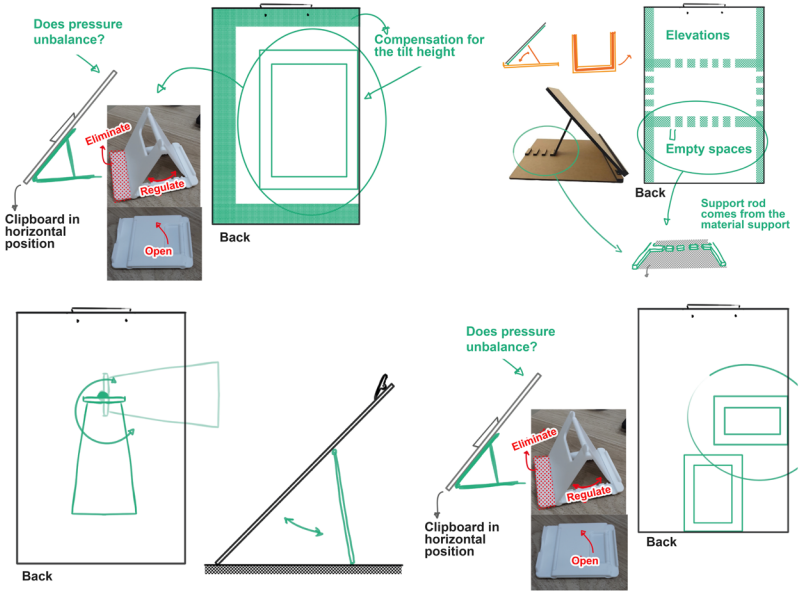
Source: Created by the authors (2023)

The proposed conceptual design aims to provide visually impaired students with an organizational system for drawing materials, allowing for more efficient identification. This way, the student can maintain an orderly arrangement of materials, facilitating identification and reducing concern about materials rolling off the support surface.

To provide greater comfort to visually impaired students, a system was designed to enable the use of an inclined drawing board. This system offers users the flexibility to choose the most comfortable position for drawing, based on their personal preferences. For this purpose, existing structures for inclined drawing boards were analyzed, and sketches were developed to incorporate both horizontal and vertical inclination options (Figure 4).

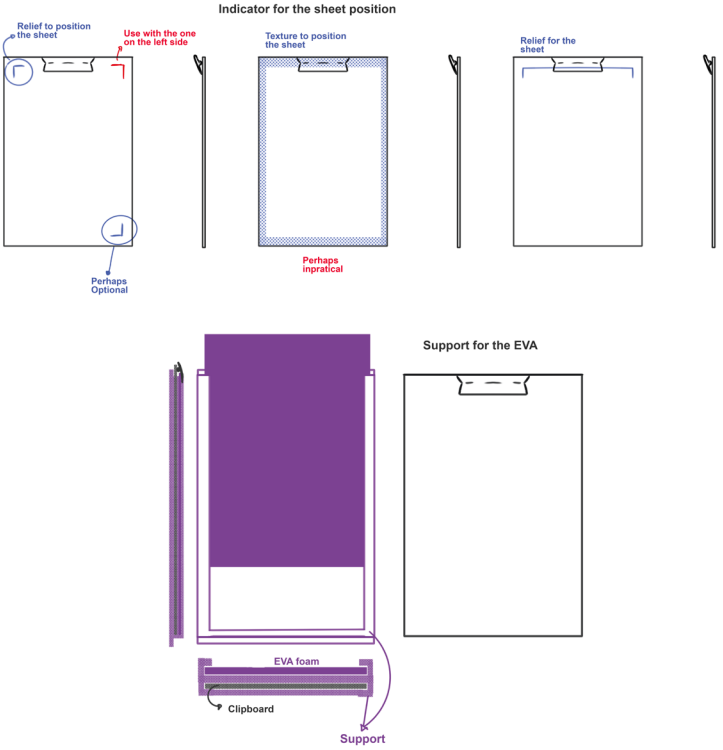
Finally, approaches were examined to guide users in precisely positioning the drawing sheet, utilizing raised indicators and textures that delimit the necessary areas for proper paper placement (Figure 5). Regarding the EVA foam support, only one sketch was developed since, due to the specifications and positioning constraints relative to the board and the need for EVA sheet replacement, this option proved to be sufficiently effective.

Figure 4
Sketches of the Inclination Structure.



Source: Made by the authors (2023).

Figure 5
Sketches of the Sheet Positioning Structures and EVA Foam Support.



Source: Made by the authors (2023).

Considering the project requirements, the most suitable proposals for each structure were selected based on the issues addressed in the requirements. This resulted in the creation of a sketch that cohesively integrates these structures into a single product. The following alternatives were considered:

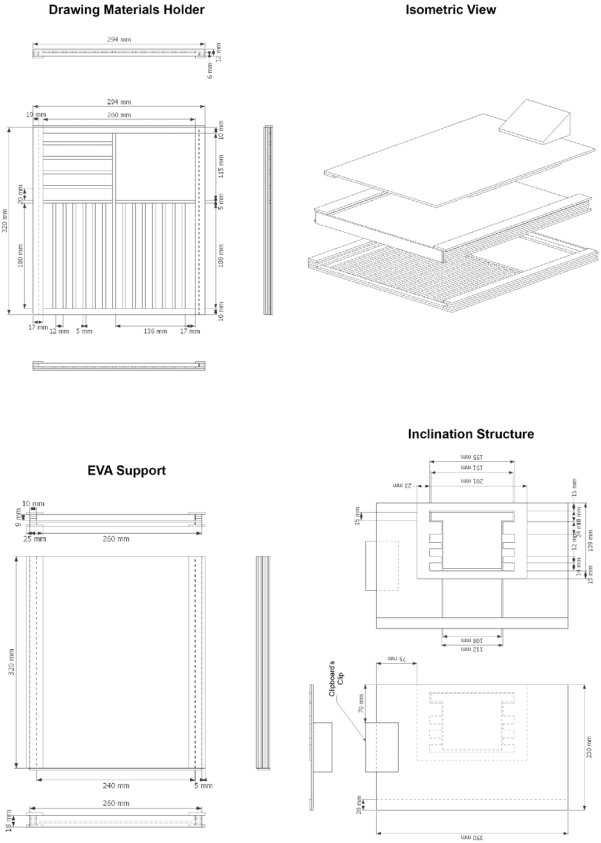
1. Inclination structure: Offers adjustable inclination variations to meet user needs and can be freely used on any supporting surface. Due to its compact volume when retracted, it is essential to employ a compensating support to avoid instability.

2. Positioning indicators: Comprise raised shapes forming ninety-degree angles on both sides of the board, facilitating user orientation for proper sheet positioning.

3. EVA foam support: This support performs three functions: it facilitates the replacement and fixation of the EVA foam material by sliding the EVA sheet into its frames; on the side opposite the EVA foam, the same drawer system is used to slide the board and correctly position the EVA sheet, allowing the drawing sheet to be placed over the EVA foam and fixed by the board; it also serves as a compartment for storing the board, enabling both to be stored together.

4. Materials support: Aims to organize the various drawing materials used by the user, preventing them from becoming scattered or mixed. It can be detached from the EVA foam support when necessary, allowing simultaneous use with the board and EVA foam. It is important to note that it was not designed to store the drawing materials within it to minimize the product's bulkiness.

Figure 6
Compilation of Prototype Views and Dimensions



Source: Created by the authors (2023)

Given the need to develop a prototype for initial evaluations with visually impaired individuals, certain modifications were implemented to adapt the structures to the dimensions of a standard drawing board available in stationery stores (Figure 6). At this stage, the decision was made to avoid creating a custom drawing board for the product, aiming to simplify and expedite the prototype development process while also aligning with cost-reduction goals.

With the specifications of the conceptual model finalized, the prototype construction began to enable usability testing and validate the proposed final product socially. For this purpose, laser cutting was chosen as the production technique, as it simplifies the manufacturing process and ensures measurement precision. The pieces were cut from 3mm raw MDF (Figure 7), adhering to the same material specifications as the drawing board used, to gain a more accurate understanding of the required dimensions for the fittings. Laser cutting was essential for maintaining a consistent finish, ensuring a unified visual quality for all components.

Figure 7
Prototype Assembly

Source: Created by the authors (2023)

During the assembly process, and especially upon its completion, reflections were made on the materials used, the model's dimensions, the precision of the cuts, the three-dimensionality of the prototype, and the functionality of the overall structure. This allowed for identifying adjustments, improvements, and adaptations that were not apparent during the conceptual phase.

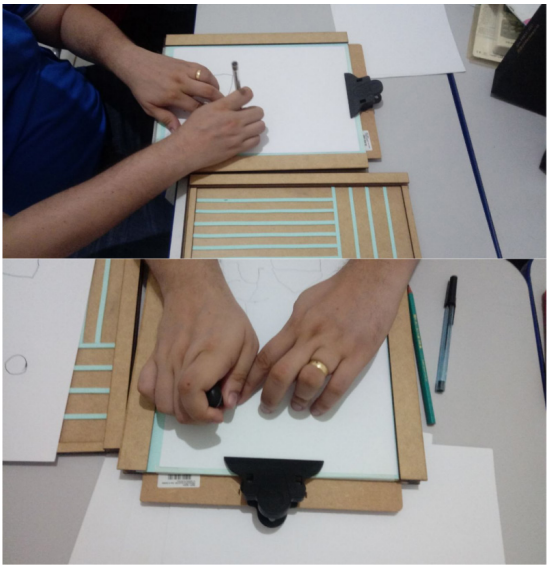
These observations included:

- Adjusting the size of the structure designed for inclination to enhance stability by increasing the base;
- Modifying the alignment of the EVA support fitting with the material organizer for transport;
- Increasing the dividers in the material organizer;
- Reducing fitting margin errors;
- Increasing the thickness of the EVA;
- Adding a clip to the inclination structure.

3.5. Prototype Evaluation

After completing the drawing board assembly, a visit to CAP/RN was conducted to perform a usability test (Figure 8) with Participant A, who is congenitally blind. The test yielded positive results regarding the model's functionality and was well received by the teacher. However, despite the positive feedback, areas for improvement were identified, particularly regarding usability. Additionally, a discussion was held with an arts teacher who is currently working in a different role at CAP/RN. During this dialogue, relevant points about the prototype were highlighted, generating insights for proposed improvements.

Figure 8
Usability Test of the Prototype



Source: Prepared by the authors (2023)

Below are the recommendations for improving the project, identified during the test with a visually impaired individual and conversations with the teachers from CAP/RN:

- Eliminate the loose drawing board without the EVA foam;
- Apply the functionality of a material case to the organizer by adjusting the height of the box;
- Integrate the inclination structure with the EVA foam support, or, if unfeasible, eliminate the inclination structure;
- Modify the orientation of the groove that runs the joints to a horizontal position for better ergonomic comfort;
- Increase the thickness of the EVA foam to allow greater force application during drawing.

The development of a prototype for evaluation, especially with the visually impaired audience, proved to be a crucial process for advancing the project. This stage enabled the identification of factors that could not be fully understood through conceptual design and digital modeling alone. Observations made during the manufacturing and usability processes allowed the identification of design refinements to be implemented in the next prototype. This repeated cycle of product refinement, through the application of tests with improved models, will continue to be an integral part of the process. Each iteration provides new opportunities to identify improvements, advancing the product until achieving the final goal of a definitive model that satisfactorily meets the needs established by the project parameters.

4. Considerations

This study highlights the importance of the full and equitable inclusion of people with disabilities in society, overcoming the ableist perspective often associated with this population. Furthermore, it emphasizes the need to dismantle the stigma suggesting the inability of these individuals to perform everyday tasks. This urgency becomes even more evident when considering data that reveal the ongoing struggle for constitutional rights faced by this population, which continues to grow over the years.

In the context of teaching arts to visually impaired individuals, a promising scenario has been identified, with various studies, techniques, methods, and resources aimed at mitigating prejudice related to the subject. Although there are assistive technology resources and products aimed at the artistic development of visually impaired people, acquiring them remains a challenge. This challenge affects both individuals and educational institutions or support centers, especially due to the high costs associated with these technologies. Recognizing this barrier to access, projects that prioritize cost reduction in production and, consequently, expand their reach, are of paramount importance.

The development of the proposed product in this work was made possible through the application of the methodological procedures of Bonsiepe et al. (1984) and aimed to improve a product handcrafted by teachers in inclusive schools or pedagogical support centers. By considering both the technical functionality of the product and the teaching techniques and methods for drawing for visually impaired individuals, it was possible to develop a conceptual model aligned with the specific needs of visually impaired students interested in learning and practicing drawing.

For this conceptual model, solution proposals were established based on the identification of problems observed from the needs of blind teachers. This stage culminated in the construction of a prototype, which was executed and evaluated. This allowed for the social validation of the conceptual design of the drawing board and the identification of potential improvements. Thus, monitoring the manufacturing of the prototype and its evaluation at CAP/RN was fundamental in generating insights for design refinement. Consequently, it is hoped that in the future, the drawing board can be produced by CAP/RN and contribute to other educational spaces, thereby expanding the availability of products for visually impaired individuals.

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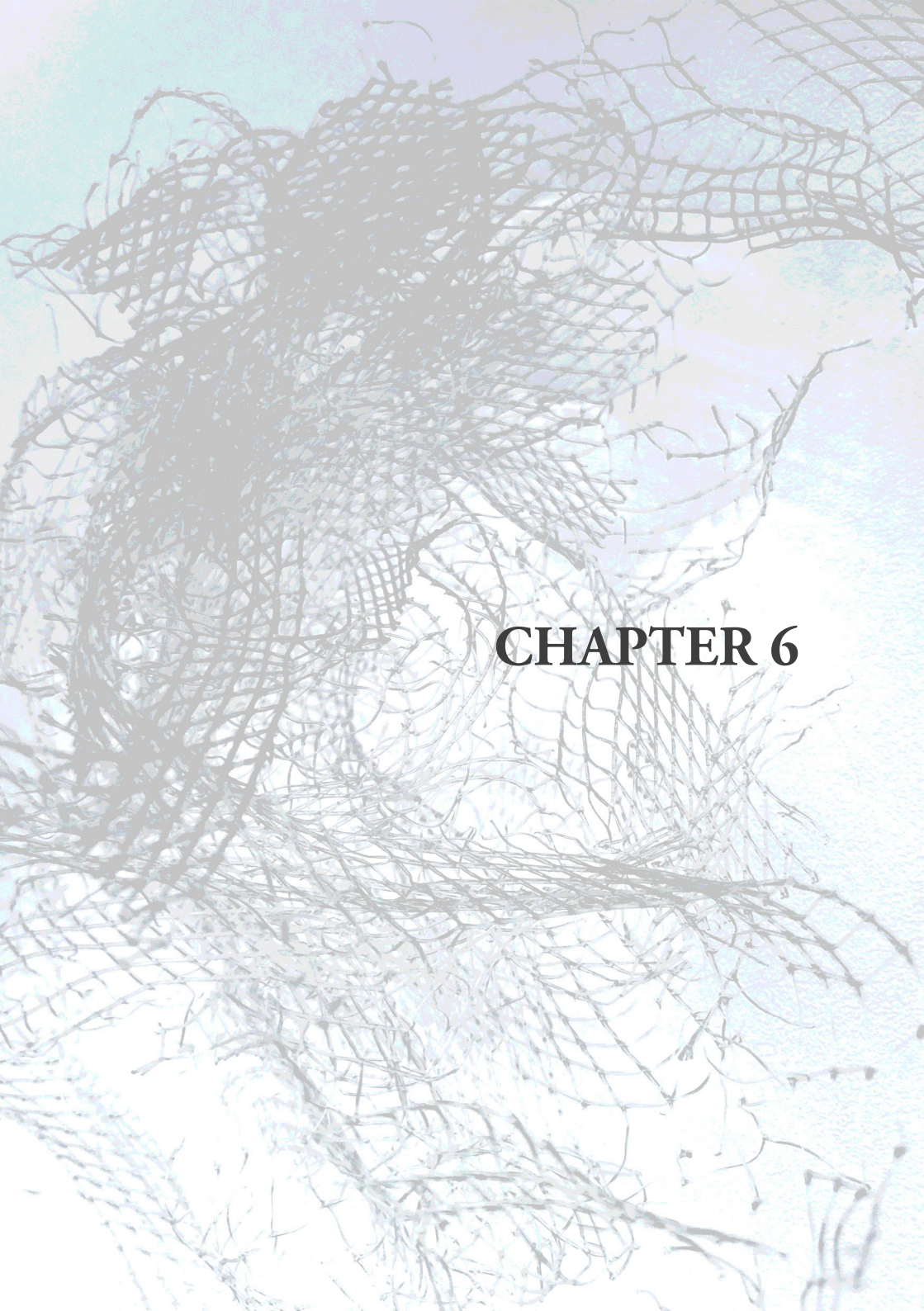

CHAPTER 6

ARTISTIC AND CURATORIAL PRACTICES ON SOCIAL MEDIA: ALGORITHMS AND CROSSROADS

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Abstract

This chapter aims to critically reflect on Brazilian Black artistic and curatorial practices shared on social media in the early 2020s from a counter-colonial and Afro-diasporic perspective, using Leda Maria Martins' conceptual framework of crossroads[1]. The theoretical articulation seeks to present the concept of social media as the "mouth of the world"[2], enabling an understanding of the tensions present in posts showcasing artistic and curatorial works created and shared on platforms, particularly Instagram, by the artist Moisés Patrício and the curator Diane Lima. Examining artistic and curatorial practices through the lens of social media crossroads enables the deconstruction of universalizing logics that dominate these spaces. This approach reimagines social media as an ambivalent communicative space that disrupts hegemonic processes within contemporary visual arts while re-signifying the artistic experience today. These practices encompass the subjectivities and themes inherent to the realities of artists, curators, and art educators, utilizing the aesthetic, poetic, and communicative resources provided by these platforms. These crossroads challenge the regimes of visibility and invisibility within algorithmic systems, expanding and re-signifying the sensory experience of art and social media in contemporary times.

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1. Translated from the original term *encruzilhadas*.

2. Translated from the original term *boca do mundo.*

1. Crossroads: social media as the "mouth of the world"!

Laroyê, Exu![3]

Reflecting on the present time, crossroads, and the production of Black Brazilian artists, curators, and art educators also involves considering the artistic and curatorial practices shared daily on social media. This dialogue is established through the crossroads of art, social media, and artificial intelligence (AI). In this context, we consider social media to be composed of AI systems whose algorithms play a fundamental role in shaping everything that is created and shared on these platforms. Who is visible in the arts? Who is visible on social media? How, and for whom, is visibility constructed on social media?

This chapter aims to explore these questions and critically analyze artistic and curatorial practices on social media from a counter-colonial perspective—an approach developed by Antônio Bispo dos Santos (known as Nêgo Bispo), a quilombola master from the Quilombo do Saco-Curtume (São João do Piauí, PI). In his speeches and writings, Nêgo Bispo asserts the concept of counter-colonization by addressing the resistance of quilombola, Indigenous, and other communities brutally affected by colonial violence in Brazil since the Portuguese invasion in 1500.

Using this perspective, alongside Leda Maria Martins' conceptual framework of crossroads, we do not aim to draw absolute conclusions or propose definitive theoretical postulates. Instead, we seek to provoke discussions about the artistic and curatorial production of Black Brazilians shared on social media during the 2020s. To do so, we present examples of posts shared on the Instagram profiles of artist and babalorixá Moisés Patrício (@moisespatricio[4]) and curator, writer, and researcher Diane Lima (@dianelima[5]).

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3. *Laroyé*: a salutation to Exu, the orixá of crossroads.

4. Instagram profile @moisespatricio. https://www.instagram.com/moisespatricio. Accessed on: August 31, 2024.

5. Instagram profile @dianelima. https://www.instagram.com/dianelima. Accessed on: August 31, 2024.

We analyze these posts through the lens of art and media theory, particularly focusing on the intersection of contemporary visual art and social media poetics. Christine Mello's concept of "extremities" (Mello, 2017) serves as a foundation to consider how art and curatorial practices are re-signified on social media.

The practices created and shared on Instagram—chosen as the primary reference for this analysis—are positioned outside the hegemonic center of contemporary art. Poetics shared on these platforms emerge as a phenomenon of "extremities," as Christine Mello describes, generating crossroads in art, communication, and social media. Mello's concept of "extremities" introduces a new way of interpreting liminal and decentralized artistic practices, enabling us to observe the tensions inherent in artistic and curatorial works as forces that disrupt hegemonic logics. This approach involves three critical vectors—deconstruction, contamination, and sharing—that facilitate the emergence of these crossroads, reshaping contemporary art and social media.

The crossroads as a conceptual operator signifies the possibility of understanding the artistic and curatorial practices shared on social media in an intersectional way, considering both the territory in which these practices are shared and the interpretative possibilities of Brazilian Afrodiasporic artistic production. It involves thinking about the crossroads as a conceptual operator of transit, considering that African cultures were reterritorialized, transcreated, and modified in Brazil. Algorithmic logics and the poetic and aesthetic resources of social media, in this sense, function as crossroads that challenge and reframe contemporary artistic production in the 2020s. As Leda Maria Martins states:

> Black peoples constitute themselves at the crossroads of these multiple and polysemic knowledges. Brazilian cultural fabric is founded on processes of transnational, multiethnic, and multilingual crossings, from which various vernacular formations emerge—some wearing new faces, others mimicking, with subtle differences, ancient styles.

> In attempting to better grasp the dynamic variety of these processes of semiotic transit, interactions, and intersections, the notion of the "crossroads" has been used by me since 1991 as both a concept and a semiotic operation that allows us to cleave the forms that emerge from there (Martins, 2021, p. 50 [our translation]).

As an analytical-methodological tool, Leda Maria Martins articulates the crossroads as a conceptual operator in two terms that open analytical pathways and a pluriversal range of meanings, reflecting the nature of the crossroads itself: as a principle offering the possibility of interpreting and reading Afrodiasporic knowledge production, and as a territory where these exchanges are established amid relations of conflict. In other words, crossings[6] generate other possibilities of transit and language.

When thinking about artistic and curatorial practices shared on social media through the lens of the crossroads as a conceptual operator, we see both possibilities occurring: the crossroads as a perspective for reading works produced and shared on social media by Black Brazilian artists, curators, and art educators as part of their artistic and curatorial practices; and social media as a crossroads, an ambivalent, intense, and conflictual territory where these exchanges are established. This duality generates poetic crossroads through the artistic and communicational languages and procedures inherent to these platforms, as well as ethical crossroads that challenge the regimes of visibility, invisibility, and other forms of oppression derived from the algorithmic logics of these apps.

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6. In this chapter, 'crossings' (translated from the original term encruzas) refers to the practical or symbolic territories where exchanges and interactions occur. These crossings highlight the generative and transformative potential of Afro-diasporic practices, often arising in contexts of conflict, negotiation, and creativity. 'Crossroads,' on the other hand, is used as a broader conceptual operator, symbolizing an intersectional and pluriversal space for the interpretation and creation of Afro-diasporic knowledge.

It is from these two possibilities that we derive the concept of social network as the "mouth of the world" (Macêdo, 2023), inspired by the notion of Exu Enugbarijó. This concept refers to the territory where artistic and curatorial practices occur on social networks, as well as the poetics of crossroads (Macêdo, 2023). It encompasses three experimental communicational artistic procedures — Yangí, Òkòtó, and Enugbarijó — which offer a new way of interpreting posts and works created and shared on social networks, all inspired by the notions of Exu. It also engages with the reading vectors of Christine Mello's approach to extremities: deconstruction, contamination, and sharing. In this chapter, we will focus on analyses that approach the social network as a crossroads, as the "mouth of the world," a territory that tensions, affects, and characterizes what we consider to be Black Brazilian artistic and curatorial practices shared on these platforms.

To understand the conceptual operator of crossroads, it is essential to know the principles and notions of Exu within the Brazilian Afro-diasporic philosophical framework. After all, Exu is the orixá of crossroads; he embodies the crossroads itself. He represents language and governs the Nagô[7] system.

Leda Maria Martins' crossroads theory presents Exu as a means to reveal both his own notions and principles, as well as the elements that constitute the territories of his crossroads. Exu is the articulator, conductor, and maintainer of the dynamic Nagô system. He establishes connections across all boundaries of worlds, mediating every act of creation and interpretation of knowledge. Yoruba cosmology teaches that nothing can

7. Nagô, or Anagô, was one of the last ethnic groups forcibly brought to Brazil by the colonial slave regime. This group consists of people from sub-Saharan Africa (southwest Nigeria, Benin, Togo, among other countries) who spoke the Yoruba language. In the African diaspora, the term Nagô has come to reverence the cultures and populations of the Yoruba ethnic group. Though often used synonymously, both terms represent a vast and diverse cultural complex with a plurality of languages and cultures. For clarity on Afro-diasporic philosophical aspects and in alignment with the scholars and thinkers engaged in this dialogue, this chapter uses "Yoruba" and "Nagô" interchangeably, without hierarchy or distinction.

be accomplished without Exu, not even what we recognize, describe, and experience as art. Exu is the driving force and movement of life. As sung in the chants of the xirês[8] and terreiros, Exu is whatever he chooses to be.

The conceptual operator of crossroads, as a prompt for opening analytical possibilities in the arts, is crucial not only as a theoretical and methodological tool but also as a means of understanding the creation, conflict, and expansion that the crossroads represent as a territory. The destabilizing and creative energy of crossroads should propel the emergence of a new art history, a counter-colonial history where Black Brazilian artists, curators, art educators, and art workers are not excluded or rendered invisible but are instead recognized in their plurality and uniqueness as fundamental creators and articulators in the art system.

Artistic and curatorial practices shared on social networks, viewed through the conceptual operator of crossroads, reflect the presence and action of Exu as a constitutive and communicative principle of these spaces. This perspective allows us to conceptualize social networks as crossroads, as the "mouth of the world," a place of transitions between states, languages, and meanings. This idea is drawn from the notion of Exu Enugbarijó, the collective mouth that consumes and returns everything in a transformed state, much like the reinterpretations of posts and the blending of languages that occur when posts are reshared in the processes of co-creation, co-curation, and systemic agency within online communities inherent to these apps.

Thus, inspired by Enugbarijó, we can view social networks as one of the mouths of the world, as communicational, poetic, and political crossroads. If Exu is the mouth that consumes everything, then social networks are one of the world's mouths, devouring all that is created and shared on these platforms. Following the principle of Enugbarijó, the master of the collective mouth, we can say that social networks

8. Xirê: a ritual with music, dance, and other manifestations evoking the orixás.

are the mouth that consumes everything and returns it transformed. A mouth with a voracious appetite, sharp teeth, and tongues, which communicates, multiplies, transforms, and expands through a pluriversal array of languages, intensities, and chaos. Social networks, like the crossroads themselves, consume everything shared within them, from the power of artistic and curatorial practices to the spread of hate speech, algorithmic racism (Silva, 2022), and various other forms of violence and oppression. Social networks function as ethical, aesthetic, and poetic crossroads. They are spaces of communication, exchange, creation, crisis, order, and disorder, as Exu teaches us.

These artistic and curatorial practices at the crossroads of art, communication, and social networks point to new paths of rupture and exploration at the boundaries of art. They reveal the complex communicational and technological fabric that encodes these apps. As Rufino (2019) states, these artistic and curatorial practices, viewed through the analytical lens of the crossroads operator, allow for an in-depth exploration of cracks, corners, folds, and interstices. These practices establish a new paradigm in art, communication, and social networks, driven by the possibilities generated by these apps embedded in a media culture that challenges artists, curators, and art educators with its languages and potential for interaction and community agency online.

Crossroads occur both in relation to the character, content, and languages present in each post shared by artists, curators, and art educators, and in relation to the algorithmic arrangements of these AI systems. These crossroads are articulated within the communicational processes of these spaces and in the exchanges facilitated within these online communities through simple elements like likes, shares, direct messages, interactions, and comments. bell hooks[9] (2021, p. 161) teaches us that "There is

9. bell hooks (written in lowercase) is the pseudonym of Gloria Jean Watkins. The name bell hooks was a tribute to her maternal great-grandmother, Bell Blair Hooks. According to the author, the lowercase spelling aims to emphasize the content of her writing rather than her personality.

no better place to learn the art of love than in a community." In the case of artistic and curatorial practices shared on social networks as the "mouth of the world," these communities are crossroads of affections, power, affinities, discord, hate, racism, and all types of discrimination, happening continuously and simultaneously, much like the infinite scroll[10] structuring the timelines of these apps.

2. Artistic practices on social networks

Artistic practices on social networks consist of the sharing of posts on these apps, based on issues related to the artistic and communicational nature of these digital social platforms. In other words, these practices are shaped by the aesthetic and poetic elements and the media specificities of each app, as noted by Annet Dekker (2021). Therefore, we understand artistic practices on social networks as the poetic and aesthetic communicational experiences created and shared on these platforms; the circulation of artworks and artistic processes; the sharing of subjectivities, affections, activism, and institutional critique; and the agency of these online communities by Black Brazilian artists, curators, and art educators, which is the focus of this analysis.

These are artistic practices situated at the crossroads of art, communication, and social networks, based on the tensions proposed in Afro-Brazilian. These practices use the functionalities of AI systems, managed by algorithms that determine the visibility regimes and logics of these applications. These crossroads, therefore, are composed of ethical, aesthetic, political, and poetic intersections mediated on Instagram, which deconstruct and reframe contemporary art.

It is important to highlight that artistic practices shared on social networks, the communicational processes, and the poetic and aesthetic

10. Infinite scroll: a very common pattern on social networks, where the user starts browsing at the top of the screen and keeps scrolling without ever reaching the end of the page. It is one of the strategies used by these apps to capture our attention and keep us connected as long as possible.

elements inherent to these apps define the ways in which posts are created and articulated. These posts work to build and mediate an online community around the works of these artists, aiming to generate affinities, exchanges, circulation, and even the sale of works, products, and services. In this way, these transmedia movements (Jenkins, 2008) initiated on social networks also break the boundary of the online world, generating income and providing a way for artistic work to exist in the offline environment.

An example of this is the long-running series *Aceita?* by Moisés Patrício, created in 2014 for the Instagram social network. The series has since expanded into other formats, such as photography and painting, and has been integrated into various exhibitions in museums and galleries in Brazil and around the world. It is an artistic practice initially conceived for Instagram that comes to exist outside of it in different contexts and art exhibitions. This can be seen in the post accessible via the QR Code[11] below.

11. QR CODE: To facilitate the reading, experience, and understanding of the artistic works shared on Instagram, QR Codes like the one below will be provided throughout this chapter. To read these codes, simply point your smartphone or tablet camera at them. If you are not redirected to the link, check if your device settings are enabled for QR Code scanning. If this option is unavailable, you can download a QR Code reader app from your device's app store.

Figure 1[12]
Carousel post Shared on the Feed[13] with a Call to the Aceita? Exhibition by Moisés Patrício, at a Subway Station in São Paulo.

Source: Patrício, 2012

Aceita? is an example of an artistic practice on social networks, where the aesthetic and poetic elements of Instagram, in this case, articulate the circulation and continuous presence of this artwork both within and outside of the app. The series consists of photographs in over 1,200 posts, where the palm of Moisés Patrício's right hand extends to offer objects found on the streets of São Paulo, words, and gestures related to the situations he experiences in his everyday life in the city and his creative process. Moisés chooses to record his right hand in an offering gesture—a key gesture in *Candomblé*—making a sociopolitical critique of the racist and slaveholding heritage that reduces the role of Black people to mere labor. By incorporating elements he encounters along his path, Moisés Patrício returns to circulation what society has discarded, or what he wishes to highlight as provocation.

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12. Available at: https://www.instagram.com/p/CXM04HFstXc/?igshid=MzRlODBiNWFlZA==. Accessed on: Aug 31, 2024.

13. Also known as a newsfeed, it is the area of the app where posts from the profiles a person follows on social media appear. It gathers all shared content on the platform and integrates the posts that make up a profile on Instagram. Posts shared on the feed have no time limit and can be accessed at any time by anyone visiting a profile. This type of post has been a part of Instagram since its launch in 2010.

These photo performances prompt reflection on the exclusionary nature of urban spaces and art circuits, while also serving as an offering to Exu. Moisés Patrício is a babalorixá, and by sharing posts with images of his right hand offering something in various contexts, he activates a fictional construct that calls on individuals to respond within social networks—by liking, commenting on posts, or sharing them. The *Aceita?* series reveals much about the individual repertoires of those who engage with it. An artwork shared on social media, it fosters dialogues and stimulates reflections in everyone who comes into contact with these posts on Instagram (see Figure 2).

Figure 2[14]
On Moisés Patrício's Instagram profile, it is possible to observe the aesthetic and poetic use of images that make up the long-running Aceita? series, articulated by the artist on Instagram.

Source: Patrício, 2012.

As can be observed in the work of Moisés Patrício, artistic practices at the crossroads, on social networks as the "mouth of the world," are composed of posts in digital and interactive languages that exist solely within these apps. Shared posts that raise and address counter-hegemonic issues and crossings, such as the subjectivities of Black Brazilian artists, curators, and art educators; their works and artistic processes; political-social contexts, racism, sexism, LGBTQIAPN+phobia, and all the other

14. Available at: https://www.instagram.com/moisespatricio. Accessed: March 28, 2023.

factors and affects that, combined, shape the way one positions oneself in the world and within online communities created and mediated on these digital social platforms. As art critic and professor Maria Amélia Bulhões states in *Práticas artísticas em redes sociais virtuais* [Artistic Practices in Virtual Social Networks] (2011), in a general context related to artistic production in these apps:

> Artists who produce these works generally participate in interdisciplinary teams that maintain their own websites to host their projects, or else they take part in events dedicated to their dissemination. They enter a field called by many 'art of communication,' which, according to Fred Forest, is characterized by simulation, interactivity, and real-time functionality. This artistic production problematizes the field of visual arts through the many questions it raises, such as interactivity, real-time operation, immateriality, and transience. Some of these works also question the very field of electronic media by releasing software, engaging in 'hacktivism,' and conducting other experiments that disrupt the control of technological information, which these artists view as a source of economic and political power to be destabilized (Bulhões, 2012, p. 49 [our translation]).

When discussing the interactivity inherent in artistic practices on social networks, it is important to remember that interactivity in the visual arts has its origins in the artistic avant-gardes of the 1960s and 1970s, with a greater focus on sharing creative processes and the desire for more exchange and communication with the public and other artists. The proposal of interactive digital works began to gain more prominence in Brazil with the experiences of networked art, with an emphasis on postal art, and the use of telephones, computers, slow-scan TV, satellites, and television. With the advent of net art, the plural characteristics of cyberspace and other virtual digital environments, with their poetic and aesthetic resources, began to prioritize communication and the potential of interactivity even further. As Maria Amélia Bulhões recalls:

> In Julio Plaza (2000), in a classic text, he observes the existence of three levels of interactivity in the visual arts. The first relates to polysemy, ambiguity, and the multiplicity of readings of the 'open work,' characterized by passive participation. The second is marked by physical interaction, where the public can move and modify the work in some way, an active participation. The third involves the adoption of computational interfaces, in which the machine becomes an agent of aesthetic creation, with numerically generated images, establishing a perceptual interaction (Bulhões, 2012, p. 49 [our translation]).

According to Maria Amélia Bulhões, within the realm of networked art, there is the possibility of developing different levels of interactivity, ranging from the most basic, where the user can contact the artist via email, keeping the interaction private without necessarily affecting the work, to a more controlled or even artist-guided participation, and up to the most complex level, where the person can become a co-author in fact, modifying and expanding the data received from the artist and the software mediating the artistic process.

These are co-creative movements very present in what we know as social networks today, more specifically on Instagram. Movements of Engubarijó, where one swallows in one form to return it in another. From the sharing of the initial post, it is possible to establish crossovers between languages through the inclusion of other elements, such as texts, GIFs[15], and music in posts on the feed, in stories[16], in reels[17], or in direct messages. This way, we contribute to or create interference in the

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15. GIF: Graphic Interchange Format, a commonly used image format on the internet for static images or small animations.

16. Instagram Stories: Instagram's feature that allows users to create and share images, GIFs, text, and short-duration videos (1 to 15 seconds). Stories are available for 24 hours.

17. Reels: A feature similar to TikTok's format, allowing users to record, upload, and edit short videos with transition effects, music clips, filters, texts, images, etc.

aesthetic aspects of the post and initiate a collective performance in the network. Like Yangí, the ancestral Exu, who is in everything, and even when shattered, rises, reconstructs, and continues on its path.

The social network, as a place of interaction between various crossroads and communicational processes, challenges our very notion of communication. This prompts us to consider the social network as an agent of meaning-making regimes that create temporalities within itself. Given this, we ask: how are these regimes of meaning and temporalities organized? In light of this, we ask ourselves: how are these regimes of meaning and temporalities organized? To better understand, we can imagine social networks as crossroads, a mouth that consumes everything and returns it transformed, following the spiral time of Exu Òkòtó, which breaks linearities. This concept is simultaneously collective and individual, reflecting the multiple temporalities of social networks, with permanent timelines in the feed and ephemeral ones in Instagram stories, for example.

The languages of social media can be temporalized in diverse ways. This type of space allows for the experience of simultaneous states of temporality within these apps. It pertains to the experience of navigating between these temporal states. According to Christine Mello, there are extensive and intensive times in the network.

Extensive time represents traces or indices of the network's performance—what has happened and been recorded. Intensive time, on the other hand, is the live network, organized in real-time. It is the state of temporal intensity where most social media interactions occur, such as stories. Thus, the more intensity in the network—driven by sharing, for instance—the more unstable and intense it becomes. This intensity is what makes the network a phenomenon of unstable nature; its power lies in its instability. This instability is inherent to the movements of Enugbarijó, the collective mouth that, through its intensive transitions, returns posts, artistic tensions, and communicational processes in a transformed way. It is in this state of intensive temporality that the network sometimes becomes an experience through its language, attaining the status of performance, much like Exu Òkòtó and his spiral time performances (Martins, 2021).

This multiple time, shaped by individual choices on social media, is also present in the artistic practices shared online as crossroads. It can be experienced in Instagram Stories, which embody a logic of temporalities that become mutable through sharing, either sequentially or punctuated by ruptures in the artistic work's temporal flow. In these crossroads, those who follow shared posts can also participate by interrupting, collaborating, or experiencing the artistic flow proposed by each individual and the app's dynamics.

Thus, the context of artistic work is the network, and the content, is the way the piece is created and shared in these apps. The artist emerges as a content creator within the formats dictated by the social network, and their action is a form of collective performance, whether intentional or not.

The sharing (Mello, 2017) extremities vector, as the dominant vector in these spaces, is the driving force of this performance, happening collectively not only with the online community engaged with the artist's profile but also with all participants of the social network through algorithmic logics that dictate and influence how, when, and to whom the shared post will perform. Consequently, the artist, as an agent of this artistic and communicational process, is not isolated in their artistic proposition; it is through co-creation and exchange with their online community and the interference of the AI system that the artistic practice materializes. It's a crossroads of continuous transitions. The social network, as a mouth that eats, composes, dynamizes, and returns it transformed into living artistic practices, performs in various ways and in temporalities determined by these systems' algorithms and the contact time of each individual with the shared post.

In the artistic practices of social networks as crossroads, the intensiveness of interactivity is essential for posts to be mobilized within online communities. This mobilization is part of the collective network performance articulated from each post. Like Enugbarijó, in its intense hunger and eagerness for transformation, social media and their AI systems stimulate this intensity. It's also a crossroads tied to a characteristic of this

business model—a market strategy by big techs[18] aimed at generating data and keeping users on these platforms for as long as possible.

The artistic practices shared on social media, akin to crossroads, are in constant transformation; they are not seen as universal, even though they are part of an AI system with codes that universalize them. Consequently, Black artistic production on social media, besides challenging the hegemonic standard both in the presence of these bodies and in the articulations these posts produce, seeks to dismantle it.

The question that arises here, paralleling the famous quote by writer and activist Audre Lorde, "The master's tools will never dismantle the master's house [our translation]" stated in a speech at a 1979 conference, is: can the master's tools dismantle the master's house? Lorde asserts that they cannot, reflecting on the experiences of Black women in our society. We believe that, although they may not dismantle it, they can be one of the pathways pointing towards deconstruction—a sociopolitical infiltration strategy that plants seeds and sparks reflections extending beyond social media.

However, it's important to emphasize that this cannot be a singular, isolated movement; it requires more than just reflection. Thus, counter-colonization is an urgent action, both within and outside social media, as taught by Nêgo Bispo. It is essential to highlight that Brazilian Black artistic practices shared on social media represent a form of counter-colonization, created and shared in an environment that reproduces racism in all its facets. These are transgressive artistic actions, yet these social media articulations alone are not enough to achieve the social transformation we need. Exu is the crossroads, never a one-way street; it is the rupture of the one-way street.

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18. Big techs: large economic and technological conglomerates that have become some of the world's most aggressive, extractive, and profitable business models.

3. Curatorial practices on social media

Curatorial practices on social media also incorporate the logic of these platforms both poetically and structurally. They are linked to the agency of these online communities and the algorithmic logic that determines visibility regimes within these apps. As curator and researcher André Pitol observes, these curatorial terms refer to curatorial processes in new media, involving decisions made by both the curator and the online community about posts or shared data on these platforms (Pitol, 2023, n.p.). In other words, curatorial practices occur in co-curation movements between the curator, the online communities articulated on these platforms, and the artificial intelligence systems that power these apps.

Our focus here is on Black Brazilian curatorial practices shared on Instagram, which emerge from the agency of online communities and the activist communication characteristic of social networks. These practices can also be seen as a form of "curatorial activism," a term coined by writer and curator Maura Reilly (2018) to describe the practice of organizing art exhibitions to showcase works that have been marginalized or excluded from the mainstream art system. According to Reilly, this practice is committed to counter-hegemonic initiatives that highlight historically silenced voices—works by Black, Indigenous, women, and LGBTQIAPN+ artists, among others. These curatorial practices on the fringes of contemporary art deconstruct, challenge, and redefine the status of curatorship today.

Curatorial practices at the crossroads offer new perspectives for both art and social media, as they can be understood as organizing forces for alternative curatorial approaches. They articulate and take into account the specificities, functionalities, and languages of social media as key elements in constructing Black Brazilian curatorial narratives. These curatorial practices, like Exu, embody the plurality and dynamism inherent in Afro-diasporic cultures as forms of resistance, survival, and ways of being in the world.

Curatorial practices at crossroads, developed for social media platforms, integrate the logic of these apps as structuring elements, both poetically and structurally. These logics are deeply tied to the algorithmic dynamics that shape visibility regimes within these platforms. These curatorial initiatives often do not aim to create institutionalized curatorial spaces but instead seek to engage communities around specific works, actions, artists, or themes tied to subjectivities, affections, activism, and the lived experiences of Black Brazilians. Understanding the micro-narratives proposed on social media requires active participation in these narratives—that is, being part of the online community that sustains them. This collective co-curation involves not only the members of these communities but also the algorithms that organize and govern these platforms, a central feature of these apps.

Curatorial practices on social media as crossroads are processual, often experimental. This process comprises various simultaneous crossroads, resulting in different possibilities and ambiguities. These notions evolve with each interaction on these platforms, following an evolutionary path akin to Exu Òkòtó and his spiral time.

We are interested in exploring Black Brazilian curatorial practices shared on Instagram, emerging from the crossroads of online community agency, where the curatorial process intersects with artistic practices. Due to the nature of social networks, these curatorial practices tend to approach the artistic field. As André Pitol (2023) states in his doctoral thesis on digital curatorial processes as artistic practice:

> Faced with this disciplinary crossroads, we choose to investigate curatorial practices from the perspective of the artistic field. Considering artistic practices within a digital culture where artists use various elements from a wide spectrum of digital media—such as software and databases—more for art than for formal research within the humanities, Graham (2010) notes that curatorship has a methodological aspect. Depending on its application and

> context, curatorship can function as a tool, a method, a practice, or even a process. According to the author, "the methods of curating—locating, arranging, interpreting, and disseminating—have been radically transformed by new networked and participatory media" (Graham, 2010, p. 166). Furthermore, he argues that the boundaries between artistic tools and curatorial tools have become porous, as if operations and art-as-research practices involving the arrangement and composition of objects/data, or the categorization of these objects and data, were activities that curators also undertake (Pitol, 2023, p. 134 [our translation]).

These curatorial practices arise from plural curatorial thinking that deconstructs the "white cube" curatorial model by seeking to dismantle the supposed universal neutrality present in hegemonic curatorial thought. Consequently, these practices position themselves as a form of curatorial activism (Reilly, 2018) on social media. It is necessary to break with the predominantly white narratives in these spaces, even though algorithmic racism works tirelessly to maintain racial privileges within these apps.

It is important to highlight that Maura Reilly, despite coining the term curatorial activism, is not the only one discussing activism and its connections to the field of arts. The relationships between art and activism are understood from various perspectives. Although interactions on social media are significant artistic, curatorial, and communicational actions, art transcends simple posts with "#art" and "#activism." We agree with Luciara Ribeiro (2021) in stating that one of the social functions of art is to challenge society and question dominant structures. Activism, therefore, is already intrinsically linked to art.

Thus, we emphasize the role of the curator as an agent of curatorial processes and, on social media, as someone who facilitates artistic practices articulated by online communities. According to Giselle Beiguelman, in an interview with Claudia Nonato (2013):

> The most interesting curatorial model seems to me to be one that recovers some elements of curatorship as formulated in the art field—the curator as a kind of process agent, in that they create frameworks and censor; and the curator as a filterer, which is this curator of the network era, who engages in processes of framing through others' eyes. I think the fusion of these two elements results in the most creative model (Beiguelman, cited in Nonato, 2013, p. 87 [our translation]).

On social media, curatorial practices are articulated as a management of processes within these online communities, with the curator potentially acting as a mediator in the creation of these micronarratives and dialogues. In cases where this mediation does not occur, the goal may be to stimulate communication flows, chaos, or even discriminatory comments of various kinds, alongside the unmoderated intensification of social network dynamics.

These challenges and convergences highlight the relationship between artistic and curatorial practices on social media as crossroads. This relationship is quite common in curatorial practices on these apps, where the boundaries between the roles of artist and curator often blur—sometimes by choice, other times due to the inherent characteristics and dynamics of these systems. Giselle Beiguelman (as cited in Nonato, 2013) reflects on the convergence between curatorial activities and artistic practice, suggesting that "curation [can] be seen in two ways: as a result dependent on the artist or as an independent curatorial proposition." This can be observed in the artistic and curatorial practices shared by Diane Lima on her Instagram profile.

Diane Lima has developed a long-term artistic and curatorial practice on Instagram, which began in mid-2018[19] and continues to the present day (Figures 7 to 9). These practices involve engaging with her community by curating themes and tensions related to her work, emotions, Northeastern origins[20], issues concerning Black women, and decolonial curatorial processes, which are fundamental to her work and life.

In her posts, Diane Lima incorporates short phrases or quotes from Black authors such as Saidiya Hartman, Dénètem Touam Bona, and Hortense Spillers; excerpts from films; snippets from lectures; advice from her mother, grandmother, aunts, and other family members; announcements of events and publications she is involved in; elements of popular and regional expressions from Northeastern Brazil; and other subjects that are significant to her (see Figure 3).

Figure 3[21]
Diane Lima's profile. Diane Lima showcases the aesthetic and poetic use of images in her long-term series articulated on Instagram.

Source: Lima, 2011.

19. January 15, 2018, marks the date of the first post in Diane Lima's artistic and curatorial series designed for social networks. Available at: https://www.instagram.com/p/Bd_FMJll-b7i/?igshid=MzRlODBiNWFlZA==. Accessed on: August 31, 2024.

20. Diane Lima is from Mundo Novo, Bahia, Brazil.

21. Available at: https://www.instagram.com/dianelima/. Accessed on: September 23, 2023.

Her black-and-white posts, featuring short texts in white font, highlight a critical aesthetic—a visual parody of the black cube within the white cube Thereby reinforcing her critique of Eurocentric art, which she challenges through her activist actions and projects. The descriptive field is also crucial in her work, as this textual space complements the provocations embedded in the text within the image (see Figures 4 to 6).

Figures 4 to 6[22]
Three posts shared on Diane Lima's Instagram feed. The posts illustrate the aesthetic and poetic approach of her long-term series articulated on the platform.

Source: Lima, 2011.

In this way, Diane Lima extends her curatorial work to social networks, centering on multidisciplinary artistic and curatorial practices. Her interventions propose discussions about ancestral memories, symbolic violence, epistemic justice, decolonial curation by Black women, as well as ethics and aesthetics of resistance.

Diane Lima extends her curatorial practice to Instagram, creating a parallel and complementary platform for her work in other spaces. She engages her community through posts that reflect the themes central to her practice. This approach was evident, for example, in her contribution

22. QR Code 1: Available at: https://www.instagram.com/p/CuB_w-xOdLe9AGPGdF15Ais-i596vQnMNh-1x8A0/. Accessed on: August 31, 2024.
QR Code 2: Available at: https://www.instagram.com/p/CkWuk8WvXX9wYKRCXz-64bRtE6zV-MTiVI2R-K40/. Accessed on: August 31, 2024.
QR Code 3: Available at: https://www.instagram.com/p/Bd_FMJllb7iDy9M6ftPJjb4FTGK_Uhn-fu55wE40/. Accessed on: August 31, 2024.]

to the collective curatorship of the 35th São Paulo Biennial[23]. One of the Biennial's foundational axes was the concept of spiraling time and the poetics of the body-as-canvas by Leda Maria Martins, along with Exu's principles. Diane Lima brought some of these themes and curatorial references to her Instagram posts, expanding the Biennial's curatorial framework into a networked curatorship, mediated through her profile in interactive engagement with her online community.

Art critic, curator, and professor Priscila Arantes emphasizes the importance of examining how elements of media culture, such as collaborative processes and networking, are present in current curatorial practices and how they relate to the aesthetics of interfaces (Arantes, 2005b). She also discusses how art and media rewrite art history by employing artistic and curatorial strategies to update, recombine, remix, and re/write it (Arantes, 2005a). Social media curatorial practices are part of this movement, incorporating elements such as co-curation with online communities and algorithmic mediation by these systems.

According to André Pitol, "networked co-curation is a practice and model for disseminating archives and museums using social media and other Web 2.0 technologies, such as social networks, to curate collections of digital heritage" (Pitol, 2023, p. 157 [our translation]). This approach allows for the collective production of digital narratives among various participants in an online community. In the context of social media curatorial practices, artificial intelligence systems also play a role in this co-curation, as they determine the visibility regimes that enable interactions on these platforms.

Amid these cultural and political intersections, social media curatorial practices emerge as a crossroads between curator, online community, and

23. The curatorial collective of the 35th São Paulo Biennial (2023) included Brazilian curator and researcher Diane Lima, Brazilian anthropologist Hélio Menezes, Portuguese writer and artist Grada Kilomba, and Spanish curator Manuel Borja-Villel, former director of the Reina Sofía Museum (Madrid, Spain).

system algorithms. These curatorial narratives are shared with the digital social platforms where they unfold and with the online communities they engage. This collective curatorial practice generates the poetics of the crossroads, which, like Exu Yangí, disperses through shares and posts but remains integral to the collective agency it embodies.

In this collective co-curation, situated at the crossroads between curators, online communities, and algorithms, the aesthetic and poetic resources characteristic of these applications are employed both as a vector for the contamination of languages—not only to subvert the curatorial status—but also as an inevitable consequence of curating in these spaces. This occurs because curatorial practices on social media cannot be fully controlled, as the curatorial process is shared with the digital social platform—Instagram—and all those who are part of this social network.

It represents a crossroads that highlights the transition of online curatorial practices towards a kind of networked collective curation. This approach takes into account both the people who are part of this community and the algorithms that articulate the functioning of these applications, emphasizing the relationships between the curator, shared content, the members of the community, and the machine operations. It is a crossroads that drives different actions, sometimes even contradictory ones, like Enugbarijó, transforming the social network into a kind of "collective mouth of the world." According to Annett Decker, in *Curating Digital Art: From Presenting and Collecting Digital Art to Networked Co-Curation*:

> Instead of merely being controversial or trying to break with traditional curation, curating in digital platforms required a new approach. First of all, acknowledging that some things cannot be controlled and that curatorial authority was now shared with the platform (i.e., software) and its users. Investigating this terrain Tedone noticed a shift in the role of curatorial agency that she framed as moving from online curation to networked co-curation'; emphasizing the alliance between a curator, objects, users, and machine operations. Driven by different and sometimes

> competing economic, cultural, and socio-political agendas the 'exhibition space' is now characterized as a collision of different interests in which the curator is merely a node. This means that: a curator needs to take into account a complex interrelated network of dependencies and contexts that are often invisible or incomprehensible to most people (Dekker, 2021, p. 27).

One of the consequences of this shift is that the traditional roles of curator, artist, and audience—and perhaps even the division of labor categories in the artistic field—become blurred and merge in ways that categories like artist and curator overlap in artistic and curatorial practices on social media. Highlighting this tension provides an opportunity to delve deeper into the political and social impacts involved in these cultural, media, and digital processes. In this sense, these tensions can be viewed as tactics to rethink the crossroads that shape the dynamics of power, authority, and cultural control at the core of hegemonic colonial curation. In this context, curatorial practices shared on social media enable the agency of alternative relationships between poetics, sociopolitical issues, curators, artists, and the people who participate in these online communities.

When considering social networks and their algorithmic logics, the curator—if this is still the most appropriate term to use when referring to the agents of curatorial practices on these applications—will develop methods of operation that provoke tension and criticism through their practices created and shared on social networks. In light of the increasing prevalence of artistic and curatorial practices being disseminated on social media platforms, the hegemonic role of the curator can be challenged in these contexts. The question arises: what happens to this function and the role of art institutions in this process? Crossroads, curatorial practices on social media, have prompted inquiries into the power dynamics and the "authorities" of the art system.

The exhibition space is currently characterized by a confluence of diverse issues, intersections, and interests, with the curator serving as a pivotal figure within the broader process. In the context of curatorial practices disseminated through social networks, it becomes imperative to acknowledge the intricate interplay of diverse issues and contexts that often remain imperceptible or elusive. These intricacies encompass the underlying algorithmic logics and the operational dynamics of these applications, both from the perspective of the individuals tasked with curation and within the broader ambit of the online community.

4. Final considerations: beginning, middle and beginning

When we think in a counter-colonial way, artistic and curatorial practices on social networks, rather than simply subverting hegemonic norms, can also challenge dominant logics by creating alternative forms of artistic expression within these spaces. However, as crossroads, with their inherent ambivalence, occupying these spaces inevitably feeds algorithmic logics and benefits the business models of big tech companies.

In this sense, and due to the nature of these platforms, the focus of these practices shared on Instagram intersects artistic production with communication processes and algorithmic systems. This shifts attention from the created and shared post to the networked performance—how this sharing is articulated by the online community and, therefore, also by artificial intelligence. This dynamic expands into a notion of collective and networked art and curation. Such an expansion mirrors Exu Òkòtó, with its spiraling growth and the cosmology of time governed by the coexistence of temporalities, by the "beginning, middle, and beginning" (Santos, 2023, p. 102), as taught by master Nêgo Bispo.

Because of their performative networked nature, artistic and curatorial practices on social media as crossroads signal a shift in hegemonic thinking—one that deconstructs traditional artistic production and embraces a process of co-curation and algorithmic co-creation with the online community articulated on these platforms. These crossroads of

art, communication, and social networks, like Exu with his obé, function as a counter-colonial blade and a transgressive force within contemporary artistic production. Axé![24]

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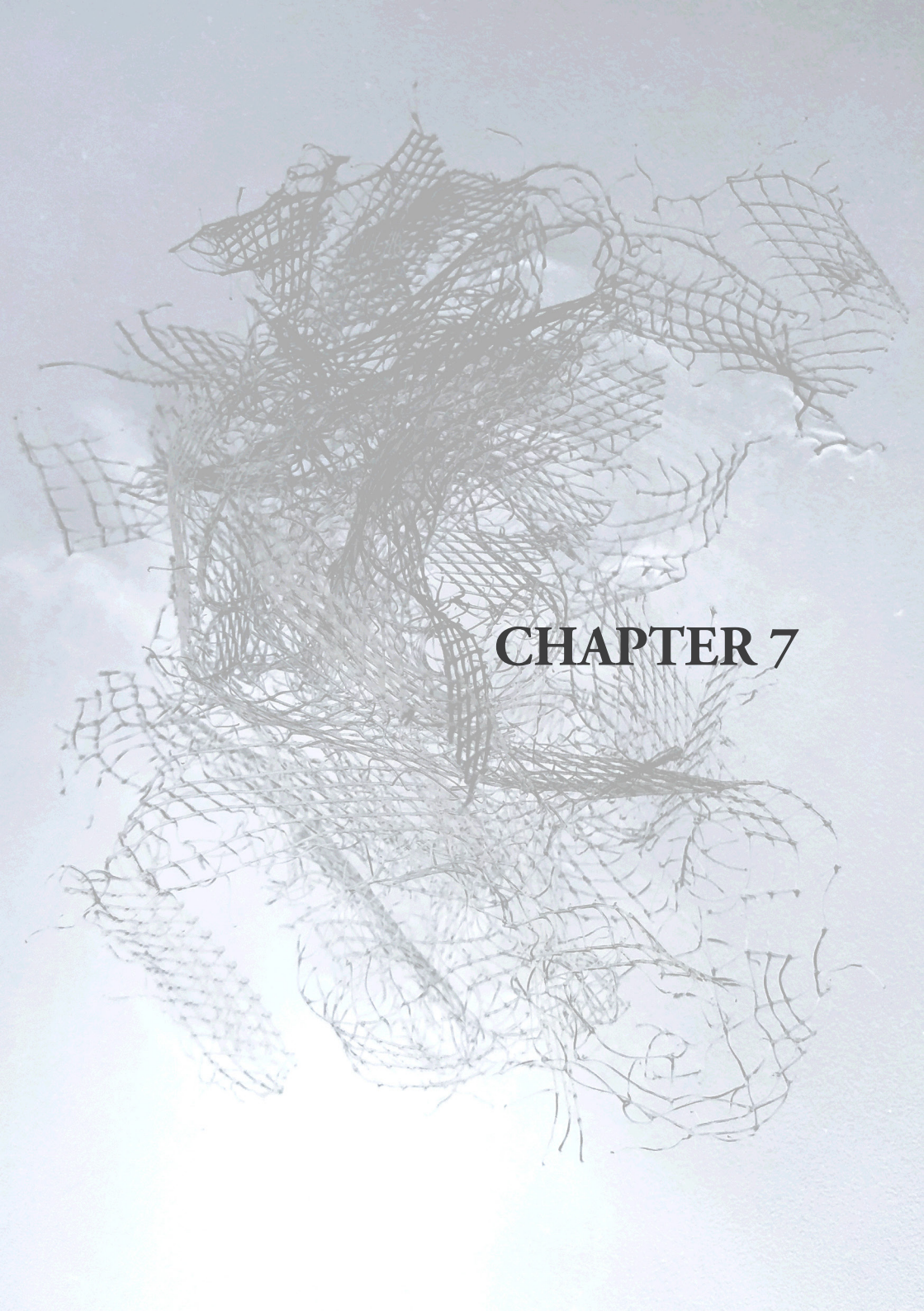

CHAPTER 7

FORM AGAINST FUNCTION: PRETO MATHEUS AND THE POETIC (PSEUDO)ILLEGIBILITY OF THE LETTER

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Abstract

For over a decade Preto Matheus has been developing his visual poetry based on the creation of bespoke alphabetic fonts. This process began with his participation in the 4e25 collective, with the development of what was called "typograpixo" (pixo typography), widely explored in the visual poems that Matheus collected in his book *Quem leu leu* [Whoever read it read it] (2017), a book that's actually a cardboard box containing poems printed on loose sheets of paper. More recently his production has included the development of a series of one-word poems using his Criptotipia (something like "cryptotype", from the Greek, krupos, "hidden"; unrelated with cryptocurrencies.) among other processes. Here we aim to explore how the artistic work of Preto Matheus, whose profession is incidentally designer, establishes a paradoxical relationship with font design, challenging the traditional notion of legibility in the name of a playful relationship with the decipherment of the letter, using, however, tools from the constructivist tradition, such as the grid. To this end, it is necessary to take into account, on the one hand, the nature of the connection between fonts (or types) and text and, on the other, the historical link between constructive artistic movements and design. To that effect, we will argue that both the connection with the 'dirty' writing of the pixo —a term referring to a distinct tradition of Brazilian graffiti— and the anti-functional focus on the frontier of legibility tend to place Matheus' work within the scope of what Lucio Agra calls monstructivism.

1. Performing visual poetry

At a book and/or graphic arts fair, the visitors that come near one of the stands are asked the following question: "Can you read this?" The seller points to one of the silkscreens or prints on display. The most common answer is "no": the visual poems in question clearly hinder immediate readability. However, many accept the challenge and, through trial and error, slowly decipher the words from their design, guided by the seller. Children that are themselves learning to read especially enjoy watching their parents or other adults having reading difficulties similar to theirs. Faced with the visual poems of Preto Matheus, writing and its decoding return to the state of mystery and enigma, the transparency of the letter – the clarity that has almost always been the objective of the typographic style – is transformed into opacity, the decoding of the letter becomes part of a playful game with the poem's (pseudo)illegibility, no one is definitively literate.

The performance described above has been repeated in the many graphic arts and and book fairs in which SQN Biblioteca (SQN – the Portuguese acronym for "actually not" – a library, an editorial project founded by the artist, focusing on the confluence of artists' books, experimental writing and urban culture) has participated in recent years. Its origins are pragmatic and commercial. By retaining fair visitors at the publisher's stand, it facilitates the presentation of SQN Biblioteca's products (books, screen prints, prints, notebooks) and therefore sales.

Such performance, however, also implies a very unusual form of encounter between a non-specialized public and visual poems, quite different from traditional frameworks such as the book or the gallery. Whether they buy something or not, it is possible to suspect that the majority of the fair visitors questioned don't acknowledge that the game in which they found themselves was conceived as poetry or even art in the broadest sense. And yet, when the meaning of the words finally emerges, their impact is undeniable.

The supposedly hermetic nature of poetic language experiments, which their detractors constantly complain about, does not repel here the non-specialized public, but invites them to its game. Perhaps there is a parallel with the traditional figure of the Brazilian fair singer, as invoked in the fragment "Circuladô de fulô" ("Surrounded by flowers", but spelled in a way that mimics oral accent) from the book Galáxias (Galaxies) by Haroldo de Campos, later set to music by Caetano Veloso. The fair situation facilitates a direct encounter between a broad public and a non-normative aesthetic experience as in the visual poems of Preto Matheus, and in the unorthodox sonority of the instrument invented by the singer "sounding like a shamisen and made with just a taut wire, a cable and, an old tin can" [our translation] in the Galáxias fragment.

In both cases, this is done without the supposedly populist framing, but perhaps in a more paternalistic framing of institutions such as the school, the museum, the culture industry, the academy, and similar institutions. In both situations, the public at large, or (to use a dangerous term, that's nevertheless full of beautiful promises) the "people" – which Campos, quoting Mayakovsky, describes it in its ultra-creative dimension as "maker of languages"[1] – reveals itself as willing and capable of facing aesthetic estrangement.

For over a decade Preto Matheus has been developing his visual poetry based on the creation of bespoke alphabetic fonts. This process began with his participation in the 4e25 collective, with the development of what was called typograpixo (pixo typography), widely explored in the visual poems that Matheus collected in his book *Quem leu leu* [Whoever read it read it] (2017), a book that's actually a cardboard box containing poems printed in loose paper sheets. More recently his production has included the development of a series of one-word poems using his Criptotipia (something like "cryptotype", from the Greek krupos meaning 'hidden', unrelated to cryptocurrencies) among other processes.

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1. Translated from the original inventa línguas.

Here we aim to explore how the artistic work of Preto Matheus, who is incidentally a designer by profession, establishes a paradoxical relationship with font design, playing against the traditional notion of legibility in the name of a playful relationship with the decipherment of the letter. However, it employs tools from the constructivist tradition, such as the grid. To this end, it is necessary to take into account, on the one hand, the nature of the connection between fonts (or types) and text and, on the other, the historical link between constructive artistic movements and design. To that effect, we will argue that both the connection with the 'dirty' writing of the pixo —a term referring to a distinct tradition of Brazilian graffiti— and the anti-functional focus at the frontier of legibility tend to place Matheus' work within the scope of what Lucio Agra calls monstructivism.

We begin here with what can be described as the performance of certain visual poems. However, this performance does not entail translating the words and graphic elements of the poem into sound values, as discussed by Johanna Drucker (2009) and Brian Reed (2009) or as exemplified by the show and album "Poesia é risco/Risco é poesia" [Poetry is Risk/Risk is Poetry] (1995), a collaboration between the poet Augusto de Campos and his musician son, Cid Campos. In the performance in question, the "exposed" poem does not constitute a score for its sound realization but for its silent decoding, which becomes the theme of the dialogue between the vendors at SQN Biblioteca and the more curious portion of the graphic fair audience.

It is worth noting that Paul Zumthor, a key figure in understanding so-called vocal poetry, specifically highlights that even in silent reading, performance is intrinsically present:

> I am particularly convinced that the idea of performance should be broadly extended; it should encompass all the phenomena that nowadays comprise what we call reception, but I associate it with the decisive moment when all elements crystallize in and for sensory perception – an

> engagement of the body. Furthermore, it seems to me that criticism, albeit recently and in a somewhat confused manner, is committed to such a direction. The term and the idea of performance tend (at least in Anglo-Saxon usage) to cover a whole range of theatricality: there lies a sign. Is not all 'literature,' fundamentally, theater? (Zumthor, 2014, p. 18 [our translation]).

This position also resonates with that of Robert Bringhurst, a poet and typographer more directly associated with writing and books. According to him, the "typographer stands to the text as the theatrical director does to the play or the musician to the score" (Bringhurst, 2005, p. 26). Even a theater theorist—who sees a clear distinction between words written to be read (silently, if you'll allow me such redundancy here) and words written to be spoken—like Patrice Pavis (2010, p. 28), argues that: "The 'performance,' the act of enunciating the text in the performative sense of linguistics, of interpreting a certain version and understanding, makes poetry (or any text) a dramatic text awaiting staging."

The idea that the graphic design of a text, be it in the form of a book, poster, Instagram post, installation or graffiti, corresponds to a certain staging of its words is particularly useful, in my view, for thinking about the visual poetry of Preto Matheus. A professional graphic and book designer, he is well-versed in the conventions and expectations of the field, having created graphic projects for publishers such as Impressões de Minas and Aletria, as well as projects like Descobridores da Matemática [Discoverers of Mathematics] at UFMG, among others. In this context, as Richard Hendel (2003, p. 34) reminds us, many decisions fall to publishers, typically in dialogue with the authors. In the context of SQN Biblioteca—where Matheus, beyond being a designer, is also the editor and proprietor—his daring as a "director" of texts manifests more directly.

To the conceptual poem Odisseia Vácuo [Vacuum Odyssey] by Renato Negrão, he responds with an accordion book, in which the motif of the circle is distributed across the two covers and also takes the form of a cutout that serves as the "O" in the names of the author and work

(Figure 1). My combinatorial poem, composed entirely of numbered questions, 100 perguntas difáceis ou o triângulo amoroso [100 Difficult Questions or the Love Triangle], was "staged," here in a partnership between Matheus and graphic artist Clarice Lacerda, as a deck of cards. Another work of mine, the collection of experimental writings Um autor de sucesso [A Successful Author], was given the more traditional "stage" of the codex format. Its pages, however, were printed on manila paper, a recycled, imperfect material typically used for packaging rather than books. Incidentally, the texts contained therein are likewise composed of recycled words, detritus of common language accumulated online[2]

Figure 1
Book designed by Preto Matheus: Odisseia Vácuo (above); 100 perguntas difáceis (left); Um autor de sucesso (right).

Source: SQN Library.

2. I always sign my creative work as Miguel Javaral.

I could go on describing each of SQN Biblioteca's book projects, all of which, in my biased opinion, represent "staging" that is both bold and provocative. However, it is in Matheus's own visual poetry that the graphic "staging" of the word reaches, I believe, its most expressive peak. To extend the same analogy, Preto Matheus, as in Elizabethan theater, simultaneously assumes the roles we today distinguish as authorship, direction, and performance. The series of visual poems titled Criptotipia [Cryptotypy], based on the typeface of the same name, is exemplary in this regard. These are one-word poems in which the graphic "staging" constitutes the entirety of the work. This is not unprecedented. For example, as early as the 1970s, we find in Augusto de Campos's work (2009, pp. 201–202; 209) poems such as "Rever" [See again], included in *Equivocábulos* [Equivocabularies] (1970), and Código [Code] (1973), from *Enigmagens* [Enigmages].

In "Rever" [See again], a perfect palindrome, the word undergoes two mirroring processes. In the first, the central letter "v" becomes the axis of a symmetrical figuration where the outermost letters are mirrored, inviting readings indistinctly from left to right or vice versa, a more intense version of the bidirectional reading the Greeks called boustrophedon. The second mirroring consists of the word being printed in the same position on two consecutive pages of the same sheet of paper, maintaining its identity "through a mirror," referencing Lewis Carroll's *Through the Looking-Glass*.

Regarding "Código" [Code], it is worth revisiting the description proposed by Sérgio Delgado Moya:

> "Código," the logo-poem designed by Augusto de Campos for the literary magazine of the same name, ingeniously transforms the letters composing the publication's title into a series of concentric circles suggesting a labyrinth. The word "código" is fully legible, as is the word "God." And like that word, the image of a "code" formed by the concentric circles of letters. The final result functions perfectly as a logo, effectively conveying the meaning of the title for which it

> was designed, both verbally and visually. The effect is the suspension of the tendency to alternately read the letters as forming a word or view them as elements of a figure: one reads and sees the word "código" and, simultaneously, sees and also reads the labyrinthine figure (Moya, 2017, pp. 113–114 [our translation]).

It is worth adding that there's a temporal dimension, a journey of sorts, for the reader who finds themselves lost in the labyrinth of language until they manage to "break the code" of the poem and achieve the suspension between reading and seeing, as highlighted by Moya. In "Rever" (something like review or revise) the font used, sans serif capital letters, is secondary in relation to other elements of the graphic "staging" of the poem. In "Código", the shape of the letters, composed basically of circles juxtaposed with straight vertical lines, is fundamental to the labyrinthine appearance. In Preto Matheus's Criptotipias, the poems are developed based on the shape of the letters, with the bespoke font previously developed by the poet himself. Visually, the poems in the series (Figure 2) resemble geometric abstract art in the constructivist tradition – such as, for instance, *Espaço modulado Nº 4* [Modulated Space] (1958) by Brazilian artist Lygia Clark. Each of the letters is constructed in a completely orthogonal manner, with rectangles of equal dimensions that are, in most cases, cut out by equally orthogonal recesses.

Figure 2
Poem by Preto Matheus from the "Criptotipia" series

Source: Black Matheus personal archive.

When faced with a poem (Figure 2), the reader will probably recognize some characters: the initial "M" and the final "O", which also repeats as the fourth letter. The penultimate letter also quickly reveals itself to be an "U". The "N" in the third position, which, instead of visually relating to the "M," appears here as an upside-down "U", also tends to reveal itself easily – at least this is what's been observed at the above mentioned fairs. However, the second letter, a rectangle without indentations, which is often confused with an "O", is actually an "I". This fact reflects one of the rules of the Criptotipia: each letter corresponds to only one shape. This also means that the design of the letter "A", the sixth letter, is based on what would be its lowercase version in most fonts. Both here and in the tipograpixo font, there is no distinction between uppercase and

lowercase. The "R", the penultimate letter of the poem in question, which is sometimes confused with a "K", in turn refers to the shape of the capital letter. Perhaps the most obscure character is the "T", the fifth letter, which illustrates another of the rules of Criptotipia: all letters must stem from a rectangular form, leaving the least possible amount of negative space. In this case, that makes the vertical axis of the letter "T" too wide in comparison with most fonts.

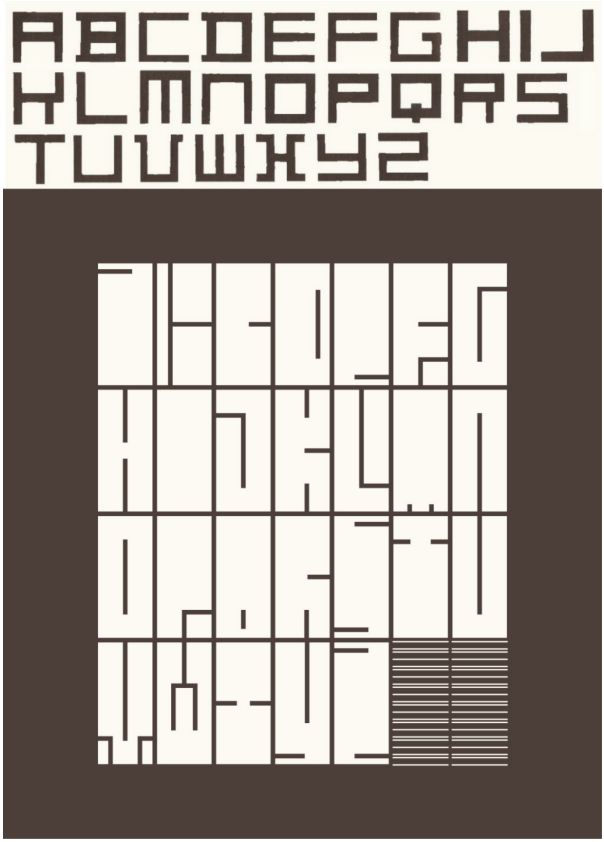
Once the last letter is deciphered, we come across the word, in this case "minotauro" [minotaur], the monster that inhabits this labyrinth of language. The poem, consisting of a single word and presented in an almost spatial manner—lacking succession and, therefore, the time that for Lessing defines poetry— gains a temporal dimension and becomes narrative through the intentional delay in alphabetical decipherment. What Jorge Luis Borges, one of Preto Matheus' favorite authors, does in his short story "The House of Asterion", to reveal only at the very last moment that the reader is in the middle of the labyrinth, in the presence of the Minotaur (who is the narrator for most of the story), is duplicated here in the context of the "mere" decoding of letters.

2. Playing with legibility

As can be seen from the description above, the forms of Criptotipia are already a kind of game in themselves, with the designer choosing to deal with self-imposed limitations, including the exclusion of any rounded shapes or even diagonal lines. Such restrictions end up functioning as the contraintes (voluntary restrictions) at the center of the type of writing linked to OuLiPo (Ouvroir de Littérature Potentielle, Potential Literature Workshop) since the 1960s, demanding unusual creative solutions that supposedly "free" writings would hardly ever achieve. Once more, the intentional exclusion of rounded and diagonal shapes in font construction has many precedents. The alphabet developed by the Dutch artist Theo Van Doesburg (Figure 3), founder of the De Stijl movement and its magazine, also fits those criteria, and is itself tributary,

as shown by Christian Wecker (2008, pp. 7-11), of other sources. However, comparing this alphabet with Criptotipia (Figure 3), we see that Van Doesburg maintains the maximum possible legibility, distorting the shape of the sans serif capital letters as little as possible and ensuring negative space for each letter, while for Matheus the priority seems to be the maximum occupation of the rectangle that frames each of the characters, creating its characteristic (pseudo)illegibility.

Figure 3
Theo Van Doesburg's Alphabet [redesigned by Preto Matheus] (above); Criptotipia by Preto Matheus (below).



Source: Black Matheus personal archive.

In an extremely influential 1923 text entitled The New Typography, the Hungarian artist László Moholy-Nagy – then newly appointed as faculty member at Walter Gropius' legendary Bauhaus school, where Van Doesburg also dabbled – sums up the credo of typographic functionalism:

> Typography is a tool of communication. It must be communication in its most intense form. The emphasis must be on absolute clarity since this distinguishes the character of our own writing from that of ancient pictographic forms. […] Therefore priority: unequivocal clarity in all typographical compositions. Legibility— communication must never be impaired by an a priori aesthetics. Letters may never be forced into a preconceived framework, for instance a square (*as cited in* Kostelanetz, 1991, p. 75 [our translation]).

Although Moholy-Nagy seems to be describing more precisely to the standard layouts of his time, his description of forcing letters into a preconceived structure – in this case a rectangle rather than a square – perfectly describes the process used to construct the Criptotipia. The Hungarian artist's proposal for what was then the "new typography" – a process that, as Patrick Rösller (2022) shows, had initiators and repercussions far beyond the Bauhaus in interwar Germany – marks the transition to the concept of graphic design established over the last hundred years. This idea, which transcends technological changes, can be conceived as an application of Moholy-Nagy's greatest motto, later transformed into a slogan for the field of design as a whole: "form follows function." This concept would be implemented, for example, in another milestone in the relationship between art in the constructive tradition and graphic design: the graphic renovation of Jornal do Brasil, one of the main Brazilian daily newspapers of the time, under the responsibility of sculptor Amílcar de Castro, in 1957. For Moya, there:

> form and function took absolute precedence over the ornamental frames and vines that characterized the *Jornal do Brasil* for the better part of its history. Uniform, sans

> serif typography was adopted for the newspaper, along with more dynamic use of photographs informed in large part by Castro's previous work in the magazines *A Cigarra* and *Manchete*, the former a cultural publication with a largely female readership and the latter a modern photojournalism magazine in the style of Paris Match (Moya, 2017, p. 93 [our translation]).

To think in terms of ornament – which would constitute a "crime" according to Adolf Loos's provocative motto, which would become another slogan for modernist architecture and design – in relation to "Criptotipia" yields curious results. The shape of the letters themselves presents the opposite extreme of what is usually called ornamentation, resorting instead to the geometry of primary forms, to a defined and anonymous texture (*faktura*) and, in particular, to the visual organization of a grid, traces that describes much of the abstract painting in the constructivist tradition, from the work of the Russian Constructivists and the Dutch *De Stijl* in the first decades of the 20th century to that of Brazilian Concrete and Neoconcrete art from the 1950s into the 1960s. Form, however, is ostensibly used here against the supposed function of typography, as defined, for example, by Mohony-Nagy in the aforementioned excerpt. It does not tend towards communication, but towards play. In opposition to a supposedly "transparent" effectiveness of the letter, what we have here is a playful emphasis on its opacity. To return to our theatrical analogy, the letters in Preto Matheus' work tend to stage the text in the Brechtian manner, relying precisely on their distancing or alienation effect (*Verfremdungseffekt*). For the German playwright Bertold Brecht (1974, pp. 92-93 [our translation]): "The performer's self-observation, an artful and artistic act of self-alienation, stop[s] the spectator from losing himself in the character completely, i.e. to the point of giving up his own identity, and lent a splendid remoteness to the events."

The language in Preto Matheus' visual poems is ostensibly made into a labyrinth, a habitat for monsters. Not only the Minotaur that stares at us from the depths of the labyrinth-like letters of its name, but the monstrous

process of coding and decoding that remain hidden in the supposed functional "transparency" of a world in which the primary sign is money (which, for a long time already, has not had a concrete signifier; not only in the mercantilist sense of gold, but even in that of paper money as a real physical object) and whose digital and programmed nature is disguised through supposedly intuitive, and therefore naturalized, interfaces. Is this encounter between the monstrous and the constructive that lends itself to the notion of monstructivism, developed by Lucio Agra (2010, p. 4, [our translation]), as a way to describe the poetics of works "generated from artistic practices that advocate containment, economy and functionality (constructivism, concretism) and that, in these, show how much they can be seen beyond the limits of their own perspectives. The deterministic equation of chaos. The measure of the unmeasurable."

Moving through such territory undoubtedly means taking into account the harmful side of the constructive project, the line that connects the utopian proposition of Le Corbusier's machine-for-living to the dystopian car-centric world built in the post-war period by bureaucrats like Robert Moses (and its generic versions distributed throughout the world), as described by Marshall Berman (2010). A process whose most enduring consequence is global warming and the mental and physical isolation of several generations, easy prey to the psychological fragmentation of digital bubbles. Rick Poyner captures the deep connection between the contemporary world and the field of design, a discipline that owes much to the Bauhaus pioneers. While design began as a specific way of intervening in the world, it has largely abandoned the utopian spirit and revolutionary politics that characterized many of its early practitioners. Poyner summarizes:

> It is no exaggeration to say that designers are engaged in nothing less than the manufacture of contemporary reality. Today, we live and breathe design. Few of the experiences we value at home, at leisure, in the city or the mall are free of its alchemical touch. We have absorbed design so deeply

> into ourselves that we no longer recognize the myriad ways in which it prompts, cajoles, disturbs, and excites us. It's completely natural. It's just the way things are (Poyner, 2000, p. 176 [our translation]).

But we must avoid here the temptation of understanding that line in terms of a "good versus evil" moralism. Although multiple ideas developed within the scope of artistic constructivism were incorporated by the corporate world in the post-war period, the world we live in is much less the result of the relationship between design and the avant-garde than of the predatory and increasingly global development of capitalism. Undoubtedly, in the 1920s, both leaders of industry and avant-garde artists used terms such as efficiency and mass production, but neither the latter had as their fundamental goal the expansion of profit margins, nor the former had much interest in the construction of a "new mankind". By the mid-1960s, the British designer Ken Garland was already publishing his manifesto *First things first*, denouncing the assimilation of design to the world of market capitalism and demanding for it more significant social functions, incidentally the theme of the text by Rick Poyner quoted above.

Although the category of monstructivism is intended by Lucio Agra (2010, p. 2) as a "dialogue above and beyond time", it does not seem to be a coincidence that the periods he focuses on are precisely the height of the avant-garde in the 1920s and the apex of the neo-avant-garde, between the mid-1960s and mid-1970s. Moments of extreme creativity and, despite the absolute rhetoric of the typical statements of what Arthur Danto (1997) called the Age of Manifestos, not that much in terms of conceptual purity. In the 1920s, Agra focuses on the dialogue, at first sight somewhat paradoxical, between constructivism and Dada, exemplified by the fact that Theo Van Doesburg himself had a Dadaist pseudonym, I. K. Bonset, as well as by the closeness between Lazló Moholy-Nagy and the sui generis Dadaist – or, as he preferred, Merz – Kurt Schwitters, in whose work Agra found the term monstructivism

itself. Moholy-Nagy is also not far removed from Brechtian distancing, having designed sets for plays staged by Erwin Piskator, a key partner of the German playwright. Similarly, Jamie Hilder observes that, from the late 1950s to the mid-1960s,

> There is a general trend in the Brazilians' [Concrete Poetry] work [...], that moves from clean, ordered works that approach the popular by using the poster form, or by referring to consumer goods, like Décio Pignatari's "Beba Coca Cola" or "LIFE," towards poems that implement photographic printing techniques or more illustrative methods, utilizing structures beyond the semantic possibilities of verbal language (Hilder, 2016, p. 199 [our translation]).

A tendency exemplified by the works in the "Popcretos" [a portmanteau word made out of "pop" and "concreto", concrete] series (1964-1966) by Augusto de Campos and "Cr$isto é a solução" (1966) by Décio Pignatari. But which, we may add, reaches its peak in the interaction between the Concrete Poets of the Noigandres group and the groovy generation (to use the slang of the time) of Tropicalism, in the single-issue magazine *Navilouca* [a portmanteau of "nave", ship, and "louca", crazy] (1972), led by Torquato Neto and Waly Salomão – another focus of Agra's analysis.

On the other hand, the emphasis on systematization and legibility in typography long precede the "new typography" of the 1920s, and perhaps makes up the core of the typographic tradition. As Henri-Jean Martin (2001) recounts, if Gutenberg and his associates still had as their model for the new printed book something quite similar to the manuscripts we associate with the Middle Ages – composed in typefaces inspired by the calligraphic hands that we now call Gothic and with space left for capital letters to be added by hand –, at the turn of the 14th to the 15th century, Italian publishers were already producing typefaces inspired by humanistic calligraphy, which would become the so-called Roman types, the basis for all serif fonts used to this day. In addition to aligning itself with the idea of the "return of the classics" in vogue at the time with the intellectual

circles of the peninsula, this transformation spread throughout Europe (with the notable exception of German-speaking territories) as a gain in legibility. This gain also resulted in greater commercial efficiency: with more legible typefaces, smaller letters sizes could be used and fewer pages needed to be composed and printed, thus reducing the total cost of the book. Even the idea that letters should be constructed geometrically in a grid, as opposed to following the movement of the scribes' pen, appeared much earlier than one might imagine. As Jacques André explains:

> practically all the ingredients of computerized typography can be found in the cartoons for the "romain du roi" face designed in France by the Bignon Commission in 1695 and later cut by Philippe Grandjean: Each letter was drawn on a grid and defined with the help of geometric constructions using circles and straight lines. This method could not be directly used to cut the punches, however, because it required that lines be drawn to a precision of one hundredth of a millimeter (even today no tool can do that) (André, 2001, p. 384 [our translation]).

In a field as prone to the fast succession of fads as design, font design has an almost uncanny stability, and in this it distinguishes itself from graphic design in general or even from book design. A text published today – say a lecture-performance on artificial intelligence and the Anthropocene to be circulated only as an ebook, a completely up-to-date work – could very well be conveyed through a version of the font named after Claude Garamond, a French punchmaker who died in 1561. If the same lecture-performance were to be presented in a new building, constructed using current techniques, based on a 16th century architectural design, such a building would be considered the height of kitsch or postmodernism. Its written version being published in a font from the same period is just something normal, probably imperceptible to the vast majority of readers. The emphasis on legibility as a transparent process of writing has deep roots in the Western episteme, as it relates to the emergence, in the monastic environments of the Middle Ages, of a culture of silent reading. According to Malcolm Parkes:

> The more [the written word] was perceived as the medium which transmitted the authorities of the past (and in the Middle Ages these texts held a greater authority for many more people than before), the less it was perceived merely as a record of the spoken word. Whereas in the fourth century Augustine had regarded letters as signs of sounds, and the sounds themselves as signs of the things we think, by the seventh century Isidore regarded letters as signs without sounds which have the power to convey to us silently (sine voce) the sayings of those who are absent. The letters themselves are the signs of things. Writing is a visible language which can signal directly to the mind through the eye (Parkes, 1999, p. 93 [our translation]).

From this angle we can understand the aversion, even within the typographic tradition itself, to anything that highlights the artificial nature of writing, that draws attention to the process of coding-decoding, that reveals that its (supposed) transparency – hard-won by the visual inventiveness of hundreds of generations of scribes, typographers and, more recently, designers,– is also nothing more than artifice normalized by convention. It is interesting to note what Robert Bringhurst, conveying perhaps the typographic tradition as a whole, has to say about logotypes and logograms, forms that necessarily emphasize their specifically visual character and, thus, the opacity of writing:

> Logotypes and logograms push typography in the direction of hieroglyphics, which tend to be looked at rather than read. They also push it toward the realm of candy and drugs, which tend to provoke dependent responses, and away from the realm of food, which tends to promote autonomous being. Good typography is like bread: ready to be admired, appraised and dissected before it is consumed (Bringhurst, 1997, p. 49 [our translation]).

It would be foolish to make Bringhurst a straw man here, a supposed personification of typographic conservatism. In his seminal book *The*

Elements of Typographic Style, surprisingly poetic and personal for a book that could be just another bland and supposedly neutral technical manual, he makes a point of highlighting the value of deviation from the norm, which blazes new trails in typography, invites the reader to break – deliberately and beautifully – the rules he describes and pays respect to the work of Guillaume Apollinaire and Guy Davenport, in which the boundary between authorship and design tends to disappear. There is also no point in arguing with the fact that texts conceived for extensive reading, like the one you, the reader, has before your eyes, would become almost unbearably difficult, as well as extremely cumbersome, if they were composed in the fonts that Preto Matheus developed for his ostensibly synthetic and visual poetry. However, the analogy in the quoted passage has an unavoidable puritanical flavor. The consumption of sweets and drugs is discouraged due to their addictive nature, as opposed to the honesty of everyday bread. I do not know the poet/typographer's position on prohibitionism. But unfortunately, in most countries around the world, drug use remains illegal, making it difficult to treat those who become addicted to them, fueling the violence generated by drug trafficking and the militarization of the police, contributing to mass incarceration and, in the Brazilian case, to the genocide of black and/or marginalized youth.

3. Designing pixo

After this relatively long excursion into the history of design, type and writing, it is time to return to Preto Matheus' work and the relationship of part of it with a form of writing that is treated – not metaphorically, like the ornament for Adolf Loos, but literally – as a crime: pixo, a particularly Brazilian form of graffiti culture. I have already discussed elsewhere the culture of pixo and its relationship with the typography of pixo developed by the 4e25 collective, of which Matheus, together with Kid Azucrina, was one of the key figures and in which he wrote his visual poems collected in the book *Quem Leu Leu* [Whoever read it read it] (2017)[3].

3. See Duarte (2018) and Duarte (2022).

But it is worth revisiting some fundamental points here. I am specifically talking about pixo with an "X" as opposed to the generic act of "*pichação*" with "CH", the Portuguese word for graffiti, the one that generally describes the act of writing on walls and other city surfaces. Pixo proper is a specifically Brazilian culture of urban writing, in many ways analogous to the taggers of New York graffiti culture, but taking unique forms both in the styling of the tags as well as their graphics and cultural impact. The pixo itself tends to be the highly stylized graffiti mark of the pixador (pixo maker) alias, intentionally illegible for those who are not familiar with his universe.

As pixo researcher André Pires Guerra Aguiar (2021, p. 26) points out, when taggers seek to communicate with the general public, they often add standard-legibility graffiti to their tags, for example, with protest slogans. At the core of the tag itself, however, lies the silence of graphic hermeticism, the secrecy and anonymity of the tags, and that of the late nights in which taggers carry out their illegal work. This silence contrasts, ultimately, with the enormous noise that their practice generates within the hostile architecture of large Brazilian metropolises – the same architecture that, at least in part, was the unforeseen dystopian result of the reinforced concrete utopia dreamed up by Le Corbusier and co. As Armando Silva (2001, p. 5) and Milene Migliano (2013) report, the very distinction between graffiti, as a form of street art, and pixo is a specifically Brazilian construction. It was even legally enshrined in a law of 2011, nicknamed the Graffiti Law, sanctioned by President Dilma Rousseff, which decriminalizes graffiti that is accompanied by written authorization from the respective property owner, qualifying, however, the absence of such an agreement as characterizing "*pichação*" (illegal graffiti).

In Brazil, the term graffiti has been associated with urban art, or street art. In this context, it is worth mentioning the role of the trend sometimes called wild style, a visual language that emerged as one of the elements of Hip Hop culture in New York in the late 1970s and spread throughout the

rest of the world along with its other elements – rap and break dancing –, with special resonance in places with large concentration of post-diaspora urban black people, such as large Brazilian, North American, African, and European cities. The world of wild style graffiti is also based on the logic of tags, that is, the graffiti artist's alias written in an elaborate script, more interested in visual virtuosity than in legibility, since, like pixo, wildstyle originally sought to communicate only with a small group of insiders. From the 1980s onwards, the bright colors and sinuous shapes of wildstyle – perhaps inspired by the fonts used on the covers of funk and disco records in the 1970s – were appropriated by media and advertising as signifiers of trendy and cool youth cultures. At the same time, some graffiti artists from the original New York scene became renowned visual artists, especially Jean-Michel Basquiat, Keith Harring and Fab 5 Freddy, although only the latter used the characteristic forms of wildstyle. As it is currently practiced, the street art wing of Brazilian graffiti – increasingly interrelated with practices such as stencils and stickers – encompasses a variety of styles and languages as diverse as easel painting, with these artistic universes increasingly interconnected. According to Milene Migliano, the remodeling of graffiti as street art:

> has been changing the way it is produced on the city streets, [creating many situations] in which public institutions have commissioned works. Several art galleries have been created to sell graffiti art, and meetings have been held bringing together graffiti artists from all over the world, such as the *Bienal Internacional do Graffiti* [International Graffiti Biennial] (BIG), which took place in Belo Horizonte in September 2008. Graffiti has thus become legitimate through its practice as street art, causing much discussion among practitioners about how this change its place in the world, since graffiti emerged as a way of taking over the city without authorization, as a tactical mode of operation […] being [now] appropriated and re-signified by galleries and dealers, [creating] commercial uses for its works (Migliano, 2009, pp. 48-49 [our translation]).

Pixo originally opposed the legitimization of street art entirely. In the context of the emergence of hip-hop culture, there was already a distinction between what was called a "writer", a legitimate practitioner of wildstyle, and a "tagger", someone who was more interested in leaving his mark than in producing what was called a "piece", that is, a work that was visually striking. Outsiders, unable to relate to decodewildstyle pieces as writing, have always been able to appreciate them as visual imagery, figurative or even abstract paintings.

If in that context it was expected that a "tagger" would at least aspire to become a "writer", contemporary Brazilian pixo celebrates its independence from street art, even though the two practices remain mostly close to each other. In the documentary *Luz, Câmera, PICHAÇÃO* [Lights, Camera, Graffiti] (Coelho, Guerra, Caetano et al., 2016), Rio de Janeiro pixadora Anarkia says: "I don't want graffiti to make this city more colorful". For her, it is pixo as an act, the risky and illegal activity of leaving her mark on the city, that matters. To make an analogy with canonical contemporary art, we can perhaps say that pixo is closer to Performance and Conceptual Art – focused respectively on the body and on social discourses –, while street art-style graffiti would be more similar to Abstract Expressionism, focused on visual texture, and Pop Art, interested above all in the iconography of contemporary society.

The pixo colors are matte black, silver and white, a palette selected to allow maximum contrast with the available/desired, mostly gray, walls and other urban surfaces. It is said that sometimes the police itself exercise its aesthetic criticism when searching the backpacks of suspected pixadores: whoever carries a less stoic palette of paints has a better chance of being released and continuing to color the city with their graffiti. Those who are not so lucky face the usual treatment by the armed wing of the state: humiliation, threats, physical aggression. More rarely, they are taken into custody to a police station to answer for their actions under the law. In extreme cases, the urban scribe may become part of the monstrous

statistics of the genocide of Black and/or marginalized youth, a hallmark of a Brazil in which the Democratic Rule of Law has never been effectively implemented: sometimes a wall is worth more than a life.

Being, at once, a playful game and a matter of life and death, almost everything about pixo as a writing practice is equally paradoxical. The goal is always to achieve maximum visual impact, whether through the intense repetition of a tag (a strategy typical of Rio de Janeiro pixo), or by over-sizing it (a favorite strategy of São Paulo pixo), or by the enormous effort involved in reaching the top of a building or a well-guarded target. However, for those outside pixo culture, the only message is that someone was there and introduced some sort of visual noise into the urban landscape. The real message, the alias that defines the author of that heroic act together with the design and/or acronym that represents her crew, will only be received by the small portion of observers close to the pixo culture. This creates a curious mix of exhibitionism and secrecy: in addition to being conditioned by the necessarily fast writing, by the characteristics of the instruments used (spray, painter roller and, for smaller and closer surfaces, the marker) and by the ambition of a striking and distinctive design, the elaborate design of the tag aims to disguise the name it represents for the uninitiated. A name that, by the way, is just an alias, to be discarded and perhaps replaced by another when its own success turns its writer into an easy target for the repressive apparatus. It's such a weird kind of self-centered writing, that does not intend to reveal anything about its authors, other than that they exist and were there.

Founded in 2010, by Preto Matheus and Kid Azucrina, the 4e25 collective was a house in which, until its dissolution in 2018, more than a dozen people lived at some point. It was also a mix of graffiti and pixo crew, an independent publisher of cardboard books, object books, as well as more traditional publications. It served as an artistic studio, a makeshift advertising and/or counter-advertising agency, and, for just over a year, a venue/bar/gallery based in the Malleta Building, the heart of bohemian

Belo Horizonte. The *portmanteau* word tipograpixo, which designates the font that defined the collective's actions, not only merged typography and pixo, but also grapixo, a hybrid form of street-art-style graffiti and pixo that has a significant presence on the streets of Belo Horizonte. 4e25's integration with the more orthodox pixo culture can be measured, for instance, by the protest grapixo made by the collective demanding the release of the crew "os piores de belô" ["the worst of Belô", the affectioned nickname by which the inhabitants of Belo Horizonte call their city], who were held in preventive detention in 2010 for the crime of gang formation, a charge whose penalty in Brazilian law is often far more severe than of vandalism and that was considered unusually harsh for young people that just sprayed buildings with paint. But mainly by the fact that their interventions on the city walls were not crossed by other pixadores, a frequent reaction to works of street art that they consider to be unrepresentative of the culture.

However, unlike the orthodox pixadores who limit the stylization of their writing to the tags and to the city, the 4e25 collective began to use their distinct lettering on the most diverse kinds of texts and surfaces, including the visual poems of Preto Matheus, created from 2010 onwards and published in the brochure *Par Ceria Ímpar*, in 2014, and in the box-like book *Quem leu leu*, as well as sporadically on the walls of Belo Horizonte and even tattooed. The visual artist and 4e25 founder, Kid Azucrina, who was already spreading paint in the streets of Belo Horizonte before the collective was formed, was inspired by the work of designer Tony de Marco, who was in turn inspired by São Paulo pixo, to respond in graphic design proper to the writings of the streets, using the framework of the constructivist design tradition to systematize the strikinglly anti-functionalist style of pixo. Initially used in the speech bubbles of the Churrascaria cartoon series, which began in 2010, the tipograpixo became the element that unified all the interests, productions and actions of the collective, be it painted, drawn or digitally constructed.

The production of digital fonts that reference pixo, generally the version native to the city of São Paulo, is now commonplace, with its letters printed on t-shirts, stickers, and similar popular items. One could argue that the assimilation of pixo into mainstream culture — or at least beyond the strictly underground — is already underway. Ironically, this process closely mirrors what happened with New York's wild style, repeating the well-known cycle of cultural appropriation of originally subversive forms by the marketplace. Although unintentionally, 4e25's tipograpixo is part of this context. But I believe that in many ways it also goes beyond. While many of the digital fonts that try to translate the dirty writing of pixo into the realm of pixels do so by copying the characteristic texture of spray or roller painting, sometimes generating results close to the kitsch of many decorative fonts, 4e25's work takes a very analytical approach to the visual essence of the so-called straight or squared pixo – of São Paulo origin, but widely practiced in Belo Horizonte –, its very characteristic geometrical formula. If, as photographer Choque states in the documentary *Pixo* (Wainer & Oliveira, 2009), the angular lines of the São Paulo-style pixo may be derived from the logos of the punk rock, hardcore and metal bands that inspired São Paulo's pixadores in the early 1980s, their shapes also allowed relatively large, sometimes truly enormous, surfaces to be covered in a proportionally fast manner, as well as being able to be deformed in order to adapt to the available space.

By analytically translating straight pixo into a visual language composed exclusively of orthogonal lines and circle segments, and organizing it on a grid, tipograpixo becomes very ill suited for attack and flight situations, a circumstance for which the collective developed other designs, sometimes composed of a single line, that is, a single gesture of the hand holding the spray can. But the geometrical nature of the tipograpixo, on the other hand, guaranteed the total translatability of the shapes of the walls onto the screens, pages, bodies, etc. The tipograpixo that appears in a digital design is not a mere imitation of a form of writing that actually occurs on the streets, like so many fonts inspired by pixo, but exactly the same lettering that appears on multiple surfaces. The walls, pages, screens and bodies were united by exactly the same form of inscription.

The deemed "monstrous" writing of pixo, pure urban visual noise to its many enemies, is translated here into the geometrical language of the constructivist tradition. In a way that is perhaps opposite, yet symmetrical, to the Criptotipia, the tipograpixo of Kid Azucrina, Preto Matheus and co. seems to also require the label of monstrutivism. Among the many poems collected in *Quem leu leu*, "Doe a quem doer" [Donate to anyone who's in pain] (Figure 4), an empathetic inversion of a popular expression ("doa a quem doer", no matter who it hurts) whose harshness perhaps borders on cruelty, stands out for not immediately referring to the straight pixo, but rather to the geometric sans serif types characteristic of the "new typography" of the 1920s. For instance, the famous Futura typeface, designed by Paul Renner in 1924-26, which would become the favorite font of the orthodox phase of Brazilian Concrete Poetry, from the mid-1950s to the mid-1960s. And not only, since, as stated by Jamie Hilder,

> Many of the early Swiss and German concrete poems are set in Futura font as well, which is perhaps less surprising when one considers their proximity to the Bauhaus, the birthplace of rational typography. Hansjörg Mayer would produce a series of concrete poetry pamphlets called Futura in the mid-1960s, and used the font himself in the majority of his compositions. Futura's design emphasizes its geometrical character, with the letters based on the primary shapes of circles, squares, and triangles, continuing the epoch's embrace of the rational (Hilder, 2016, p. 113 [our translation]).

However, when we contrast the aforementioned poem by Preto Matheus with other poems more characteristically composed in tipograpixo – for instance, "precorceito" (Figure 4) – we understand that it uses exactly the same geometric shapes to construct its letters. In "precorceito" the first two letters, "P" and "R", resemble the letters of the "new typography" of the 1920s, while the next three – "E", "C" and "O" – distance themselves from it and are closer in style to pixo. They achieve that in part by

replacing what could be straight lines at the base and the top of the letters with semi-circles opening to the outer side of the respective character. The mix works visually because all the letters are constructed with the same geometric elements and on the same grid. This poem consists of a single word—a common feature of the Criptotipia series, though not typical of works composed in tipograpixo. Here, the word is a portmanteau blending "prejudice" and "color", encapsulating the sistemic racism that, while intolerable, continues to pervade the lives of most people in Brazil. This includes the poet himself, who proudly embraces his Black identity through his artistic name ("*Preto*" meaning Black in Portuguese). A portmanteau word perhaps transformed, in a retaliatory manner, into what the Afro-Brazilian scholar Lélia González (2020) called pretuguês, itself a portmanteau word that aims to describe the non-normative Portuguese linguistic variants used by the Black population of Brazil. Unlike in Criptotipia, however, even though it consists of only one word, the text takes here a certain precedence over what we have been calling its visual staging.

The version of tipograpixo used is one of the simplest and most legible among those that make up the poems of *Quem leu leu*. Perhaps, precisely because it is a neologism, the trial-and-error process used to decipher other poems can be easily frustrated here. It is the association between racism, pretuguês [A blend of Black and Portuguese, used to refer to the way Afro-Brazilians speak Portuguese] and the equally marginalized and creative language of pixo – could it be called a kind of visual pretuguês? – that merges the text with its graphic form.

Although the criminal classification of graffiti in Brazilian law occurs, as we have seen, based on whether or not the inscription is authorized – that is, what is typified is "pichação" with "CH" and not "pixação" with an "X" – stylistic elements of pixo tend to attract the interest of the repressive arms of the State, instead of abiding by the law and, therefore, to the Democratic Rule of Law[4].

4. Translated from the original *Estado Democrático de Direito.*

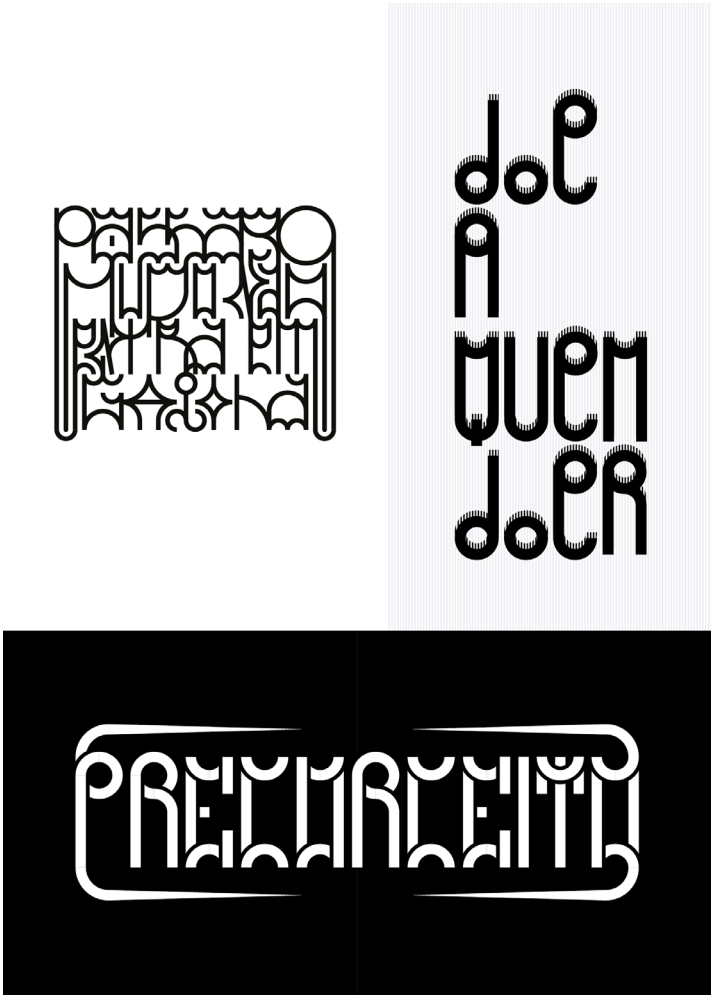
When a cultural institution invited several visual artists to paint part of its glass walls, the fact that one of the artists used the visual language of pixo was enough for the institution to receive a visit from the police. Preto Matheus and Kid Azucrina themselves were once detained day in an overcrowded cell for almost a whole day after being approached by a Belo Horizonte Municipal Guard vehicle on a Saturday afternoon. They were calmly painting a wall, in the authorized manner, with a poem from the typograpixo series. They didn't have the written permission with them, but they figured that by painting in broad daylight it would be obvious that the work was authorized. The fact that the shapes and colors (or rather, the lack of colors) used were reminiscent of the pixo culture was enough for the agents, who were supposed to enforce the law, to start behaving like autocratic art critics. The two were only released after other Belo Horizonte artists managed to find a lawyer that would represent them in the police station.

The poem in question was "r = erre" (from the verb to err) and seemed to comment on the range of errors that characterized that whole situation. At the same time, it remained true to its essence: a tribute to the act of wandering, the alternate meaning of the Portuguese verb "errar". This applied to the wanderings of the poet and his artist partner, those of the 4e25 collective as a whole, and even the wanderings that define the broader culture of pixo. "Aprenda errando" (learn by making mistakes/wandering) says another of *Quem Leu Leu*'s poems, transforming into advice the motto of the fair singer of Circulador de Fulô by Haroldo de Campos, "pelo torto fiz direito" (something like "in uneven lines I wrote right").

Unlike Criptotipia, which has a reasonably uniform (pseudo)illegibility, poems composed in tipograpixo vary greatly in the degree of difficulty they pose to the reader. A poem like "precorceito" has a readability quite close to that of a conventional decorative font. A text like "pássaro mudo não entra em gaiola" [a mute bird does not enter a cage] (Figure 4), on the other hand, normally requires a considerable amount of time to

be deciphered. Another difference between the series is the fact that, in theory, the difficulty of reading Criptotipia could be described as universalist, while tipograpixo would give up its secrets much more quickly to those who are already familiar with the culture of pixo.

Figure 4
Some poems from the collection Quem Leu Leu



Source: Black Matheus personal archive.

In practice, however, what has been observed in the encounter of both series with the public, during the fairs, is an enormous ease for people close to pixo culture to also decipher the constructivist forms of Criptotipia. But what elements make up tipograpixo (pseudo)illegibility? First, unlike Criptotipia and the vast majority of fonts, tipograpixo is not a finite alphabet with a defined number of characters. While, in most fonts, the basic design of a letter varies only between upper and lower case, the visual language developed by the 4e25 collective has a much larger number of designs for each letter. This is a feature that sets it apart from most digital fonts inspired by pixo and brings it closer to the actual form of urban writing.

In "pássaro mudo não entra em gaiola", a poem with only 27 letters, the letter "A" appears six times, but is represented by four different designs. Three of these designs derive from the lowercase form of the letter (varying the number of semi-circles that open outwards at the top and bottom of the character) and one from the uppercase forms, maintaining however the same height and not having distinct functions: in the same word – "gaiola" – the form that would be uppercase appears as the second letter and the supposedly lowercase one as the last. The "O" appears in the poem both as a perfect circle (in "pássaro"), as an almost rectangular shape with semi-circles opening upward and downward (in "mudo" and "não") and as a shape close to a rhombus composed of quarter circles (in "gaiola"), not to mention the distortions of proportion that tipograpixo retains from type of the urban writing that inspired it.

In short, each letter takes on many forms, sometimes in the same poem or in the same word, preventing decoding by deduction. A second element that ostensibly slows down the reading of the poems collected in *Quem leu leu* are the numerous interactions or collisions between letter forms. Unlike in Criptotipia, we can safely say that tipograpixo is typified in Adolf Loos's aesthetic/penal code: in many of the poems, ornamentation reigns supreme, considerably reducing legibility. In "pássaro mudo não entra em gaiola", the shape of the first and last letters of the word

"pássaro" (bird), which make up the entire first line of the poem, are stretched vertically beyond the fourth and last line, made up by the word "gaiola" (cage), returning, after making a semi-circular curve, to join the extreme letters of the third line, "entra em" (enters into).

Typography has long included linked letters, which, when printed using movable types require a distinct piece. The 4e25 collective's process – equating painting techiniques and computer graphics processes, through a shared grid – enables an almost infinite and yet methodical proliferation of such elements. If in traditional typographic practice the function of ligatures is to harmonize the encounters between letters, in tipograpixo they assume a purely ornamental function. They often become anti-functional, making reading difficult. Sometimes they also assume a figurative function, such as the cage shape that underlines the words of the poem and brings it closer to Apollinaire's Caligrams.

As for the text of the tipograpixo poems, it should be noted that, due to the very nature of the font, they must be quite condensed. But they also have other common traits. They often develop a pun or other form of paronomasia. Some are commonplace phrases with a different turn, such as the aforementioned "Doe a quem doer". Many, such as "pássaro mudo não entra em gaiola" (the silent bird doesn't enter cages), have the incisive flavor of popular proverbs, perhaps quite natural for the work of a small town Minas Gerais native like Preto Matheus, born and raised in Manhuaçu. But this is apparently contradictory when conveyed by letters whose shape necessarily refers to the concrete jungle of big cities. Another inevitable association of its synthetic and playful phrases would be that with advertising slogans. A proximity with advertising that Jamie Hinde (2016) and Sérgio Delgado Moya (2017) also observe in the case of Concrete Poetry, both Brazilian and international, and that Patrick Rösller (2022) highlights in the context of the emergence of the "new typography" of the 1920s. In fact, Matheus was a reasonably sought-after advertising copywriter, but he was unable to adapt to the ultra-profit oriented environment of the advertising agencies. The

product that he chose to push was now his eminently countercultural worldview. In a world that proclaims maximum efficiency in business and communication, Matheus chose to subvert, in his peculiar play with forms, the naturalized primacy of functions.

4. Coming to terms

"All ornaments are grist to the cat burglar's mill" wrote Walter Benjamin (2005, p. 209. [our translation])), in 1929. He was referring to Surrealism, perhaps the avant-garde movement further removed from the constructivist tradition, but the phrase could be applied much more literally to those who practice pixo, as, for those who climb façades, all ornaments are useful. As the reader will have probably noticed, this text also does not shy away from producing connections that may seem purely ornamental. The analogy between theater and the visual organization of the text, for example. As Hal Foster (1996) recounts, Michael Fried's mid-1960s condemnation of Minimalism focused on its obsession with literal space, accusing it of being tainted by theatricality. A high crime of art in the view of a critic formed in the orthodox strand of USA visual art modernism founded by Clement Greenberg.

For Fried (as cited in Foster, 1996, p. 64 [our translation]), the "concept of art" is "meaningful only within the individual arts" and "what lies between the arts is theatre". For Foster, even if Fried's condemnation was unfounded, it had the virtue of understanding how an artistic movement that had been created within a certain strand of late modernism and, in particular, its constructivist wing, actually pointed to the transformation that would result in what we now call contemporary art, clearly postmodern in its outlook.

This unsettled position, which would actually describe much of the neo-avant-garde works of the 1960s, is similar to that which Jamie Hilder (2016, p. 199) describes for another artistic strand of interest to us here: "in concrete poetry there is a tension between the popular and austere styles that makes it difficult to position it as either modern or postmodern;

it is much better approached as both." In the Brazilian case, in the polemic between Roberto Schwarz (1989) and Augusto de Campos, in 1985, what the former insinuates is precisely that the visual aspect of the latter's poem "Póstudo" would be merely decorative, echoing the theatricality that Fried would find between the arts. Even in the production of Brazilian concrete poets from the Noigandres group, with the exception of Augusto himself and Ronaldo Azeredo, the emphasis on the properly visual dimension diminishes considerably from the mid-1960s onward. An example of this would be the Galáxias, possibly Haroldo de Campos' masterpiece, in which the verbal and even vocal element take precedence over the interplay between word and image.

Likewise, the wear and tear caused by generations of uninspired imitators of early concrete poetry led to a more or less widespread critical feeling that visual poetry as a whole was a mostly dated phenomenon, ignoring all the interesting work that was produced in this field later and exiling many visual poets to the more institutionally defined borders of the visual arts. What we have tried to show here is that, on the contrary, the inquiry into the visual staging of the word makes up a fundamental dimension of the process that leads to the contemporary nonspecific art described by Florencia Garramuño (2014) and that, in the works of Preto Matheus, it can be the means by which monstrutivist connections are made between cultural territories so apparently foreign to each other, such as the dirty writing of pixo and the "new typography" of the 1920s; language experiments, urban culture and the general public at fairs; the legible and the visible.

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CHAPTER 8

3D SCANNING, PARAMETRIC DESIGN, AND DIGITAL FABRICATION IN THE CONTEXT OF ASSISTIVE PRODUCT DEVELOPMENT

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Abstract

This chapter discusses how 3D scanning, parametric design, and digital fabrication enhance the development of assistive products. These technologies allow, respectively: greater adaptation of devices to the user's body; dynamic exploration of different shapes through parameter variation; and the incorporation of aesthetic demands such as color, detail, and specific materials. First, we will examine the potential of 3D scanning, parametric design, and digital fabrication. Next, we will present three examples of assistive products that employ these digital technologies, entirely or to a significant degree, in the creative processes. This will demonstrate how these methods contribute to the creation of individualized and unique products. Finally, we will analyze a specific case study, highlighting how the application of these technologies and their resulting uniqueness can increase the user's self-esteem.

1. Introduction

Digital technologies provide greater flexibility in the production of objects, differentiating them from those created through large-scale manufacturing of identical products, made using molds. In such mass production, the goal is to supply a generalized need without accounting for the unique characteristics of individual human beings, instead addressing the average requirements of most people. Those who do not fit this standardized profile must adapt to participate as active and functional members of society (Hawkins, 2022, p. 9).

However, this reality has changed significantly due to technological advancements that enable adaptive production and product customization for everyone. This can occur through the user's selection and combination of project components or through personalization that incorporates specific material details into the product.

Assistive technologies are particularly well-suited to this context within the healthcare field. Each person has or is going to have distinct physical and functional limitations, and these technologies prioritize the development of products tailored to individual needs. This new perspective on assistive technologies considers not only the functional aspect but also the sociocultural context experienced by the user. As a result, everyone's body is seen as unique rather than an average of a desired standard.

Individuals with visual, auditory, or motor impairments who are supported by such assistive technologies do not need to adapt to interact with these devices. On the contrary, their preferences and needs serve as the guidelines for creating the object, which can then be customized and/or personalized.

2. Potentialities of 3d digitization, parametric design, and digital fabrication

Digital technologies enhance the processes of designing and producing artifacts. In addition to enabling the creation of virtual objects that are

mathematically defined and manipulable through algorithms, these technologies establish a direct correlation between what can be digitally created and what can be physically constructed. Conversely, they also incorporate the possibility of translating physical objects into virtual objects through digitization, allowing everyday three-dimensional objects to exist as models within a computer.

In this context, digital fabrication processes mediate the flow of information between digital and physical media. As Kolarevic (2003, p. 33) suggests, "constructability" is a direct function of "computability." Consequently, the steps involved in the information flow can begin with the dimensional capture of a physical three-dimensional object, ensuring the representation of its geometry in the virtual plane. This capture enables manipulation of the virtual model through various algorithms, such as parametric design systems. Such manipulation may result in alterations to the object's original shape and/or its subsequent materialization in the physical medium, facilitated by different digital fabrication technologies.

As proposed by Moles (1990, p. 112), it is possible to achieve a "singularized multiplicity" of products, characterized by their distinctiveness, through the use of various algorithms whose variations derive directly from their numerical properties. The object is established as the result of algorithmic manipulations which, when adjusted, allow creators to generate multiple distinct objects that are nonetheless similar in their structure. These variations yield unique representations and materializations tailored to the specific needs and preferences of users.

Considering the aforementioned potential of digital technologies, we will now present three stages involved in the design and materialization of assistive products. When employed together, these stages broaden the possibilities for customizing and/or personalizing such devices. They are: 3D digitization, parametric design, and digital fabrication utilizing additive manufacturing. These technological procedures result, respectively, in the capture of dimensional data from a physical artifact—or even a person—into the digital realm; the manipulation of the virtual

model's geometry through computational systems employing parametric equations; and the physical materialization of the model.

Objects are, essentially, numerical descriptions defined by topologies and geometries, which can be physically represented or three-dimensionally printed to meet the individual needs of each user. The information thus flows between the physical and digital realms in a process that is not necessarily unilateral.

2.1. 3D Digitization

The process of translating physical objects into the digital realm is the reverse of computer-assisted digital manufacturing. From any physical object, it is possible to generate a digital representation of its geometry, a process commonly referred to as reverse engineering. In this context, scanning technologies create highly accurate 3D models of pre-existing objects.

An example of this technique can be found in the project developed for the Pinacoteca of the State of São Paulo, as described by Celani et al. (2008, pp. 231-232). In this project, the redesign of part of the museum's permanent collection was requested, which involved digitizing 3D pieces from the collection. According to the authors, geometric models of real-world objects could be obtained manually, semi-automatically, or automatically. In the manual method, the user measures the real-world object with a measuring device and transfers the values into CAD software to produce a geometric model. In contrast, the automatic and semi-automatic methods perform both measurement and 3D modeling with minimal or no user intervention, making them significantly faster, especially for complex surfaces.

By associating the concept of reverse engineering with augmented sculpting, Adzhiev, Comninos, and Pasko (2003, p. 211) emphasize the importance of this creative approach as a process that can start from the digitization of a physical object. Once existing as a digital model, the

object can be manipulated and, eventually, manufactured into a new, distinct 3D object.

New visual configurations can be realized through different creative pathways. As Kolarevic (2003, pp. 31-33) suggests, translational approaches stand out, moving either from the physical to the digital or from the digital to the physical.

Alencastro et al. (2019), building on Pavlidis et al. (2007), consider 3D digitization as composed of three stages: a) preparation, which defines the technique, methodology, scanning location, and safety planning; b) digital acquisition, which refers to the data capture of the object's surface; c) processing, which involves the modeling phase of the object, determined by different processes.

According to Celani and Cancherini (2009), 3D digitization techniques can be divided into two main groups based on the technology used: contact and non-contact 3D digitization techniques. Rocha (2017, p. 22) points out that the creation of 3D models using the non-contact method is advantageous, as it allows visualization of the object from different angles and provides simultaneous virtual access to the representation for multiple users.

In this context, the most common methods are laser scanning, structured light, and photogrammetry. The triangulation method uses an infrared laser beam that, when it contacts the object's surface, is distorted and captured by a camera. By triangulating the scanned object, the camera, and the laser, the original shape of the scanned element can be mapped. This type of technology can be employed in fixed platforms with rotating bases or manually, with the scanner moved around the object, person, or environment being scanned. The structured light method uses a video projector to cast distributed sequences of patterns onto the object's surface. A camera captures the patterns deformed by the surface, enabling the calculation of the positions of the points that make up the object's topography. Photogrammetry, the most accessible and popular method,

is based on the successive capture of images at regular distances around an object, using a dedicated camera or a mobile phone camera. The technique relates a set of sequentially captured images around an object, utilizing the principle of stereoscopy[1]. Specific software interprets these images and reconstructs the 3D model. The sequential grouping of these images to create the three-dimensional object is ensured by the richness of detail in both the photographed object and the background in which it is positioned. Elements such as colors, textures, and shadows play an important role in the grouping and mapping of the set (Bernier, Luyt, Reinhard, 2015, pp. 26–29).

3D scanning, therefore, allows that dimensional or anatomical data of an object or person can be accurately captured to serve as the basis for bespoke customization processes, such as the creation of assistive devices. The geometric structure of the object or the user's body is digitally transposed and made available for subsequent manipulations.

In the case of parametric design, algorithms are used to create complex and personalized products or structures. This process provides a set of parameters or variables used to generate a unique solution.

Assuming the digitized model maintains precision in relation to the physical object or anatomy to be represented, 3D scanning becomes an essential tool for capturing and mapping the physical elements in the digital realm. It is the most accurate way to digitally reproduce the geometry of human anatomy. This involves digitally representing a physical model using various 3D scanning devices. The accuracy of the object's representation may vary depending on the scanning device used.

Once scanned, the three-dimensional object is represented as a digital model on a computer using spatial coordinates: x (width), y (depth), and

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1. According to Siscoutto (2018) et al., three-dimensional (or stereoscopic) vision results from "…the brain's interpretation of the two two-dimensional images captured by each eye from its perspective, along with visual accommodation information about the degree of visual convergence and divergence."

z (height). In the virtual space, the object is described through numerical data, which can undergo parametric manipulations and restructurings. Visualization occurs through techniques that transform the data stored in the machine's memory into images displayed on the two-dimensional support of the screen.

2.2. Parametric Design

New imaging technologies involve sophisticated programs for scanning, processing, and three-dimensional modeling, which are becoming increasingly accessible and commonplace. These systems incorporate programming and data parameterization to achieve precise and personalized results.

Parametric design functions as an algorithmic system oriented toward problem-solving. It is based on translating relationships between internal and external variables and establishing correspondences between design elements and their parameters (Assasi, 2019). A parametric project is a technological tool that uses algorithms to conceive and subsequently produce complex and personalized products or structures. These algorithms rely on a set of parameters and variables to generate a unique solution.

According to Casini (2022, p. 299), parametric design can be defined as a process based on an algorithmic approach that expresses parameters and rules to define, encode, and clarify the relationship between the designer's intent and the design response. For this author, parametric design primarily involves describing and creating geometry flexibly by linking decision variables and constraints (parameters), which establish interdependencies between objects and define their transformational behavior.

The notion of parametrics used to describe three-dimensional models in mathematics has been investigated since the end of the 19th century. However, it was not until the late 20th century that Ivan Sutherland

created Sketchpad—without directly using the term parametric—a digital interactive model capable of accelerating the calculation of parametric equations.

In 1982, AutoCAD was launched; however, its parametric functionality was only added in the AutoCAD 2010 version. The first commercially popular parametric engineering software was Pro/ENGINEER, released in 1988 and created by Samuel Geisberg. In 1993, many of the parametric features of Pro/ENGINEER were introduced into CATIA v4 by Dassault Systèmes.

It was only in the 2000s that parametric software, such as ArchiCAD and Revit, became commercially available. The parametric equations used in Revit were embedded in the user interface and were limited. However, scripting interfaces enabled parametric modeling in projects. These interfaces and the available programming languages gained popularity, especially when visual programming packages became available, allowing for the creation of complex equations and algorithms using the parameters of CAD or BIM software. In the first 20 years of the 21st century, 3D modeling programs based on parametric equations, such as 3D Studio Max, Maya, and Rhino, have been widely used in architecture. Parametric visual programming packages were developed for these programs, such as Rhino Grasshopper 3D, Maya Embedded Language (MEL), and Max Creation Graph (Assasi, 2019).

In parametric design, equations are used to describe the relationships between objects, defining associative and linked geometry. This establishes interdependencies between objects, with their behaviors defined during transformations. These interdependencies become the structural and organizing principles for generating and transforming geometry. How these are structured and reconfigured depends largely on the designer's skill in accurately creating these relationships (Kolarevic, 2008, p. 121).

In essence, parametric design aims to overcome the limitations resulting from the independent nature of design elements in conventional

computer-assisted drawings. It is based on defining the relationships between elements, whether simple or grouped, and how these relationships are organized and controlled (Casini, 2022, p. 299).

Kolarevic (2008, p. 122) emphasizes that the potential of parametric design lies in the designer's ability to effectively edit the nuances of the underlying parametric generative system. This ability requires expertise and skill, as the designer must intuitively know which small quantitative changes can produce qualitatively different results.

Instead of designing a single solution, the designer now creates a multidimensional design space. Each dimension represents one of the critical parameters exposed by the parametric model, which varies according to the design situation (Casini, 2022, p. 300).

2.3. Digital Fabrication

It is now possible for an object to transition between the physical and digital environments (and vice versa), according to the project's requirements and the inventor's subjectivity.

In conventional manufacturing processes, many steps are performed manually or with the aid of non-automated machines. In digitally controlled processes, however, most steps can be automated. Automated manufacturing processes offer an alternative for materializing virtual models of varying complexities, enabling the production of prototypes and final objects.

This automation began with machines performing subtractive manufacturing, such as computer numerical control (CNC) lathes and milling machines. These machines were large and expensive, making them accessible only to large industries. Recently, additive manufacturing machines, employing more affordable technologies, have been introduced to a broader audience.

In general, the automated process is divided into five stages (Celani, 2009, p. 167). The first stage defines the proposed model, considering its objective, scale, and configuration. The second stage includes the definition of the production techniques and materials. The third stage refers to the preparation of files to produce the model. The fourth stage is related to part production of the parts of the model. And in the fifth stage, the assembly of the parts and the finishing takes place. The three intermediate stages differentiate digital processes from manual or non-automated ones. However, the final stage (assembly and finishing) is common to both.

Digital computation and fabrication use CAD (Computer-Aided Design) and CAM (Computer-Aided Manufacturing) technologies to transform virtual models into physical objects. In other words, a virtual model made of bits is encoded by computer software and processed by a digital fabrication machine, which decodes these electronic impulses and materializes them into the realm of atoms. One of the most remarkable features of digital fabrication is its ability to transform highly complex virtual models into physical solids.

Using CNC (Computer Numerically Controlled) machines, it is possible to reproduce objects using various materials and techniques. Automated production processes are subdivided into three main methods: a) additive process (also known as 3D printing or rapid prototyping), that builds three-dimensional objects by depositing successive layers of material; b) subtractive process, that removes specific volumes of solid materials through machining, utilizing multiple axes; c) laser cutting process, that cuts thin materials (such as paper and fabric) or thicker materials (such as wood and acrylic).

Given the specificity of each digital manufacturing technology, it becomes essential to become familiar with and understand them. Kolarevic (2008, p.123) emphasizes that the design process should be based on the capabilities of the machines. A thorough understanding of techniques and materials necessarily implies the selection of the appropriate technology,

as each project "chooses" its specific type of production. Thus, it is the designer's responsibility to integrate this knowledge to establish an intrinsic and interdependent relationship between the conceptualization and the execution of the object—that is, its materialization.

3. The creation of assistive products: some examples

The term "assistive technology" refers to technology designed for use in devices or products aimed at enhancing, maintaining, or improving the functional abilities of individuals with disabilities or reduced mobility. However, as previously mentioned, we understand that the design of assistive technology can also address gaps in user satisfaction and needs. This outcome can be achieved if the creation process involves collaborative work between the team and the user, prioritizing the use of the aforementioned digital technologies to expand customization and/or personalization possibilities.

When utilized in an interconnected manner, digital technologies enable the production of personalized and tailor-made devices that meet the preferences and needs of everyone. The creation of assistive products has been significantly transformed by the ability to obtain precise anatomical measurements of an individual, dynamic exploration of shapes by varying parameters, and digital fabrication of objects to meet specific demands.

In this section, we present examples of assistive products that illustrate how the use of 3D scanning, parametric design, and/or digital manufacturing facilitates the customization and/or personalization of these objects, emphasizing the principle that the user is a decision-making agent in the design process. Subsequently, examples will be provided in three areas: visual impairment, hearing impairment, and motor impairment.

Among existing assistive products for low vision, eyeglasses are the most explored from an aesthetic perspective (Pullin, 2009). Many fashion brands invest in various frame models, elevating eyeglasses to the category of accessories. Despite the variety of frame models, they are rarely personalized to fit the facial measurements of everyone.

The project by Bertol et al. (2010) investigates the personalization of eyeglass frames that are aesthetically and ergonomically adapted to the individual measurements of the user. Using 3D scanning, anthropometric data of the user's face—such as measurements of the nasal, ocular, and facial regions—were obtained to create an accurate facial virtual model. This facial model was imported in 3D modeling software, enabling a matrix frame design, developed using parametric design, to be adapted to the user's measurements. The parameters of the design, including lens and temple measurements, were adjusted to fit the individual's facial shape while adhering to ergonomic requirements based on the proportions of eyeglass frames as defined by ISO 8624 standards. Once the frame design was finalized, the production phase began, with the frame being machined using a CNC milling machine.

In the context of assistive products available on the market for hearing, invisibility is a key design premise. The miniaturization of technology has enabled the reduction in the size of devices. However, it is worth noting that the smaller the device, the greater the loss in performance (Pullin, 2009; Profita et al., 2018). However, in opposition to invisibility, there are some user groups have created online forums to share personalization proposals for their own hearing aids. These proposals include different colors and visual elements, giving visibility to the devices and elevating them to the status of fashion accessories (Profita et al., 2018).

In this context, the OH behind-the-ear hearing aid, designed by Cunha (2017), proposes customization to counter the trend of hearing aid invisibility. The new product has a functional part in the shape of a flat cylinder, located in exposed areas of the ear, and it can be customized through interchangeable rings with different finishings that cover the functional part of the device. The device is intended to symbolize an accessory rather than being hidden as a medical item. The designer's proposal is for the hearing aid to allow the user to exercise his/her right to choose by using the product as a form of self-expression. Using universal anthropometric measurements, the hearing aid was modeled in parametric

design software. For the final prototype, an additive manufacturing technique was used, specifically Fused Deposition Modeling (FDM)[2].

In the category of assistive products designed for the loss of upper and/or lower limbs, there is currently a gap in the availability of prostheses that foster a strong sense of identification between the user and the device. The prosthesis models available on the market largely prioritizes mechanical features, focusing on meeting functional requirements for restoring lost movement. Generally speaking, insufficient attention is paid to the aesthetic qualities of prosthetics, which may lead users to abandon these devices.

The Swedish researcher Anders Lindén Døviken, in partnership with Norsk Teknisk Ortopedi (NTO), developed a customized surface for an upper-limb myoelectric prosthesis, with the active participation of the user (Døviken & Wallerud, 2023). The project considered the preferences of the user, who was born with a congenital upper-limb disability. It incorporated the user's conceptual suggestion to represent human anatomy on the prosthesis. The surface of the prosthesis was designed to simulate the visual characteristics of muscles distributed along the forearm region.

To build the prototype of the prosthetic surface, a 3D scan was performed on a plaster mold of the user's residual limb. Subsequently, a surface was modeled in parametric design software, encompassing both the area occupied by the scanned residual limb and the prosthesis's internal electronic components. Textures were applied to simulate muscles, adhering to the user's proposed design. Once the digital model of the surface was finalized, it proceeded to the fabrication stage using 3D printing with PLA (polylactic acid), employing fused deposition modeling (FDM) technology.

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2. In this manufacturing process, each cross-sectional layer is created by melting a filament, which solidifies upon cooling.

After printing, the piece underwent several finishing steps to mitigate the "layered lines" characteristic typical of the printing process. A spray coating was applied to fill the originally printed surface, which was then sanded and received a base layer of red paint. Over this base layer, acrylic paint was manually applied to simulate the muscular coverage of the forearm. The final prototype pleased the user, meeting their desire for a prosthesis that closely resembled their measurements and anatomical visual references.

These projects demonstrate how 3D scanning, parametric design, and digital fabrication technologies enhance the interaction between producers and users. They highlight how the potential of digital technologies makes products more suitable and tailored to users, ensuring aesthetic value and promoting pleasure and well-being.

4. Case study

Motivated by the high number of lower-limb amputations annually in the United States, industrial designer William Root developed the EXO Prosthetic Leg[3]. This prosthesis partially restores the lost limb's functionality and helps rebuild the user's self-esteem.

The design of the prosthetic aims to adapt it to the user's body anatomy by combining 3D scanning, advanced 3D modeling software, and 3D printing, simplifying the production steps for limb prosthetics. Traditional production processes require multiple molds, workshops equipped with expensive machinery, and highly trained technicians. This significantly increases the final cost, making the product less accessible and limiting the range of available models. Root simplified the production to just three stages, making it more precise, less expensive, personalized, and better suited to the user's anatomy.

3. Its name references the exoskeleton, an external bone structure that provides support. Information about the "EXO Prosthetic Leg" is available at: https://willrootdesign.com/exo-prosthetic-leg. Accessed on: October 7th, 2024.

In producing the EXO Prosthetic Leg, the first step was capturing the user's anatomical measurements. A contact 3D scanner[4] was used to create an accurate digital model of the patient's residual limb and the intact limb on the opposite side of the amputation. Based on the scan of the intact limb, anatomical measurements were referenced for constructing the prosthetic. For scanning the residual limb, a technology called FitSocket, developed by the MIT Biomechatronics Lab, was used. This technology captured the properties of the user's leg tissue, ensuring a better fit between the residual limb and the prosthetic socket.

The second step combined the geometries obtained from scanning the residual limb and the intact limb into a parametric mesh model using 3D modeling software. This precise virtual model, which replicated the user's lost lower limb, was digitally adapted to integrate a structure that allowed for the attachment of the prosthetic's functional mechanisms. Using the parametric tools of the 3D modeling software, the prosthetic's external mesh was designed with a personalizable perforated surface pattern. By making the prosthetic hollow internally and perforated externally, its weight was reduced. The patterns covering the structure can be personalized, allowing the user to identify with their prosthetic.

The third step involved materializing the finalized virtual models from the modeling phase using additive digital manufacturing methods. Components of the prosthetic, such as the leg socket, calf, and foot, were 3D printed using the Selective Laser Sintering (SLS) technique[5]. After printing the prosthetic parts, assembly was completed using connectors that joined the structural elements to the functional mechanisms of the prosthetic.

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4. The scanner used in the EXO Prosthetic Leg project is a contact scanner model, which employs a digital or manual probe; these are slower and more costly. By contrast, the 3D scanners discussed in section 2.1 of this chapter are more accessible and do not require direct contact with the object, as they use lasers and/or structured light.

5. In this method, the laser fuses metal particles to form the final titanium piece, ensuring durability, lightness, and biocompatibility.

The final prosthetic limb was produced through an automated process that not only ensured anatomical precision concerning the lost limb but also reduced the prosthetic's cost and enabled user personalization. This case study demonstrates that, in the context of assistive products, there is an effective integration of 3D scanning, parametric design, and digital fabrication technologies. The continuous feedback between the physical and digital realms ensures a creative dynamic, allowing for constant revisions and adaptations throughout the project.

Moreover, these technologies guarantee a better fit of the prosthetic to the user's body, and by varying the external mesh parameters, they allow for the incorporation of user-specific features. This project exemplifies a successful balance between functionality and aesthetics. The possibility of customization and personalization contributes to increased self-confidence and self-esteem, fostering a sense of belonging between the user and the product. Beyond being functional instruments, prostheses created with these technologies promote greater social acceptance for their users.

5. Final considerations

3D scanning, parametric design, and digital fabrication enhance the creation of assistive products, making them more bespoke and appealing to individuals with hearing, visual, or motor impairments. These technologies allow users to be at the center of the design process, manage it, and incorporate their dimensional data. A good integration of users with assistive devices ensures greater comfort during use, improves physical adaptation, and minimizes the chances of abandonment of the device. In addition to their functionality, these devices promote greater social acceptance of individuals with disabilities within their sociocultural contexts, consequently increasing their self-esteem.

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