

Collaboration and Creative Autonomy: AI in the Process of Creation in Art and Design

Colaboración y autonomía creativa: IA en el proceso de creación en arte y diseño

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KEYWORDS

Art-Design; creative autonomy; Artificial Intelligence; collaboration.

ABSTRACT

This article investigates the role of Artificial Intelligence (AI) as a collaborator in the creative process in art and design, especially in computational generative creation. With the advancement in the complexity of AI tools, the possibility of machine-human co-authorship arises, where the code actively participates in creative decisions and directly impacts the result. We explore how AI and programming tools can act beyond technical support, taking on a more autonomous role and offering new paths for creation. The study also considers ChatGPT as an auxiliary tool for learning and solving problems in creative programming, highlighting its potential and limitations. It is important to highlight that Artificial Intelligence will be used during the process of developing and editing programming codes and not as an image creation agent itself. Therefore, important questions about the appropriation of artists' images and identities by AI will be discussed at another time. The research, developed in the Postgraduate Program in Design at Anhembi Morumbi University seeks to expand understanding of the relationships between art, technology and creative autonomy, contributing to the interdisciplinary debate in the field of contemporary design.

PALABRAS CLAVE

Arte-Diseño; autonomía creativa; Inteligencia Artificial; colaboración.

RESUMEN

Este artículo investiga el papel de la Inteligencia Artificial (IA) como colaboradora en el proceso creativo en arte y diseño, especialmente en la creación generativa computacional. Con el avance en la complejidad de las herramientas de IA, surge la posibilidad de una coautoría máquina-humano, en la que el código participa activamente en las decisiones creativas y repercute directamente en el resultado. Exploramos cómo la IA y las herramientas de programación pueden actuar más allá del soporte técnico, asumiendo un papel más autónomo y ofreciendo nuevas vías para la creación. El estudio también considera ChatGPT como una herramienta auxiliar para el aprendizaje y la resolución de problemas en la programación creativa, destacando su potencial y sus limitaciones. Es importante destacar que la Inteligencia Artificial será utilizada durante el proceso de desarrollo y edición de códigos de programación y no como un agente de creación de imágenes en sí mismo. Por lo tanto, las cuestiones importantes sobre la apropiación de imágenes e identidades de artistas por parte de la IA se discutirán en otro momento. La investigación, desarrollada en el Programa de Postgrado en Diseño de la Universidad Anhembi Morumbi, pretende ampliar la comprensión de las relaciones entre arte, tecnología y autonomía creativa, contribuyendo al debate interdisciplinar en el campo del diseño contemporáneo.

INTRODUCTION

Technology, especially programming and Artificial Intelligence (AI), has profoundly transformed the way artists and designers conceive their artworks, opening up space for new dynamics of collaboration between humans and machines. Computational tools that previously performed auxiliary functions now play a central role in the conception of artworks, actively collaborating with the artist-designer¹ and influencing creative decisions. In this context, a new dynamic of creation emerges and the role of the collaborative agent is to act as a creative partner who contributes autonomously and actively to the development and innovation of the work, bringing suggestions, making decisions, and enhancing the artistic process through artificial intelligence.

This article explores the collaborative relationship between artist and machine, focusing especially on the potential of computational generative creation — an area where programming plays a fundamental role in generating aesthetic and conceptual results. Computational generative creation is a creative process that uses algorithms and artificial intelligence to produce artworks of art, design, music and other visual and sound expressions. Based on computer systems that follow a set of previously defined rules or instructions, this approach allows generating unique, variable and potentially infinite content. Unlike manual creation, where the artist controls every detail, in generative

¹ In this paper, “artist-designer” will be used to refer to the creator of the work, who is an artist and designer and works in both areas simultaneously

creation, the artist configures parameters and guides the algorithm, but the result is influenced by random processes or internal logic of the system, generating unexpected and innovative results. Generative creation is widely used in computational art, where simple elements can be manipulated by algorithms to create complex compositions. It is also applied in design and architecture to explore creative solutions, generating variations adaptable to the needs of the user or the environment.

Our objective is to investigate how the machine can be considered a co-author in the creative process, questioning the limits between human control and code autonomy. Additionally, this article explores the use of ChatGPT, an Artificial Intelligence tool, to support creative programming learning. In the next topics, examples of previous creative artworks will be presented, illustrating the collaboration between machine and artist in creating generative art and design. Then, the development of a new work that explores the limits of code autonomy and its influence on creative results will be described. The experience with ChatGPT as an auxiliary tool will be analyzed, addressing the level of apparent autonomy of the codes and how this autonomy impacts the creative process. Thus, the text seeks to deepen understanding of human-machine collaboration, emphasizing the role of AI in expanding artistic possibilities and questioning traditional concepts of authorship.

1. AUTONOMY IN THE CREATIVE PROCESS

The idea of autonomy in the field of generative creation has been discussed in depth, especially with regard to the role of machines as creative agents. According to Couchot (2007), autonomy can be understood as the ability of a system to create its own rules, differing from simply following previously defined instructions. In the field of art and design, this concept is particularly relevant when considering computational generative creation, where codes and algorithms can make decisions that have not been explicitly programmed to influence the final result. The concept of "low autonomy" (Couchot, 2007) refers to systems capable of performing functions beyond what was programmed, but still within determined parameters. These systems do not replace the artist, but expand their creative capacity, suggesting new paths and possibilities that might otherwise go unnoticed. In generative creation, the interaction between the artist and the programmed code is often a two-way street, where the code "responds" to the artist, creating a collaboration between them.

In the book *Arte: espaço_tempo_imagem* (2004), Suzete Venturelli explores Edgar Morin's vision of the concept of autonomy as a basis for a scientific understanding of the subject. Morin proposes a definition of subject based on the logic of the living being, highlighting that autonomy is inseparable from self-organization — or "self-eco-organization" —, a concept that emphasizes the interdependence of the living being with its environment. For him, autonomy arises from a complex interaction with the external world, and this dynamic is not limited to living beings; it is also present in machines, such as computers, which are capable of reorganization and regeneration. Venturelli thus highlights Morin's perspective that the subject is not an isolated system, but rather an organism that adapts and develops in constant relationship with the environment.

2. COLLABORATION AND CO-AUTHORSHIP BETWEEN THE ARTIST-DESIGNER AND CODE

The relationship between artist and code has been explored from various perspectives in the field of art and design. Julio Plaza (2003) addresses the idea of technological collaboration as a partnership between man and machine, in which both contribute to the final result of the work. Plaza uses the situation where a spectator contributes to the artistic-conceptual result in an exhibition; the visitor would have an influence on the result of the artwork when interacting and creating in the environment. Here, the role of the code, that would be created together with the artist-designer, will be analyzed in a similar way. In both situations, a pre-established context is placed — the work in the exhibition and the basic code — however both situations also have factors that are beyond the creator's control or initial prediction, where the viewer and the code can generate results that escape the control of the original context.

This situation challenges previously established concepts of authorship, where the artist-designer is seen as the sole creator. Instead, the program becomes a co-author by generating elements that the artist may not have anticipated. In practice, this can be observed in generative art systems, where the parameters established by the artist are expanded by the code's own behavior. The program expands the creation of unpredictable forms, which leads to a work that reflects both the human input and the autonomous choices of the code. Joshua Davis and Sougwen Chung are two artists that use this shift in dynamic in their work. Davis defines input parameters and allows the algorithm to explore its own creative space, resulting in artworks that combine the initial artistic vision with decisions generated by the code. One example of his artwork using programming is shown in *Noise Paintings* (Figure 1), which shows some of the results a single code can create using randomness. In an interview for the Youtube Channel *Art Cafe*, Davis describes his process of collaboration with code, guided by questions:

How do I use technology to walk a path and to execute an idea [...] based on randomness and chance? How can I get it [the code] to drop this beautiful accident? (Art Cafe, 2023, 14:48)

A similar collaboration with a machine can be seen in the projects like *Omnia per Omnia* by Sougwen Chung & D.O.U.G._L.A.S. Figure 2 shows the process of the painting that is described as “a collaborative drawing performance between Sougwen and a swarm of custom-designed drawing robots” (Chung, 2018). The artist uses robots that respond to her gestures, creating artworks that involve both her intentionality and the machine's autonomy. The co-authorship can be seen in these examples when there is a dynamic exchange, where both agents — human and machine — influence and shape the result in ways that can be unexpected and enriching. The collaboration concept is evident since she cites the robots and algorithm as a collaborator in the final piece, having the artist's credit as “Sougwen Chung & D.O.U.G._L.A.S. (Drawing Operations Unit: Generation_3 Live Autonomous System).”

3. USING CHATGPT IN CREATIVE LEARNING. POSSIBILITIES AND LIMITATIONS

Using AI tools like ChatGPT in learning creative programming introduces a new educational paradigm. These tools not only facilitate access to technical knowledge, but



Figure 1. Images created using programming. Adapted from Noise paintings series, Joshua Davis, 2016. Retrieved from <https://www.behance.net/gallery/38833779/Noise-Paintings>.



Figure 2. Collaborative drawing performance between artist and drawing robots. Adapted from Omnia per Omnia, by Sougwen Chung & D.O.U.G. L.A.S., 2018. Retrieved from <https://sougwen.com/project/omniaperomnia>.

also encourage an exploratory and experimental approach. With the ability to generate code, offer suggestions, and solve problems, AI serves as an enabler of active learning. This brings a shift in the way artist-designers approach programming, allowing them to focus more on creative exploration and experimentation rather than memorizing rules or solving technical problems. It also provides assistance to beginning programmers who may not have access to teaching resources or have limited access to them. This dynamic flow of creation is especially relevant in a field like generative art, where the possibilities are vast and often unpredictable.

Despite the countless possibilities, co-authorship between artist-designer and program still has limitations. When working with the technical part of the tool, it is common for AI to present incomplete or incorrect information, so the artist-designer's basic mastery of the media, in this case, programming, is extremely necessary. It is also required to develop a "relationship" with ChatGPT, where the artist-designer learns the best ways to interact with the tool. The limitations of AI and code are also conceptual. Although code has the ability to create unexpected and innovative artworks, it operates within the

confines of pre-programmed instructions. The "low autonomy" described by Couchot (2007) applies more directly in this situation, in which algorithms can perform actions not directly predicted by the programmer, but are unable to create truly new rules. Likewise, AI is not capable of developing creations with poetic complexity, which is the irreplaceable role of the artist-designer.

4. CREATION WITH THE HELP OF CHATGPT

The use of Artificial Intelligence as an aid in programming came from the desire to learn the basics of creative programming. With initial ideas about the aesthetic for the final work and resources like YouTube tutorials and programming websites, ChatGPT played a practical role in fixing errors, significantly reducing creation time. So, it was possible to dedicate more time to the poetics and aesthetic creation of the work. The first creative code was created to combine organic and natural shapes with geometric shapes and it was important that the programming was done in a way that allowed a wide variation of results. The main resource used was "random", which allowed the constant change of all factors whenever the code was activated. The work *Lúcido e Cerrado* is the result of this first experience, which can be seen, in part, in Figure 3.

With the experience gained in creating *Lúcido e Cerrado*, it was possible to increase the complexity of the program. The images below are part of a creative experiment without a specific poetic or visual intention, but based on code provided by programmer Steve from "Steven's Makerspace" channel on Youtube. In a tutorial², he taught how to create a visual effect of spots and, in his case, there was a specific relationship between the colors and the size of the spots, so depending on the size and position of the spots, they would take on different colors within a palette defined by him. A change was made so that the size of the spots and colors switched every time the code was activated, factors that did

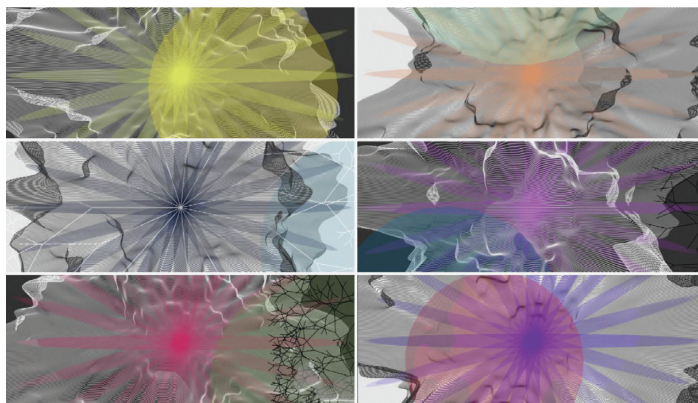


Figure 3. Generative art series. *Lúcido e Cerrado*, Beatriz Costa, 2023. Personal collection.

²The tutorial by Steve's Makerspace can be seen in <https://www.youtube.com/watch?v=9Lmeyvbf0rA>



Figure 4. *Generative design series. Experimentos, Beatriz Costa, 2024a. Personal collection.*



Figure 5. *Generative design series. Experimentos, Beatriz Costa, 2024a. Personal collection.*

not occur in the original code. Lines that formed waves and circles were also added to create greater variation between images. Both lines and circles were constructed with randomly decided colors and interacted with the background of the spots through the possible blend modes³. In Figure 4, for example, the background had blue colors but at the intersection with the circles, the background became red with dark green. The waves had great variation in the number and separation of lines, size on the screen, ripple angle and transparency, as in the Figure 5 example. Therefore, the construction of this code was focused on increasing the possibilities of results and the use of ChatGPT was limited to correcting technical errors in the code and adding lines, which required more complex factors to achieve the result.

In the following work, AI played a greater role in building the code, as there was no intended visual direction for the result. The focus was on increasing the possibilities and variation of results using simple shapes. The initial inspiration was the DVD-Video screensaver created in the 90's, that slides on the television screen and when it hits the

³ The use of Blend Mode and its variables can be accessed at <https://p5js.org/reference/p5/blendMode/>

corners it changes color (Figure 6). The prompt used was a request for a code with the same function as the DVD-Video screensaver.

To increase the possibilities, the code was changed to work as follows: The animation has 35 shapes in total, which are decided between 6 choices - rectangle, line, spiral, four-pointed star, circle and fractal tree. These shapes would be generated in random quantities each to form the complete set of 35. The colors of the shapes and the background would be decided randomly and change within a time interval. This would make the animation have more varied and “unexpected” results than the initial inspiration. Through the blend mode feature, the shapes could interact with each other and with the background when they were overlapped, forming new colors at the intersection. The amount of use of random resources and a large possibility of choices meant that *Brilhante Infinito I* (Figure 7) was a work with extensive variation between results. Each animation is different from the previous and next one and throughout its construction, the image becomes more complex and different through the overlapping of shapes and colors⁴.

ChatGPT provided the initial code based on the idea presented and also helped with some of the changes, such as time resources in the animation. Technical errors occurred particularly when dealing with the changing colors of the shapes and background within the time interval, which were resolved with the help of the AI tool.



Figure 6. DVD video screensaver reproduction. Screenshot from Bouncing DVD Logo Screensaver 4K 60fps - 10 hours NO LOOP, by Raúl Blanco, 2019, YouTube. Retrieved from <https://www.youtube.com/watch?v=5mGuCdICcNM>.

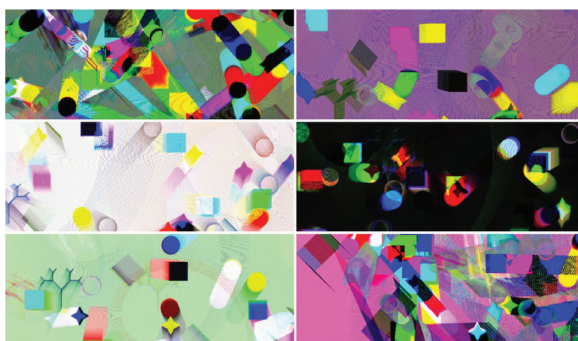


Figure 7. Screenshot from the live animation process of the work. Screenshot from *Brilhante Infinito I*, by Beatriz Costa, 2024b, p5js. Retrieved from https://editor.p5js.org/beatrizn/full/F0hB_hgfY.

⁴ *Brilhante Infinito* can be seen as an animation in https://editor.p5js.org/beatrizn/full/F0hB_hgfY

5. THE CREATION OF “(AI)INTERAÇÃO” (2024)

5.1. Process

OpenAI introduced the GPT-4 model in March 2023, which now allows images and documents to be used in initial prompts. In May 2024, GPT-4.0 was released with these new functions available for free. However, OpenAI allows the use of resources for a limited number of prompts, starting to require a subscription or allowing the user to continue using a less advanced version. These questions will be detailed at the end of this topic. In order to experiment with image analysis, 4 models were digitally designed for the AI to create a code (Figure 8). Based on this analysis, Chat created a code that results in Figure 9. It is possible to see that the main items were identified - lines and squares - but their formation has some differences. For example, 4 images were used to demonstrate the variation in results that the same code should generate. However, the code provided by ChatGPT displays a single image.

From this initial code, changes were made in order to build variation, using random and conditional as in previous artworks. Here ChatGPT helped with a function not previously used, creating groups randomly to be the initial parameter of the code. The prompts were as follows:



Figure 8. Digital images drawn to use as a ChatGPT test prompt. Created by Beatriz Costa, 2024c. Personal collection.

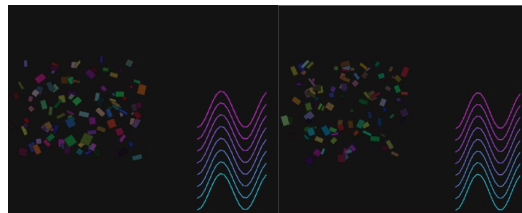


Figure 9. Images created by the code provided by ChatGPT after analysis of drawings. Created by Beatriz Costa, 2024d. Personal collection.

Prompt 1: “Consider group N, which contains the numbers from 0 to 100. Separate the numbers into 4 groups [...] The rule will be as follows and will only apply to the group of rectangles: Each time the code is triggered, it must choose between a number from 0 to 100. This number will dictate the color family of the rectangles.”

Prompt 2: “Consider L = letters from A to Z. Consider L1, L2 and L3, which are 3 groups containing letters. The letters are not repeated between groups. [...] This way, we will ensure that, when a letter from L1 is drawn, the waves rotate on the screen, from the starting point (center) from 0° to 60°. If any letter from L2 is selected, from 61° to 120°, and if L3 is selected, from 121° to 180°.”

Using ChatGPT to form these rules allowed two features to be added to the code. First, the multiple possibilities when combining groups of letters and numbers with existing random factors. Then, there is a decrease in the artist-designer's control over events, since the AI selects the groups and characteristics, which were added to the code and will be modified each time it is activated. To finalize the construction of the lines and rectangles, the code was changed so that both were decided by the letter drawn and they could not have the same color. Figure 10 is an example for this stage in the creation process.

From that point on, experimentation began with other elements, such as triangles, squares and ellipses. All code components have the possibility of randomly varying between different blend modes, allowing dynamic interaction between them, and constructed by random schemes of letters and numbers to define colors and angles, as well as random variations in the positioning and size. This leads to a bigger diversity in the results, which can be seen in Figure 11. In this example, the final creation called *(AI)nteração* is the code⁵ itself, having the images as possibilities and parts of the work.

5.2. Differences between the use of GPT4 and GPT4.0 in the creative process

In the whole creative process detailed previously, GPT-4 was used as support in creative programming, offering solutions to technical problems, optimizing code, and generating ideas. However, its interpretative capacity was limited to text, restricting interactions to

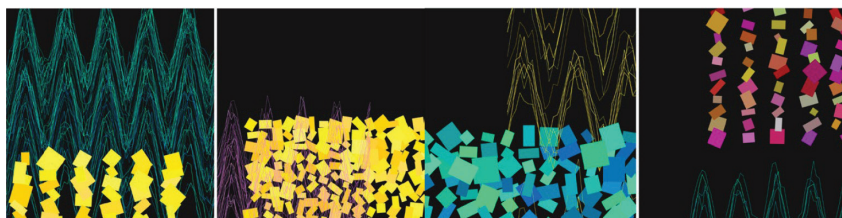


Figure 10. Examples of the initial code results during the creation of *(AI)nteração*. Created by Beatriz Costa, 2024e. Personal collection.

⁵ *(AI)nteração* can be seen at <https://editor.p5js.org/beacoxta/full/Kd-10GzsV>. It's encouraged to refresh the page multiple times to experience the range of possibilities and variation of the code.

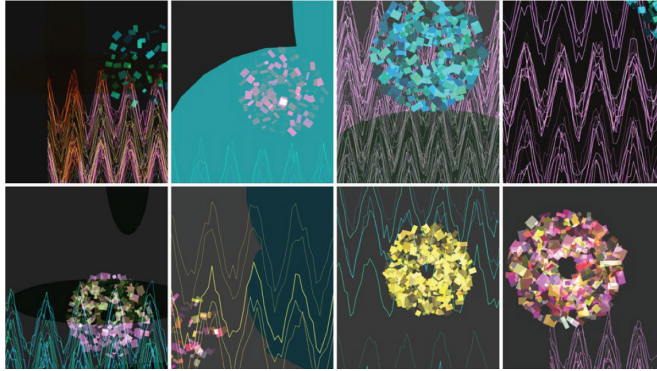


Figure 11. *Examples of results during the creation of (AI)Interação. Created by Beatriz Costa, 2024f.*

the verbal field and requiring detailed descriptions from the artist-designer for the AI to fully understand the project's needs.

GPT-4.0 introduced an innovation by incorporating image analysis. This functionality enabled the artist-designer to provide visual inputs directly to the system, allowing for a more direct interpretation of artistic intentions. For example, when supplied with images, GPT-4.0 identified visual elements, such as geometric shapes and patterns, and suggested code based on these features. This reduced the time needed for initial conception and facilitated experimentation with more complex visual elements. The ability to provide visual inputs allowed the AI to act more autonomously, proposing interpretations directly based on the artistic materials provided. The use of the initial images also made the communication easier, since the tool has shown to have a linguistic difficulty where it didn't respond to the prompts fully. This particular change from the GPT-4 to GPT-4.0 resulted in a more dynamic collaboration, where the AI could suggest variations unforeseen by the artist-designer, expanding creative possibilities. On the other hand, the previous text limitation, while challenging, also fostered the development of descriptive skills, making the process more dependent on human interaction.

A significant distinction between ChatGPT-4.0 and ChatGPT-4 lies in their ability to process context and maintain coherence throughout interactions. ChatGPT-4.0 demonstrates an advanced capacity to relate to the conversation's history, allowing it to build upon prior exchanges and generate more consistent, nuanced, and accurate responses. This contextual awareness is particularly beneficial in creative processes, where continuity and a deeper understanding of prior inputs can greatly enhance collaboration. In contrast, ChatGPT-4 is more prone to errors in responses, especially in complex or layered prompts, which can hinder its usefulness in projects requiring precision and adaptability. In this experience, that change made a difference, but it wasn't shown to be essential to the creative process, therefore, having access to ChatGPT-4 can be enough to assist and introduce a beginner to programming.

Thus, as seen in the experiments and creation processes, working with GPT-4 and GPT-4.0 has shown to have both positive and negative ramifications. A negative highlight to the GPT-4.0 is the subscription-based usage model, restricting full access to many users due to cost. During the creative process, after using all the free prompts provided by OpenAI, the artist-designer can start a new chat to continue using the 4.0 resources. This change, though, was proven to make the continuity of the work hard, since the AI's capacity of "learning" from the previous prompts and answers is often necessary for the best results. Ultimately, the changes introduced by GPT-4.0 expanded the AI's role in the creative process and can be considered positive for the work development in the future. But, while the AI can operate within programmed parameters, it cannot yet create its own rules or paradigms. In this sense, AI-generated creativity still remains largely an extension of the initial programming and conceptual ideas from the artist-designer rather than truly independent creator.

FINAL CONSIDERATIONS

This study investigated the role of Artificial Intelligence as a collaborator in the creative process in art-design, focusing on the co-authorship between artist-designer and machine. The analysis of GPT-4 and GPT-4.0 tools highlighted the evolution of AI capabilities in supporting and expanding creative possibilities, as well as their technical and conceptual limitations. The use of tools such as ChatGPT demonstrated that AI could play a crucial role in solving technical problems, accelerating the creative process, and proposing new ideas and possibilities. The experiences described illustrate how the artist-designer can shape and be shaped by the AI's behavior, generating works that combine human intentionality with the code's limited autonomy. Although the advantages of using AI are evident, some ethical and practical concerns emerge. The growing dependence on AI tools raises questions about accessibility and equity in the artistic field. Additionally, transparency in using these tools becomes essential to ensure that human-machine collaboration is understood in an honest and ethical way.

By exploring the code's role as a co-author, this article challenges traditional notions of authorship and collaboration, proposing a new perspective where it becomes a significant creative agent and reinforcing AI's role as an agent in contemporary design. Furthermore, the research offers practical insights for applying AI to projects in art and design, from conception to execution. Future research could explore systems with greater autonomy, further expanding the possibilities of co-authorship.

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BIOGRAPHY

Beatriz Costa do Nascimento is an artist-designer, programmer and researcher with a bachelor's degree in Visual Arts from the University of São Paulo (USP), currently in the Anhembi Morumbi University's Postgraduate Program in Design with a Coordination for the Improvement of Higher Education Personnel (Capes) grant.

Suzete Venturelli is a researcher, artist and teacher, currently a full professor at the University of Brasília (UnB) and Anhembi Morumbi University (UAM), in the Postgraduate Programs in Visual Arts and Design, respectively. She is also a fellow at the National Council of Scientific and Technological Development (CNPq).