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# Affective Computational Interfaces

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**Abstract.** The following text describes the development of affective computer interfaces that seek to provoke visual, tactile, gustatory and olfactory interactions, a process by which an external or internal stimulus causes a specific reaction that produce a perception, considering that in the *deleuzian* and *guattarian* sense (1992), an idea can thoroughly cross creative activities. For the authors, an idea arises in three distinct forms: (1) at one moment arises; (2) in the philosophical context; (3) in the form of concepts; in another moment, it appears in the artistic production of visual artists, in which artist invents perceptions, and it also occurs with musicians because according to the authors, the musician creates affections. Considering this and artistic and design computational production, we describe below the results of collaborative research that has in common the poetics of interactivity, provided by computational processes and methods that approach different ideas involving affective cartography, body, art, nature and artificial life, wearable computers and emergency.

**Keywords:** Interfaces · Poetics · Affectivity · Emergency

## 1 Introduction

Computational art has been a fundamental element in the development of research projects at University of Brasília's technological art laboratory Media Lab/UnB, and since 2018, it also has had Anhembi Morumbi University as a collaborator. According to Venturelli (2017), computational art even if it is occasioned by concepts that arise from aesthetic ideas, is now minimally written based on computing. An informed writing that the author defines as n-dimensional. The drivers were designed for the series of artists of the 1980s, that is: on an axis is an invisible construction elaborated by logistic formalisms in a network of codes; and on a second axis, is a form of social expression in the evolutionary memories of the binary code (in the Darwinian sense).

The translation makes readable and interpretable a social memory, that is layered in scriptures of knowledge. Computational art seeks to bring from tradition the questions of science to the context of art. For the author, two postulates derive from computational art: programming, as an internal organization, and interactivity, as a condition of circulation and modification of data. In order to complete the possibilities worked by the artists, it is necessary to integrate in these perspectives: cybernetics, artificial intelligence and softwares that present the possibility of creativity and learning on their own. Consequently, computational art goes through a path where all disciplines mingle.

Computational art means creation by associating different media with computational processes. To discourse on computational art means to penetrate a complex mutant logic of discoveries and applications. Interactivity is not only a possibility offered by computational art, but it is, in fact, the foundation of the system in the treatment of information emanating from the user.

Systems are user centric. Public from computational art is effectively different from the public from traditional art works. The second one likes to interpret stories, images and music, but the first one want to do something more: they appreciate works that can be manipulated in its presentation, preferring artistic works that require others participation to make operation possible.

Users are able to generate and display a work. The role of the artist is to create some items of possibilities, through variables that are often part of a code executed by the computational process step by step. The artist uses his or hers knowledge to generate a work whose performance is specific to the user. The computer automates a generation of work so that users can get to know the work and explore their own views. Both the user and the artist are part of the work. The interactor is an artist and appreciates the work for the interactivity it contains; according to some art critics, this interactivity is the reason for a computational computer to have merit or not. The object for the computational artist is software.

The generation of artists that the author is part faced the need to learn formalism for the elaboration of codes, to also be able to “break” them in the production. The study did not belong to the field of arts because university education in Brazil was quite fragmented. Allied to the chaos, confusion, lack of technology and cultural access delineated in the art teaching implementation of arts education in Brazilian schools in the 1970s, the university education was cloistered in the reactionary universe that valued only the “artistic genius”. Education, in general, is not an incentive to approximate the areas of knowledge or an art as a field of knowledge. The model in Brazil today has changed and is more focused on the transdisciplinary ones that are practitioners of smaller companies, in team or in group. From the moment that the graduate programs in art emerged, art research consolidated in the institutions and approaching with other areas became necessary, as we shall see later, in the reports of computational art works, performed and developed since 2017.

## 2 It Is All Sensation

For Deleuze and Guattari (1992), a work of art is a being of sensation and nothing else, since it exists in itself. In the context of computational work, sensation goes through the involvement in manipulation of different materials, as means of producing a compound of perceptions and affections. Often, in contact with people, perceptions are no longer perceptions; they seem independent of those people who experience them. Just as the effects they provoke, they are no longer feelings or affections, they go beyond the strength of those whom submit to them.

The authors remind us that sensations, perceptions and affections are beings, whose validity is within themselves and does not exceed any time lived beyond a work. It could be said that they exist in the absence of human, because is a composite of perceptions and affections itself. From this perspective, we bring transdisciplinary contributions on issues related to the materiality of emotional manifestations in the context of our research. They question the tangible and sensorial dimension of works of art, which awakens our imagination about how aesthetic images and narratives can be formed by emotions. The aim is to study sets of flows, circulations and affective intensities in the computational context for both the art and the field of design. It also seeks to build relationships with emotions using different artistic media. On this axis we discuss next, how emotional manifestations arise in the imaginary, how they are elaborated and produced.

Works of art involving hybrid features of art and computer design, overflow in the strictly computational environment, whether digital or not. But they consider an integral part of the work, the relation of interactivity between machines and living beings, or between machines only. They find their roots in the Dadaist movement of the 1920s, and more specifically in the work of Marcel Duchamp and Man Ray. Combinatory processes that follow combinatorial rules of Dadaist poetry were adopted by members of concrete poetry in Brazil, for example, through execution of their combinatorial sequences, and many authors of computational environments are still inspired by this type of creation. In the 1960s, the movement of contemporary art fluxus in Brazil, we have linked kinship with the Rex Group (1966–1967)<sup>1</sup>, that was created in São Paulo, also influenced by Dadaism, because it touched mainly the visual arts, but also music and literature, and aimed with a devastating sense of humor, to break boundaries between the arts and the world, to build a link between art and life.

## 3 Affective Materiality

Emotion encompasses a semantic spectrum related to states of mind that allow us to touch on very concrete aspects of fluids, forms, and roughness of affectivity. In this perspective, our reflection brings contributions on issues related to materiality in the creation of works that intend to provoke some kind of emotional involvement through its poetics. In the scope of artistic cartography, the feeling of affection, which in the

<sup>1</sup> <http://enciclopedia.itaucultural.org.br/grupo434025/grupo-rex>.

work #prece\_, was treated as a memory of the emotions, whereas the work deals with the poetic mapping inserted and concerns people who disappeared from Brasilia, the capital city of Brazil. In this work, interaction takes place through the social network twitter, where an interactor is able to add names of people from their family that are missing and thus, the cartography appears through postings. This work raises the following question: how to historicize and archive affective, fugitive, snapshot and variable phenomena? (see Fig. 1).



Fig. 1. Artwork #prece\_ exhibited at *Museu Nacional*, Brasilia-Brazil.

## 4 Ipêfeito

The work *Ipêfeito* (see Fig. 2) analyzes a computational arte\_design relation through a research project that has developed a computational device emerging, since it presents itself as an unconventional visualization of data of environments. It functions as an artistic work by proposing reflections about our relationship with the environment and nature.

The work in question interweaves concepts of art, technology and design, to result in a wearable device, which aims to measure the quality of the air in which it is exposed through the MQ-7 gas sensor, detecting the carbon monoxide gas (CO), released into the environment naturally or by human action by burning fossil fuels, thermoelectric plants, heating systems and others. The visualization of the presence of the CO gas is possible through the leds present in the dress, which switches off when this gas is detected by the sensor, and all this action is controlled through the Lilypad arduino board, designed to be sewn into clothes and accessories.

The work involves natural and biological issues because it proposes to visually expose the action of a highly toxic gas found in our environment, but which has its emitting sources in greater quantity anthropic, that is, by human causes. Technology plays a fundamental role in enabling this visualization, where from electronic devices coupled in a dress, the interactor observes the assiduity of the CO gas, having the dress as a visual artifice where, due to the contribution of technology, it also becomes a device, a wearable.



Fig. 2. Wearable attached with lilypad board and sensor

## 5 Unveiled Body

The “Unveiled Body” project seeks a dialogue between interfaces, the body and the digital medium with cameras, computers and projectors. Together, these interfaces allow a moment to explore the visual and plastic potentials of the unveiled body and the surrounding nature, it also gives opportunity to be placed next to other textures, expanding a powerful dialogue that comes from this observation. The images are captured by digital cameras and later the collages are produced by editing photos of plants with various textures, combined with photos of regions of the body, with the intention of approaching it as visual and plastic power, as well as enlarging the context of aesthetic experiences from the textures present in these forms.

Subsequently, these images are processed inside a code within the processing program, which together with the camera of the computer, interprets the color change of the pixels of the captured image and, in this unstable area of color change, projects the collage, causing the printing from the motion, unveiling a “hidden” image behind that disturbance in the pixels (see Fig. 3). As the person moves in front of the camera, the projected image is transformed, so that the motion captured by the color change its pixels through the software processing, identifies the area and replaces it with the collage image. This replaced area changes cyclically over a period of time.



**Fig. 3.** Collages made from photographs of body parts and plant textures.

The experience of the work takes place in an environment with music, where the purpose is to stimulate the movement and consequently the interaction and revelation of the collage. The act of unveiling an image, a region, is related to the act of unveiling the body, to discover its limits and sensations, in the case of the work “Body Unveiled”, it moves to observe. This observation has the potential to open dialogue with new textures and collages by mixing different textures. The viewer’s gaze is guided by curiosity and strangeness stimuli to keep moving and observing, to extend the aesthetic experience with the veiled image, taking that look into a space of imagination.

## 6 Emotional Politics: Orchis Food Truck Project

In the genesis of our artistic process, at the center of the system and the device of artistic work, affectivity can be studied under the angle of individual and collective sensibility, as in an informational relational process. In this sense, our research is interested in several aspects related to art and nature, its sharing and its collective work with teams and other laboratories. In addition, we study the effects of human relationships with their environment, to understand current political issues and individual feelings, as proposed in the work Orchis Food Truck (see Fig. 4).

The term Orchis, which means testicles, was first used by Theophrastus (c.372: 287 BC), Greek philosopher, disciple of Aristotle. Theophrastus compared the tuberous roots of some Mediterranean orchids with the human testicles. For this reason, since the Middle Ages, aphrodisiac properties are attributed to orchids. The relation of art and nature is not recent, but the relation artificial\_natural gave rise to a type of art that became known as bioarte (1997), or art and artificial life (2004). In the Computational Art Research Laboratory of the Universidade de Brasília (Media Lab/UnB), we developed an artistic project, in which a beautiful Orchid controls a 3D chocolate printer that symbolically controls the artificial nature, currently referred as technology, to enter into communication with humans.



**Fig. 4.** Artwork Orchis Food Truck, exhibited at Museu Nacional da República, Brasília-Brazil

The first prototype of the Orchid as an aphrodisiac cyber flower, converted the flower's vital signs like moisture and heat from the environment, to the 3D printer that printed real-time random shapes from genetic algorithms. It was thought about the possibility of generating mutating forms to approximate the context of artificial life in relation to natural life, with generative forms as environment for the print.

## 7 Morphogenesis

In the artistic context, we think of its origin in the primitive geometric cube as morphogenesis of the design, which, when subdivided by random parameters, generates a complex pattern by repeating itself within the form. The repetition of the pattern gives rise to a form known as fractal. The modeling of the final form is given from the logic of self-similarity.

For Mandelbrot (2016), fractals are graphic representations of chaos and the logic of self-similarity refers to the forms of nature. The research considers that the origin of its form, is its DNA, that arises from algorithms structured from the concept of art and artificial life, meaning that no two equal impressions will ever occur. Another characteristic, which according to Varela and Maturana, the living being is defined according to its capacity to self-organize. After the artificially generated form, artificial life, establishes contact with the natural environment, receiving signals that will cause

its mutation and new adaptation of its morphogenesis. The Food Truck, in this proposal aims to bring to the community of Brasília-Brazil located in risky areas, moments of socialization, considering the relation of art and gastronomy.

From the morphogenic (see Fig. 5) point of view, Media Lab/UnB research works with the primitive form of the cube as a original element. It is considered that, when subdivided by random parameters, it generates a complex pattern that repeats itself inside the form. The repetition of the pattern gives rise to a form known as fractal<sup>2</sup>, as shown in the figure below.

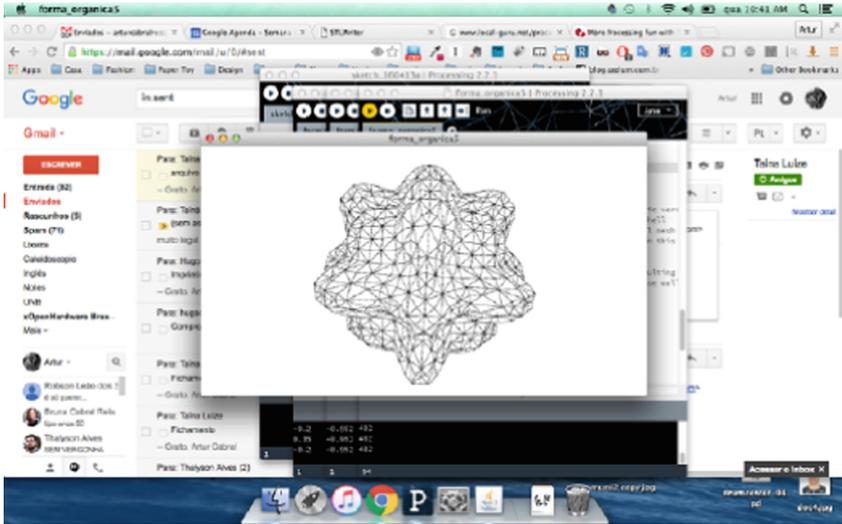


Fig. 5. Form created from pattern repetition

## 8 Art and Artificial Life

The initial genes in this generative way function as parameters stored in an array of variables that constitute the genetic matrix of the form to be printed. The sensors that monitor the plant, as well as the plant itself, acting as a natural sensor, sends data to the system, producing a new matrix and altering the generation of the form, synthesized as a new genetic coding. From a process known as “crossing over”, the original form exchanges information between the matrices of different genetic codes for a mutation to occur (see Fig. 6). The final form gives rise to a genetically modified organism. As feedback to the plant, the system returns process data in the sound form, which functions as stimuli for the monitored plant. The prints resulting from this process are sequences in which the primitive forms intertwine with poetic results, unexpected, and therefore emergent forms.

<sup>2</sup> Theory developed by Benoit Mandelbrot (2016).



Fig. 6. Printed forms made by the orchid

In another experience we proposed a telematic version of the process, through which an orchid was monitored in an environment located at Museu do Amanhã - Rio de Janeiro, Brazil, where the *Hyperorganic* event (coordinated by professor Guto Nóbrega) was held in 2018. A setup was tested in which the two laboratories remained connected via video conferencing through Google Hangout platform (see Fig. 7).



Fig. 7. Remote vision of the Media Lab during the *Hyperorganics* event

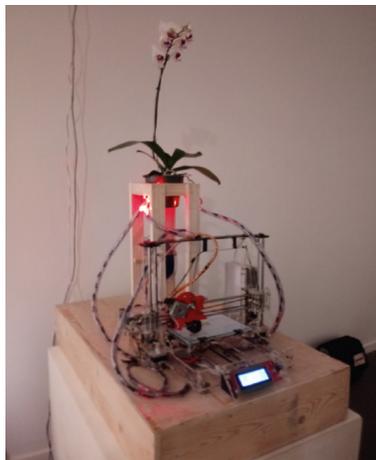
Data exchanges between the two environments (Media Lab/UnB and Museu do Amanhã) were facilitated using the OSC protocol, which interconnected the two laboratories through the NANO server, located in the laboratory at UFRJ in Rio de Janeiro, Brazil. The ambient signals (temperature, humidity and lighting) were captured immediately from the sensors connected to the Arduino and consequently sent to the network. But the galvanic response of the plant requires very specific and variable adjustments because it is a living organism. Two electrodes are connected to the plant leaf so that, a small current transits from one point to the other through the leaf.

Variations of this potential depends on the conductivity of the plant, which varies according to its biological characteristics and its interaction with the environment. After setting up the system at the Museu do Amanhã, we began the experiments. A 40 in. TV screen was used as a monitor for the plant signals sent to the server, as well as for receiving images of the Media Lab/UnB in Brasilia. After a series of adjustments that practically took place in the first and second days of the experiment, we finally got a good response of the system to the given stimulus in the orchid. The data traveled from a setup at the Museu do Amanhã to a server at UFRJ and could be viewed in the form of graphs in our interface, created in the programming language JavaScript for this purpose.

## 9 Orchid Prints Its Aphrodisiac Information

In the new version of the proposal, the orchid prints its aphrodisiac information in chocolate, as an art form in a Food Truck. Aphrodisiac type of foods such as chocolate, pepper or cinnamon have nutrients with stimulating properties and therefore increase the production of sex hormones and activate libido.

The first version of the proposal shows how its signals are transmitted, and in a process of visualization, the viewer realizes that there is a correlation with the printer. The new version aims to mount a 3D printer to print specifically chocolate. For its formal fulfillment, was necessary structure from the current open source technology of 3D printing, an adaptation to make printing of information in the form of chocolate possible. For the first version, with the team and support of teachers specialized engineers, it was possible to implement the current system. The new proposal is based on our own experience on setting-up a 3D printer created from the philosophy of free hardware and software (see Figs. 8 and 9).



**Fig. 8.** First version of the work exhibited (2017).



**Fig. 9.** New version with chocolate print (2018)

## 10 Conclusion

How to study emotions in the context of computer art? To do so, it is necessary to advance studies on computational and cybernetic art to create interactive systems with artificial life components involving nature and programmable machines. According to Venturelli (2017), computational art is an art form, which is structured from four basic references: a definition, an ontology, aesthetic characteristics and recognition of its status as art. For the author, computational art shows that creation in this field involves more general common issues, in *statu nascendi*, to the artistic, technoscientific and social domains, which provide the modes of structuring, methodology and programming techniques introduced in the process.

Computational poetic does not always refer to the computer or to logical-mathematical operations; sometimes it is based on intuition only, in which art works as mathematics without logic and truth. In the development of the work, artistic references were analyzed by renowned Brazilian artists such as Guto Nóbrega, Gilberto Prado and Eduardo Kac, who in the field of art and technology approach issues that will be studied as the machinic relation and nature, when they complement themselves and raise the possibility of coexistence.

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