

Jônatas Manzolli**Multimodal generative installations and the creation of new Art form based on interactivity narratives****Topic: (Multimodal Installation, Music)****Author: Jônatas Manzolli**

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Abstract:

We present the development of generative installations and interactive narratives as an interdisciplinary research methodology. The key points introduced here are: investigation of new paradigms on human cognition mediated by interactive technologies that attempt to describe how the creativity operates [1]; development of new technologies that incorporate interactive techniques based on the integration of multimodal signals [2]; the creation of new Art forms based on interactivity narratives, digital music instruments, virtual soundscapes and synthetic visualization [3]. These systems can be evaluated from the perspective of the interaction between agents and devices generating sounds, video and 3D graphics. Therefore, the unfolding concept is: the behavior of agents in an immersive space, interacting with various devices, could indicate how this space affect their actions and how meaning is constructed in the course of their interaction [2]. Our research project is anchored in a multimodal laboratory where we study human cognition and music creativity supported by digital interfaces, computer graphics and motion capture. It is an interactive environment with a large 3D screen and an eight channel sound diffusion system. In order to describe interaction and the generative design in such environment, we present two works: "**Danças do Vento**", a interactive multimodal soundscape and "**Eólia**", a virtual harp played with a mobile phone. Moreover, immersion in such systems might induce a unified implicit and explicit experience, facilitating creativity, discovery and understanding by both expert and novice users.

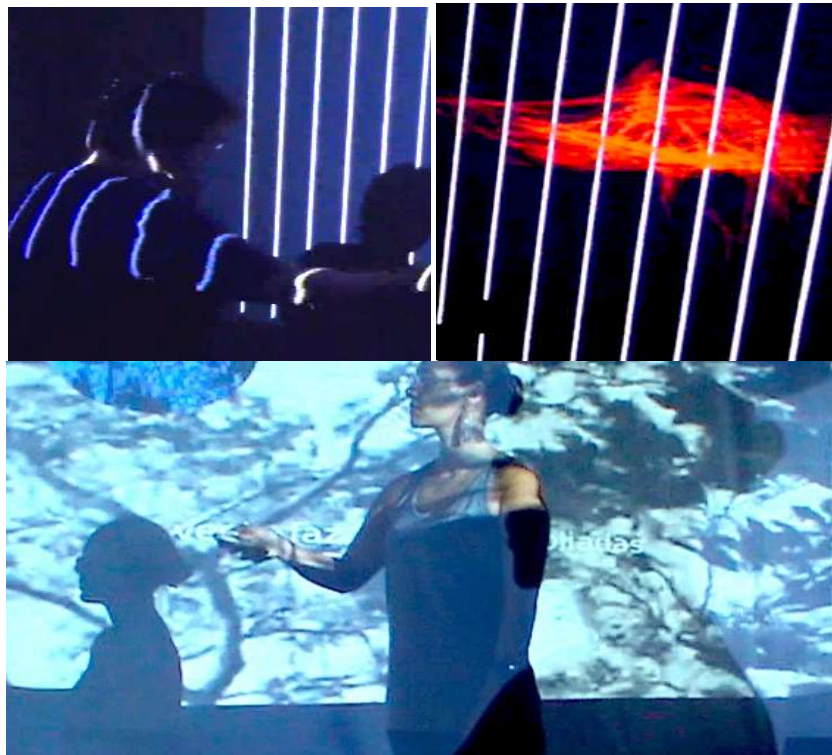


Figure 1: the virtual harp (top), performance of "Danças do Vento" (bottom).

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Multimodal Generative Installations and the Creation of New Art form based on Interactive Narratives

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– Abstract

We present a recent study on multimodal generative installations that can be described as immersive and interactive infrastructures in which is possible to generate, interact, analyse and storage multimodal information (audio, video, images, human movement and bio-signals). The article starts with a theoretical viewpoint based on the motion of Presence followed by the description of the computer environment implemented in our study. The aim is to discuss a unified experience where data and users are merged in space and evolve coherent in time. Our approach is based on two kinds of interactions implicit and explicit one and on expansions of the local virtual experience to a ubiquitous one, using the Internet. Shortly, we discuss how the implicit and explicit interactions, local and remote agencies are used to digitally synthesize images and sounds in real time and to furnish the man-machine interplay within immersive environments. Finally, four multimodal installations are presented to exemplify the interactive and generative design used in these artistic works.

– 1. Introduction

– Firstly, this paper describes compositional processes and generative design of four recent multimodal works where integrated theoretical and technological framework was deployed in the search of delivering novel ways of technologically mediated perception and interaction with immersive digital media [18-20]. Complementary, our research is anchored in a series of artworks described as interactivity narratives and supported by digital music instruments, virtual soundscapes and synthetic visualization [14-16]. We also have studied how virtual spaces, furnished with interactive soundscapes, digitally generated sounds and 3D animations and interactive video-clips contribute in understanding creativity [17].

– On the other hand, recent research has attempted to study human cognition and understand how the creativity operates in different contexts [1-6]. It has been developed research on interactive techniques based on the integration of multimodal signals and the analysis and storage of audio, video, images, human movement and bio-signals in virtual reality spaces [7-9]. There are viewpoints concerning to the analysis of body motion and emotional contains when apply to the design of intelligent user interfaces and to enhance the man-machine interplay [10-12]. There is also research in the perception and interpretation of complex intentional movement patterns using neuroimage techniques [13].

– Dialoguing with these recent studies, this paper reports recent developments obtained at the

NICS/Unicamp and the eXperience Induction Machine (XIM) at University Pompeu Fabra, Barcelona. The XIM laboratory is an immersive room equipped with a number of sensors and effectors that has been constructed to study human cognition [8, 9,19].

– In the following section a theoretical viewpoint anchored on the motion of Presence is presented. It follows a section on an interactive environment model that is based on implicit and explicit interaction, performance with digital musical instruments (DMI) and the boids algorithm used as core computer engine. Last section elucidates the previous ones describing four different multimodal installations: “Danças do Vento” Portuguese for wind dances, “Eólia” for Aeolean, “Pássaros de Papel” for paperbirds, and CromaCrono≈ for chroma-chronos.

– 2. Theoretical Perspective

Next sub-sections introduce a set of definitions related to the terminology used in the study followed by a brief discussion on the concept of Presence that furnishes most of our assumptions on the immersive rule of multimodal interactions.

2.1 Starting Points

Our study aims to a) create a unified experience where data and users are merged in space (i.e. a true mixed reality experience) and b) evolve coherent in time (i.e. narrative progression); c) explore and exploit both implicit and explicit cues from users in their individual and collective interaction with the system; d) use novel multi-modal sensing and effector systems to boost interaction with and understanding of the dataflow generated during man-machine interplay.

We also acquire that in these processes the computer acts as an autonomous adaptive sentient guide that assists humans to explore creative spaces and discover novel patterns driven by both their implicit and explicit (re)actions.

Moreover, the user parametrical control on the computer GUI and agent’s movements captured by tracking systems are called here as *explicit interactions*, complementary, *implicit interactions* are related to capture of bio-signals to infer affective states and subliminal perception, and *ubiquitous interaction* is remote agent interaction over the Internet. Figure 1 presents the general schema of the study. It illustrates a) two kinds of interaction within a mixed reality space (implicit and explicit), and b) the expansion of the local virtual experience to ubiquitous interaction using mobile devices (see also Figure 2).

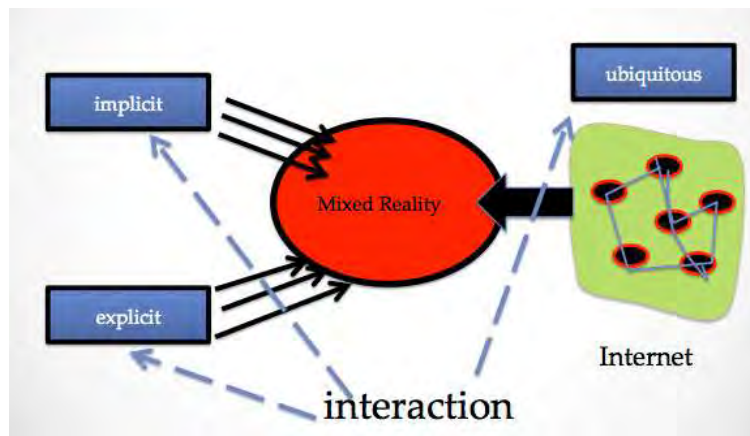


Figure 1: Diagram of the general schema of the research reported here. It is based on implicit, explicit interaction on a mixed reality environment and ubiquitous interaction over the Internet.

2.2 Presence & Virtual Reality

In order to study the constructions of meaningful relationship between agents and environmental stimuli in a virtual space and explore their interaction with animations and sound-generative processes in real time, our research is anchored on the motion that interactive media within mixed/virtual reality environments induces a agent coupling with the space. It is defined as the *sensing of Presence* [7].

The theoretical viewpoint is that the delivery of Presence is closely tied to an understanding of consciousness and, in particular, of the interplay of implicit and explicit factors in the construction of human behaviour. Presence has long been a key concept in tele-operation and virtual reality (VR) and has been defined as the “*sense of being in a virtual environment*” [18]. It is not clear, however, how this “sense” is generated and it is not uncommon to see it explained with the notion of “the suspension of disbelief” coined by in the early 19th century by the poet and philosopher Coleridge.

– It is also found in recent literature that the notion of Presence results from the interplay of both central and peripheral factors and that it should be assessed through a number of convergent measures that include measures of the subjective, physiological and the behavioural state of the user [20]. Therefore, Presence, induced by virtual and/or physical sources of stimulation, is governed by a number of principles that underlie human experience, creativity and discovery. In our approach the notion of Presence indicates that there are essential inputs for the construction of self-referral agencies. Thus we deploy methodological efforts focusing on interactive media within mixed reality environments in order to study the constructions of meaningful relationships between agents and environmental stimuli in virtual spaces [19].

The assumption is that the interaction of an agent or group of agents with an immersive space, using various interactive devices, indicates how these processes affect their behaviour and the meaning that is constructed by them. Therefore we explore human accessible mixed reality systems where the information about the users’ explicit (e.g. actions, gestures, vocalizations, etc.) and implicit (e.g. affective states, subliminal perception, action tendencies, cognitive states, etc.) interactions within the environment dynamically shape the data’s presentation to the user and thus the user’s Presence in the data space [17].

– 3. Interactive Environment Model

– Our objective is to test the environment capacities and functionalities to produce audio-visuals as stimuli (effectors) and motion tracking and biosignals caption to evaluate agents' responses (sensing). We search for correlation between implicit and explicit interaction related to real time transformations on audio and video. We are using audio descriptors analysis [21] and movement descriptors analysis to study the interactive control of music based on body expressions [10,11]. Within this analytical perspective, our aim is to test generation of audio, video and the system capacity to integrate bodily expressed movements and their correlation to emotional contents.

– For controlling the dataflow, we are using digital musical instruments (DMIs) [22]. DMIs differ from their acoustic counterparts by using computer technology for sound generation and electronic instrumentation techniques for the acquisition of performer movements, allowing for unprecedented control of sound and media synthesis; performer actions are mapped to the control of sound synthesis parameters and computer graphics generation using either explicitly-designed associations or intermediate transformations or machine learning systems [23].

– Our model also dialogues with the mathematical notion of dynamic system. We conceive that man-machine interaction can be described by concepts such as stability, instability, and disturbance and it is capable of producing self-organized behaviour when implicit and explicit interactions are coupled. Moreover, we started our modelling, searching for a simulation of dynamic system to be the core of the machine counterpart behaviour. Thus, we chose the boids algorithm to be our intrinsic machine generative engine, for its characteristic of simulating in computer software the collective organization of bird flocking.

– Created by Reynolds [24-25], the boids algorithm is a computer model of a dynamic system that simulates bird flocking controlled by a set of simple rules to determine their flights, collective organization and trajectories in space. Reynolds declares that procedural models simulating complex natural phenomenon can aid scientific understanding of them. Further, the computer simulations help to recreate the phenomenon and control it and they can be also used in computer animation, games and the arts.

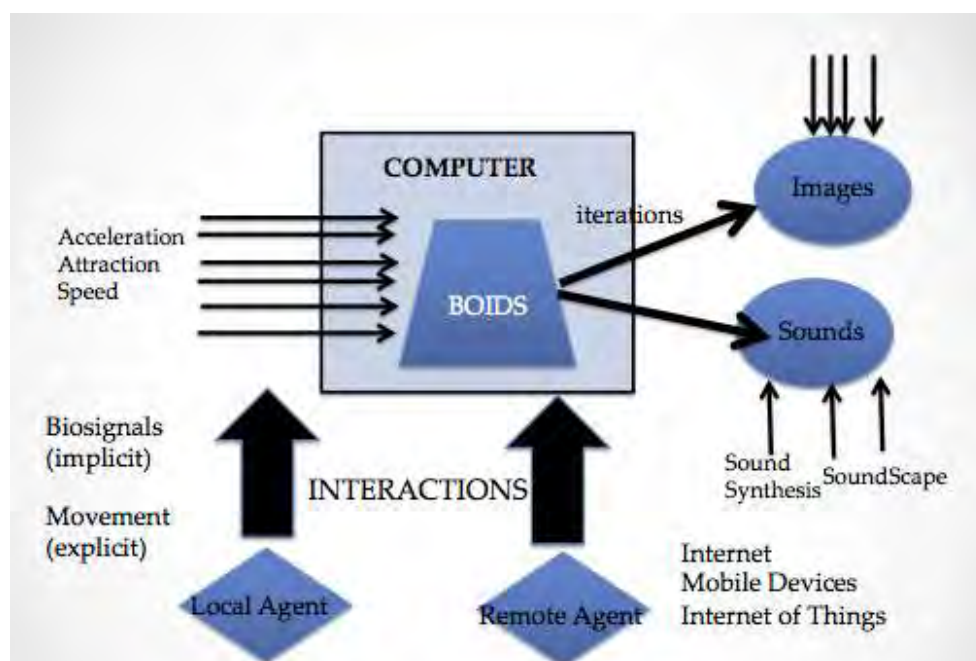


Figure 2: The diagram synthesizes all aspects of the model discussed until now. The explicit interaction based on body movement and the GUI control, the implicit interaction based on capture of bio-signals, the boids algorithm generating images and sounds in real time, and remote agent interaction over the Internet.

– 4. Multimodal Installations

Shortly, in the context of creating computer systems for aiding generative composition and interactive performance with multimodal content, this article presents a research on implementation of computational resources for controlling immersive digital processes and managing and sharing via Internet, a multimodal interactive process.

In the next sub-sections we presented the room infrastructure used in our research followed by brief descriptions of four multimedia installations: “Danças do Vento”, inspired by the dynamic behaviour of wind, “Eólea”, a virtual Aeolian harp, “Pássaros de Papel”, a parallel between migrating birds and people, and “CromaCrono≈, a system for audio-visual improvisation in real time.

The reported works are based on a) physical spaces and infrastructure for interaction and digital immersion; b) development of computational models for interacting with digital devices producing sensory multimodal signals; c) computer simulations to test the systems behaviour and d) interactive performances with local and remotes agents.

The rule of these installations can roughly be classified in three main purposes: a) performer-interaction (single or group performances); b) interactive sound installations, typically group performances where performers interact with objects in a space creating/modifying sound or media events; c) dance-music works, group performances typically involving dancers and musicians, where dancer movements can influence the music being performed.

4.1 Infrastructure

The interactive room used to create the installations is a multiuser mixed-reality space covering a surface area of 7x7m (Figure 3, left) equipped with a set of sensors and effectors. The effectors

include computer graphics projected in 4 complementary walls and an octophonic sound system. The sensors are: system for capturing and analyse human motion and a system for capturing bio-signals. Two microphones and a video camera are placed as audio-visual sensors and recording devices.

The infrastructure provides physical space and audio-visuals to experiment with sonification and visualization and to interact with synthetic devices such as soundscapes, interactive video, animation and 3D-graphics. It is also possible to the agents to perform music, dance and acting.

All these are linked to the concept of mixed reality where agents in the physical world and avatars are exchange information in real-time. The data-flow of the environment is presented in (Figure3, right). There are three systems working together: Effector System: produces visual and audio stimuli and receive information from the sensing system and from a Database; Sensing System: produces multimodal signals to be used as controller of the effector system and storage information; Storage System: storages all information that circulate from sensing and effector systems.

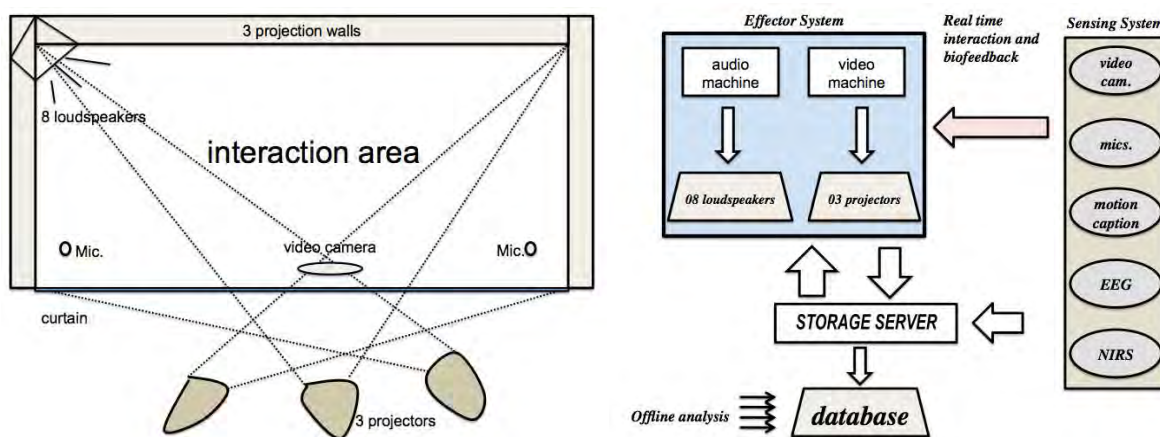


Figure 3: Interactive room basic infrastructure (left). Dataflow of the processes in the environment (right)

4.2 Two wind Installations: Danças do Vento & Eólea

In these two installations we search for relating performers' movements with sounds and images resembling dynamics and rhythmic behaviour of the wind. In "Danças do Vento", the concept is to build an interactive performance environment organized in four different "wind dances". It proposes an interaction with sights and soundscapes described as "emotional states of the wind": Breeze: wind softness, Chimes: wind chants, Wind-works: products of wind energy, and Storms: wild wind rumblings. This work can be accessed in:

http://estudio.nics.unicamp.br/watch_video.php?v=9HMYHGGRO54H

In "Eólea", the concept was to build a virtual Aeolian harp. We simulate the wind behaviour using the numerical orbit produced by the boids algorithm. Similar to the blowing of the wind in open air, the boids are used to interact with a 23-strings virtual harp. The string sound is synthesized in real time by the Karplus Strong algorithm [26]. Performer's movement with a mobile phone disturb, disperse

and/or attract the boids what provoke collisions between the boids and the virtual strings, and than sounds are generated. This work can be accessed in:

http://estudio.nics.unicamp.br/watch_video.php?v=5WX6U6HU8R27

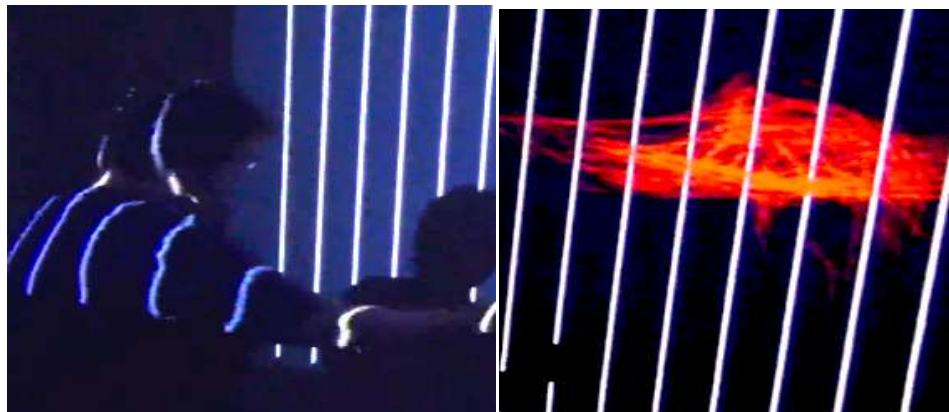


Figure 4: Image of “Danças do Vento” (top). Image of a performance with the virtual harp “Eólia” (bottom)

4.3 Pássaros de Papel

This multimodal installation addresses two concepts: a) human ability to extract data from natural and artificial phenomena in different scientific disciplines which by far exceeds our ability to understand them, and b) since many of these natural and artificial phenomena we don't comprehend, migration of birds and people are not yet fully understood. Probably because limitations on our ability to represent and experiencing migratory phenomena and live together with others.

“Pássaros de Papel” establishes a parallel between birds and people migrations. It stats that *when birds fluttering their way south in their wrinkled V-shaped flocks comes to mind, often along their path, between breeding and wintering grounds, comes an spontaneous sensation: they are not only flying wings in the sky. They are spreading ideas, producing colours in dark storms and many times expressing people's behaviour.*

“Pássaros de Papel” structural elements are: large screen projection, soundscape in a quadriphonic sound diffusion system and local network to interact with mobile phones. It is presented in a semi-darkened room, the graphic animation and the quadriphonic soundscape that features birdsongs, people's voice and environment sounds, are modified and mutated by the visitors.

The interactive soundscape consisted of samples from three sound database: a) birdsongs and environment sounds related to migration of birds, b) people's song, voice, sound of crowded squares, celebrations, football games, etc. and c) pre-composed low frequency drones.

The boids algorithm is applied to generate large digital birds. Differently from the previous installations, the boids numerical trajectories are used to generate colourful wings. In other to obtain these wing like shapes, a two-dimensional bicubic interpolation is applied to the boids sequence of (x,y) points. Interactions with human agents modify attraction, velocity and acceleration of the boids that in turning are used to mould shapes, dispersion in space, number of wings and fluttering behaviour.

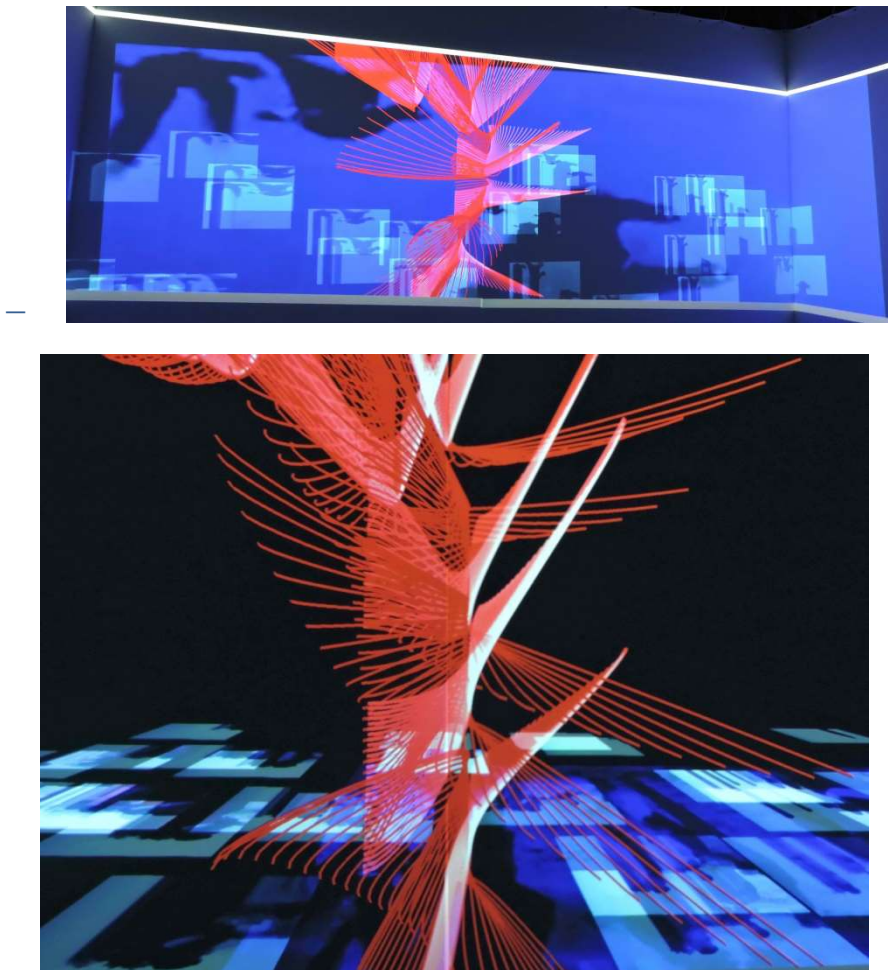


Figure 5: Photos of “Pássaros de Papel” featuring the large screen projection and the wing-shapes generated with the BOIDS algorithm and bicubic interpolation curves.

4.4 CromaCrono≈

This is a system for audio-visual improvisation that produces digitally synthesized sounds and images in real time. Departing from observations on the way sensory processes are integrated with the environment, CromaCrono≈ paradigm exploits the interaction of space and time from the human agent perspective.

It expands the notion of texture: from physical and tactile sensations to the cloud of events that are perceived surrounding the subject. Than, texture is conceived as a mass with a density of interwoven processes, which increases as much the processes are interconnected.

In CromaCrono \approx , Simple geometric shapes and computer-synthesized sounds support that textural architecture (see figure 6). The boids are used to control several parallel processes generating an animated audio-visual in real time. Boids trajectories are used to display hundreds of primitive geometric shapes varying in shape, colour, speed and dispersion in space. All this variations produce a visual texture that is coupled with generative rules for controlling sounds and interactions with local and remote agents.

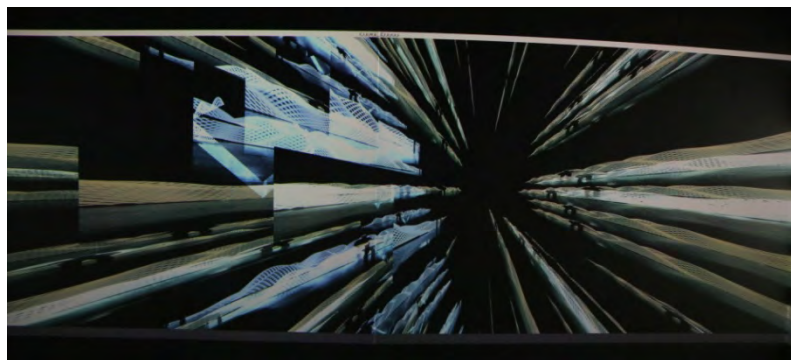


Figure 6: Photos of the CromaCrono \approx environment illustrating the complex animated texture produced by the system in real time. It is an audio-visual texture of interwoven processes which density increases as much they are interconnected.

Sounds are generated in real time by four different standard synthesis methods: additive synthesis, FM, wave-shapping, and Karplus and Strong algorithm. A granular synthesis engine post-process is applied to the initial synthesis signal according to spatial projection of two colour-voices: the bluish and reddish ones. In other to emphasize the visual discrimination of two independent interwoven textures, the opposition in the colour spectrum defined these starting colours.

The shapes in the complex visual textures (see figure 6) are associated to sound synthesis engines: spheres to additive synthesis, squared frames to FM, planes to waveshapping and triangular frames to Karplus Strong. Colour shades are changed in real time by audio inputs. The colour RGB vector representation is coupled to variations on audio features extracted from microphone inputs, and from

the sounds produced by the systems. Audio features extracted from the audio are: variations on the fundamental frequency, variations on the audio intensity and the spectral Chroma.

Therefore, the whole system works as a unified generative process that digitally synthesizes sounds and images, receive GUI and remote control from the Internet, and in turn generate audio and image outputs (see figure 7, top).

Despite of many processes controlled simultaneously, the system is design to operate in a loop of 14 parameters. They are organized in a “Composition Curve” with 10 iterated-sections, 140 parameters in total (see figure 7, bottom). That economical representation allows fast transmission and communication peer to peer over the Internet.

Genetic Algorithms operate over the whole generative engine. Mutation, crossover, insertion, selection are applied to the 14 control-parameters and structural operations shift (left/right), transposition (up/down), new-curve, square-curve and undone are applied to the whole curve.

Economic set of parameters and small set of compositional operations, make possible to evolve and share in real time compositions/improvisations via Internet. Local and remote agents control together the generative process of CromaCrono. Sound and images are synthesized in local machines while agents exchange parameters that produce a “texture of times”.

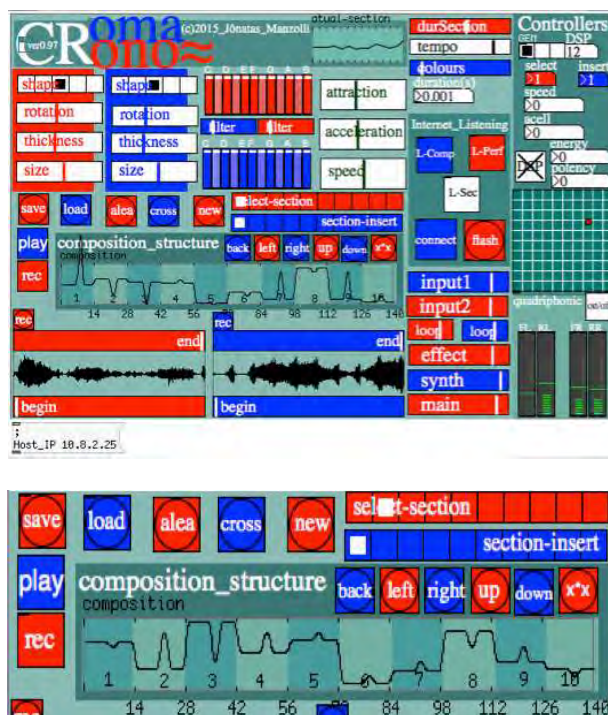


Figure 7: GUI of CromaCrono showing all the integrated control parameters of the system (top), and in detail the “Composition Curve” and the buttons to apply genetic and structural operations over the curve. A remote user can also “press” the buttons using a mirror program in a location via a VPN connection.

– 5. Discussion and Conclusion

We presented a paper on the development of multimodal installations based on a methodology anchored in interactive mixed reality spaces. Starting upon the concept of Presence, a computer model to interact with local and remote agents affording implicit and explicit information was discussed. Four examples described mechanism for generating sound and images via computational mechanisms. Generative processes instantiated on the computer use the boids algorithm in both images and sounds generation and then the system generate animations, control soundscapes and digitally synthesized sounds.

Each installation has specific characteristics, different aspects in which their interactive narratives are constructed. “Danças do Vento” departs from the dynamic behaviour of the wind to create visuals and soundscapes featuring four different “wind dances”. “Eólia” simulates a virtual Aeolian harp. The trajectory of boids, modified by performers using mobile devices, produce sounds when the boids collide with the virtual strings as the wind plays strings in an outdoor space. “Pássaros de Papel”, draws a parallel between migrating birds and people and its generative algorithm is based on bi-cubic interpolations of the points generated by the boids. CromaCrono≈ is a system for audio-visual improvisation in real time. In this case, the boids are used to control parallel processes generating a complex audio-visual texture composed by four primitive geometric shapes, colours and digitally synthesized sounds. A small set of parameters controlled by genetic algorithms makes possible to share a real time improvisation via Internet controlled by local and remote agents. Despite of each installation has a specific design they all preserve an aesthetic unit aligned to principles of interaction discussed in the paper.

Finally, we would like to point out that Art, in particular generative and digital Arts, play an essential component in the study of creativity. Whereas Science is by necessity bound by the state of the art and the opinion of peers, Art can boldly leap beyond the shackles of collective expectations and norms elaborating and validating new principles.

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Ben Baruch Blich

The logic of curatorship: Between displaying and representing as a matter of selection. (Paper)



Abstract:

The ideas I intend to put forward in this paper are intuitively known and practiced by each and every one of us, even without a title of a curator. After all, we all decorate our houses by hanging paintings, posters, photographs, by placing statues and all sorts of furniture – chairs, tables, cabinets, cupboards, as well as lamps, stereo sets, telephones, computers, etc. to make our private intimate surroundings agreeable, pleasant and cozy.

Topic: Curating Art, Design, Architecture

Unknowingly, we all act as curators facing by each and every choice we make a dilemma of selection - should we use all or most of our collection of paintings, posters, furniture we own and display them in our private homes, or should we choose and pick those we consider important, representing taste, autobiography, political inclinations, etc., and put emphasis on those articles we find significant. In short, should we display whatever is available, or exhibit those pieces which represent an idea, an inclination, an ideology.

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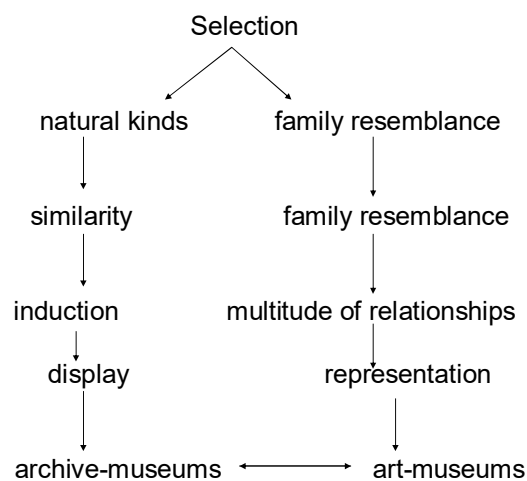
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Keywords: Representation, display, natural kinds, family resemblance, curators, art, design, architecture.