Computer
Art
Congress
4th computer art congress

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COMPUTER ART & DESIGN FOR ALL

PROCEEDINGS OF THE 4TH COMPUTER ART CONGRESS
1-3 September 2014 – School of Fine Arts/ UFRJ, Rio de Janeiro, Brazil

Edited
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FOREWORD

The 4th edition of CAC (2014) is organized with the collaboration of NANO Lab, supported by the Graduate Program in Visual Arts, at the School of Fine Arts of the Federal University of Rio de Janeiro (UFRJ). The 4th edition of the Computer Art Congress includes the Composite Session (summer 2014) of the Caiia-HUBB of the Planetary collegium, coordinated by Roy Ascott, and the 5th edition of the event Hiperorgânicos, promoted by NANO Lab which is coordinated by Carlos Augusto (Guto) Nóbrega and Maria Luiza (Malu) Fragoso. Since September 2010 NANO Lab promotes practical and theoretical research in Art with specific focus on the intersection with technology and science, offering laboratory space for practical and theoretical research in the thematic area of hybrid-natures. The motivation of this research Lab is to consolidate a transdisciplinary space for reflection and promotion of new cognitive models based on practical and dialogical exchanges.

Computer Art began its development by the 50's of the last century and the general thought was that it would mature only by the next millennium. By the 90's the Internet, the WWW, and the development of interactive interfaces changed the possibilities to go from static to a dynamic and totally new multidimensional art form based on feedback, processes, multiplicity and improvisation. The spreading of digital cultural practices adds to these debates, feeding either the technophobia or techno lovers points of view, with many paradoxes. The arts and sciences considered by many as apparently dichotomous approaches also bring fuel to this debate. Deeply connected with mathematics, sciences, logic and highly experimental speculations, Computer Art has founded its development and terminology in scientific concepts, frequently demystifying the sacred reverence that the mainstream ART community has cultivated.

Art critics and theorists evaluating such art with the canonical parameters of traditional art forms, maybe unaware of the complexities related with such background, have overlooked its importance. However this situation has changed with the popularity of computer technologies, its transdisciplinary and pervasive characteristics, accessible prices, the way it expands sensory experiences, the emergence of cyberspace and cyber culture, and the development of IDEs (Interface Development Environment) by artists. These facts bring radical changes within the cultural and sociopolitical field, overcoming limitations and the mannerisms imbued within the contemporary art field.

CAC. 4 came to Rio de Janeiro under the coordination of Malu Fragoso and Tania Fraga, who participates in CAC since the 2nd edition in Mexico (2008). Promoting this reunion at the Federal University of Rio de Janeiro brings about important issues, such as the recognition of the serious research in Computer Art developed in Brazil since the '50s. In the last decade we acknowledge in Brazil, as in other countries, the blooming educational programs focusing on the intersection between art, technology and computing at universities, cultural centers, governmental projects, among others. Parallel to institutional initiative a significant number of artists and researchers have dedicated their work to the creation of independent garage-labs or *fablabs*. Even the fields of architecture and design have begun to focus on these ideas bringing together projects

that seemed to be conceptually separated for decades. Most of the work presented at the 5th Hiperorgânicos was possible because of the partnership between the School of Fine Arts and the Faculty of Architecture, through the promotion of NANO Lab and LAMO3D and the interaction of our graduate and undergraduate students.

It is important to emphasize that the field of Computer Art is firming up and in-depth reflection is required on the issues related to its reverberations within society. Therefore, to have the 4th Computer Art Congress held in Brazil, with the participation of the Planetary Collegium, within one of its most respected institution, the School of Fine Arts of the Federal University of Rio de Janeiro, is already bringing incentives to all of us artists and researchers. The opportunity to share artistic proposals and ideas with such selected group is already an immense privilege, which will surely influence the near future development of Computer Art in Brazil.

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KEYNOTES ABSTRACTS

- **Context Engineering the Subject/Object Relationship to Generate New forms of Perception and Cognition**

CARL SMITH

Hybrid techniques and technologies are generating a conceptual and experiential working space to reconfigure new relationships between the perceiver and the perceived. We can now hack the individual's sense of self and relationship to the world (exploring the subject/object relationship). As a result of these perceptual technologies (that merge the physical and the virtual dimensions of reality) new forms of vision and knowledge construction are becoming available. How adaptable is our perception? What are the limits of stretching the materiality of the body? New methodologies are being designed and require the investigation of new literacy strategies. This presentation will examine how these technologies, techniques and methodologies are enabling a new era of sensory augmentation, perceptual adaptation, context engineering and emerging literacy forms. Among these, the ability to alter our senses and develop entirely new ones provides us with a new type of (self) control. Context engineering creates a new economy where we no longer focus on transforming the content (as the primary activity), but instead focus on how we can reconfigure our own senses and make our perception the 'content'. This represents an opportunity to humanise technology. The objective of 'Human Centric Hybrid Literacy' is to develop our understanding of all the processes related to hybrid data, interaction and knowledge creation, in this emerging field.

Keywords: Perceptual technologies, Hybrid Literacy, Human Centric, Context Engineering, Perspective.

- **Investigations in "Digital Image Processing" at USP and UNICAMP. A personal experience from the early beginnings of this art (1969/70)**

GIORGIO MOSCATI

In the talk the result of my collaboration with the plastic artist WALDEMAR CORDEIRO, almost half a century ago (1968-1970) will be described. At that time CORDERO was already well known due to his works in the field of CONCRATE ART. Our collaboration gave as a result the creation of two works considerd innovatives in the use of COMPUTERS to generate "ART WORKS" and "MANIPULATE IMAGES". A description of the capabilities of computers available in BRAZIL at that time and how it was possible to create ART WORKS that were immediately recognized internationally as innovative. In the talk the ART WORKS produced will be described in detais.

- **Metabolic Simulations: Digestive Machines in Art and Science**

GUNALAN NADARAJAN

This talk presents a critical genealogy of machinic simulations of digestive processes from the history of art and science in order to excavate alternative imaginaries of the intersections between biology and machines. Beginning with the Aristotelian concept of 'pepsis' that prepares and complicates the bio-epistemic space for the philosophical disputes

between the iatromechanical and iatrochemical conceptions of digestion, the talk will present a variety of digestive simulations and experiments that systematically demonstrated and often *theatricalized* the dynamics of these processes, including the iatromechanical 'balance chair' of Sanctorius, the 'moving anatomy' of Vaucanson's defecating duck and the canine machinations of Pavlov's experiments on conditioned reflexes to food. It will be shown that these exemplary cases of 'metabolic simulation' in addition to reflecting a tension between accurate science and artful depiction, expose the uncomfortable place of digestion in our emerging sense of embodiment. The notion of metabolic simulation will be developed further as a critical trope for an epistemic mapping of machines *vis a vis* the 'biological' drawing on a wide range of examples including the digestive contraptions of Bettelheim's autistic patient, Joey 'the Mechanical Boy'; contemporary art works like Delvoye's *Cloaca*; and the emerging technologies of artificial gastroenterological organs and the field of 'gastrobotics'. It will be proposed that such simulations exemplify how notions of consumption and alimentation figure and/or are marginalized in the historical development of machines as well as of our notions of embodiment.

Keywords: Embodiment, History of Machines, History of Biology

- **Current challenges of computer art**

LUCIA SANTAELLA

Since 1968, when the first computer art exhibition Cybernetic Serendipity was held in London, it's been almost 50 years of development of this art. Since then, computer art has accompanied pari passu the growing complexity of technological equipment and has multiplied into a plurality of tendencies, also reaching a diversity of correlations between art and science. Given the pluralism of this framework, this paper aims to explore some of the main current challenges in computer art. The main clue of pluralism lies, first of all, in the multiplication of names that this kind of art has received, which also implies a multiplication in the ways to interpret and understand it. Therefore, the topics that will be placed here under discussion are: (a) the challenge of documentation and preservation of works given the obsolescence of equipment used to produce them. (b) The modes and circuits of production and spaces of circulation and exhibition of the works. (c) Reconciliation and lack of conciliation between computer art and what is currently called contemporary art.

Keywords: pluralism, preservation, obsolescence, contemporary art

- **Body encoded**

NINA CZEGLEDY

Lately, century long beliefs of our corporeality have shifted in the process of encoding (and decoding) the human body allowing us opportunities for new expressions of identity on a borderless scale. Representation of an image has always been mediated, but due to recent advances in digital technology, the nature of mediation is changing remarkably. Thus the impact of the digital revolution significantly shifted common perceptions of the human body. The computer is a commercially generated instrument and as such, it does not promote extensive philosophical investigation. Nevertheless, digital manipulations created a dramatic change, a new affinity in the relationship between humans and machines. Are there any

specific correlations between mechanistic and ontological viewpoints? How are our brains calculating the meaning and sense out of this revised perceiving process? For many centuries in medical science the human body has been represented in numerous ways, yet partly due to moral and religious concerns, this representation has an uneven history. Today the body is viewed with a wide range of scientifically derived and technically supported methods, which have revealed new features of a previously undreamt subtlety. Homo sapiens has become a key site of scientific, social, political and cultural interpretations. In contrast to historical renderings, contemporary artists take vastly different approaches in how they depict the human body. Today the body in art as well as science is frequently politicized, symbolized, and even digitized in order to manipulate, to dissect and provoke. Artists explore the body as a technological, ideological and aesthetic construct including the intimate physical relationship with modern technology. Deconstructing particularities between scientific and artistic representation artists approach immediate and technically mediated perception, making us aware that the body has itself become a medium. This presentation is exploring analog and digital approaches offering a scientific gaze at the human body.

- **When the medium is moist – Towards an art that is telematic, technoetic, cybernetic and syncretic.**

ROY ASCOTT

The concept of moistmedia, that I introduced some twenty years ago to signal the convergence of silicon dry computational systems and wet biological process, can also serve to bridge the gulf that divides the ancient practices of traditional societies, involving plants and vegetal rituals, and the contemporary chemistry of mind. In my view the creative use of pharmacology, of both field, forest and laboratory, will constitute the primary development of art in this century. And whether a work of art is immaterial or moist, questions of consciousness will inform its development. Consciousness, like space, is primordial. It is no more generated by the brain than space is generated by the body. The brain is the organ of access, and when it is pharmacologically informed, it can attain levels of consciousness from which we can derive not only great beauty and delight, but insight and wisdom. It was here, in Brazil, nearly 20 years ago, that I first came to understand the efficacy of the chemical and the syncretic, in both urban and forest societies, introduced to me by a group of extremely adventurous and innovative Brazilian artists, some responsible for the conference here today.The many technologies - digital, electronic, somatic, plant and chemical - developed over millennia to widen and intensify the mind and the senses , have led to the emergent faculty of cyberception, with which society is trying to reconcile its traditional institutions, many of which have passed their sell-by date.. It is our emergent hypercortex, and its telematic potential, that challenges our social creativity. And, it is our sense of Self - the isolated, solitary self of western culture since the Enlightenment - that is giving way to the the multiple-self, for which we need new organisms of learning and creativity, and new systems and structures of society.

Keywords: Moistmedia, consciousness, brain chemistry, multiple-self , hyper cortex, creative organism.

HIPERORGÂNICOS / SENSITIVE SHELTERS:

- **International Symposium and Open Lab for Research of Art, Hybridization and Bio-Telematics.**

  2014's Edition of HIPERORGÂNICOS International Symposium and Open Lab for Research of Art, Hybridization and Bio-Telematics explores the concept of "Sensitive Shelters". Set to happen on 1st, 2nd and 3rd of September 2014, within the context of the 4º Computer Art Congress -CAC4, the 5th HIPERORGÂNICOS is composed two events: a Open Lab and a symposium with artists and scholars. Both activities are telematic based in nature and will be realized in presence or remotely supported by videoconference and data service. HIPEROGÂNICOS is structured over the investigative axes: art, hybridization and bio-telematics, motivated by the necessity of re-thinking art and its diverse forms of interlace with science and technology, on a special concern to the new possibilities of connectivity between natural and artificial organisms (inherent question to the relations man/machine) and the telematic potential of such interconnections, supported by contemporary communication networks. Nowadays, on the forefront investigations mobilizing research groups in Brazil, within and outside universities, are networked processes, labs distributed and interconnected in local and/or global scale. Such potential of the technologically based networked processes, already pointed by the pioneer of telematic art, Roy Ascott (1990), addresses models which are organically inherent. These models are inspirational for the creation, development and implementation of new connective realms. An integrative model (Nóbrega, 2009) has been investigated by NANO – Nucleus of Art and New Organisms / PPGAV/EBA/UFRJ, where practices are articulated in the experimentation with hybridization of natural organic life (currently plants and bees) with synthetic ones.

- **Open Lab & Roundtables**

  Developed under the theme "Sensitive Shelters" the event will present the project "Telebiosfera" an immersive environment in the form of a semi-dome, built for a bio-telecommunication experience, which has as its main interface a terrarium. In practice, the Open Lab consist in a immersive encounter (full day) between special guest artists and the public, providing experimental exchange of low and high state of the art technologies, with focus on the construction of a hyperorganic model which integrates in its body practices of hybridization, robotics, sound, data visualization, performance and architecture. Guest artists and public will be invited to explore such concepts in practice through processes during the event. Round Tables are proposed as a forum for the discussion of artistic issues inherent to the Open Lab processes within contemporary questions, as well as an interface with CAC.4 under the theme: "Field And Flow, neeting the Nature of NATURE". Our Roundtables are scheduled along the CAC4 programme. There will be access to the Roundtable through a web conference link (to be informed on the website soon). Presentations will be performed locally and remotely. The Roundtables will have the format of 15-18 minutes speech followed by discussions.

ABSTRACTS

- **Los *E-textiles* como una estrategia social**

AMOR- MUÑOZ

El elemento textil ha acompañado al hombre a lo largo de la historia en su evolución y transformaciones tecnológicas. En esta ponencia se hará un recorrido histórico sobre el textil y su relación con las máquinas y y la importancia que ha tenido en las revoluciones industriales. Hablaremos del surgimiento de los *E-textiles* y su desarrollo, la perspectiva que hay sobre estos como una segunda piel y una interfaz con el mundo contemporáneo. La última parte de la conferencia se enfocará a ver el otro lado de la moneda. Analizaremos proyectos de*E-textiles* interdisciplinarios y de corte social como Maquila Región 4 y Yuca-Tech, que que usan el performance y la electrónica experimental, con el uso de medios tradicionales como el textil, para crear piezas que logren insertarse en el ámbito de lo social y generar experiencias colectivas, usando el arte y la tecnología como plataformas de reflexión y crítica social.

- **The Inventive Nature of the Image**

ANDREIA OLIVEIRA

In the face of the complex, hybrid, expanded reality within which we currently find ourselves, the relation between man and machine, polarised along the divide of the natural and the artificial and revolving about anthropocentric posturings, is no longer sustainable. This tension is pressingly and unavoidably producing interdisciplinary crossings where Art, Science, Technology and Philosophy dialogue around common axes. In the perspective of a discourse based on concepts such as flux, field and nature emerging from a processual and systemic vision, we bring forth the idea of image, milieu and invention as developed by Gilbert Simondon. We understand invention as a mode of human and non-human existence where the act of invention belongs to the nature of Nature. As a much valued concept in the area of Art and Technology, invention is problematised through the concepts of the image and the milieu (field) where the milieu is conceived, not as a geographical concept, but as that which clothes experience and includes the technological. This causal conditioning between the experiential, the technological and geographical milieus is what Gilbert Simondon designates an associated milieu. The image is herewith understood as a temporary, intermediate reality between subject and object which exists within a polymorphous, evolutive diversity. The image, as structuring and functional, dephases itself in a transductive cycle: motor-image, perception-image, mental-image and invention-image. Thus, invention works by activating the fluxes of fields through the action of the future on the present as opening new regimes of images.

Keywords: Nature, invention, image, milieu.

- **Title: Re-thinking space through parametric design and digital fabrication**

ANDRÉS PASSARO BARCH

This lecture discusses the experience of the workshop, held by the NANO-LAMO partnership within the areas of "parametric design and digital fabrication", which had the concept of "sensitive shelters" as its main theme. The mentioned workshop focused on

responsive interactivity between shelters and users, a duality that leads to possible formal mutations through the use of sensors, which perceive changes in light, proximity, humidity, heat and sound as an input.

Keywords: parametric design, digital fabrication, user, interaction, shelter

- **Action Potential**

AUGUSTINE LEUDAR

Augustine discusses the history of plant electrophysiology from inception with the work of Charles Darwin and electrophysiologist Dr. Burdon Sanderson until the present time. He discusses some of the controversial findings of recent research in the field such as the possibility of communication across the mychorhizal network, plant neurobiology and plant learning. He discusses his practice in sonifying electrical signals in plants, how science can be integrated with art with particular reference to spatial audio and describes his work in the area to date including the current installation. He also looks at some of the cultural roots of our view of plants and how this differs in other cultures and the relationship between plants and sound.

Keywords: Spatial audio, plant electrophysiology

- **Network Music Sync Working Group**

CARLOS EDUARDO BATISTA

The Network Music Sync Working Group wants to analyze all technical aspects involved in performing networked music activities. Based on the previous multimedia and art related experiments and projects conducted by the LAViD/UFPB and TeleMídia/PUC-Rio groups (with results such as the Ginga middleware and the Arthron platform), arises a working group that is building a platform provided with mechanisms that manage strategies for audio transmission for musicians aiming to interconnect and perform networked music activities. The software platform for musical experimentation relies on a network of SiM servers, which is a software that facilitates the composition, performance and reproduction of musical pieces involving musicians and musical elements geographically distributed, and interconnected through the RNP's (Brazilian national research and education network) backbone. The platform defines mechanisms that facilitate the easy establishment of requirements and timing constraints between the elements involved in a musical piece whose execution and playback require multiple remote points for audio input and output. Different types of musical performances are supported by the platform, implementing different latency manipulation mechanisms for each audio stream connection that it builds. The platform provides different interaction interfaces, including HTML/Web, a standalone multi-platform interface and a VST plugin for usage along with DAW (Digital Audio Workstation) software.

Keywords: networked music, distributed multimedia systems

- **Synaptic connections in technological poetics**

CLEOMAR ROCHA

Synapses are the basis of contact among neurons, and are triggered by neuronal intracerebral process and also by external stimuli. The result of this process are thoughts, the reasoning. The stimuli from language are important part of synapses and can be metaphorized by

communication. People can stimulate new synapses using the language. The use of Information and communications technology optimize the communication and streamlines spatial and temporal collaborative actions, those whose products are the result of actions of several people. Within the art, this actions can be considered collaborative actions linked to their poetic means. The production of the art technological, to take the technological media as poetic material, establish several connections, that can be the collaborative production or the invitation to the agency. This is the way chosen by this speech, contextualizing the use of interactive media in technological poetics, as the trigger of synaptic connections.

Keywords: technological art, interactive media, synaptic connections.

- **The carnal collective body: when technology becomes a strategy of sensorial and perceptual destabilization**

ISABELLE CHOINIÈRE'S

This conference will present Isabelle Choinière's main research-creation strategy which is the development of a specific relationship between the performing body and technology where technology becomes the activator of a process of sensory-perceptual reconfiguration. An other process of learning. Addressed through practices of the body (somatics), her research reintroduces the body and its specific intelligence into an understanding and construction of the proposed relationship: development of emerging cognitive, aesthetic and communicative paradigms. Those strategies of sensori-perceptual destabilization demand an ontological transition of the body - through its contact with technology - which leads to two emerging concepts: that of the carnal collective body and of the collective mediated/sound body. The conference will look at the ways in which the infiltration of technological thought in the new contemporary performative scene - involving technology - will find applications in the development of new performative models. Where the interiority of the body will become mediatized, where new realities will emerge.

Keywords: Performing body, somatic, technology, sensation, perception, ontology, carnal body, mediated body.

- **Tele-sonorous body: a reflexion about dance created for, in, into the Networked Art**

IVANI SANTANA

This article discusses the concept of tele-sonorous bodies as applied to dance configurations designed specifically for distributed environments, and interconnected by advanced telecommunication networks. The concept of the tele-sonorous body is substantiated by studies of Peirce's semiotics (Santaella, 2001), the cognitive sciences (Gallagher, 2005) and by reflections on the art of sound (Migone, 2012). The prefix " tele" refers to the term telematics and to projects configured as network art. The goal is to investigate new forms of relationships between remote bodies through the concept of tele-sonorous body, thus removing the primacy of the image usually found in the field of telematic dance. I wish to address two interrelated issues: the understanding that the body is sonorous and the exploitation of this condition in network art configurations. To illustrate, I will explain the research into the body/sound relationship that motivated the performance *Darmstadt 58*, and *Gretas do Tempo* (*Gaps in Time*), both created in a local network environments. Darmstadt 58 is part of the international project *Embodied Varios Darmstadt 58* (EVD58) conducted from Brazil and developed with Spain and Mexico in 2013. In 2014, we have a new creation named *Personare* for the EVD58 project which we created with Portugal and Chile.

Gaps in Time is an artistic project composed of three works: *Memoirs of a memory:* screen dance; *Memoirs in time:* interactive telematic installation; and *Memoirs in space:* soundwalk for dance. I believe the concept of the tele-sonorous body can assist in this investigation, thus opening up methodological experimentation toward creating strategies that support the propositions asserted in this paper: presence, time and visibility.

Keywords: Telematics, Sound, Body, Dance, Networked Art

- **The Enhancement of "Field And Flow" in Musical Diffusion**

LEONARDO FUKS

Field and Flow are essential terms and concepts in acoustics. Flow may refer to the transfer of energy, through pulses and waves and also to the movement of particles. We live immersed in an ever-changing acoustic field, that provides us with a huge amount of information and stimuli. In the case of a music show with huge public address systems, most of the field and flow variables, present on stage are highly filtered out and simplified. We will try to address concepts and possible solutions to enhance the sensations of field and flow in live and playback musical diffusion. In a general model, the acoustic field of a given environment encompasses a gamut of sound sources, sound reflectors, absorbers, diffusers, resonators, sound "sinks" and other structures that define this moving map of sound and vibration. There are some typical sound fields, named by their nature, that greatly depend on the position of the observer, the occurrence of locomotion of the observer and/or sources, the relationship between the size of the sources and the frequency distribution, among other factors. Diffuse field, far field, near field, free field, semianechoic field, each one corresponding to a rather specific acoustic ambient. If we take into account the flow of particles present on the stage, around and close to the players, such as that from a wind instrument, from the mouth of a singer, from the air-conditioner outlets, the wide vibrations of a drum head, among others, new signals and sounds may be collected, processed and sent to the listeners in a more selective and customized way, entailing the experience of enhanced and augmented reality.

- **An interface between Merleau-Ponty's concepts and Gretchen Schiller's *mediadance* category**

LUDMILA PIMENTEL

In 2003, Gretchen Schiller uses the term *mediadance* to refer to art practices, which integrate digital technology into choreographic work in her thesis (Plymouth University, England). This article develops the main idea that this kind of art is an actual category that promotes new sensual experiences for the human body, . We are interested to investigate and reflect about the forms of embodiment promoted in its contemporary processes reviewing Merleau-Ponty's concepts promoting an interface with Schiller category

- **Art history: intersections with computer art**

NARA CRISTINA SANTOS

Art history needs to establish constant intersections with other areas of knowledge such as computer science, robotics, biology and neuroscience, for example, to support a historiography consistent with the network and the flow of information that computer art presents the contemporary art field.

Keywords: art history - computer art - systems - flow - network

- **From the Studio to the Lab: Art´s contribution to "renetting" the Nature**

RAQUEL RENNÓ

Each socio-historical context has its own approach to understand life. Technoscience (considering biotechnology as part of it) is not merely a neutral knowledge about reality, but a production mechanism of natural and social reality. In biotechnology, the part, the gene, designates the whole, life itself. This implies that information can be unrelated to the context from which it arises, ignoring the specificity of local. Life reduced to genetic information, is the result of a long journey in which it´s possible to identify three key moments that overlap today: the Natural History of the eighteenth century, in which life is absent (the Botanical Garden filled with timeless taxonomies) the evolutionism, which historicizes life and genetic engineering of the late twentieth century and early twenty-first century, which promotes decontextualization of life, the genetic database of a life-information suitable for transformation and manipulation. Art applied to biotechnology is in contact with new subjectivities, new life forms and discourses and generates new modes of expression that put emphasis on the problems that exist behind the specificity of the tools of biotechnology.

Artists often unveil these ideologies and visions hidden in the scientific discourse under a layer of objectivity. Proposals to create art in biotechnology analyzed in this paper propose or evidence not so much a "denaturalization", but the production of a new nature.

Keywords: Art and biotechnology, artificial life, genetic code.

- **Art and biotechnology, artificial life, genetic code.**

RAQUEL RENNÓ

Associate Professor – Center for Culture, Languages and Technology – Cecult, UFRB (Universidade Federal do Recôncavo da Bahia, Brazil). Digital art researcher at CNPQ (Conselho Nacional de Desenvolvimento Científico e Tecnológico, Brazil) in arts, science and technology, member of the International Society for Biosemiotics Studies, Institut Català D´Antropologia (ICA, Barcelona) and the International Center for Info Ethics (ICIE, ZKM, Karlsruhe). Holds a PhD in Communication and Semiotics and was a postdoctoral research fellow in the Photonics Dept. at Mackenzie University, Brazil . Has been working since 2001 in digital art projects with artists from Spain and Finland. Has presented papers and projects at UCSD (University of California, San Diego), Plymouth University, Universidad de Buenos Aires and Sussex University. Currently is part of ZZZINC, a cultural association for cultural innovation and research in Barcelona, Spain and is a consultant for online courses in art, science and technologies at Universitat Oberta de Catalunya (UOC, Spain).

- **Electroacoustic music environments: re-thinking music composition and listening**

RODRIGO CICCHELLI VELLOSO

In this talk, we discuss the transformations which the craft of music composition and listening have gone through since the *musique concrète*,*Elektronische Musik* and *Computer Music* revolutions. After a brief historic account in which contemporary settings such as *free improvisation* and*participatory sonic art installation*s will also be analyzed, we tackle the

challenges facing composers today when the notions of *authorship* and *music*itself have been weakened.

Keywords: Electroacoustic music, Music composition, Listening

- **CyberBioDiversity**

SUZETE VENTURELLI

How art behaves on planetary social issues? How artists engaged in social movements? What do you might to do save the nature? In this sense, this paper is aimed to describe the creation of cyber toyart with interactive objects, aiming to collaborate with these issues. The proposal includes the installation of a machine entertaining game. The player has to try to pick up objects like stuffed animals, toys or gadgets. The machine will be placed in the Paço of Arts that inaugurates the installation entitled Extinction! The artist was invited by Priscila Arantes, technical director and curator of the Paço of Arts, to develop a project in augmented reality. Extinction! consists of a computer system for game art, considering the hybridization between art, activism, design, pervasive and ubiquitous computing (related to artificial intelligence concept), and augmented reality. The public is invited to play on a machine to catch bugs, which may, in a given time, catch balls with markers that show a virtual Mico-Leão, modeled on free 3D modeling software. The markers are displayed in augmented reality software through installed on computers or on mobile devices such as mobile cameras. Visitors can take the ball to get hold of. To play, you must purchase chips (R$3), which are inserted into the machine to reboot. The funds raised will be donated to the the machine for Greenpeace ONG, to be invested in raising awareness of the importance of preserving forests for the survival of living species. The poetic relates the virtual image to the situation of the living species of our planet, suffering threatened by deforestation, other factors enter. On the outside of the machine, there will be information about extinction in Brazil. The Partnerships are University of Brasilia, Greenpeace and Midialab-Unb. The computational artists Team are Anelise Witt, Z. Gabriel Dos Anjos and professeur Edison Pratini.

Keywords: Computer art, Toyart, CyberBioDiversity

- **BRISA - Sensitive territories: Art and Nature**

WALMERI RIBEIRO

This communication aims to introduce the research and artistic creation project BRISA. Methodologically founded on the *Performance practice as research*, proposing that, from an incorporated experience, political, poetic, aesthetics and cognitive issues can be raised as possible creative fields as well as of the construction of critical thinking, the project BRISA is formed by a transdisciplinary research network that involves artists from different fields (audiovisual, body arts, art and technology, visual arts and music), geographers, urbanists and residents from the studied regions, in a collaborative practice of investigation and creation. By proposing to belong to this field of research, BRISA aims to dialogue with art issues in the Anthropocene era, investigating new methodologies and practices on the relations of art with and to the Nature.

PLANETARY COLLEGIUM ABSTRACTS - MEMBERS OF THE CAIIA-HUB OF THE PLANETARY COLLEGIUM, UNIVERSITY OF PLYMOUTH

- **Syncretic practices between art and architecture. Towards an adaptive architecture for social activism, play and occupation.**

ALEJANDRO QUINTEROS

This research investigates new practices, technologies, methods and designs that arise from the syncretic relationship between art and architecture. The aim of this project is to create a theoretical and practical design toolset to implement for the construction of functional adaptive dwellings. This project proposes that adaptability as a fundamental human behaviour inexorably tied with our continuously evolving relationship with nature has persistently determined humanity's designs in the architecture of the dwelling. As the rise of information technologies, the appearance of the connectedness, cheap chips and the presage of the internet of things permeates every aspect of a particular section of people clustered in particular cities around the globe. A unique consciousness is evolving where this adaptability paradigm is gaining a place of balance between us our technologies, our position on social justice and to other cultures and societies. The intention of this investigation is to apply this toolset for the purpose of occupy and reclaim space and places within the city and its expanded metropolitan areas.

Keywords: Art, Architecture, Adaptive, Dwelling

- **Houdinist Ontology, a case study of the escapist nature of Nature.**

BENJAMIN POTHIER

In this post-biological world that some people describe as the "Anthropocene", or the "Next Nature", Science is usually presented as a way to "solve the mysteries" of Nature. In the meantime human history on this planet is rich of various belief systems that have offered and to some extend still offer eso- or exoteric ways to understand , canalize or harmonize with Nature.The world "Nature" itself carries various significations, from the "wild Nature" of the environment, to the "secret nature" of things. "Nature [physis] loves to hide". This famous quote from Heraclites could look a bit outdated in a post-biological world. Yet in terms of human knowledge "what we know" is still nothing compared to "what we don't know". The first verse of the Tao tö king, a classic chinese book written in 600 AD describes in those ways the "Tao" or "way" to harmonize with Nature: "The tao that can be told is not the eternal Tao. The name that can be named is not the eternal Name." Putting an emphasis on this apparent impossibility to net the nature of Nature. Or at least to net it through the use of human languages. And as the Anthropologist and writer Gary Snyder stressed it:

[...] Language and culture emerge from our biological-social natural existence, animals that we were/are. Language is a mind-body system that coevolved with our needs and nerves. Like imagination and the body, language rises unbidden. It is of a complexity that eludes our rational intellectual capacities. All attempts at scientific description of natural languages have fallen short of completeness, as the descriptive linguists readily confess(...). Using a natural language, I will present some ancient perspective on Nature, as well as contemporary intellectual trends regarding this issue.

Keywords: "Next Nature" "natural language" "patterns" "Biology" "Nature" "Ontology"

- **Self as a Flow of Consciousness Through Moist and Silicon Media.**

BLANKA EARHART

Our modes of interaction with each other and the world are changing and expanding in a myriad new ways. We have the opportunity to expand and intensify ourselves in unprecedented ways yet the process is complicated and filled with uncertainty. The investment that we make into our new representations is often frustrated by the fragmentation of our psyche resulting from splitting of our image among many platforms and conceptual readings. Today, more than ever, we are finding ourselves in need of producing a unifying meaning. Our sense of expansion, which is facilitated by electronic media and global connectivity, is haunted by the inability to own oneself. The traditional ways, in which we are used to structure our subjectivity are subverted and rendered ineffective. Narratives, which usually produce meaning through contextualization of our experiences presently, communicate primarily the intensity of the experience. Simultaneously, our ability to make meaning by acting within a narrative is suspended in unlimited choices. Yet precisely reclaiming our stories and agency within the kaleidoscopic world holds the promise of meaningful experience across multiple platforms, be they biological or electronic. Using narratives as structures propelling one into different experiences empowers a subject to act in its own unique ways. Living in a world is a creative act, in which a subject channels all the possibilities into existence. This unfolding through a specific aperture can be employed across different media. Maintaining a coherent subject in situations where one is split into a multitude of data and squeezed into pre-defined categories requires critical evaluation. Perhaps understanding oneself as a flow of consciousness through moist and silicon media may be the first step in reclaiming the sovereignty of the self and in unifying one's self perception across different platforms.

Keywords: consciousness, fragmentation, self, technology, unification

- **Capturing Gaddafi: Narrative as System Currency**

DIANE DERR

This presentation explores the construction of narrative through multiple vehicles and its function as currency in a system of representation. Within the networked model of communication, as characterized by Gustavo Cardoso, the channeling of information through multiple forms of communication devices produces alternative interpretations and representations. This results in narrative as currency in the system and streams of information, which expand, contract, dissipate, start, stop, are cut off, and begin again. This presentation will examine the event of former Libyan President Muammar Gaddafi's murder captured on cell phones and distributed through Western and Middle Eastern broadcast news media. In doing so, it will address the causal relationship between the multiplicities of constructed narrative and narrative as system currency.

Keywords: Narrative, systems, media

- **Fathom**

JANE GRANT

Fathom is a sound installation by Jane Grant and John Matthias, which was commissioned by the River Tamar Project and was premiered at the Factory Cooperage Building in Royal William Yard, Plymouth, UK in September 2013. Visitors entering the installation were able to hear live and edited sound recorded underwater in Plymouth Sound, a large estuarine body of water from which the Plym, Tamar and Hamaoze Rivers flow into the sea. Six-step ladders in the centre of the installation space surrounded by several additional speakers enabled visitors to climb out of the underwater sonic environment, above the fathom, and hear live acoustic sound relayed by microphones above the water. In *Fathom* the artists created a surface or boundary form within a three-dimensional space, a sculptural plane that ruptured the expectation of transmission and dissipation, a boundary between an underwater sonic world and our familiar acoustic territory but all taking place within our acoustic domain inside a large room within a large old Royal Navy complex of buildings used in the nineteenth century. Above the fathom, over the 6ft surface of water, airborne atmospheric sounds were just detectable, drawn from birds and human-made sounds. Those who wished to elevate themselves above the surface were able to stand on small steps lifting their head above the 'fathom', above the watery sonic surface and into the volume of 'air'. The sonic boundary between air and water was created using cutting edge technology in an unusual way. The sound system used Multi-cellular Array™ technology to generate a very precise sound field, through the manipulation of phase, amplitude and equalisation. The system is more often used for localising sound at large-scale events, such as the recent concerts in London's Hyde Park, where the audience experience has to be delivered with minimal disturbance to local residents. It is the only one of its kind, and is at the absolute forefront of modern professional audio. Sound is thought of as pervasive, it is everywhere and unlike vision we cannot turn away from it. *Fathom* shifts our perception of this phenomenon, creating a vast but specific volume of sound, with a definite but mutable boundary that differentiates the world of water from our world of air.

- **Feel the Force…**

MIKE PHILLIPS

"Lesabéndio fell asleep. He dreamed of an enormous solar system – and it appeared to him like a system of millions of rubber bands that were continuously being stretched apart and then rebounding back together again." (Scheerbart, 2012, p.114)

From the atomic forces that bind our molecules, the algorithms of repulsion and attraction that coalesce our social networks, to the astronomical gravitational forces that maintain the spin of our Universe, this paper explores the network ties that bind and divide us.

Resolving a series of art works (exploring nano-art, the 'Internet of Things' (ioT) and data visualisation) in immersive Fulldome environments, the focus is on the interconnectivity of things and the invisible networks that surround them - keeping them hovering in a tensegrity of forces, neither too close nor, and, or, xor, not, nand, xnor too far away.

To understand the nature of these forces we need to develop instruments that can negotiate meaning by measuring patterns in their fluctuation. In many ways the works described here are examples of such instruments, devices that attempt to articulate a set of relationships between things that normally lie outside our normal frame of reference - from the smallest unimaginable thing to the incredulously large thing.

The function of these instrumental art works is effectively to ferment a network protocol that could possibly unify the flocking Boids forces of separation, alignment and cohesion with algorithmic cardinal sins Lust, Gluttony, Greed, Sloth, Wrath, Envy and Pride.The works being discussed include nano-art projects by the author ('A Mote it is...'. 'spectre ['spɛktə/]' and Exposure) and the Fulldome work being developed as part of the European Mobile Dome Labs collaborative project (www.emdl.eu). A media archaeological element recovers network art from the mid 1980's and explores its influence on the erosion and decay of the 'Objet d'art' and the network colonisation of the space that remains.

Scheerbart, P., 1913. Lesabéndio, An Asteroid Novel. Translated by C. Svendsen., 2012. New York: Wakefield Press.

Keywords: Visualisation, Internet of Things, Fulldome, Nano-Art, Network.

- **Synthetic Journey in the World of Things.**

MUJIN BAO

We live in a world that operates on bits and bytes. Reality has become synthetic, a convergence of the material and the immaterial. The synthetic power of new media art – integrative, interdisciplinary, interative – expresses the blurred boundary between the animated and the inert, the perceived and the imagined, rekindling a discourse about relationships between nature and culture. The media art works explore a synthetic journey of uncanny visions ranging from the desire to transcend the corporal to the construction of synthetic worlds; from telematic dreaming to transgenic hybrids; from whimsical apparatuses to the deadpan gaze of magnetic fields.

Keywords: Synthetic Reality, Media Art Works, Perception of Reality.

- **The tracks imprinted in the mesh netting of connections and relationships defining the nature of artistic work**

PAOLA LOPREIATO

Body, life, nature, poetry, emotion and technology intertwine constantly in the works that I do. Works that are the result of research that moves through different languages and modes of expression, always in search of sincere emotion, able to flow into our inner self with techniques and solutions sometimes as simple as water, sometimes as complex as the human mind only can be. Body, light, sound, music and technologies are the themes and tools at the same time, that embodies the intent to merge into a single gesture, into a single event the essence of a human nature, the essence of perception, which is also the awareness of being and the flow of life. Lights, sounds, images, words, movement, action are the essential elements that run through my artistic works, used to produce energy pressure that pushes towards our consciousness with the desire to arouse motions of soul, to be able to touch and stir our imagination, to shake the inner worlds. Energy that maybe can be able to join two parts of our mind and create a link, a

bridge, a new emotion, a discovery, causing sparking of memory or intuition on what nature is. Any of my work has its own history as well as the person I was when I created it; each work brings with it, imprinted in its folds, the tracks, sometimes secret, of the person, the mind that I was when I experienced those choices, which placed those events in that order. These tracks are preserved in the nuances of a sound or a light, in a dynamic contrast, in a game of the rhythm, in a still image; these tracks are imprinted in the mesh netting of connections and relationships that define the work itself and the nature of the work.

Keywords: Body, life, nature, poetry, emotion, technology.

- **Linking the Light of Nature and the Light of the Mind**

SETH RISKIN

Light features in conscious perception of both the outer world of nature and the inner world of human experience. Physical light is the basis of all human-scale visual perception of the natural world, and this light pronounces itself at the outer limits of what we know, e. g., in Big Bang, Relativity and Quantum theories. As light founds and frames our conscious experience of nature, it is also intrinsic to the human inner world. For example, the aspirant meets with a series of yogic lights through the progression of meditation, and a transfiguring light is encountered at the time of death, or spiritual enlightenment. At the extremes of conscious experience, whether inwardly or outwardly focused, physical light appears to merge with psychological light; the two lights, inner and outer, become one, implicating the body as the cross-point of psychic and physical experiences. This talk explores light as a liminal experience, one that straddles the perception of the inner and outer worlds. Here the light-body, the experience of the conjunction of the body and light, plays a special, symbolic role: it marks the conscious convergence of the perception of light as an object and the perception of self, i. e., the union of inner and outer worlds. As a case study on this point, the author describes his original art form *Light Dance* which uses body-mounted light instruments and body movement in performance. Through art and associated research, *Light Dance* explores a realm of human experience in which the light of nature and the light of the mind are one.

Keywords: light, consciousness, body, visual perception

- **Finding Flow in Rebellion**

TEGAN BRISTOW

I will address the contribution of what is seen to be rebellion in the making of digital aesthetic practices in Southern and East Africa. In actuality the practices are not rebellious at all but are rather the impression thereof. This begs the question, how do we understand ridged global norms? And what are the contributions of difference and presumed rebellion? Does a ritualised or social form of thinking reflect more closely the workings of nature? Can we find flow rather than field in the construction of these new aesthetics?

Keywords: Digital Art, Africa, Flow, Presumed Rebellion, Flow.

- **Curating Process: A Curatorial Aesthetic of Emergence**

XIAOYING JULIETTE YUAN

Curating Process: A Curatorial Aesthetic of Emergence is a long term project focusing on the research on the curatorial aesthetic and methodology of process-based art. From my curatorial position, I suggest that an effective method of fully investigating the creative process is to give up some measure of authority and instead position oneself in the artist's role and become a collaborator with the artist in seeing the work realized. Instead of inviting viewers to focus on discrete objects, images and fixed relationships, Process curating promotes a curatorial aesthetic of emergence, the emergence of meaning, form, medium, and ideas, asking the public to investigate the artist's life and working methods with the same curiosity and passion as they receive the finished artworks. Christiane Paul, art critic and Adjunct Curator at the Whitney Museum of American Art recognized the shift in curatorial attention from a single object for display to an entire history of an object's creation when she stated that new media work is, "often characterized as process-oriented, time-based, dynamic, and real-time; participatory, collaborative, and performative: modular, variable, generative, and customizable." Driven by the changing nature of artists' works in art and technology, curators adopted new strategies of presenting artists' works through process-oriented temporary events such as online galleries, artists' workshops, open studios, panel discussions, or popup shows. I would be delighted to share a couple of projects I curated with some pioneer artists in the field of art and technology at this conference. I take for my Object to curate and to display, the entire body of the ephemeral outcomes produced during their processes. These studies and thought diagrams are the real core of an artist's process and are essential to fully understand the object that is finally exhibited.

Keywords: Curator, curating, aesthetic, process, art and technology

CAC.4 POSTERS

- **Mobile Art vs. Corporate networks**

ANA CAROLINA DA CUNHA

The emergence of mobile network technologies came to enhance the communicational and rhizomatic possibilities of the internet. With capabilities to communicate and establish collective and democratic mobile platforms, cellular networks may represent to some artists a significant revolution in participatory proposals. However, most authors are not aware of or do not realize that nearly all wireless platforms are generally governed by commercial entities. Thus, this mercantile sovereignty can represent a significant obstacle to both art producers and the participant public, in terms of creative freedom, artistic expression and the effective participation of spectators. The corporate dominance of physical infrastructures and operating mobile communications can restrict the artist‰Ûªs freedom and technical implementation when it comes to host and run their projects. Furthermore, a full control over data banks and digital filtering systems can regulate the contents, restrain certain accesses, and generate participants with impoverished and colonized subjectivities, therefore limiting their participatory actions. This research presents the specific context and analyzes the problematics

and possible solutions regarding the influence of communication corporations in the production and public participation in locative media projects.

- **SET – Techno-Synesthetic Experiences**

PROPONENTS: FILIPI DIAS DE OLIVEIRA, ALANA APARECIDA DOS SANTOS, AROLDO MASCARENHAS NETO AND LEONARDO NUNES GUIMARÃES

This is a workshop of visual and sound generation developed from the concept of Synesthesia, proposing experiments that explore the senses in an amplified form. Using hybrid devices constituted of natural elements (fruits) and electronic / computational elements (Arduino, sensors, Processing, MAX/MSP.), the participants are invited to pierce the fruits using the fork-conectors (linked to Arduino and MAX/MSP) in order to generate sounds. In a second moment, they are asked to position themselves around a table with white sheets and washable ink. Blindfolded, they are encouraged to make abstract paintings with their hands, expressing the sounds created in the previous step. A webcam installed above the desk with the paintings captures the images during the process which projects on a screen the deconstructed images (generated by Processing). Participants can learn with this experience the operation of this interaction, resulting in a collaborative practice.

- **Maiitsoh**

BENJAMIN POTHIER

A transmedia project and an interactive documentary installation about computer history. Is a playfull interactive kiosk containing interviews & public interventions from artists, poets and some of the best thinkers of our times on computer, creativity and consciousness related research topics. It's a poetification of Computer History and a physical, metaphorical and conceptual icon of the opensource culture. Is an independent project, made of recycled materials and opensource software and videos. Brings us vitually from Blechley Park, the place of birth of the information age, to the M.I.T. from Zen Budhism to Cognitive Sciences., from visual research to visual poems.

- **Eco_Artificial: Interdisciplinary between Art/Science in contemporary**

RONALDO RIBEIRO

This panel have its focuses on the interdisciplinary between Art/Science that occurred in the development of a research paper in GameArt and artificial Life called "Eco_Artificial". The work consisted the development of an artificial ecosystem in which two types of artificial life interact. In it you figure that essecialmente Digital Reef is the basis of system power and artificial creatures that need to feed that Digital Reef to prevent their extinction. The first artificial organism cited, including, merges aspects of physical structures, specifically coral reefs and slums, hence its name be "Digital Reef". The text will tell the interdisciplinary work carried out by researchers involved in the development of GameArt, being a Computer Science and other Visual Arts. And how from their differences, new results have been added to the research by making it more diverse.

CAC.4 WORKSHOPS

- **From the Art of Memory to Augmented Reality -Art /Science/Technology boosting our Brains**

PROPONENT: MARIA MANUELA LOPES PT

Playful exploration of the participant's memory skills, addressing the importance of training the potential of memory through applying varied artistic methodologies and augmented reality strategies, for a natural neuro-enahncement. Using a transdisciplinary artistic experience, creativity and metaphors of memory to produce moments of discovery around the connections between brain functioning and visual language using attention, *mnemotechics* and other stimulation games to allow to consider the power art has in proving a background for contrast and management of multisensory information. To train and boost your memory, considering possibilities for augmented reality/ building annotated reality scenarios/enhance reality for handicapped persons and as memory aids.

- **#SelfiePixel**

PROPONENT: CRISTINA AMAZONAS

Participants are invited to produce a sef-portrait #selfiepixel by interacting with the software PIXEL ESPELHO. Will be generated .TIFfiles, single or sequenced (also .JPG or .PNG). Each participant will be responsible for formatting your selfie as collective decision of exposure. The self-portrait can be printed or projected, as photo or animation (video). Proposals for performances and sketches will be welcomed and focused to incorporate the installation.

- **SET - Techno-Synesthetic Experiences**

PROPONENTS: FILIPI DIAS DE OLIVEIRA, ALANA APARECIDA DOS SANTOS, AROLDO MASCARENHAS NETO AND LEONARDO NUNES GUIMARÃES

A workshop of visual and sound generation developed from the concept of Synesthesia, proposing experiments that explore the senses in an amplified form. Using hybrid devices constituted of natural elements (fruits) and electronic / computational elements (Arduino, sensors, Processing, MAX/MSP.), the participants are invited to pierce the fruits using the fork-conectors (linked to Arduino and MAX/MSP) in order to generate sounds. In a second moment, they are asked to position themselves around a table with white sheets and washable ink. Blindfolded, they are encouraged to make abstract paintings with their hands, expressing the sounds created in the previous step. A webcam installed above the desk with the paintings captures the images during the process, which projects on a screen the deconstructed images (generated by Processing). Participants can learn with this experience the operation of this interaction, resulting in a collaborative practice.

- **On, In, Around, and Between Bodies: Fashion and Technology Workshop**

PROPONENT: BRIAN KANE

Presentation, discussion and hands on workshop investigating emerging aesthetic, cultural, technological trends in apparel, textiles, social media, and mobile computing. Participants will conceptualize and rapid prototype wearable concepts in the workshop, and will have a full understanding of how to undertake a wearable project on their own afterwards.

- **F!t: artgames as experimental platforms for complex multimodal human cognitive--aesthetic-affective behavior**

PROPONENTS: THIAGO LADISLAU AND MAIRA FRÓES

Over the past two decades, scientific evidence findings have converged to suggest a pivotal role of unconscious perceptual information processing on creative problem solving (Bechara et al. 1994, 1997; Gao Y and Zhang H 2014) raising the theoretical possibility that more than logical scrutinity is demanded to intelligent behavior. In line with this possibility, our team addresses experimentally the hypothesis that aesthetical and affective-emotional transits would lead to cognitive gain. To test it in a controlled way, we have built a platform of artgames – entitled F!T (Multi Media Fusion 2). Basically, game goals are insinuated as fit, challenging player-controlled incursions throughout a series of phases. Game versions in this platform are experienced as distinct aesthetical and affective charges. Our goal is to share with participants the essence of an *art(hard)sci* problematization, and how it is achievable from the perspective of computational arts.

EXHIBITION: COMPUTER ART & DESIGN FOR ALL

- **Synesthesic Landscape**

ALEXANDRA CAETANO AND EUFRASIO PRATES

The artwork is an interactive system that proposes the construction of synesthesic landscapes via the capturing of brain waves' variation. The dynamic and unforeseeable landscapes are composed by fractal sounds and oscillations of colors by reflecting neurological patterns externalized by the crossing of the senses.

- **It Had to Be With You**

ALEXANDRA TEIXEIRA RIGGS

It Had to Be With You is an interactive poem about family, culture, language, and secrets. The poem unfolds as a series of words animated in time to music. In order to change the path of the narrative, interrupt it by clicking on one of the highlighted words. This will lead you into a new path, with more clickable words and potential paths.

- **Trilhos Urbanos**

ANDRÉ PARENTE AND PEDRO PARENTE

The installation is formed at the same time by a still background image and a moving image, a window – the first one featuring expressive graphisms, and the second indicating the visualization process of the movements that leave trails over the first. The spectators' motions in space trigger a sensor affecting the movement of a window over the image, creating an anamorphosis in the still image that results from the movement of the window. This installation works with the customized software, Corisco, created by Pedro Parente.

- **ARt[In]Muzz**

ANDREA CAPSSA AND GIOVANNA CASIMIRO

ARt[In]Muzz is a project in discovery. Uses augmented reality to build its dynamics, proposing a new experience between artwork, public and the artist. It attempts to establish a prime medium of exposure, connected, immediate, in which the real and the virtual are ubiquitous, simultaneously, in order to deterritorialize the artwork and to demystify the exhibition space.

- **Argument**

ANDREW AMES

Argument: Limited Edition is a small edition of thirty laser-cut, hand-assembled acrylic game sets completed between 2012 and 2013. The Argument board and its pieces set a landscape: the game's rules create a situation for players to either collaborate or compete—the players decide. The circular design of the game board is intended to foster collaborative play; players sit around the board as equals. Players choose how to play, and the decision changes how they interact with the game and one another. In competitive play, the person who removes all of his or her pieces and collects the most pieces, wins. In collaborative play, everyone can win, but only if all pieces are removed from the table and everyone ends with the same number of pieces they started with.

- **200 Million Years - Durée**

ANNA BARROS (IN MEMORIAM) CURATED BY NARA CRISTINA SANTOS

This work of *Nanoart* was developed from three images obtained with an electronic microscope scanner and with an atomic energy microscope (at the Physics Institute of USP São Carlos and the Laboratory of Thin Films of USPSP). The work investigates the poetics between duration and memory that is established in a relation between the images - obtained with the microscopes – of a few organic samples: a 200 million years old petrified tree, found in the paleontological reserve of Mata, in Rio Grande do Sul; a seed of Ypê and of Resedá; and a branch of Resedá and a peel of Ypê. These images are worked in digital 3D animation, and the sound adds a tactile vibration feature. Scientific images are thus transformed by the imagination of the artist in 3D programs.

- **GIF Free For All**

BILL MILLER

As the WWW has grown and changed over time, so has the way users engage with web-safe file formats. The animated GIF is one such file format that has a range of uses from popular culture to experimental media and everywhere in between. Its is a particular moving image type that is ubiquitous and has fostered a number of exhibition formats that challenge the dominant modes for presenting digital art works. This exhibition invites 20 artists to create animated GIFs that fit within their larger body of work with the format while also engaging with the conference topic. The generated work will be presented on a large screen within the browser and looping through the moving images.

- **Becomes**

BRIAN KANE

A 2-dimensional simulated photoshop selection made from metal wire and programmable LED's is installed in the exhibition space. The animated 2D display creates the illusion of a separate architectural space which is intersecting the real space of the room. The effect simulates the "marching ants" animated outline effect of a selection being made in Photoshop, causing the viewer to feel as if the real world is a Photoshop manipulation.

- **Drawmba**

BRIAN KANE

Four modified Roomba floor cleaners are modified with ink cans and paintbrushes so they leave marks on the floor beneath them, and have also been modified so that they can be controlled via wifi by user's smartphones. Left alone, the Roombas will make linear patterns as they go about their existing programming, but when a user takes control they can make curves and abstract shapes. Once a user or someone from the event thinks the drawing is done, they can remove the paper sheets and hang them on the wall, and place new sheets of blank paper on the ground.

- **Upstream Flow**

BRUNO VIANNA

This series of motion graphic works subverts the usage of computational video algorithms. This is a field in computer science dedicated to the analysis of video, with the goal of extracting useful information from it, from camera movement evaluation to recognizing faces. However, these videos do not take advantage of the data extraction possibilities in the software. Instead, it will use that information aesthetically, generating visual patterns and glitches that refer to images of surveillance. It rebuilds their meaning, denying their potential for control.

- **Cognoise**

DANILO ANDRADE DE MENESES, EUFRASIO PRATES, JOSÉ OTÁVIO POMPEU E SILVA AND MAIRA MONTEIRO FROIS

COGNOISE is a performance that intends to bring participants into a complex synesthetic experience which we expect will drive a re-evaluation of the noise-pattern tension, leading us to consider elusive and unpredictable orders as intrinsic to our creative expressions, from fine arts to computational technologies.

- **Amoreiras (Red Mulberry)**

GILBERTTO PRADO AND GRUPO POÉTICAS DIGITAIS

Amoreiras is a project on autonomy, artificial learning, nature and the environment. The main actors are five young red mulberry trees at Paulista Avenue, cultural and economic center of São Paulo. A microphone measures ambient noises, used as a representation of the pollution level in the city, and "motor-driven prosthesis" move the branches in order to help the trees get rid of the soot in their leaves. An artificial learning algorithm allows the trees to observe and learn from each others behavior, in a dance of trees, prosthesis and algorithms, making apparent and poetic the

swaying of the branches, sometimes (in)voluntary-mechanical , sometimes caused by the wind itself running against the leaves. The intention of this presentation is show the video of the projet and one prototype and acrylic box that was coupled to the trees.

- **Telebiosfera**

GUTO NÓBREGA

"Telebiosfera" is an immersive environment in the form of a semi-dome, built for a bio-telecommunication experience, which has as its main interface a terrarium.Augenblick

- **Augenblick**

JACK STERNNER

The work addresses the grammatization of omniscience. In content, form and method, the work considers the transformation of culture from one responsive to an omniscient spiritual presence, to one equally beholden to an omnipotent electronic apparatus. News broadcast footage archived for the past decade is combined with contemporary cinematic imagery using a computer program to procedurally edit and display the work. Natural language processing, speech analytics, and humanities computing techniques are used for content analysis.

- **Monument**

KATHERINE GUILLEN AND ANTENOR FERREIRA CORREA

Monument is a visual music work resulting from a multimedia approach accomplished through a collaboration between a Brazilian musician and an American visual artist. The work was inspired by the poem "The Monument" by Elizabeth Bishop (1911-1979) an American poet who lived in and wrote in Brazil. The artists used the imagery and sentiment of Bishop's text as a starting point for their partnership. Working initially separated, each artist conceived their particular way to "read" the poem through music and images. Later, they worked together in order to mix their primary ideas. Both artists share an interest in hybrid uses of technology. Isomorphic procedures were applied to set up the musical environment, rhythmic structure, and the general form of the work. Hand drawn, painted and digitally manipulated imagery were combined for the visual animation.

- **Black Like Me**

LINDSAY GRACE

In a world full of racism and stereotype, this game is about the all-too-common effort to match by color. Black Like Me, employs critical design to encourage players toward situational analysis instead of mere attribute matching. Players are presented with a color matching game at the surface, but the game cannot be one if players look only at color. Players are encouraged to subvert the suggested game rules. The game is designed to train players toward perceiving ambiguity and employing alternative play strategies. Games train players toward specific understanding of the world, this game aims to undo that training.

- **S.H.A.S.T – Housing System for Homeless Bees**

MARIA LUIZA (MALU) FRAGOSO

S.H.A.S.T. (Sistema Habitacional para Abelhas sem Teto/ Housing System for Homeless Bees) is a telematic art piece which implies the construction of a hybrid home, or a sensitive shelter, provided as beehive for actual bees in a farm in Rio de Janeiro. The art piece is composed of three modules: an active beehive monitored and sensitive; an empty beehive installed at specific sites for attracting bees, also monitored and sensitive; and a series of objects and immersive installations capable of expressing to the public the context and content of these beehives. The artwork has different approaches to social needs and intervention. Also brings about the necessity of an enhanced perception and consciousness over human/nature interaction through technology. Our inter is to explore and investigate possibilities on transcultural levels to develop this work with the help of T_2EIA team. Link for S.H.A.S.T. http://www.nano.eba.ufrj.br/s-h-a-s-t-sistema-habitacional-para-abelhas-sem-teto/ or http://www.nano.eba.ufrj.br/nano_projetos/s-h-a-s-t/. For CAC4 exhibit a prototype of an interactive installation was created. A module in acrylic receives data as synthetic images projected inside the module from the beehive.

- **Trace**

MARIA MANUELA LOPES

Trace was developed as a re-enactment of neuropsychological assessment archival data of Alzheimer's disease patients under a clinical trial in Hospital de Santa Maria, Lisbon.The sentences were freely written by the patients and had no specific rules. Their approximate translation to English, including the grammatical errors, is presented in a printed transcript. The drawings also belong to the archive of traces left by the patients when responding to assessment guidelines. The work is created in the form of montage and has been developed to work across a panoramic installation intended to invoke the experience of juxtapo- sition and duration in the discourse surrounding neuroscientific studies of memory loss. Trace plays with the liminal state of autobiographical memory in Alzheimer's disease by metaphorically alluding to the process of memory: encoding the initial absorption of sensual events imprinted as traces in the nervous system preserving the effects of experience across time.

- **Stealth**

MARTIN REICHE

Stealth is an auditive racing game that shows how the "easy" task of listening can be hard and complex if you as a player are not used to trust your ears but your eyes. The player slips into the role of the blind driver of a high speed car in a two-dimensional world. He has no other choice as to find his way based on what he hears. Leaving the track and crashing with objects will result in acoustic punishment and the player will eventually realize that the whole game is not really about driving a car through an acoustic labyrinth, but about how we perceive our very world.

- **Uncanny**

PAOLA BARRETO

Inspired by the philosophical fiction "Vampyroteuthis infernalis", published by Vilém Flusser and Louis Bec in 1987, the work consists in an audiovisual projection on a dark room. Inside this "black box" images are projected continuously, in loop. Nevertheless, they can only be seen when

someone enters the room and keep on moving inside the space, revealing, through the captured shape of his own body, scenes hidden behind the darkness. The projection results then in a mix of the visitor's image (captured by a infrared camera) and the undercover video loop, producing a hybrid and phantasmagoric screen, haunted by a furious figure which eventually shows up entirely. Thus, in this *vampyroteuthic* cinema, the projection is conceived as a communicational process, in which the I and the other merge to produce the images to be seen.

- **MASA**

ROLANDO SANCHES E ANDREA SOSA

MASA is an interactive installation, where all humanity's solidarity and love make the impossible happen. There is a corpse lying in the center of a room, and six participants, can make this human being come to life again. An overhead projection displays the body of a dead man on the floor. Each participant has a heartbeat sensor attached to their index finger which captures their cardiac pulse. The installation proposes the increase of heart rate. So, participants may jump. When the heart rate of all users is above 160 heartbeats per minute, the corpse come to life again.

- **Netgyre**

THOMAS RUSSELL STOREY

Netgyre is a networked installation that visualizes the physical effects of ethereal "virtual" activity in the networked world. Referencing the oceanic "garbage patches" formed by man-made debris caught in the confluence of ocean currents, *netgyre* is a website that records traffic as 3D debris caught in a simulated vortex. Over time, the virtual trash accumulates, allocating more "waste" memory and generating more entropic heat as the server perpetually runs the simulation. The intention is to betray the lie behind the notion of the internet as a disembodied activity and foreground the physical traces of this activity. The simulation is persistently accessible as well. People observing netgyre through their browsers are embodied in the space as spheres, texture mapped with an image captured from an available webcam. The simulation thus occupies a public volume, a "landmark" in network space.

SURVIVAL? *MEME*? LOOPS AND THE TECHNOLOGICAL REPETITION IN ART

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ABSTRACT

This is an exploratory paper about loops, survivals and *memes*. Loops are regarded as conceptual, mechanical or technological actualizations of the virtual idea of cycle and repetition. In fact, more than repetitions, loops are means of producing something – through repetition - that goes beyond their initial situation, elements or parameters. A loopis the repetition of something aiming to create meaning or behavior that surpasses its constituent parts. Through repetition, loops create difference.The purpose here is not to deal with all forms all loops, or a specific loop.

KEYWORDS

Automation, repetition, survival, loop.

INTRODUCTION

The head is the organ of exchange, but the heart is the amorous organ of repetition.
G. Deleuze.

A scholar is just a library's way of making another library.
Daniel C. Dennet

Thepurpose of this paperis to discuss the idea of repetition and its materialization in different technological artifacts. Loops can be found in objects of different complexities, from simple loops where what is repeated is constant – always the same motif or mechanics –to repetitive processeswhere an exterior input couldbe integrated or a user couldparticipate in different ways.

Specifically in computer programming (and in computer art), a loop is a sequence of instructions that is continually repeated until a certain condition is reached. A loop is a fundamental programming idea that is commonly used to write programs.[1]

Loops could be thought as products of human interpretation of the world, a way of understanding nature. Human beings have always understood the world as a sequence of cycles of nature (such as day and night, seasons, lunar phases). From the early beginnings of history to present days, the loop as an idea can be traced, materialized in several objects and machines, in material artifacts such as optical devices of pre-cinema, concrete music, fractal images, videogames and computer programming [1].

Not just artist-developers deal with loops. During regular use of computers – software like music and video players – we deal with modes of repetitive media reproduction; we also experience media types (such as animated GIFS[2]) that are based on loops. There are instant messages applications that put the emphasis onanimated GIFS loops, such as *Relay*,[3] where the animated GIFloop acts as visual/graphical communication. When we talk with artistsand museums crew, we use the word loop. In parties and festivals, we see DJs and VJs using loops to create their art and interventions. In daily activities, we execute movements that could be identified as a sequence of processes.Moreover, our body works through feedback processes, as the field of Cybernetics shows. Loops are a fascinating object of study: when they get our attention, we tend to see loops everywhere.

To consider daily routines as loops is an exaggerated (and general) way of seeingthem. But it shows howloop is understood in this paper: not just a programming tool, but also a way of thinking, of creatingmeaninginour lives and art. Is the loop, as a digital tool, rootedin human nature? Is the loop the beginning of technological development? Where are the boundaries between human and artificial, nature and culture? [2] We consider the loop as a way of interpreting the environment where human beings live. This interpretation directly

[1] There are also infinite loops that have no exit routine. They are loops that create error, continually repeating until the operating system senses it and terminates the program. These loops "kill" the routine of a program, making it "crash".

[2] A GIF (Graphics Interchange Format) is a bitmap image format released in 1987 by CompuServe. AOL bought the company in 1998, leaving the GIF patent to expire, so the format is now public domain. The GIF89a version (with metadata, animation and transparent background) is such a well-compressed format that even the Internet connections of that time could download it quickly. GIFs are moving digital images of a pre-Flash era, when homepages were adorned with flickering frames, banners and graphics in infinite loops. Recently, animated GIFs have become very popular again: easy to create and to share.

[3] http://relay.im

influencesthe concepts and tools created. Looking at loops makes easy to understand howtechnology is human grounded – therefore, human.

H. Bergon, F. Nietzsche and G. Deleuze have explored different aspects of habit, memory, desire, difference and repetition. Their work is the classical and most common reference in studies that deal with repetition.

However, here we attempt to do an exploratory and essayistic exercise of thinking. Our purpose is tolook atloops as actualizationsof a virtual idea of repetition. Thistake us to the concept of "survival" in the work of the art historian Aby Warburg(1866-1929), and also tothe idea of "meme",developed by Richard Dawkins in*The Selfish Gene* (1976). These are different ways of understanding the same object, both rooted in ancient greek terms:*minemosyne* (the embodiment of memory and mother of the muses, inspiration of Warburg's studies) and*mimeme* (as something that is imitated, conceptualized by Dawkins as *memes*).

If we think loops as survivals, what survives isthe idea of repetition, an intention, a structure, a way of solving problems.

If we think loops as *memes*, what survives and continues is an imitation of something, in several and infinite ways. But what is imitated? The first built loop? Or a conceptual way of understanding nature?

In both cases, what survives is identified as a certain cyclic or feedback manner inwhich events and information flow. This concept(this idea) is the loop, something basic and very important in our work as digital and computer art developers. As shown here,materializations of this idea take several forms along History.

When did human beings start using loops toautomaterepetition processes done beforeby their bodies (manually)? Did the cyclical aspects of nature inspirethem? Did the loop arrive with a technology that allows it, or was it an anterior concept – an idea behind these objects?

WRITTEN LOOPS

In the field of Informatics and Computer Programming, it is often considered that the first loop was written by Ada Lovelace (1815-1852) to calculate Bernoulli numbers, as described in some *Notes* of her translation of Federico Luigi Menabrea's "Sketch of the Analytical Engine invented by Charles Babbage", published in 1842.In *Note C*,Ada introduced the concept of "backing" – making an operation card move back into a position so that it could work on the next data card. In her words, the reason for doing this was "to secure the possibility of bringing any particular card or set of cards into use any number of times successively in the solution of one problem"[3].This idea, which we call "looping", was hinted in Menabrea's article, but not well developed. It is believed that it has also been mentioned in earlier discussions between Ada and Babbage. In *Note F*, she showed that, by using the backing process (a loop), she could solve a system of linear equations of any size by repeating just a few operations. She wrote out the details of solving a ten by ten system of linear equations. She also discussed the possibility of generating tables of prime numbers by a simple looping procedure.

The Analytical Engine's ability to loop is noted early on by Menabrea. This machine's looping mechanism is directly inherited from Joseph Marie Jacquard's mechanical loom (1801), as noted in the memoir by Menabrea:

> It will now be inquired how the machine can by itself, and without having recourse to the hand of man, assume the successive dispositions suited to the operations. The solution of this problem has been taken from Jacquard's apparatus, used for the manufacture of brocaded stuffs" [3].

Jacquard's loom was a very early application of a loop in the context of ordering a machine to produce a repeated output. It is also recognized as a very early form of stored program. Charles Babbage adapted Jacquard's storing procedure in the Analytical Engine; the presence or absence of a hole generated a simple on-off command to the machine. The Analytical Engine had many essential features found in modern digital computer: it could be programmed through the use of punched cards (an idea borrowed from Jacquard's loom). It could execute functions which we later gave modern names: conditional branching, looping (iteration), microprogramming, parallel processing, iteration, latching, polling, and pulse-shaping, amongst others, though Babbage has never used these terms. It had a variety of outputs including hardcopy printout, punched cards, graph plotting and automatic production of stereotypes - trays of soft material into which results were impressed and could be used as molds for making printing plates.

Punched Cards for Analytical Engine

Later,in the second half of the 1950s and through the 1960s, loops continue to evolve in computer programming. The technical restrictions of early computers (such as memory space) forced programmers to build programs that could carry out complicated tasks with very few instructions. The shorter a program was, the more space you had left for other programs, and the faster a program ran. The loop found a fruitful environment to a development related to aesthetics of code.

Steven Levy, writing about those early years in MIT and specifically about the TX-0, talked about how a code could be written with an aesthetic view, or not. Loops were associated with beauty [4]

> Sometimes when you didn't need speed or space much, and you weren't thinking about art and beauty, you'd hack together an ugly program, attacking the problem with "brute force" methods. "Well, we can do this by adding twenty numbers," Samson might say to himself, "and it's quicker to write instructions to do that than to think out a loop in the beginning and the end to do the same job in seven or eight instructions." But the latter program might be admired by fellow hackers, and some programs were bummed to the fewest lines so artfully that the author's peers would look at it and almost melt with awe.

DIGITAL IMAGES CREATED BY REPETITIVE PROCESSES

Nowadaysanyone can create images through code – just think in vector images. In fact, there are different kinds of images that are made not by drawing, but by establishing a process of creation. Fractals are good examples of images created by mathematical formula repetition.

Fractal geometry has been developed to deal, describe and analyze the complexity of irregular shapes of the world, since it is not possible to describe nature only by classic geometric figures (cones, cubes, cylinders or spheres). Fractal geometry was conceived to model irregular patterns of nature and to understand phenomena as turbulence in fluids, clusters of galaxies, stock prices and natural elements (such as mountains, clouds, rivers, lightning). Here the repetition is deeply incrusted in the way of creating images.

The mathematics behind fractals began to take shape in the 17th century when the mathematician and philosopher Gottfried Leibniz pondered recursive self-similarity.

Fractals are repetitive processes. They areformed by a formula (sometimes very simple) repeated *n* times in a feedback loop; the result of a calculation is used as an input for the next calculation. Here we find repetition in the process of creating the image. Indeed, the fractal image is, itself, a process.

Those images, consisting results of mathematical equations translated into picture, are characterized by the property of self-similarity: a portion of these figures reproduces exactly or approximately the entire image. They may be divided into parts similar to the original object, or roughly similar, regardless of scale.

Using a mathematical rule described by W. Sierpinski in 1915, the "Sierpinski Triangle" is a well-known example of fractal geometry. Sierpinski defined it before the creation of fractal geometry, so it is sometimes described as a "pre-fractal". The Sierpinski rule creates a sequence of self-similar triangular structures and increasing complexity. The sequence begins with a triangle, which is divided into four smaller triangles. The rule is then applied again in the three triangles of edges (not in the central one) to create the fourth image. And so on. Repeating the process, the Sierpinski triangle becomes more and more detailed:

Sierpinski Triangle: formation process

In fractals, image synthesis starts from calculation: the shape is defined by an equation or a rule of construction. The fractal image is computational, obtained not by fixing the visual appearance of an object through light (as in photograph/cinema), nor by manually using ink, but by means of models. This synthesis enables the formation of technical images not through light, but from a creative process that evolves and is designed like a diagram, a mental projection. It is a way to create images inseparable from the use of computers and mathematics.

LOOPS IN MUSIC

It is easy to see and recognize the importance of loops in current'smusic creation. In this field, the repetition is obtained mostly based on sound recording.[4] The act of recording a sound implied a new composition method that was based more on listening than onwriting. But does the loop, in music, imply mechanical apparatus to be actualized?

Even before the Pierre Schaeffer's *sillonfermé*, music had experienced loops. If we understand loops as an idea, a desire for repetition, we will find loops in ritual music, chants or mantras.

Another possibility is to think that a loop exists when there is a material support for its repetition. If so, probably one of the firsts loops would be Pierre Shaeffer's*sillonfermé.* With the technology of turntables, Schaeffer created and mixed different sounds recorded directly on disks. Those disks, created with closed grooves, could infinitely repeat the recorded sound in an infinite loop. These sounds could be played backwards and at different speeds. Schaeffer used the volume controls of the turntable to create *fade-in* and *fade-out* effects. He used the available sound effects in the studio where he worked (*Radio NationaleFrançaise* and*Radiodiffusion-Television Françaises)* and recorded sounds on the streets: amateur musicians, voices of friends, piano, locomotives. Schaeffer's work was not just juxtaposing sounds: each "sound object"- as he called – was carefully listened, altered and rhythmically structured.

[4] This goes beyond the space of this paper, but we just want to point out that the record of sound is not the only way to work with loops in music. For example, an electronic oscillator is an electronic circuit that produces a repetitive, oscillating electronic signal, often a sine wave or a square wave. In the development of electronic music, German composers firstly adopted this manner of creation, as KarlheinzStockhausen. The French musicians, in those early years, preferred what they called "*musique concrète*", based on the recording of sound and on the act of listening. The most representative artist and theoretician of this movement was Pierre Schaeffer.

© Schaeffer, GRM. Schematic illustrations of a spiral recorded sound (left) – a time that passes – and a sound recorded in a closed circular loop, a "fragment of sound" "a time that does not belong to any time" according to Schaeffer [5].

If we extract the technological specificities, loops are practiced under several forms, since humans started to use repetitions to keep something in their memories. What changed, along time, was the material of the recordings. In the beginning, in oral repetitions, what was repeated was printed in the human mind, inside the brain. Later, loops could be found in the choruses, transpositions of voices, counterpoints, in musical writing.

Could the material support be a paper? If so, the most paradigmatic musical loop, totally self-referential, can be found in Gustav Mahler's *The song of the Earth* (*Das Lied von der Erde*, 1908/1909). It consists in the repetition of the word *ewig*"eternally", in the end, *ad aeternam.*

Here the repetition is obtained by musical writing. In a glance, we could think it is a non-technological loop. Maybe it is just a repetition and not a loop. But it isan idea imprisoned on a paper.

It seems that it is already an actualization of the idea of the repetition, using a technological support: writing.

Can the repetitive processes of fractal creation have a parallel in music? In Alvin Lucier's composition *I am sitting in a room*, the recorded voice is played and recorded, again and again, in a room, by means of magnetic tape. Each new-recorded repetition receives resonances of the room. So, gradually the voice becomes a noise.[5]Here, once again the artist does not create the work unities one by one (notes, phases, sketches), but he creates a way of producing the work. Once the process is created and functioning, it moves on.[6]

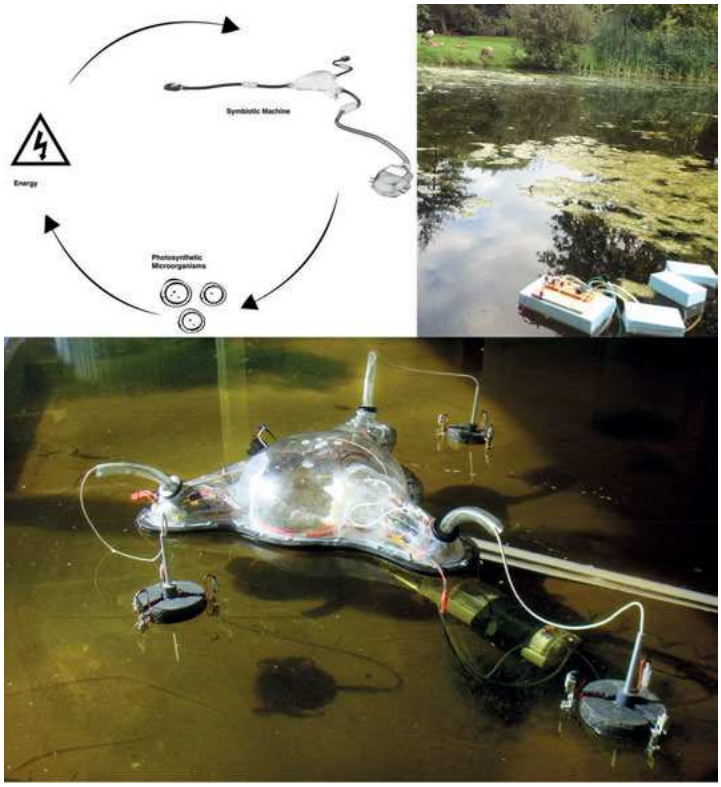
LOOPS AND ARTIFICIAL LIFE

As seen, loop processes can generate difference. This can easily be understood in feedback processes that include conditions to be met. This is clear in Cybernetics, which shows similarities in organisms and machines, as a science of control and adaptation. Complexes projects, using biological, chemical and design knowledge, use a series of cyclic repetitions to control behavior of machines that explore tensions and proximities between nature and technology, living organisms and mechanics.

[5] http://www.ubu.com/sound/lucier.html

[6] This is also what happens in installations based on video feedback.

Ivan Henriques's Symbiotic Machine [6] is an autonomous photosynthetic bio-machine, which harvests energy from photosynthetic organisms, applying this energy to movement to be able to collect photosynthetic organisms again. A life cycle with functions was idealized in order to program the machine and activate independent mechanical parts of the stomach: it has to eat, move, sunbath, rest, search for food, wash itself, in loop. Inside this general loop feedback, several others loops allows whole machine to work. As the artist says, this is a robot that just exists for itself: it is a machine with the aim of simply exist, not to serve humans.



Left: Symbiotic machine's loop. Right: Early prototype: nature inspires machines. Bottom: Symbiotic Machine– Amsterdam.© Ivan Henriques.

SURVIVAL OR MEME?MEMORY OR MIMESIS?

Warburg's concept of survival assumed a temporal model for art history radically different from any employed at his time. He thereby introduced the problem of memory into the *longue durée* of the history of motifs and images: a problem that (as Warburg himself observed) transcends turning points in historiography and boundaries between cultures[7].*Nachleben der Antike* (afterlife – or survival – of Antiquity) is the main theme of his work and research. Warburg, in his *Atlas Mnemosyne*, searched the expressive values in visible material. He worked themes as "when the dancing Salomé from the Bible appears as a Greek maenad or as a servant carrying a basket of fruit – as has been imitated so well aware by Ghirlandaio – rushes in the style of a victory of a Roman triumphal arch"[8]. Warburg considered necessary to find

> the matrix that imprints in memory the expressive forms of the maximum interior exaltation, expressed in gestural language with such intensity that these engrams of the emotional experience survives as inheritance from memory, determining in an exemplary manner the outline created by the artist's hand at the moment which the highest values of gestural language wish to emerge in creation by his hand[8].

Here, inspired by Warburg method, we highlight the survivals of the loop as a *motif*. But the actualizations of this motif have different materializations: sound, moving images, code and image. So, what we present is the inspiration generated by his method, but with an interpretation that does not focus imagery or symbolic study of the images. Here the *leit motif* survives as different processes, not formal configurations. But even in different configurations, we can organize all these objects in groups of similarities.

Another way to understand the different continuities of loopscan be achieved by consideringthe loop not as a continuity of memories, but as *mimesis*. The longevity of an idea in this way would be conceptualized by relating it to the greek*mimeme*. That is what Richard Dawkins developed in the last chapter of his book *Selfish Gene* (1976) [9]. Dawkins defines*memes* as replicators, as genes. He transposes some of thebiological genes characteristics to cultural *memes,* saying that both havelongevity, fecundity and copy fidelity:

> The longevity of any one copy of a meme is probably relatively unimportant, as it is for any one copy of a gene. (...) As in the case of genes, fecundity is much more important than longevity of particular copies. If the meme is a scientific idea, its spread will depend on how acceptable it is to the population of individual scientists; a rough measure of its survival value could be obtained by counting the number of times it is referred to in successive years in scientific journals.

In fact, the distinction between genes and *memes* would be that *memes* are not high-fidelity replicators at all. Every time a scientist hears an idea and passes it on to somebody else, he is likely to change it somewhat. *Memes* are transmitted in altered form, subject to continuous mutation and also to blending. For Dawkins, an "idea-meme" might be defined as an entity that is capable of being transmitted from one brain to another.

CONCLUSION

As we showed here, computers did not precede loops. This reinforces that technology is intrinsically linked to cultural and historical aspects of human life.

This paper has no conclusion. We are not attempting to find one. Its writing is restrict to 4.000 words. As a loop, it returns to its beginning. So, we will return to the beginning of this research –when we started to study loops. This has begun with a challenge found in Manovich's *The language of new media* [10]: "Can the loop be a new narrative form appropriate for the computer age?"

For the author, the loop gave birth not only to cinema (as we can find in the optical devices such as *Thaumatrope*, *Phenakistoscope*, *Zoetrope, Praxinoscope, Zoopraxiscope* and others of the late 19th century), but also in computer programming. Manovich understandsthat programming involves altering the linear flow of data through control structures, the loop being the most elementary of these control structures.

Contrary to the directional flow of a computer algorithm, the loop enables a conditional flux, as it progresses from start to end by executing a series of repetitions.

We agree with Manovich. But we also think there were loops in Mahler's musical composition and notation. Does an idea start in the mind or in the materialized object? Is existence virtual or actual?

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PIXEL ESPELHO (MIRROR PIXEL)

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ABSTRACT

This paper discusses experiments with the software art platform Pixel Espelho, developed to investigate digital image. Experiments are based on implemented algorithms aimed to blend the available forms of image capturing and processing. The program works as a procedural photographic filter based on parameters given by the attributes of the pixels that compose the input image. The transformation occurs in a logical and calculated way depending exclusively on the interaction with the keyboard, the lanterns, the webcam and the mirror. The image is deconstructed and reconstructed in real time, and in this systematic and intuitive speed concepts are worked : pixel, resolution, shape, color, brightness and lighting [Figure 1]. The observation of software developments and public presentations raises some thinking by displaying a structured imagistic universe, contextualized and powered by the digital advent.

KEYWORDS

Pixel Art, Interactivity, ArtScience, Multidisciplinarity, Image Processing, Video Art
Urban Intervention, Procedural Selfies,Cognitive Neuroscience, Visual Perception

Figure 1 – Artist's Self-Portraits using Pixel Espelho, 2012

INTRODUCTION

"...linguistic communication, both the spoken and the written word, is no longer capable of transmitting the thoughts and concepts through which we have concerned the world. And, new codes are being elaborated. And one of the most important codes is the code of technical images." [1]

Information is no longer in linear text, but in its unfoldings, the invention of the technical image as we find in Vílém Flusser´s legacy.[2] Digital imaging came up reinforcing the computational need of structuring technical image attributes so that we could try and explicitate this code mentioned by the philosopher. The ability to process large amounts of data makes possible the meticulous evaluation of image metadata automatically recorded from electronic cameras and devices.That means you could use Artificial Intelligence techniques [3] to produce visual knowledge. [4]

The technical domain presented by digital images configure a computer science challenge of designing a data type able to generate tacit, complex and non-explicitable visual knowledge. Most of this technological research either is focused on engineering practical matters nor is locked in a commercial codec patent universe.

"The significance of the image is magical, lies on its surface and may be captured at a glance."[5] Flusser's intuitive and highly aesthetical image fruition dialogues with contemporaneous neuroscientific and neurophilosophical models, suggesting that perceptual sense and perceptual concepts are framed in visual attributes through unpredictable, non-pictorial processing. We propose Pixel Espelho as metaphorical platform to access non-obvious cognitive structures, favored by proposed conceptual isomorphisms and high aesthetical impregnation.

Historically, the cinema itself proposed, pioneerly, the illusion as a form of pleasure and wonder, specially represented by the large magnification of the projected visual stimuli. The french illusionist and film maker Georges Méliès was one of the first to realize that films had the power to capture dreams. At late 19th century with a crude technology he made crowds wonder at a movie theather.

For about ten years, the artist/photographer experienced projecting slides on a white 4mx3m dimensions wall, counting with a diverse public, comprising adults and children. I realized how interaction can be varied and fun. Some individuals, especially children, do not resist trying to handle the projected image: touching, hugging, kissing, animal shadows with hands, funny gestures, etc .

Given this domain, multidisciplinary research emerged as a promissing path to address these complexities. This research is aimed to highlight the fundamental elements of digital images on a aesthetical basis, while shedding lights on the artistic roots and scientific (bio) physical correlates of the technical image in pixels.

THE PIXEL ESPELHO SOFTWARE ART PLATFORM

With the above goals in mind, we have developed Pixel Espelho as an experimental software art platform in which mathematical and aesthetic-digital concepts are made available for real-time manipulation. The basic attributes of digital images are opened for interaction through a custom interface with the technological apparatus.

The computational interface occurs primarily via the keyboard [Figure 2] and the webcam [Figure 3]. The software is always adjusted to compose a set interactivity suited to local conditions and demands of exposure.

Figure 2 – Pixel Espelho keyboard, version 2012.

Figure 3 – Webcam de fole, 2012

The programs were coded in Processing.org (Java) [6], a quick and intuitive programming language scheduled to accept a wide range of input and output devices (keyboard, mouse, joystick, kinect, brain sensors, etc). Highlight the Arduino processor [7] that offers an open hardware platform apt to build custom physical devices.

The immersive environment is presented as site art and adds to interaction mirrors, lanterns, projections, reflections and shadows. [Figure 4]. The technological interface is incorporated into the art installation in allegoric,hidden and/or masked form; and can be multiply controlled by public, artist and/or director.

Thus the platform presents itself opened to a diverse range of artistic expression, as it was experienced during these two years of research. [Table 1].

Figure 4 – "Mirror reflectives | Vampyroteuthis Poetik" Scientiarum Historia VI, Brazil, 2013

Art experiment	Partners
Music	Iara Rennó, Rafael Rocha, Negro Léo, Felappi, Scott Henderson Trio, Vernon Reid, Maya Azucena
Performance	Alexandre Constantino, Alê Gabeira, Alex Hamburger, Sideral
Visual Arts / Painting	Manny Bernabé, Alex Pitanga, Fernando Reis
Sound Art	Franz Manata, Saulo Laudares, Bruno Queiroz
Hibrid Art	Labfest "HiperOrgânicos", Nano/EBA/UFRJ
Video Art Instalation	Scientiarum Historia Congress, "I A R A" music concert
Urban Intervention	Vide Urbe, Science Museum
Party / Entertainment	Ronald Duarte, Bosco Bedeschi, Rio das Ostras Jazz Festival
Lectures	PechaKucha, Bits Transdisciplinares

Table 1 – List of partners for art experiments in Rio de janeiro, Brazil during 2012 and 2013.

Should be emphasized the strong role of the script and editing of images, videos and sounds captured live and/or pre-recorded. Translates into a "non-linear script" the control of display and manipulation of media content, accessible from a data structure built in real time.

The interaction potential of the projected image is a charming universe and becomes even more compelling when experienced within a multimedia narrative in real time. Adding a video capturing device to it you see people clowning to webcams, producing multiple selfies, scripting hand animations, etc.

The possibilities to generate narratives are infinite and the more dialogue with other art forms, the more enriching, cognitive and immersive installation will be presented. Pixel Espelho appears as a technological tool that makes available through the computer keyboard real-time image manipulation, based on their elementary attributes implemented on the programming code [Table 2] The public has the chance to intervene according to subjective personal choices and figure out how logically the digital image apparatus proceed.

Pixel Espelho Software Art Plataform	Features
The Software (OpenSource Processing.org language)	Live Video capture, Keyboard input, Image Processing, Image Recording, Hard Disk Recording, Log Recording
Art Installation	Keyboard, Webcam, Mirrors, Projections, Lanterns, Reflexions, Shadows

Table 2 – Technical details of the Pixel Espelho software platform.

GENERAL EXPERIMENTAL IMPLICATIONS IN THEORY AND PRACTICE

Experiments provided by the Pixel Espelho software platform are based on implemented algorithms (The OpenSource Processing Language) aimed to blend the available forms of capturing and processing, as constrained by contemporary technological devices. Possibilities of new interpretations of the technical image and visual knowledge generation have been evaluated experimentally in a range of different formats and rooting contextualization. In order to address them from both theoretical and conceptual perspectives, we have been seeking a conjoint angle to technological, biological, cognitive and aesthetical attributes engaged in visual processing.

Free manipulation of technical image variables represented as pixel form, size and color, predicted in Pixel Espelho, enables public to play with imagetic perceptual resolution. Through free magnification of pixel size, for example, while keeping constant screen size, captured scene and distance to the resulting projected image, the observer/interactor travels from abstract to figurative transducts of the original scene, from impressive aesthetic sensing to expressive cognitive image interpretation. This range of possibilities determined by qualities of Pixel Espelho interactivity impacts on recent neurocognitive and neurophilosophical models aimed to address visual experience.

Predominantly based on direct and indirect experimental evidence, neurophysiological processing of the visual field is in part provided by high resolution images brought about by light rays directed to a very limited, circumscribed region of the retina, the fovea, where photoreceptors are most densely packed. Our accurate visual experience is moment by moment, determined by stimulation of this small visual hotspot. It is confined to what we are directly looking at. It means that we barely experience the peripheries of our visual field; in fact, its activation is assigned to blurred, colorless image drafts. Scanning the visual scene through dynamic, fast and short saccadic eye movements allied to short memory, feeds higher order processing, above the retina, in the brain circuitry. Nevertheless, a bulk of evidence claiming that the pictorial, detailed, uniform, colorful and continuous impression of the image is a high level non-pictographic, non-retinian, but conceptual, image sketch, triggered by internal functional models of the world, is gradually driving our current view of the extracted attributes of the visual objects at sorts of illusory attributes, albeit coherent with presumptive physical qualities [8].

Figure 5 – EAV Parque Lage, Rio de Janeiro, Brazil, 2012.

Normal perception is directed to the world, i.e., we are aware of a prompt sensorial access to a detailed world, but its internal representation is virtual, demanding a constant actualization to sustain the illusion of a detailed visual world. As proposed by Alva Noe [9], "... seeing is much like touching than it is like depicting". Through technical manipulations of image resolution, coupled to form/color resources of high artistic aesthetical impregnation, the sense of wholeness is technically structured, but not technically signified. Herein boosted by strong artistic rapture, Pixel Espelho stands for a metaphorical technical presence, normally absent to conscious inspection, as the image is transduced from reality to imagetic magic, surfacing the technology as high order creative speculum of human cognitive abilities. It rescues to the technique the place of art and magic, and returns image to the place of imagination.

Pixel Espelho induces to the public the illusion and euphoria of large scale self-observation, whether or not modulated by aesthetical and/or mathematical criteria.

The possibilities of interventions created from the algorithm are endless, although operationally and structurally predicted. In consequence the software displays a technologically refined aesthetics. Mostly in an intuitive basis, the experimenter deals with the concept of pixel,

resolution and shape; and manipulates variables such as color, brightness and saturation, intervening on the captured technological "realism". Commands given by the public enables image under manipulation to oscillate from a realistic portrayal of the digital camera, to its complete deconstruction, turning image aesthetics unpredictable and far from a realistic picture. The viewer is not passive; he/she operates a kind of construction/deconstruction imagetic game, and becomes immersed and absorbed by its aesthetic and mathematical properties. Direct manipulations of captured selfie´s [Figure 1] include definition of pixel´s shapes and colors that are calculated by the algorithm and adjusted in real time.

PIXEL ESPELHO: ARTISTIC PRESENTATIONS AND ACADEMIC INTERVENTIONS

This project won the II Mostra VideUrbe (Rio de Janeiro, Brazil 2012), and was strategically installed at urban points of Rio de Janeiro, as site-art. The experience to exhibit an academic work with technological appeal and artistic bias has caught a direct dialogue between the public and my research. The imagetic real-time reply given through commands chosen from a repertoire offered by the computer keyboard drives imagination of experimenters onto an explicit mathematical logic platform provided by the digital image attributes [1].

Several projection surfaces were used, from traditional screens and monitors, through urban furniture [Figure 5], human body and mirrors [Figure 6]. Projections at mirrored surfaces incorporated a playful atmosphere to visuality, adding illusion and phantasmagoria, and generating new imagistic realities. Two interactive installations with projections on reflexive mirrors were exposed in Congress Scientiarum Historia V and VI (Brazil 2012 and 2013), providing the public with a codified, reflected and reverberated imagetic experience through optical and technological devices.

Figure 6 – "Pixel & Mirror", V Scientiarum Historia, Experientia.1, Rio de Janeiro, Brazil, 2012

The project expanded, with the incorporation of features which enable the input to be presented also as a pre-recorded image or video [Table 2]. This allowed the study of live image narratives in contemporary art, especially at performances and music concerts. We experienced a rich exchange with musicians, actors, dancers, painters, sound artists, etc. [Figure 7]. One interactive installation with three reflexive mirrors was presented live on stage, at a pop music concert in Rio de Janeiro (I A R A, Sesc Copacabana, Brazil 2013).

Figure 7 – Art experiments in Rio de Janeiro, Brazil, 2013. From left to right : "I A R A" concert, Iara Rennó; Performance "The individual trilogy", Alexandre Constantino; "Live Paint Pixel Bambu", Alê Gabeira; Labfest "Hiperorgânicos", Nano / EBA / UFRJ.

The experimental work performed so far is fully backed by the principles of Flusser. For him, unlike traditional images, technical images ontologically imagine text, conceiving images who imagine the world.

CONCLUSION

Although only superficially addressable here, we understand the present paper inspires a rich transdisciplinary dialogue, as bringing to scene, around the concept of technical image [2], a spectrum of disciplines, including digital images and information technology, photography and artificial intelligence [3], contemporary neurobiology of visual perception [8] and the twentieth century great advances chiefly represented by the philosophy of photography, as recognized nowadays [2, 10, 11].

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ADDITIONAL LINKS

Pixel Espelho | CAC 2014 https://flic.kr/s/aHsjXF1Lee

Pixel Espelho | Cumlus Aveiro 2014 http://youtu.be/_RKv-d_c740

Pixel Espelho | PechaKucha Rio de Janeiro 2012 http://youtu.be/J3mlLMOWaEQ

Pixel Espelho | Video Doc.http://www.youtube.com/user/CristinaCarioca/playlists

Pixel Espelho | Photo Doc.https://www.flickr.com/photos/cristinaamazonas/collections

SYNCRETIC LIAISON
THE MATHEMATICAL THINKING IN THE COMPUTATIONAL ARTS CREATION

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ABSTRACT

$$Dv = \frac{12\,pi}{200}$$

This essay presents and reflects upon the creation in computational art based on *visual mathematics*[1] and *behavioral mathematics*[2]. The simulation of simple virtual environments this being substituted by experiments with interaction and perception digitally expanded with cyber-physics systems, among others. Thus, mobile devices and pervasive technologies will change the future of think, and artistic opportunities of human-computer interfaces, with its extended responsiveness who will modify the individual's perception as well, the notion of your own self based on hypercomplex systems[3]. These systems integrate the brain-computer interfaces, providing abstractions for artistic creation and modeling, computational poetic and aesthetic.

KEYWORDS

Computer Art, Brain Computer Interface (BCI), Virtual Reality, Interactive Computer Art, Cyber-Physical Systems, Visual Mathematics, Quaternion, Behavior Mathematics

[1] The visual mathematics is the imagery representation of syncretic possibilities between numeric-topological tessituras in virtual and immersive media supports. [ ] (Louro, Revista Recet, 2009, pp47]

[2] The Behavioral Mathematics is the imagery dynamic representation, numeric-topological, which simulates affectivity through computer codes to approximate models of realistic behavior in immersion environments or interaction. [11]

[3] In mathematics, a hypercomplex number is a traditional term for an element of an algebra over the field of real numbers. In the nineteenth century number systems called quaternions, tessarines, coquaternions, biquaternions, and octonions became established concepts in mathematical literature, [10] added to the real and complex numbers. The concept of a hypercomplex number covered them all, and called for a discipline to explain and classify them. After some centurieslurking around, complex numbers gained a geometric meaning: multiplying a number z by i rotates it 90° counterclockwise, zw is seen as a sequence of dilatations and rotations, everything is concisely explained by $z=a+bi=|z|(\cos(\theta)+i\sin(\theta))=|z|\ e\ i\theta$. Of course, these discoveries were historically highly non-trivial and are the hard-won result of a great struggling of people like Bombelli, Euler, Argand and Gauss while trying to understand these weird numbers.

INTRODUCTION

The mathematical approachs for computational art permeates the *illusionist mathematics*[4] [5] [16], after focus efforts towards a visual logic programming exploration in search of models capable of reproducing sensitive and changing architectures, controlled by numerical-topologic arguments arising from mathematical intuition [14] [12] in computational art.

The significance of such statement for Computer Art is that, therefore a movement may happen in a deterministic system, its stochastic behavior may occur in a software due to many of its iterative loops, thus creating very expressive results, but for the mathematicians, such approach shows the beauty of mathematics. Therefore, the mathematical treatment for similar problems is extremely necessary for the achievement of expressive artistic goals.

Assuming that in this transmedia scenarios, from adjustments and controls for users, are the computational parameterizations who develop proper collision detection, and the rotations of objects in three-dimensional spaces that make use of hypercomplex numbers called quaternions[5]. [5] This numeric system called quaternion reveals possibilities of interaction between humans and machines, in order to smoothen the movements that occur in successive experience and in the virtual recognition. [10][9]

Highlighted for the concept about patterns that constitutes a structure capable of replicability in the production of three-dimensional worlds. It is what tells us Louro & Fraga & Louro [16] when they say that the study of patterns constitutes an essential element for understanding the growth of three-dimensional structures in cyberspace.

According to the author, there are specific types of patterns that are directly related to the development and expansion of the three-dimensional structure and its transformation into a timeline, which leads us to different reflections on evolutionary computation in certain complex systems. [10]

Summing up, develop a three-dimensional scenarios means to reflect integrated intelligences based on immersive environments with high complexity computation, visual perception, and imaging synthesis. These systems integrate the dynamics of the physical and mental processes, brain-computer interfaces, providing abstractions for artistic modeling, poetic and aesthetic, which presupposes computational mathematics and embedded systems in devices whose main mission is not computation, such as sensory devices, scientific instruments, medical devices, cars, toys, but successive approximations exploiting embodied interactions, responsive-sensitive environments, *behavior mathematics* or *visual mathematics*. [10][13][15][16]

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[4] The ilusionist mathematics are numerical-topological images which are creating with successive movements an immersive environment of dreams and visual contrasts. [11]

[5] Quaternions were first described by Irish mathematician William Rowan Hamilton in(1805-1865) in 1843, and are defined in R4 space and is sometimes symbolized by H in honor of its creator. Quaternions can be interpreted in various ways. (Louro, pp 48 [17])These can be considered as a vector of dimension four, a complex number with three imaginary units. An hypercomplex number.Quaternions [they were are members of the 4D space of dilative rotations in the 3D space. Hamilton made tremendous effort in promoting these numbers, but vector algebra is often cleaner. If I am not mistaken, Maxwell's equations, originally written in cumbersome quaternion notation! However, because quaternions are good in describing rotations in 3D and do not suffer from problems as the gimbal lock, they are still used today in computer simulations, along with Euler angles and matrices. [14]

The Mathematical called nonlinear, with advances of computer technology have established a stage of transformation in art and science. In a short time, the digital technologies have changed the ergonomy, visual perception and seizure behaviors. By observing the contemporary environment we projected onto him our worldview, which left us as legacy perceptive, and true scientific seizures that occurred, beyond all the collective imagination carefully constructed by the means of mass communication. What we are able to perceive are reflections, or redundancies would say Claude Shannon (1948) [16], the world filtered by our perceptual and cognitive system. The computer simulation is an important aspect in the observation units of mathematical forms.

A CREATIVE SET: INTUITION AND TOPOLOGICAL TESSITURAS.

The present approach intend to understand the singular aspects that characterize the choices put to artists and mathematicians for a customized implementation for Computer Art [1]. However, as Poincaré says "we can understand that this feeling, this intuition of mathematical order, which enables us to guess hidden harmonies and relations, cannot belong to every one. Some have neither this delicate feeling that is difficult to define, nor a power of memory and attention above the common, and so they are absolutely incapable of understanding even the first steps of higher mathematics" [15]

The images are representations of mathematical models that we conceive mentally, ie, are diagrammatic visual signs that present the behavior of our intuition, or at least arguments are of the same nature. The relationship in the production of imaging techniques with emotions, "a priori", the numeric-algorithmic constructions topological animations, previously planned, with cognitive fundations through tessitura of the imaginary and the characters portrayal, based on the literature and mythology, unveils, for furthermore, the transdisciplinary nature of staff in affective modeling and cognitive repositories.

In the planning of movements, its effects, interactions and emotions are discussed possible numeric-topological inferences involving sensors to increase the degree of immersion and interactivity.

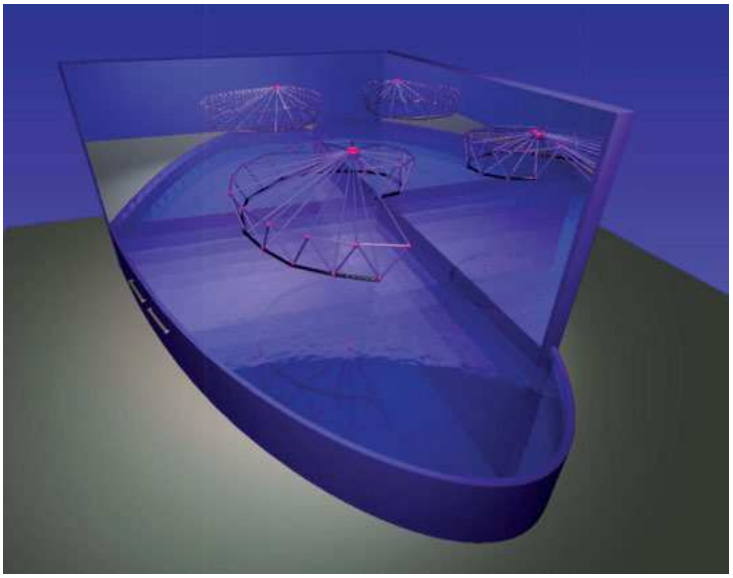

Figure 1 – Tania Fraga - NumericVariations

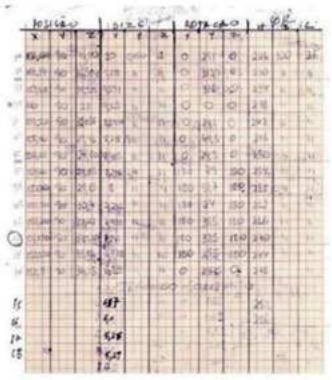

Figure 1a *Figure 1b* *Figure 1c*

The hidden mathematics(Figure 1a, 1b, 1c) that characterizes behaviors in the creative process of these productions in visual arts, unveils morphologies as computational intelligence. These morphologies are shown above in works where visual effects and cognitive expectations through affective states "a priori" were studied in artistic composition.

THE PATH: N-DIMENSIONAL DETERMINISTIC IMAGES USING QUATERNIONS, OCTONIONS

The most important issue we need to point to is that for these settings the computer will mediate dozens of processes linked together through thousands of lines of codes. The mathematical relations are many and, for the purpose and clarity of the subject, we choose to

focus on one of them that which has produced many discussions with a very interesting artistic result what are shown at figures 04 and 05.

I have solved myself (says Colonna) some problems with the concept of many mathematical function, as. It allows in particular describe mathematically irregular and disordered phenomena unreachable using the euclidean and not-euclidean geometry. The Figures {2,3,4,5,6) were designed and manufactured including mathematical models, programs, calculations and visualizations by Jean-François Colonna from CMAP (Centre de Mathématiques Appliquées) UMR CNRS 7641 / Ecole Polytechnique, France.

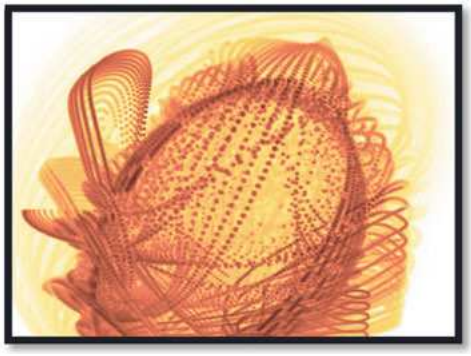

Figure 2 – Tribute to Isaac Newton Artistic View of Solar System

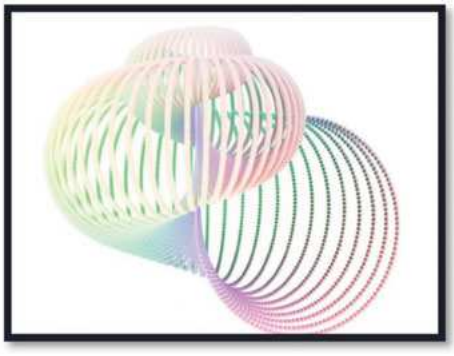

Figure 3 – Based on Jeener surface

Note that the parametric equations of Jeener surface we can see through black and white display with depth-cueing of the normal field with:

$$Du = \frac{8.pi}{200} \qquad Dv = \frac{12.pi}{200}$$

Thus, each of the normal vector is visualized using 32 spheres with decreasing radii in order to show its direction.

Following the parametric equations of Jeener surface 1 we have:

$$F(u,v) = e^{ku}(1+\cos(v))\cos(u)$$

$$x$$

$$F(u,v) = e^{ku}(1+\cos(v))\sin(u)$$

$$y$$

$$F(u,v) = e^{ku}(2+\sin(v))$$

$$z$$

$$k = \frac{\log(2)}{2.pi}$$

$$u \in [-2.pi, +2.pi]$$

$$v \in [-\frac{pi}{2}, +pi]$$

The attributes of each sphere are chosen as follows:

RADIUS = constant

$$RED = 1 - K\left(\frac{dF(u,v)}{R\,du}\,\frac{dF(u,v)}{x\,dv}\right)$$

$$GREEN = 1 - K\left(\frac{dF(u,v)}{V\,du}\,\frac{dF(u,v)}{y\,dv}\right)$$

$$BLUE = 1 - K\left(\frac{dF(u,v)}{B\,du}\,\frac{dF(u,v)}{z\,dv}\right)$$

$$Du = \frac{8.pi}{200}$$

$$Dv = \frac{3.pi}{200}$$

For the sphere paradigm to be helpful, we must sample these data; I call this process *atomization*. This process will give us a set of points; each of them will be visualized as a lighted sphere centered on it (by the way, these sets can be very far from our daily experiments; then, three-dimensional clues must be given-like depth cueing or again fog effects.

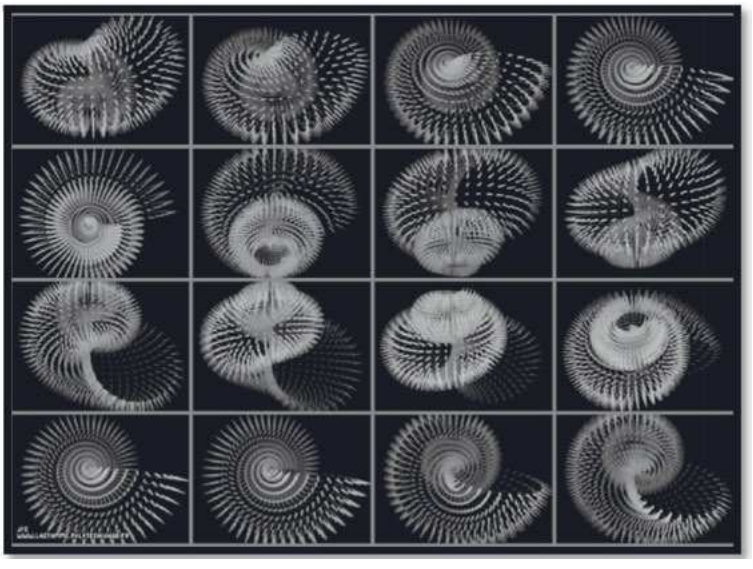

Figure 4 – a rotation of this normal field

The atomization process (displaying a continuous object with a finite number of colored spheres) reveals the intricate inner details of the surface without the ambiguities of transparencies, when the apparent variation of the size of spheres (due to the projection) gives a good depth cue.

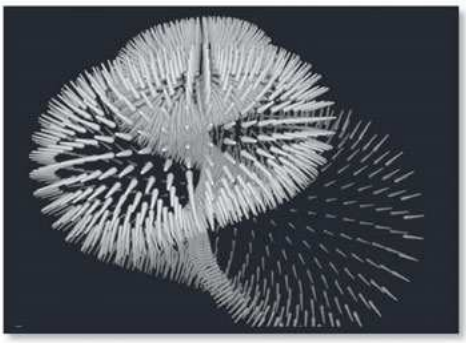

Figure 5 – pseudo-quaternionic Tribute to José Hernández.

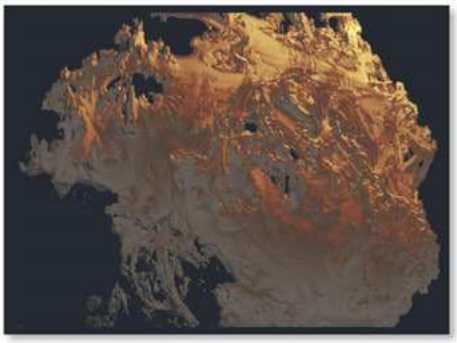

Figure 6 – Colonna.

RESSONANCES:

Summing up, develop a three-dimensional scenarios means to reflect integrated intelligences based on immersive environments with high complexity computation, visual perception, and imaging synthesis. These systems integrate the dynamics of the physical and mental processes, brain-computer interfaces, providing abstractions for artistic modeling, poetic and aesthetic, which presupposes computational mathematics and embedded systems in devices whose main mission is not computation, such as sensory devices, scientific instruments, medical devices, cars, toys, but the *successive approximations method*[6] exploiting embodied interactions, responsive-sensitive environments, behavior mathematics or visual mathematics. [10][13][15][16]

In conclusion, it is possible to speculate on the growing possibility of entwining art and mathematics. These objects could be constructed with its own characteristics and behaviors, they are called *automata*[7] *objects* and this will provide the sensation of the world who we define, or who was explored around sucessive aproximations in the computational art. We are convinced that the cognitive, affective and human sensory systems are developing potential symbiosis with machines [6] (pp: 438, 494-495). Perhaps we will fail to understand all factors inherent to the complexity of the phenomena involved when we intertwine humans and machines. [10]

Mathematicians and artists continue to create stunning works for technology and to explore the visualization and visual perception of mathematics in creative process. There are many contributions to this science, mathematics, which in its purest form provides the

[6] This method allows, according to Louro & Fraga, weave and expand nonlinear processes by establishing multiple patterns toward increasingly complex structures; it provides the aglutinamento of signs on new meanings, awakening sensitivities, instigating curiosity, stimulating actions for itself and others, bringing paradoxical situations to be experienced.

[7] An Automata is (plural for Automaton) is an object that contains all your automata objects for an specific system.

structure and beauty in "n" dimensions, the creation of perception, reflection of the application, as convergence of know-how, and always presents as expression of technology and culture of a people or group of people, seeking to transcend and survive.

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SEX BOT MANTRA: A CYBRID PERFORMANCE BY THE POSTHUMAN TANTRA

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ABSTRACT

This article presents the creative process that culminated in the cybrid performance "Sex Bot Mantra", by the group of performers known as Posthuman Tantra, which is directed by the multimedia artist Edgar Franco. It underlines the transmedia fictional universe "Posthuman Dawn", which is used as context for the performance's creation - a world inspired by future possibilities made by technological advances and the emergence of the transhuman, and also the techgnostic aspects of such hypertechnological future. Finally, it also depicts aesthetic aspects and technological developments existent in the performance, which makes use of traditional multimedia resources and also contemporary ones, such as videos and augmented reality (AR) applications.

KEYWORDS

Performance, Art & Technology, Posthuman, Science Fiction, Electronic Music.

INTRODUCTION: THE POSTHUMAN TANTRA

The Posthuman Tantra is a transmedia music project that creates electronic and digital songs and has as influence music genres such as psychedelic rock, sci-fi, dark, industrial and ambient. The project was created by the artist and researcher Edgar Franco in 2004. At first, the music of Posthuman Tantra emerged in order to be the sound track for the trasmedia fictional universe "Posthuman Dawn" - a sci-fi world created by Franco with basis in the fusion between DNA and silicon, where new creatures are a mixture of human, animal, vegetal and machine. The music and the concepts that engender the aesthetic and fictional aspects of the project are influenced by the techgnostic ideas of thinkers such as Robert Anton Wilson, Terence McKenna, Buckminster Fuller, Teilhard de Chardin, Aldous Huxley, Madame Blavatsky, John C. Lilly, Timothy Leary, Rupert Sheldrake, Ken Wilber, P. K. Dick, Stanislav Grof, Ray Kurzweil, Hans Moravec, Vernon Vinge, and also the works of artists involved with new technologies and thoughts about the posthuman: Orlan, H. R. Giger, Mark Pauline, Natasha Vita More, Stelarc, Roy Ascott and Eduardo Kac. Techgnostic thoughts and the search for transcendental aspects within a hypertechnological context also form the conceptual range of songs and performances of the band, something that entails investigations about movements such as The Extropy, Transhumanism and Immortalism.

The Posthuman Tantra intends to be a constant union between the visual creations of Edgar Franco and the universes of electronic music and multimedia performances. Since its creation, the Posthuman Tantra has participated in several compilations in 4 continents and has released a number of albums, some in partnership with the French band Melek-tha, its debut album "Pissing Nanorobots" (2004), "Biotech Werewolves" (2013) - by the English label 412 Recordings - and two official albums, "Neocortex-Plug-in" (2007) and "Transhuman Reconnection Ecstasy" (2010), both released by the Swiss label Legatus Records, with which the band has a contract for two more albums.

The band has received positive reviews from important publications about electronic music, such as the magazine "Judas Kiss" from England, the Belarusian website "The Machinist" and the Brazilian magazine "Rock Hard Valhalla. In 2010, Posthuman Tantra and Legatus Records released its second full-lenght "Transhuman Reconnection Ecstasy" with great success within the specialized media, and also in 2010 the band became a group of performers and began doing live performances with its debut taking place at the "Woodgothic Festival II", in São Thomé das Letras (MG). This festival is considered to be one of the most important for the Brazilian gothic scene, and also gathered international attractions.

The live performances of the Posthuman Tantra are multimedia presentations with basis in the "Posthuman Dawn" and display videos, computer and electronic applications, and artistic acts exclusively created by Franco in partnership with the members of the research group "CriaCiber - Criation and Cyberart", which is part of the post graduation program in Arts and Visual Culture of UFG – Goiás Federal University/Brazil. The computer effects of augmented reality (AR) give the performance a cybrid character for it creates "cybrid environments - which aggregate simultaneously the real and the virtual" [1]. The Posthuman Tantra was one of the first performer bands in the world to use such resource on stage.

The aesthetic ecosystem of Posthuman Tantra's performances envelops strong techgnostic aspects and proposes an approach between transcendence and hypertechnology by means

of a contextualization with basis in science fiction. At the same time, it also rejects the aseptic character of advertising imagery, which leads into consumerism and the destruction of the biosphere perpetrated by multinational companies with the support of global advertising agencies.

These performances comprise electronic music, multimedia projections, narration in the form of "HQtrônicas" (electronic comics), augmented reality (AR), face detecting effects, and elements of electronic wizardry. Such elements give shape to a cyber-ritual that invites the audience to enter a transhuman world of reconnection with the cosmic essence, and blends the mythical transcendental universe of the shamans from ancestral Brazilian cultures to the new digital cosmogonies of telematic nets.

The cybrid performances of the Posthuman Tantra have been presented in academic events such as 9# ART / 10# ART e 11# ART - International Meeting of Art and Technology (Brasília, 2010, 2011, 2012), 10 Dimensions of Art and Technology (João Pessoa, UFPB, 2010), III, IV, VII National Seminar of Art and Visual Culture of UFG (Goiânia, 2010, 2011, 2014), II FAM - International Festival of Art and Media (Anápolis, 2011), Performances Festival Test Tube (UnB, Brasília, 2012), I Alternative Art and Culture Festival of Tejuco UFU (Ituiutaba, 2012), 8º National Symposium of Contemporary Art of UFSM (Santa Maria, 2013), I Congress of Philosophy of Goiás/UFG (Goiás, 2014), and also in important national events of independent music such as II Woodgothic Festival (São Thomé das Letras, 2010) and 16º Goiânia Noise Festival (Goiânia, 2010).

THE POSTHUMAN DAWN: A FICTIONAL TRANSMEDIA UNIVERSE

The creation of wide fictional universes that make possible the development of works in several audiovisual formats has won greater attention after the franchise "Star Wars" came out by the end of the 1970s and beginning of the 1980s. As time passed by, support characters that were part of George Lucas' saga have secured their presence in other kind of products, e.g. comics that show other aspects of that universe, cartoons, board and computer games that were added to the traditional trifles and toys linked to the series, all of which aroused interest of fans to diverse aspects of the story.

The media phenomenon caused by the fictional universe of "Star Wars", the appearing of new stories developing further aspects of its cosmogony, and the spreading of the saga over diverse formats of storytelling can be pointed out as a good example of transmedia narrative - or transmedia storytelling - of which another known example is the franchise Matrix (1999). For the MIT (USA) professor and researcher of media Henry Jenkins [2]:

> A transmedia narrative develops itself through multiple platforms of media, with each new text adding distinctively and valuably to the whole. The ideal form of transmedia narrative has each media doing what it does best - in order to allow a story to be introduced in a movie, be extended for television, novels and comics, and have its universe explored in games or experienced as an amusement park attraction.

Jenkins' conceptualization is broad, nevertheless, the author is too committed to treating the phenomenon of transmedia narratives as something linked to the market and the acquisition of entertainment products. His point of view turns away from the so called authorial perspectives

of art and, like other researchers of the phenomenon, it is linked to the concept of franchise and cultural industry even though within the media convergence perspective. About transmedia products the author adds that:

> Each access to the franchise must be autonomous so that it is not necessary to enjoy a movie in order to enjoy a game, and vice versa. Each product is a point of access to the franchise as a whole. The understanding obtained through these various media supports a depth of experience that induces to more consumption. [2]

Furthermore, Jenkins introduces the idea that we live "in an age when few artists are comfortable working equally with all media"[2], which reaffirms his belief that - also within the context of the so called convergence culture - the development of entertainment products by the culture industry has a subdivided character. For Edgar Franco - as an artist interested in developing authorial poetics detached from the marketing and purshase obsessions - it is relevant to deceive such subdivided perspective of transmedia narratives within the context of the culture industry, and endeavor to produce works of art that make use of the same transmedia strategies, yet aiming at a poetic point of view and self-expression. The transmedia fictional universe "Posthuman Dawn" - a work in progress developed by him since 2000, and for which he has produced works of art for multiple supports - is Franco's personal effort to take the transmedia narratives into the context of art.

Edgar Franco's work for multiple media has as basis the science fiction universe "Posthuman Dawn"[4]. These works are ruled by the idea of "conceptual displacement", defined by the American author P. K. Dick [3], for they displace time, gnosis and technology to a hypothetical future, in order to actually discuss contemporary questions. The "Posthuman Dawn" is a fictional future world created by Franco and inspired by artists, scientists and philosophers who think over the impact of new technologies - bioengineering, nanotechnology, robotics, telematics and virtual reality - on the human species. Other sources of inspiration for the creation of the "Posthuman Dawn" are movies such as eXistenZ, Matrix, The Thirteenth Floor, Gattaca and Avatar (which deal with such issues and incorporate them into pop culture), and sects like the Immortalists, Prometheism, Transtopianism and the Raelian Movement. This last one, for instance, believes in cloning as means to access eternal life, that in the future, transgenic food might end hunger on the planet, and that nanotechnology and robotics are panaceas that will eliminate human labor. The movement is lead by the pseudo-guru Raël, a hedonist who builds his speech with basis on the most optimist foresights of science and propers his thoughts on controversial messianic affirmations.

Still immersed into the study and investigation of these polemic thoughts about technoscientific advances, predictions and experiences, the seed for this poetic-fictional universe came into being in the year of 2000, and was later baptized as "Posthuman Dawn". The starting point was to imagine a not too far away future where most of science and high technology propositions have become ordinary reality, and the human race has passed through an abrupt rupture of values in a physical way - change in shape - and in a moral way, ideologically/religiously/socially/culturally - meaning a change in content. That is a future when the transfer of the human consciousness into computer chips has become possible and ordinary, when millions of people will abandon their organic bodies in exchange for robotic interfaces. Also in this hypothetic future, bioengineering has developed enough as to allow the genetic hybridization between humans and animals, creating uncountable anthropomorphic mixtures, i.e. beings

with physical traits that instantly remind us of mythological chimeras. These two posthuman "species" became antagonistic and hegemonic cultures that fight for power in capital cities around the world, while a small portion of inhabitants, an oppressed lineage that is about to be extinct, insists in preserving their human traits and resists to the changes.

Two of these three races that inhabit this future planet Earth can be called posthuman: The Extropians - non-biological beings that result from the upload of consciousness into computer chips, and the Technogenetics - hybrid beings of human and animal, creations of the advances in biotechnology and nanoengineering. Both races, Extropians and Technogenetics, count with special servers: Extropians have Silicon Golems - robots with advanced artificial intelligence, of which some fight for equal rights before the other races -, and Organic Golems - biologic robots who serve the Technogenetics. The third race present in this context is called Resistant, the so called "traditional" human beings, a race that is in the edge of extinction and represents less than 5% of the planet's inhabitants.

SEX BOT MANTRA: A MULTIMEDIA PERFORMANCE

The live performances of the Posthuman Tantra are multimedia presentations that make use of videos, computer and electronic applications, and artistic acts created exclusively by Edgar Franco [4] together with the members of the research group CriaCiber - Creation and Cyberart. Furthermore, the Posthuman Tantra was one of the first bands in the world to ever use the computer effects of augmented reality (AR) on stage. For the band's performances, Franco counts with VJs, guest performers and also the priceless assistance of his wife Rose Franco, who plays keyboards and controllers for some songs.

For the cybrid multimedia performance "Sex Bot Mantra", the Posthuman Tantra takes onto the stage the fictional universe of the "Posthuman Dawn", and adds to the digital ambient sound several audiovisual resources that aim at simulating a posthuman context, in which the performer Edgar Franco and his guests pass through hypertechnological rituals of transmutation into hybrid creatures. "Sex Bot Mantra" contains strong sensual and techgnostic aspects, and proposes an approximation between transcendence, eroticism and hypertechnology, at the same time that rejects the aseptic character of advertising imagery, which leads into consumerism and the destruction of the biosphere perpetrated by multinational companies with the support of global advertising agencies. The basic set of the performance "Sex Bot Mantra" is formed by nine acts. These are structured according to the digital songs that give name to each of them and include their main concepts. The presentation lasts 50 minutes. The nine acts are: I – Biotech Antenna; II – Ciberpajelança; III – Transhuman Werewolves' Mutation; IV – The Little Bob's New Toy: Sexual Initiation With a Multifunctional Robot; V – Os Mistérios Insondáveis (The Unfathomable Mysteries); VI – Penetrating The Virgin Bioport; VII – Tênue Esfera Azul (Delicate Blue Sphere); VIII – O Selvagem (The Wild); IX – Tema o Homem, Ame o Lobo (Fear the Man, Love the Wolf).

Act II: "Ciberpajelança" - This act follows a song that summons a shamanic ritualistic atmosphere for the embodiment of a totem or "pajelança" (conjuring). This track proposes a conceptual blending of vegetal realities - i.e. the achievement of transcendental levels of consciousness by use of advanced ancestral technologies, or entheogen, also known as plants of power like the Ayahuasca and the Psylocibe Cubensis - with virtual realities, i.e. the

creation of cosmogonies and digital worlds aiming at new forms of consciousness expansion. Edgar Franco takes over the identity of a "ciberpajé" - or cybershaman - who combines both vegetal realities and virtual realities in the search for transcendence. The performer embodies a technomystic totem who has snakes coming out of his back. The computer effect of augmented reality (AR) allows the viewers to see live, on a big screen, how the musician becomes a posthuman hybrid creature.

Figure 1 – Edgar Franco during the performance of Act II - Photo by Veramar Martins.

Act III: Transhuman Werewolves' Mutation - This act suggests the reconnection of man and nature through the incorporation of animal genes into the human body. Throughout the technological development of the last centuries, the man has lost the perception that he is a natural being and became detached from nature and its creatures. The performance proposes that the hypertechnology used to manipulate the genetic code is like an ouroboros, or a process of reversion by which men will meet his natural dimension again. When he embodies the genetics of a wolf, who still lives integrated with nature, he will understand once more his natural and cosmic connection. This performance makes use of augmented reality (AR) and face detecting effects as means to transform - live - Edgar Franco's and guest performers' faces into a transgenic werewolf. The change can be seen on the big screen while the "ciberpajé" sings the song "Transhuman Werewolves' Mutation".

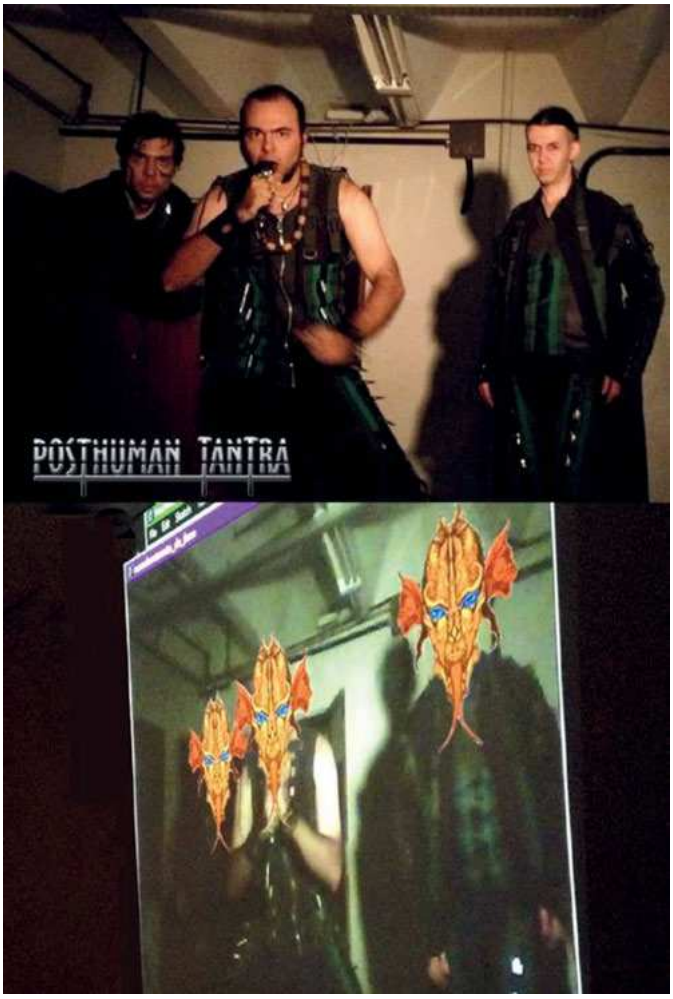

Figure 2 – Act III being performed at the event Test Tube (UnB, Brasília, 2012)
Photo by Hidemi Nomura.

Act IV: Little Bob's New Toy - Sexual Initiation with a Multifunctional Robot - This track talks about emerging sexuality and its controversies in the posthuman context. It tells the story of a mentor who buys a multifunctional robot for his pupil in order to make his sexual initiation. In this case, a cyborg takes place of a human to play that role, and by doing so, it reconfigures the jung man's pleasures and desires, and eventually causes him to develop a technofetishist sexual degeneration. It is about the entertainment industry investing massively in the post-biological sex, on the search for immediate pleasures. The exclusive video created for this performance is based on sexual machine-organic servomechanisms, and ends with the metaphor of blood covering the screen, which represents the unrestrained violence of the act. While the song is played, Edgar Franco [4] performs the penetration of a multifunctional robot with obscene gestures, which is one of the most controversial moments of the performance and came to cause an act of deliberate censorship during a University event. Read more about it bellow.

Figure 3 – Ciberpajé performing Act IV - in event at UniEvangélica, Anápolis, GO, Brazil, 2013 - shortly before the group was censored.
Photo by José Loures.

Act VI: Pentrating the Virgin Bioport - This act has been inspired by the movie eXistenZ, by canadian movie director David Cronenberg. In the movie, the so called "bioport" is a new hypertechnologic hole that is opened on the basis of the player's spine like an outlet, and into which an organic virtual reality game console can be inserted. The console is made out of transgenic amphibians and is fed by the users blood. The performance underlines the eroticizing of such opening. During this act, one of the performers has an opened "bioport" on her back - a plug-in P10 - and the simulation also counts with an exclusive video, effects of electronic wizardry and artificial blood.

CONCLUSION: "SEX BOT MANTRA", A PLAIN INSURRECTION AGAINST ADVERTISING ASEPSIS AND MULTINATIONAL CORPORATIONS

In an interview conducted by professor Dr. Ademir Luiz for the UEG's newspaper "Erudito Pelo **Não** Dito", Edgar Franco [4] was questioned about the adverse reactions from the academic audience who watched one of Posthuman Tantra's performances, which the interviewer had also watched. While some people cheered and applauded, others left the room exasperated

by the insinuations of sex and violence. The interviewer also questioned the performer about the real motivation of such conservative attitude from the side of members of an academic community. In order to answer such question, Franco evoked the thought of one of the greatest contemporary artists in his opinion, the English comic designer Alan Moore, who also declared himself a magician, as Edgar Franco, i.e. a person who manipulates symbols as a means to seek change in the world's perception. Moore points out that the real artist gives people "what they need" and not "what they want".

In the 20th century, art was overcome by entertainment, and the common sense began to consider the empty entertainment produced by the mass media as a kind of art. Notice that even nullities who participate in reality shows are considered "artists". The world of advertisement is teeming with "black magicians" who manipulate symbols only to induce the consumerism. The adds are clean, polished, beautiful, show young faces, well-fed families, all is aseptic - almost like in a hospital - in an idealized world that only intends to induce the purchase of goods. The visual language of advertisement is the dominant language of the globalized world. It dictates the rules to other imagery systems, it contaminates all audio-visual media. As an artist, Edgar Franco rises against this dissimulated asepsis, this pseudo-cleansing that covers up all the dirt around the destruction of the planet and other species, only to secure the profit of few.

According to Franco [4], the people who left the showroom during the performance made him proud, for they made him sure that his artistic purpose is being accomplished. There is no authentic work of art that does not provoke nor disturb. Moreover, the performance's sex insinuations are in no way more aggressive than that of nearly naked dancers who insinuate anal sex with grotesque dance movements on national TV on Sundays. Nevertheless, these dancers are wrapped up with that advertising asepsis, and for this reason, they are accepted and praised by those who are subjugated by the magical control of multinational enterprises. The Posthuman Tantra denies this asepsis and gives a new context to the symbolic and conceptual manipulation of such elements, and, in the case of the sex insinuation, the group carry out a reflection about the emerging technofetishism.

The Posthuman Tantra has been presenting its work in several academic events in the country. Its proposition has called attention of the academic world for being iconoclastic and unusual, and its reception is generally the same: love or hate. Few stay irresponsive while watching the performance. Actually, on October 22nd of 2013 the group was interrupted while performing the forth act - of the 8 acts previously planned - at the "International Congress of Research, Teaching and Extension of the UniEvangélica of Anápolis/GO. By the end of the fourth act, called "Sexual Initiation with a Multifunctional Robot", the organization of the event turned on the lights in the auditorium and, in an open act of explicit censorship, shouted out loud that the presentation was over. That was an attitude that caused great embarrassment for the all members of the Posthuman Tantra. The duration time of the performance had been previously agreed upon by the event organization, and the group still had 25 minutes left to present. After such act of censorship, Franco tried to ponder over the situation, but was not heard, and so declared to all present audience that the group was being censored and the whole episode was registered in video. The Posthuman Tantra was invited by the organization of the event, who should know what their performance dealt with - there are videos, photos and other details about it in channels of Youtube, Myspace and Facebook. The Post Graduation Program in Art and Visual Culture of UFG - Federal University of Goiás, for which Edgar Franco teaches permanently,

sent a "motion of repudiation" to the rector and vice-rector of UniEvangélica Anápolis for the act of censorship.

For Franco [4], the Posthuman Tantra is an artistic ritualistic space. During the presentations, he indeed embodies the role of "ciberpajé", manipulates symbols and secrets as means to modify reality. The performer knows the difficulty to rise against the empire of multinational corporations and their conglomerate of "black magicians" - the great "awarded" global advertising agencies - , yet, he takes this challenge in a quixotic way, because for him there is no art other than the one that seeks to change the world. The artist knows about the restricted reach of his performances, but says that through morphic resonance some of the ideas existent in his work might survive and go on living in the core of our culture.

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ON MEDIA ART SOFTWARE

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ABSTRACT

In this contribution we deal with 'media art software'. What is it? How can we describe it? What would be the purpose of such endeavor? If we accept that we are living in a 'software society', what is the place of media art software? How does it define our community and practice as media artists? Our intention is to explore different perspectives on media art software by taking into account insights from 'software studies', 'software criticism', and 'software as culture'. We also present some cases of study and we conclude by recalling the necessity of documenting software (names, versions, platforms, algorithms) but also to reflect on the software itself: how it works and what it does to an artwork.

KEYWORDS

Media art software, software studies, software criticism, software culture.

INTRODUCTION

The field of 'media art' represents a vast and exciting territory to investigate the role of software as object, as ideology, and as semiotic apparatus. The pioneers of the relationship between art, media, science, and technology experimented early with new materials and devices, realizing that computers provided huge potential to sketch, add, and modify parametric, stochastic or generative processes. Artists have always created and adapted their own tools and, in the digital era, part of those tools can be recognized as 'media art software'.

The literature available in our domain already covers valuable reflections on software and art. There exist studies on the history of media art, exploring concepts, ideas, visions, and styles. Moreover, our field has several dedicated conferences and exhibitions that publish catalogs and document the variety of artists, artworks, techniques, and materials. Of course, we are still far from accepting that media art benefits from the recognition it deserves among other communities and the general public, but it seems that the increasing presence of software in every aspect of the culture will motivate the change. We are optimistic.

In this scenario, we want to contribute with some thoughts on 'media art software'. Our intention is to evoke some questions that have not been fully explored related precisely to media art software as object and as ideology. The notes and insights we present emerge from our own ongoing practice in the field: as experimental media artist, as scholar, as organizer of congresses, as curator, and as program director of graduate and undergraduate academic programs.

MEDIA ART SOFTWARE AS MEDIA

How can we define 'media art software' as media? First of all, we suggest a distinction between this term and other related forms: media art software is not artistic software, at least not in the sense of Gourinova and Shulgin: "artistic software is, first and foremost, software created for purposes different than traditional pragmatic ones. Such programs are not seen as tools for the production and manipulation of digital objects - from online bank accounts to works of art - they are works of art in their own right" [4]. As we can see, artistic software is more related to software art. It is an artwork in form of software. Technically speaking, this kind of software is, most of the times, the source code and its compiled result. As any other software, it can be distributed, accessed, installed, used.

Software art is exhibited and curated, and KURATOR has been one platform interested on software curating. For its members there is a difference between software as art and software in general: "software is defined as a set of formal instructions, or, algorithms, a logical score that can be translated into a computer program and executed by a machine. It also includes associated documentation concerned with the operation of a data processing system (e.g. compilers, library routines, manuals, and circuit diagrams)" [5]. We believe it is important to distinguish between 'art as software' and 'software to create media art', even though in everyday practice the distinction may be become difficult. Some artists, for example, often use a piece of 'software art' as an authoring tool to produce her original work. However, we can also notice that much of the artwork already resides in the software; as if the generated work would be a descendant.

Also related to media art software is the tag 'media software': "programs to create and interact with environments and media objects (...) They are a subtype of 'application software' (...) Media software allows creating, publishing, accessing, exchanging and simulating different types of media such as images, animated sequences, 3D models, characters, spaces, texts, maps, interactive elements, as well as various projects and services that use those elements" [6]. Media software can be seen much like authoring tools and social networks. Although media art software acts as an authoring system, the term 'media software' seems better suited within the context of personal and professional production of media content. The outcomes are expected to fulfill a function and not 'for purposes different than traditional pragmatic ones'.

Reas and Fry account for the importance of software in arts: "software holds a unique position among artistic media because of its ability to produce dynamic forms, process gestures, define behavior, simulate natural systems, and integrate other media including sound, image, and text" [8]. Reas and Fry not only write about media and software but they are also the beginners and main developers of Processing, a programming tool specifically created for artists and designers that is exemplary of media art software.

In their book, Reas and Fry dedicated a useful appendix to present other development tools for art; and they are all programming languages. Media art software could be then better seized if understood as an authoring system [10] where software applications and programming languages interrelate and cooperate. As we know, the great majority of software application users mainly communicate with it though its GUI, but a lot of these programs can also be extended with scripts and computer code. This means that GUI and programming languages lay in the same container; they are like two creative modes and/or layers that can be used separately or integrative.

A final remark. Artists have always explored and combined new materials. In the digital terrain this often means hacking, modifying, disrupting, connecting, and remixing software components, scripts, source code, and binary files (besides hardware and devices). In that form, media artists may consider any software as a potential environment and laboratory to create media artworks, even if it is an accounting application or an office suite.

MEDIA ART SOFTWARE AND CULTURE

What are the effects of media art software? One of the pioneers of digital art, Jack Burnham, curated in 1970 one of the first exhibitions of our field: Software, Information Technology: Its New Meaning for Art. As Edward Shanken points out, Burnham's idea of software was of a metaphor for art: "He conceived of 'software' as parallel to the aesthetic principles, concepts, or programs that underlie the formal embodiment of the actual art objects, which in turn parallel 'hardware'" [9]. We agree. Most studies on art movements understand art mainly from the aesthetics standpoint, concentrating on the experiences from the visitor side, on the dialogue that was established, and the altered effects that remain at the end of the day (most of the time in the viewer, and for Burnham, also in the manipulated artwork).

Is it possible to say the similar about media art software? Is there an aesthetics of media art software? To tackle this question we have to direct our discussion towards 'software criticism',

which completes the aesthetic approaches. Software critics reflect on ethical, political, and socio-historical questions.

For example, Matthew Fuller understands software as a form of digital subjectivity [2]. The accent is put on the human-computer interface as the window and mirror of software, but also of a series of ideological, historical, and political values attached to it. To study the HCI implies to investigate power relations between the user and the way the software acts as a model of action. This idea goes along, although not exactly formulated as software criticism, with Winograd and Flores: "We encounter the deep questions of design when we recognize that in designing tools we are designing ways of being" [11].

In a recent essay, Alexander Galloway thinks about the question of interfaces and claims that they are not objects, but rather processes and effects [3]. He observes the computer as a set of actions that relate to the world, so he embraces the philosophical standpoint of ethics to develop his arguments. For the author, the interface is a functional analog to ideology. Hence, the interface is not the object, but it is within it. It is manifested at the surface level of digital media, devices, and graphical representations.

Later, Galloway claims that software inherits some properties from interfaces. Software would be an allegorical analogy to ideology, i.e. more a simulation than a vehicle of ideology: "What is crucial in software is the translation of ideological force into data structures and symbolic language" [3].

These brief insights into software criticism allow to think about 'media art software' differently. First, following Galloway, software functions in a dialectical fashion that requires *visibility and invisibility*. While computing code might be hidden as it is, only to be interpreted and parsed, at the same time, the artist/developer has a high degree of declarative reflexivity (variables, functions, etc.). This resonates with our earlier coupling of software applications and programming languages: media art can also have two entry points for software criticism and should take into account the dialectical logic between invisibility and syntax formalism.

Second, following Fuller, our practice as media artists could also be thought in terms of 'speculative software'. If software simulates ideology, then such simulations might be interrogated. Speculative software would be software that reveals its processes as it enacts them: "What characterizes speculative work in software is, first, the ability to operate reflexively upon itself and the condition of being software (...) to make visible the dynamics, structures, regimes, and drives of each of the little events which it connects to. Second, (...) to make the ready ordering of data, categories, and subjects spasm out of control. Third, it is to subject the consequences of these first two stages to the havoc of invention" [2].

Finally, let's come back to digital subjectivity. Nake and Grabowski seem to summarize Fuller and Burnham. They see 'aesthetic computing' as the introduction of subjectivism into computing... with all its consequences. They recall a very important aspect of software and computers: "the computer does not directly operate on the pixels on the screen. It operates on their representations in the display buffer, and further down on this scale of manipulability are representations of other entities that form the real stuff of programs" [7].

For any speculative effort on software, it seems necessary to go further down the GUI. The more we know the software, the more we can interrogate its simulations. But before simulations, there are bits and bytes, functions and classes, visual representations, etc. How can we access to them? How they relate between them?

MEDIA ART SOFTWARE AS UNIT OPERATION

When adopting the point of view of objects themselves, questions like 'what happens inside a media art software?', 'why it works the way it does?', or even, 'what is like to be one of it?' rise. Although it is not our aim to answer these questions, we would rather like to discuss some ideas.

Nowadays, one of the philosophical perspectives that suits well for thinking about objects themselves is 'speculative realism' (SR). Thinkers of this area strive to go further the correlationist position, for which being exists only as a correlate between mind and world: if things exist, they do so only for humans. Philosopher Graham Harman has coined the notion 'object-oriented philosophy' to observe that "objects do not relate merely through human use but through any use, including all relations between one object and any other" [1]. Extending this idea, Ian Bogost calls for an 'object-oriented ontology' (OOO) which is interested on the existence of objects in general (including humans) and attributing to all objects the same ontological status: there would be no distinction between the types and they all should be treated equally.

A more appropriate term for Bogost to refer to objects and things, with a less heavier correlationist tradition behind these terms, is unit. The behavior of a unit (functions, interactions) are operations. Units represent three things at once: an isolated and unique unit; an enclosing universe; and a part of another system. In this sense, a unit can be described in different manners: analytical or synthetical; culturally or scientifically; but no one would be more important than any other because they have the same ontological status.

What is behind all units? Bogost dribbles deterministic critics by making reference to Alan Badiou. There is nothing behind or above units, no ur-structure. Units simply operate and they relate according to a configurational pattern.

OOO and unit operations might offer a glance into 'media art software' when we try to approach it as object. If we identify software applications and programming languages as units, the next analytical step should be to explore its constituent units in order to see their relationships at a given moment. Or we could also take a synthetical path: creating domain categories to organize them. Or we could map its transversal properties and mode of existence into other domains such as history, social, political, etc.

But if we accept that all units have the same ontological status, there would be no 'real' or 'definitive' definition of media art software. It would not make any difference to define it from its technological specifications or from its role within the development of arts and sciences, or from any other point of view (for example, configuration of bits, visual representations, remixes and hybridizations, narrative and discourse, exhibition and distribution). Instead, the task would be to make evident its diversity: the multiplicity of objects and the complexity of their interactions with other objects (including humans).

One visually perceptible form of OOO are 'ontographs'. Ontographs could be manifested with any media (words, images, sounds, scripts, etc.) with the intention of showing the variety of units (how much their are and how they exist). The main objective of an ontograph is to reveal objects and their relationships in a configuration "celebrated merely on the basis of existence" and not only from a human-centered strand.

A COUPLE OF BRIEF EXAMPLES

We have been working with digital artist Jean-Pierre Balpe, pioneer in digital literature and well-known for his work on generated fiction and poetry. Recently, he migrated one of his Hypercard generators into a web platform: the 'Poèmes Stein' generator[1]. Artistically speaking, the generated poems invite a reflection on life in general. Sometimes texts might sound weird and conceptual but that is the point: to provoke images in the reader through different and even unrelated words.

Figure 1 shows two examples of graphical rendering. The figure to the left depicts a generated poem along with a parametric GUI. The figure to the right shows a different rendering of the same web service. In this case, the user generates a poem and she can also select, click, drag&drop any letter of the text. It is also possible to randomize the position of each letter and to restore the system to the original state.

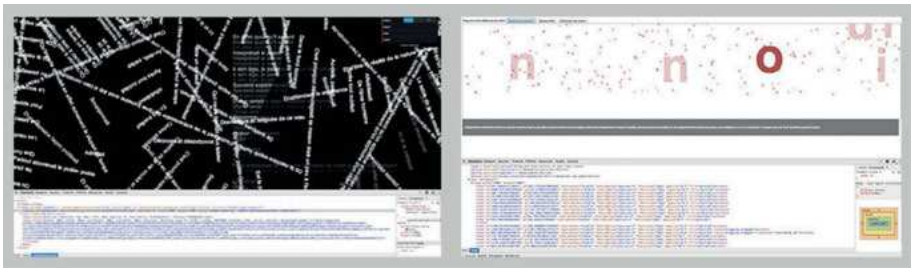

Figure 1 – Graphic rendering of generative poems

These interfaces are significant because of their differences and similarities. They might look similar from the standpoint of accessing and handling information, but they are fundamentally different in the way the browser treats the information. The first case uses Processing.js 1.4.1 and dat.gui. The second relies uniquely on D3.js. A look at the web console panel of the web browser shows how different the elements are rendered. In the first case, the text is not rendered and all transformations occur in the graphic engine. In the second case, all the letters of a poem are created as independent SVG text tags.

Let's consider another situation: How would it look an ontograph of a 'media art software'? Where to start: Its GUI components, or the language reference, or the algorithms? Figure 2 shows different representations of Processing.

[1] Samuel Szoniecky, associate professor at Paris 8, was in charge of the technical migration, translating code from Hypercard into a web database, a GUI based on Adobe Flex and a API for accessing the generated text. For us, our work has been mainly on the graphical rendering of text. The reader can interact with some examples at: http://brooom.org/poemesStein/

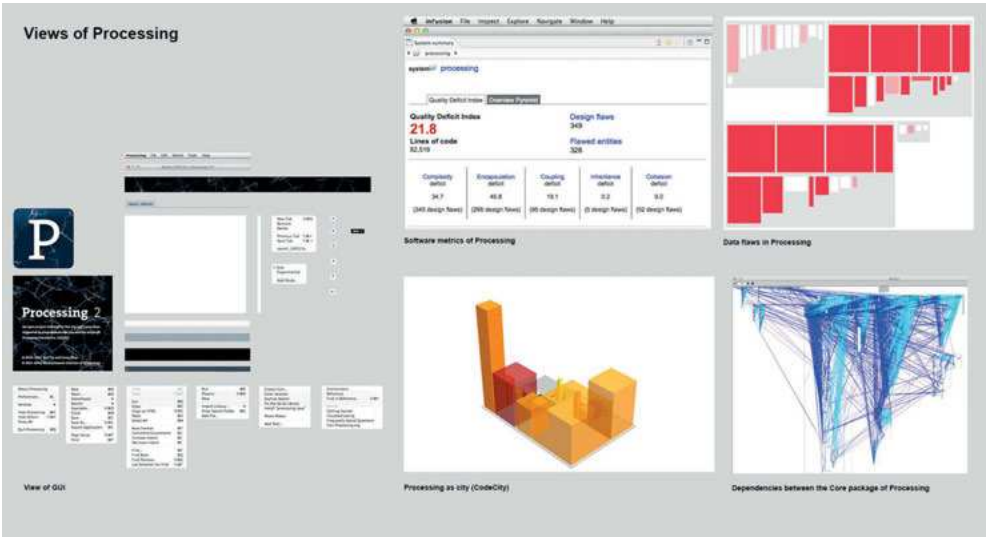

Figure 2 – Views of Processing 2.0

In any case, we believe that considering 'media art software' as unit-operations might contribute with new perspectives. If media art is also an interrogation of our current tools and paradigms and, agreeing with Nake and Grabowski, the aesthetics of the interface gives us access to the algorithmic side of the program, then we ask: What else? Which are those algorithms? Can we access to them, analyze them or visualize them? Why are they implemented in such computing structure? Can we experiment with such structures? Can we propose new data structures (that is, moving besides, above/below or behind/beyond conditional statements, loops, variables, functions)? For media artists, these questions would imply making art into machine.

CONCLUSION: QUESTIONS AND PROPOSALS FOR MEDIA ART SOFTWARE

In this final section, we want to present some ideas and proposals regarding our discussion on media art software. As the reader will see, there are more questions than answers. But, in the similar way to our discussion, we only attempt to sketch some parts that a larger study of media art software would consider.

QUESTIONING MEDIA ART SOFTWARE

- Should media art software…
- keep an open perspective in order to support different kinds of media, programming paradigms, mathematics, physics, visual styles?
- support one or more different UI programming paradigms, i.e. a GUI, OOP, visual programming?
- employ language metaphors from art itself into its user interface? Or from which domain: art, science, robotics, mathematics, cybernetics, biology, media?

- offer in itself an ontographical representation of its units-operations? Something like a a software visualization?
- make evident its ideology (in the same way as a language reference makes evident its units-operations)?
- Is media art software…
- currently considered itself as defining tool to become a media artist? Do media artists need to use one or more of them to be considered as such?
- defining us as community and field in front of other domains? Are we perceived through the software we use?
- synonymous of multiple (layers of) software for graphics and simulations, in the same way as cinema has been equated to Final Cut and photography to Photoshop?

PROPOSALS

1. We believe it is more and more important to document the traces of our software in order to theorize in the long tail. The media art community introduces innovative uses of software and also foster the transcoding i.e. exchanging, hybridizing, remixing, simulating, enhancing, media. We believe it is necessary to document rigorously the software used in the production, distribution, and exhibition of an artwork: at least the names of software, the platform on which were running, and the versions. For example, in the 2nd Computer Art Congress, in Mexico, there are only 24 mentions to software applications, where three of them were custom-made and the rest were open or proprietary. The most cited were: Flash and Photoshop, followed by Processing and Max/MSP [12].
2. We believe it is necessary to reflect on why we choose a particular media art software? How it communicates with our artwork? These questions can be tackled from the ethical, political, aesthetical, technological, historical, and/or philosophical point of view. The answer could be short or long, but not doing it should be rare.
3. We believe that any time we teach or participate in multidisciplinary artistic and scholar gatherings, it would be interesting, in the same spirit of recommending the best artworks, films, or books... to recommend the best 'media art software'. But to do that maybe we need first a pool of media art software, something like a Wikipedia entry of 'List of Media Art Software', which is non-existent today.

For us, software art is important because it shows how software could behave differently, mainly through ruptures of function. To understand such ruptures demands also to understand how the software operates (at the surface level but also deeper in the programming code).

There is an aesthetics of software when we discover and use new software. Not only it is appealing to see and to interact with its elements, it also represents the vision of another artist or designer (or an assembly of both): how she thought the names, icons, functions, and which algorithms were implemented. Perhaps we all use similar functions and data structures and, like natural language, we do not perceive clearly changes over time, but it is interesting to observe how are they implemented differently. How does the semantic of meaning operate?

We think there is a deep and large effect underlying the best media art software. As fuzzy as these software might be -some users might see it in a software application, a videogame, or perhaps in the classic LOGO language-, the more we use it, the more we go deeper into its ecology and ideology. To fully adopt it shapes us as media artists, but at the same time it also means to challenge its paradigms and mode of existence. When we discover new software it happens that the mere production of 'Hello World' is satisfying, but it is also of the most significant importance precisely because it embraces engagement.

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BETWEEN SENSE AND SENSOR: UNDERSTANDING THE MATERIALITY OF COMMUNICATION IN INTERACTIVE MEDIA ART

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ABSTRACT

The paper presents investigations for creating more successful thinking-acting attitudes in the Media Art production, as means to contribute to expression and autonomy of people, as well as in a way to embrace its essential transdisciplinary aspects. The chosen objects of the study are "sensors", whose concept and materiality play a key role as an elementary piece of contemporary interactive media art installations and performances. "Sensors" are an object of analysis that bridges the micro universe of the physical world and the broader and infinite universe of making sense through the body experience in space.

KEYWORDS

Interactive Media Art, sensors, materiality of communication, tangible interfaces, Media archaeology.

INTRODUCTION

This article presents preliminary thoughts of a research that investigates procedures for creating a more successful thinking-acting attitude in the Media Art production, in a way to embrace its essential transdisciplinary aspects, especially regarding the blurred boundaries between the scientific and artistic fields. Therefore, the methodology used in the research has a historical and an analytical approach, through Media Archaeology, Cultural Techniques and Second-order Cybernetics.

As an artist, researcher and cultural agent in the Media Art field, I have observed that although we count on known powerful thoughts and tools for overcoming a variety of problems arisen with the advent of digital technology. In practice, we are still attached to a dispersive and critical consuming-based cultural lifestyle, which also influences the Media Art scene. Media Art production is plenty of very hermetic conceptual and technical artworks and processes, and at the same time of very superficial and naive ones, in which proposals do not go beyond a mere rearrangement of the brand new "Made in China" electronic tools offered by the market. Few initiatives in the world have realised the potential of Media Art as a means to allow expression and autonomy of people, as well as articulation of communities in a very concrete and effective way.

On the one hand, there is a historical and culturally constructed gap between theory and practice (Senett, 2009)[1], that leads us to our difficulties in dealing with the very present "black-boxes"[1][2] of our everyday lives. The current cultural situation in dealing with technology pleads us to simply ignore the inner content of the black-boxes and the necessity to learn while dealing with them (Flusser, 2008, p. 84)[3].

On the other hand, as an attempt at whitening those black-boxes, the ideas of "presence" and "materiality of communication", whose basis are compiled at Hans Ulrich Gumbrecht (2004)[4] – from insights on Friedrich Kittlers' production in Media History and Theory[5] – seems to be a promising viewpoint to review interactive Media Art production, privileging learning and handcraft processes through its electronic and digital materiality.

After this short contextualization, the next step to understand this proposal is to take a look at Art History and the meaning of "interactive Media Art".

FROM PARTICIPATION TO INTERACTION: SOME EXAMPLES

At the beginning of the 19th century emerged artworks and artistic movements that stated the crisis of representation in the Art field. The object of art started to be neglected in order to emphasise art process. The artists started proposing more and more artworks in which the role of the audience was required for the artwork to be appreciated and experienced[6]. Those initiatives also contributed to reviews on the exhibition spaces themselves.

[1] The direct meaning of a black-box refers to electronic devices, whose circuits and way of working are hiden in their shape. However, in the cybernetic perpective "our Black Box is not a physical object, but a concept (a phantasm) we use in order to develop what Bateson calls an explanatory principle, which we evoke when we are faced with an uncertain confusion. It has no substance, and so can neither be opened, nor does it have an inside. Its function is to allow the creation of an explanation of some observed behaviour and any object/mechanism that seems to generate this about which we are uncertain. It is the invention of the observer" (Glanville, 2009, p.154)

In 1942 in a exhibition called "First papers of surrealism" Duchamp proposed the "Twine" installation[7]. As he was also participating in the exhibition design, he filled the whole space with twines, in a way that the visitors needed to go thought the materiality of the work to experience it, and to reach the others artists' artworks. As usual, there are several possible interpretations of this work, but the intention here is to show the beginning of the trend in Art, to physically include the audience in the artwork. And "*Duchamp himself, also tended to stress more his twine's functional value than its symbolic meaning*" (John, 2008, p.01).

Another significant example in this trend is the "Relational Objects" series by the Brazilian artist Lygia Clark, who contributed largely in the Art History to what it is called Participative Art, mainly in the 1960's and 1970's[8]. In this series of works she used objects to engage people in situations for exchanging. The objects themselves had no meaning. And curiously, at the end of her life and career, she expressed that she considered herself rather a psychologist than an artist.

As a contemporary example, let us take a look at an artwork from the Venezuelan/based in USA artist Ernesto Klar. "Relational Lights" is a direct citation to Lygia Clark's "Relational Objects", however created in a totally different technological context. The work is composed by white lines, projected from above on the floor, in a dark room. Smog attributes an apparent materiality for those lines, which are reactive according to people's position and movement in the room. The reaction of the system is based on the input data received by a camera (light-sensitive equipment) placed also in the ceiling. This data received by the camera is sent to a software running on a computer, programmed to give specific feedbacks to people's movements, visualized in the lines' movements and respective sounds.

Image 1 – "Relational lights", by Ernesto Klar (Photo: Mário Ladeira).

INTERACTION

After those examples it is possible to discuss what is here understood as interactive Media Art. It is about two or more permeable systems in communication, whose structures can be transformed and updated in real time, according to both (or more) sides' feedbacks. In a second-order cybernetics perspective, for the British cybernetician Ranulph Glanville, interaction can be defined as "*mutual responsiveness that may lead to novelty, in which no participant has formal control over the proceedings. Interaction occurs between participants, not because of any of them*" (Glanville, 2001, p. 3)[9].

After this explanation, it is easier to understand why sensors were chosen as object of studies, to better understand interactive media art practices, and therefore to propose more aware, active and creative practices in the field. The concept and materiality of a sensor play a key role as an elementary piece of contemporary interactive Media Art installations and performances. "Sensors" are an object of analysis that enables us to bridge the micro universe of the physical world and the broader and infinite universe of making sense through body experience in space. Furthermore, sensors often take part of the so called tangible interfaces in Media Art, as a strategy to capture presence and engagement of public, meanwhile the role of the interactor is itself part of the artwork.

SENSORS AND CYBERNETIC MODELS

Like Media Art, Cybernetics is a transdisciplinary approach of understanding and interacting with the world. Since the Macy Conferences (1946–1953), the topics discussed by the participants range from minimal/abstract/mathematical structures to human relationships [10]. Cybernetics "*is a word invented to define a new field in science. It combines under one heading the study of what in a human context is sometimes loosely described as thinking and in engineering is known as control and communication. In other words, cybernetics attempts to find the common elements in the functioning of automatic machines and of the human nervous system, and to develop a theory which will cover the entire field of control and communication in living organisms*" (Wiener 1974, quoted in Foerster, 1995, p. 07)[11].

This definition points out why Cybernetics (and specially Second-order Cybernetics[2]) plays an important role to understand Media Art as a transdisciplinary expression of knowledge and why it is intended to be the epistemological basis of this research. Moreover at Gumbrecht's viewpoint, "*The second-order observer rediscovered the human body and, more specifically, the human senses as an integral part of any world-observation(...)* it *brought up the question of a possible compatibility between a world-appropriation by concepts (which I call 'experience') and a world-observation through the senses (which I shall call 'perception')"* (Gumbrecht, 2004, p. 39)[12].

[2] In "Cybernetics of Cybernetics: The control of control and the communication of communication" Heinz von Foerster opens the publication distinguishing First order Cybernetics as the "*cybernetics of observed systems*" and Second order Cybernetics as the "*Cybernetics of observing systems*" (Foerster, 1995, p. 1). "Second order Cybernetics (...) was developed between 1968 and 1975 in recognition of the power and consequences of Cybernetic examination of circularity. It is Cybernetics, when Cybernetics is subjected to the critique and the understandings of Cybernetics. It is the Cybernetics in which the role of the observer is appreciated and acknowledged rather than disguised as had become traditional in western science: and is thus the Cybernetics that considers observing, rather than observed systems" (Glanville, 2001, p. 3)[9].

In a technical and material perspective, Gumbrecht's statement is the basis to see the role of a sensor in an interactive media artwork (installation or performance) as the fundamental part of such a system, allowing the world-appropriation simultaneously by senses and concepts.

Therefore, a sensor can be understood as the part of a working system that detects and responds to some type of input from the surrounding environment. The inputs can be, for example, light, heat, motion, moisture, pressure, and/or other numerous physical/chemical phenomena. Probably every reader has already heard of some of them: Temperature sensor, rotary sensor, infrared sensor, ultrasonic sensor, light sensor, moisture sensor, pressure sensor, accelerometers, capacitive sensor... There are uncountable types of them and they are spread everywhere in our everyday lives in many of the devices we use. Mainly they are projected to measure something in order to regulate systems.

SENSORS IN THE ART CONTEXT: EMERGENT QUESTIONS AND POSSIBLE PATHS

These are parallel investigations for a central issue, which is to understand how sensors get into the art field and the resulting aesthetical implications. At the *Exposition International du Surréalisme* (Paris, 1938), "*Duchamp had thought of installing 'magic eyes' so that the lights would have gone on automatically as soon as the spectator had broken an invisible ray when passing in front of the painting." Duchamp's wish proved unfeasible, but Man Ray adapted the idea for the opening night, turning out the lights and handing out flashlights at the entrance so that visitors could use them to view the artworks "on display*"[13]. The solution retained much of Duchamp's original intention: the viewers got close to the art, engaged with their bodies in artistic fruition.

After this short panorama in the Art History and technical issues, a couple of questions are arising: Considering the sensors, their material appeal leads me to the question: How can aesthetic experiments with sensors contribute to rescue a handcraft approach to Media Art production?

There is a proliferation of them on the market and they become available for people in a quite democratic way, what definitely increases our access to technology development. However, only few people know their specificities, limitations, or how to use them adequately in a certain context, and would therefore be able to use them expressively, as part of a language with its specific grammatical structure. So, how can we use them, in order to communicate?

Looking through a cybernetic viewpoint, I work on the hypothesis that the development of sensors also contributes to frame Human-machine interaction and the Media Art fields. Regarding this possible influence, I investigate: When was the first sensor used in the art context? What kind of sensor was it? How did the device get integrated to the whole artistic proposal?

And, in a more specific question: How does the concept-device of a sensor influence the creation of cybernetic models and the understanding of the concept of feedback? To answer these questions a media archaeological research is proposed.

Media archaeology

Although Media Archaeology is a relative new field on Media Studies, it is already possible to identify different approaches to it. For the Finnish media theorist Jussi Parrika, "*it is an exciting theoretical opening to think about material media cultures in a historical perspective*"[14]. It corresponds to a scientific approach of Media Theory that embraces investigations about dead and obsolete media, their specificities and contexts, making relationships with the current technologies, and contributing for creating alternative histories for the technological development.

According to Erkki Huhtamo, "*it could be even seen as a form of spatialized, conversational "historical writing", as a way of maintaining a dialogue with the technological past"*[15]. This approach helps to clarify, when and how the first sensors were created, their basic principles, history, influences in media design.

Sensor principles

The origin of a sensor as a device in the History of Culture is rooted in observations and experiments with nature and living organisms. That is why, the history and genealogy of sensing is also a field to look at in order to understand the role played by the concept, the materiality and the functions of sensors in a dynamic system.

Valentino Braitenberg asserts in the biological notes of the conceptual vehicles he described in "Vehicles – Experiments in synthetic Psychology": "*When the cooperation of various input nerves in the activation of spinal motoneurons was analysed, three facts emerged. They turned out to be fundamental discoveries about the computational properties of synapses, even before the techniques of electrical recording of single neurons were developed"*(1984, p.109). Those three facts explained the functional relations between the "*macroscopical input-output experiments*" and the microscopical universe of the electrical properties of neural cell membranes, constituting as the fundamental operations of the calculus of propositions: conjunction(AND), disjunction(OR) and negation(NOT), which are coincidentally the logic elements used by greek philosophers [16].

This relationship lead me to look in a broader way at sensing phenomena: through the lens of its very materiality, exploring the manipulation of electricity and electric impulses through conductive and non-conductive materials and/or their inherent behaviours.

On the one hand, the recent experiments with sensors made with conductive fabrics are promissing tools to experiment intermodal interfaces with sensors, embedded in body and/or space, with posterior analysis of their relationships. On the other hand, the principle of sensors observed in organic materials, such as wood in the work of Achim Menges, mutual influence of nature and machines: the machinic principle can be attached to structures with no computational control. In the project "HygroScope: Meteorosensitive Morphology" (2012 Centre George Pompidou Paris), Menges explores a "*mode of responsive architecture based on the combination of material inherent behaviour and computational morphogenesis. The dimensional instability of wood in relation to moisture content is employed to construct a climate responsive architectural morphology. Suspended within a humidity controlled glass case the model opens and closes in response to climate changes with no need for any technical equipment or energy. (...) The material structure itself is the machine*" [16].

Furthermore, such initiatives, added by the democratization of digital culture access (Do-It-Yourself culture), are references that could lead us to think about more sustainable and ethical attitudes in the field of interactive Media Art.

Do-It-Yourself culture and practical experiments: De Novo, Ercília as example

The first artistic experiments with electronic and digital technology were based in very restricted research and technological centers [17]. Nowadays in count on completely different context, in which a huge amount of information about electronics, programming, sensors and other electronic devices are available and shared on the internet, in papers and books being published, contributing largely to the Do-it-Yourself (DIY) Culture and Communities.

This is an important aspect that allows us also to experiment aesthetically with those materials, which that in a not so far past were available only among specialists. As an example I can mention a previous project, "De novo, Ercília"[18], an interactive sound installation that invites visitors to walk through it, trying different body patterns by the interaction with a structure full of silicon bands. It is inspired by a story from the book "Invisible Cities" of Italo Calvino, in which the author quotes Ercília, a city where wires are extended to refer to relationships between people and things. From time to time, Ercília is abandoned and reassembled elsewhere. Thus, as metaphors of urban development and the human existence suggested by the author, "De Novo, Ercília" is a traveling project, whose sounds are updated in every new context (city) where it is assembled, including sounds of the local relationships.

Technically it is a wooden box with its interior intertwining with silicon tubes. Through the interaction with them, sounds are triggered, which are the feedback of the system for the physical engagement of the public. This way, the public creates their own narrative of the city through their body.

Image 2 – Eduardo Fukushima performing at "De Novo, Ercília" at MIS Museu da Imagem e do Som (São Paulo, February 2012) (Photo: Gal Oppido)

Although the whole system in its several assemblages never was completely stable and predictable (ironically as the urban development and the human existence), the experience of creating and building "De Novo, Ercília" triggered a lot of issues that I was not aware at that time, and that have now become part of my interests in my current PhD research, especially in consonance with recent readings of Hans Ulrich Gumbrecht[19].

MATERIALITY OF COMMUNICATION: BETWEEN PRESENCE EFFECT AND MEANING EFFECT

In a critical perspective over the occidental development of knowledge construction based on the abstract instance of meaning attribution, Gumbrecht defines "materialities of communication" as "*all those phenomena and conditions that contribute to the production of meaning, without being meaning themselves*"(2004, p. 8). Also developing the concept of "presence" as a spatial rather than temporal notion, Gumbrecht connects Media History and body culture, considering that "*we no longer believed that a meaning complex could be kept separated from its mediality*" (2004, p. II)[20].

This perspective has a special significance for the Media Art field, which can be understood as mediated aesthetic experience which arrises from the tension and oscillation between "presence effects" and "meaning effects".

In Between: a presence tester system towards materiality of communication

"In Between" is a practical starting point to discuss these topics is an aesthetic experiment. The idea is bring the technical knowledge about sensors to discuss how ephemeral, rare and improbable communication is, especially between bodies in our everyday lives, although it seems (or we fake) we are connected the whole time. The very first idea is to create a performance-based system that would work as a presence tester. Performers improvising movements can form intelligible images in transparent bubbles, followed by intelligible sounds, when the bodies somehow get into a synchronization, an understanding, or a shared emotion.

Considering the presence effect as a conjugation of body and space, it is needed to decompose technically how to get sensing data from each of these parts (body, space and objects) and in a second moment to analyze the possible relations among them. This perspective refers to the understanding of interactive artworks as systems, only able to work through the flux of information among the parts.

Regarding this pre-analysis, the technical experimentation aims to discover which would be the most appropriate sensor to use in this case. Starting with the body as reference, wearable pieces will be tested: bend sensor in articulations, pressure sensor in zones of contact (on the own body and with others), accelerometers in the members and a biometric sensor: heartbeat (internal/emotional). The choice of such sensor types is mainly related to their appeal for their direct tactile aspect.

The sensing data from the space as reference is intended to be tested through distance sensors (also attached to wearable pieces) and by a kinectic camera, fixed above the available playing area. This resources would work as a strategy to embrace the idea of

otherness, supplying information about the space itself and its relationships with and in between the bodies.

The combination of these data shapes and materialises communication: In a kind of agent-based modelling, the participants influence the system creating sounds and images, which range from chaos to order, from abstract to concrete (inteligible).

Certainly there will be physical limitations to overcome. And the challenge is precisely to find solutions, like Duchamp found (especially in dialogue with Man Ray), in order to maintain what is intened to express with such a proposition, and if the chosen solution will communicate it.

CONCLUSION

This writing is a first draft of possible connections of the mutual influence of the aesthetic and the technological aspects of interactive Media Art. Understanding the mediality of interactive systems is essential to handle more creative and sustainable propositions in the field of interactive Media Art, where thinking and doing actions cannot be seen apart anymore, as we are socially and historically used to do.

In this universe, the DIY culture deserves special attention, once it presents a concrete way of paradigm changing in the creative scene, that could also contribute to turn the "interactor" of the Media History into a "maker".

The discussion of these topics are part of a broader aim of this research, which is to present the critics, artists, theoreticians and enthusiasts of the field a more critical approach to Media Art production. The scene is plenty of projects that oscilate between two extremes: On the one hand, very conceptual and hermetic artworks; and on the hand, very technical experimentation with no purpose behind. New makers must find the middle path.

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ÁREAS DE RISCOS: CITY, UBIQUITY AND PLAY

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ABSTRACT

Áreas de Riscos (Areas of Risks) is a project of ubiquitous games for mobile devices that explores subjective relations between people and the urban space by registering moves and permanences. The system is composed of two games: Riscos and Áreas, respectively related to routes and places marking. There are firstly theoretical questionings about the contemporaneity, its aspects such as emergent and rhizomatic systems and their relation with urbanism and society, especially in comparison with modernists' principles. The study also involves people's everyday experiences and narratives. The player is understood as a narrator of his operations in the urban space. Moreover, there is a study about games and their potential for change, notably when they are ubiquitous and collaborative. The research led to a further investigation about ubiquity. In ubiquitous games, there is not a clear distinction between game and reality, so that both situations can benefit from one another. The process starts with a study of the major concepts, followed by an analysis of similar projecyts, generation of alternatives, development and discussion about the results. During the process, Riscos came first and Áreas was incorporated after a reinterpretation, generating a system of games overlapped and composed of both. Áreas de Riscos is about a cartographic construction of places and routes, exploring errancy and people's otherness in the urban space, adopted as a playful space. Players enter very few data about themselves, so that their identity in the game is the graphics generated as a result of their actions and permanences in space. Finally, Riscos and Áreas are complementary. Working as a system, they report people's tactics and everyday practices, forming poetic, complex, emergent and unexpected cartographies of the city.

KEYWORDS

Ubiquitous games, city, cartography, narrative, design.

INTRODUCTION

The proposed project is a system of ubiquitous games that explores the relation between people and the city by marking places and routes. The city is adopted as a playful space and there is no clear distinction between game and reality, what makes them ubiquitous games. Riscos came first and Áreas was incorporated after a reinterpretation, generating a system composed of both games. The starting point is a theoretical concern about the contemporary period and its manifestations as collaborative, complex and emergent systems. Subjective relations with the urban space are a fundamental issue, since the contemporaneity implies different appropriations of the city.

Under a poetic perspective, Walter Benjamin says that to live means to leave traces [1]. However, there are only a few mechanisms and situations to truly register everyday experiences. There is an intention to explore the narrator role of the player, in the sense that he constructs collectively a vivid cartography of the city, from his individual experiences and relations to routes and places. Cartography is understood as a dynamic configuration that follows constant transformations of space, opposed to the representation of a static whole, as it is done on maps [2].

Games are an adequate support and concept to the study, since they have an essential quality of synthesis. They deal with an autonomous reality that completes a meaning in itself. In order to play, one must make clear the connection between parts and the whole. According to McGonigal [3], games can be a very powerful platform to creating the future in the contemporary context. Today's challenge is to promote a better integration between games and daily life. It will lead society to its reinvention. Moreover, when play and daily life are integrated, the scenario stimulates players' engagement and immersive participation.

The project is justified by the study of a ubiquitous game as a transformation object, which instigates reflection about contemporary behaviours and the subjective relations between people and the urban space. The objectives are to conceive a system of emergent games that explores the city, promotes collaborative processes, generates new cartographies, registers urban experiences, incorporates game to the daily life and creates new meanings, interactions and relations to the city.

METHOD

The contemporary context is the project's theoretical starting point. The research approach involved issues such as emergent and rhizomatic systems and their relations with urbanism and society, especially in comparison with modernists' principles, as well as people's everyday practices, their experiences and narratives, exploring the role of the player as a narrator of his operations in the urban space. There is also a study about urban games and their potential for change, notably when they are ubiquitous and collaborative. Ubiquity was also an important concept to guide some technologic and poetic decisions. During the process, requisites and solutions were generated. The final solution came from a combination of different proposals, later developed and detailed. Because of the project's digital nature and the current step

of development, many decisions were considered subject to adjustment according to the feedback received in the procedures of test and implementation. In the end, the proposed solution is evaluated, as well as its perspectives and future possibilities.

THEORETICAL CONCERN

City and contemporaneity

The city is a dynamic set of multiple subjectivities, formed by a confluence of experiences, appropiations, apprehensions and symbolic and imaginary relations of its inhabitants. This idea of a fragmented and disperse city, instead of a delimited and globalized totality, corroborates the contemporary discussion in urbanism. A better comprehension of the actual situation can be brought by a comparison with principles from modernism, not limited to the field of urbanism.

Christopher Alexander, in *A city is not a tree* [4], compares the structure of cities spontaneously generated with the one of artificial cities, projected after ideas of sectorization and hierarchy. According to Alexander, artificial cities are conceived after a tree plan, a rigid spatial and hierarchical structure. One of the most eloquent critics to this plan is its reduction of possible and unpredictable combinations between elements, reducing the potencial interactions and relations in the city. In contrast to the tree and expanding to social and cultural context, Deleuze and Guattari [5] bring the concept of rizhome, a non-hierarchical agency without a center. Rizhomes have as main features connection and heterogeneity, multiplicity, inexistence of unities and asignifying rupture.

While the modern context shows an industrial society, based on ideas such as order, universal reason, hierarchy and funcionalism, contemporary society has complexity, transformation, uncertainty, autoregulation and flexibility as predominant paradigms. There are no more beliefs in absolute truths and linear progress, neither in the standardization of knowledge and production.

François Ascher [6] defines the contemporary period as a third modernity, where a more rational, individualist and diferentiated society emerges. Neourbanism, as the author refers to the current urbanism, must conceive places that take into account the use of individual portable devices and the different nature of the activities practiced in the same place that derive from it.

The city is a clear case of an emergent system, for it is the result of what use people make of it. Emergent systems, for Steven Johnson [7], solve problems through a mass of relative simple elements, instead of counting on a unique intelligent executive power. The knowledge is obtained in a bottom-up direction and have as characteristics indirect control, feedback (regulation of the causes by their effects), interaction between neighbors and pattern recognition. For this reason, there is a further interest in city's discussions from a closer zoom. Thus, it is possible to observe its emergences, procedures, subjects, appropriations and ways of operating.

WAYS OF OPERTATING, EXPERIENCE AND NARRATION

People's behavior and their ways of operating constitute a constant update in the urban planning of every city. They make it an alive and experimental system.

Michel de Certeau [8] studies the ways of operating of city users: people's appropriations, artifices and arts of doing in the given space and time. Actions schemes can be divided between strategies and tactics. Strategies are linked to institutions and structures of power, are formal and impose a up-bottom direction. Tactics, on the other hand, are the victory of the weak over the stronger, of space over time. It is a constant game with events, in order to transform them into operating opportunities. It is about the actions of the ordinary man, someone who represents either everyone or no one in society's murmur.

There is a direct relation with a game's system. After all, it is a situation with absolute rules, where people obtain advantages precisely by interpretating and acting over what is established. Games with simple rules, but multiple possible moves, bring strategy and tactic closer, enriching experience and providing emergent developments.

Nevertheless, there is a certain difficulty to aprehend and register those movements. Though the practices occur after a prescribed syntax, over a technocratically constructed space, they constitute heterogeneous stories with great inventivity and richness in combination of elements. Statistics do not take into account those artifices and contents by categorizing them according to homogeneous classification and taxonomy functions, forgeting a great series of narratives that compound everyday life. For Certeau, there is a constant collective writing of an urban text, which, however, participants are not able to read. Despite the impossibility to register the above cited movements, narration can be seen as a form of consciousness about the action, recaptured, and the creation of a new experience about what was already lived. Register made by who practiced the action renews the practice and favors reflection. Therefore, it reinforces the individual's role as a narrator of his daily relations with space. Cities are not only constituted of physical elements, but also of heterogeneous images, real ou dreamed. They are an extension and space multiplication of individual and collective memories and fictions.

Participation, even (or maybe especially) when anonymous, is a form of apprehension and creation of urban experiences. When associated with narration, it ensures a continuity of the experience itself. The posture over space is now active and conscious. It becomes, above all, an invitation to errancy and otherness, as well as to discussion of strategies and imposed disciplines. Together with the relation of experimentation and game in space, these are all assumptions of the International Situationists.

The International Situacionist group [9], led by Guy Debord and founded in the fifties, stood up for the idea that each individual must construct his own situations of daily life, breaking with the dominant alienation and obtaining pleasure. They criticized passive posture, non-participation, monotony and society's alienation in modern everyday life. They proposed practices such as dérive, psycogeography and deviation, which were mainly wanderings in the city that stimulated new interpretations of places based on the experince practiced. Play is very present in the activities of the Situacionists. They intended to create constantly new games, as well as a superior game, in which there would be a collective and

effective participation in life. There are many similarities with Johan Huizinga's [10] idea of play: a volunteer action over space under a temporal limit (the so-called magic circle), of consented rules. These rules only make sense in this universe, exterior to ordinary life.

PLAY

Huizinga defines play's fundamental characteristics: volunteer and free activity, real life evasion to a temporary sphere of self-orientated activity, potencial to absorb the player completely and at any time, isolation of the magic circle in time and space and possibility of repetition. Play creates order and is order, rules are absolute and a limited and temporary perfection is created, environment is instable and tense, filled with uncertainty and ethics.

According to Jesse Schell [11], play can be seen as a ludic activity to solve problems. Its basic structure is an elemental tetrad, whose essential and equally important pilars are mechanics, aesthetics, story and technology. Mechanics is about the rules and devices, objectives and ways to reach them, and what actually occurs. Aesthetics is appearances, smells, sounds, tastes and sensations, directly related to the player's experience and perception. Story gives a meaning to the game and conducts the other elements being a sequence of events, which can be either linear and previously determined or ramified and emergent. Technology is about materials and interactions that make the game possible.

UBIQUITOUS GAMES

A contemporary expression of play is pervasive or ubiquous games. They break time and space borders, do not isolate game from real life anymore and their contract becomes a secret agreement involving some actions separated from reality. Montola et al [12] define an ubiquitous game (ubigame) as a game that has one or more salient aspects that expand the magic circle spatially, temporaly or socially. The integration between play and daily life, without a clear distinction of their limites, constitutes one of the main features of an ubigame.

Ubiquitous, which originally means something that is present everywhere at the same time, is an expression usually adopted in the computing field [13]. Ubiquitous computing (ubicomp) emerges in a context where computing is dissolved in everyday activities, in a transparent instead of intrusive approach. Ubicomp intends to make people's actions simpler and not to call attention to technology. Its vision is reinforced by smart spaces, ambients where multiple devices and even daily objects are interconnected by a communication network.

Expanding the concept to the city, ubicomp can be understood as a new layer of the urban ambient [14], inextricably connected not only to the way people compound and interact with space, but also to their actions, routes and permanences. In this sense, ubicomp is a completely coherent approach to the contemporary understanding of the city and its multiple and overlapping attributes, as well as the theoretical questionings that originated the present project.

ÁREAS DE RISCOS

According to a previous description of the project [15], Schell's elemental tetrad is adopted to clarify the proposed system of games. Áreas de Riscos' story is a city ocupation by a complex network of places and routes. The cartography generated by players is an overlapped mix of traces and circles over a map of the urban space. Interface's aesthetics, especially visual issues, is a result of players' interactions upon the preexisting map, composed of different layers. Colors differentiate players, in addition to enriching final composition. Aesthetics experience is complemented by the meaning agregated to circles and lines in the interface, connecting abstract graphic elements to particular experiences of moving through the city. The technology is based on mobile devices that allow georefering resources. For the presentation of the screens' surface elements, it is chosen iPhone 5 model of iOS system. An essencial technologic aspect is the exploration of ubicomp potentialities, which defined the use of a middleware combined to a game engine in order to develop the first prototype. Middleware is a technology that mediates the interaction between disparate applications across the heterogeneous computing platforms, usually over a network. Mechanics can be summarized by the categories: space and time, goal, objects, actions and rules. In the system, there is no spatial delimitation. It can be played wherever people want, in matches that take twenty-four hours. As soon as a match is over, results are counted in a general ranking. In relation to other mechanics' aspects, Riscos and Áreas are explained separatedely.

Riscos is both a collaborative and competitive game. Its goal is to have the longest continuous route at the end of each match. A route's total distance is calculated by the sum of distances of all line segments interconnected. Knots and lines are the objects of the game. Available actions for players are: navigating freely over the map and cartography, creating a new knot, choosing to get together or to try to break an opponent's line (when crossing it), isolating profiles, changing game, seeing previous matches and rankings. The main rule for each player is to create his route out of connections between knots. Each knot is created when the player marks his georeferenced position on the map. Players own a limited number of knots, so they need to use them strategically. When creating a new knot, if the generated line crosses an opponent's line, the player must choose between getting together as a team or trying to break the other's line. If he crosses simultaneously more than one line, he has the opportunity to join just one of them, so that the others become automatic conflicts.

Áreas is mainly a collaborative game and its goal is to have a place in the strongest intersection – the one with more overlapped places – at the end of each match. Who wins the game is not an individual player, but an instersection (shared place). The objects of the game are places and their intersections. Available actions for players are: navigating freely over the map and cartography, creating a new place, making one place bigger, substituting an existing place by another, isolating profiles, changing game, seing previous matches and rankings. The main rule for each player is to create places digitally out of his physical georeferenced position. Players also own a limited number of places, therefore

it is important to choose carefully where to mark. When creating a new place, there are three possible situations. The first is the unimpeded marking of a place. The second occurs when a player wants to mark a place inside one of his own previously marked places. In this case, the player can only make the older place bigger. There is no limit of times that the player can return to an old place to make it bigger, since this action is intercalated with the creation of new places. Places reduce their sizes slowly and gradually in the course of time. The third situation is when a player tries to create a place that has an intersection with one of his previously marked places. Since the game intends to promote the discovery and meaning of new places in the city, this action is not available. For this reason, when this situation occurs, the player has the option to substitute the older place, but not to mantain two at an intersection. There are two complementary incentives, when we think about the games' motivations to use the city. On the one hand, it is proposed that the player reinforces the places where he often goes, generating feedback of an increasing size and a better chance of forming intersections with other places. On the other hand, there is also an evident advantage of marking places near other players' ones, especially places with already many intersections. Indirectly, it stimulates errancy, otherness and exploration of the city.

There is also Áreas de Riscos, the mode of visualization of both games overlapped that gives the name to the system. In this mode, there is a possible combined action of both games, in which a new knot and a new place from the same physical position are created simultaneously.

Since it is a system of games, it is essential to open a clear and direct access between them. Players can transit between three modes: Áreas, Riscos and Áreas de Riscos. All screens allow players to change mode, except when players need to give a confirmation about an action before continuing.

Figure 1 – Main screens of Riscos, Áreas and Áreas de Riscos

Figure 2 – Isolation screens

NEXT STEPS

A game only exists when it is played. In this sense, a step of elements and rules balancing is essential, in order to help providing a steady flow to the player. Flow is defined as an undescribed pleasure that occurs when someone is completely envolved in an activity. A state of flow is related to the correspondence between one's habilities and the challenges proposed, in an increasing graphic [16].

The current step of the project is a partnership with developers, with the view to make practicable tests and elements' balancing. At the moment, the system is being developed together with students of the Department of Computer Science of the University of Brasília, in the context of the evolution of a middleware technology. The development phase implies a series of adjustments of system's details, especially to make it coherent to the assumptions of the middleware software. There are some variable elements in the games that can be adapted or influenced by device's, player's and ambient's features such as battery, memory, contacts, georeferencing resources and barometer, just to name a few.

In addition, this work can be later used as content for analysis and hypothesis development about city occupation patterns and observation of flows in the passing of time. In this case, there are many possible applications, from public utility to poetic expression.

CONCLUSION

As a conclusion, the use of a ubicomp approach brings an essential paradox to the games. At the same time that the system is a capture of the city by the player, the player himself is captured by the city through register mechanisms. At the same time that ubicomp promises an integrated and renovated urban environment, reviewing all possible activities, politic and cultural representations, it creates an advanced form of panopticon, a constant vigilance that control individual movements and freedom [14].

Finally, there is a reflection about how these games would transform players' life and their relation with the vivid space. They are directly connected with everyday life and create new meanings to the daily visited places. The city is seen as a playful space and a confusion of routes and places of anonymous subjects. It is not known whether people are willing to change their habitual routes to answer game's tatics. Anyway, the narrator condition of the player creates a conscience of the practice on space. He is empowered to break automatization and observe daily life from a different and exterior perspective. There are also open possibilities of appropriation and socialization. Ultimately, the game may be only a pretext.

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REENGINEERING OF THE SENSORIUM AND IMAGINARY LANDSCAPE: MIXED REALITY

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ABSTRACT

The landscape is understood as the space of experience dominated by the embodiment of subjects and objects. Thus, the space is part of the body. Body and space are blended, mixed, impregnated because the spatial structure of landscape belongs to the description of our surroundings. Geotagging transforms the territorial configuration of the landscape by creating an abstract projection of connection nodes in a global cartography.

KEYWORDS

Territory in flux; sensorium; mixed reality; environment art.

ART AND LANDSCAPE: MIXED REALITY

The landscape as the mediator between different levels of perception and action is also a testimony of the civilizing process that is taking place nowadays in the Occidental Arts. The art has not always resulted exclusively of visual processes, it has also been conceptual throughout its history, reveling the typical phases of development in which it will come to pass in time. The idealization of natural elements resulted in the creation of gardens, as appropriate places for the admiration of nature and it has also resurfaced the Garden of Eden's myth.

Centuries after, the painting presents great panoramas, totalizing visions, geographies of places and the human attitude against the ground space, the construction of a miniature world in scales perceptible with the body in the ground, as in the landscape paintings of Pieter Brueghel (1525 -1569).

In Europe of the sixteenth and seventeenth centuries, both artists and cartographers used the same vocabulary to describe the geographical representations. Jean Marc Besse states that 'painters and geographers share the same cognitive attitude and visual acuity', they depart from the empirical experience of understanding the world's signs, driven by the same interests: the rock colors, the movement of the water of rivers and of the winds. The cartographer and the painter share not only the perception of the earth's surface, but mainly its subject – the landscape. It is important to emphasize the relevance of Leonard da Vinci, who, during his several journeys, studied the geological formations of the areas he visited. This work is expressed in the local maps and feature richness of detail considered in greater degree to cartographers. The artist used painted the rivers, settlements and valleys in such a realistic way that we have the impression of looking at a landscape from an airplane.

In the late 50's – another representative historic moment – artists are once more interested in the landscape with the purpose of relating it to artistic productions. Land Art offers a way of relating art to the countryside in the context of *Earth Art*, and the 'protagonist of the aesthetic experience is the environment, space in whichindividuals interact, while *the other*, in the broadest sense, in which the *self* is confronted'. It also means a rupture with the traditional position of the viewer, who in *land art* no longer gazes upon the work of art, but inhabits it, expanding the notion of a conceived, perceived space. Instead of mapping roads and landscapes, the art intends to record processes of translating contemplation into human action next to the landscapes that it constantly modifies.

In this century the work with technologies, the 3D world of computers take the viewer back to the scene. They allow the creation as action, the works are interventions of embedded data in the urban and cultural spheres, creating geographies of emergency and transience, updated in time of the communication context. Louise Poissant, regarding the interactivity in the Arts, states 'that it is a response to the feeling that the audience has to be aware of: they want to move the representation registration to that of the action'. In fact, interaction prevents the user to maintain the distance, the intellectual distance, the criticism, compared to the*trompe-l'oeil* of the view paintings, in which three-dimensional perspective functioned as a visual recovery of a tactile experience.

The interactivity art has also demystified the role of the artist as a creative author, giving him/her the function of a context designer, the one who prepares the ground to the reception. The work presents itself as a field of co-creation in which users interact with the device and create a renewed aesthetic experience.

The work *14 Bis* is an intervention in augmented reality (AR) done collaboratively, in honor of the 50th anniversary of Brasília (Brazil). It had as a poetic reference the song Tropicália, by Caetano Veloso, which deals with the construction of the new capital of Brazil, inaugurated in 1960 and idealized by the architects Oscar Niemeyer and Lúcio Costa. Recreating Santos Dumont's (1873 - 1932) invention as a synthetic image, the project was idealized with the intention of honoring the Brazilian cultural thought.

So that the work exists in Mixed and Augmented Reality, it was necessary to measure the point of appearance, by using a GPS (Global Positioning System) and inserting the geodesic coordinates in the *Layar* software, a free browser for augmented reality, compatible to the android operating system used in cell phones and tablets.

The Mixed Reality (MR) is the hybridization that connects us to the physical and digital worlds, the 'real' and the 'virtual'. Domingues states that 'with today's locative, ubiquitous and mobile technologies, men realize their fictional desires of living in parallel worlds, in *paracosmos* that mix physical materiality and data immateriality, placing them in what we call cybrid realities to cybrid existence.

14Bis, *Funartsquared, 2010*[1].

In loco, this cybridization is reflected in the level of the sensory perception of a combination of information from the physical environment, from the user and the data generated by a computer system and from the mobile and locative interface. Thus, we have the anthropomorphic proposal of Peter Anders, based on the human body, in the experience, between space and information. Domingues states that the subject *cybridizes* himself/herself in the subject-object-environment flow.

[1] *14-Bis*development team: Drª. Leci Augusto; Msc. Camila C. Hamdan; Leandro Gaby Andersen Trindade; LuizGustavo UnB/ Gama.

THE BOUNDARIES OF OUR BODY

Human sensory changes in the speed of the development of technological devices. In the industrial capitalism, in the nineteenth century, the machines actually assume the leadership of the economy, transform cities, take farmers from their lands and turn them into workers, change customs and the relationship with the world, a fact criticized poetically by Charles Chaplin in *Modern Times*, whose protagonist works continuously on a treadmill, making himself an integral part of the machine, his consciousness remains attached to the mechanical movements. With the advent of high-tech machines, computers, robotics and telematics, in post-industrial capitalism, machines get an amazing power and influence over subjectivity. This happens because these new technologies, besides their widespread, possess a high degree of sophistication that promotes, with the wishes production system, characteristic of this model of capitalism, a high degree of interaction and relationships. That is, machines are not only literally negotiating human relationships through a variety of portable devices such as telephones, television, computers, the Internet, but also promoting the emergence of a direct human-machine relationship in the re-engineering of senses and of life.

We model our sensuousness in accordance with the mechanic production of subjectivity that behaves like gear on the interactive interfaces. Roy Ascott states that the interaction presupposes a reciprocal effect, so that one thing affects the other, adds or transforms, and if we are dealing with a work of art, a 'transformation of consciousness' that emerges from the experience, in which the opened meaning models new relations to reality, new ways of feeling in a context interactions with artistic systems. The interaction between art objects and protagonists in mixed worlds allows a multisensory that carries the redefinition of the human.

In cyberculture, artistic creation with new interactive media shows a rejection of old art categories, in its place, new fields that pervade the human-computer interaction (HIC), imposing 'shareable affections' within a set of sensory experiences that coordinate signals and that trigger the body's perception and proprioception. Diana Domingues in the article- *Ciberadão e a magia das cibercoisas pervasivas*- , speaks of a 'biology of interactivity' in which the technological apparatus adapted to the biological alters profoundly the sensory synthesis, because they allow symbiotic processes that expand to virtual worlds the body's and environment's naturalsignals in regenerative changes. The author alludes to the book *Symbiotic Man: Perspectives for the Third Millennium*, by Joël de Rosnay, that describes the evolution of the interfaces between humans and machines and speaks of numerous functions that are being studied from biological signals, access roads funding and decoding of information.

Interacting on the landscape where the plane *14 Bis* is located, the body falls into places, searches territories, compares landscapes and explores relationships. In this sense, the landscape is contaminated by this being-in-the-world, ontological condition of coexistence. And so, Geography, as the science of concrete things, allows itself to be invaded by external processes, categories that transcend disciplinary boundaries and the landscape defines itself in categories of natural and artificial objects that make up space and time for the present and past relations of human work, confirming the assumptions of Milton Santos that 'nothing is fixed nor motionless in the landscape'. Therefore, the human experience of occupying the existential space creates natural and artificial streams, vital directions and of interactions with

communication networks, demonstratingthe existence of the symbiotic relationship between human - landscape - communication network, and in 'the frequency of shifts reveals in the human, a body with a materially sensitive certitude.

Merleau - Ponty's Phenomenology of Perception, aiming to reach the things themselves, describes the phenomena as they are experienced by consciousness, understands that subject and object are interrelated in the process of dialectical knowledge. He assumes that world knowledge, even in scientific terms, is given from the subject's own experience in the world as a body in the world. The body is the subject of perception, seen as the source of the senses, as significance of the relationship of the subject in the world and, the subject seen in its totality, in its structure of relations to things around it. The author draws attention to what is perceived by man, the phenomenon, occurs in a field which he belongs. The emphasis is to demonstrate that the relationship in the world is physique and always significant.

From this perspective, consciousness is not separated from lived experience, it acquires a meaning and is defined as perception, so that there is no separation and opposition between the rational and sensitive data in the act of apprehension of things, and our experiences are the source of all knowledge acquired in the world and the world comes into existence only when we assign it a meaning. Thus, consciousness is continually turning itself to the world.

Derrick de Kerkhove speaks of how the media edits the environment and therefore the user, our sensorium is being edited by the daily media, by electronic devices: cell phones, computers, tablets affect our strategies of information processing. The author speaks of a 'biotechnology'. This experience can be observed with the use of sensors and devices attached to the body as a means of projecting emotions, media that act as interfaces between language, body and world. In the book culture the consciousness subjectivity performs a psychosensorial synthesis within the body. With the screen, there is a reversal of the consciousness to the outside, it is projected on the screen, we enter in the information.

CONCLUSION

Interaction in the mixed landscape of the 14 Bis reveals the state of presence-absence as a result of computer vision of cell phone cameras and of post-extrusion biological human vision, the act of looking is shared between the eye of the satellite in the sky and the human eye projected on the screen of the phone, neuropsychophysiology expanding human perception that characterizes the biocybrid condition. Our cognitive and motion models are expanded in the landscape, geo-referenced by a Geographic Information System (GIS) and by computer codes information. And the body attached to the mobile device translates there engineering of sensuousness.

The living space in this context is presented as historical and mixed reality in which man is a modifying agent. And time updates the immateriality of the work process which, when completed, returns to the void in its timelessness. Because the 'real' time, in *14 Bis* is just the point in time in which it updates the system that is composed by the user's input. In this sense, the concept of time is linked to interactivity, the presence of the object *hic et nunc* before the perceiving subject.

In the art's field, The landscape intervention in mixed and augmented reality represents a cultural transgression that moves from the excessive, the unknown, the hidden, to clarity, to order, the revealed in the becoming of the cybrid landscape, the one that results from the sum of natural elements with the cyber data, which the ordered set of categories creates a new meaning to the everyday experience in the space in the reengineering of life.

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POETICS OF BODY-SPACE ARTICULATIONS

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ABSTRACT

The text deals with design and art relationships, considering Anthony Dunne and Caio Vassão's references of the terms "critical design" and "metadesign", respectively, to name two conceptual instances of discussions about dressed objects and body-space articulations: body-structure and body-system. From this approach the Divisor (1968/2004), the Ethiculators (2009), and the A-thing (2013) projects are presented to situate dressing as mediated spatial experiences and unconventional modes of designing everyday objects.

KEYWORDS

Art and design, body-space articulations, spatial experiences, body dressed.

INTRODUCTION

The research context of this text is about design and art relationships, more specifically about projects that work with the act of dressing, in the elaboration of unusual body-space articulations. The presented works are Divisor (1968/1990) by Brazilian artist Lygia Pape, Ethiculators (2009) by British artists Anthony Dunne and Fiona Raby, and A-thing (2013) by Brazilian artists Agda Carvalho and Luisa Paraguai, all of which explore pragmatic elements of physical objects [forms and materialities] focusing on the aesthetic, social and cultural possible interventions.

Firstly, it is necessary to contextualise two theoretical terms **"**critical design**"**[1] and **"**metadesign**"**[2], to define specific attributes of the everyday condition of dressing.

Dunne and Raby write that design processes have to consider conceptual models to extend **"**the borderline zone between pragmatic design and emotional experience**"**[3]. Their proposal about design is to challenge our perception and consciousness of our relation with the environment. For them, critical design **"**uses speculative design proposals to challenge narrow assumptions, preconceptions and givens about the role products play in everyday life**"**[4]. It is more of an attitude, the author writes, and this intention of provoking unusual actions and sparking debates is one of the perspectives of the artistic investigation.

Considering the "metadesign" [5] concept, the systemic relationships among body, object and space, are fundamental to comprehend design projects. The author presents three conceptual elements of the term to define models of research and reading art and design products; but in this text, we are going to consider only the "Procedural Project and Emergence" aspect [6]. It is about abstract elements of design processes with no control and with possibilities of including unpredictable and unplanned results.That said, design is dependent on an articulation between users and their modes of apprehension and behaviour. And hence, our intention with this text is to investigate the bodily conditions as well as the physical and spatial attributes in each project, in order to understand the articulations with the practices of dressing. To dress is to embody an abstract system between body and space, extended to all different situations or occasions.**"**All people **'**dress**'**the body in some way, be it through clothing, tattooing, cosmetics or other forms of body painting**"** [7].

The physical space, constructed by people**'**s actions, is understood as **"**a sensory experience**"**[8], one that is explored and habited, as movements of mediation, interaction and perception between people and objects. It emphasises the presence and the bodily experience as an engenderment of our existence in the world. We inhabit our bodies, which inhabit the world. **"**(...) the idea of space – always comprehended as the spatiality of the world – is integrated to the most immediate and functional attributes of the existence, that is, to the objects that render it "perceptible" as a familiar and habitable locality; as such, it even becomes unfeasible to conceive of space outside the perimeters of the world's referentiality, and its particular familiarity and reliability**"** [9].

After the brief theoretical framework, focused on the formal and systemic characteristics, two conceptual instances are presented to reflect on the aforementioned projects: body-structure (which depends on the materiality and formal attributes) and body-system (which reorganizes unpredictabilities during interactions between user and object). Our understanding is that these categories are not linear occurrences, but recurrent abstractions generated by the act of dressing.

BODY-STRUCTURE

The conceptual instance named 'body-structure'describes inter-relationships between formal aspects and material elements of each project. These physical characteristics [for example the flexibility, hardness, volume and weight of forms, textures] and dressing attributes of objects build our comprehension of the world, our perceptive experiences. "The possibility of revealing those more profound aspects of an object, or its 'real being', is conditioned to a kind of experience that its functional meaning is extended and takes place in a shared space of a habitation"[10]. Distinct experiences of dressing propose bodily potentialities and spatial articulations while mediating social and cultural aspects of everyday situations. It is crucial to comprehend that design approaches related to everyday objects and situations are challenged by such projects when they evoke other attitudes, gestures and modes of behaviour to signify body and space articulations.

The Divisor work (1968/2004), in the socio-cultural context of the 60s, defines the body open to an experimentation of sensory attributes, while it questions aspects related to the individual and the collective (figure1a). The body is recognised by a sensory event. The proposal of the project reinvents itself on each experience that reconfigures the relationship between people and places. Its fluid structure works as a membrane – a 30mX30m fabric with lots of holes – but, when bodies occupy it, it proposes an experience to be shared. At the same time, it is possible to recognise the individual place in the Divisor's structure (figure1b). As each head emerges in the holes, bodies become integrated to the structure. Ultimately, the piece becomes a dynamic construction, dependent on the collective movement and on the spatial articulation with the place/environment.

Figure1a and 1b – Divisor at Hong Kong in 2004. Fonte: http://lygiapape.org.br/news/wp-content/uploads/2013/05/divisorHK.jpg

Anthony Dunne and Fiona Raby with the Ethiculators work (2009) extend the functionality of objects by investigating alternatives and creating other priorities to lifestyle. So, they have interests in "design as a medium, to ask questions and provoke and stimulate people, designers and industry"[11].

The project has four devices: foragers, esprit public (public mind), after life –see you soon and ethiculators. The intention is to speculate strategies and practices of agricultural production to propose other organisational models. Understanding the present unsustainable lifestyle whereby natural resources are used without any control, the authors intend to provoke

critical attitudes and challenge the common sense of consumption. For them, design can propose other possibilities of extending functionalities and limits of the everyday experience.

The rigid fiberglass structure (figure2a), emphasises the body-structure and defines unusual modes of dressing. This balance between material aspects of the object and cultural processes of meaning investigates other attributes and dimensions within the body and space articulations. While the mask covers the face, the object defines a perceptive mode of bodily orientation by creating contours to the eyes and mouth (figura2b). The possibility of not being able to speak and smell creates a re-elaboration of the senses. The performer wears conic extensors elements that make it impossible to talk and reach the ground. The objectwornextends tactile attributes to the senses of smell and taste, while the body balances the mask and sustains these elements tracking the environment and checking spatial changes.

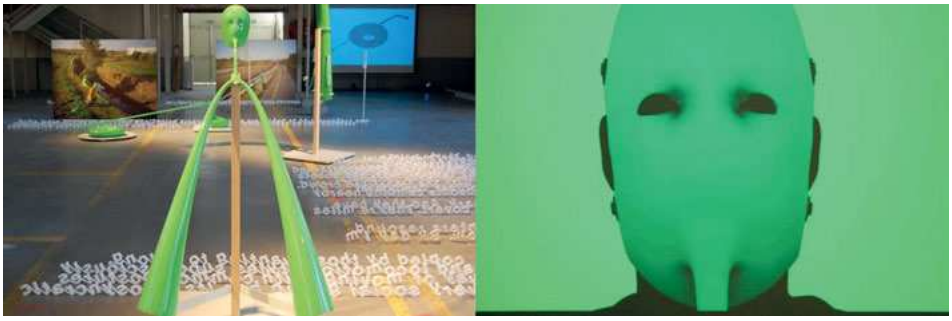

Figure 2a – Forager and ethiculator devices at the Exposition in 2010. Font: http://inhabitat.com/nyc/born-out-of-necessity-at-moma-seeks-solutions-for-pressing-problem-through-innovative-design/moma-foragers2/

The A-thing Project (2013) works pulse oximetry technology to visualize body information [the heart frequency and the oxygen level] and to investigate the spatial perception. A soft and flexible structure (figure3a) covers the performer's body and evokes a sensory dialogue with the environment around, amplifying visceral sounds visually. The design of modular and asymmetrical elements defines the material form, in which suggestive tactile mini-tentacles monitor the space through their subtle movements. Those imperceptible constraints and expansions of the cloth change the shape while they organize the object's structure. The body-structure presents itself as a silhouette that exposes the articulation between the performer and the object. This tactile and close interaction explicits personal appropriations to understand and to recognise the physical space.

Figure 3a – A-thing at the EmMeios#5 Exhibition, in Brasilia, in 2013. Font: from authors.
Figure 3b – Data Visualisation of performer's heart frequencies and the level of oxygen saturation. Font: from authors.

A-thing's structure occupies the performer's body while it responds dynamically to physiological transformations. The act of dressing can expand the territorial body limit while the performer articulates the space sensorially. The process of working with the body–movements and gestures–is extracted from material realities–shapes and textures of the object –that intrinsically are dependent on the physical and immediate contact.

The physical space is occupied and constructed by the performer's movements. It emerges from those investigative body actions that create"a perceptive experience as an active exploration mode of the world. (...) experience is not a passive interior state, but a mode of active engagement with the world"[12]. This permanent explorative body state is a lifestyle condition, discussed by the A-thing project, about the use of technology and everyday routines.

Each project, related to the body-structure conceptual term, potentially modifies the performer's comprehension about the bodily experience, and turns it into a constant and dynamical event. It is an open process, exposing a way of being into the world mediated by the materiality and functionality of objects –constraints and specificities of shapes and textiles –that entails embodying a particular mode of existence. The uncertainty of those unstable answers can evoke renewed experiences "to understand our facticity"[13].

BODY-SYSTEM

Each project works with emergent functions and characteristics that depend on mediated interactions, integrating bodies, objects and space. The conceptual instance named 'body-system'describes those situations that include people's physical actions and experiences of dressing. Our capacities of understanding the world "are rooted in the structures of our biological embodiment but are lived and experienced within a domain of consensual action and cultural history"[14]. The process is variable and the design solutions change according

to "open systems that can be modified by their users and evolve through use time"[15]. The unpredictable is inherent of the body-system context, since it is not possible to design all instances and it is responsible for a dynamic process of creation and uses of technology. It means that choices and decisions occur dynamically during a non-linear design process. Considering those projects, the body reorganizes materialities, absorbs and reacts from data and vital information during the whole process of performing with them. "The world is not what I think but what I live; I am open to the world and I communicate with it undoubtedly, but I cannot have it, it is inexhaustible"[16].

So, as the author writes, each project augments modes of accessing the world, such that we are no longer required to conform to it.In the Divisor project, the body-system emerges from an apparent simple material, but when it modulates participants'collective actions and behaviours other "configurations of things and realities take place. They take form"[17]. An imprecise situation, once the formal configurations reveal combinations of distinct bodies and their chosen directions. The visual configuration expresses the shared experience of space, situated and defined by the action. The mobility of the group depends on participants'decisions and movements, changing the situation of a personal choice to a collective condition. "There is no (art)work: only its development in a thousand of pathways: the body follows an architecture: the head rises upwards and the body weighs its weight. Self-ownership occurs as the structure reveals itself – lucid: a surface composed of multiple cracks"[18]. According to the artist, the Divisor project evokes a spatial situation and participants define limits and contours for the whole piece, articulating body-space relationships. The size of the cloth creates certain limits while it pulses conducted by the rhythm and the flux of participants' body displacements. It is worn by a collective body. "(...) such a framework recognises that bodies are socially constituted, always situated in culture and the outcome of individual practices directed towards the body: in other words. 'Dress'is the result of 'dressing'or'getting dressed'"[19]. Participants'bodies formalize the comprehension of the space around as a sensory condition, while they breathe covered by the huge length of cloth. It is a space–time experience.

Ethiculators exists only when it is dressed by people, since their actions install the structure on the physical space and give meanings. "The phenomenon is not comprehended as an ideality, it is an element, the medium, a privileged context of ever manifestation of what is going to be veiled and can be presented and revealed at the same time"[20]. Confirming the author, the proposal of the Ethiculators project is to define a spatial situation dependent on people's behaviours and their understanding about being in the world. It is the essence of the happening.

In this process the performer initiates a silent and intense experience with dressing, while he/she assumes all object's implications. His/Her movements and gestures respond to the weight, the texture, and the form of the structure and conforms his/her understanding as an experienced space. "The idea of dress as situated bodily practice as a theoretical and methodological framework for understanding the complex dynamic relationship between the body, dress and culture"[21]. According to the author, the object worn –the mask –protects and connects to the explored territory in a relational condition to the other and the world. These exchanges between body and environment determine fluxes of information –possible movements of tracking and mapping environmental data. While the performer learns how

to organize his/her movements as from the structure in action, it is possible to invent other rhythms of displacements in the space, considering unpredictable elements.

The A-thing project investigates "the possibility of self-consciousness as a process inside the reality of phenomenon and in the materiality of the facts"[22]. It assumes the formal configuration open to the performer's senses by the comprehension of textures and resistances through his/her physical contacts. Hence, the dressed structure with its specific materiality evokes performer's sensory experience and thus, the various possible meanings. This inhabiting act defines the body, and"constitutes the environment of the self, to be inseparable from the self"[23].

The body as a system organizes itself perceiving distances, tracking presences and monitoring obstacles of the place. "Essentially spatialized, it exists while it configures the state of being in the world"[24]. A-thing investigates the body-space articulations while the performer is moving, and extends these gestures as a visual layer in the space. Physiological data –heart frequency and oxygen saturation–is translated into dynamic visual configurations. Working with green circles of different scales and densities of traces (figure3b), the rhythm of body is visually re-codified dynamically. This pattern is a diagrammatic and meta-design exercise that presents performer's reactions while performing. The comprehension of the world is knowledge as "the result of an going interpretation that emerges from our capacities of understanding"[25]. It is a live process of constant reconstruction of actions.

FINAL CONSIDERATIONS

The text enquires into, from the theoretical perspective of Design, two conceptual terms – body-structure and body-system –to think about the experience of the body in the space, based on three specific projects. The body-structure instance subverts materiality and form to extend spatial experiences, while the body-system instance explores unusual actions of dressing–individual or collective. The Divisor, Ethiculators and A-thing projects situate the dressed body as the place of experimentation, creating, with their own specific structure and materiality, singular modes of integrating bodies, objects and space –the poetics of body-space articulations.

It is important to clarify that all three projects question certain functional limits of objects, and the modes of using them, when they constrain the mobility of people's bodies and propose other kindsof gestures for everyday actions. For example, the Divisor project elects mobility to discuss the collective body-structure and its interferences on the perception of the world, while the body-system proposes a simultaneous walk dependent on the collaborative process of participants.

This kind of investigation is proper of the art field, but the Ethiculators, named as a design project by Dunne and Raby, reveals the possibility of including a systemic unpredictability into the design process. They create a material filter to observe and to act in the world that does not properly follow the dress codes defined in the design field. In some way, it extends the standard attributes of the project.

When it comes to art –the construction of relationships between distinct realities and human behaviours –the dressed body is a sensory proposal of being in the world related to the everyday life. The A-thing project makes visible this relational situation [26] –object and physical space –that conditions body movements and gestures. Its body-system, using the physiological historic data, creates a diagram, accumulating information of every happening.

Comprehending that, historically, the act of dressing is determined by cultural and social rules, the design field –with the structural and systemic aspects of each project –is an answer to those impositions. The reason of our choice of composing the Divisor project, from the 1960's, with the Ethiculators and the A-thing contemporaneous projects, is clear with this affirmation. They signify spatial marks of the experience with dressing. The body is the focus of the art experimentation and the dressed body evokes a poetic landmark.

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ART MAKING WITH MEMORY MATTER: MNEMO-MEDIA,CREATIVITY AND IMPAIRMENT FROM HUMAN TO HYPER-HUMAN

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ABSTRACT

In a time period when the technologies to preserve our memories and enhance our humane bodies are developing at a fast pace, my project explores concepts of normality, memory, body, and representation. Art is a powerful tool to enhance public awareness of several disorders, handicaps and also cognitive difficulties, questioning norms of behaviour and normality.

Does loosing our memory means becoming simultaneously visually/audio/motor/'self'-impaired? By being present in my practice-based research at clinical trials with Alzheimer´s disease patients, I have enlarged my humanness, which surfaced, into my artwork. I concluded that my embodied presence/looking at scientific/medical practices was powerful leaving behind traces of my experience and new meanings. The complexities of memory functioning, its loss and the intricacies of its research have surfaced in my installation-art.

KEYWORDS

Arts-led Research, Alzheimer's Disease, Memory Enhancement,Art/Science, Impairment.

INTRODUCTION

Does loosing our memory means becoming simultaneously visually, audio, motor and self-impaired? In the age of neuroenhancement are we (will we be considered) all impaired? I argue that artists can raise awareness of these factors through their interpretations, their construction of aesthetic experiences and provocative actions.

My previous research/projects have shown that our fragmented reminiscences and relationship to objects, language and knowledge are characterised by paradox and challenge in a permanent search for meaning. As a result, it is possible to address the notion of wholeness and memory functioning via interaction through art installations.

In the practice-based PhD research on the Representational Strategies on Alzheimer´s Disease, through self-examination and montage strategies I developed the ability to identify certain almost-universal human flaws and slippages, and recognised memory's powerful association with attention/narrative/habit. I gained a deeper understanding of the implications and possibilities that surround the acquisition and maintenance of memory and it's potential enhancement, as well as ideas to pursue new artistic/research explorations.

I found visual plasticity, narrative and metaphorical richness, in the neuropsychological dementia assessment materials and in laboratory representational strategies(Latour, 1990); allowing translations and simultaneously evoking absence/presence (blots and gels instead of cells, cells instead of brains, diagnostic images instead of the patient's body). I will use as example*The Assessment*, one of the projects developed during the time frame of the research, to demonstrate my meanings.

At present as part of my Postdoc research plan I am doing a residency at IBMC[1] and collaborating with NERRI[2] observing the development of new technologies,building of public awareness of the neuro-enhacement methods, as well as the development of ethical guides and policies to monitor their uses. Human enhancement techniqueshave been used since ever but the new technologies (i.e. nanotechnology, bionics, pharmaceutics, etc.) will have far-reaching implications both for individuals and for society. My new works (*Platonia* and *Boxes, shadows and Definitions*) developed under the umbrella of *Art Making With Memory Matters*, weave the experience gained in the PhD project with the clash to this exhilarating enhancements reality.

BACKGROUND THEORY/PRACTICE

Memory and Alzheimer's disease

Memory is understood to be fundamental to the constitution of the self /understanding of the world [1] working in tandem with external archives and aids of memory ranging from personal

[1] Instituto de Biologia Molecular e Celular, Universidade do Porto.
[2] NERRI - EuropeanResearchproject,Neuro-EnhancementResponsibleResearchandInnovation,NERRI(CienciaVivaand11othercountries) http://www.nerri.eu/eng/home.aspx

mnemonic objects (e.g. cell phones, computers) to collective, social/public memory (e.g. gardens, museums).

Memory is a multiple system [2]; a group of different abilities mediated by distinct brain systems. Each neural system holds differing connections and receives different information from distinct brain structures; to create a unified experience of memory.

In neuropsychology, when a test is performed on a patient's memory, the meaning associated with memory is, the process of encoding, storage and retrieval. The act of remembering, in neural terms, is described as a network of connections among nerve cells [3].

Human memory is complex, fragile and defines our individuality. We mentally store our experiences and knowledge of the world as memories. However, memories are easily forgotten, and its retrieval, through the act of remembering, is inexact and faulty. Subjectively, it is understood that memories are mediated, personal and subject to change, rather than a fixed archive of pristine data awaiting the appropriate command to re-form them into images.

Memory is a complex construction, a biological phenomenon rooted in the senses, that begins with perception and actively utilizes many areas of the brain to reassemble a thought into a coherent whole. Different types of memory are stored and evoked using diverse neuronal networks located in distinct parts of the brain. Memories, therefore, consist of an association between groups of neurons that triggers other associations to create specific patterns. I propose that this process in a multiplicity of systems implies a tendency to assemble, and may be evoked through montage, juxtaposition and video installation. In Alzheimer's disease communication within this system seems to be disrupted; the assembling capacity therefore seems to be shattered.

Alzheimer's is a silent, neurodegenerative disease that effaces the map of connections drawn from the experience of living; its onset is heralded by destruction of autobiographical memory. According to neuroscientist André Dellacourte [4], Alzheimer's disease is the most common form of dementia, a brain pathology that leads to a progressive cognitive decline in the ability to remember, learn, think and communicate. Sufferers present difficulty accessing and using words, recognizing faces, images, places and objects. It is a complex phenomenon, due to the coexistence of two degenerating biological processes, tau protein aggregation and Beta-amyloid deposition, that affect polymodal association in brain areas (i.e. synapse networking). The progressive loss of brain network connections inhibits patients from assessing not just recent events, but well-rehearsed skills and known facts:

> It is not just about remembering things; it is about where things are and how they work. It is about the retrieval of knowledge; it guides speaking, sleeping and rolling in the grass. [5 - p199]

As Joan Gibbons [6] claims, art became an important agency to the memory-work required by contemporary life and culture by challenging ontological assumptions that underpin much recent research on memory, including understandings of biological memory, and the role of it's enhancement.

Science, Medicine and Art

Scientific and medical investigation is based on practices of assemblage and incorporation of techniques, habits, ideas, images and conversations [7]. Representation is the substitution of symptoms and behaviours. Life science studies focuses on surveillance using practices of assessing, recording and archiving [8] Looking is linked to other activities that ascribe meaning to what vision uncovers, such as experimenting, measuring, analysing and ordering[9]. Observing means constructing and bringing into being[10]. This process may be evoked through montage, juxtaposition and video in art installations [11]. Truth, knowledge and vision are intertwined in the scientific representational strategies [12]. My work extends and challenges this entwined relationship.

Cultural theorists [13][14] reflect on the importance of artist's use of biology, materials, processes and theory; exposing attempts to decode the cultural codes also enclosed in the scientific images in a bid to make them a space in which other fields of culture may be inscribed. As an artist I tend to embed social and cultural factors within my art experiments and to offer critiques of the very technologies it embraces. Today there is increasing realisation that those outside the discipline of science may be able to ask questions of science that have not been adequately addressed.

Human Enhancement

Significant developments in perceptual aids for people with disabilities may offer a glimpse at an entirely different future.Research in Cochlear implants[3], and Artificial Retinas[4] are some of the most recent technological developments to suppress deficiencies in hearing and sight. Both are considered to be therapeutic forms of human enhancement providing the means of overcoming a perceived disability. Near-future technologies could give rise to people who are able to perceive a wide range of stimuli previously invisible or inaudible. Human enhancement may include any activity by which we improve our bodies, minds or performances, but the controversy starts when this improvements are considered to boost our capacities beyond the *statistically normal range* of functioning for an individual [15]

Humans have long used several cognitive enhancement methods to expand the competence and range of the various mental activities we perform [16].

> Neuroenhancement describes the use of neuroscience-based techniques for enhancing cognitive function by acting directly on the human brain and nervous system, altering its properties to increase performance (....) This includes transcranial electromagnetic stimulation methods, such as transcranial direct current stimulation (tDCS) and transcranial magnetic stimulation (TMS), along with deep brain stimulation, neurofeedback, behavioral training techniques, and these and other techniques in conjunction with neuroimaging.[17]

[3] http://www.washington.edu/news/2013/10/09/new-strategy-lets-cochlear-implant-users-hear-music/ (accessed 23/07/2014)

[4]http://www.washingtonpost.com/national/health-science/first-us-artificial-retina-approved-device-could-restore-some-sight-to-blind/2013/02/14/72f91894-76e6-11e2-aa12-e6cf1d31106b_story.html (accessed 23/07/2014)

The methods described above and others cited by Eduard deBono Foundation[5],such as lateral thinking or creativity, or many well know smart drugs promoted by pharmaceutical companies and advertisements, or even coffee, can be used to improve perception, attention, memory, creativity and other forms of cognition or reduce the costs and duration of treatment in specific pathologies.In this view, neuroenhancement implies operating directly on our nervous systems, to improve our cognitive function and increase our capabilities.

Hub Zwart [18], resumes the scholarly debate around the themes of neuroehnancement referring post-humanism, bio-conservatism and the work of Peter Sloterdijk as the most important examples. Until recently the debate was polarized between the authors in favour of a complete technological remake of our human capacities (trans and post humanists), and the opposed defenders of the natural evolution (bio conservatives), [19] He draws attention to Francis Fukuyama [20] concerned evaluation of the possible alterations of the brain as matter and the human personality by the intake of the future genomically targeted neuropharmaceutics. Peter Sloterdijk[6] places the debate in a different platform considering the will to self enhance as typically humane condition and analyses this history of 'self-improvement' in a broader historical perspective extending Nietzsche and Foucault's views on our dependence of self improvement. Sloterdijk emphasizes de role of exercises, defending arts and culture as systems of examples to transposefrom one generation totheother importantcognitiveand moralcontentfortheir survival[21] Zwart calls attention to our neurological plasticity and the way our brain networks are "sculpted by our socio-technical environments.

DESCRIPTION OF RESEARCH

My PhD practice-based research was in the Instituto de Medicina Molecular and hospital Santa Maria, in Lisbon. This provided a unique and complementary scientific/laboratory/artist studio in which to develop a progressive and situated practice-based inquiry into how memory loss is scientifically researched.

The late or scarce physical symptoms of Alzheimer's disease prompt my interest in how the intermediation of the technological image substitutes for some clinical sensorial examination of the body, and how certain laboratory practices turn the biological materiality of the loss of memory into a visible phenomenon. In clinical practice, it is assumed a supposed neutrality of the technologies and objectivity, methodological consistency and precision era ascribed to the images.[7]Representation is the substitution of symptoms and behaviours reported by the patient. Images are seen as essential to systems of power and concepts of knowledge and self-regulation.[8]

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[5] http://edwarddebonofoundation.com/

[6] Sloterdijk, P. 2009. *Du musst dein Leben ändern. Über Anthropotechnik*. Frankfurt: Suhrkamp.
Turgenev, I. 1861/1965. Fathers and sons. Harmondsworth: Penguin. cited in Hub Zwart. 2013.

[7] 'The notion of photographic truth hinges on the idea that the camera is an objective device for the capturing of reality, and that it renders this objectivity despite the subjective vision of the person using the camera.' (Sturken and Cartwright, 2002: 280)

[8] Foucault coined the notion of biopower as a reflex on the body on the regulatory power institutions. The training, exercise and regulation of the body, categorized and registered through photography, is explained as the simultaneous rise of 19th-century social institutions and the emergence of photography. For expansion, see Practices of Looking (Marita Struken and Lisa Cartwright, 2002).

I accompanied several patients under various clinical and therapeutic approaches. Personal experience on location allowed me to focus on my topic, share moments of tension, hope and drama, and to observe and participate in moments of corporeality.

Within neurological discourse and practice, attempts are made to understand Alzheimer's by observation, visualization, and measuring and archiving methods. These ascribe meanings that are confined to specific areas of knowledge and therefore correspond to standard ways of understanding. These models of knowing are inaccessible to those outside the specific biomedical field and, I would argue, are opaque; they reflect socio-cultural norms and are thus unable to evoke the subject of memory. They also fail to reflect the agony of being lost in oneself, and the material reality of the bodily practices to which patients are subjected because they are perceived to be outside the norm.

Alzheimer's patients gradually lose the ability to comprehend narrative structure and the chronological time systems (i.e. contextual memory –[22]) that orient our personal autobiographical memory system. Lacking an almost permanent translation of the world, it becomes difficult for them to function. Though attended by caregivers, doctors, nurses, family and friends, their shattering neuronal and cognitive condition threatens to dissolve connections with the world and to exile them in that fundamental solitude of the sick and demented. Gradually, as forgetting details extends to loss of concepts, they not only forget how to read or write but cannot understand the significance of a book or a pencil, in speech, written word, image or even as an object. Further, interpreting space and moving becomes difficult and threatening.

The Assessment

During my research I submitted myself to three[9] neuropsychological assessment tests similar to those undergone by patients followed during a clinical trial for a new therapeutic drug. The act of being assessed, whether myself in the studio, or a patient in the laboratory, is an intimate action, performed with an economy of means.

The Assessment (Fig.1) is a double split-screen projection of foursimultaneous video narratives: the condensation of an extended exploration of different actions, moments, locations, and materials.When placed in sequence and presented together, the fragments of video establish previously invisible links that approach the separate actions and construct bridges, transforming what was an invisible link (such as a whistle[10] that later identifies the protagonist) into a necessary narrative. The idea of assessment is transposed from the content and context of the images to the negotiation between viewer and multiple viewpoints, i.e. multiple simultaneous projections, implying a heterogeneous outlook. The multidimensionality of the installation and the fragmented experience of the viewer becomes the representation of multiple layers of memory and meaning, in a constant interrelation between the external experience and its internal reality.

[9] These are MMSE, ADAS – Cog and NTB. Examples of the tests may be found in the appendix.

[10] The whistle is one of ten objects used in the recognition test of the neuropsychological assessment. The other nine are a baby's rattle, doll's bed, wallet, harmonica, plastic flower, carnival mask, funnel, scissors and stethoscope.

Figure 1 – Maria Manuela Lopes, 2011/12, The Assessment.. *Video stills, screen a and b.*

These articulated fragments of memory and fragmented bodies, mainly hands and representations of the body, aim tochange the path of our understanding of the construction of autobiographical memory and identity from a basis in lived or observed experience to a witnessing process of permanent reconstruction – or, in the case of patients, to an increase in the gaps and silence and absence.

The evolution of *The Assessment* stems from the emotions I experienced during the diagnosis and follow-up procedures of Alzheimer patients, and from reflection on the data I capturedin the molecular biology laboratory plus those I was producing in the studio by a mimicking strategy.

Once diagnosed, Alzheimer's patients become trapped in a semi-visible network of assessment strategies; they surrender to the vigilance that surrounds their condition and become observed – hence the *panopticon* metaphor [23]– by everybody, all the time (Fig. 2). The institution constitutes the medical and scientific archive by producing endless chains of inscriptions and actions, as noted. Outside the institutional frame, friends and relatives silently observe every mood, move and sentence to identify growing flaws. The most frightening observer is the patient himself.

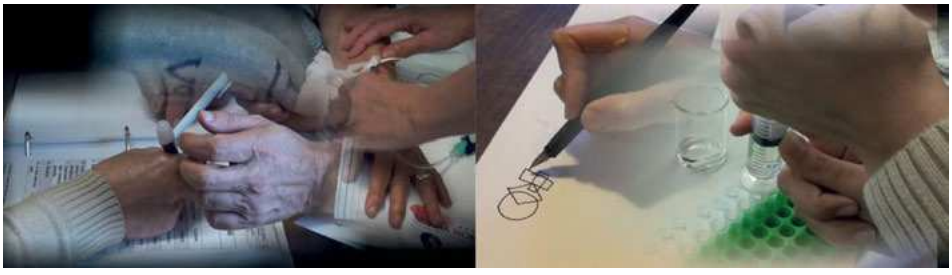

Figure 2 – Maria Manuela Lopes, 2011/12, The Assessment.. *Video stills, screen a and b.*

The installation unsettles conventional representations of the loss of memory, and also unsettles viewing relationships. The audiovisual work offers ways to negotiate individual memory loss, and explore scientific practices for investigating this process. My visual strategies in post production incorporate editing grammars, strategies such as fractures, slow motion, mute moments or repetitions, which engage the viewer in an emotional affective reaction. I

intend to draw viewers into the process of memory and remembering without relying on their identification with the theme, but allowing through experience and feeling an engagement and intellectual reflection.

Art is a powerful tool to enhance public awareness of several disorders and handicaps (such as visual, sound, or motor impairment) and also cognitive difficulties (such as attention) and question norms of behaviour and normality. My collaborative art/science research projects are discursively located within the paradigms of memory, life sciences and visual arts. Within the process it allows the boundaries between aesthetics, philosophic and scientific disciplines to become significant in a relational network associated with the themes of remembering/forgetting, presence/absence, and concepts of self-identity.

The work developed so far (Fig. 3) explore/expand on the representational strategies of memory studies in the laboratory through art practice, alluding to the complex, fluid and multiple nature of memory and the studies on its functioning/dys-functioning and enhancement/preservation. The pathways explored involve the production and dissemination of art installations and contact with different audiences in the form of workshops that experiment with traditional mnemonic techniques, augmented reality and cognitive stimulation strategies, that promote a network of artistic, scientific, scholarly, poetic, technically and methodological layers and further questions.

Figure 3 – Maria Manuela Lopes, 2011/12, The Assessment.. Video stills, screen a and b.

RELATED WORK

Practice-led arts research may be used to enhance the skills of future generations of artists/researcher's and to bridge the gap between technological development and different research areas such as the humanities, the visual arts and the life sciences [24], [25]. Further, art may have a therapeutic value beyond enhancing cognitive flexibility, as proven by various artistic and scientific practices correlated, such as Diane Gromala's [26] artwork and related scientific work, utilising Virtual Reality (VR) systems and biofeedback, for instance to manage chronic pain. Concurrently, this project aims to stimulate debate on the current understanding on the nature, metaphors, containers and enhancement of memory and further encourage transdisciplinar arts-lead research.

CONCLUSION

The arts projects and research have explored the dynamics of the encounter between diseased bodies, institutionalised scientific practices and diagnostic images, focusing on the enactment and re-enactment of the originating performances, their experiential sensory qualities and their power to address the subject of memory. These findings have been extended into cultural, social and political contexts by contrasting them with other 'realities' and private/public cultural practices.

As an artist I close the loop by feeding back into the wider culture – if not with an explicit revelation of the kind for which scientists strive, at least with a willingness to contemplate new forms of knowledge. This is to be achieved using visual and sound languages that are not explicitly bound by the laws of empiricism and logic, but are rather strategies that emphasise play, dialectics, drama, humour, and ambiguity as paths to evoke autobiographical memory. As an artist in residence I may not be able to exert substantial influence, but the challenge to expose concerns to a broad audience is a major motivational factor in the production of my research, eliciting a change of attitude in an audience. I emphasize that the installation works embodies the power to communicate complex scientific and human concerns through art, and demonstrates the strength of using aesthetic strategies to present complex notions of disease, memory, archiving, clinic diagnostic and treatment or therapies. The new projects explore how we take for granted human enhancement methods from the eyeglasses or the motorbike, to the cell phones or tea and shiver when hear words such as nanorobot, gene-therapy or cyborg.

Visual arts, may and should contribute to fuel the debate on body, cognitive and memory enhancement extending the public interest beyond the existing scientific research on bionic limbs or cosmetic surgery or speculations on the bio-ethical grammar, of permissions, policies or rules for research and on whether to and to what extent individuals will be allowed to make autonomous and informed choices [27] and how to minimize risks and harmful consequences.

Arts research may play an important role in making visible the implications of new technological developments as well as may use its freedom to provide possible scenarios for exploration of enhancement possibilities in a near future; reflectingon the current technologies and techniques impacting on society, or anticipating the social changes to come (as the consideration that normal now may be handicap tomorrow) foreseeing the pressure ordinary people will suffer to undertake 'smart drugs' and specific therapies to enhance their natural capacities and increase their performance.

How will the social, political, legal, and moral landscape, therefore aesthetics, change due to pressure from reasonably expected advances in science and technology? Will the availability of techniques that can enhance performance impose new concepts of normality, impairment or even Humanness? In a period when sensual augmentation become normalized, those who decide not to augment their perceptual capabilities may become regarded and treated as "disabled". With the possibilities of a future that aims to exclude the deficit of sight, hearing, motor limitation, memory and cognitive impairment, I wonder and explore if the glitch, the uneven, the contingency or imperfection of or bodies/minds /performances aren't the poetic side of life that makes us truly unique as individuals.

My projects encourage the public to be critical about adjudications of health/illness by providing viewers with a way to experience the limitations of normal perception and memory. Spectators are invited to reflect on 'normality' and to what extent our notions of the perceiving, remember or the norm are socially constructed and technologically embedded.

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AESTHETICS OF THE DATABASE – IMAGE AND MEDIA AS A WAY OF THINKING

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ABRACT

Throughout the 20th and 21st centuries, with the beginning of a new stage in the history of culture based on the increasingly ubiquitous presence of media and image devices, the rise of a series of thinkers that employ forms of media as a starting point for theoretical development can be noted. More than viewing the media device solely as a technical object, many of these theoreticians have considered them as articulating concepts of new epistemological and ontological visions of the world. *Aesthetics of the database: image and media as a way of thinking*dialogues, in this sense, with theoreticians,like Walter Benjamin, Lev Manovich and Jacques Derrida, and artistic productions that incorporate the database as a fertile starting point in thinking about contemporary culture.*Aesthetics of the database: image and media as a way of thinking*dialogues also with *Live Archive* curatorship presented in October 2013 at Paço das Artes.

KEYWORDS:

Aesthetics, database, computational art, new media

CINEMA, NARRATIVE AND DATABASE

Among the many philosophers in media studies that emerged in the last century, Walter Benjamin has possibly become the one whose reference is unquestionable when discussing issues pertinent to narrative and the realm of images. Unlike Henri Bergson, who incorporates the discussion about the moving image and cinema to develop his philosophy of duration, the philosopher associated to the Frankfurt School draws attention to the cinematographic montage as a methodological strategy and operative concept in thinking about new narrative formats, different to the linear and hegemonic ones which shape official history.

For Benjamin, the theory of memory as described by Bergsonin *Matter and Memory*is aimed at a type of experience which undergoes a number of mutations throughout the 19th and 20th centuries. The experience ceases to be the authentic experience of duration to develop itself by means of collisions and interruptions. It is in this context that Benjamin introduces the notion of montage, borrowed from the cinema, as a strategic methodology to approach historiographicalwritings.

Within this perspective, history and media become intertwined: history is conceived as medium/media, a sort of collage of times and memories. In the same way as the film editor edits/cuts/interrupts the filmic *continuum*, the historian rewrites history: imploding the *continuum* of the history of domination and opening space for the present time (*Jeitzi*g)

If the debate on the relation between history, narrative, image and cinema is the starting point for thinkers like Walter Benjamin, within the context of the 21st century theoreticians turn to the new narrative formats arising from the relation with digital media and the database.

In *Narrated Theory: Multiple Projection and Multiple Narration (Past and Future)* Peter Weibel (2005) discusses the changes occurred in the cinematographic code from the 1960s onwards, when many filmmakers began developing experiments with the screen. The use of multiple projection – beyond the single projection predominant in 'traditional' cinema – represented not only a simple invasion of space through the visual image, but a new approach to narrative. Beyond the single and linear narrative, the observer has the possibility to experiment a multiplicity of different narratives, states Weibel. (2005, p. 336):

> "From the onset, the extension of the simple screen to multiple screens did not only represent an expansion of visual horizons and astaggering intensification of the visual experience. It has always been employed in developing a new approach towards narration. For the first time, the subjective response to the world was not forced into a falsely objective, constructed style, but presented in the same diffuse and fragmentary way in which it was experienced."

Lev Manovich (2001), on the other hand, signals to the idea that the predominant cultural form in contemporary times is not the narrative, but the database. For the theoretician, cinema favours the narrative as a key for the understanding of a cultural form which expresses modernity; the database, in turn, would be the cultural form inherent to contemporaneity and to the informational age:

> "In computer science, database is defined as a structured collection of data. The data stored in a database is organized for fast search and retrieval by a computer and therefore **it is**

> **anything but a simple collection of items.** (...) Following art historian Ervin Panofsky´s analysis of linear perspective as a "symbolic form" of the modern age, we may even call database a new symbolic form of the computer age (or, as philosopher Jean François Lyotard called it in his famous book The *Postmodern Condition*, "computerized society", a new way to structure our experience of ourselves and of the world. Indeed, if, after the death of God (Nietzsche), the end of grand Narratives of Enlightenment (Lyotard), and the arrival of the web (Tim Berners-Lee), the world appears to us as an endless and unstructured collection of images, texts, and other data records." (Manovich 2001, p.219)

The database manifests itself most prominently on the Internet. A webpage originally structured in HTML language, for example, is formed by a list of separately stored elements: texts, images and links interconnected to other data access pages. On the other hand, the web's open nature – the fact that its pages are 'archives' that can be edited by its users –indicates that the sites are never 'finalized'; new pages or links are always added to the previously existing ones. According toManovich, these properties, contribute to the anti-narrative nature that characterizes the web: "If new elements are being added over time, the result is a collection, not a story." (Manovich, 2001, p.221)

The relationship between archive, database and narrative is also the starting point for the collection of essaysentitled *Database Aesthetics: Art in the Age of Information Overflow*, edited by Victoria Vesna (2007). Two essays in this collection, especially *Ocean, Database, Recut* by Grahame Weinbren and *The Database as System as a Cultural Form: Anatomies of Cultural Narratives* by Christiane Paul present less radical visions than those developed by Lev Manovich. Unlike a formal incompatibility between narrative and database, the authors carry out a thinking exercise in narrative formats based on the database:

> "My suggestion is that narrative and database are in different categories, so they do not fall in to the binary opposition that Manovich asserts (...) Manovich attributes meaning to *Man with a Movie Camera's* underlying database, or at least to the film's acknowledgment of it. My thesis is that the database form abounds with such expressive possibilities, largely unexplored – for example, in the very fact that a database can be a region of alternative story constructs". (Weinbren In Vesna, 2007, p.69)

For Christiane Paul the database – normally understood as a computational information storage system – is a collection of data that maintains, to a certain extent, the tradition of data 'storages' such as books, the library or the archive. What distinguishes the computational database from its predecessor is the possibility of recovering and filtering data in multiple ways. On the other hand, and possibly more importantly, the database is not only a collection of stored material, but also the system that holds the information in a specific way:

> "The database is not only constituted as a data repository. A database is essentially a system that holds the *hardware* that stores the data, the *software* which allows the storage of the data in it's respective repository to recover, filter and alter them, similar to the user who adds on an extra level to the understanding of the data as information."(Paul in Vesna, 2007, p.96)

Hence the narrative and the database are not excluding forms. As noted by Christiane Paul, this is the case of computer games, narratives whosecomponents are organized in a database.

Within this perspective, an interactive narrative can be understood as the 'sum' of possible trajectories, virtually present in a database.

In the same way as these authors, I believe that itis of less interestto us to view the narrative and the database as incompatible strategies. The database allows us not only to rethink the single and linear narrative – once it can be seen as an apparatus that offers us the possibility of building multiple narratives – but also the formats for storing and for accessing the information in the context of contemporary culture.

ARTISTIC POETICS WITH ARCHIVE AND DATABASE

It is within this perspective, in thinking the statute of the archive and of the database in the contemporary context, that I developed the curatorial project *Arquivo Vivo* (*Live Archive*) presented in October 2013 at Paço das Artes, São Paulo. Creating a dialogue with the concept of *Archive Fever*, proposed by Jacques Derrida, who regards the archive as an incomplete and lacunaryapparatus, and hence one that is always open to new and constant rewritings, *Arquivo Vivo* presented 22 works by national and international artists which, in varying ways, incorporated themes and procedures that concern the archive and the database and their relation to history, memory and oblivion.

Artists who appropriate themselves of archive material, who create fictitious archives, who develop projects from an archival modality, who re-enact well known works in the history of art, artists who prompt the debate on cataloguing and archiving processes, artists who incorporate the archive in their own connective issue, were some of the procedures incorporated in the show from the articulation of the following three main vectors:

- Archiving and appropriation of documents and historical works and of the history of art
- Archive in the body and Body as archive
- Artist archives, institutional archive and database

In the first vector we find artistic projects that generally appropriate themselves of historical documents or re-enact emblematic works/documentation in the history of art. By appropriating these archives/documents, the artist deconstructs and modifies the 'original' meaning, leading to the idea that the archive is always open to other readings and interpretations.

This was the case of the Project *As pérolas, comoteescrevi*, by Brazilian artist Regina Parra, for example. The project is a video installation formed by three synchronized projections. Each projection is composed of images of immigrants that have clandestinely entered Brazil and currently live in São Paulo. The migrants read extracts from the letter written by AméricoVespúcio in 1503 where he coins the term *New World*. The projection in multiple screens, added to the polyphony of the variety of accents of the immigrants reading the historical document of the Americas, alludes not only to a fragmented and multiple narrative, which is built in the relation with the spectator, but also to the power relations and the colonizing processes that have marked our history.

Within the *Archive in the body and Body as archive* vector, we find projects that consider the body to be a type of archive and/or incorporate the archive in the body's connective tissue

itself. Here the body can be understood as a type of scripture that incorporates marks, traces, signifying indications of a body/message in the constant process of generation of meaning. *Time Capsule*, by Brazilian artist Eduardo Kac, was one of the projects that composed this vector. In this process Kac implants an identification microchip in his ankle, which is later Web-scanned, thus registering the artist to an animal-identification database (used to track lost pets). The work includes a webcast and a live television broadcast. Not only does the project raise the debate on issues relating to digital memory, but also about the surveillance and information control apparatuses of the present.

In regards to the *Artist archives, institutional archive and database* vector, we find not only projects that foreground personal and/or institutional archives, but also proposals that generate complex classification systems and databases in varying mediums.

Brazilian artists RejaneCantoni and Leonardo Crescenti present *Fala*, an autonomous and interactive talking machine that is built on a database composed of the twenty most commonly used words in forty different languages. In the installation, a microphone creates the interface with a "chorus" of forty mobile phones. All the devices are in sound-capturing mode to record voices and other sounds in the exhibition space. The autonomous talking machine analyses the information and establishes equivalences with its database, generating an audio-visual result with a similar semantic meaning to the captured sound, as a type of "Chinese whispers" conversation. In other words, it reproduces and exhibits an identical or similar word to that which was heard in the screens of the mobile phones on display, highlighting the fact that the database is an apparatus open to a multiplicity of possible meanings and relations.

Inthe Japanese artist Masaki Fujihata's work *Simultaneous Echoes* we are given the possibility of generating several musical pieces in real time using an audio-visual database in 3D. *Simultaneous* Echoes is part of the project *Fields-Works,* which comprises a series of projects that recreates collective memories in the cybernetic space with the use of GPS technology. The project explores the way in which fragmented musical elements recorded in several locations and in different moments can be reconstructed in the cybernetic space, creating the possibility to produce "singular" musical pieces, activated and generated by the interacting public.

Expiração 09 gathers material compiled during more than ten years from the archive of the Brazilian artist Pablo Lobato. For the project, Lobato creates a software aimed at defining the periods of existence of specific sections of this archive, which are selected, copied to computers and have their respective matrices erased. As in a roll of the dice, at the beginning of an exhibition the period of existence of each video is randomly defined by the software, between 01 and x days (where x = maximum period of the exhibition). By the end of this period, all the videos are totally erased, leaving only the first frame exhibited on a blank screen with a low level of opacity.

It is interesting to realize that, despite the diversity of projects presented in*Live Archive*, they all explore the dynamic and relational possibility provided by the database. Furthermore, it raises discussions about information control and surveillance, and also on digital memory, all of which are fundamental topics when thinking about the 'culture' of the database.

To finalize, I would like to draw attention to Brazilian artist Lucas Bambozzi's*net art* project, which despite not being part of the *Live Archive*exhibition also dialogues with many of the issues raised in the show. The project is an online system of editing and indexing videos that have been made available in audio-visual file sharing websites such as You Tube. With the use of an interface it is possible to use keywords to edit videos and thus produce an audio-visual narrative. The

configuration of the project uses a program that predicts that the keywords established by the users give access to completely different images than those linked to the keywords chosen by the web users. In this sense, the project does not only point to the issue of online editing, it also discusses the current indexing processes which obviously filter information and data, directing the meanings and significations exposed on the web.

There is no denying that the database is a cultural form that is pervasive in our time. Thinking about the database, in this sense, can be a fertile mechanism to help us reflect not only on the way we store our information, but above all, upon the narrative that we intend to build with this information. After all, as affirmed by Jacques Derrida (2001), what is stored, how it is stored and who stores it are not only vectors of the same "equation" but fundamental elements in understanding the culture of a particular time.

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WEARCODE: HARDWARE DESIGN EMBEDDED IN WEARABLE INTERFACE FOR INTERACTIVE COMMUNICATION OF THE VISUALLY IMPAIRED IN POINT OF SALE

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ABSTRACT

WearCode consists of a wearable and microcontrolled interface providing to the visually impaired information about the product handled at the point of sale through remote communication with the retailer information network (data server). The methodology considered the bibliographic reference and experimental practice in the laboratory for its development. Among the main results, there was the ability of the system to eliminate possible difficulties for the visually impaired at the time of purchase, such as: dependence on others and difficulty in making decisions due to insufficient or unreliable information to identify the product.

KEYWORDS

Wearable interface, visual impairment, interaction at point of sale, embedded technology, remote access.

INTRODUCTION

According to data published by the World Health Organization [1], more than 285 million people worldwide have some type of visual impairment, among them, 246 million people have moderate or severe vision loss and 39 million are blind.

According to data collected by the Brazilian Institute of Geography and Statistics - IBGE [2], in the 2010 census, among the various types of disabilities, the visual impairment has higher occurrence, affecting 18.6% of the Brazilian population, which corresponds more than 35 million people. Out of this total, more than 729,000 people are totally blind.

These numbers become even more impressive considering the sufferable access conditions to these people, at different levels of education, culture, mobility and consumption arising from the fragile and inconsistent Brazilian public policies. Such scenario not only reveals a significant portion of the population lacking resources that promote full exercise of their rights and duties as citizens, but also reinforces the need for research and projects to meet specific needs of this population, like those developed in the experience of consumption.

When visually impaired decide to buy a certain product, there are three situations that could occur. At first, they go to the place where they are used to shop, accompanied by another person who will guide them in this process. In the second situation, a person close to them makes the purchase of the product requested by the visually impaired without their presence. And third and least common situation, the visually impaired go shopping alone.

In the first case, if the place chosen for the purchase is a space where the visually impaired are used to go, the service will be provided with attention and probably of relaxation, because of the pre-existing contact between them and the shop attendants. In some cases, even the manager or owner will personally assist the customer. And the companion will be by their side if there is any need or even to give an opinion about the choice they made.

On the other hand, in unfamiliar stores, the shopping experience for visually impaired can be frustrated when performed without the support and feedback of a companion they trust. However, in both contexts, the success of the purchase does not seem fully warranted to the visually impaired, even when accompanied by relatives or people they know.

Deprived of sight, the visually impaired face great difficulties when shopping; it starts with the dependence on others and is extended to the unpreparedness of the sellers on the personalized service for their needs. So, there is a lack of domestic products intended to promote the autonomy of visually impaired in point of sale, which is the main motivation of this research embodied in the WearCode proposal: a wearable and microcontrolled interface providing to the visually impaired information about the product in point of sale through remote communication with the retailer information network (data server).

With the growth of mobile telephony, broadband and wireless networks, the mobility and computing across multiple platforms and devices become increasingly viable and ordinary [3], [4], [5], [6], [7], [8]. As pointed out by Gutiérrez [9], WLANs still provide users the convenience and flexibility at work that help to "reduce costs and increase the service level to organizations".

For Castells [10], this context is configured as the information age, which is characterized by the predominance of knowledge networks in all fields of social life. The networks shall promote information generation and spread of knowledge and its applications with new technologies and contemporary social practices.

The methodology applied for this research included the articulation between the theoretical scope about the personal mobile interfaces - with emphasis on the concepts inherent in Wi-Fi standard and embedded systems [11], [12], [13], [14], [15] - and the development of the functional hardware prototype of the wearable and microcontrolled interface in laboratory.

Thus, WearCode aims to provide autonomy for the visually impaired, considering the independence on others; reliability and transparency, since communication is mediated by technology directly between the visually impaired and the product in the point of sale; mobility, since the interface is wireless and wearable; performance and organizational tasks, as it provides greater flexibility in decision making; elimination of noise and wear, such as insufficient or unreliable information to identify the product.

MATERIALS

For the development of the microcontrolled, remote access and wearable interface, a number of electronic components of a high standard were acquired as commodities[1], considering the needs of the project. Their specific applications in the prototype are presented below:

a) STM32F100RBT6B: the microcontrollers STM32F1xxx series are the Cortex-M3 family, from STMicroelectronics, and are based on ARMv7M architecture. The device acts as the core of the circuit, managing all other peripherals: Barcode reader, Wi-Fi and Speex[2] audio;

b) Omni-directional optical reader Metrologic MS3780 Fusion Laser is the first device to make contact with the product in the point of sale; when playing the bar code printed on the package, it establishes communication with the microcontroller through the interruption[3] and the UART[4]protocol and sends data to the microcontroller of the product that is being read;

c) Wi-Fi-SPI Interface MRF24WB0MA Microchip acts as a language translator. This is an interface with built-in antenna, which accesses a Wi-Fi network available in the environment and data travels through an SPI[5] network, allowing the microcontroller to operate unhindered by FreeRTOS[6];

d) Amplifier-integrator circuit[7] uses various commodity components to build an RC[8]network as an operational amplifier's filter[9] in order to synthesize the audio wave targeting a headset;

e) For the power supply circuit, the following energy conversion devices were used: STMicroelectronics ST1S14 evaluation adapter of DC-DC[10] converter; STMicroelectronics L6902D evaluation's adapter of electric flow driver[11]; and NiMH[12] batteries, 1.2 V x 2900 mAh.

1. Electronic components of large industrial production: resistors, capacitors, inductors and transistors.
2. Treatment of open-source audio enabling the compression and transmission of digital audio oriented to human speech. It is used in this project to convert the raw data coming from the Wi-Fi network to where the wearable interface is connected in an audible format to visually impaired.
3. Phenomenon of programming through which a hardware is interrupted by calling the execution priority for itself during the procedure.
4. Universal Asynchronous Receiver Transmitter consists of a serial communication port master-master (both can initiate communication) enabling the microcontroller's communication with other devices in the circuit.
5. Serial Peripheral Interface consists of a serial communication port master-slave (only one device can initiate communication) providing the microcontroller's communication with other devices in the circuit.
6. Free Real Time Operating System consists of an operating system for the execution of multiple tasks, in which the response time to an (external or internal) event is pre-defined.
7. It consists of an electronic circuit that performs a process of integration (infinitesimal sum) of the signals arising from the variation of the input signal, as the variation in the time interval analyzed.

8. Filter in the form of a network that uses resistors and capacitors.
9. It consists of an electronic circuit that uses a small amount of energy to control a larger amount. An operational amplifier presents high gain of energy between the controller and the controlled power.
10. It consists of an electronic circuit that converts a DC voltage with certain amplitude, in other DC voltage with different amplitude.
11. It consists of an electronic circuit, from a fixed input voltage and variable electric flow, generating a variable output voltage and fixed electric flow.
12. Nickel Metal Hydride.

Figure 1 – WearCode concept

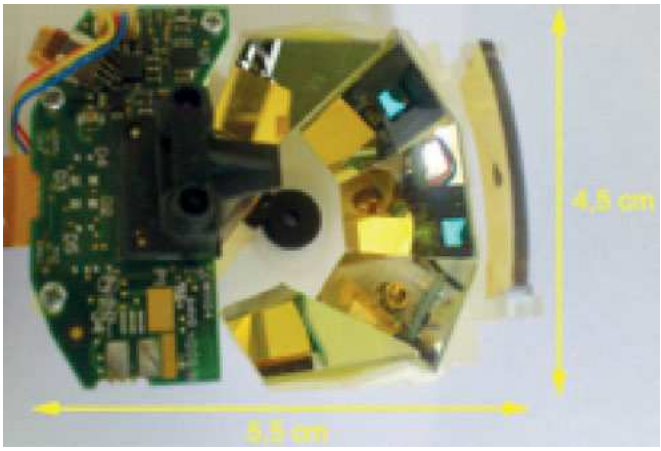

Figure.2 – Omni-directional optical reader

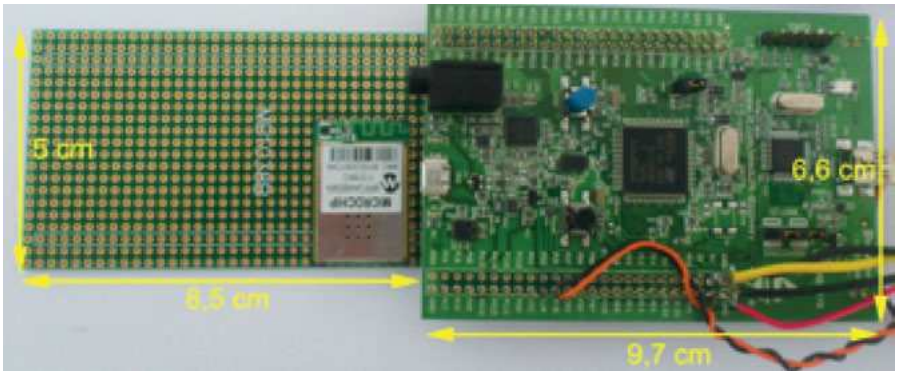

Figure 3 – WearCode proto control board

Methods

The method adopted for the development of microcontrolled interface, remote access and wearable interface involved four phases as follows:

a) development of the power supply in order to meet the needs of the devices in the circuit which has a NiMH-battery's charger-monitor for autonomy of the circuit;

b) debugging and establishment of communication protocol of the optical reader with ARMv7M microcontroller architecture;

c) introduction of Wi-Fi communication with a standard DHCP[13] server through the Wi-Fi interface/SPI Microchip in order to translate and mediate the identified product, the data on the server and the information to be delivered to the visually impaired;

d) development of a sound output data based on Speex protocol, aiming to deliver the information to the visually impaired through headphones.

Obtained Results

As a result, there is a standalone microcontroller electronic circuit with the following characteristics:

a. Self-sufficiency in monitoring and recharging the batteries to achieve high efficiency during charging; avoids wasting energy during use; and uses batteries in order to prolong their life;

b. TCP / IP connection through a Wi-Fi network in order to enable the bidirectional traffic to 32 kB / s. Prior establishment of network parameters by firmware. Feedback to the visually impaired about possible miscommunication with the network;

c. Interpretation of barcodes printed on any package, identifying and storing the read literal code for future use;

d. Audio synthesizing via Speex protocol in an electronic output scaled for headphones;

e. Monitoring section in the firmware based on FreeRTOS establishing a logical order of priority for each circuit functions;

The features of the circuit will be detailed in the next section in order to expose its features and demonstrate its benefits for the wearable interface.

13. Dynamic Host Configuration Protocol consists of a TCP / IP service protocol that offers dynamic configuration of terminals, providing host IP addresses and other configuration parameters for network clients.

Priority actions and energy controlling

Every microcontroller firmware consists of one FreeRTOS written in C language and compiled to ARMv7M. Therein, the following is parameterized: data connection for the Wi-Fi network via TCP / IP (detailed below); communications with all peripheral circuit; and the supervision of circuit power. The latter ensures that the visually impaired are aware of the level of battery that powers the circuit, as well as interface monitoring performed by a server connected to the same network.

So there is properly priority of all the above actions, the firmware provides the implementation of actions as shown below:

a. Supervision of battery levels in order to communicate the visually impaired and the server about the need to shutdown when it is no longer possible to continue operation due to the insufficient battery level, thus preserving the battery life. According to Robbins and Miller [13], NiMH high-density batteries (as used in the interface) extend its operation when discharged within its normal discharge curve, and not beyond its minimum charge state. The firmware only performs the following actions from the identification of the full operation of this instance;
b. Location/setting up TCP / IP connection through the network so the wearable interface is always searching previous parameterized Wi-Fi network to communicate with the server. The firmware does not perform the following actions if this is not met;
c. Data entry from reading the product barcode, since the use of wearable interface itself occurs in this process. Query to the database installed on the server to which it is connected, and audible and intelligible response to the visually impaired with information concerning the product. The circuit is readily able to read any product and only performs the following actions when it is fully met.

Wi-Fi connection via TCP / IP

The connection to the Wi-Fi network is performed based on pre-set parameters in the firmware. This was written considering that the inclusion of these parameters occurs in an easier way, using global constants of the C language. Meanwhile, the fact that these parameters are intrinsic to the code itself prevents any mishandling by visually impaired or others. Thus, for every new Wi-Fi network to which the wearable interface connects, a new firmware needs to be recorded to the flash memory of the microcontroller, restricting access to a specific Wi-Fi network.

When the TCP / IP connection is established, an IP address is assigned to the wearable interface via a DHCP server, which can communicate with any program or service that is

running on that network. Thus, data access is two-way between the retailer and the wearable interface of the visually impaired through "a wireless long range stable network with a globally established protocol enabling the development of a myriad of software" [11] for communication between the server and the wearable interface.

Optical reading of the product and feedback to the visually impaired

The optical reader applied on the wearable interface is omni-directional, that is, it is able to read the printed barcode from any angle. This characteristic is essential for the visually impaired to get the information about the product quickly, thus avoiding possible frustrations caused by the absence or delay of feedback.

The Speex protocol provides compression, transmission and decompression of audio used for sending data from the server to the wearable interface in the point of sale through the Wi-Fi network, to which both are connected. Through the use of its open libraries to ARMv7M, the result of its processing consists of a digital audio waveform by pulse-width modulation (PWM) integrated through an operational amplifier in amplifier-integrator configuration, which transforms the wave coming from the Speex in an analog audio wave to headphones.

Speex protocol, as it is open source, therefore in constant development, and by being focused on transmitting human voice, was proved to be an ideal tool for delivering the data of the retailer database to the visually impaired, that want more than an audible and intelligible information, they want a quick and accurate understanding about what they are about to purchase.

CONCLUSION

Visually impaired people represent a significant portion of the Brazilian population. Nevertheless, there are few initiatives aiming to promote independent consumption experience for this population in the point of sale.

These findings motivated the research and development of an embedded system that acts as a basis for wearable interface subject to significant developments and improvements. In this sense, a prototype of WearCode interface was built intended to the interaction of the visually impaired in the point of sale in order to provide their independence on others when shopping through the remote and direct communication with the retailer network information.

Among its main features, there is the quality of the wireless connection (Wi-Fi), providing greater reliability in the use of the resources offered by WearCode, since this connection is enshrined in the market and widespread. As well as direct access to retail data server via the TCP / IP protocol, which enhances transparency in data and reduces the possibility of any information obtained by visually impaired to be outdated or mistaken. Moreover, the technological system is embedded to the wearable interface providing hands free for handling the products, whose information is wanted, as well as full access to the retail digital system for visually impaired, wherever it is within the point of sale.

WearCode is the starting point for a significant number of features that can be offered to the visually impaired at the time of their purchases. As it is a microcontroller system with easy

replacement firmware and access to a network that enables cloud computing, the subsequent development of the resources offered to visually impaired are meaningful, given the possible improvements through software amendments applied to developed hardware.

In this sense, the continuity of this research considers additive developments to both hardware and software as follows:

a. Computer vision: replacement of the optical barcode reader for an image detection and recognition system;
b. External serial flash memory: by adding this component to the microcontroller through the SPI network, it will be possible to store compressed audioexcerpts in the interface providing the communication with the visually impaired through audio when the communication with Wi-Fi network is not present;
c. Data Encryption: in order to prevent commercial espionage or misuse of the retailer, an encryption system can be deployed in both systems (retail server and interface's firmware) so that only lawful authenticated connections are established in the network available to the visually impaired.
d. Cloud computing: in addition to processing power of the Cortex-M3, constituting the core of the interface, it can also rely on expressive sophistication of software made in the retail server, since it has a reliable high-speed network available to both network extremes (retail server and interface's firmware).
e. Audio Input: in addition to the input related to the barcode on the product package analyzed by the visually impaired, other information about the product - that the retailer has access - can be questioned at the time of purchase. Therefore, it is possible to consider adding an audio input through a MEMS-based digital microphone[14], in order to be handled by SPEEX protocol, now in the reverse direction to output, so that the command voice from the visually impaired can be interpreted and processed on the server, and then the proper feedback is delivered.

14. Micro-electromechanical systems consist of electrical-mechanic sensors, in microscopic scale, able to build accelerometers, gyroscopes, pressure sensors, microphones, etc.

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COMPUTER ART – FOR ALL – IN TIMES OF GLOBAL CRISIS?

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ABSTRACT

We are living in a world reaching a critical point where the equilibrium between a healthy environment, the energy our society needs to maintain or improve this lifestyle and the interconnected economies could pass more quickly than expected from the current complex balance to a complete new reality where unbalance would be the rule and human beings would need to be as creative as never before to survive. Environmental problems, economic uncertainty and political complexity have been around for a long time. What was different before was the speed and depth of transformations compared with today's sudden changes. The frequent occurrence and severity that certain weather and climate-related events are having around us - such as floods, twisters, etc. - is increasing, and the ability of human beings on modifying adjacent surroundings as well as very distant places have turn into a power capable of altering the whole planet. Have computer art a role in all this? Have computer artists a responsibility in this context? Aiming to use digital art as a catalyst with the intent of engendering a deeper awareness and creating lasting intellectual working partnerships in solving our global environmental crisis, three initiatives were launched and have been well received by the international community of computer-based artists and humanitarian organizations as well: the *Balance-Unbalance* program, '*art*! ⋈ *climate*' contest -in collaboration with the Red Cross / Red Crescent Climate Centre- and the online network EChO.

KEYWORDS

Computer music, media arts, humanitarian, climate change.

INTRODUCTION

We are living in a world reaching a critical point where the equilibrium between a healthy environment, the energy our society needs to maintain or improve this lifestyle and the interconnected economies could pass more quickly than expected from the current complex balance to a complete new reality where unbalance would be the rule and human beings would need to be as creative as never before to survive. Environmental problems, economic uncertainty and political complexity have been around for a long time. What was different before was the speed and depth of transformations compared with today's sudden changes. The frequent occurrence and severity that certain weather and climate-related events are having around us - such as floods, twisters, etc. - is increasing, and the ability of human beings on modifying adjacent surroundings as well as very distant places have turn into a power capable of altering the whole planet.

The global climate is changing, and communities around the world are suffering the consequences. Traditional disaster management approaches are not enough to deal with rising risks, and new forms of collaboration are needed to inspire people and organizations to link knowledge with action. Have computer artists a responsibility in this context? Have computer art a role in all this?

Artists could inspire new explorations regarding how to actively participate in this major challenge of our environmental crisis. We need to develop innovative ways to facilitate a paradigm shift towards a sustainable future. We need to discuss proposals for the future from a diversity of cultural perspectives and socio-economic situations with open minds. Creative thinking, innovative tools and transdisciplinary actions could help to produce perceptual, intellectual and pragmatic changes. It is not about an indulgent utopia for the future nor about a desire, but a matter of survival.

Aiming to use digital art as a catalyst with the intent of engendering a deeper awareness and creating lasting intellectual working partnerships in helping to solve our environmental crisis, three initiatives were launched and have been well received by the international community of computer-based artists and by humanitarian and cultural organizations, policy makers, educators and experts from a variety of fields. Those initiatives are: the *Balance-Unbalance* program, the '*art*! ⋈ *climate*' contest, and the online network EChO.

BALANCE-UNBALANCE

The arts could play a major part in helping the global society to understand the magnitude of the crisis we are facing, and in promoting the awareness around environmental matters. And it could also be a very good vehicle to disseminate proposals that could produce changes in our behavior and decisions, influencing our chances for the future. Artists could promote inter and transdisciplinary actions focusing on the global environmental crisis and our responsibility regarding the turning point we are living in defining the future of life on Earth.

The *Balance-Unbalance* project was launched with an international conference in 2010, aiming to develop the role of the media arts and artists in dealing with environmental challenges. *Balance-Unbalance* explores intersections between nature, art, science, technology and

society as we are moving into an era of unprecedented ecological threats. The first conference was held in Buenos Aires, Argentina and was named in Spanish "Equilibrio-Desequilibrio". It was organized by the Electronic Arts Research Centre (CEIArtE) from the National University of Tres de Febrero [1]. Papers were delivered by a representative of the National Secretary of Environment and Sustainable Development of Argentina, experts and students from different universities with chemical, agricultural and environmental engineering backgrounds (some of them specialists in pollution, renewable energies and food technologies), a lawyer, a sociologist and philosopher, artists coming from Argentina, Brazil and Canada, and an astrophysicist.

Balance-Unbalance (a.k.a. BunB) was held again in 2011, this time at Concordia University, in the city of Montreal, Canada [2]. Those were two days of reflection, debate, information exchange and promotion of projects and actions regarding the environment and our responsibility at this defining moment in history. This conference was possible thanks to the direct involvement of faculty from Concordia University coming from very diverse backgrounds, like communication, political sciences, geography, management, music, digital arts and design. There was an amazing number of submissions received to participate in the conference with paper presentations, posters, films, electroacoustic and computer music, art installations and also a diversity of transdisciplinary sessions with open structures to accommodate all kind of innovative proposals, always considering digital art as the interconnecting hub and the environmental crisis as the umbrella covering us all.

Once again in 2013, a third edition of *Balance-Unbalance* was showing the high potential of these actions. The expected catalyzer started to work and the digital arts were, step-by-step, leading the way.

This time the conference was held at the Noosa biosphere, an ecological reserve recognized by UNESCO in Australia [3]. The Noosa Biosphere is a dynamic learning laboratory for sustainability in one of the most pristine and diverse environments in Australia. The three-day conference took place at Central Queensland University, with satellite events in several other places, including Lake Cootharaba.

As it is shown in Figure 1, an e-book with some of the papers presented at the 2013 *Balance-Unbalance* conference was published and it can be downloaded from the Internet for free [4].

The conference theme: 'Future Nature, Future Culture[s]' aimed to challenge our expectations of Earth, provoke our understanding of nature and inspire our actions for a sustainable future. *Balance-Unbalance* was proposing to ask ourselves: "What we will be calling nature in 20, 50 or 100 years? How we will live in the future? How could creativity help us shape a society of understanding and interconnectedness? What role could transdisciplinary thought and action play in reimaging a sustainable future?" considering that: "All is interconnected. No person, no animal, no object or idea can exist independently. Our limited knowledge of life can be expanded, but to do so we need better ways to understand each other. This includes a deeper awareness of how different human societies can comprehend cultural differences and synergies. There is a dramatic need for a paradigm shift and we need to act now if we are going to survive as a species." (from the *Balance-Unbalance* 2013 website).

Like in previous editions, digital art was not only part of the papers in the form of theoretical analysis and proposals but a substantial component of the event. Works by Peter

Gilbert, Karola Obermueller, Sarah Pirrie, Roslyn Taplin, Teresa Connors, Andrew Denton, Rene Burton, Krista Caballero, Frank Ekeberg, Hamilton Mestizo, Ian Clothier, Todd Ingalls, Mary Bates Neubauer, Mónica Mendes, Pedro Ângelo, Nuno Correia, Jim Denley, Monika Brooks, Dale Gorfinkel, Garth Paine and Proyecto AbRiGo were presented at Queensland Central University and the Noosa Regional Gallery, where also the Leweton Cultural Group was performing. A number of artistic events were also held in partnership with the Floating Land festival and presented in Boreen Point and locations within the region. Several articles on research-creation projects presented during this conference are being published by Leonardo, Journal of the International Society of the Arts, Sciences and Technology (MIT Press) at the time of this writing, in a special section devoted to *Balance-Unbalance* [5].

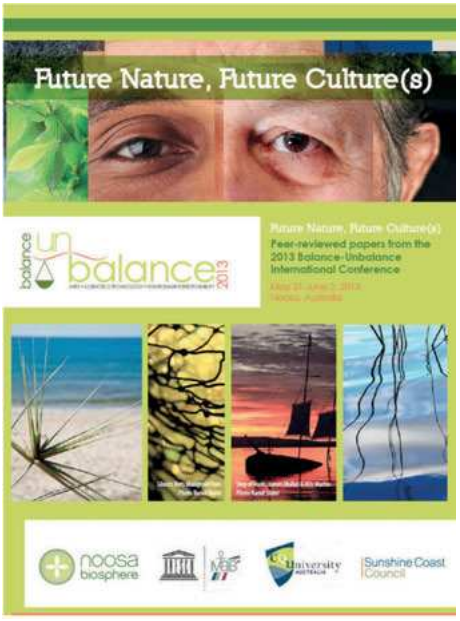

Figure 1 – e-book with peer-reviewed papers from the 2013 Balance-Unbalance *international conference.*

After the first *Balance-Unbalance* conference was held in Argentina in 2010, other associated initiatives were also produced: "Balance-Unbalance. Environmental Responsibility" ("Equilibrio-Desequilibrio. Responsabilidad medioambiental") was a digital arts exhibiton presented by CEIArtE at the National University of Lomaz de Zamora, Buenos Aires province, in 2011. A second exhibition was presented at the same venue in 2012: "Balance-Unbalance. Sustainably economy, sustainable energy, habitable environment" ("Equilibrio-Desequilibrio. Economía sostenible, energía sustentable, medio ambiente habitable"). The third exhibition of the series was held in a central location of downtown Buenos Aires, the San Martin Cultural Centre, during the 2012 *Electronic November* large-scale festival of media arts: "Balance-Unbalance. Knowledge-Action in Times of Uncertainty" ("Equilibrio-Desequilibrio. Conocimiento-Acción en Tiempos de Incertidumbre"). Always linking computer art with environmental issues, these exhibitions presented interactive Internet works, electronic sculptures, video installations, telematic pieces, artistic interventions, site-specific interactive

installations, electroacoustic and soundscape works as well as sound art installations by artists from Argentina, Brazil, Canada, Chile, Colombia, France, Mexico and Spain.

ART! ⋈ CLIMATE

Sometimes experiments take their own way, and an unexpected positive consequence in the form of a project -with an excellent potential- becomes a possibility. *Balance-Unbalance* had no resources to invite keynote speakers for the conference but still we were able to bring in Dr. Pablo Suarez, Associate Director of the Red Cross / Red Crescent Climate Centre to Montreal for the conference in 2011. As a direct result of Dr. Suarez participation in *Balance-Unbalance*, the '*art*! ⋈ *climate*' project was born shortly after [6].

The Red Cross / Red Crescent Climate Centre and the Electronic Arts Research Centre (CEIArtE) joined forces to develop the *art*! ⋈ *climate* contest for the creation of digital sound-based art miniatures focusing on the environmental crisis and climate change related issues. The Climate Centre's mission is to help address the humanitarian consequences of climate change and extreme weather events. In its efforts to engage people at risk, government agencies, academic institutions and other stakeholders, it has become clear that information is rarely sufficient to trigger behavior change. As a result, the Climate Centre is designing and facilitating methods for learning and dialogue that involve not only the brainpower but also the emotions of participants (such as collaborative workshops, participatory games and short educational films, linking information, decisions and consequences on disaster management).

The *art*! ⋈ *climate* contest had two main objectives: a) Provide the Climate Centre with sound-based art material that can support their actions; and b) Improve knowledge about the human dimensions of the environmental crisis and promote awareness about the effects of climate change, both among creative artists and among those exposed to their work.

The first *art*! ⋈ *climate* contest has been co-sponsored by Hexagram, the Research-Creation Centre in Media Arts and Technologies of Concordia University, Canada, the Central Queensland University and the Noosa Biosphere Reserve in Australia, and Leonardo/ISAST.

For this contest, sound art miniatures implied short creations of sound art/music produced using new technologies and encompassing what is known as soundscapes, electroacoustic and computer music, sonorizations, and sonifications.

RED CROSS/RED CRESCENT
CLIMATE CENTRE
International Federation of Red Cross and Red Crescent Societies
The Netherlands Red Cross

News

'Sound art' on a climate theme: competition results
20 March 2014
by the Climate Centre

The results have been announced in the first-ever international contest for the creation of sound art focusing on climate impacts and global environmental issues.

The competition was organized by the Electronic Arts Research Centre of the National University of Tres de Febrero in Argentina and the Climate Centre.

It was also supported by the Balance-Unbalance international conference, which uses art as "a catalyst to explore intersections between nature, science, technology and society".

The Hexagram-Concordia Centre for Research-Creation in Media Arts and Technologies of Concordia University, Montreal, also took part.

Sound artists were asked to address two themes: a broad category including anything related to climate change and extreme weather, and another concentrating on mosquito-borne diseases like malaria and dengue that are affected by climate factors.

Figure 2 – Official announcement of the art! ⋈ climate *results in the Red Cross/Red Crescent Climate Centre web page.*

The categories available for the contest were two: 'Mosquitoes' and 'Open Theme'. The 'Mosquitoes' category aimed to support initiatives to raise awareness and better manage the growing risk of malaria, dengue and other mosquito-borne diseases that are showing new regional and seasonal patterns due to changes in rainfall and temperature - an issue highlighted in several Red Cross projects in Africa, Asia and the Americas. The 'Open Theme' category invited submissions about other dimensions of changing environmental conditions.

The works were selected by a jury of internationally recognized composers and new media artists: Marc Battier, Andrés Burbano, Joel Chadabe, Ricardo Dal Farra, Alireza Farhang, Rajmil Fischman, Arturo Gervasoni, Leigh Landy, Fabián Luna, Raúl Minsburg, Jaime Oliver, Julien Ottavi, Garth Paine, Andrea Polli, Paul Rudy, Suzanne Thorpe, Barry Truax, Michel van Dartel, and members of the Climate Centre as well, finding that was possible to have good artistic works that could also fulfill the specific needs of an humanitarian organization for its daily field actions. Selected works came from sound artists and electroacoustic composers from all over the world: Argentina, Australia, Austria, Brazil, Canada, Colombia, Czeck Republic, France, Germany, Greece, Israel, Italy, Mexico, New Zealand, Peru, Portugal, Romania, Spain, The Netherlands, South-Korea, United Kingdom, United States, Venezuela [7]. All pieces are now available in SoundCloud both for listening online and for download, under a Creative Commons license [8].

Composing digital sound art miniatures proved to be a great way for musicians to stop being spectators and start to contribute actively to humanitarian goals.

EChO

EChO is a project proposing to match a public online database devoted to electronic art projects focusing on environmental issues with a virtual meeting point to facilitate communication between key players (research groups, humanitarian organizations, policy makers, artists associations, opinion formers, technology innovators, etc.) EChO's goal is to connect, hence empower initiatives from around the world aiming to help in facing major ecological threats and finding solutions for a sustainable -and humanly livable- future.

There are many projects by artists and artist-related organizations working in the media arts field and focusing on environmental problems. There are also many governmental, intergovernmental and non-governmental organizations, as well as private institutions, searching for solutions to the ecological threats for human life either at the local, regional or global level. EChO expects to be of help in connecting those potential partners to face the problems that embrace us all. This project proposes to facilitate the building of links between computer artists working on facing the environmental crisis and projects or programs from organizations around the world as a way to empower otherwise unrelated initiatives and actions. The fundamental concept supporting EChO is to create a network to develop forces large enough to turn good will into actions, to convert individual projects with a significant potential into something that could reach an international community and eventually develop and increase its original scope. It could be a way to analyze, test and promote artistic projects using science and digital technologies in considering solutions for the environmental problems defying our existence. It is proposed as a network building, to inspire and enable collective actions reaching the stated goals through specific objectives.

CONCLUSIONS

In this context of global threats: Can the computer arts and artists help? Yes, we can help. We can reflect, produce and act. Everyone has a responsibility in the construction of the future, computer artists as well.

A large part of the population is living in uncertainty [regarding basic needs] and many barely surviving. When the *Balance-Unbalance* project started some years ago it probably appeared to be a naïve, good-will based, utopian initiative, trying to join intelligence and forces from a variety of fields in using e-art as a catalyst to face a problem we all share: the complex environmental crisis. Bringing people from very different sectors of society together, today *Balance-Unbalance* and its associated projects are not only proving it is feasible to connect artistic creation and realistic tools for change but to actually make that happen. The computer arts as a driving force for…? Yes, sometimes it happens that the unexpected but highly desired occurs: the possibility to work on a project where artistic quality, knowledge building and humanitarian actions are all together in a balanced equation to confront the unbalance.

The '*art*! ⋈ *climate*' project became possible as a creation-knowledge-action proposal to reach those who are already affected or in imminent danger from the consequences of climate change, and also to those who are not directly touched by it yet. It can be seen as a tool but it is not less artistic for being that. On the contrary, the principal idea here grows from a cooperative effort, having powerful means based on artistic creations -with a value independently from its potential

functionality- and simultaneously, a tangible application in humanitarian actions. The Red Cross / Red Crescent Climate Centre has found the '*art*! ⋈ *climate*' project helpful according to its goals and objectives. It seems to be a true collaboration that can have an effect on "real people" while preserving the significance and meaning of each contribution and action [9].

EChO is still in an early stage of development but many people is convinced of its potential "benefits" in a variety of ways. EChO wants to help in building a network without duplicating efforts but to extend our possibilities and learn from each other, empowering the significant actions that artists working with digital means could offer to face environmental challenges. Please feel welcomed to share your thoughts and send your feedback about it.

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THE MEDIATED BODY

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ABSTRACT

Digital technologies increasingly express dissatisfaction with the Cartesian split, a desire for technologically engaged embodied experience.Can we truly have embodied virtual experience? How does mediation through technology affect embodied experience? What new possibilities can the mediated body present for the future? This paper looks briefly at the history of embodiment in new media and current explorations of body and digital/new media, positing a theory of the, "mediated body."

KEYWORDS

Mediation, body, virtual embodiment, physical computing.

INTRODUCTION

As we engage with technology from screen based work to online interactions and beyond, we find ourselves dissatisfied with the Cartesian split and seek to find ways to assert our physicality, to have embodied experience while also intellectually engaged. Can we truly have embodied virtual experience? How does mediation through technology affect embodied experience? What new possibilities can the mediated body present for the future?

To begin to answer these queries, we must first form a basic working definition of what constitutes a "mediated body." What is the mediated body? To, "mediate," as defined by the Oxford English Dictionary, is to, "form a connecting link," or, "be a means of conveying." Taking this in context of New Media Art, mediation carries an added connotation of technology/media as means of conveyance. The "mediated body," uses technology to create work in which the body is prevalent & the medium amplifies connection to body.

The concept of embodiment itself is a subject worthy of much more expansive discussion and has been explored in cognitive psychology, science, philosophy, art theory, and religion among many other fields. For our purposes, we will consider embodiment as strong mind body connection, an exploration and grounding in the corporeal, and engagement of the physical senses. Through investigation of the mediated body we will look at works that directly represent, immerse, or engage the body as a key element.

In looking at mediation on the body, this paper will examine the relationship of the screen to the body, innovations in how artists use technology to depict the body, body as image and virtual double, and body as collaborator or input source. It is important to note that many of the works included do not fit neatly into a single category but touch on qualities of multiple areas of body and media explorations, and therein often lies the success of the work.

While many of the works in this brief overview favor the sense of sight as primary, the more senses we can engage simultaneously, the stronger our grounding in physicality and connections between physical and psyche are. Even in those works whose primary experience for the audience is visual, those falling under classification of representation of the body, the success of the representation usually lies in a multi-sensory fully embodied experienceof the subjectwith which viewers then empathize and emotionally engage. As we look to the future and continue to push forward with mediation of the body, works will increasingly seek multi-sensory engagement and/or multimodal interaction.

BODY & SCREEN & BODY AS VIRTUAL DOUBLE

Mankind has been fascinated with the body and it's relationship to the visual world long before new media existed. Plato's cave functions not only as metaphor for relating ideas and the philosopher's place in society but also is apt when we talk about how we approach visual work, particularly video. Theorists such as Lev Manovich have related cinema to Plato's cave, recognizing that the theatre going audience willfully imprisons their bodies increasingly to gain "virtual mobile gaze," connecting their eye with the eye of the camera. [1] In direct reaction, artists begin to seek to liberate the viewer's body or subvert traditional ways of

physically relating to the screen. This is seen in incredibly diverse ways: from experimental video to installation, interactive art, and on.

Joan Jonas' *Vertical Roll* uses the medium of video to abstract the human form. Exploiting a flaw in video, she fractures and deconstructs the body, changing the viewers' relation to it. We're still in one place looking at the body, but we're seeing how the mediation changes things; there is a push and pull between the grounded, corporeal aspect of her performance and the disjunctive presence of the media. Distortion operates not only as formal construct but also reminds us that we are viewing a "virtual double." [2]

Figure 1 – Joan Jonas, Vertical Roll*, 1972. From: Circa 1971: Early Video and Film, http://www.marthagarzon.com/contemporary_art/2012/11/circa-1971-early-video-film/. (accessed May 2014).*

This virtual double operates in two main ways. The virtual double (as we see in Jonas's piece) is a virtual image of the body as stand-in for the artist and extension of the artist. In other contexts, the virtual double is used in terms of the spectator entering into the virtual space of the work. As Manovich points out, the traditional relationship of viewer to screen "doubles the viewing subject, who now exists in two spaces: the familiar space of her body and the virtual space of the image within the screen." [1]

Virtual Reality changes the body's relationship to the screen. With it we trade the virtual mobile gaze & body that remains still for an environment in which to move our gaze we have to physically move. "VR... establishes a radically new type of relationship between the body of the viewer and the image. ...now the spectator has to move in physical space in order to experience movement in virtual space." [1] However in its early versions, the technology relies on heavy head mounted

VR apparatus thus causing the viewer to become even more locked in. As Manovich notes, "… VR imprisons the body to an unprecedented extent. … The user was able to turn around and rotate her head in any direction, but could not move away from the machine more than a few steps." [1] In early VR work by Char Davies, *Osmose (1995)* and *Ephemere (1998)* she explores both the virtual body of the participant as he moves through imagined landscapes, and also his corporeal body as part of the image, putting the VR wearer's body on display for others. The viewer's body and how it relates to the technology becomes a part of the visual language of the installation. Davies states, "Immersive virtual space, when stripped of its conventions, can provide an intriguing spatio-temporal context in which to explore the self's subjective experience of 'being-in-the-world'—as embodied consciousness in an enveloping space where boundaries between inner/outer, and mind/body dissolve." [3]

Figure 2 – Char Davies. Osmose, *1995. From: Char Davies Immersence, http://www.immersence.com/osmose/ (accessed May 10, 2014).*

Figure 3 – Char Davies. Osmose, *1995. From: Char Davies Immersence, http://www.immersence.com/osmose/ (accessed May 10, 2014).*

Figure 4 – Char Davies. Osmose, *1995. From: Char Davies Immersence, http://www.immersence.com/osmose/ (accessed May 10, 2014).*

BODY AS VIRTUAL DOUBLE

Mona Hatoum's *Corps Etranger,* sets up a unique relationship between the observer and artist's bodies by virtually bringing the observer inside Hatoum's body so observer both becomes the *foreign body* and also ventures inside a *foreign body*. Representative and immersive, this work is particularly interesting as an example of both kinds of virtual double at once while also engaging the viewers physically. We physically walk into the shrine-like space of the installation, virtually explore the interior of her body, inserting our (viewing subject) virtual double into her (image) virtual double. Thus we are both physically and virtually engaged while forced to think on the deeply corporeal aspects of the artist's inner workings. As Hatoum declares, "...the internal workings of our body are completely foreign to us most of the time," [4] and by focusing on them she forces viewers to contemplate the complexities and power of their physical beings. Michael Archer questions Hatoum about the impetus to work with the body coming from an exploration of the contrast in Western thinking and "the attitude in Lebanon, where there is no straightforward split between mind and body." Discussing this Hatoum states, "The first thing I noticed when I came here [London] was how divorced people were from their bodies... For me the embodiment of an artwork is within the physical realm; the body is the axis of our perceptions..." [5] It is difficult to engage this work without challenging any ideas that our intellectual and physical bodies are not strongly connected.

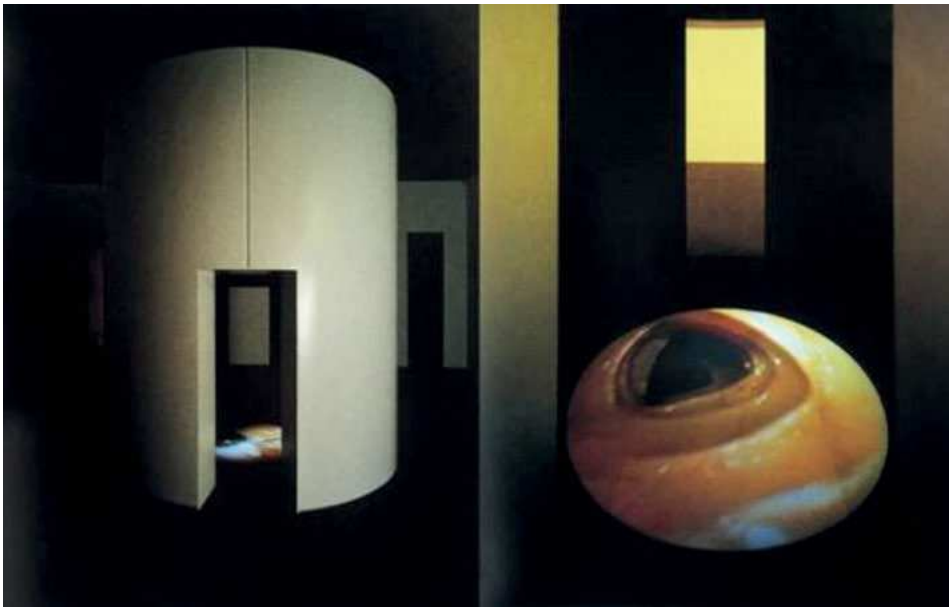

Figure 5 – Mona Hatoum. Corps Étranger. *1994. From: Mona* Hatoum. *1997, New York: Phaedon Press.*

Figure 6 – Mona Hatoum. Corps Étranger. *1994. From:* Mona Hatoum. *1997, New York: Phaedon Press.*

In *Face to Face*, Ann Hamilton creates image from her body in another way by using her body as the viewing apparatus when making the image. Using her mouth as a pinhole camera, she creates intimate portraits in which the subject must stand in close proximity face to face with the artist during creation. The process and resultant images relating the ocular shape of the mouth with the eye make a correlation to how we consume images visually and how we physically consume nourishment, equating close conversation and interaction to mental nourishment. By literally creating the images in *Face to Face* with her body, Hamilton further asserts this connection between mental and physical. [6]

Figure 7:Ann Hamilton. Face to Face, *2001. From: The Liquid Bodies Archive, http://liquidbodies.blogspot.com/2012/12/ann-hamilton-face-to-face-2001-and.html (accessed May 10, 2014).*

Figure 8 – Ann Hamilton. Face to Face *58, 2001. From: Ann Hamilton Studio, http://www.annhamiltonstudio.com/prints/face_to_face.html (accessed May 10, 2014).*

Mental and physical connection is rarely more present than in dance; therefore works that incorporate new media with dance have some of the strongest potential to achieve the mediated body. Early pioneers of such exploration include Merce Cunningham, Riverbed, and Bill T. Jones. In 1989, in collaboration with Riverbed, Merce Cunningham uses *Life Forms* software to aid in choreography by choreographing virtual dancers/avatars in the computer then adapts these movements to what a real life dancer's body will physically allow. Through this process, Cunningham finds new ranges of motion. As Cunningham explains, "... *Life Forms*is not revolutionizing dance but expanding it because you see movement in a way that was always there - but wasn't visible to the naked eye." [7] Riverbed later collaborates with Bill T. Jones to create prints, video animation, and installation of gestural figures based off motion

capture of Jone's dancing. Cunningham goes on to collaborate with the creators of another software, *Biped*, using images of virtual dancers onstage with the live performance exploring relations between the live dancers and their virtual doubles. [8] These works use technology to both represent and engage the dancers' bodies.

Figure 9 – Merce Cunningham. Oceans. *Source: Jeff Christensen/Associated Press. 2005, Digital Image. From: http://www.cbc.ca/news/arts/merce-cunningham-final-tour-includes-montreal-stop-1.898588. (accessed May 10, 2014).*

Figure 10 – Merce Cunningham & Riverbed. Biped, *1999. From: Merce Cunningham Dance Capsules, http://dancecapsules.mercecunningham.org/overview.cfm?capid=46049(accessed May 10, 2014).*

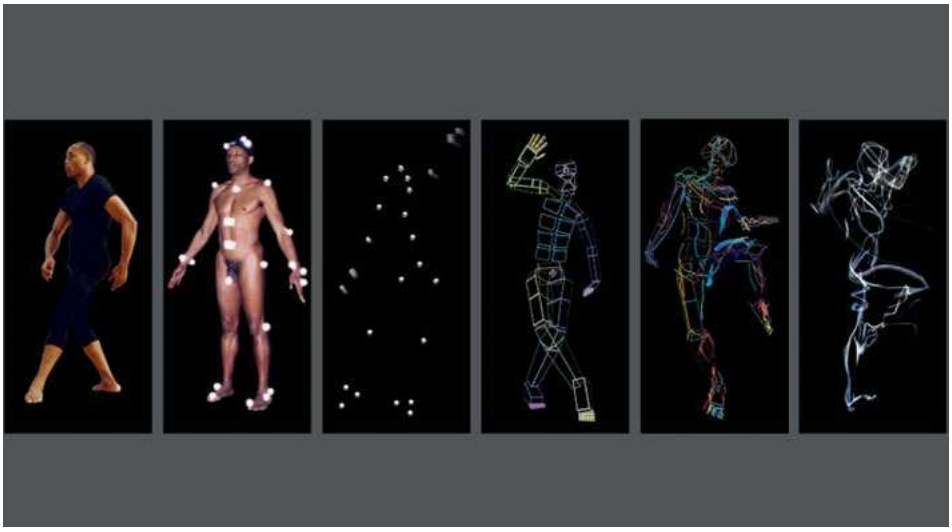

Figure 11 – Bill T. Jones & Riverbed. Ghostcatching*:* Seven stages in the transformation of Bill T Jones into the virtual soloist*, 1999. From: Open Ended Group: Ghostcatching, http://openendedgroup.com/artworks/gc.html (accessed May 10, 2014).*

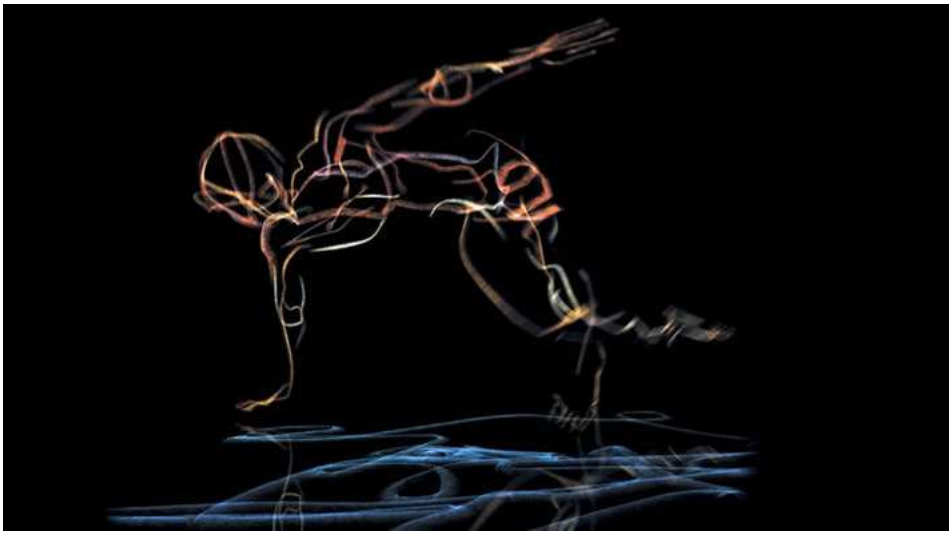

Figure 12 – Bill T. Jones & Riverbed. Ghostcatching*, 1999. From: Lincoln Center Institute: Ghostcatching, http://www.lcinstitute.org/about-lci/works-of-art/item/81-ghostcatching (accessed May 10, 2014).*

BODY AS COLLABORATOR/INPUT SOURCE

Starting within these early explorations, we also find innovations such as Troika Ranch's work. "Interactivity has been an essential and integral component of Troika Ranch's work since the company's inception. Interactivity is the energetic linkage of human action to digital content

and the feedback loop that is formed by this relationship…" [9] Troika Ranch founders, Mark Coniglio and Dawn Stoppiello collaborate to invent the MidiDancer in 1989, "a bodysuit outfitted with plastic fibers that measure the flexion and extension of the major joints on the body. When a joint moves, it sends a signal to the computer. This signal is then transformed into code that manipulates other theatrical equipment – video cameras or digital sound devices." [9] Later they do some of the pioneering work with camera vision in dance, creating the *Isadora* program to create a looped process of collaboration between dancer, computer, and back again, utilizing camera vision to trigger music, video, lighting, and more through the dancer's movement. This technology spreads and is picked up by other dance companies such as Chunky Move also creating innovative work.

Figure 13 – Troika Ranch. Dawn Stoppiello in MidiDancer. From: Troika Ranch: Gallery: Earlier Works*, http://www.troikaranch.org/galleryEarly/g-ew.html.(accessed May 10, 2014).*

Figure 14 – Troika Ranch. 16 Revolutions, *2006. From: Troika Ranch:* 16 Revolutions, *http://www.troikaranch.org/gallery16Rev/g-16rev.html#. (accessed May 10, 2014).*

Figure 15 – Chunky Move. Mortal Engine, *2009.Source: Andrew Curtis. Digital Image. From: Territory Festival: Mortal Engine – Chunky Move, http://territoryfest.com/about/archive/performance/dvigatel/. (accessed May 10, 2014).*

Sometimes in using body as collaborator, the technology that mediates the body can act as augmentation. In Merry Lynn Morris's *Rolling Dance Chair Project,* technology becomes the very mechanism facilitating disabled dancers to realize a far larger range of motion than achievable in other types of wheelchairs. Through an app, the omnidirectional chair is able to sense the dancer's movement and respond. For Morris, who states, "Anybody in any body should have the right to dance. An accident or a disability needn't relegate the people you love to your back, pushing you, telling you where to go," the *Rolling Dance Chair* is "an extension of dance, not an obstacle." [10] Her desire to create a chair that fluidly integrates into the user's physical being allowing greater autonomy and range of motion comes from her childhood experiences with her father and their shared enjoyment of dance before and after he becomes paralyzed in a car accident. Later observing dancers in wheelchairs having to work around limitations of cumbersome wheels and parts, she becomes inspired to develop a chair that flows and dances as one with the performer. The project allows greater immersion in movement for the dancers, no longer having to think constantly about how to work with a chair but instead moving freely and intuitively through supportive mediation of the body.

Figure 16 – Merry Lynn Morris. Rolling Dance Chair, *Source: Jim Reed, Photographer Tampa Tribune Staff, 2011. From: Arts and Disability: Dance Chair Innovation: Patent Receives International Notice, http://artsanddisability.blogspot.com/2011/08/dance-chair-innovation-patent-receives.html. (accessed May 10, 2014).*

Figure 17 – Merry Lynn Morris. Rolling Dance Chair. *From: Arts and Disability: Verlezza Dance Company Debuts New Dance Chair with Merry Lynn Morris, http://artsanddisability.blogspot.com/2011/07/verlezza-dance-company-debuts-prototype.html. (accessed May 10, 2014).*

David Rokeby's *Very Nervous System* uses his body to create a musical score based on the artist'smovements. Rokeby's thought process behind this piece illustrates an impulse towards the mediated body. Rokeby explains, "The computer as a medium is strongly biased. And so my impulse while using the computer was to work solidly against these biases. Because the computer is purely logical, the language of interaction should strive to be intuitive. Because the computer removes you from your body, the body should be strongly engaged. Because the computer's activity takes place on the tiny playing fields of integrated circuits, the encounter with the computer should take place in human-scaled physical space. Because the computer is objective and disinterested, the experience should be intimate." [11]This duality highlights the very nature of our bodies: every large-scale movement in the physical plane has an impetus in our own organic circuits of neurons. Cybernetic collaboration and Jazz-like improvisation between participant, artist, and computer is central to the work; through this participants make visceral and moving connections. Rokeby recounts interaction of a blind child with the work as, "amazing," and, "quite startling," in how *Very Nervous System* redefined the space for the child, creating invisible, "walls," the child, "bounced off." He is interested in adapting the environment to better fit our vulnerable bodies as well as moving beyond conscious thought to visceral, embodied, intuitive reaction. "With *Very Nervous System*... the body responds more quickly than consciousness does."[12]

Figure 18 – David Rokeby: David Rokeby in Very Nervous System in the street in Potsdam in 1993, *1993. From: Rokeby Works: Very Nervous System, http://www.davidrokeby.com/vns.html. (accessed May 10, 2014).*

Just as Hatoum forces us to think about unconscious body processes by representing them through video, many artists working with physical computing are using biofeedback as material. In Mariko Mori's *Wave UFO*, partakers are hooked up to electrodes then climb inside a full scale UFO sculpture and lie back to watch animations based on live input from their brainwaves. The intimate space of the UFO interior, allowing for only three people at once, creates a shared experience. Watching both the depiction of their own brainwaves and those of their 2 co-viewers, participants become aware of how their energy impacts those around them. By mediating thought patterns in a way that draws awareness to stress or tranquility, viewers are encouraged to focus on finding shared inner peace and feel a gentle wave of meditation, which lasts for a time beyond the session. [13]

Figure 19 – Mariko Mori. Wave UFO, *1999-2003. From: We Make Money Not Art: Wave UFO, http://we-make-money-not-art.com/archives/2005/06/wave-ufo-by-mar.php. (accessed May 10, 2014).*

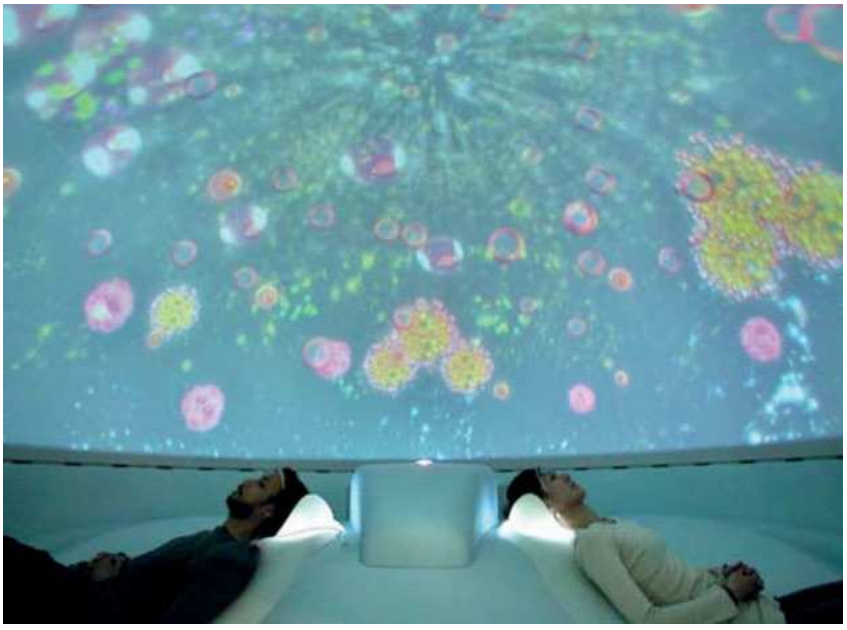

Figure 20 – Mariko Mori. Wave UFO, *1999-2003. From: We Make Money Not Art: Wave UFO, http://we-make-money-not-art.com/archives/2005/06/wave-ufo-by-mar.php. (accessed May 10, 2014).*

Another project using biofeedback to highlight emotions is *Intimacy 2.0* by Studio Roosegaarde. The work playfully approaches interpersonal communication by making clothing that *blushes* with the wearer. "Exploring the relation between intimacy and technology,"

Intimacy 2.0 garments become more or less translucent based on the wearer's biofeedback. As Studio Roosegaarde explains, "Social interactions determine the garments' level of transparency, creating a sensual play of disclosure." [14] This work engages the wearer's body as input source and communicates to others her subconscious responses thereby influencing interpersonal exchanges. As such it is a prime example of how the mediated body can change how we relate to the world.

Figure 21 – Intimacy 2.0, *Studio Roosegaarde, 2010-2011. From: Studio Roosegaarde: Intimacy 2.0, http://www.studioroosegaarde.net/project/intimacy/photo/#intimacy-2-0. (accessed May 10, 2014).*

Figure 22 – Intimacy 2.0, *Studio Roosegaarde, 2010-2011. From: Studio Roosegaarde: Intimacy 2.0, http://www.studioroosegaarde.net/project/intimacy/photo/#intimacy-2-0. (accessed May 10, 2014).*

Disclosure and intimacy are also prevalent in the thought process of filmmaker, Rob Spence, the "Eyeborg Guy." In the *Eyeborg Project*, Spence uses his augmentation to create the ultimate point of view shots by putting a camera in his eye. Having lost use of an eye in an accident when he was 12 and later as an adult having a glass eye put in it's place, for Spence, the next logical step is to put a camera in his eye. This experiment brings up many of the same intimacy issues surrounding conversation that Hamilton's *Face to Face* series eludes to. Spence is highly aware of the ethics surrounding the filming of intimate moments and to signal to others that he is not filming at a given moment, thereby putting them at ease, he will often wear an eye-patch. For Spence, this also has the added bonus of, "eye-patches are cool." [15] There are intriguing connections to the style of filming resulting from this process and the concept of virtual mobile gaze. While the final viewing audience is presumably still watching the video from a stationary standpoint, in connecting their eye to the eye of the camera they are also connecting their eye to Spence's eye, getting a chance to see through the filmmaker's eye in an unprecedented way. [16]

Figure 23 – Rob Spence. The Eyeborg Project, *2009. Courtesy of Rob Spence.*

Figure 24 – Rob Spence. *The Eyeborg Project*, 2008-2014. From: The Eyeborg Project, http://eyeborgproject.com/. (accessed May 10, 2014).

Tony Quan, a graffiti artist who goes by the moniker Tempt One, is also using his eyes in collaboration with new media technology to create work. Originally a graffiti writer using the traditional medium of spray-paint, Tempt's change in approach comes out of necessity when his ALS (Amyotrophic Lateral Sclerosis) renders him completely paralyzed. Through collaboration, Graffiti Research Lab, Free Art and Technology, OpenFrameworks and the Ebeling Group have created a low cost eye-tracking system that allows Tempt to draw with his eyes. [17] This work both engages the body as input source/collaborator and is augmentation through mediation, an example of how the mediated body can help overcome challenges of our physical limitations.

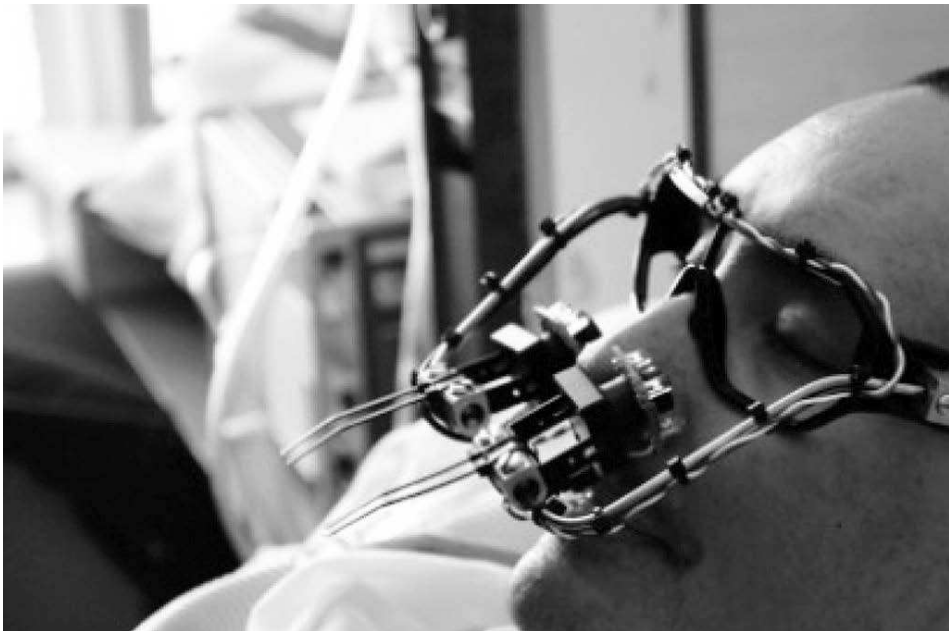

Figure 25 – The Eyewriter Team. The Eyewriter Project. *From: The Eyewriter Project, http://eyewriter.org/. (accessed May 10, 2014).*

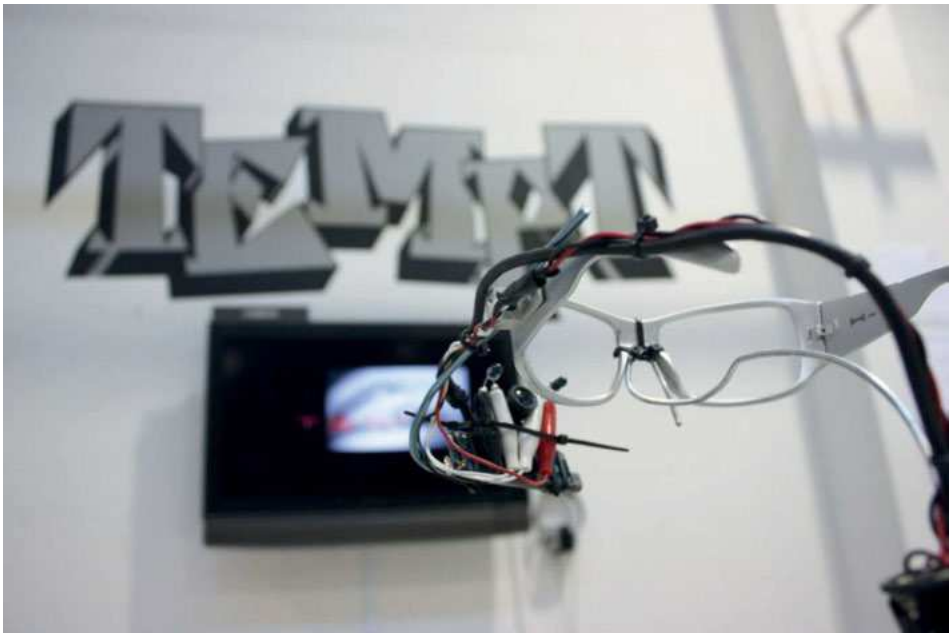

Figure 26 – The Eyewriter Team. The Eyewriter Project. *From: The Eyewriter Project, http://eyewriter.org/. (accessed May 10, 2014).*

Figure 27 – The Eyewriter Team. The Eyewriter Project. *From: The Eyewriter Project, http://eyewriter.org/. (accessed May 10, 2014).*

With an aim at taking the body as input source/collaborator model to the most mobile and integrated level, engineer Katia Vega has coined the term, "Beauty Technician," for herself and is creating, "smart," makeup and other micro-wearable-technology with applications in daily life and art. "Wearable computing has changed the way individuals interact with computers, intertwining natural capabilities of the human body with processing apparatus," Vega explains. "Beauty Technology transforms our body into an interactive platform by hiding technology in beauty products to create muscle-based interfaces... I started looking at technology that could disappear in everyday objects. ...the question is: how can your body be an interactive platform?" [18] Her inventions both integrate nearly seamlessly into the wearer's body and avoid the technophobia associated with more permanent body modifications and augmentations thereby engaging a broader possible user base. Even in its current early stages, the work has realized and envisioned applications in visual art/fashion, commercial/daily life user-interfaces, and augmentation for impaired individuals. Vega's

work is the logical extension of a long exploration of mediation on the body and carries great potential for the next most realized version of the mediated body.

Figure 28 – Katia Vega. Eyelashes Tech, *2013. From: Crunch Wear:* Katia Vega designs Smart Faux Fingernails and Eyelashes, *http://www.crunchwear.com/katia-vega-designs-smart-faux-fingernails-eyelashes/. (accessed May 10, 2014).*

Figure 29 – Katia Vega. Eyelashes Tech, *2013. From: Crunch Wear:* Katia Vega designs Smart Faux Fingernails and Eyelashes, *http://www.crunchwear.com/katia-vega-designs-smart-faux-fingernails-eyelashes/. (accessed May 10, 2014).*

CONCLUSION

Whether through representation, engagement, or immersion, all of the work here explore a connection between body, mind, and technology, providing different embodiments of the mediated body.Much of the work represents and engages primarily the artist's body. While this is provocative and can lead to stronger awareness within the observer's body as well through empathic connection, a push towards engagement and immersion of the observer as participant's body is increasingly explored. Work that engages the participants' body as a platform in a manner that is not cumbersome but is instead integrative and intuitive is the ultimate trajectory of the mediated body. This does not always mean attaching components to ourselves, although it often can.Immersive environments, which encourage kinetic engagement and operate through multimodal interaction, can help participants reach an equally embodied state.

Not only can mediating the body provide awareness of mind body connection and create unique collaborations between man and machine, but also it creates opportunities for wider inclusion in the arts, both facilitating differently-abled artists to work and allowing accessibility to wider diverse audiences. It can also create both completely new forms of art and new ways of relating to the world around us. We have just begun to hint at the full potential and future of the mediated body.

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NUMERICVARIATIONS: EXOENDOGENOUS COMPUTER ART EXPLORING NEURAL CONNECTIONS

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ABSTRACT

In this essay is presented a customized software implementation for Computer Art, '**NumericVariations**[1]'. With it, it is intended to explore neural connections for performances and installations. This approach was made possible by recent neuroscience research, and the development of a Brain Computer Interface (BCI) integrated with a virtual reality framework, both allowing an experimental interactive 3D artwork to emerge. The outcome of this art research propitiates a symbiosis among humans and computers. Users' emotional states – excitement and frustration – are gathered by a neural helmet connected to the computer. The helmet passes the related data for these states to autonomous processes within virtual realms. The final artistic implementation will be used either for performances or site specific installations or both. It allows audiences to experience how the fluctuations of emotions within human minds affect behaviors of autonomous agents within the virtual realms. The emotions, captured through the neural helmet, influence but not control the behaviors of automated computational processes. The whole resultant interactivity was defined by the author as exoendogenous interactivity.

KEYWORDS

Computer Art, Brazilian Computer Art, Brain Computer Interface (BCI), Virtual Reality, Interactive Computer Art, Exoendogenous interactivity

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INTRODUCTION

Although Computer Art has existed for more than 60 years there is a lot of resistance within the artistic metier to accept it as an art form. Meanwhile, there is an increasing number of artists who develop customized software and hardware. A large field of different possibilities for artworks produced through computer coding is happening. Usually such artworks are evaluated with past criteria, criteria that deny their main characteristics, which are to be what they never were before. Therefore, such artworks have to be approached with different evaluation methods.

There are huge differences between computer artworks and other means of creating art. There are convergences and divergences which are not at the focus here [1]. The present approach does not intend to enhance one kind of art by depreciating the other, but rather understand the singular aspects that characterize a customized software implementation for Computer Art [2].

Similar to traditional artworks, computer artworks are poetic and aesthetic creations of human minds evoking emotions, sensations and a labyrinth of representations and, sometimes, ambiguities and paradoxes. These subjective sets intensify mental connections allowing the human sensory apparatus to be entwined with mathematics. They establish different relationships causing different readings. Therefore, numerical relations and functions are woven with sensory experiences and the results are not always predictable.

The software implementation to be used for an experimental artwork, as it is described in this essay, was developed within this field. The sensorial experiments proposed here by the artist are entwined with mathematical concepts. To achieve their poetic and aesthetic expressions this artwork also uses neural data and other related procedures able to be translated by numbers [3]. The expansion of these concepts are beyond the limits of this essay but a very brief draft will be delineated at the next section.

The interactors experimenting with these settings and environments face a major challenge. Their understanding of the emerging configurations and of their different ways to perceive and respond to these virtual realms, which are mediated by computational devices, allow them to constantly re invent their own ways to perceive[2].

Within these sensorial and affective fields the sensory stimuli establish a complex network of data and relationships. They create so many possible organizations that may or may not have been foreseen by the artist-programmer [1]. Since computer languages were not designed for artistic expression, sometimes it is necessary to subvert their use. Such innovative and original attempts, exploring the immanent potentialities of computer languages allow the emergence of new poetic and aesthetic solutions [3] [4].

[2] Their own esthesis, from the Greek, 'Aisthēsía'. The performers Ederson Lopes and Mirtes Calheiros, working with this implementation, have stated several times that such awareness has arisen, constantly, in their minds during interaction.

THE POETIC AND AESTHETIC APPROACHES WITHIN THE PRESENT ART RESEARCH:

Although this essay aims to present a customized software implementation, the term 'artistic research' will be briefly presented here, owed to the importance of its poetic and aesthetic goals. Artistic research in this approach means an "art that understands itself as research, in that scientific processes or conclusions become the instrument of art and are used in the artworks" [5]. Such instruments are related to the poetics in focus at the artwork. Poetics is an adopted word, borrowed from the literary domain and transferred into the field of contemporary art. Here it is used with semiotic freedom to explore many relations emerged within the programming environment during the process of programming the artwork. To describe them in depth will be the goal of another essay.

Concisely, I point to the fact that this term is designed to put into place the means to depict artistic expression from mental images, giving the interaction another status, that of also being a target open to modifications. It is used mainly as a concept to describe how one may produce results and which tools are used to overlay signification over virtual signs. Perhaps the Greek word 'techne', which is the etymological source for the word technology, could also be applied for the development of techniques for virtual poetics, but such use could become confused. For the present approach, is enough to say that such techniques emerged of questionings related with the actual construct of the sciences and the models of artistic research which are within close proximity of the scientific territory.

On the other side, the aesthetic qualities of the artwork are related with the qualities of expression and the sense perceptions [6]. The expressive and sensory fields are entwined within the artwork and, for example, is hard to separate, for a theoretical analysis, how parameters for interaction are chosen and how the neural data are transformed. Geometric transformations related with time variations and space dimensions, the numeric variations, synthesized in the artwork title, are studied and chosen among a huge range of possible choices. The behavior of virtual agents entwined with the human emotions of the interactors creates results that are not literal and prominent. Carefully, I shoot the photos and I draw the images that I want to map. The choices for shapes and colors are worked in ranges thus their proportions, hues, saturation and values create harmonious virtual realms and will not be lost during interaction.

The virtual domains are compositions of colors, movements and shapes carefully selected rather than aimless mixtures of whatever randomly available possibilities. In this artwork, shimmering colors, forms, lights and cameras in movements, metaphorically express the unending changes of life. Space and time, as generally described, named, numbered and analyzed by mathematicians, are dreamed by the artist within myself. They create almost unbounded numeric variations, a perplexity I will never totally understand. They condense out of my mind, in entwined geometries, shifting, creating delicate wave patterns over wire frame structures, suggesting living things. Flickering lights are combined with darkness; colors, shapes, space and time are woven together as a tapestry: the burning heat of the reds; the unfathomable depths of the indigo and navy blues; the ranges of dark grays and blacks, for establishing contrasts with bright bold tropical colors. There are hidden seeds waiting for the users' emotions, which will trigger growth behaviors; there are flight behavioral patterns allowing some agents to flee; sometimes there are changing relations among the velocities, the positions and the gravities, distinguishing, for

example, determined realm or even the camera movement flying through it; and many, many others functions, characterizing the agents' behaviors, which are woven through numeric threads.

Maybe, it might be naive in a world disturbed by wars and terrorism, that anyone may spend time looking for experiments with sensations and feelings. But, I chose to be an artist, because, as artist I have the freedom of choice. By doing this, I create the graphics in such a way that they are influenced by the neural helmet outputs data, but they are not controlled by them. Since I am convinced about the impossibility to use control to understand life phenomena, I chose to weave deeply intertwined nets in which the virtual and the human are united to present metaphorical realities. Therefore, some of the final results, only a part of the whole, sometimes, are almost unnoticeable. I am convinced it is appropriate to calling them symbiotic relationships. Their choice is a poetic choice.

I also do not want to control what the participants will feel. I want to lead them toward a metaphorical journey. A journey with different meanings for the diverse eyes of different beholders. Therefore, the whole set of 11 virtual realms were created as a journey going from a beginning until an end. An end that is not the final but, maybe, another beginning. The journey is open to interpretation. It can be understood either as a journey pointing to the amazing development of the brain or towards the evolution of life. The journey begins with the egg as a symbol and its clear connotations and denotations as ovule (figure 01) and finishes with 'panspermia' [7] (figure 02), meaning the seeding of the Universe with ideas or life. I want to give the public as much freedom as possible for their own interpretation.

The customized software implementation described here will be used in performances and site specific installations which are, in themselves, topics for other essays.

EXOENDOGENOUS BRAIN COMPUTER INTERFACE (BCI) FOR ARTWORKS:

An interface is a boundary between two things. This essay presents an interface between the human brain and a customized Computer Art implementation which is intended to explore neural connections, highlighting creative interactions. It establishes a membrane that is flexible, not permanent, not invasive, between the biological and the electronic brains. It is rather different of a prosthetic device, which would aid one to overcome, for example, a disability. Also it is rather different from the goal to understand the workings of the biological or the electromechanical brains.

The present research is an art-research. It aims to achieve poetic and aesthetic possibilities, resultant of the experimentation with this type of interface as stated at the section before. It has no focus on the operational aspects either of both kind of brains or of any possible practical applications. It is not a procedure helping to make machines more intelligent, affective or sensitive. It is not a research to understand how the biological brains work. It is not either to achieve the development of algorithms. It is nothing more than an artwork for fruition, for expression of poetic and aesthetic qualities, for experimentation with sensations.

The aforementioned approach was made possible by the creation, in 2010, of the robotic artwork Caracolomobile[3] (which had a neural interface) [8], by recent neuroscience research [9] [18], by artificial intelligence research [10] [11], and a Brain Computer Interface (BCI) [12] [13] [14] integrated with a virtual reality interface that has been in development since 2003.

These interfaces were merged allowing the creation of 3D artworks, experimental and interactive. The achieved solutions propitiate a symbiosis where the interactors' emotional states, such as excitements and frustrations, affect the virtual realms within the computer creating slightly different configurations. These final outcomes take into account that audiences will perceive activities owed to human mental states fluctuations affecting, but not controlling, automated machine processes, something inconceivable in the recent past.

For the approach stated before many other questions were formulated. For example: How to maximize expression, aesthetic and poetic qualities in order to create something meaningful, using data from sets of neurons into works of art? How the biological and electronic brains may work together?

In order to achieve the main artwork goal and to answer the questions outlined above it was necessary to understand the possibilities available in the market. Also, it was important to achieve an agreement about the logistical difficulties someone has to face when creating a custom implementation to be presented in exhibitions and performances.

Therefore, firstly, there was the need to find a sufficiently complex device that would allow data to be reliable and that were simple enough to allow their manipulation and use by non-technical interactors, such as artists or audiences. Secondly, there was the certainty that the most important feature of such artworks would be their aesthetic and poetic qualities. Thus, after experimenting with other commercial devices available, the Emotiv neural helmet[4] was chosen.

What does this device allow? It permits to read facial expressions, emotional states and a few cognitive data related to movements. After researching the results of such data I came at the conclusion that the most interesting and challenging approach for the aforementioned artwork would be to use the helmet's affective suite.

The next step was to find how and which of the scanned data would affect the virtual realms, allowing expressive and poetic results that were not too literal.

The French thinker Edmund Couchot has classified the kinds of interactions as exogenous and endogenous [15]. Exogenous interaction is the paradigmatic approach of the question and answer, of which we are accustomed to handle when working with computers. On the other hand, endogenous interactions are the ones that happen between autonomous processes (agents) that act without any human control.

As an artist there was a visceral desire to find ways to research symbiotic processes among computers and humans. These would aim to explore modes of actions between humans and machines. The potential of the computers would be explored to expand human aspects. Human

[3] http://www.springerlink.com/content/d8u21638134u834g/export-citation/, vol 21
http://vimeo.com/15751832
Accessed April 29th 2014. This robot was built with an award from the Brazilian Cultural Institute Itau, in 2010.
[4] http://emotiv.com

sensitivities would be utilized to affect machine processes. Thus, I arrived at the idea to implement artworks using human emotions to influence autonomous agents behaviors, either being them robotic or virtual. It would be possible, then to experiment how human emotions would affect autonomous processes. This should happen in such a way that virtual agents would have to be influenced when perceiving and acting on their own robotic or virtual environments, or both.

Consequently, as a result, the concept of exoendogenous interactivity was created [12]. What is this? After the computer digitize the interactor's input data in an exogenous way these data will be used by autonomous, endogenous, processes within the virtual domains affecting, as said above, the way in which the agents perceive their own virtual environments and, therefore, could determine their own behavior. In the future this approach will be used to extend these solutions to an artwork[5] using interactors mixed with virtual and robotic agents [16]. It was concluded that this kind of research might allow the emergence of meaningful processes arising in a kind of very interesting human-machine symbiosis.

Since the human body acts by outputting the brain's electrical impulses, these impulses could be used to interfere in the virtual agents' behaviors. Human behaviors may be conscious instructions or unconscious sensorial and emotional fluctuations. Someone helpless to control their own unconscious impulses may have these impulses read and translated to numbers. These states are owed to the action of neural fields captured and scanned through non-intrusive devices, such as the Emotiv neural helmet, which is connected to the human mind. When translated into numbers such data may be used by electric-mechanical systems. Wherefore, an experiment was conceived in which these stimuli could affect autonomous agents that exist within virtual realms.

These virtual agents were planned as sets of design principles that enable them to provide appropriate behaviors within a given virtual environment. They are small systems which can be regarded as relatively intelligent. An agent is any process that may be viewed as able to perceiving its environment through sensors (virtual or physical) and then acting upon them. In the case of robotic artworks they act through actuators [10]. They are relatively simple sets of instructions programmed to produce complex and unpredicted behaviors. Although very simple these sets of instructions organized as software may exceed the capabilities of their programmers. The Deep Blue chess playing computer developed by IBM, in 1997, and Stanley, the robotic car created at Stanford University that won the DARPA Grand Challenge, in 2005, are just two examples showing the progression of the development of autonomous processes using computers.

NUMERICVARIATIONS[6]

As stated above the first result of such symbiosis was achieved by the robotic artwork Caracolomobile [8]. Following this approach we have begun to develop the customized implementation 'NumericVariations', to create a set of 3D virtual interactive domains.

[5] 'NumericTessitures' a work in progress.

[6] The Brain computer interface (BCI) for this implementation was done with the collaboration of the software engineer Mario Pichiliani, the Java programmer Pedro Garcia, the mathematician Donizetti Louro with the support of the Institute of Mathematics and Art from São Paulo. See: http://www.ima.mat.br. Accessed May 11th, 2014

This implementation uses algorithms for collision detection and avoidance, for organization and growth of fractal trees, for elevation of fractal terrains, for particles, for behaviors related to collective flocks (with prey and predator behaviors, and of proximity, separation and alignment parameters for flights), among others [17]. In them the interactor's emotional data, interfere with the behavior of endogenous virtual agents. 'NumericVariations' is a customized software written in Java (Java3D™), which portrays a set of 11 virtual domains shown at the Figures 01 and 02.

The American choreographer, Maida Withers, has considered that the use of this implementation in performances would allow the exploration of its unfathomable potential. Therefore, a set of performances entitled MindFluctuations will use it as virtual scenarios.

Bellow, Figures 01, and 02, show a sequence of images of 'NumericVariations'. Figure 03 shows the computer environment and the performers Ederson Lopes and Mirtes Calheiros affecting a virtual realm with their emotions.

VIRTUAL REALITY SETTINGS FOR ARTWORKS

What virtual realities are? How may someone describe them? Which are the differences among a virtual reality artwork and any other applicative?

Looking for answers one may say that a virtual reality, realm, domain or world, is a simulation of a 3D environment with geometrical, topological and physical characteristics similar to the physical world. Although all simulations can share such characteristics, the artworks are conceived to develop singular and specific ones. These simulations may be perceived in their deepness through the use of proper devices such as polarized glasses (active or passive), Pulfrich glasses, anaglyph 3D glasses (red and blue or orange and green), or 3D lenticular auto stereoscopic displays.

For navigation it is possible to use devices such as mouses, keyboards, data gloves, data suits, joysticks, dance carpets, smart phones, pens, touch screens, among others.

Figure 1 – Virtual domains with the version for one projector and the panoramic version for two projectors.

Figure 2 – Virtual domains with the version for one projector and the panoramic version for two projectors.

Figure 3 – The computer set up and the performers Ederson lopes and Mirtes Calheiros interacting with the virtual realms.

Within these settings the computer will mediate dozens of processes linked together through thousands of lines of codes[7]. There are whole arrays of sub systems such as packages

[7] 'NumericVariations' customized implementation has a repertoire of around 280 Java classes with approximate 70,000 lines of code.

for: geometries, autonomous behaviors, animations, materials, lights (illuminations), camera movements, interactions, navigation, utilities, input and output controls, mathematical functions, images for textures and animations, and scene graph creations, among others.

The use of neural data adds a few more unknowns to this situation. To use them for exhibitions and performances, it is important understand their working conditions. In response to them the artist-programmer must have at one's fingertips some strategies to deal with possible delays that may occur during the data transfers to the computer due to the helmet readings.

When the interactors feel something, such as excitement or frustration, some sets of neurons within their brain will fire, creating variations within the electric gradients of neurons' fields. The neural helmet captures the variations of these electrical impulses and the helmet interprets them sending them to the computer. These electrical impulses are then translated as numerical data. These data are programmed to interfere with the behaviors of the autonomous agents within the virtual environments.

If anyone is waiting a literal type of interaction with input and output data in real time, it may be very frustrating when it does not happen. And this will only happen if the computer were outstanding machines and the whole environment controlled. In my own experience this has never happened until now in the art exhibitions I participated.

Depending of the computer specification, the traffic of these data may produce lags, which have to be considered by the artist-programmer, in which case they will not affect negatively the audience´s fruition. Therefore, I decided to create procedures and situations in which the agents' behaviors will not interfere in any specific type of interaction, even if they were affected by a network of processes, either electrostatic or neural.

Consequently, the public will need to be informed that they will not have literal interaction. This kind of interaction is becoming well known by the public that looks for it without being aware of other more interesting alternatives. Of course, for artists, the exoendogenous interactions are much more stimulating since therein lies the vitality and more challenging ways to conceptualize innovative Computer Art researches.

Also, if the resulting exoendogenous interactions are too literal they could be exchanged for much simpler exogenous types. Meanwhile, such use of neural data could be characterized as nothing more than an approach aiming to call attentions instead of developing interesting artistic researches.

For each virtual object or autonomous agents' behaviors within a virtual domain it is necessary to define algorithms such as the ones pointed to at the precedent section. They need to be added to other properties, such as: colors, shapes, proportions, textures, illumination, movements, accelerations, velocities and gravities, camera location, paths and related movements, among many others attributes. Redundant procedures must be studied and backups prepared since faults and noises may happen during the data transit among computers and devices.

For an artwork all these characteristics must be conceived and chosen. Its qualities must ensure the best aesthetic and poetic contents throughout the whole artwork. Faults must be changed into improvements. Artworks, in general, are focused on sensory perception

and upon similar relations even if these were not easily unveiled. It does not matter if they are subjected to realistic renderings or other more abstract and dashing ones. Thus, lights, illumination, colors, materials, proportions, and any similar artistic characteristics must be carefully chosen. Photographs for big projections must have the best possible resolution and, if and when pixelation occur, the images must be conceived to maintain the quality of the whole.

The 'NumericVariation' implementation described at section 3 is such an artwork. It shows a set of 11 (eleven) virtual realms and figures numbers 01 and 02 show images of its version 1.

REVERBERATIONS:

Summing up, I would like to weave a few considerations emerged upon reflecting over many thoughts I have established and coalesced as results of the process of making things either material or virtual. The main point is that one of the basic requirements of communication is the efficient sharing of knowledge. I am convinced that the joining of forces to expand the intellectual vision will lead into the future to a historical achievement that will only happen through collaboration among the many professionals needed to carry out complexes projects. This conviction is based on trust on human capacity to self organize, upon the need for intellectual self determination, and the benefits of spontaneous cooperation.

The philosophical problem arising from Goedel's theorem adds other components to this set up owing to his logical conclusion that no system can alone explain itself. Accordingly, perhaps we will never understand the whole unfathomable potential that the biological brain's system poses to us.

But by being optimistic I would like to point to the furthering of changes owing to the sharing of knowledge that the free software and hardware communities are providing. This is provoking the emergence of an improvement causing a huge transformation in society. The role of computer artists in this process are becoming relevant. Artists, experimenting with sensory and semiotic characteristics, may integrate them with other inherent aspects of computer languages. In this context one wonders: Which systems of organization resulting from these new sensory expressive gatherings could be developed? What new morphologies could be studied?

Computer Art courses need to be created. Beyond traditional disciplines to train artists it is necessary to introduce the study of mathematics, physics, and topics of computer science and robotics. This logical universe is generally averse to artists, and may be quite difficult, but not impossible, to embed such subjects in a curricula.

Throughout the last 60 years, the gigantic efforts demonstrated by many computer artists to surpass their own limitations demonstrate such fact. Even without having had access to training in related scientific areas, many artists, such as myself, often with very low budgets, are developing creative strategies to design works and projects anchored in visual, gestural, auditory and tactile languages, integrating them with mathematics.

Semiotic universes fighting against stereotypes and the dulling of our capabilities may constitute a singular art research approach. The profile of the artists who will explore such domains is of the artist-researcher, that is, one who delights in unknown exploratory sensorial adventures and the challenges of diving into other knowledge areas.

The type of experimental artwork emerging from this context demands an intensive work of partnership, cooperation and collaboration with scientists and technical developers. The emergence and proliferation of hack and garage laboratories begin to deploy and probably will boost such partnerships. The exercise of freedom, possible through the development of Computer Art, enriches this process and has a latent potential to uncover new and exciting niches of experimental research to be explored.

In conclusion, it is possible to speculate on the growing capacity of the cognitive, affective and human sensory systems for developing potential symbiosis with machines [6] (pp: 438, 494-495). Maybe it is unlikely that someday we might understand and relate with all factors inherent to the complexity of the phenomena involved within human neural affective and cognitive systems [15]. But, I am convinced that while we are here, on this planet, our task is to try forever.

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THOUGHTS UPON THE MORPHOGENESIS

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ABSTRACT

The present paper discusses the thoughts that guided the development of the system Morphogenesis, presented in the field of Computer Evolutionary Art. It was developed as a Multiagent Complex Adaptive System, built with Genetic Algorithms and Swarm Intelligence to generate emergent behaviors, simulating the evolutionary process. It is presented a discussion about the levels of significance suggested by the Morphogenesis, the emerging discussions instigated by public and the author's statement for the poetic.

KEYWORDS

Computational Evolutionary Art, Emergence, Artificial Life and Evolution.

INTRODUCTION

This paper presents the thoughts on the main questions and empirical process of balancing the work of art named Morphogenesis. It is related to the way we communicate everyday, make decisions and interact to each other, reproduce and die. These cycles tend to begin and to end, but yet belong to a permanent flow: life itself. In this sense, the poetic suggests a reflection upon the unpredictability and randomness of the process of life, contradictorily built upon adaptation, specialization and proficiency. It was created inspired by the view of life and evolution of authors like Darwin [4], Schrödinger [17], Dawkins [5, 6], Varela [20] and Cox [3]. Morphogenesis aims to express the evolutionary process of life maintenance, which occurs in a similar way to another complex systems, like the spatial organization of our cities or the flow of information on the Internet.

The computational system Morphogenesis focuses on the volatility of the consequences of our actions facing the complexity of our social interactions structure. It consists in a computational system, developed as a Multiagent Complex Adaptive System [11], built by Genetic Algorithms and Swarm Artificial Intelligence to generate movement, feeding, fighting and reproduction behaviors. All those behaviors are programmed at the computational agent level considering its neighbors in the environment. From the instructions on the micro level, macro patterns of behavior emerge from the groups of creatures [12]. This emergence is essential to the adaptation and survival of the species, simulating the evolutionary process by means of natural selection proposed by Darwin [4] and applied to other systems by Dawkins [5].

Furthermore, Morphogenesis is conceived as an accelerated system to allow the interactor to visualize the evolutionary process. It uses the human interaction with the mouse, keyboard, joystick, touchscreen or a camera as an outside factor of inconstancy to the delicate ecological equilibrium of it's endogenous interactions. Each agent represents the dissolution of our social responsibility facing the number and complexity of the macro autonomous system known as our society [8]. But in contrast to that, it also shows the unpredictable consequences of our unintended actions.

As well, Morphogenesis transcends the patterns of the living beings creating an analogy to an impossible microscopic world of the images. As if it was possible to see the living cells of every picture fighting to impose its shapes, colors and sounds. It illustrates the competition between the fundaments of visual language: points, lines, shapes, colors, tones, textures, dimensions, scales, movements, directions, spaces, proportions. It also incorporates the resulting soundscapes of the agents' interactions [16]. It's interface shows the cellular battles of the beings as a dynamic composition, varying from contrasts to harmonies. Hence, the poetic is comprehended as a semantic re-signification of the computational processes. Examples of its interface can be seen at Figures 1 and 2.

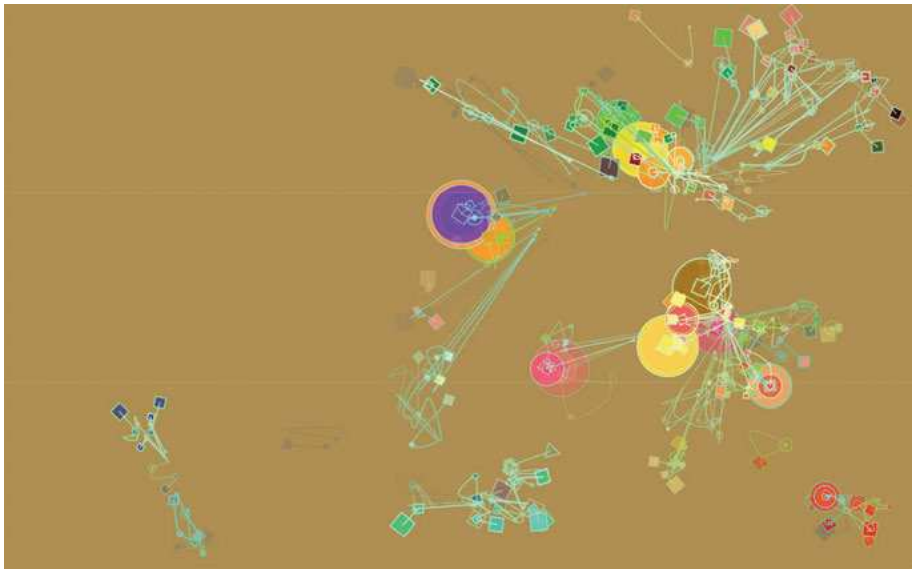

Figure 1 – Example of the agents' self-organization in the Morphogenesis.

Figure 2 – Another example of the agents' self-organization after several generations.

For more detailed information about the Morphogenesis behavior, development and discussions, other publications from the author can be consulted [19]. The present article aims to discuss the levels of emergence proposed for the Morphogenesis, the emergent discussions verbalized from its inter-actors and the author's statement for the poetic.

THE LEVELS OF EXPERIMENTATION

Before the discussion about the levels of interpretations suggested by the Morphogenesis, it is important to make a brief reflection about it's nature. The poetic is proposed as Computer Art, understood not only as the expression by means of computational processes, but as a field with it's own aesthetics experiences. It is built upon deterministic and probabilistic processes, generating complex systems with unpredictable feedbacks rendered by its interface. In this sense, its behavior is quite different from the works of the 80s and 90s, focused on fractal algorithms experimentation or just with mutation on image composition [13]. More than that, the poetic is comprehended as a direct result from the nature of these language, representing the multiple possibilities inside the randomness of this non-deterministic and deterministic logical processes. In this sense, the computational processes are not only the raw material of its constitution, but also the focus of the expressed poetic. Those are the processes that the inter-actors should experiment, explore, interact and reflex about: those unpredictable probabilities that explain the paradox of life suggested by Schrödinger back in 1943.

As points out Rocha [15] about the cybernetic aesthetic experience, computational poetics have some specificities from the machine's systems, like mathematics, logic, engineering and sciences, not only it's plastic elements. It relates Art, Science and Technology in a single way. According to the author, in this kind of work of art it is common to have the inter-actor dedicated to it's questions after the initial assimilation. He continues to think about the impact of the occurrence, improving its aesthetic experience. Therefore, the projects may be developed to be experienced in several extracts, levels of interpretations and possible reflections. It keeps the possibility of ambiguity, fundamental for the artistic message. In addiction, they it generate the multiplicity of the interpretative act as an aesthetic notion. Consequently, the poetic was conceived according to these assumptions, creating different extracts of significance to be perceived. Then, the aesthetic experience becomes deeper, departing from the surface of the first contact, its interface, roaming to the questionings about our very existence on this planet. As such, to be experienced on every level, the Morphogenesis demands from its inter-actor a deep engagement, patience, availability, curiosity and autonomy, as points out Couchot [2] about the characteristics of the current interactive poetics.

The first contact with the Morphogenesis begins with the perception of its random colorful arrangements and sound compositions. The aesthetic appreciation starts with the assimilation of this dynamic visual and its acoustic elements. In this moment, it is expected that the public's attention turns to the self-arranged nearby colors, dynamic shapes, organic lines, continuous movements and scales. This is the most superficial level of contact with the poetic Morphogenesis. It provokes the viewer by the presentation of a non-Euclidian topological organization of the agents that grow like a rhizome [7] from units that metaphorically represents the fundaments of Euclidian space. From the endogenous interactions of the agents it can be perceived the syntax of its behavior rules. This is the first level of experimentation of Morphogenesis, the direct appreciation of its interface.

Nevertheless, it is expected that the inter-actor feel free to interfere on the endogenous behavior of the system. When that happens, the mix of exogenous and endogenous interactions tends to promote a new kind of experience to the public, which becomes part of the system. The perceptions of the displacements, reactions, relations and deaths of the agents are reframed. The immersion process begins, and the inter-actor is invited to dive

in this new impossible universe that is offered to him. In this moment, the endo-aesthetic experience starts, and the watcher participate in the observed world. According to Giannetti [10], in these situations, the inter-actor has the perceptive experience and a consciousness inside the simulation game, an endo-system. At the Morphogenesis, it is comprehended that it consists on a peculiar world simulation, creating an imaginary endo-system. This is needed so that the internal actor can be situated on his new environment. Therefore, it is believed that the artificial universe conceived is proposed to be a poetic orientation: a structure of strategies to produce aesthetic sensations in a given poetic context. At this time, it is expected the appreciation of the interactive elements of the poetic, started from the creation of an affective bond to the agents. The public should experiment the possibilities of the creature's reactions and the alternatives elaborated to save, protect or even kill them. When it happens, the inter-actors' attention turns to the structural aspects of the poetic. The computational agents are comprehended as autopoietic units [20] and there is the inference of life. The creatures are seen as rational organisms, able to fight, reproduce and die, even when generated exclusively by computational processes. In these situations, considering the inter-actor as a part of the system, it occurs a hybrid world (moist media), mixing the digital world (dry media) and the biological world (wet media), as suggested by Sommerer e Mignonneau [18]. This is the second level of experimentation designed for the Morphogenesis, the perception of the interference possibilities on its endo-system.

However, considering this kind of relationship between the inter-actor and the system, it is plausible to assume that it could be an even deeper dive into the levels of observation suggested. When seeing themselves as part of the complex system, it is possible that some inter-actors could elaborate a reflection about influencing another complex systems of their daily life. As an example, some people could think about the impact of their actions at social or environment levels, evaluating the occupation of the cities or any other complex system in which we are also acting as agents on micro levels. In these situations, there might be a transposition from the experience with the artificial accelerated system to the real material world. This is one of the deepest levels of impact suggested for by the Morphogenesis. If it happens, there will be a complete poetic expression of computational processes reframe. It opens the discussion about the invisible emergence that surrounds us since the beginning of life on this planet. Despite improbable, this is the third level of experimentation idealized for the Morphogenesis. It is more reflexive, about the transposition of its internal significance to the world of the inter-actors.

Even so, this is not the last designed level for the system. In a philosophical dimension of reflection about the questions suggested by the Morphogenesis, it may be possible even to provoke the inter-actors into a deeper subject. Assuming the possibility of existence of the impossible imagined system, designed without a central controller that guides each agent, it is expressed the emergence of life. In this sense, it may be possible to the most incredulous spectator, to perceive the demonstration of autopoietic systems as viable to this world. Despite it looks redundant to our own life process; its accelerated time could better illustrate the evolution of the species guided by adaptation, selection and proficiency. In this context, the Morphogenesis could be important to demonstrate how the theory of evolution by means of natural selection could be a reasonable way to explain the world that we were born at without a clear finality. More than that, it suggests that this world may be beautiful without the need

for a Manichean model of human pre-stabilized moral [1]. It might be possible because in the imagined world of Morphogenesis, all the stereotypes related to the material world may not apply, like the relevance of a good behavior or the will for the continuity of life. For this to happen, the artificial microscopic world was designed to behave in a similar way of biological processes that evolved naturally, but without the figurative personification of the computational agents into biological creatures. In this sense, it could be used to explain the mechanics of complex systems by a tacit way, by the experimentation of the aesthetic experience. This could be a useful purpose for the poetic because those kinds of behavior are very difficult to comprehend without the demanded time of reflection [5]. They have a counterintuitive characteristic of the higher scale of amplitude when compared to our percepto-cognitive system and the common heuristics that we developed to evaluate randomness in large scales and the origin of complex objects/systems. This is the fourth level of significance designed for the Morphogenesis, about the mechanics of life and the entire Universe. This is an important dimension of the poetic because, according to Poissant [14], every work of art, even the most abstract, brings with itself the ideological and technical clime of its time, with or without the consent of its author.

Those are the four level of experimentation designed for the Morphogenesis. They vary between the entertainment with the colored and loud arrangements of its interface and the reflexive questionings about the mechanics of our Universe when interacting with its narrative.

THE EMERGENT DISCUSSIONS

After observing the public interacting with the morphogenesis, and talking to them freely about its poetic, some unexpected discussions were brought to light. Those aren't designed when conceiving its algorithms, but emerged from the perception of the inter-actors. The first example is the statistic tendencies of the generational superposition. It must be clear that, in the first models of the system, there was no relation to the oxidation of materials or entropy. On these versions, it was possible to an individual creature to stay alive and see several hundreds of descendants to be born. But still, even without the power of entropy and the effects of aging, there is similar behavior of the frequency of generations on the artificial world. Could our evolutionary property of death be just a need for genetic substitution for variability? Is this a central feature of the forging by evolution that the creatures should perish so that the species can evolve? when looking at this matter exclusively in probabilistic terms, it is clear the relation between the creatures generation and its frequency of distribution. However, this was a subject invisible to the author because of the will to research the impact of the forever-living agents on the behavior of the artificial population. The answer is that it behaves in the exactly same way, substituting the old agents for new ones so the adaptation continues.

Another interesting subject that emerged from the system was the notion of leadership. In any version ever created of the system there is a way to create a hierarchy between groups of collaborative agents. However, when the sum of the energy of each agent is made to define their movement, there is a tendency to make the group to follow the strongest agent, the one with more energy. This happens because when the weakest ones move away from the group, inspired by the higher sum of the group energy, they return as soon as they realize they are too weak when alone. But it doesn't happen so frequently when a strong creature move away. In most cases, the

group tends to adjust its distance to keep the creature within the group. As the probability of the agents positioning is calculated at each new frame, there is a great chance that the strong one can change significantly the direction of the entire group.

There was also another question emerged from the poetic about the meaning of life. It was defined at the present study as the co-emergence between the autopoietic unity and the environment, guided by the quest of organized energy. In this sense, life was suggested as an individual property. However, as propose by Cox [3], the death is the destiny of every living being, but life itself continues. To think of life as a process bigger than the individual is more acceptable when facing direct connections as parents and sons. But when we amplify this inference, its consequences can lead to an unexpected conclusion. What is the exact point that defines the continuity of life? Aren't we increments of the same unicellular life that one day manifested itself on earth? So aren't we just different avatars of the same life, trying to dominate the globe making use of our flexible and specialized attributes and resources? The relation to every creature alive on earth is corroborated by the identical sequences present on our DNA. If life were a collective process, it would be a mutant creature highly effective that escaped the dark porous corner of the ocean to occupy the entire surface of the earth in an incontestable dominance.

There are yet other reflections originated from the emergent behavior of the Morphogenesis. Some of them are in an even higher level of abstraction. For example, we may consider that the cells in our bodies were independent mono-cellular living beings one day, as the creatures of the Morphogenesis. At some point at the evolutionary road, they started to act in a collaborative interdependent way. At this high level of interdependence, the resulted creatures are comprehended as a complete entity, able to a symbolic representation of the world, rationalization processes and even self-identification. All these processes occur in another level of support, in which the minor cells are not able to offer the absolute structure for the complete system. The same way as our brain cells responsible for our synapses are not able to account for a unity of thought. They can die without realizing the dimension of complexity that emerges from its own life. On the other hand, we may look at the coordination present in the social structures of complex living beings, like ants and bees, which use a bottom-up approach of organization. Would it be possible to believe that other emergent macro entities could exist, originated from minor unities like us? Those macro entities could be able to perform rationalization processes or self-identification. Aren't we a living proof of the potential of this process? Could those entities be gods under construction? Considering the mechanics of life, it would be much more reasonable to believe in emergent gods than top-down models of rational creation.

Summarizing, the affinity between the public and different contexts of complex systems allowed the inter-actors to experiment complete contrasting aesthetic experience when in touch with the Morphogenesis. The public also cited other relevant subjects about the role of technology. Could our adaptation be more accelerated by its resources? How it modifies us in a post-human or post-biological context? What is selected by evolution when we blur the boundaries of Cumulative Natural Selection? At this point, evolutionary process is not only centered on the genotype/phenotype relation to be defined by the triad genes, culture and technology? Trying to answer all those questions was not the aim of the Morphogenesis. In opposition to that, the goal was to instigate this questionings by the Morphogenesis.

THE STATEMENT OF THE MORPHOGENESIS

What is expected from the Morphogenesis in terms of poetic expression is to demonstrate the mechanics of the process of life evolution. In this operation, we seek for energy with quality [17], manifesting the attraction we feel for organized complexity [5]. In this process, we mix and transmit our almost immutable registers to the next generation, making life permanent. In an unpredictable way, from minor changes selected naturally and cumulated along the years, we become an active and mutant entity, that emerge in an invisible scale of time. In this sense, life as an individual property can be seen as just a bend in the irreversible flow of energy that changes the matter. But when defined as continuity, life projects itself by the course of time indefinitely to the unknown. Just like that, our bodies die. But life continues to expand in a Universe with an absolute tendency to decay. Thereupon, we are able to keep the paradox of energy imbalance that is life, winning the everyday battle against entropy, generation after generation.

In this sense, it is reinforced the suggestion made by Galanter [9] that, in the context of aesthetics and Arts, the notion of complexity as information quantity should be abandoned in favor to the notion of Effective Complexity. In the context of Computer Evolutionary Art, it is plausible to assume a relation between Effective Complexity and aesthetic value [19]. Artists should seek for Effective Complexity when working on Computer Evolutionary works of Art, not just for a single level of emergence to generate a top-down designed visualization. This kind of process demands emphasis on the bottom-up approach of balancing the system, always seeking for several levels of emergence. The reward in terms of aesthetic experience is that the poetic will allow the public to experiment the mechanics of complex systems in a tacit way, so difficult for us to realize when evaluating the impact of our actions in the world that surrounds us.

CONCLUSION

The Morphogenesis was designed with four levels of experimentation for the spectator. It flows from the superficial level of the arrangements of its interface to the endo-aesthetic level of the interaction with its narrative. Even with all those levels designed as a complex adaptive system another unfolding relation emerged from its inter-actors. To keep those several levels of emergence, at the field of Computer Evolutionary Art, artists should aim for the Effective Complexity when creating their systems. It is the exact product of the cumulated extracts of emergence, with proficiency, heterogeneity and improbability in a single step, just like evolution itself.

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ARTISTIC VISUALIZATION PERSPECTIVE FOR THE (PEDESTRIAN PERMIT) PROJECT IN VRT APPLICATION FOR AUTONOMOUS CITY (PARIS)

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ABSTRACT

For several years research in computer graphics aims to develop render to simulate true life especially in 3D rendering environment. This photorealistic method for 3D rendering and modeling is already applied on the platform"Virtual Reality Application For The road safety education for Children in Urban Areas"which been applied in the project R&I *Terra Dynamica*in citu / Paragraph laboratory Paris 8 University.

But through observation and research, applying the non-photorealistic render method can promote an attractive communicative imagery that carries information to children, more easily through colors, illustrative shapes and visual effects.

In general, the non-photorealistic imagery techniques are based on mimicking traditional artistic techniques like handcraft; oil painting, gravure, and watercolor end so one. Combining the imitation of traditional styles, particularly the expressionism, with illustrated 3D scenes; produces a non-linear perspective and a characteristic visualization. With this stylization and abstraction tools and techniques, we aim to produce an artistic reflection and vision with 2D videos depending on a stream of the dynamic data of the (Pedestrian Permit) project.

KEYWORDS

Visual communication, virtual realty, simulation, computer graphics, expressionism.

INTRODUCTION

First of all, we need to introduce the platform we are going to express and present our non-photorealistic vision on. This Virtual Reality application consists of an innovative application platform designed for pedestrian simulation, integrating a virtual reality application for child risk prevention and education in urban areas. This platform is an open platform, designed and based on a collaborative research and technologies; which refers to a dynamic animation of autonomous city (Paris), containing an artificial intelligence and behavior modeling for pedestrians, crowds, vehicles and traffic in 3D visual and an audio environment, trough the framework *TerraDynamica* project in Paris.

In the beginning we chose 2 guiding methods to construct our artistic vision, through this virtual reality application in (pedestrian permit) project. One of the most important functions in visual communication is transforming information and the eye or the visual guidance in the scene on imagery or video, so the viewer getstheinformationfast andwithoutinterferencewithin thedetails.

As a technology, virtual reality forms a bridge between human senses and computer outputs. Because the relationship between general media and culture is complex, the use of an analytical tool is necessary to understand its workings.So semiotics isa good way to analyze virtual empiricism because it acknowledges meaning derived from both this technology content and its unique expression.

So we aim to explore and apply the visual communication studies and the interface semiotics analysis to the use ofvisualandsemanticencodingandreduction, and employing the semanticappropriatelyin order totransferthe largest amount ofinformation in the current platform, through an general artistic method (the expressionism) in order to reach our goal.

The process of simplification and reduction for figures and semantic drawings (the signs) is already amplified in traffic, thosepresiders are actual techniques which implement semantic or drawing diagrams, as we see in the administration of traffic in urban cities.

And regarding many digital artistic forms for children education, whether it's 3D or 2D visuals, illustration and cartoon has always been the most dominant techniques of all.

Same asprevious, the actual platform is using a photo-realistic render in a 3D visualization of the city and it elements like pedestrian, signs, vehicles, extra... and so we propose a non photo-realistic render method according to our former objectives.

THEORETICAL REFERENCE

"*Richard Gregory* wrote, "We are so familiar with seeing that it takes leap of imagination to realize that there are problems to be solved (p.17)". While we humans had to learn how to walk to talk and read, we never had learn how to see. Thus, unlike walking or talking or reading, we are less cognizant of the many processes that contribute to what we see".

Many artiststoday are attempting to identify and describe the visual communication process.

So before starting to analyze the actual statement of the project we need to ask a few questions.

- What is the procedure that affects vision in visual communication?
- What are the methodologies utilized by visual communication researchers?
- How does knowledge contribute?
- How do viewers utilize and perceive different media?
- What is the role of semiotics in motion picture?

In visual communication, a part or the whole of perception relies on vision, and it was presented or expressed with two dimensional or metaphorical images as the global image. The details include: signs, typography, drawing, graphic design, illustration, color, electronic resources, etc. It also explores the idea that a visual message to support text has a greater power to inform, educate, or persuade a person or audience, but in our project the text wasn't included in the experiments.

A big part of the perception is the result of a combination of sensations but not of individual sensory elements. Visual perception is a result of organizing sensory elements in a form of various groups, because the brain classifies by its nature the visual material in discrete groups. So what we see when looking at a picture or a video is modified by our collective memory, andwhat we precede is what we have seen in the past or what we want to see according too our inner expectation.

In this project we deal with different theories, mentioning the sensual theories and perceptual theories, which form a mechanism of communication through visual, and describing the conveyance and the path of an idea or information in to a form that can be read or looked at.

In general, there are rules that redirect the elements and their perception in imageries and video, so the whole is different from the sum of its parts.

The rules or laws in sensual theories are mostly related to the Fundamental Grouping system, which combines the discrete elements within a scene so the brain will understand through a series of four fundamental principlesand grouping systems. According to The Gestalt theory (forms or shapes), the elements that compose a design are affected by where they are and by what surrounds them.That means that parts and elements identified individually have different characteristics to the whole, and they organize the whole. So perceptual vision correlates with four rules, which are similarity, proximity, continuity and common Fate. Theserules would be applied in our research in order to achieve our target.

But in fact, the human eye is constantly in motion while scanning an image. The viewer constructs the scene with short-lived eye fixations that the mind combines into a whole picture; it means that the eye merely takes all the visual stimuli and effects, and the brain arranges the sensations into a coherent image, which delivers information and sensation. This finding helped to explain how the mind perceives difficult images.

The theory of constructivism is generally attributed to *Jean Piaget*, who articulated a mechanism by which knowledge is internalized by learners, children in our case. He suggested that through the process of accommodation and assimilation, individuals construct new

knowledge from their experiences in conceptual manner. Piaget's extensive has made affective and cognitive studies on children for intellectual development. *Julian Hochberg*, psychology professorin (Columbia Uni.), 1970,found that when individuals assimilate, they incorporate and integrate their new experience into an existing framework or a structure without changing it. This may occur when individual experiences are aligned with their internal representations of the world, but may also occur as a failure to change a faulty understanding. In contrast, when individual experiences contradict their internal representations, they may change their perceptions of the experiences to fit their internal representations. According to the theory, the state of accommodation is reframing our mental representation of the external world to fit new experiences, a part of this theory concerns the language links between context and identity. Howard Giles developed the theory of communication;it argues "When people interact they adjust their speech, their vocal patterns and their gestures, to accommodate to others" that refers to the strategies through which individuals adapt to each other's communicative behaviors, in order to reduce these social differences.

In our case of study the visual accommodation is relaying on the abstraction of the visual representation.So the existing framework is easy to adopt and to be understood no mater the personality or the background of the spectator.

In Perceptual theory,Semiotics is one of the systems of communication,which sense and signs take the form of words, images, sounds, gestures and objects. In visual aspect semiotics has so much impact on the form because it identifies the contents according to its reference and composition. In motion picture, temporary process in a scene has an impact on semiotics, because the animation of picture or text mid interprets the signs, signals, or behavior differently. Contemporary semioticians have studied signs not only in isolation, but also as part of semiotic 'sign systems' (such as medium or genre). They study how meanings are made and how reality is represented.

Pictorial semiotics and Gestalt theory in particular constitute a part of the foundational layer of contemporary pictorial semiotics and a starting point for visual analyses. While semiotic methods of analysis have been applied in various fields, like anthropology (the study of popular culture), advertising, geography, architecture, film, and art history. The majority of semiotics methods and approaches emphasize the systemic character of the object under analysis. This, in turn, requires an analysis for the entire procedures that composing the imageries and the animation in the scene. In this case, the elements in a picture are considered as systems of signs in which elements interact in ways similar to letters, words, and sentences.

In temporal semiotics,the meaning can berevealed only with continuity, like music,movies and video games. So interactions and conditional actions are affecting the semiotics of the scene, that means not only words and signs can interfere with the meaning and the results, but also gestures, images, non-linguistic sounds.

Semiotics can help advance some of the major goals of Human-Computer Interaction (HCI) and be useful when designing interactive products, and it appears that the paradigm of the analysis should include Functionalism, Social Relativism, Neo-humanism, Choice between Objectivity and Subjectivity, Choice between Order and Conflict and Assumptions

about Reality. (*Hirschheim and colleagues'* paradigms at the base of information systems development)

As previously mentioned, elements could be considered as a node and can be placed in the paradigm according to level, composition and functionality in the architecture of semiotic.

In our actual platform we applied the interaction knowledge between module machine and human, as the following table.

Interaction between modules:

- Child <-> Permits Module: Control and response
- ACA <-> Child: Control and response.
- ACA <-> Davi platform: voice command.

So it actually applied the interaction method to dynamics and statics projected data, whichare the elements of the scene. In this case the immersivedispositive (VRT) application is creatingdifferent results through interaction between elements and human in temporal statement; that change by artificial intelligence participant in eachcourse of pedestrian permit simulation.

That means all the moves and shifts of trajectory by the pedestrians and cars in our simulation are not subject to any form of active monitoring on our part. In this case the relations between units arethe syntagmatic structurethat should be measured by the composition level of the image.

In games and motion pictures the narrative is based on sequences and causes, like in film and television narrative sequences, there are also syntagmatic forms based on spatial relationships for montage in graphic design, which works through juxtaposition and on conceptual relationships, to expose an idea or retrospective for an idea. So the distinctions between the modes of narrative, description, exposition and argument are not clear-cut "(Brooks & Warren 1972, 44). In motion picture there is more than one type of syntagmatic structure, but some can be dominant, depending on its role and reference.

So by combining that cognitive knowledge and analysis, we aim to construct a new artistic visualization perspective for the (Pedestrian Permit) project In VRT application for autonomous city (Paris).

TECHNICAL METHODS

Applying a non photo-realistic render (NPR) and visual communication studies in (pedestrian permit) project:

First we will explain the executive and operational stepsthat would lead us to a non photo-realistic render in order to produce a visual communicative environment.

- **The outline (contour):**

Usually, outlines don't exist in real life, so the photo-realistic render mustn't apply to the outline in terms of rendering or graphics design, and the shapes should be presented according to luminance and color only and the gradient they make.

Therefore, we will adopt the ink outline style to show outlines specific form relying on a full three-dimensional scaling in drawing cartoon image.

According to 3D (NPR) application for outline, there are 3 guidelines that can produce a wide range of line drawings, and often contribute to more complex illustrations.

- Silhouettes or "contours" separate front facing from back-facing regions of the surface, as a function of viewpoint.
- In 3D creases are paths that define statically on the mesh surface generally representing sharp features.
- Suggestive contours that are dynamic features similar to silhouettes that are view dependent and help denote the shape.

There are many methods in visual art concerning simplifying lines and shape in the animation field that we can quote from.Overall the abbreviation of elements and characters is necessarily followed by the artistic technical style, so mutating shapes and summarizing or exaggeratingin certain parts in term of creation and design lead to a simplified draw in proportion to the core idea of a n arrative or a scenario.

In process of designing a character, usually the text provides adescription of the character life style, the general situation, the specifications, etc. Therefore the design follows the character's profile, starting from lines drawing through modulation, coloring,until the final render.

Figure 1 –The actual 3D environment the application of (NPR) Illustration tech the application of (NPR) gravure tech.

- **The coloring**

As we refer previously the color can deliver an expression and a sign, and it can redirect the scene or guide the eye to a certain point. Usually, the diversity and brightness of colors attract the children, so are pastel colors for younger kids.

Worth mentioning that some colors are dominant, like red or black in deferent uses, that lead the viewer to a certain point even leading him to a certain feeling.

Briefly, the non-realistic coloring impact affects the script or the objective, and redirects the narrative goal or the imagination, so it has to be related to the subject and the target in a way that provides the right sense and direction in the same time.

- **Coloring techniques:**

  There is many ways and styles in coloring, some of it referring to a certain traditional art school, but digital graphic technology can mimic and produce different and merged coloring techniques in the same imagery.

  Among the traditional techniques:

  - Aquarelle
  - Oily
  - Acrylic
  - Pastel
  - Charcoal
  - Collage, which relies on adding different elements and textures during the coloring process.

Since we are dealing with a large amount of pedestrians and a wide area in the city with a lot of buildings and monuments, we figured on applying several layers of coloring techniques and effects, to separate the focal point from the backgroundcrowded with elements.

- **The luminance**

  The luminance of the dynamic flow of the module (city and the pedestrians) is under the influence of a realistic method. The platform can produce visualizations for weather, which impacts on the lighting and the colors on the whole city. We are determined to use and apply its effects without changing it.

- **The texture**

  Adding different textures to our scene can help separating the elements from the background, but it can also produce disruption. Usually the photo-realistic render uses texturing in term of description and definition for the element, but in a (NPR) this uses are not the same according to many 3D renders for kids and cartoon.In a 2D render the texture is more used to unify the elements in the same environment, creatinga certain artistic vision.

  In a visual communication aspect, the identification and the signs should be, according to our project, presented as a front layer, so the visualization of the city can adopt a different texture like 3D technology can produce.

The non photo-realisticintraditional art:

- **Humans use imagery to communicate visual information.**

  People, as content creators, are interested in these tools for the production of imagery to communicate visual information, but the important point is: the appropriate form of imagery for a given task depends upon the nature or purpose of this communication, as well as the artistic vision and school.

  There are many artistic schools that digital art can mimic and imitate as a brush pattern or a plugging effect through the wide paradigm of computer and digital arts.

- **Why choosing the impressionism method and style?**

  This method can provide:

  - Impressionistmethod providesvideo as a different visionand perspective for therealityin terms ofshape, color, luminance and texture.
  - It can also provide the scene with signs and identificationwithout distraction, which traditional realistic art can't provide without the interaction of abstract.
  - The imagery can carry information without the help of another medium like sound or text.

The principle that the impressionism re-explores the world transmutes the reality and re-configured the narratives and it signs in a different perception and presentation from either the artist or the intended target.

Currently many of the digital art graphics workexcept for the photo- realistic renderthat are extensive and variableapplications under the influence of Impressionism, including some of the 3D art works that can be observed in several games combing different artistic styles and techniques.

- **Software**

  - Adobe suite
  - Adobe After effect
  - Adobe Premier
  - Terra dynamica process

Semiotic interference in the visual presentation and (VRT)

One of the sciencesthat interferessignificantly with the visual communication aspect and it mediations is the semioticofinterface based on the management of theinteractivevisuals and its executiveor functionalemployment, like Interactivegames and web sites.

Since the surface in this project and plat form is a visual display that mediates between the machine and the user (human), we will explain certain points that indicate and direct our video in the scene through analyzing, by recalling the components of the project and its visual and semantic impact on the scene.

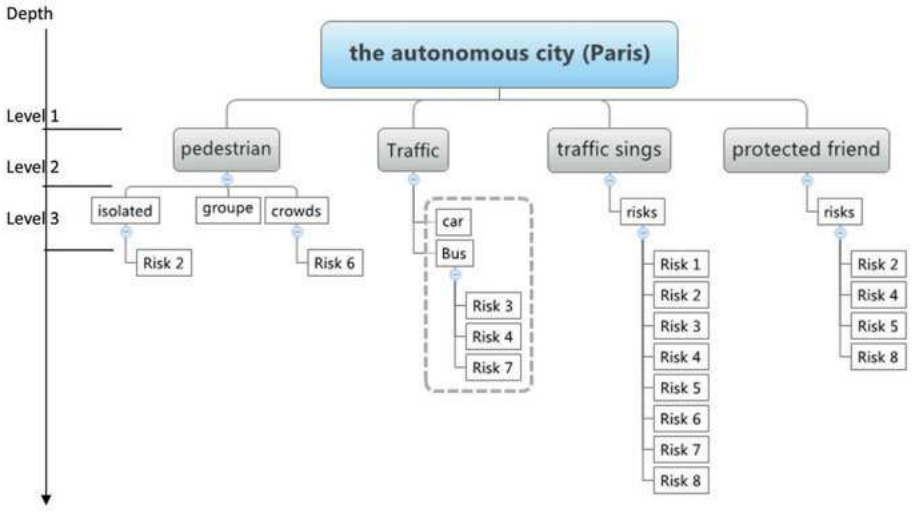

Figure 2 – Architecture of the visuals

- Pedestrians (grouped, isolated, crowd).
- Vehicles(bus, car).
- Environment (City and buildings, plants, monuments).
- Player associated characters (protected friends).

Figure 3 – the actual project.

Figure 4 – the actual project elements.

According to the previous analysis, we find that most elements are functional and interactive in its region of strategy, which means they affect and get affected by the platform in term of plying. Some of these elements only purpose is to deliver signs and indications, like Traffic signs, others like Pedestrians have more than one function as they represent the pedestrians, which are a sign of civilization in the street, and they add 2 kinds of risks for the player, like pedestrian crossing without traffic light and crowd coming from opposite directions. To conclude, the pedestrians interfere with the levels in the experience for the child, by their behavior (wrong/right). They gravitate in an area facing the player; and they always remain visible to the player, and they act differently depending on the actual coordinates on the path.

Also, the vehicles interact with the player as transactional and functional node, and add more deferent kinds of risks for the player.

Protected friends are also recognized as interactive elements, by adding more obstacles to the player with the risks they make.We can therefore obtain the player's results through the functional and effective elements to evaluate their progress in the experience.

The autonomous city of Paris is more a presentational element, which is connected with dynamic data made from actual plans of a Parisian neighborhood in order to give the most realistic and educational experience possible. So the main objective of the city visualization is to present and simulate the real city, explain the location, and add few risks and obstacles with choosing a direction in the journey.

CONCLUSION

Human culture is an expansive subject, and there are many research specifically assessed in terms of virtual empiricism, to decrease the difficulty associated with interpreting meaning from cultural interactions with signs and actions, in an experiential virtual reality media. Immersing the individual in a simulated world, with the advancements in computer graphics function by providing renditions of imaginary content that either resemble real-world objects or concretize abstract concepts and transfer signs information in term of the experience itself is ideal.

The fact that the visual element performance and their homogeneity in a visual system or medium, engaging participants in the scene of task, the present study explored how the different regions of the visual field contribute and interact.

So in order to fully benefice from all the elements of the game, we will separate the actual visualization to 2 levels concerning what they present and their functionality in transferring information and their state of interactivity.

The first level will hold all the interactive elements; which are:

- The vehicles
- The pedestrians, the no-player characters and the player character.
- The group of friends and the cartoonish character (fox).

The second level consists of the autonomous city of Paris (buildings and monuments).

Figure 5 – Separate visual data. Statics and dynamics elements in real time projection.

So by applying the visual communication studies and the interface semiotics analysis, we came to certain conclusion for the visualization of the second level or the background elements, by using a harmonious coloring and graphic design and decreasing the level of the details by blending them with one technique (simplifying the outlines); focusing on their presentation as an environmental form and map, according to its dynamic and actual data, in order to complete the "Pedestrian Permit" program.

As for the first level, we will apply more outlines with ink style and technique, use brighter and stronger colors to give us a more cartoonish approach, so the child would be more focused on the risks in entertaining visual aspect.

The coloring technique will be unified so it doesn't separate the two levels completely.

As 2D video render, the silhouettes and outlines cannot be rendered differently, but can promote style and coloring that match and mimic many non-realistic artistic styles, like marker, pencil, brush, etc...

Figure 6 – (NPR) sample1. Applying aquarelle method on 2D video.

Figure 7 – (NPR) sample2.Applying aquarelle and inkmethod on 2D video.

Figure 8 – (NPR) sample1. Appling cartoon animation method and adding cartoonish root sign.

We have picked few techniques that support our objective and deliver a non-realistic render, which can deliver information and entertainment in the same time for children as simulation visualized in 3D in dynamic and 2D artistic methods in(VRT) application.

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