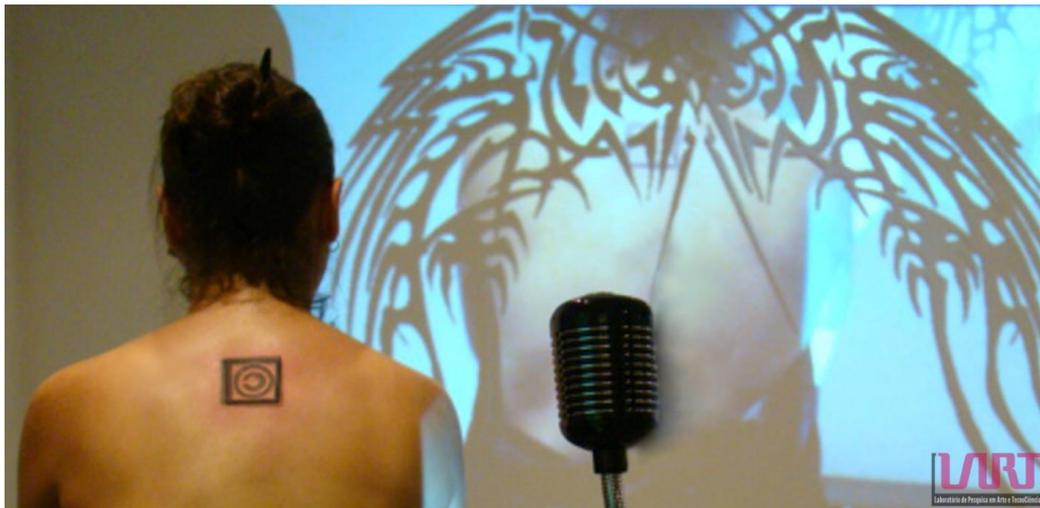


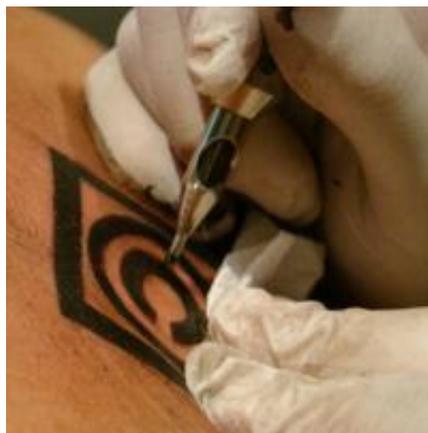
# BIOCYBRID ECOLOGY: ART, TECHNOSCIENCE AND LIVING SYSTEMS

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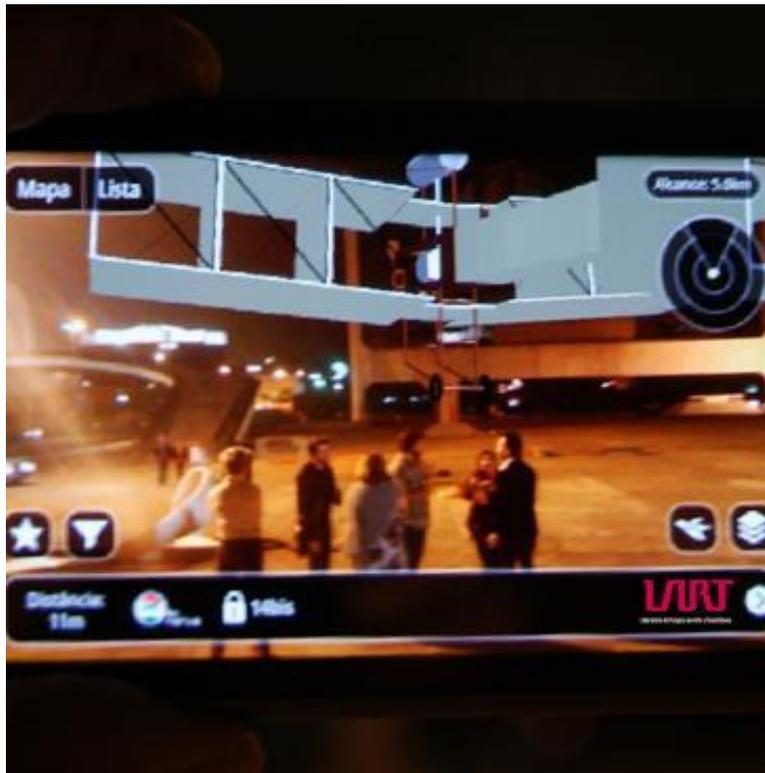
The article is about two transdisciplinary art projects, developed in Brazil. These works were made by the augmented reality technology. In the first, the body tattooed with AR code, in performance art was connected in network for modelling winds. The second, an object modelling - 14BIS-, Santos Dumont's aeroplane was in the sky. These artistic works describe the reinvention of the environment by physical space and cyber data.



*Image 1. Opened Body Connection. Computer vision system and projection of the wing actually increased from the tattoo.*



*Image 2: Opened Body Connection. Cyberperformance held at the Museum of Image and Sound/MIS during the IV International Festival of Mobile Creativity - Mobilefest on November 14, 2009, in São Paulo-SP, Brazil.*



*Image 3: 14 Bis airplane. Latin America Memorial, São Paulo, Brazil. September 2010.*

Our goal in this paper is to describe the theoretical-practical context of our current production, developed in Brazil, in the Laboratory of Research in Art and Technoscience, that from a transdisciplinary approach offers us a new vision of nature and reality integrating concepts of Philosophy, Biology, Physics, Art, Computing and Engineering, as systemic parts of knowledge, in which 'all disciplines investigate the same issues, all sciences become a single science.' [2]

Thus, we find in Art and Technoscience a way that allows us to contribute with the reflections about the contemporary human being in the environment in which he/she lives. The challenge of relating art and software engineering, automotive, electronics and biomedical research at the Faculty of Gama, Brazil, is unprecedented in Latin America. To guarantee this, we rely on national agencies to foster scientific and technology research that enable the formation of human resources for research in the country. The partnership between the Government, companies and universities in which it begins, allows us to generate new ideas and suggestions that can contribute to our common goal of expanding knowledge of human possibilities.

The current scientific world has unveiled a new condition of life on the planet. We are increasingly concerned with the nature and the human being, thus, innovative possibilities of artistic creation emerge.

Studies that approach art, biology and technology research of artists and precursor scientists of the body dialogue as support, manipulation, speech, expression, and biological view and that overturned or challenged the physical, emotional and sensitivity limits of the human being concurrently with technologic developments of his/her time, have been of great importance for our research.

### Assumptions of body art: visible and invisible imagination

The body in motion as a proposal to challenge the physical limits of the human being can be seen in the 'Manifest of Futurism' by Fillippo Marinetti (1909), which explores the notion of speed and strength in sculpture at the beginning of the twentieth century. The body that is represented there, crawls, fighting against an 'invisible' force which introduces the concept of time as the fourth dimension represented in a sculpture. The 'invisible' forces grounded in technological developments of this time, for example, the work *Unique Forms of Continuity in Space* (1913) by Umberto Boccioni, suggests the viewing and the tactility of informational data from an unseen force, where perception is not only in the hand, but on the whole body/mind complex that it touches.

Gestural actions are also noted in Pollock's *Action Painting* (1947), in which the visceral motion of his action, allowed to record information of the violence of his muscular body gestures through the paint on panels. Abstract art emerges then, as a painting from hand signals of the body as expressive means.

The paintings and conceptual objects of the 60s start the dialogue of the moving body, which soon become ephemeral artistic actions experienced in performances, *happenings* as social and conceptual criticism that relate the aesthetic art of the event and the human condition of the time. Yves Klein's (1960) female bodies as 'living brushes' contribute to the visual record of biological images, in a process of stamping anthropometry.

The principle of using the body as support and artistic expression also comes from the conceptual physiology of the *Body Art* (1960) movement, in which performing creations are developed with public participation, in places related to the concept of the presentation. Artists experience bodily limits of sensitivity and affection: pain, pleasure, discomfort, intimacy and happiness in intuitive, cognitive, basic and complex emotions in the performing actions.

Thus, the set of logical operations of the possibilities of human actions are considered as natural languages used in the analog art (op art and kinetic art, Fluxus, *happening*) with the intuitive use of the concept of algorithm (instructions to perform a certain task) leading to an explicit integration with the public. [10]

In parallel with the artistic manifestations, technological advances in programming languages, artificial languages or digital codes created sequences of signs in the form of letters of intuitive instructions from control systems, instruction and game rules. [10] It was with the mathematical, logical and cryptanalyst Alan Turing, in 1937, that the concept of algorithm and the area of Computer Science were created, by the *Turing Machine* through the computing devices designed to help investigate the extent and limits of what can be computed.

There are many trials and artistic provocations that test the limits of the human body and assign in experiential character, in performing and objectual actions, the visible and invisible imaginary, involving questions about life itself.

Today, seven decades after Alan Turing and much artistic experimentation, proposals for computing the sensitivity and affectivity of information through human body emerge. In this sense, we consider the concept of 'biocybrid ecology' we have proposed as a perspective of a systemic view of interaction, perception and cognition through practice and theory of techno-artistic that allows reengineering life.

Reframing of consciousness attained in the post-biological era, lived in the 'Cybrid Architecture.' [1] proposed by Peter Anders, where the properties of the informational data of the cyberspace are entered into the physical world we know, in which a new quality emerges, the cybrid, composed of contents added to the hybrid world of cyber data.

These are systems that allow a co-existence in a continuum between the virtual and physical reality endowed by an interface for vision and interaction. They hybridize the physical and digital spaces, simultaneously, overlapping them in a hybrid that becomes cybrid. [5]

In this sense, the important technological change, proposed by Mark Weiser, [9] is the one that fundamentally changes our lives from the place of technology. In this way, what really matters is not the technology itself, but its relationship with us. According to the author, in the last fifty years there has been in computing major investments in research on the relation of bodies with the technologies.

Today the Internet is taking us through an era of widespread distributed computing for the relationship of ubiquitous computing. It is the relationships and interrelationships of technology in our lives, in the environment and in our bodies, when shared between each one of us and the things of the world, everywhere, that ubiquitous computing has aimed to make the use of computers emotionally invisible to the user, making it available throughout the physical environment, subtly, characterized by the spread of properties that make the cybrid emerges.

The bonding of synthetic data to the real world creates scenarios by inserting the virtual to the real. This is the mixed urban life or mixed reality whose actions mix spaces that aggregate and paste information to specific locations. Mobile and locative technologies are used, pasting data on the reality to be viewed through devices such as webcams and/or cellphone cameras.

In this sense, we are going to describe the work *Opened Body Connection* as an artwork that uses the technology of augmented reality (AR), approximates the human body of the desire for ubiquitous technologies and contributes to new perceptions of reality, for the production, awareness and interaction of natural and artificial feelings as an integrated whole of the body in interaction with the environment.

For two hours, three-dimensional animations ranged the body being tattooed in a ritualistic moment experienced in the interstitial space between flesh and the cyber of data. On the back, the figure of the tattooed copyleft, as a marker of augmented reality that allows the machine to enter on it three-dimensional animated wings. In this sense, the marker makes a pun on the concept of copywriter, which is commonly used in reference to copyright, the intellectual works and their authors. Thus, copy-

left opens a new thinking that enables the copyright as a way to subvert the rules of copyright protection and remove barriers to the use, distribution and modification, in this case, of a creative work, demanding the same freedoms to be preserved in modified versions.

*Opened Body Connection* is an artistic proposal that alludes to the body without authorship, copyright, collective and artistic production with the use of free software and open source for the continued process. In this sense, the body is not unique, but open, built by multiple senses of the connection. They are cyber data flowing through it and beyond it in direct contact, invisible, tangible by the network sensations. A freedom to bend boundaries that transforms the organic into a cyborg body. Skin with a data cloud that are seen and experienced by the sharing of information. A cyber performance configured in the relationship between humans and the environment, a mixture of information, transmitted in real time by the Internet through streaming of sounds, images and texts in an interaction channel composed of social networks.

Another artwork that uses augmented mobile reality and geo tagness for mixed landscapes is *The 14 Bis Air Plane*. Expanded interactions and mixed landscape generated the *14 Bis* cybrid system, to celebrate Brasilia's 50th birthday, in a public event that explored mobile and locative interface in mixed reality. LART creative practice put in the Brazilian capital's sky the historical plane *14 Bis*, invented by the pioneer of aerospace engineering, Santos Dumont. The virtual plane in real scale (with a length of 15 meters) is geolocated in augmented reality, with the tag code placed in the satellite exploring the Global Positioning System and results into the data visualization apparition of the historical plane flying in the city sky.

## Perception and cognition in the new human condition

Thus, the phenomenon of behavior and perception is, according to Merleau-Ponty, the first contact with the world that takes as its starting point the existential facticity, human phenomenal, doing a transformation of subjectivity, making the body the subject of perception. Similarly, ubiquitous computing presents a new approach to appropriate technology for our lives, called 'calm technology' [9] involving the center and periphery of human attention.

It is in the periphery that things are tuned by a large portion of our brain devoted to processing sensory peripheral to the notion of ecological perceptual possibilities [4] applied to the psychology of things. [7] It is the mixed environments that people are surrounded by intuitive interfaces embedded in everyday objects and around them.

The perception, according to Alva Noe [6], is not something that happens to us or in us, it is something we do. Consciousness of perception depends on the capacity of action in a physiological process of brain thinking, on the ability of the body as a whole. To perceive, according to this enactive approach of perception, is not only to have feelings, but it is to have the sensations that we understand. According to the author, the content of perception is not like the content of an image; the world is not given to consciousness at once, but it is gradually acquired through active perceptive exploration of the knowledge of the body.

According to the biologists Humberto Maturana and Francisco Varela, enaction is guided by the understanding of perception through the actions of the subject in space. 'To the extent that these local situa-

tions are constantly changing due to the activity of the individual perceiver, the necessary point of reference for understanding the perception is no longer a world previously given, regardless of the subject of perception, but the sensory-motor structure of the subject.' [8]

Cognition, in its structures, emerges from the sensory-motor experienced schemas that allow the action to be built and guided by perception. It is the experiential sensorimotor contextualized structure, 'the way the subject perceiver is written in a body, [...] determines how the subject can act and be modulated by the events of the environment.' [8]

By taking a creative capacity of operational intervention upon life on manipulations of its conception and procreation, the human being participates actively, in the perspective of evolution, of a process which could alter its nature.

The construction of techniques and production of tools have always followed the human phenomenon. The formation of man – anthropogenesis – coincides symbiotically with the technogenesis that the first tool of man was his own body. In this context, nature reflects the interdependence between anthropogenesis and technogenesis in an ecological way in a new human condition.

Oliver Dyens [3] examines the convergence of computing, communication and biotechnology into a new paradigm of information as a very important thing of what is happening with the 'human condition', that was thought to be essentially unchanged.

### Physiology of the Emotions in biocybrid feel

Physiological data, image processing in expert systems are the basis of Biomedical Engineering, thus, a new concept of biocybrid emerges [2], reaffirming the body/environment biology in the cultural scene of existence in Cyberculture, in sensorimotor experiences in ubiquitous computing, differs from the connections and evasions of virtual environments for the mixed bioconnected spaces.

For these reflections, the James-Lange theories (the actions perceive the emotions and the brain interprets them), Cannon-Bard (emotion is felt first and then follows the cognitive actions, the thalamus and amygdala plays a central role, interpreting an emotional situation and, simultaneously, triggering the sending of signals to the Autonomic Nervous System and to the cerebral cortex, which interprets the situation cognitively) and Shachter-Singer (contributes with differences in emotion and self-perception), are extremely important for the 'Physiology of Emotions' in the aspect of a Biocybrid Ecology, of an emotion in a dynamic state of physical events, cognitive, and cyber data with the use of ECG, EMG, Galvanic Skin Resistance – GSR and NTC thermistor for creative, artistic purposes in human edges for expansion interfaces and perceptual and affective supplementation.

Environments and smart objects, augmented reality, ubiquitous computing, pervasive and tangible, make it possible to understand the body experiences in human-computer interaction, of emotions, cognition and perception through the body, physiology and behavior.

We give voice to human free will, by monitoring and detection of biological motion signals produced as a result of conscious choice or not, measured by technology. For this interaction, the LART Research Group adds the research of physicians, therapists, computer programmers and engineers with the

aim of detecting emotional expression, turning it into sounds and images projected on the environment, in a process called Data Visualization in which we contribute to the propose of the New Abstraction construction.

Featuring biosensors, one can detect tension and intentional movements of any person during an action, in a daily performance from or even in rituals that transcend one's own body, as part of a complex ecology of the cosmos.

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