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*cyber***PRINT***: Towards an Architecture of Being*

Abstract
This project involves the *design, construction and performance of an "architecture of being" that expresses selfhood in virtual space and real time using:* (1) physiological data as its building material, (2) architectural design as its expressive intent, (3) digital space as its medium, (4) screen projection as its enveloping and viewing technique, (5) user interactivity and performance as its partner, and (6) interdisciplinary collaborations among Architecture, Choreography, Modern Dance, Music, Bioengineering, Medicine and Computer Science as its creative and technical contexts.

The paper presents the implementation of the ***cyber*PRINT** during a series of techno-media performances at the Rose Wagner Performing Art Center in Salt Lake City, USA, in May 2000. This work is believed to be the first of its kind in the world. The ***cyber*PRINT** is building a new area of creative inquiry in architecture by means of collaborations with the arts and sciences.

Thematic and Contextual Form
Since time immemorial, we human beings have been trying to represent to ourselves graphically, with the hope that such visual externalizations of our physical and/or psychological being would help us understand who or what we are. The prehistoric frescoes of Altamira, the history of pictures, masks and anatomical studies, surrealism, and lately the ups and downs of cyberspace are all representative efforts of the same origin (Ellis 1993, Feher et al 1989, Sennett 1994, Stafford 1991, Sterlac 1995, Wentwick 1971).

The observation of these works through time and the space reveals the use of an ample range of metaphors to graphically express identity and human life. Nevertheless, in spite of such diversity, all these visualizations sooner or later, directly or indirectly, end up referring to the body as their foundation and inspiration (Frank 1995, Johnson 1987, Lacoff & Johnson 1998, Merleau-Ponty 1963, Valéry 1989).

This project is inserted within this ancestral tradition when exploring the visual representation of being and the human body in the light of new technologies and means. Its center is the graphical representation of "body in motion," that is to say, the creative visual expression of the human body in real time. Until now, and for millenia, such a task has been the competition of the "performance arts" (music, dance, theater). The "plastic arts," due to their language and means based on immovable images and objects, have stayed in the margin since, presented alone, they can only respond to the changing nature of vital phenomena in a limited manner. Although the arrival of cinematography somewhat modified this situation, sculpture and architecture continued to be expressed on film as **permanent and material** . It was not until the invention of computation and its descendant, digital space, that these restrictions were finally raised, thereby realizing the unexplored potential of sculpture and architecture.

This work approaches such a challenge by means of the design, construction and implementation of a **"architecture of being" that express the fluidity of the human body in real time. The rendered virtual architecture uses human-body-movement-originated physiological signals and transforms them into forms in three-dimensional space in real time.** Since resulting designs represent the individual whose biological data generate and maintain them, the device is really a "***cyber*PRINT**" or a "personal printing" of said individual in digital space. ***Cyber*PRINT**s may be displayed *via* digital projection or virtual reality, and create living visual representations of that person with which himself and others may interact in ways unimaginable until now. This new type of architectural experience provokes in all participants deep and lasting aesthetic and reflective answers, whether they are observers or users.

But what has architecture got to do with the representation of being and the body? Architecture has always been interested in the study of personal space, individuality, and the body as way to respond to the necessities of shelter, identification and improvement of the human existence. From one perspective, the design of fluid digital constructions that represent being is just an extension of this tradition. On the other hand, this task implies a radical change: instead of architecture determining human activity as it has been until now, ***cyber*PRINT** allows human activity to literally determine architecture. The result is a fundamental transformation in form in that, up to here, we have interacted with and created architecture. Form follows life...

The relevance of architecture to approach the thematics of atmospheres and virtual beings is recognized by vangard architectural theoreticians (Anders 1999, Benedikt 1991, Mitchell 1995, Negroponte 1995). Nevertheless, the work made in this area until now has focused on responding to the apparently "anti-architectural" qualities of the virtual thing: immateriality, lack of gravity, fluidity, space discontinuity, multidimensionality, *etc.* (AD#133 1998, Chu 1998, Davis 1996; Novak 1995, 1998; Möller 1996). It is remarkable to observe that these studies have lent little or no attention to the central role that the body plays in the conception and perception of virtual architectures (Beckmann 1998, Frank 1998). In responding to this fault, ***cyber*PRINT** not only ensures virtual reality a unique place in architectural investigations, but also it opens up completely new opportunities of expression and study.

Although the use of the body to direct electronically musical and mediatic events is not something new in the contemporary scenic arts (Davies 1999, Dominguez 1997, Novak & Sharir 1994, Kisselgoff 1998, Schiphorst *et al* 1994, Sharir & Salen 1997), most of these works have been restricted to choreographic strategies with little attention to *the potential of interactive virtual space atmospheres*. The production and performance of *cyberPRINT* offer us a completely new type of artistic expression.

Methodology

Given the unique character of this company (no precedents exist), ***cyber*PRINT** was presented numerous artistic, mediatic, technical, conceptual, and design challenges which demanded a great interdisciplinary collaboration between architecture, art (choreography, modern dance, and music) and science (biomedical engineering, medicine and computer science).

Concretely, *cyber*PRINT obtains its raw material from non-invasive medical sensors that measure the vital signs of an individual in real time and numerical format. For this aim we used the **BioRadio 110, an instrument made by Cleveland Medical Devices Inc. (of the Cleveland, Ohio—http://www.clevemed.com).** The BioRadio 110 is a light and programmable physiological monitor that measures, records and radio-transmits biological signals such as electrocardiogram, electroencephalogram, etc. (Figures 1 and 2). This instrument's chief advantage was the elimination of the restrictions on movement associated with the traditional medical sensors, an essential thing for the type of performance required by our project. The BioRadio 110 sends its measurements directly *via* radio signals to a PC where they are processed by a program written to generate a virtual architecture according to predetermined design parameters.

BioRadio 110 is used to collect the activity of three physiological functions that have historically been associated with human life: (1) respiratory and muscle activity; (2) cardiac activity; and (3) brain (nervous) activity. Since the physiological data can be represented any way in the digital space, the center of our work was the design of tempero-spatial parameters that organize the natural transformation of physiological data into three-dimensional representations that express the three functions to be deciphered (Figure 3).

The design of ***cyber*PRINT** meant developing (in layman's terms):

1) new rules, aesthetic techniques and conventions to visualize to the body and humanity in the digital atmosphere (vocabulary and syntax)
2) the relation between the intentions of designer and the expectations of user and audience (the world of meaning, semantics)
3) a system to obtain a concrete aesthetic audience response (pragmatic)

The project is based on the area of architectural knowledge called "Basic Design." This area consists of principles (*e.g.*, scale, form, rate, balance, color, structure, *etc.*), elements (*e.g.*, lines, figures, objects, spaces, *etc.*) and organizative rules (*e.g.*, hierarchy, layers, topology, symmetry, *etc.*) essential to the three-dimensional designs and their relations to psychology and human conduct.

Aesthetic Investigation

***Cyber*PRINT** investigates the following questions: Can a person be graphically represented in virtual reality, unlimited by corporal reality? How will thoughts, emotions, and movements appear in a world that this completely technologically mediated? What is an "architecture of being"? Can the language of architecture be used to visualize human life? Does an aesthetic logic exist that can express an immersive atmosphere of change? What is the aesthetic result of the visual interactions between the real being and the virtual being? How are modern dance, music, and choreography integrated the architecture in a scenic unit? What methods, languages, technologies, and knowledge

function as common elements among these arts? Can their differences help to develop new classes of artistic and/or architectural discernments?

Since a theoretical and philosophical discussion on this thematic or the ***cyber*PRINT** would demand more space than permitted here, the reader is referred to the authors' other works if he or she wishes greater depth (Bermudez *et al* 1999a, 1999b, and Gondeck-Becker *et al* 1997).

Implementation

***Cyber*PRINT** was implemented for the first time during **"Body Automatic Body Resistant,"** a techno-media event directed by internationally famous choreographer and multimedia artist Yacov Sharir (professor of the University of Texas) performed by the Repertory Dance Theater of Salt Lake City, Utah as part of its "Millennium" program in the 1999-2000 season. Nine shows took place in the Rose Wagner Performing Arts Center in Salt Lake City in May 2000. The objective of this implementation was to explore the new opportunities of performance allowed by the technologies and contemporary means in the collaborative context between choreography, modern dance, music and the architecture.

In addition to Yacov Sharir, ***cyber*PRINT** relied on the musical contribution of Tom Lopez, a composer of electronic and interactive music from the Oberlin Conservatory (Ohio) and the technical lighting support of Amarante Lucero, a professor of engineering of the University of Texas who is a lighting designer and a programmer of robotic lights.

During the performance, the choreographer Sharir was connected to the ***cyber*PRINT** generator which immediately created a virtual architecture, establishing the context and expression of his physical-psycho-intellectual state. In other words, the architectural atmosphere Sharir acted within was the "architecturalization" of his being in conjunction with the music created by the composer Tom Lopez. When dancing, Sharir inhabited and interacted with his ***cyber*PRINT**, constantly altering his own vital signals and thus maintaining life and change in his "architecture of being." The result: choreography, dance, music and architecture all rolled up into one new indivisible art form. Sharir and the audience experienced ***cyber*PRINT** through a large-screen projection system. Figures 4-11 give an idea of the type of expression reached.

Future Work

Based on the experience acquired in our first series of performances, the project will now proceed with the creation of a public artistic work in which people will be able freely to experience their own ***cyber*PRINT**s. As it will be totally participative and interactive, ***cyber*PRINT** will make every user an artist-architect, since the person will effortlessly generate his or her own architecture. While creating his or her "architecture of being," ***cyber*PRINT** will throw his or her usual self-perception of existential condition into crisis. This will give rise to multiple interpretations (from the erotic to the spiritual) fillling the participative space of the artistic installation. A recording of the digital printing of the participant may be stored on disc or videocassette to be voluntarily reviewed later, thus maintaining the possibility for new interpretations.

Acknowledgements

This work was made possible with the support of an educational and creative grant from the University of Utah. Investigations were financed by the US National Institutes of Health. Many thanks to the manufacturer of medical instruments, Cleveland Medical Devices Inc., for its technological and economic assistance. Special recognition for the Repertory Dance Theater of Salt Lake City, Utah, for its generous artistic and logistical support.

Illustrations

Figure 1. The physiological sensors of the BioRadio 110 being placed on the body of the choreographer Yacov Sharir prior to the performance.
Figure 2. The physiological data generated by Yacov Sharir's body are measured and radio transmitted to a PC where they are used to construct the virtual architecture or cyber***PRINT***.
Figure 3. The technology in action. In the first plane the artist is connected to the BioRadio 110; behind him (blurred by the the flash of the the camera) is the cyber***PRINT*** *projected directly from the the computer where the the data is transformed into a three-dimensional visualization.*
Figures 4 to 11. These images are video captures of the implementation of cyber***PRINT*** *on 2000 May 13 in the Rose Wagner Performing Arts Center in Salt Lake City, Utah, USA.*

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