

# Body Electric and Reality Feedback loops: Virtual Interactive Space & Entertainment Potentials

Associate Professor Anthony Lewis-Brooks  
Department of Software and Media Technology,  
Aalborg University Esbjerg, Niels Bohrs vej 8,  
6700 Esbjerg, Denmark.  
*tonybrooks@cs.aau.dk*

## Abstract

This paper informs on the use of body function as an unequivocal and intuitive interactive interface within causal virtual environments that give an immediate and direct feedback to the sourced body for subsequent interaction/reaction. The environments have been termed as Virtual Interactive Spaces (VIS) (Brooks 1999). The use of such systems that enable an immersed proactive experience can be utilized in entertainment and the human sciences. This paper informs of the author's research which parallels these two modes of inquiry with a focus the virtual entertainment potentials of VIS.

**Key words:** Evolution of Performance Art; Education of Audience; Interface of the Future; Environment controller and navigator; SoundScapes.

## 1. Introduction

The paper informs of the use of the human body as a direct interface in virtual entertainment environments/Virtual Interactive Space (hereafter termed collectively as VIS). It discusses the author's unique body of work involving two parallel complementary strains of research where play/entertainment and the human interface have been central. The concept that results from this work is utilized in educating, designing and training towards a tailored adaptable system that is accessible and beneficial to all. The system maintains a balanced between applied theory, technical design and social understanding. The concept is a *virtual* layered construct having an upper *user perceived* play/entertainment level built upon subsequent lower levels which are utilized in analysis and computer data extraction processes. This aspect is the focus of a prior publication (Brooks 2004a) and is thus only briefly described in this paper.

## 2. Context

In Europe, many Laboratories involved with visualization research of the phenomena related to VIS are necessarily restricted to utilization within commercial restraints. In such instances academic requirements for such facilities are for data mining, computer aided design (CAD), and similar such vertical

thinking<sup>1</sup> strategies. The artist is positioned passively upon a distant horizon where consideration of potential collaborations is rarely considered by the lab team. This paper states the case for the artist and discusses the logistics involved in such instances which require interdisciplinary collaboration and investment in artist involvement in research projects involving VIS. Such investments are suggested at benefiting, for example, the educational inter-disciplinary infrastructure associated to such a laboratory; the eventual realization of financial input resulting from potentially more commercial applications and product; as well as assisting towards future employment opportunities for students in the corporate world. The author exemplifies through his experience in the field and informs with a chronicle of relevant installations of alternative VIS environments which has paralleled the development of his SoundScapes body of research (Brooks 2003).

## 3. Background and Basic Technologies.

Apart from ongoing workshops and research presentations on a global scale the author has publicly presented his work in prestigious stage performances and interactive installations at major international venues. The creation of these pieces was built upon the use of technologies to enable a capture of the body gesture of the stage performer (usually the author in his one man shows) or the public within the interactive space of the installation. Early experimentation with biofeedback sensors enabled body function signals such as brainwave activity, muscle tension, galvanic skin response, and heart beat to be captured and routed to multimedia feedback for manipulation of the feedback relative to the source. Such a reality feedback loop affects with relative effecting of the sourced human(s). Later a desire for non-tangible interfaces promoted research and use of invisible sensor technology systems. The popular commercially available Soundbeam ultrasound sensor is one sensor utilized which is set up as a linear invisible keyboard in space that can control various multimedia by gesture within the space up to around 6 meters. Another set up incorporates a 3D volumetric infrared sensor (Brooks et al 2002) and various camera systems that are interfaced to a personal computer. Combinations of these sourcing technologies

that manipulate multimedia feedback (auditive, image, vibration) are selected to optimize user interaction and experience. Thus an enjoyable and entertaining feedback motivates an optimal user state.

#### 4. The Body in Art – a historical perspective

<sup>1</sup>The early 1960s saw the human body nascent as a catalyst for artistic interpretation and expression. This movement came to full bloom in the '70s with numerous works presented at various levels to various scale, from loft spaces to galleries in performance and installation.

Confrontational conceptual artists had found a genre that had evolved from the early Futurist, Dada and Surrealist movements from the early part of the 20<sup>th</sup> century. In considering the lineage Carlson (1996) states that “The interest of futurists in movement and change drew them away from the static work of art and provided an important impetus for the general shift in modern artistic interest from product to process, turning even painters and sculptors into performance artists.” In discussing the following Dadaism movement Fischer-Liche, (1997) write that the movement “aimed at challenging and reexamining the purely passive attitude of expectation and customary practices of spectator reception. In this way, they attempted to dissolve the discrepancies between art and society for the duration of the performance.” The movement following Dadaism was Surrealism who in Antonin Artaud had an influential spokesman who is quoted “in his visionary *The Theater and Its Double* advancing his own powerful version of the argument found throughout the early 20<sup>th</sup> Century avant-garde that the traditional theater had lost contact with the deeper and more significant realms of human life.” He further states of the need for a “spectacle of “direct” and “objective” action.” (Carlson, 1996, pp. 91-92)

Reflecting on the resulting conceptual movement that emerged from the above Goldberg (1998 pp 13) states as to the fact that “the body – as a measure of space, of identity and of narrative – so central to the art of the '70s, now pervades the art and scholarship ...” Further she informs of the importance of performance as a reference not only in art history but also in “contemporary culture, whether in philosophy, photography, architecture, anthropology, or media studies.” Whichever form it takes she says it “provides incomparable material for examining contemporary viewpoints on such issues as the body, gender or multiculturalism. This is because live work by artists unites the psychological with the perceptual, the

conceptual with the practical, thought with action.” Goldberg (1998 pp 9)

Many of these artists used the body as a central element of the ‘canvas’ often abusing or decorating the flesh and provoking audiences – bringing them into the action.

Other influential references in the field dictate a mention. Leon Theremin for example, a Russian physicist, created instruments that were affected by body conductance proximity. The Terpsitone system is of specific interest which was designed for full body rather than his better known invention which named after him was only designed for hand interaction. This system responded to gesture with sound, visuals and vibration.

A review extract of the work of Chris Burden (Shoot 1971 & Trans-fixed 1974<sup>ii</sup>) suggests as to how artists were expressing with *reality* in mind - “These sensational events had a tremendous impact on other performance artists, in part because they emphasized the absolute reality of performance art over other forms of drama in theatre.” (Goldberg 1998 pp 106 – 107) Thus a natural evolution for the art form that has been described as capable of *emphasizing the absolute reality* to incorporate virtual environments

At the turn of the 21<sup>st</sup> Century the use of the body as an interactive interface within performance art, computer science, and research is now commonplace. A supplemented vocabulary has been superimposed to that used in the '60s and '70s whereby new terminologies referring to emerging technologies and strategies are apparent. This is exemplified by reading any call of proceedings of cutting edge conferences in the field. For example in September 2001 a leading European education organization in Germany<sup>iii</sup> held a conference titled CAST01 // living in mixed realities. The conference targeted a dialogue among researchers, artists, and designers so as to stimulate intercultural cooperation to reflect on issues and improve life in a digital networked society.<sup>iv</sup>

One of the main Themes relative to this paper is a section of the proceedings titled *Performative Perception // The body as instrument*. The papers presented under this theme present the case of how technology empowers the use of the body as an intuitive interface with the required minimum latency (a constant problematic area). The new content interaction that such technological advances allow enables innovative explorations of the body, the senses, and the mind (all of which are independent) which have consequences for quality of life issues. The part of Art concerned issues of aesthetics, perception, creativity and human values. The author in his body of research implements such fundamental values which are deemed as core of the work.

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<sup>1</sup> The focus of this paper is on the use of the human body as an interface to virtual environments, thus a selected period and form is briefly referenced only. The author acknowledges the information gives only limited credence to the historical importance of this section.

## 5. Embodied Interaction and VIS

In discussing VIS we must discuss the human and the consideration of the means of interaction. Paul Dourish (2001) points out that traditional approaches to HCI design do not take full account of embodiment, i.e. they are not in accord with the activity they aim to support. More generally, the everyday practice of HCI is as non-rationalized and uncritical as those whose activity it aims to support. In the publication he suggests that *embodied interaction* turns action into meaning and defines it as – “Embodied interaction is not a technology or a set of rules. It is a perspective on the relationship between people and systems. The questions of how it should be developed, explored and instantiated remain open research questions.”<sup>v</sup>

Relative to Dourish’s statement the use of embodied interaction and the tools that achieve this through the human body in a VIS is an attempt to account for each user preference and limitation. The activity that is the aim to support is a creative expression within an interactive environment that encourages a reciprocating expression, witnessed by an observer as a fluid causal interaction where the user is manipulating a feedback that stimulates the senses. In this way, a series of “*Body Electric and Reality Feedback Loops*” which in (minimal latency) real-time looks as one sinuous action/interaction causal sequence.

This system has been used in VR navigation (Brooks 2002), entertainment (Brooks 2004b, Brooks & Turner 2003) and therapy/rehabilitation (Brooks 1999, Brooks 2004a).

## 6. Play & Entertainment across genres

The concept of SoundScapes revolves around the creation of a ‘play’ experience that is stimulating and entertaining for the user. Various examples are listed in this section so as to stimulate discussion and to exemplify the diverse applications for VIS.

An example of the entertainment value of the author’s concept within therapy and rehabilitation is with the Dolphin game (figure 1) that was created in the software program Flash as a specific exercise game for acquired brain injured patients. The interface to the game was two sensors that controlled the dolphin as it swam for dead fish that fell from the top of the screen. There was a score system and various additional agents to interact with as the game levels progressed. This example proved successful for the user group that was involved in the project. Often they would compare scores to see if they could achieve higher rank than their fellow trainees. The dolphin was controlled by body or limb gesticulation in the VIS. In this way the user is targeted to attain the “flow” state common in video game psychology so as to achieve a level of “aesthetic resonance” – [www.bris.ac.uk/carehere](http://www.bris.ac.uk/carehere)



**Figure 1 Dolphin Game<sup>vi</sup> opening window – gratis download at [www.soundscapes.dk](http://www.soundscapes.dk)**

As mentioned earlier in the text another form of entertainment that is implemented as a parallel complimentary research to that with special needs (example above with dolphin and brain injury rehabilitation) is with performance art. The author utilizes the same technologies in stage performance and interactive installations created for the public. In the stage performances biofeedback techniques are used that capture brainwaves, muscle tension, galvanic skin response and heartbeats in combination with other sensor and camera techniques for whole body and gesture tracking (figure 2).



**Figure 2 Author performing with biofeedback and VIS – Danish National TV circa 1995**

The use of sensors on the body not new - American pioneer Laurie Anderson’s performance “Drum Dance” in *Home of the Brave* (1985) – available on video - is suggested as a fine example of ‘entertaining’ with wearable sensor triggers that initiated various drum sounds as she struck the areas of her attire that had sensors inbuilt.



**Figure 3 Three images of children from a workshop in the C.O.I.L. installation**

In Interactive installations use is made of system programming that accounts for public intervention within the VIS. A popular and successful example of one of the author's public installations was 'The COIL' (Circle of Interactive Light) that toured leading Scandinavian Museums of Modern Art for two years - 1998 - 1999. The COIL consisted of numerous invisible passive sensors that were set up in a large room (ubiquitous / pervasive). Any movement within the room activated actions that made the space 'playable.' Author created interactive sculptures, interactive painting, and musical events formed the available playful holistic collage.



**Figure 4 Interactive sculpture in the C.O.I.L.**

The public were encouraged to explore and encounter and communicate. Workshops were hosted for schools as well as for disabled groups in the museum closing times. A prerequisite was that all ages were able to enjoy the COIL.



**Figure 5 Mother and child enjoying the Circle of Interactive Light C.O.I.L.**

One startling discovery from the installation was that when sitting in the dark and observing the various interactions and then conducting interviews afterwards where the public told of their experience one could suggest as to the vocation or social and cultural backgrounds of the individuals. This is similar to that mentioned by Hakola (2001) also where the author suggests that the public create their own choreographical patterns related to their background.

Interactive Painting – a live active installation event where the artist paints on an interactive canvas under the observation of the audience has a proven value and entertainment value and is the subject of prior publication which details and extends the concept in use with live music painting events (for education, performance and installation) in Europe and New Zealand (Brooks 2004b).

Roskilde in Denmark is an annual pilgrimage for music fans throughout the world. It is one of Europe's biggest festivals with approximately 150000 people attending. In the millennium festival the author created two virtual installations that were interconnected with audiovisuals. Sensor technologies enabled interactions between the two large erections such that within each location the actors were able to view their co-actors who were located in the second installation. The feedback was virtual musical instruments and image manipulation.

### 7. Science fact - Science fiction – the artist's role.

The significance of the above examples is that they only hint at the potential use of VIS in art and human science. An adage of reference is that often 'before Science fact there was science fiction'. A statement exemplified by the detail that Arthur C. Clarke wrote about communication satellites in 1945 long before they were even a gleam in scientist's eyes. Similarly, a visit to any cinema to view the latest offerings of celluloid fantasia gives credence to the view that the writer and artist (as just two examples of more lateral thinking creators) are becoming ever more important as the seers towards innovative creations and strategies of the future. This is also witnessed within successful progressive corporate infrastructures.

### 8. Entertainment

The word entertainment is often quoted as "giving the audience what they want" - utilizing that knowledge within the research of therapy and rehabilitation is a simple but effective way to tailor the design of interactive environments relative to the goals of the intervention. The verb *Entertain* means to [1] provide with amusement or enjoyment [2] show hospitality [3] give attention or consideration to. The word originates from the French *entretenir*, from Latin *tenere* 'to hold.' In consideration of the applications outlined in this paper one can imagine how if a therapy is fun and entertaining a personal motivation which otherwise may be missing is present. This simple conceptual parallel between the therapy and performance art is novel and has been accredited by experts within various organizations. It has been funded at National and International level and is a constantly evolving body of work that is taking advantage of new technologies and inputs as they become available.

A suggested study relating to the earlier examples is

where the reader interested for further details initiates a reading assignment between human science, game psychology and performance art. For example Antonio Damasio's "The Feeling of What Happens: Body, emotion and the making of consciousness" and inter-relate the many human attributes that is discussed with the issues that are inherent to the VIS mentioned in this and the other referenced publications. In this way one can interpret themselves key issues and thus potentially develop their own fruitful cross fertilization as a result.

### 9. Conclusion - a new generation of therapists

The reading assignment suggested above is included as the author forever wishes to "turn-on" a new generation of therapists that evolve VIS into what the potential of utilizing technology in the human sciences with an artistic creativity and lateral thinking strategy is envisioned. In the text of some of those publications a new futuristic virtual body interface built upon nano technology is outlined, one that eliminates the need for any special clothing, hardware or other peripherals. The entertainment interface of the future will be the free air space around one's own body, tailored and controllable maybe from the mind. I would love to be here to play!

### Acknowledgements

The author acknowledges his good fortune that over the years versions of the VIS concept corresponding to the above examples have been presented throughout the world. He has led, directed and produced on many of these occasions, including at the location of the Olympic Games in 1996 in The Centre for the Performing Arts, Atlanta, USA, and in 2000 in Sydney, Australia for the millennium Olympics Paralympics. On other occasions the author has been invited to support events where the VIS concept was implemented, for example in New Zealand and throughout Europe. These events present the artistic talents of many co-performers, staff and supporters. The list is too long and it would not be professional to list any one name over any other. To those artists who have contributed in whatever from all over the world I wish to extend a heartfelt thank you and hope that this contribution inspires others to explore interactive entertainment technology applied in quality of life research and development so as to help others.

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Disclaimer: The concept of SoundScapes is an open platform for creative adaptation that gives an opportunity for potential improvement of quality of life. This can be through entertainment or in therapy or rehabilitation issues. Due to the scope of the concept there is often a necessity to give background and other pertinent details of the concept for a reader to associate the understandings required for a full picture in publications such as this. Therefore some details overlap between publications and whilst every effort is made to be brief yet explicit the author hopes that this does not affect the reading or deter the reader from exploring specifics within the research which is explained more fully in the author's referenced publications.

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### End notes

<sup>i</sup> E. De Bono, *Lateral Thinking* Ward Lock Education 1970

<sup>ii</sup> Refer to the Goldberg book in reference section.

<sup>iii</sup> MARS Exploratory Media Lab  
<http://imk.fraunhofer.de/mars> <http://netzspannung.org>

<sup>iv</sup> Cast01 (2001) Proceedings Chairs preface pp.8

<sup>v</sup> Dourish, P. (2001) *Where the Action Is: The Foundations of Embodied Interaction* MIT press, pp. 192

<sup>vi</sup> Dolphin game c/o P. McAtomeney.

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