The Cube: An Audiovisual Interactive Installation

Stavros Didakis*
MA Candidate, Sonic Arts Research Centre
Queen's University, Belfast, Northern Ireland, UK
Email: stavrosdee@msn.com

***Abstract* — New cross-disciplinary areas from sonic arts, to wireless interfaces, and visual graphics have been implemented into one system that applies high-level interaction from the user/participant. An embedded tangible controller is used to navigate between six different audiovisual landscapes and presents aspects of live-gaming performance as the user is able to "unlock" stages and explore virtual worlds. Other interactive approaches such as mobile technologies, website interaction accompanied with texts, visuals, and sounds have also been researched and applied, to create an immersive environment for communication between the audience and the installation.**

Keywords: Installation, Sensors, Live-Gaming, Interaction, Networks

I. INTRODUCTION

A. Background

During the mid 60s, new media art was born; a form of expression between different artistic genres that enables a unique mixture of unconventional experiences. The "Cybernetic Serendipity", presented at the Institute of Contemporary Arts in London (1968), was perhaps the first exhibition related to the art of the digital media and crafted well the idea that there is a way to upgrade a piece of art with new elements extracted from other important areas of our technological lives, and integrate them together as a new form of intellectual and artistic approach. A variety of technological advancements have enabled new ways for interactivity to all forms of art, making the computer an essential tool as it has become "more and more adapted to the human senses and action" [1]. It seems though rather important to understand how to use in balance the collision of art, science, technology and design, and as Professor Muriel Cooper stated [2], the recognition of the arts may be of higher importance than all the sciences, as is seems that "the arts is the science of enjoying life".

Following the philosophy that a proper combinational pattern can provide a step further to the evolution of our perception and state of mind, this project claims to have successfully merged harmonically artistic and technological elements into an interactive installation system where the participant becomes an author, director and maestro. The outcome of this experience may provide a new way for cross-disciplinary subjects to be experienced.

B. System Overview

One of the most important considerations for the design of this installation was to create a system that is able to control complex audiovisual data in a high level of accuracy, and provide the audience ways to interact with many parameters of the system, as well as to be able to transform a "constant flux of information that engages the participant in the way a performance might do" [3].

The system operates in a generative way always dependent on the user manipulation by using a wireless tangible interface as the main controller for navigation through six audiovisual spaces. As in Jeffrey Shaw's landmark piece "The Legible City" where the user can navigate a simulated city by riding a stationary bike, using this controller the user can visit sonic and visual worlds wherein unpredictable rules exist. Proximity detection is used in order to sense the necessity of the user to enter inside a specific stage, revealing sounds, videos, and visual graphics. The interactive performance then becomes an amalgamation of human effort and computer processing in real-time, providing "a new medium for artistic creation or even, in a more philosophical register, a new understanding of what constitutes an event" [4].

The information is distributed from the network to computers that each one performs a specific task for the accomplishment of this goal. The user experiences directly the alteration of his/her interaction from a powerful sound system and from three projection panels that are positioned with 90 degrees difference with each other, shaping an open-cube.

Further interactive approaches have been designed for the foyer area of the installation and provide the means for the participants to communicate with the system in alternative ways by using mobile devices such as phones, PDAs, or laptops to select sounds and images or send their messages/ideas/suggestions. Purposefully the interfaces are open for interaction, "and in themselves represent a level of content that warrants investigation" [3], as they try to extract participant engagement and devotion.

* Sponsored by Alexander S. Onassis Public Benefit Foundation. The installation is sponsored from the CETL, NI.

C. Initiatives

The strongest motivation for the underlying concept of the installation, is the 1997 movie "Cube" [5], directed by Vincenzo Natali, and produced by Cube Libre. In contrast with the movie though, this Cube uses its artistic and technological dynamics to provide a new state of interactive experience.

The suggested geometry from the movie is used for the construction of a cubic chamber of projection panels wherein the participants can alter the audio and visual algorithmic possibilities, defining the performing incidences and also create a sequence of events that finally becomes an inquisitive discovery. The combination of the user interaction and the computer performance transforms an empty and meaningless shape into a live object with feelings, moods, oddities and idiosyncrasies.

II. System Architecture

A. Architectural Space

The system is installed inside the state-of-the-art Sonic Laboratory of the Sonic Arts Research Centre [6]. The sound system uses 48-channel diffusion with a 360 degrees movement around the cubic room which is mounted in the middle position of the ground floor. The sound system surrounds the users and transforms the interaction into a fascinating experience, combined with images and videos from the projection panels.

Since the installation exists inside a characteristic physical space, it "incorporates underlying spatial and architectonic elements" [7], which are of great importance and are treated accordingly. Different lighting conditions reveal specific passages during the performance as also elevated panels are placed in various positions to bind the installation inside the physical space.

B. Interface Controller

For the purposes of this installation an interface was designed that enables high level control, and it gives the ability to the users to "coordinate the responses of the machine in an evolving musical context" [7]. A tangible cube object was used for the implementation of a triple-axis wireless accelerometer [8] that provides free movement of up to 30m of distance, and uses the angle tilt movements to control navigation or other control parameters, similar as in [9]. The performance of the interface may be closely matched to a game device like the Nintendo's Wii™ Remote Controller [10].

Figure 1 - Sonic Laboratory (SARC, Belfast)

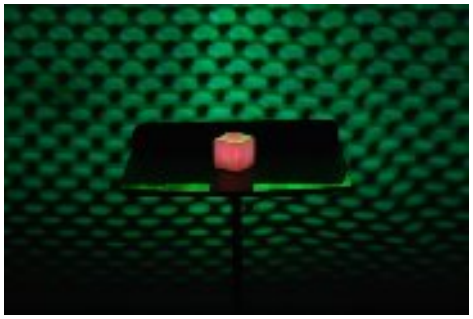

Figure 3 - Cube Controller (Photo by Neil Harrison)

Despite the simple design of the controller, a divergent dynamic mapping to a variety of control parameters has been implemented that makes the interaction even more meaningful, as it has also been suggested in [11].

The data received from the sensor are processed, analyzed, and filtered so that the values are within a useful and efficient range. The output signals are then distributed to the audiovisual processing stages with no faults or weaknesses whatsoever. There is a potential for improvisation depending on the gestural movement of the object. No instructions are given for the controller's use; the participant has to make effort to understand the reactions back from the system.

C. Networking

For the network implementation, Open Sound Control protocol is used [12] [13], to enable bi-directional communication between the main server and the processing clients. A variety of programming functions are used to help the system understand where, how, and when the information packages should be sent. If a specific process is valid inside a given context, the server distributes the requested information, and may receive data from the other computers as well. In spite of the structure complexity this system has, the network performance has been optimized to the maximum and no liabilities – like latency – have been presented so far.

D. Navigation System

The installation uses complete automation to the navigation system, which consists of six cubes that appear on the front screen. The objects are directly controlled from the interface and gestural movements create a gravitational field that defines the selection process.

A software proximity detector has been implemented that makes use of a fuzzy logic algorithm, allowing the interpolation between the six selections. The detector is attached to the audio and visual output, enabling a fascinating generative way to control the system. As in [14], there is an isomorphic approach, where changes in the sound modality cause changes in a different modality, the 3D visuals. While the user explores the sonic and visual field, the audio frequencies of the sources change accordingly, and when the detector senses a movement close to a source, an entrance point of a stage is revealed.

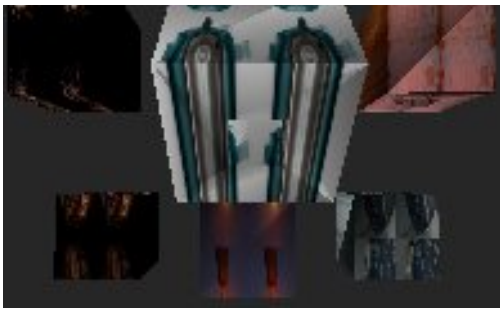

Figure 4 - Navigation Interface

E. Sonic Stages

In each stage there is an electro-acoustic composition that comprises from a fixed-media part and a part of sonic layers that are controlled from the interface.

The interface commands relate to the electro-acoustic compositions by triggering the sound material that is closely matched to the main temporal and harmonic structure of the pieces they relate to. The combination of the triggered layers with the structural functions is that what shapes the composition and thus the performance itself.

The quality and quantity of the sonic transformations are defined by the composers, as different generative sonic algorithms have been programmed for each stage. Sounds may be triggered, granulated or not, as also the ambience of the sonic elements may change while in different temporal conditions. Further than that, spatial sound diffusion, spectral processing, filtering, equalization and many other transformations are enabled with the use of the wireless interface.

Many of the algorithms inherit the game-like approach, where the interface is a joystick and the composition is a locked mystery that the users have to explore and open musical passages through the rotation of their gestural movements. The layers of sound may be fused together - or not - giving the freedom to the user to decide what is the continuance of the experience.

F. Visual Accompaniment

As it has been already suggested in [15], "there is substantial empirical evidence that music and moving image interact in powerful and effective ways". This argument was a good initiative to set up a stage where videos and visual graphics would accompany the compositions in such a way that they could reflect their artistic qualities. The video landscapes that have been prepared try to express a variety of moods like tension levels, disturbing or euphoric passages, space qualities like metallic structures, liquid forms, shifting organisms, philosophical metaphors or even Eastern rules and traditions.

As far as the navigation system is concerned, visual graphics have been used in Jitter [16] in order to create six cubes that are navigable in a three-dimensional space. The texture of each cube displays a characteristic image from each stage so that the participants have immediate feedback of the selection system. The cubes on the screen are moveable depending on the gesture of the user, and at a specific threshold level an entrance point is revealed from the selected object to let the corresponding video pass through the projections. By entering and exiting stages different transitions happen that reveal hidden dimensions or synaesthetic stimulus [17].

G. Foyer Area

The development of the installation is taken even further by establishing a wireless network in the foyer area and developing a dynamic website that the visitors can use as a way to communicate with the system. From the website the users may want to use the electronic guest-book as a new social environment.

A thorough research was conducted to find ways for mobile interaction with a large audience in a sense that seems logical, acceptable and creative. Perspiration and logic both suggested WiFi 802.11b to be adopted, as it is one of the most common wireless protocols, and probably the only one that provides instant access to a global network, such as the Internet. As long as a hotspot provides access, any WiFi enabled device can participate to the foyer installation interactively, in a similar way as used in [18]. The system provides the opportunity for these devices to contribute from a website that was designed for the purposes of this installation. In the interactive website the visitors can write their comments and suggestions and also select between the six cubes in order to have a short preview. The information is linked with Open Sound Control, and is sent over the network and into the system. The data are processed internally and then displayed on the screen that is installed in the foyer area.

The purpose of this process is threefold. Initially, the screen is used to inform the visitors about the installation and its creators. Secondly, the screen is used as an electronic guestbook wherein the comments that are sent are displayed as scrolling multi-line text and may reflect the experiences of the participants. There is a speech function implemented that receives the text and generates spoken words, personalizing the interaction and creating a fun way to convert one medium into another. Finally, the process also serves as a preview section of the performances. The concept may be perceived as a communication path between multiple users and the system, creating a new and enjoyable social experience, as in [19].

III. DISCUSSION

The showcase installation was in 4th of June 2007 in SARC (Belfast). The visitors were really amazed by the impressive installation, and they seemed very curious to understand the concept and the way they can interact with the controller. Each person tried at least once the cubic object for some time and they seemed very pleased to explore the audiovisual landscapes.

The performance lasted for four hours, and the behavior of the system was outstanding. It worked stable with no glitches or other anomalies, as its processing

optimization has been configured to the maximum. The automation of the system is complete, and no configuration or other parameter alteration is needed.

The foyer area showed a remarkable traffic, as many people tried the system in a social context, submitting comments between themselves in a sense SMS mobile services work. The entertainment they received was more than expected, and although they did not submit their comments in the normal guest-book sense, it provided the means to exchange ideas and thoughts.

Further developments of the system will involve better algorithmic interactive utilities for both audio and visuals, and perhaps incorporate the wireless network functions of the foyer into the main system in order to create an even more interesting approach to interactive systems design. Another plan for the future may be to create multiple wireless controllers that each one will influence both the system and the other controllers as well. This in a sense will create an ideal audiovisual gaming atmosphere, engaging the participants in multiple levels that can be interchangeable always depending on the different possibilities that occur at each time.

IV. Conclusion

In this installation different technological advancements have been implemented in one complete system in order to provide a way for a game-like performance to be experienced from the users with the manipulation of an interactive controller. Variables such as motion and stasis affect the performance of the system, and in some cases the system stops "breathing" if no activity is sensed. For this reason, the system can be perceived as an organism with its own character and behavior, but it needs the human element to function and furthermore to be influenced dynamically by it. One basic consideration of the interaction, was to demonstrate its capabilities "that are immediately apparent to the user" [20], and to provide high-level audio manipulation.

Different aspects of interactivity have been studied and analyzed both theoretically as well as practical. The system mechanics have tried to resolve and combine different variables encountered, "into a concrete performance" [18], constructing the architecture of this game-like creative environment.

Figure 2 – Installation (photo by Neil Harrison)

Any number of participants may contribute with the use of mobile devices as a supplementary system has been set up in the foyer area of the installation.

The collaborative effort for interactivity defines the artistic and technological performance of the system. In conclusion, observational deduction reveals that the system provides the means for imagination enhancement, and may drive the participants into unexplored conscious or unconscious synaesthesias.

Acknowledgments

I would like to thank Johannes Birringer for his valuable help and artistic direction, which without it many stages would not have been materialized. I would also like to thank Pedro Rebelo for giving us the opportunity to create this installation. Lastly I would like to thank the following composers that participated: Mike Andrews, Luca Forcucci, Niall Coghlan, Nick Brightwell, Rory Bryson and Olivier Touche.

References

[1] A. Lucianni, "Enaction and Visual Arts: Toward Dynamic Instrumental Visual Arts," *2nd International Conference on Enactive Interfaces*, Genoa, pp. 2 – 10, 2005.

[2] M. Cooper, Interview from the New York Times, 11 November 2003.

[3] C. Paul "*Digital Art*," Thames & Hudson Ltd, London, 2003.

[4] http://people.brunel.ac.uk/dap/machuma.html

[5] http://www.imdb.com/title/tt0123755/

[6] http://www.sarc.qub.ac.uk

[7] R. Rowe, "*Interactive Music Systems*," MIT Press, Massachusetts, 1993.

[8] http://www.sparkfun.com/

[9] W. S. Yeo, "The Bluetooth Radio Ball Interface (BRBI): A Wireless Interface for Music/Sound Control and Motion Sonification," in *Proceedings of the International Computer Music Conference*, New Orleans, LA, 2006.

[10] http://wii.nintendo.com/

[11] A. Hunt, M. M. Wanderley, and M. Paradis, "The Importance of Parameter Mapping in Electronic Instrument Design," *Proceedings of the 2002 Conference on New Musical Instruments for Musical Expression*, Dublin, 2002.

[12] http://www.cnmat.berkeley.edu/OpenSoundControl/

[13] M. Wright, A. Freed, and A. Momeni, "OpenSound Control: State of the Art 2003," in *Proceedings of the 2003 Conference on New Interfaces for Musical Expression*, Montreal, pp. 153-159, 2003.

[14] R. F. Cadiz, "A Fuzzy Logic Model for Compositional Approaches to Audio-Visual Media," in *Proceedings of the International Computer Music Conference*, Miami, Florida, 2004.

[15] B. Courribet, "Composing Audio-Visual Art: The Issue of Time and the Concept of Transduction," in *Sound and Music Computing Conference*, Marseille, 2006.

[16] http://www.cycling74.com

[17] G. Berman, "Synaesthesia and the Arts", in *Leonardo*, vol. 32, pp. 15-22, 1999.

[18] A. Tanaka and P. Gemeinboeck, "A Framework for Spatial Interaction in Locative Media," in *Proceedings of the 2006 Conference on New Interfaces for Musical Expression*, Paris, pp. 26 – 30, 2006.

[19] http://www.simpletext.info/

[20] T. Argyriou, and A. Bulayev, "i-Map Trans-European Project. Reseach and Development of See you in Walhalla," in *Spielsysteme-Internationales, Interaktionslabor. Eine Documentation*, J. Birringer, K. Behringer, Ed., Gottelborn, 2006.

[21] J. Maeda "*Creative Code*," Thames & Hudson, London, 2004.