

ORME: AN INTERACTIVE AUDIOVISUAL INSTALLATION

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ABSTRACT

"Orme" (footsteps) is an interactive audiovisual installation., thought to be realized in a closed room. One person at a time enters the room and interacts with a virtual ambient projected on the floor. This virtual ambient recalls sensations of intra-uterine life contrasting with a picture of footsteps on a seashore.

1. DETAILS IN SHORT

Title: Orme

Author: Davide Morelli

Genre: audiovisual interactive installation

Duration: variable (5/10 minutes)

Ambient: Medium room (about 6x6x4 m), without light pollution.

Hardware: 2 PC, videocamera, videoprojector, quadriphony.

2. BRIEF DESCRIPTION

On the floor of a closed room are projected pictures that recall the intra-uterine life and pictures of footsteps on a seashore.

A camera scans the room for human presence, whenever it finds movement a virtual ambient (also projected on the floor) is influenced: a group of spheres move towards the person and reacts to thrusts (mass, inertial and friction laws are simulated).

Every virtual object is linked to a parameter of audio synthesis (a sinusoidal frequency, it's amplitude, a granulator voice position, etc..) that the person can control directly, just interacting with virtual objects.

Using Artificial Neural Networks various procedures are triggered when the virtual ambient general state reaches situations rean enough to a set of stored situations. Eg when many virtual objects are pushed simultaneously the artificial neural networks teducts the general state as "chaotic".

The informations generated by the artificial neural networks are passed to a finite state machine that keeps track of what has happened up to this moment. Each state reached by the finite state machine has associated

different pictures and sound samples, hence it implements the macrostructure of the performance.

3. TECHNICAL DATA

3.1. Hardware

The installation needs:

- A video-projector
- quadriphony
- a PC (laptop) with a usb camera, the camera should be placed near the projector
- a PC (another laptop) in LAN with the first PC, its output goes to the video-projector

3.2. Software

EyesWeb [1] is used to acquire the presence and the position of a person inside the room.

PureData [2] is used to analyze datas from EyesWeb (EyesWeb talks to PureData using OSC), for the mapping, event managing and audio synthesis

Externals: GEM [3], ann [4], pmpd [5]

PC's OS:

- First PC: EyesWeb runs on Windows2000 or WindowsXP
- Second PC: Win32, Linux or OSx

4. LOGISTICS

A single medium sized room (6x6 m), minimum height 4 m (the higher videoprojector the better the virtual ambient), without light pollution (EyesWeb requires stable lightning). Four speakers in the four angles (for quadriphony). A single entry (a door, better if in the middle of the wall), once entered the person will be free to move everywhere in the room without a predefined pathwalk

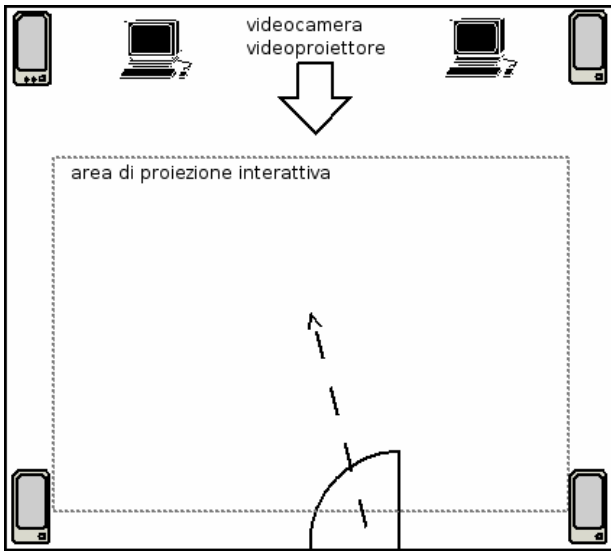


Figure 1. Logistics.

5. AESTHETIC

The virtual ambient is composed of pictures of:

- Muscles cells, neurons, mitosis
- Fetus
- Footsteps on the seashore
- Flowing water
- Sea waves

The virtual objects interacting with who is inside the room are little red spheres (about 10 cm diameter), they tend to slowly group, recalling the concepts of "cellular structures" and "organism".

The sounds are (directly and indirectly) controlled by the visitor interacting with virtual objects (spheres), pushing them and modifying their structure. Few sampled sounds are elaborated through dilatation (fft analysis and resynthesis), granulation, resonating filters (using Karplus-Strong algorithm), convolution reverb. Sampled sound are:

- Flowing water
- Sea waves
- Breathing
- Heartbeat

Are also present synthesized sounds: sinusoids arranged on A overtones, each overtone's amplitude is linked with a sphere velocity.

6. MAPPINGS

The installation is interactive because the visitor interacts with the virtual ambient displayed on the floor: he can push the spheres or let them slowly go towards him (there is a slight gravitational force between the spheres and the visitor). The virtual ambient obeys to simulated laws of mass, friction and inertia (using pmpd[5]).

6.1. Direct mapping

The first (and simpler) level of mapping is realized linking in a one-to-one relation some sound synthesis parameter to some spheres attributes:

- The velocity of each sphere is linked to the amplitude of a sinusoid
- The XY position of each sphere is linked to the XY position of the sinusoid in the quadriphony

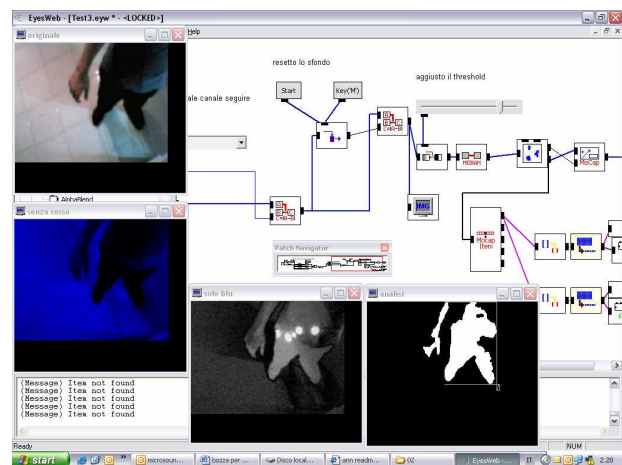
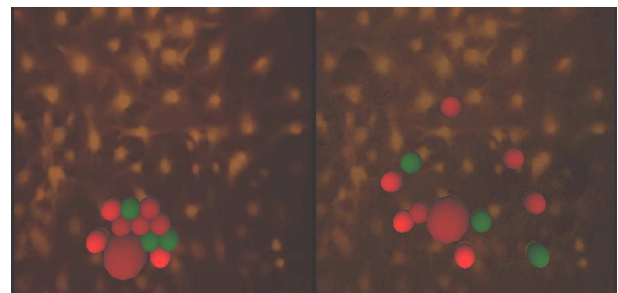


Figure 2. The EyesWeb patch that extract the visitor's position.



Figures 3a and 3b. The visitor (the biggest sphere) pushes the little spheres.

Usually the mapping is realized directly linking the performer with some sound synthesis parameter in a one-to-one relationship, here instead we link not directly the performer but the virtual objects moved by the performer. With a single move the performer can puch all the spheres. All the mappings are still one-to-one since it is the one that gives more control, we achieve a control over much more parameters simultaneously using a virtual environment that obeys to instinctively known laws (mass, friction and inertia). Using ten spheres, each sphere three parameters (x, y, velocity) we let the performers interact with thirty sound synthesis parameters (simultaneously or not).

6.2. Indirect mapping: artificial neural networks and finite state machines

The second level of mapping uses artificial neural networks and a finite state machine to determine the evolving of the performance: the artificial neural networks try to interpret the current situation with simple to understand but hard to code "meanings", eg "calm" when all the spheres have low velocity, "close" when all the spheres are close together, "chaos" etc.

An Artificial Neural Network is " is an interconnected group of artificial neurons that uses a mathematical or computational model for information processing based on a connectionist approach to computation"[6]. Using FANN [7] libs I coded a PD external that implements feed-forward multilayer perceptrons: `ann_mlp`; and `ann_td` for a time delay network (useful for gesture recognition). Both `ann_mlp` and `ann_td` are now part of the `ann` library.

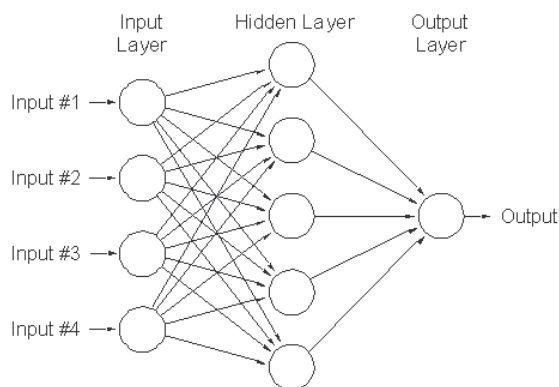


Figure 4. A feed-forward neural network scheme.

The outputs of the neural networks are the inputs of a finite state machine. A finite state machine is " a model of behaviour composed of states, transitions and actions. A state stores information about the past, i.e. it reflects the input changes from the system start to the present moment"[8].

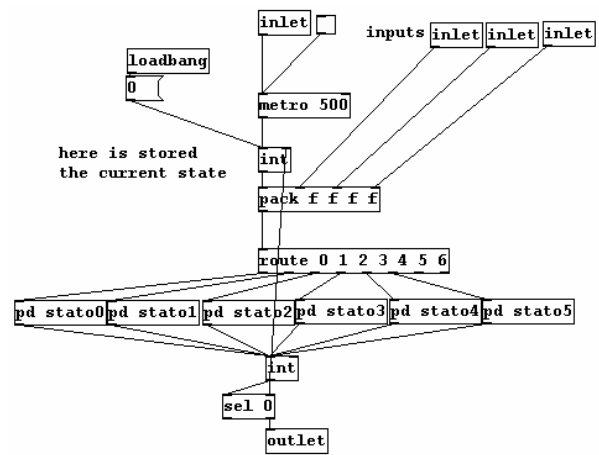


Figure 5. The implementation of a 6 states finite state machine in PD

Each state of the machine represent a section of the score, each section has associated pictures and sounds.

7. CURRICULUM VITAE

Davide Morelli was born in Livorno (Italy) on July the 31th 1975. Privately studied piano, guitar and flute, graduated in saxophone at "Istituto Pareggiato P.Mascagni" in Livorno. Attended "composizione musicale per lo spettacolo" (musical composition for theatre, ballet and cinema) with Roberto Sbolci and "ingegnere del suono" (sound engineer) with Cladio Vaira. Graduated in Information Tecnology at University of Pisa. Software developer in his small company Parser snc [9]. Composer since the age of eighteen, worked for theatre, ballet, short films.

8. LINKS

- [1] <http://www.eyesweb.org/>
- [2] <http://www-crca.ucsd.edu/~msp/software.html>
- [3] <http://gem.iem.at/>
- [4] <http://www.puredata.org/Members/dmorelli/ann>
- [5] <http://drpichon.free.fr/pmpd/>
- [6] http://en.wikipedia.org/wiki/Artificial_neural_network
- [7] <http://fann.sourceforge.net/>
- [8] http://en.wikipedia.org/wiki/Finite_state_machine
- [9] <http://www.parser.it>