Applications of the Soundscape Reconstruction (SR) Technology in Acoustic Ecology Research, Education and Entertainment

Constantinos Stratoudakis
Department of Music Studies
Ionian University, Corfu, Greece
strat@ionio.gr

Introduction

The Soundscape Reconstructor (SR) is a new technology first announced in the International Symposium of the Society of Music and the Computing on June 2007 (SMC07)[1] by the author and Dr. K. Papadimitriou. SR allows the reconstruction of the Soundscape of a given study area and takes advantage of a sampling methodology developed by a research of the Greek Society of Acoustic Ecology which was supported by three major Greek universities (Ionian, Aristotle and Crete) and the EEC program "Pythagoras". One of the characteristics of SR is its capability to be used as the engine for the realization of a series of interactive installations with educational, entertaining and artistic purposes. The addition of motion tracking technologies to the SR system for the extraction of the coordinates of a user moving in a virtual map (usually projected or printed on the floor of a virtual space) resulted in a series of installations based on SR, the typical structure of which we will present here.

Basic terms

Soundscape is the sum of all sounds that are produced by natural biological or human sources in a given area and it is the result of complex and highly interactive biological or natural procedures.[2] The methodology of sampling which was used by the research group in Greece involves not only field recordings but also subjective observations by trained researchers, measurements of the natural conditions like humidity, speed of direction of the wind, spectral analysis of the sounds etc.

The Soundscape Reconstructor is an interface initially developed in MAX/MSP which provides a real time reconstruction of the Soundscape of a geographical area for every point of it. The user can navigate and listen to the Soundscape from any point on the study area. The system can also map audiovisual elements like video, extra audio and graphics and trigger them as the user approaches specific areas on the map. The reconstruction algorithm uses sonic elements that are sampled on the field and data that are collected from the subjective observations to reconstruct a realistic Soundscape for every point of the area for the 4 seasons of the year (autumn, winter, spring, summer) and for every time of the day (in 3 hour steps).

From the application to the installation

In the first implementation of SR, realized in MAX/MSP, the user can choose a season and a time (for instance autumn, 6pm), create pathways in the area's map (displayed on screen) and listen to all the sounds that would have listened if he took the same route in the actual area. Furthermore he can choose to take the same route in another time of the day, or season of the year. The Soundscape Reconstructor reproduces the Soundscape accordingly. Pathways can be saved, loaded, time stretched and edited. Also graphics, video and data about the area and the soundscape can be mapped and reproduced. It's interesting to note that SR is not simply triggering audio events in relation with specific spots but reconstructs the Soundscape in a continuous way for every different location. Information about the nature of the Soundscape at any location and audiovisual events can be also projected and synchronized. This dataset includes volume of natural, biological and human sounds, description and volume of the origin of each sound, and of course time and geographical data.

After the completion of the pilot implementation of Soundscape Reconstructor we examined the possibilities to use it as the engine for the realization of a series of installations. This led to the idea of creating a virtual space that represents the actual area instead of using the computer screen and the mouse. The first sampled area was the Aharavi area in Northern Corfu, one of the Ionian islands of Greece. This area is protected by the Natura 2000 program because of its special ecological and natural beauty. The user can move (or stand) freely in the map or satellite photo of this area and listen to the Soundscape for any season of the year and time of the day he chooses in advance. Specific locations in the map

trigger audiovisual events that are projected in the walls of the virtual space giving information and views of special interest. The user can "record" its route, play it back for another season or time of the day and notice the variations of the Soundscape of the area, and even take it with him in MP3 form. The system records the produced sound as each guest moves on the map creating unique Soundscape tracks. This mechanism can be used for the presentation of a natural area of a special interest around 3 square miles (as in this case of Aharavi) making the audience familiar with concepts of acoustic ecology and ecology in general in an entertaining way.

The way a typical installation works is this: A DV camera (or more of the interactive area's scale is big) is watching the interactive area and feeds the video signal via a firewire cable to the motion-tracking computer which calculates the coordinates of each guest in relation with the virtual map. This system encodes all the guests' coordinates many times per second into MIDI control data and transmits them via a MIDI interface and cable to the Soundscape Reconstructor host. This computer realize the soundscape reconstruction for each user in real-time and transmit the resulting audio to the headphones of each guest. In addition they trigger supplementary video or audiovisual events which are mapped in specific locations in the virtual sound map, once the guest has approached them.

The structure can be seen in the following picture.

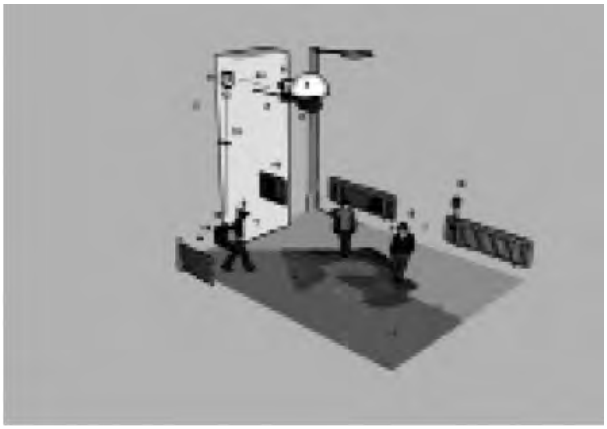

Figure1: Elements of a typical SR Installation

Basic elements explanation:

1. Floor / Soundmap (Surface 5 X 6,5 meters or more -with the same proportions- displaying a map or satellite photo of the actual area.)
2. Building or scaffolding. (Provides support for the camera and hosts the motion tracking system.
3. Camera support (For a lightweight camera)
4. Camera protection umbrella
5. Camera, Standard DV format
6. Flood light or IR light
7. Audience (1-6 persons, depending on the application)
8 Colored hat (For the color tracking)
9. Wireless headphones (Providing the Soundscape in real time)
10. Firewire cable (Transfers the DV image to the motion tracking computer)
11. MotionTracking system
12. USB MIDI interface (Transfers the coordinates of each guest to Soundscape Reconstruction computer)
13. SR host Computers (1-6 according to specification).
14. Headphones transmitter (Transmitting the Soundscape for each guest)
15. Time/Season selection pane l(It's a button based panel than gives each guest the chance to choose the season and the time of the day he wants to realize his virtual route)
16. PROJECTOR(s) or TV(s) (0-4 according to the specification)
17. Supervisor
18. Installation Information Board.

Conclusions — further research

We described the main elements and the functionality of a typical interactive installation based on the Soundscape Reconstructor technology. Our on-going research in this field is focused in three main areas.

1. Scientific research on acoustic ecology and evaluation of the sampling methodology.
2. Design of interactive installations for artistic and educational purposes.
3. Development of tools for the visually impaired persons using haptic maps and SR.

---

1 C.Stratoudakis, K.Papadimitriou. "A Dynamic Interface for the Audio-Visual Reconstruction of Soundscape, Based on the Mapping of its Properties". *SMC07 Proceedings.*

2 R.M. Schafer. 1969. *The New Soundscape: A Handbook for the Modern Music Teacher.* Canada: BMI, Don Mills.