Soundscape Models & Compositional Strategies in Acousmatic Music

By Apostolos Loufopoulos & Andreas Mniestris

This article features accompanying sound files, available online at: **http://www.akouse.gr/soundscape_journal_Vol11/loufopoulos_mniestris.html**

Abstract

Soundscape recordings of nature may often provide us with a valuable sound-basis as a primary compositional material, offering a rich sound world to transform and develop certain compositional strategies. Soundscapes can also be an inspirational source, offering a number of sound images and sound behaviours to be approached mimetically, and thus to develop a certain type of 'nature-oriented' musical language.

The soundscapes recorded on the Greek island of Corfu between 2006 and 2007 during the study of the Lake Antinioti area were captured at different times of day or night and during all seasons of the year. As such they constitute entities of different sound-environments, often demonstrating antithetical relationships regarding the existence of sound sources and sound-behaviours within their boundaries. To define these relationships through listening, one needs to consider a number of characteristics regarding sources and sound-behaviours and the manner in which these co-exist within the recorded soundscape.

Through the application of certain processing techniques, soundscapes may be transformed into different soundscapes or they may be deconstructed to their individual components. In the current research our aim was to create a rich variety of original 'sound vocabulary', overcoming basic problems existing in the recorded sound material (noise elimination, presence enhancement, event isolations, enhancement of tonality etc.) and further explore the transformational potential of the recorded and created sounds.

From a macro-perspective, and as can be concluded through the research, different 'models' of sound environments can be found within an acousmatic musical context. Such environments can be described as 'real-like' (or 'verisimilar'), 'abstract', or 'hybrid', depending on the degree to which they suggest the real world in which their constituent sources can be recognized, and also on the relationship between sounds and spaces with regard to recognition.

1. The Soundscape Project of Corfu

During 2006 a research group consisting of researchers from four Hellenic academic institutions, carried out a study of the rural environment of a NATURA 2000[1] protected area in the north of the Greek island of Corfu[2]. The aim was to study the spatial-temporal changes in the soundscape of this area by collecting, analysing and interpreting various types of data synchronously acquired.[3] These data were a) sound recordings, b) sound pressure level measurements and c) subjective observations. They were collected from 15 different points spread equidistantly, covering the whole area (spatial sampling) during two time cycles: a 24 hour cycle (one 10 minute sample every 3 hours which added up to a total of 8 samples) and a 12 month cycle (once every season, namely on the solstices and equinoxes)[4]. In this article we focus on the artistic direction of this project, which was the creation of original music based on the sound materials recorded during the data collection phase.

1 Natura 2000 is the centrepiece of EU nature & biodiversity policy. It is an EU wide network of nature protection areas established under the 1992 Habitats Directive. (http://ec.europa.eu/environment/nature/natura2000/index_en.htm).

2 Papadimitriou K., Mniestris A, Mazaris A., Tzanopoulos J.,Fragkiskos G., Koutsodimakis C., Valsamakis N., Pantis J.D.: Mapping the variations of a rural soundscape. The case study of Antinioti, Greece. (http://users.auth.gr/paki/files/soundscape/projects/Paper@WFAE09.pdf)

3 Matsinos Y.G., Mazaris A.D., Papadimitriou K.D., Mniestris A., Hatzigiannidis G., Maioglou D., Pantis J.D. (2008). Spatio-temporal variability in human and natural sounds in a rural landscape. *Landscape Ecology*, 23, 945–959.

4 ibid.

2. The Antinioti Soundscapes

2.1. Fundamental characteristics

The original sonic materials acquired from the field sound recordings can be described according to:

a) their spectral and morphological character, i.e. the spectral coverage, density, morphology, etc., and

b) their micro-structural semantic content, i.e. recognition of the sound source, space, distance etc.

Analysing the sonic materials in that way, we observed the following characteristics, which we consider fundamental:

a) Noise: The sound, quite naturally in outdoors environments, often gives a 'noisy' impression, in the sense of an almost complete absence of tonality. This 'noisy' character of most of the field recordings is the result of 'geophonic' elements on the one hand, caused mainly by wind-through-vegetation and sea surf, which were heard at almost every sampling point of the area; on the other hand it is the result of a multitude of indiscriminate sound sources coming from a continuum of very near to very far distances (such as sounds of various human activities, occasional traffic sounds from a distant major road, insect sounds etc.)

b) Complexity: In addition to 'noisiness' these sounds are characterized by a widespread spectral content, due to the sonic contribution of a plethora of sources sounding at the same time, and – perceived at the recording point – the same loudness, which makes the complexity even greater.

c) Spaciousness: Most of the time the recorded material gives the impression of a large sonic space because near sound sources coexist with discrete ones from various distances allowing for the perception of large spaces. The accuracy in capturing this characteristic depends, apart from the quality of the sound recording equipment and technique, on the landscape formations (large fields, far away hills, refraction[5] from the lake or sea, etc.)

d) Fusion: Most of the sound recordings' spectra display a broad acoustic energy distribution of various intensities. This is due to many coexisting sound sources, particularly when they sound simultaneously in comparable loudness levels.

2.2. Additional characteristics

a) Seasonal Sonic Diversity: Examination of the sound materials collected throughout a whole year revealed significant diversity of sound sources, sonic behaviours and sonic energy levels, depending on the season in which they were recorded. This is due to the yearly variation of geological phenomena, biological cycles and human activities.

b) Sonic Contrasts: Through a comparative study of the 10-minute audio samples we observed many significant differences in loudness levels and density of information. More specifically some of these recording samples are louder overall, either because of some predominant and clearly distinguishable sound sources active during the recording time or because of a plethora of such sources sounding simultaneously. In contrast, other recording samples sound very soft or "empty" either because of exclusively soft sound sources present during recording or an altogether minimal presence of sound sources.
Contrasts of this sort may appear between soundscapes during the daily and the yearly cycles (ex. early dawn vs. late night, summer vs. winter etc.)

3. The Compositional Process:

3.1 Problems and solutions regarding sonic material

Often the process of musical composition starts with solving problems related to selecting and organizing sound material as well as developing musical content from this material. During the first phase of approaching the audio recordings two basic problems had to be resolved:

1) The large amount of recorded material: Of a total of 480 ten-minute audio recordings each had to be listened to carefully and classified, in order to select a collection of fragments, from which the fundamental material for the composition was derived. In a second phase these fragments were extracted, subdivided into shorter fragments and were then used as the primary sonic material for the whole work[6].

2) The complex character of the sonic material: This is related to the usability of the sonic material as a starting point for an acousmatic piece. Indeed, the recorded soundscape very rarely contained discrete and well defined sonic events, consisting mostly of an agglomeration of many sources sounding at the same time in various degrees of loudness, proximity and locality. In addition, the tonal character of the sonic material was very limited – which was expected since it originated in a natural environment with a strong presence of 'noisy' geophysical sound sources (ex. the sea). To overcome this difficulty and in order to acquire 'well defined' sound materials for the piece, audio processing devices were applied which led to further exploration, variation and proliferation of the original sound fragments.

3.2 Transformations and compositional strategies

1) It became clear very soon, that additional recordings had to be made which would focus on certain sonic elemental gestures (ex. the sound of walking – steps on sandy ground). Sometimes these recordings were mixed with other sonic materials to create virtual soundscapes. Or they were processed in order to create isolated sonic events, which then were reintegrated into the context of the composition.

2) On other occasions, isolated sonic actions were created artificially, by applying heavy processing, rearranging the morphology of the recorded soundscapes. A characteristic example of this appears in the first part of the work Icarus[7] where a sonic event resembling a bird's 'flapping' gesture is derived from the sound of the sea. In this example, the transformation was made by applying a combination of amplitude modulation, pitch shifting and Doppler effects.

3) Very often it was necessary to separate some individual sonic elements originating in a certain sound source. Since, as we have seen, the soundscape recordings were complex entities of many simultaneously coexisting sound sources, it was necessary to use spectral filtering methods and algorithmic recognition of spectral characteristics.

4) On many occasions it was important to create sound material with intense tonal content – drones – to accompany foreground gestures, other tonal elements (like long notes) and to create harmonic backgrounds. These elements did not exist in the original materials and they had to be created artificially by means of processing through resonant filters, pitch shifting and time stretching.

4. Soundscapes and Acousmatic Appreciation

4.1. Composed structure

A "soundscape", or else a "sound environment", as it is composed in the context of a musical work or as it exists in the real world, can be structured by two categories of sonic elements:

a) sonic events, by which we mean sonic entities suggesting some kind of action. Usually they are sounds of short duration with clearly distinct beginnings and endings, evolving independently or in sequences.

b) sound *textures* (Smalley. 1997: 114), by which we are referring to entire sonic continua, which are conglomerations of a very large number of constituent micro-sounds (ex. roar of the sea, handclaps in a full theatre, etc.). A wide and more-or-less uniform distribution of energy is observed in the spectra of these sounds as well as slow – if any – changes during their temporal evolution. Textures do not suggest certain actions and even more, they do not suggest gestures. They may, however, refer to recognizable natural phenomena (ex. sound of the leaves resulting in a tree shaken by the wind).

5 Sometimes, particularly on recordings of a quiet night, a low hum is present coming from the engine of a ship passing-by many kilometres away.

6 Here the difficulty was partly reduced by the use of observer's data, where qualitative observations by a trained member of the research group, about the kind of sound sources that were forming the soundscape, were kept synchronously during the audio recording.

7 By Apostolos Loufopoulos

The combination of the above elements in various spatial[8] and temporal[9] layers constitutes the sonic basis for the composition of a soundscape. This sonic basis may be evaluated further, in detail, in relation to the loudness of each sound element, the kinds of movement each suggests and their individual timbral characteristics as they are combined. This approach relates to the microstructure of the soundscape.

On the macro-structural level, a definitive factor contributing to the shaping of musical form is the way in which the sound environments evolve over time, i.e. whether there is a gradual transition, an interruption, a fusion or a combination, etc. Thus the sonic basis for the composition of a soundscape, on the macro-structural level, can be evaluated further on the basis of the above factors, i.e. the relationship between different contributing sonic environments, the manner in which they are inter-connected as well as their relationship to the context.

4.2. Foreground-background relationships

In a soundscape, space is imaginary. This spatial percept is formed by cues emanating from the various sounding sources depending on their distances and their spread in reference to the listener (or the microphone system)[10]. The relationship of the sonic elements in regards to their positioning within this imaginary space is very important for the evaluation of the sonic context and can be described in terms of two imaginary zones, i.e. foreground and background. In other words, sonic elements within a soundscape can be on its surface (foreground), its depth (background) or the space in-between (middle ground)

4.3. Soundscape models and referentiality in the acousmatic context

All soundscapes within the context of a musical work can be described as 'virtual' since they are not real spaces but metaphors or representations of such spaces, even when they indicate specific recognizable acoustic spaces or when they are incorporated in a work as unprocessed recordings of real spaces.

The various types of soundscapes that appear in musical contexts can be described as "verisimilar" (or "real-like"), "abstract" or "hybrid".

As *verisimilar* we describe the soundscapes that suggest real spaces either as excerpts of recordings of real environments, or as soundscape compositions through the combination of sonic features, natural or artificial ('*mimetic process*', Emmerson, 1986: 17) and their spatialisation. These soundscapes are realizations of the model: 'real activities' (recognizable actions) – 'real spaces' (recognizable sites).

As *abstract* soundscapes we describe virtual soundscapes where 'real' or recognizable sound sources or places cannot be detected. However, they give an impression of an acoustic environment through spatial relationships of sonic events, i.e. impression of distance (loudness and spectral differences), reverberation and distribution within the stereophonic – or periphonic [11] – acoustic space. These soundscapes are realizations of the model: 'unreal activities' (unrecognizable actions) – 'unreal spaces' (non existing sites).

Hybrid soundscapes are a combination of the above two and can be described as 'supernatural' or 'surreal'. They realize the following relationships: a) 'unreal events' – 'real space' and b) verisimilar or 'real' events – unreal space. These soundscapes may contain 'ambivalent' elements, i.e. elements reminding of natural behaviours and natural soundscapes (ex. because of similarities with the morphological or spectral development of sound events in the natural world) but they are not sufficiently recognizable relative to their 'naturalness'.

The relationships described above are summarized in the following Figure 1.

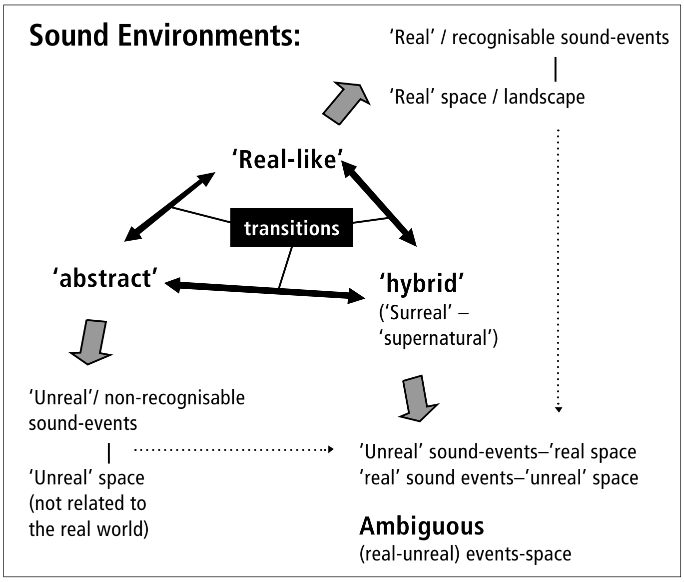

Figure 1: soundscape models within an acousmatic musical context

It is worth noting here – in relation to the above image – that during the unfolding in time of the musical context, the above types of composed soundscapes may be combined or transformed from one type to another (ex. an 'abstract' soundscape can gradually become 'verisimilar' or 'hybrid' through the gradual appearance of sonic elements suggesting recognizable sound sources etc.).

4.5. Sound Examples

A couple of characteristic examples drawn from the work *Secret Coast*[12] can be highlighted here, demonstrating different models of composed/transformed soundscapes within the acousmatic context:

(Example a): 'human walk on the shore…'

A real-like environment is demonstrated in this example, taken from the introduction of the work, although this environment is not actually 'real'. It is composed by mixing different recordings (distant sea noise, close-to-water sound, summer insects, human walk on sand) mixed in such a way as to suggest a real space, and moreover to indicate the human experience of it: the close, always present human steps, together with the change of scenery suggest a human exploring and observing the coast, and the listener being metaphorically 'in the ears' of this created observer.

(Example b): 'hybrid night…'

In this example, a 'night' atmosphere is suggested, consisting of foreground animal-like motions and ambient night sounds. During its temporal development, this night soundscape gradually becomes more and more 'supernatural' in that the sound behaviours in it gradually become mysterious and tend to get detached from the initial environment. More specifically, insect sounds become over-amplified and crispier, and animal-like gestures become more ambiguous and hard to recognize. Moreover, the ambient cricket texture (also artificially mixed) becomes interwoven with a harmonic background. This sound-environment metaphorically may suggest the idea of transition from reality to the dream world, which is dominant throughout the work.

8 i.e. sensation of distance and direction, distribution of sonic sources etc.

9 i.e. dynamic evolution, interaction, alteration, etc.

10 Blauert, J. *Spatial Hearing: Psychophysics of Human Sound Localization* MIT Press; 2nd Revised edition

11 Gerzon, M.A. "Periphony: With-Height Sound Reproduction", *J. Audio Eng. Soc., vol. 21*, pp. 2–10 (1973 Jan./Feb.)

12 By Apostolos Loufopoulos

References

Emmerson, S. (1986). The relation of language to materials. In *The Language of Electroacoustic Music* (ed. S. Emmerson), pp. 17–39. Macmillan Press, Basingstoke.

Loufopoulos, A., (2005). *Nature in Electroacoustic Music*, Ph.D. Thesis, City University London, Music Department, London, United Kingdom.

Loufopoulos, A., (2010). *Soundscapes as the primary source for electroacoustic composition* (translation from the Greek language), post-doctoral essay, Ionian University, Department of Music Studies, Corfu, Greece.

Smalley, D. (1986). Spectro-morphology and structuring processes. In *The Language of Electroacoustic Music* (ed. S. Emmerson), pp. 61–93. Macmillan Press, Basingstoke.

Smalley, D. (1996). The Listening Imagination: Listening in the Electroacoustic Era. *Contemporary Music Review*, 13 (2), 77–107.

Wishart, T. (1986). Sound Symbols and Landscapes. In *The Language of Electroacoustic Music* (ed. S. Emmerson), pp. 41–60. Macmillan Press, Basingstoke.

Apostolos Loufopoulos and Andreas Mniestris are founding members of the Hellenic Society for Acoustic Ecology and the Hellenic Electroacoustic Music Composers Association. Andreas is associate professor at the Department of Music Studies at the Ionian University in Corfu, Greece. Apostolos is scientific collaborator / faculty member at the Department of Sound Technology and Musical Instruments at the Technical Educational Institute of the Ionian Islands, Cephalonia, Greece.

http://www.ionio.gr/~tas/staff/mniestrisE.htm
http://www.essim.gr/en/members/Apostolos_lloufopoulos.htm

Towards a Theory of Museological Soundscape Design: Museology as a 'Listening Path'

By Michail Zisiou

Museological experience takes place in a fine-tuned 'museological scene' where time and space unfold as the visitor wanders among exhibits. It is indeed like telling a story…

Abstract

The traditional image of museum as a peaceful, monumental institute, where cultural heritage is preserved and presented in an uncontested way to be worshipped, is being challenged little by little in many parts of the Western world. The fulfillment of the educational and entertaining role of a new museum may be achieved through active and interactive ways of learning so that the visitor can be 'touched' and eventually acquire a complete museological experience. However, with the exception of certain innovative projects, there seems to be little awareness in the museological community at large of the communicational potential for methodically designed soundscapes. This essay underlines the necessity for the existing knowledge and experience around the fields of Soundscape and Museology to be gathered and combined in order to form a theory of Museological Soundscape Design along with an expanded model of methodology which would be incorporated in museum studies. Such a theory may be outlined in a framework of certain principles derived from various scientific fields such as museology, acoustic communication, education theory, music aesthetics, acoustics, psychoacoustics, architectural theory etc. Finally, a new field of expertise is proposed, that of soundscape designer–museologist by analogy to architect–museologist, archaeologist-museologist or educator-museologist.

The 'New Museum'

According to recent trends in museology, "both museum communicators and audience are construed as active meaning makers with the field of meaning being in permanent flux" (Hooper-Greenhill 1994, 17). Having multiple ways of perceiving exhibits is encouraged by the contemporary museological theory which has been generally influenced by the main concept of post-processual archaeology. According to this relatively new field of theoretical archaeology, material culture may be perceived as a reflection of multiple meanings which are produced through social action (Hodder and Hutson, 2003).

In the process of finding successful ways to communicate the meanings of a certain collection to the public, museologists make key decisions regarding the aspects of an artefact's context (social, personal, historical, gender, economical, technical, aesthetic, etc) which could be highlighted in order for it to form the appropriate *museological scene*. These decisions also involve classifying and grouping artefacts as well as tracing routes for the visitor to follow.