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An Introduction to Eco-Structuralism

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Abstract

This paper introduces a new approach to music composition we call eco-structuralism. The techniques of eco-structuralism include analysis and transformation of sonic structures in environmental sounds. This paper elaborates on the motivations, process and techniques of eco-structuralism as a formalized method of music making that implements the principles of eco-composition.

Of all the sounds despatched abroad,
There 's not a charge to me
Like that old measure in the boughs,
That phraseless melody
(Dickinson 1890)

1 Introduction

Environmentally-based musical composition methods have a long history. In antiquity musical phrases often mimicked nature, a characteristic that prevailed for centuries (Dahlhaus 1982). The mimetic relationship with nature shifted to inspiration from nature as composers desired to express their personal perception of the environment. This slow evolution from mimesis to abstraction contributed significantly to the debate on the perception of music (Kivy 2002). The change in these ideas of music and its role in society paved the way for compositional processes such as *Serialism*, *Musique Concrète* and *Soundscape Composition*.

This paper will briefly explore the history of environmentally based compositional methods, describing where eco-structuralism finds its place. The fundamental ideas upon which eco-structuralism is based will be examined. The practical steps of this method will then be outlined, explicitly defining the rules governing the process. Practical examples will be given to explore the current implementation of eco-structuralism, and to define areas that need more attention.

2 Environmentally Based Composition

Imitatio Naturae, the imitation of nature, was a philosophy in art that endured throughout the middle ages and onto the 18th century. This philosophy can be traced back to the

writings of Plato and Aristotle on mimesis, on mimicry (Dahlhaus 1982). This form of art was used initially as a style of writing in which the writer could take the form of a character, in effect become the character.

The philosophy of mimesis was incorporated into the liturgical writings of the Christian movement. It allowed the early Christians to continue following the example of Christ and imitate his actions, but in a humble manner, not trying to become better than him, only to be like him (Friesen 2005). This idea became central for many of their rituals and traditions, and was accordingly used throughout their art and music.

The persistence of the imitation of nature in music into the 18th century is exemplified with Vivaldi's *Le Quattro Stagioni* (*The Four Seasons*), published in 1725. This piece quite clearly demonstrates the imitative process. Over the next one hundred years however a new form of art replaced the idea of imitation. The form of *Natura Naturans*, nature in the making. No longer were artists and composers content with imitation. They wanted their music to be subjective, rather than objective. Ludwig van Beethoven's Symphony No.6, Op.68 "Pastoral", written in 1808 is an early example of this move from objectivity to subjectivity within music (Dahlhaus 1982). No longer was the composer content to imitate nature, they wanted to create their own soundscapes.

This new creative paradigm however resulted in a number of new directions, ranging from the romanticists who created nature based on idealism, and utopian desires, and the realists who portrayed the world as they saw it. As opinion became more torn, the debate on aesthetics heated up. Composers were asked to explain their music, and try to justify how something ugly could be heard as aesthetically pleasing (Dahlhaus 1982, Kivy 2002). Diverging opinions over this resulted in the development of many forms of music. One form of particular significance to this paper is atonal serialism.

Atonal theory tore down the structure of tonal music and built a new musical structure based on a very specific rule set. Because of strict serialism, atonal music was able to maintain an internal coherency and practicality (Schoenberg

1975). A paradigm of following strict musical processes has continued since this period, as can be evidenced in the music of Iannis Xenakis (1971) and other musicians who use mathematical concepts and computational models as formal frameworks for musical composition.

Along with changes in philosophy and changes in ideas on aesthetics, there were also advances in technology that contributed to new forms of music. The most notable for the purposes of this paper is the development of the tape recorder. The tape recorder allowed for a new form of composition known as *Musique Concrète*, developed by Pierre Schaeffer (Dack 1994). Using a tape recorder Schaeffer and his colleagues went beyond any previous form of imitation and made music with direct copies of nature. They then used numerous recorded sections (sound objects) to form musical structures, thus abstracting the sounds from their source and providing new sonic landscapes (Field 2000, Hodgkinson 2001). So in a complete turn of contemplation, nature was no longer being imitated, nature, or at least a copy of nature, was imitating abstract musical structures.

Whilst some composers were working on mathematical structures, and others were creating abstract structures with tape recorders and later generating them on computers, R. Murray Schafer was listening, but he wasn't listening to them. He was listening to his environment.

3 Soundscapes

Despite his best efforts, Schafer noticed that it was getting harder to hear nature. Schafer decided he needed to do something about this and began the process of documenting the decline in audibility of nature (Schafer 1994). This endeavor was taken up by others as well and became the World Soundscape Project (WSP). The WSP collected audio samples of specific places, analyzing them over a period of time in order to document the encroachment of sound pollution, and created a vocabulary in order to highlight specific audio concepts. Along with the WSP came a new compositional form called soundscape composition, which focused on the sonic environment. This was not an abstract sound recording. It had a meaningful purpose in context with its origin (Truax 2001).

Barry Truax, a member of the WSP, developed the form considerably using granular synthesis techniques. This allowed him to compose with the sound recordings, but he was always careful to retain enough of the original sound, so that the original sound could be heard. It was just transformed and modified in a musical fashion (Truax 1994a, 1994b). Many other composers have used Soundscape composition techniques, including John Rimmer (2006), David Rothenberg, Pauline Oliveros, Hildegard Westerkamp, and Francisco López (Rothenberg

& Ulvaeus 2001). Damián Keller and Truax have extended the form of soundscape composition even further, by introducing other aspects of ecology into the compositional process (Truax & Keller 1998).

3.1 Eco-composition

Art critic Robert C. Morgan coined the term eco-composer, whilst discussing the installation *Vivir sin después* created by Keller and Ariadna Capasso for the 2004 exhibition at Haim Chanin Fine Arts (Keller 2006).

Morgan used the term to describe the role played by Keller in combining aspects of ecology with compositional processes. Throughout the *Paititi* project, Keller's work takes into account the history, ethnography, and geography of the sound he is manipulating. When he created the sound recordings from the Amazon rainforest on his trip toward the land of El Dorado, he was not just trying to capture the sound of the immediate area; he was trying to capture the history of the area (Keller 2004). The creation process of the project was mimetic in nature, in that he was reenacting a previous journey, but the result was far removed from imitation. This kind of composition requires a very different kind of listening. No longer can a listener just ignore the original context of the sound. They are instead drawn into the sound and invited to take the context of the entire area into consideration (Field 2000, Keller 1999). They are offered the abuse and slavery of the local inhabitants of the area, and the starvation that followed. The listener, in turn, interprets the composition through their own set of values, upbringing, and perceptions (Keller 2004). In order to fully comprehend the musical work the listener is asked to contextualize these feelings within the framework of the composition (Keller 2000).

Other composers who have experimented with ecological implications within their music include Agostino Di Scipio (2003) who worked on interactive audible ecosystemic signal processing, Matthew Burtner (2005) who has been working in an area he called ecoacoustics, and Ana Lúcia Fontenele who has written a series of musical pieces using ecological techniques (Fontenele 2003, Keller 2005).

4 Eco-structuralism

Eco-structuralism is derived from the framework of eco-composition. It is a method for composing with the situated sound samples in a manner that is designed to reveal and retain the qualities of those sounds and contexts. Sound recordings are analyzed, and the resulting data is mapped onto resynthesis processes to create new audio material, or the data is used to arrange the sound recordings.

The fundamental principle of eco-structuralism is that the structure of the sound event must remain intact throughout the compositional process, although it is often transformed

or distorted. In maintaining structural identity, it is intended that the essence and the meaning of the sound event (and indirectly its context) should continue to resonate within the composition. The perceptions of the composer and listener to the affordances of the sound event can also inform the compositional process (Gibson 1966). Eco-structuralism attempts to find structures within the sound event that can be used to carry some sense of the events, objects and situations that caused the sound. This approach is reminiscent to Plato's search for the forms. Plato had no access to the true forms he only had access to the imperfect replicas made by the demiurge. With a sound sample, we only have a replica of an event. With analysis of that material, and critical listening approaches, we strive to achieve some semblance of its structure. That this approach is sympathetic to the general eco-composition ideals is evident in Keller identifying the importance of defining sound structure.

By zeroing in on the structure of the sound event itself, it becomes possible to extend the network of meanings along most time scales and into the realm of perceptual cues.
(Keller 2006)

If we can reveal the structure it allows us to truly make use of the ecological content from within the sound event.

4.1 The Rules of Eco-Structuralism

In eco-structuralism, patterns are derived from analysis of natural environmental sound sources that reveal structures within the material. These structural data are used as the dominant material for creating the musical composition. To the extent that these patterns remain intact the resulting music will maintain integrity with respect to its ecological content.

Some processes with which the structure is uncovered and extracted are defined below, as are methods for transforming the structure. There are many ways in which to employ the structure without destroying it. These modes of employment will be outlined within the rules.

The following list contains the rules for non-destructive collection and manipulation of structures.

Primary Rules

- Structures must be derived from natural sound sources.
- Structural data must remain in series.

Secondary Rules

- The amplitude, frequency, timbre and spatial structures may all be extracted and used as individual structures.

- Not all structures from a sound sample need be used.
- A structure may be transformed to perform a different sonic task than it initially performed.
- Small sections of the structure may be extracted and used separately, but the internal structure of that subset must remain in series.
- A structure may be transformed through elongation, compression, inversion, reversing, scaling and offsetting.
- A structure may be abstracted from, to reveal a second order underlying formative structure, which must then follow the rules of eco-structuralism.
- New tasks may be added to the set of rules as long as they obey the primary rules

The primary rules contain the overall foundation of the process and all secondary rules are bound to these. The secondary rules serve to understand how the primary rules may be interpreted.

It is acknowledged that we always deal with imperfect sound replicas, analysis and perception. Just because we may have analyzed a sound event and found a structure, does not necessarily mean it is the absolute structure, or that it is even very close to it. This allows us to find many perspectives on the sound without prioritizing one view over another.

Once structure data have been collected the composer then uses the tools and secondary rules of eco-structuralism to generate new sound material. These rules provide guides for compositional actions. The spirit of eco-structuralism is to ensure, where possible, that aesthetic characteristics of the original sound sources are captured within the structures and will remain accessible in the final composition.

5 Practical considerations

In pursuing the eco-structuralism project so far, a number of practical issues have arisen from the need to extract structural information about the sound event. As part of working through these issues an attribute study was conducted to pinpoint the various attributes of a sound event. The attribute study thus far has pinpointed the attributes of amplitude, fundamental frequency, timbre, and spatialization (Opie 2005). For each attribute of the sound event, computer programs were developed to analyze the structure of the sound. Further software tools were developed to implement and test compositional rules that could be applied to the structures.

For each attribute a software program was written to systematically analyze the sound recording and create structure data pertaining to the attribute. For example the amplitude attribute revealed the structural envelope that

pertained to the changing amplitude throughout the sound event at various degrees of temporal resolution. This envelope could then be used as a compositional component.

Programs for secondary analysis were developed that delved deeper into the data to reveal patterns in the structural data. For example a data-mining tool was developed which searched for recurring structural patterns. These recurring patterns were noted as important structures within the sound event and were extracted as fundamental structures. Probabilistic, statistic and quantizing methods were also used to search for more secondary structures.

A number of compositional programs have been created to test compositional uses of the structure data. For example, a time stretching program was developed for the fundamental frequency structure. The program took the fundamental frequency and stretched it as far as the composer wished whilst retaining the frequency curve. These techniques were considered important by Barry Truax in Soundscape composition because it enabled the sound to be put under the sonic microscope (Truax 1994a, 1994b). Compression techniques also assist in revealing large-scale structures that are not easily perceived in real-time.

This project is ongoing and we are still exploring other techniques of sound analysis and data transformation as tools for eco-structuralism. Software programs that implement these techniques, when complete, will be combined into a toolset that can be used to assist with the creation of eco-structural compositions.

6 Conclusion

The influence of nature as a compositional stimulus has long been a feature in music making. The imitation of nature has evolved and more recent composers have created abstract works inspired by their observations of natural structures. With the advent of recording devices composers harnessed the sounds of nature and manipulated them sonically, either taking them out of context, or highlighting their sonic context through signal processing. Composers have also sought to create conceptual models of nature to explore musical ideas.

Eco-structuralism is a new approach to music composition designed to maintain the characteristics and context of a sound whilst not necessarily using the original recording data directly. Eco-structuralism formalizes a method that may be used to compose within the philosophical framework of eco-composition. Eco-structuralism is a simple but comprehensive compositional approach, currently in its infancy, and in this paper we have articulated a foundation upon which we hope eco-structuralism can expand.

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