AESTHETIC IMPLICATIONS OF THE
ECO-STRUCTURALIST PROCESS

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ABSTRACT
This article explores the aesthetic implications of eco-structuralism. Eco-structuralism is a method of music composition that utilises the sonic features of natural sounds as structural elements in new compositions. This paper places eco-structuralism within an aesthetic and analytical framework. It explores views of aesthetics and nature and discusses how eco-structuralism is positioned in relation to these ideas and considers some aesthetic opportunities of the eco-structuralist process.

1. INTRODUCTION

We can hear sounds whose meanings are not intended for us as if they were music and soon call them beautiful. This is part of music’s power [19].

For a long time people have contemplated the connection between sounds in nature and musical sounds. The process of eco-structural composition is a computer music approach that exists within this tradition. Eco-structuralism is a formalised musical composition technique that uses structures derived from sound recordings to dictate the compositional process. This technique takes a serial approach to the collected data [16].

This paper will explore various aesthetic and analytical considerations that are raised by eco-structuralism. It will, firstly, consider various views on aesthetics, and then various views on analysis. These considerations will be used to understand some of the musical implications that arise in this compositional technique, and to suggest how these implications allow a more extensive understanding of eco-structuralism.

2. AESTHETIC CONSIDERATIONS

For many composers nature has been an inspiration and a metaphor for music. For others, the imitation of nature has been a source of musical material. Such mirroring of nature was, according to Rothenberg [19], an “aesthetic dream” of John Cage and goes as far back as Aristotle’s vision of techne. At one level, all environmental sounds can be heard as music, and it was in this direction that Cage was inclined. The imitation or mirroring of nature includes the imitation of bird song as melodic themes and, since the advent of sound recording and the techniques of musique concrète, the direct and manipulated use of environmental sounds as musical materials.

The process of eco-structuralism employs the forensic capabilities of digital signal processing to examine the microstructures of natural sounds and uses those data as compositional building blocks. This inevitably places eco-structuralism within the debate on aesthetics and nature. A question remains, however, about whether eco-structuralism implies the kind of psychological reaction that conflates arts and nature in Cage’s conception, or if there are more subtle aesthetic implications in the translation and reinterpretation of structural elements that eco-structuralism employs. To delve into this we need to revisit some of the background of the shifting sands of aesthetic debate.

The term aesthetics has been in use since Alexander Baumgarten first used it to distinguish between knowledge and perception of art in 1735. His idea of aesthetics was to understand how we perceive or experience art [3]. Immanuel Kant in 1790 provided aesthetics with a much more universal approach. He proposed that art be viewed from a disinterested perspective; a detached or disengaged perspective would allow the critic, he argued, to make a more pure more universal judgment on the artwork [5]. The disinterested position enabled the critic to avoid the temptation of seeking and proving pre-determined outcomes. Kant was also of the opinion that music is of such a transient state that although it can suggest sensation, it cannot articulate any precise concept or meaning [3]. In contrast, Hegel took up a counter position, stating of music:

This earliest inwardness of matter and inspiration of soul into it furnishes the medium for the mental inwardness itself as yet indefinite and for the soul into which mind concentrates itself, and finds utterance in its tones for the heart with its whole gamut of feelings and passions [4].

Nietzsche and Schopenhauer along with many other philosophers extended this emotional view on the
musical aesthetic, with Schopenhauer (1819) stating, “Music...is such a great and splendid art, it creates such a powerful reaction in man’s inmost depths, it is so thoroughly and profoundly understood by him as a uniquely universal language, even exceeding in clarity that of the phenomenal world itself” [13]. This idea led the way for many varied aesthetic ideas on the notion of feeling and emotional content in music. This perspective on aesthetics allowed the discourse to become very subjective.

Hanslick took a functional perspective and refuted the claim that music contained any emotion whatsoever saying:

The course hitherto pursued in musical aesthetics has nearly always been hampered by the false assumption that the object was not so much to inquire into what is beautiful in music as to describe the feelings which music awakens.

[11]

Hanslick went on to claim that “art aims, above all, at producing something beautiful which affects not our feelings but the organ of pure contemplation, our imagination” [11]. His view of music aesthetics was a reductionist idea that “Music has no subject beyond the combinations of notes we hear, for music speaks not only by means of sounds, it speaks nothing but sound” [11]. Hanslick argued that sound and music have momentum. What we hear, and what we recognise is not a shift or change of expressed emotion, it is more directly an expression of change and motion in tone, and within that lies the means for aesthetic expression.

Eli Siegel based his ideas somewhat on those of Hanslick, but developed an aesthetic philosophy called Aesthetic Realism. It is described as “a way of seeing reality as a whole” [10]. The core principle of Aesthetic Realism is that:

“there is no fundamental difference between the structure of reality and the structure of beauty. Moreover, the very nature of self is aesthetic”.

[10]

Aesthetic Realism takes a structuralist approach to aesthetics, but relies on an aesthetic dialectic to explain art, nature, and reality. It shares with structuralism an appreciation of the organisation of nature but understands nature to contain dialectic structures or patterns or tendencies and seeing beauty in the balance of these dualities.

Roger Scruton, in opposition to Aesthetic Realism, devised a non-realist approach to aesthetics, in which he reintroduced the emotional or experiential discourse into the debate on aesthetics. His theories were influenced by those of Schopenhauer. Scruton [21] identified five key points that need to be considered in an aesthetic of music. They are:

1. Music does not represent objects or actions, except at the margin.
2. Nevertheless music is often meaningful, in the strong sense that there is something to be understood in it.
3. Listening to music is an expression of aesthetic interest, and music is understood through the aesthetic experience.
4. Music is not a language, even if it is like a language in certain respects.
5. The expressive qualities of a work of music form the most important part of its content.

Scruton emphasises the use of ordinary words as metaphor in the discussion of music. These metaphors, he suggests, play on our imagination in order to evoke emotion.

Nick Zangwill, in response to Scruton and building on the Aesthetic realist approach to understanding music, extends the realist philosophy and criticises Scruton and other non-realist aestheticians, claiming that “Emotion is a thorough distraction when thinking about the nature of music” [22].

We can see that there is a debate in the world of aesthetics between the significance of structure in the musical object on the one hand and human perception and experience of the musical object on the other. It is not our intention to resolve this in this paper, but it is necessary to point out that the aesthetic implications of eco-structuralism are clearly more closely aligned with those who suggest that there is meaning and beauty in the structure of artistic objects that is somewhat independent of individual perceptual differences.

Eco-structuralism is concerned with how structures in the natural sound world can become generative materials for musical composition. Therefore we will next focus on the connection made between nature and aesthetics, which is the aspect of aesthetic theory which most directly impinges on eco-structuralism.

3. AESTHETICS OF NATURE

Plato gave the first template for an aesthetics of nature when he introduced the idea of the form. The form, he stated, is the universal prototype of everything in nature. Any tree is striving to achieve the pure form of “the tree”. It will never achieve this perfect form, because it is an imperfect tree in an imperfect world, however, it strives regardless toward that form. The beauty of the tree can be gauged in considering its participation in realising the form [18]. This idea was also used, in part, to establish the idea of mimesis, a philosophy and practice where the artist tries to mimic nature.

Kant also wrote about the aesthetics of nature. He ascribed the aesthetic experience of nature to be only basic, when compared to the experience of artistic beauty [20]. Kant went on to suggest that
The aesthetic pleasure of nature comes about only if an object's form agrees, accidentally, as it were, with a form that the imagination could have invented on its own. It is the comparison of the actual form with the counterfactual form that decides on whether we judge the object to be beautiful". [20]

This idea is somewhat similar to that stated by Plato, except that the form presented by Plato, and that presented by Kant have a different place of origin.

Another sceptical view of nature and aesthetics was held by Hegel who suggested that when judging the beauty of nature we feel significant vagueness and that such judgements lack sound criteria. He proposed, therefore, that an aesthetic theory could not be constructed on the beauty in nature. Instead, such a theory should be relegated to the realm of high art where objective categories are possible [20].

Schopenhauer, in his commentary on aesthetics, was also cautious when contemplating the aesthetic appeal of any individual natural object. He did, however, comment on the aesthetic appeal of a natural ensemble of objects. He was, perhaps, unable to accommodate his insights of the aesthetics of nature within the structure he had proposed previously with art [8].

Malcolm Budd provides a comprehensive coverage of aesthetics and nature. He describes how some people undertake a discourse about the intrinsic aesthetics of nature that others observe nature as a creation of God and appreciate it for its ingenious construction, as did Messiaen. He draws a parallel with aesthetic appreciation of art, where some appreciate the object while others the artist. Budd, however, makes the distinction between that which is man-made, and that which is not. He states that an aesthetic appreciation of that which is not man made must be made on its own terms, and not in considering nature to be an artefact. When you hear birdsong the aesthetic experience, he suggested, is not in hearing a pattern of sounds, and is certainly not a sound intentionally determined by artistic consideration, instead one delight's in the effortlessness of "the sounds issuing naturally from a living sentient creature, more specifically, a bird" [8]. He goes on to state that the function of the song is not to provide us with pleasure, but instead to attract a mate, or affirm its territory1. This, however, need not detract from an aesthetic response.

An attractive conception of the aesthetic represents a response as being aesthetic insofar as the response is directed at the experienced properties of an item, the nature and arrangement of its elements or the interrelationships among its parts or aspects, and which involves a felt positive or negative reaction to the item, considered in itself, rather than as satisfying a pre-existing desire for the existence of something of that kind, so that what governs the response is whether the object is intrinsically rewarding or displeasing to experience in itself [8].

In this way, a person can make an aesthetic judgement based on their experiences with that work at that present time, the aesthetic qualities are not predetermined by "arrangement of its elements". Following this position, a composer using the eco-structuralist technique will choose a sound based on their experience of that sound hoping to imbue their final composition with some of those same characteristics which formed that initial experience, but at all times the composition will itself be judged as to its intrinsic value and a transfer of aesthetic experience is in no way guaranteed. The eco-structuralist composer is still responsible for crafting the aesthetic potential of the work.

4. ANALYTICAL CONSIDERATIONS

The rise of modernist influence in music, especially in techniques such as Schoenberg's 12 tone series led to a focus on the form of music, and eco-structuralism as a kind of serialism also privileges form. However, formalism has roots as an aesthetic approach in the nineteenth century, well before serialism, with its chief source of promotion found in Kant's Critique of Judgement [15]. In this sense it was Formalism that gave precedence to formal structure of music as its essential defining characteristic. At a time when orchestration and compositional structure were seen to be somewhat independent this may seem uncontroversial, but for computer music composition where timbre and spectral morphology are understood as significant then formalism may require a more subtle definition.

The writer Eduard Hanslick [11] provided an influential view of formalist musical aesthetics in the mid nineteenth century. His views of musical structure went beyond the mathematical to embrace the metaphysical and the notion that the musical structures somehow contained the spirit of the composer or their thoughts.

In more recent times, much of the analytically-based computational musicology research, for example that by David Cope, David Huron and David Temperley, could be argued to implicitly follow a formalist view of music without the metaphorical overtones.

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1 Hartshorne has investigated bird song to find that some birds derive both aesthetic and musical pleasure from their own song [12]. To propose that the bird is the composer is however an issue not investigated, and beyond the scope of this research.
Theodor Adorno wrote numerous papers on aesthetics in which he explored and expanded on Kant’s original aesthetic ideals; one issue that deserves exploration in this context is the way he situates the aesthetic judgement of autonomous (or disinterested) music within the political (Marxist) realm. He argues that the impact of culture informs the musical process, and forces the composer to mimetically express authoritarianism, in order to give it a false sense of emancipation. He stated that “art is the sedimented history of human misery” [1].

While generally trying not to engage in political interpretations, Structuralism accepts the impact of culture on artistic appreciation and production, and indeed actively seeks to find traces of culture and identity within the art work. It is an analysis method whereby objects can be interpreted or studied in a framework of communication. The Structuralist acknowledges the ability of structure to carry meaning. They will use the structure of an art work to convey a message, and they will analyse art work assuming the same intention. The beauty therefore is inherent in the structure itself [3]. An understanding of social and cultural activities takes on an analytical importance as a source of signs to look for in a structuralist interpretation [2].

A reinterpretation of structuralism was undertaken by the postmodernists, in which the emphasis of interpretation is placed on the observer rather than the creator. It still accepts the communicative power of structure, however it also identifies the problem in which the structure alters the context or perspective of the message [3].

Eco-structuralism is clearly an approach with structuralist tendencies. Analytical methods appropriate to eco-structuralist works will likely involve analytical deconstructions of the materials and their form to observe the sources and elaborations of materials in the work. However, the social and possibly even political resonances in the source materials in particular cannot be overlooked, especially in the 21st century where ecology and the natural environment are hotly debated topics in society.

5. MACHINES AND NATURE
There may seem to be an obvious disconnect between the discussion of computer music—often made by mechanical means—and nature, especially natural sounds, processes and structures. This dialectic becomes especially critical when examining the heavy computational, analytical and even compositional processes that are undertaken by a computer in eco-structuralism. There is often considered to be a great distance between the natural and man made, and an even greater distance to the machine made. Budd commented, for example, that man made may be ‘bad enough’ but machine made is even further removed [8].

How might we reconcile this apparent distance, and what is the impact on the aesthetics of the work when significant creative control is devolved to the eco-structural processes and the computer? This idea is especially compounded when one considers that computer programming is invoked as a self-reflective task, rather than an exploration of the natural structural richness. However, we suggest that this line of argument can get problematic, especially if music is considered a human construction and therefore perhaps, as Heidegger might suggest, simply another technology.

This dilemma can, however, be avoided if one considers the computer to be an extension of the human. The computers agency is a delegation on behalf of human agency and ultimately controlled by human artistic decisions. The computer does provide a place for ideas to be developed and expanded upon without the limitations imposed by the real world or even the human mind. This increased capacity allows a composer to take real world structures and use them in a new structural context, transforming them into art forms for musical expression, treating the computer as an assistant in the process [7].

Another interesting angle on this discussion of nature and machines is that some might consider nature as a machine [9], and thus the project of eco-structuralism seems to be simply a transduction from one machine structure to another. However, while eco-structuralism is a technological enabled process we generally intend that it is a tool for music making and so we recall Lanier’s advice that; “Music must not be seduced by technology but must seduce technology” [14].

At the opposite end of that argument is the notion that humans and the machinations of humans are a part of nature [17]. David Dunn has performed many explorations in nature that incorporate a human made sound being projected into nature to capture how the environment responds to it. He views the sounds of humans and human devices as an act of communication within the natural environment [17].

Aesthetics are driven by limitations and opportunities of human perception, culture, and tools. Musical structures typically arise from any of these sources and eco-structuralism attempts to add to the richness of compositional processes and techniques by considering the natural environmental context as a source of compositional inspiration. So it is the aesthetics of eco-structuralism that we will now consider in more detail.

6. THE AESTHETICS OF ECO-STRUCTURALISM
In defining the aesthetics of eco-structuralism, we need to dissect the components of the process and give each component a weighting of importance and relevance to the overall scheme of eco-structuralism. In this way we
can determine aesthetic values of the components that relate most directly to the intrinsic process of eco-structuralism.

The source material (sounds) from which the structural content is derived has aesthetic significance, however, we know that there has been no compositional process or any kind of artistic endeavour that has created the sound. Plato and Kant have both stated that nature has a form which it aspires toward, and by which we can assess the aesthetic state of nature. Hegel and Schopenhauer, however, feel that an assessment of aesthetics in nature is unnecessary. Budd has stated that our appreciation of nature occurs when we undergo aesthetic dialogue. Such a dialog can occur between composer and listener. The composer makes the first statement by choosing and has given the sound merit by using it as a sound source. According to Budd there is an opportunity for a response by the audience in noticing and appreciating these choices in what they are hearing, potentially enhancing their aesthetic experience.

We feel that a combination of the formalist ideas and the appreciation model can work well together in understanding the aims of eco-structuralism.

Once the composer has selected a particular sound due to its aesthetic qualities, eco-structural processes allow them to analyse the natural sound with the intention of transferring some of these qualities to the composition. The philosophical idea underpinning the success of eco-structuralism is that there is some change and motion within the source sound that can be successfully captured and applied for artistic endeavours. The structures in nature are in essence templates or archetypal structure in order to use this structure to imbue their artistic endeavour with similar natural motion. Plato and Kant have both stated that nature provides a rhythm and a natural series of events that may seem very random to the casual observer, however, when compared to true randomness these events are merely irregular. This natural irregularity is something that offers many musical possibilities. When used as a compositional structure it could dictate when certain musical events take place; such as a phrase change, a musical accent, a rest, a change of musical instrument, change in tempo, a new movement, the rhythmic pattern or melodic pattern for a melody or harmony, etc.

Natural irregularity can also be used more directly in sound generation processes to produce and modify tones. One specific method we have been working with is to use the eco-structural data as a waveshaping tool. One of the benefits of this process is that it allows the composer to easily add colour to a simple sine tone in a controlled and repeatable manner. The same data can be applied to any sine wave tone to add the same colour across an entire range of pitches. As an example of this process we compare five different generated tones. Each tone began as a sine wave. The eco-structural data chosen for this was an amplitude structure generated from the file “boulanger-beach.au”, a 25 second seaside sound event captured at Aruga, from the OLPC CC collection by Dr Richard Boulanger.

The first tone is the simple sine wave at 320Hz. This unaltered sine wave can be easily generated, although it is very unnatural and clinical sounding (See figure 1).

The second tone was generated by adding the eco-structural data to the sine wave using the waveshaping synthesis method. The generated waveform was reduced in amplitude very slightly to avoid clipping at a couple of points. This waveform quite visibly and audibly has a certain roughness and colour, without disturbing the pitched quality of the tone (See figure 2).
The third tone was generated by adding the eco-structural data to the sine wave using the waveshaping synthesis method at double depth (ie eco-structure x 2). The generated waveform was reduced in amplitude to avoid clipping at numerous points. This waveform has an identical structure to figure 2, however those same irregularities have been enhanced (See figure 3).

The fourth tone is a sine wave that has been waveshaped using a random number generation algorithm. Unfortunately the waveform has now lost integrity in terms of its sine wave origin. There is still some form left, however it now contains constant zero-crossings, and needed to be halved in amplitude to reduce the constant clipping. It contains primarily white noise and can no longer function adequately as a pitched tone (See figure 4).

The fifth tone generated is a waveform which was created with the waveshaping synthesis method using the same eco-structure as in figure 2 and 3, however in this example the data has been scaled in time, and each point is interpolated from the current data point to the next data point. The time scale factor was x 10. The generated waveform was reduced in amplitude very slightly to avoid clipping at a couple of points. The resulting waveform has retained most of its contour, however, it has more colour and timbral variation than a sine wave. (See figure 5)

Figure 1: A sine wave

Figure 2: An eco-structure applied directly to the sine wave

Figure 3: An eco-structure data applied directly to the sine wave at double the depth rate

Figure 4: A random number sequence applied to a sine wave
acknowledged that eco-structuralism has, perhaps more than many compositional techniques, interesting aesthetic implications given its deliberate invocation of nature as a direct source of artistic inspiration.

9. REFERENCES


8. CONCLUSION

Eco-structuralism is most easily positioned as a post-structuralist concept, in which the preservation of the structure is the most important feature of the process but the cultural factors relating to the source materials and reception context are acknowledged as significant influences on the aesthetic experience of the work. We acknowledge the inherent flaws of the analytical process, in that the natural aesthetic properties are diminished through the analytical and re-mapping process.

If there are parallels between the aesthetic appreciation of natural sounds and eco-structural music based on those sounds, as we would hope there might be, the question of at what level these relationships manifest themselves is still an open question. Is there any similarity at the level of structural recognition, expressivity, emotion evocation or representation, timbral correspondence, or some other means of transference? As we have shown, answers to these questions invoke long debated questions about the aesthetics of music which we do not claim to have resolved in the discussion, but we do hope to have

There are a number of useful applications and benefits of this process. Because the structure is preserved in such a strict structure, the same tonal quality can be applied to any sine wave or tone in a precise and repeatable manner. This application allows a composer to add a degree of irregularity very easily, whereby they can build up an entire series of tones with similar or even identical tonal qualities, to use in a musical composition. As can be seen from figures 2, 3 and 5, the eco-structural process works as a good middle ground between pure sine waves and noise. It adds a certain degree of complexity and irregularity, without having to rely on some kind of random process.

These examples all deal with eco-structuralism at the microstructural level, however at the macrostructural level the same aesthetic potentials are also available. We have been experimenting with the use of structures as devices to alter the tempo of music, and to dictate the length of movements and phrases. This area is still under heavy investigation, and will be discussed further once we have more complete musical examples to work from.

Figure 5: A stretched, interpolated eco-structure applied to the sine wave

Note: These examples can be heard at: http://www.ecostructuralism.com/database.php


[18] Plato, *Republic VII*


