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Emerging Musical Structures in Electroacoustic Music

ABSTRACT

Background

This research seeks to propose a method for aurally transcribing electroacoustic music and some analytical techniques that use the transcription as their basis.

The term 'Electroacoustic Music' is not universally recognised to indicate a specific genre — many people exchange it freely with the other terms such as 'acousmatic' music, 'experimental' music, 'electronic' music. However, it is generally accepted and understood to identify music that focuses on timbre, and that includes both electronic — i.e., computer-generated or controlled — and acoustic — i.e., real-life — sounds as a source of material for the composition. What seems to be universally accepted about this music is that it defies analysis. The fact that is based on timbre and normally lacks regular pitch and rhythm — not to mention that it lacks a followable score — seems to make it incompatible with most if not all extant theories of music, to the extent that some have trouble applying the term 'music' to it.

In the last decades, many scholars have sought to tackle the issue, or parts of it; some with considerable success. In particular, Brian Fennelly (1967) has shown how it is possible to separate all audible sounds in a piece and label their spectral characteristics through alphanumerical strings in order to subsequently compare them. More recently, Stephan Roy (2003) has established a method to classify all sounds in three main categories, in order to simplify the transcription and relate different passages in the piece. Lastly, the *Groupe de Recherches Musicales — GRM —*, as well as others such as Pierre Couprie (2016) have pursued computerized analyses through software — e.g., the *acousmographe*, or 'Eanalysis' — that allows to set graphic representations of different sounds and their characteristics in connection to the piece's sonogram and waveform. On the other hand, recognizing the difficulties involved in the analysis of electroacoustic music, others such as Bruno Bossis (2006) and Michael Young (2016) went as far as deeming inappropriate the process of segmenting timbral music and its sounds in a traditional way.

While allowing significant advances in the comprehension of the structure of electroacoustic music and highlighting the peculiarity of the practice — not to mention influencing this very research — for the most part the above studies have tended to avoid direct relations to standard musical theories, thereby assuming a substantial lack of similarity between the repertoire in exam and more traditional music. This assumption seems to be based on the fact that the act of listening to electroacoustic music is substantially different from that of listening, for example, to a tonal piece. This research intends to provide a different perspective.

Aims and repertoire studied

Starting from the assumption that certain interpretive strategies are employed by listeners regardless of the repertoire they are listening to, this research seeks to demonstrate that structural associations and models inspired by extant theories can emerge from examining pieces that employ a very different grammar from those that were initially targeted by such theories. The final aim is the attempt to bridge the gap that exists between music theoretical pedagogy and the work of electroacoustic composers. In this view, the connection with traditional theories is crucial: it allows to assert and formalize that the difference between a classical fugue and an electronic piece is smaller than one may think.

While applicable to a variety of timbre-based music, the author chooses to exemplify his methods with an analysis of a piece by Italian composer Agostino Di Scipio, titled *Audible Ecosystems 3b*. The case of this piece seems particularly effective because it represents one of the farthest possible examples from traditional composition that could be thought of. Indeed, it is an example of what we could call high-level composition, in that only the non-linear dynamic system that generates the piece is designed by the composer, not the sonic outcome itself. Yet it is possible to show how several small-scale elements of the piece are replicated on the large-scale, and how is therefore possible to hear a clear structure in the overall experience of the piece.

Methods

The proposed transcription is the result of the attempt to generalize the methods used by B. Fennelly, S. Roy, and the GRM. Sounds in the piece are identified and labeled according to their perceived source, onomatopoeic designations, or simplified Fennelly-derived strings, in order to suggest their spectro-morphological characteristics to the reader. The process of listening to the piece and identifying the sounds is helped by running the sound file though a software such as the *acousmographe*.

All sounds are then divided in three main groups: stable, unstable and fragmentary, depending on their variability in time — i.e., the continuity of their waveform. Each group is associated to a graphic symbol. Sounds are thus laid on the score according to their symbol they are associated to, and are ordered from top to bottom starting from sounds occupying higher frequency registers to those occupying lower frequency registers, as in a traditional score. Sound labels are used as instruments names. The time line can be divided in measures when a relevant time unit is identified. In the case of Di Scipio,

each measure lasts 20 seconds. The result is a graphical score, but very close in layout to a traditional score.

The analysis begins with a formal inspection of the piece, helped by the score and by images taken from the *acousmographe*. The piece is indeed divided in sections and subsections according to the same criteria used in a traditional piece. By examining the vertical behavior of the graphic signs − that is, their movement in the frequency range − some motivic gestures are isolated and subsequently compared to each other and to large-scale frequency shifts, showing the possibility of large-scale motivic deployment. The core of the analysis, however, is based on three novel methods, called 'density patterns', 'dominance patterns', and the 'instability index' (or SI in short).

The first two track the presence and evolutions of specific sounds throughout the piece in order to provide statistics-based structural schemes. More specifically, once a musical passage is chosen for scrutiny, one can identify its density level and its dominant sounds. The term 'density' refers to a combination of elements, namely number or sounds or voices playing at the same time, rhythm of the passage, and occupied frequency range: the higher the value of these elements, the higher the density. Different density levels can be compared to show a lower- and higher-level density patterns in the piece. On the other hand, in any given passage a specific sound can be considered more or less dominant if, compared to other sounds, is more or less present and more or less loud. A dominance pattern table ranks the level of dominance of the sounds throughout the different sections of the piece: this allows to identify which sounds establish character of the piece on a small-scale level and on a large-scale level.

The last method, inspired by transformational theory, tracks the transformations in the perceived tension at different moments or passages in the piece. More specifically, a certain level of tension, or instability, is identified by noting the percentage of unstable or fragmentary sounds that are present in the passage in relation to stable ones. Percentages are rounded up and translate to numbers from 0 − lowest instability − to 4 − highest instability. In Di Scipio's case the measure is used as the minimum unit of scrutiny. Indeed, the intensity levels of the different measures of a passage are shown on a graph and connected by lines, thereby showing the SI transformations by way of exhibiting a specific linear contour. This process is repeated on a higher level, using longer passages or entire sections instead of measure, thus allowing to compare small-scale and/or large-scale patterns. Figure 1 illustrates a similarity between the linear contour of the SI graphs of subsection b and subsection b' of Di Scipio's *Audible Ecosystems 3b*.

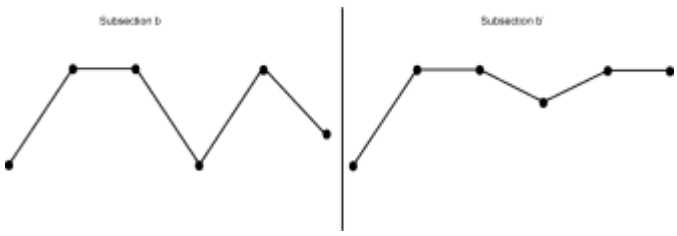

Fig. 1, SI graphs for two subsections of *Audible Ecosystems 3b.*

Implications

The result of this research has been that of illustrating quite strong structural connections between otherwise difficult-to-relate elements in the piece, as timbral and gestural small- to large-scale correlations. While most of the conclusions can − and potentially should − be heard in the piece, they were formalized in a way that attempts to fill a gap between seemingly incompatible theories. Since the methods used are quite intuitive and music-theory based, they can easily be employed by any person with a music theoretical background to illustrate quite in detail the structure of any electroacoustic piece. Indeed, it could open the electroacoustic repertoire to a larger crowd of music scholars who generally felt quite distant from it. Ultimately, the proposed methods can be extended to music that is instrumental in nature, but lacking traditional strategies of pitch and rhythm organization.

Keywords

Electroacoustic music, musical perception, analytical theory, transformational theory, timbre, transcription, Agostino Di Scipio.

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