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How something is born, lives and dies

A composer's approach for thematic evolution in electroacoustic music

by Orestis Karamanlis

Abstract

This article describes a compositional strategy that is applicable to tape, mixed or live electroacoustic pieces. It suggests that envelopes can function as musical motives similar to the old traditional fashion. A particular energy-shape can be viewed as the common denominator around which complex gestures can evolve and group together forming higher-level structural blocks. The transformation of these shapes and their merging into an architectural whole takes after the homogeneity of traditional musical forms, yet the thematic evolution using electroacoustic techniques provides an entirely different musical utterance for the composer. The strategy is exemplified by analysing a recent composition for Santur and live electronics running on SuperCollider.

Background

I was always interested in the birth and death of a musical event and its hierarchical place within a composition. In the micro-level composers are occupied by how a musical gesture will be articulated and in the macro-level by when and why it will occur. It is of no secret that many working in the studio compose in a fairly intuitive fashion. Upon deciding on the source material and going through some preliminary plans, examinations and transformations, they sculpt the sounds by constantly reacting to the soundworld, thus, becoming listeners in relation to the result and re-evaluating at every stage.

One of the advantages when working with digital technology is the ability to visualise data. Indeed many composers when working with computer music software make use of breakpoint files and graphic curves to shape the spectrum of the sound through time, and even though the ears should be the only judge of the success or failure of a particular musical gesture, it is inevitable that the visual representation of some processes influence the way we think. This is a rather complex issue to deal with: the affinity between the aural and its representation on a computer screen and how a composer's actions are influenced by this relationship. In the following paragraphs I exemplify the use of envelopes as thematic entities and the structural possibilities they offer mainly in a programming language environment.

On motive

Western tonal music considers the basic motive to be the germ of the musical idea including elements of the subsequent figures, being in a sense the 'smallest common multiple' (Schoenberg 1967, 8) ... the features of which are combined to form higher level structural units. The organisation of phrases to greater blocks enables composers to construct larger passages and movements with audibly coherent formal organisation (Hatten 2004, 240). The unity and thematic consistency resides in the use of a musical entity that functions as the foundation on top of which the whole piece is constructed. On the surface the elements may appear contrasting but in reality they are manifestations of the same idea. 'In fact, it is this being "different on the surface but alike in kernel" in which is centered the inner process of musical structure of the last centuries' (Reti 1978, 5). Smalley (1997) observed that the gestures in electroacoustic music do not possess the same hierarchies as tonal music and consequently often resist

segmentation. I will demonstrate that viewing envelopes as a means for thematic evolution provides an additional structural dimension, at least from the composer's perspective.

Applying musical shapes

In computer music software a breakpoint file [1] is not a musical sign, neither is an automation curve altering the values of a variable parameter within a signal-processing tool. It is not intended for the performer, it does not carry any symbolic connotation and contains no reference to any form of human performance. It simply provides a means to communicate with the computer in a graphic environment while representing an energetic shaping through time [2]. It is plainly a representation of a gesture, a graph, a shape, a scheme, or in other words an envelope [3] that can be as large as anyone wants and which can be easily mapped to any musical parameter. It can tell us how something is born and evolves, how something lives and dies. Being only a series of numbers usually defining energy along the vertical axis and time along the horizontal axis it can be viewed as a structural building block through the prism of a musical motive. A basic envelope-shape can function as the smallest common multiple for a whole piece. The idea of viewing a shape as a musical molecule does not make complete sense in electroacoustic terminology since the segregation of a texture is often impossible. Yet, the purpose here is not to provide a comprehensive methodology for analysis of electroacoustic pieces, but to demonstrate the specific strategy from a composer's perspective.

Let us suppose that we are working within a programming language [4], such as SuperCollider, and create an envelope-shape by drawing on a graphic window, by algorithmic generation, or by importing pre-existing data from a file. This envelope can be as complex as one wishes and can evolve over any duration. The levels of the breakpoints and the durations of the segments can be easily scaled. It can accommodate the duration of a few milliseconds resembling a grain-envelope, it can have the duration of a longer gesture, a passage, a movement or can provide the overall shape for a whole piece. We can consider an envelope to be a fundamental building block and proceed to explore this compositionally. Since it is simply an array of values, the data are liable to any kind of transformation (inversions, augmentations, retrogressions) and in general any numerical processing that can resemble the manipulation of a musical motive. Hence, within a musical piece, a basic energy-shape can be presented, varied and grouped to form higher-level structural units providing a means for 'thematic' evolution and resolution.

A step further might be to use the shapes within the context of statement and response, constructing apart from the one 'basic motive' and its variations a counter scheme, indeed similar to a sonata-like form and proceed to explore the affinities between full themes, 'shapes of considerable length and weight forming in themselves complete musical statements' (Reti 1978, 193). By applying the same envelope to different processes, i.e. mapping the same data to different parameters, a composer is able to shape time always differently but at the same time similarly. The kernel of the musical gesture is always the same but the result can be endlessly varying timbrally, texturally, and rhythmically.

Patterns and hierarchy

Treating envelopes as musical motives and exploring their affinities within the whole of a composition is not as restrictive as it may seem. It does not necessarily presuppose a thorough formal planning from the composer's point of view even though the decision is entirely a matter of preference. The sonic possibilities within a programming language environment are so rich and the mapping strategies so extensive that the model most likely encourages the artist to work with the material in an experimental and intuitive fashion. I view the process as a bottom-up strategy for an intuitive exploration, providing as a starting point a structural block on top of which a passage or even a whole piece can be built. Like that, a composition acquires an additional structural level. Not that this has anything to do with the

quality of the work, but it can prove beneficial from the composer's perspective, ensuring unity of method when considering notions of gesture, transformation, expectation, tension, release and so forth.

As mentioned, one of the most important concepts of this strategy is the mapping of the same data to any variable quality. For example, the energy-shape of the grain-size of a granulator could be similar to the behavior of a variable cut-off frequency of a filter; thus, both processes would share the same morphology. The results obtained from very distinct DSP using the same energy-shape can be greatly varied and consequently the perception of these phenomena need to be evaluated. When considering the transformation of musical motives in the case of tonal music, defined in terms of pitch and rhythmic patterns, the composer would often identify the elements that constitute the core of the idea and proceed to alter the secondary ones, always retaining something from the original quality of the motive, while also creating variations to move the piece forward [5].

If we are to consider envelopes as a means for thematic evolution then a similar approach could be adopted. If the processes applied are complex enough and the mapping to different parameters is somewhat sophisticated it would be difficult for the listener to follow. This becomes more apparent when considering simultaneous processes and polyphonic structures, making recognition almost impossible. In this case, there is a need that the composer decides on the kernel of the soundworld he wants to retain and proceeds carefully to transform and develop those elements that will increase the chance of creating a memorable shape and can be identified in a different context later in the piece. It may be also helpful if the quality of the departing sounds possess some common spectral attributes in order for the listener to perceive the energetic flow as a meaningful scheme and to be able to follow the individual lines in the case of a polyphonic design. Additionally, there needs to be a clear affinity between the time-scaling and level-scaling for the schemes to result in a coherent form.

The notion that an envelope can be treated as an 'open gesture' and mapped to variable parameters is not novel [6]. Farnell (2008, 83) wrote that 'a nice way of dividing events and flows into meaningful frames is to consider the change of energy occurring within a system'. The strategy is also very close to the d'Esquivan concept of Adaptable Gestures [7]. Julio d'Esquivan suggests that while working in SuperCollider 'gesture sets can be abstracted into patterns that can be endlessly adaptable through the use of live coding techniques ... also enhancing the workflow to strike an interesting balance between prediction and surprise'. In our case it is the idea that envelopes can be viewed as a means for thematic evolution that opens a small window for composition. Namely, one of the strengths of the strategy is its application to the electronic domain while composing mixed pieces using live electronics, incorporating both instruments and electronics that run on a programming language for realtime composition and performance. In this case the mapping could be applied equally well to pre-recorded elements or instrumental gestures in realtime, developing accordingly a thematic homogeneity between the instrumental and the electroacoustic part. The energetic dependencies between the two parts provide an elaborate method for unity and cohesion and endless possibilities to structure the piece in the micro and macro-scale.

A note on perception

So far I have suggested that the scheme→motive concept is helpful from the composer's perspective to structure the piece, neglecting the listener's side. Inevitably, we should also question whether the audience makes any sense of the strategy. It is one thing to provide a structural model to build a piece and another to investigate the impact it has on the listener who makes use of numerous musical concepts while listening to music.

With complex patterns the horizontal and vertical dimensions of the organisation of sound may be difficult to be perceived even by the experienced listener. Ideally we would need to address the

following issues: How can an energetic shape of sound be perceived as a complete entity? How can the streams be kept distinct from one another in the case of simultaneous processes? What are the factors affecting the perceptual grouping when dealing with shapes of energy? Is it possible that the sequential organisation of envelopes can teach the listener something about the structure of a particular gesture-based strategy? There are indeed indications (Bregman 2001) that sequential similarities in timbre, spatial separation and asynchronous onsets can favour the distinctiveness of a musical layer, but, in order for the listener to predict the grouping of a shape he/she needs to be able to find some similarities in the sound.

On ahead, some effort is required from the composer if he/she is indeed interested in working with identifiable behavioral relationships. The envelopes on a computer screen may be intellectually interesting for a composer, providing aliment for discussion amongst musicologists, but they cannot function in an equivalent way as melodic or rhythmic motives do [8]. Quoting Hatten (2004, 239) ‘as a more general principle, sufficient regularity of patterning enables us to take isolated events as units in a continuous chain at the next higher level’. Even if the previous statement appears to hold for tonal music, it would require a study to examine the extent to which a listener is able to identify and recall a pattern mapped to different parameters, thus engaging in the perceptual present and longing for the future. It is logical that the result will depend on the deviation between the original morphology of sound and its transformations. Taking this into account we may be able to develop further compositional strategies where the listener is guided through processes of mutations from the most apparent to the most distant interpolations.

Strategy Applied

The compositional approach as presented in the current article has been adopted so far in three new works composed at the Sonic Arts Research Centre and has proven to be fruitful from the composer’s side. Below I briefly exemplify the use of shapes in a recent piece for Santur and live electronics (*To Xáoc!*) by analysing its opening.

To Xáoc! makes use of a basic motive/envelope (and its counter part) throughout the piece but each time presented in a different way, (augmented, inverted, retrograded and so forth), or simply mapped to different parameters. Practise revealed that as soon as the initial ‘motive’ was designed the piece could develop fast by intuitively assigning the shape and its transformations to different processes and reacting to the result.

The performer communicates with the computer running SuperCollider with a simple USB footswitch (figure 1) by means of which the individual cues are triggered. Each cue-number constitutes a series of signal processing functions that manipulate the sound of the instrument or the pre-recorded elements in real time.

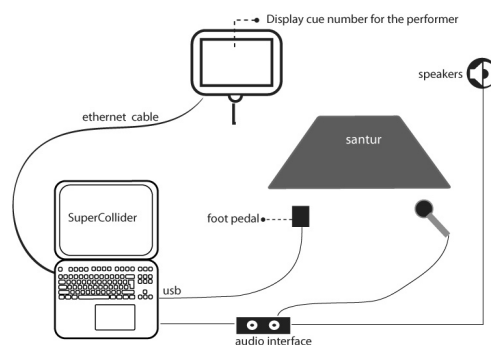


Figure 1. *To Xáoc!* Performance Layout.

The basic shape of figure 2 was drawn by hand using a GUI widget in SuperCollider that displays nodes at x/y coordinates and stores the values in an array. The horizontal axis is always mapped to time and defines the duration of the gesture, while the vertical is mapped to the desired musical parameter.

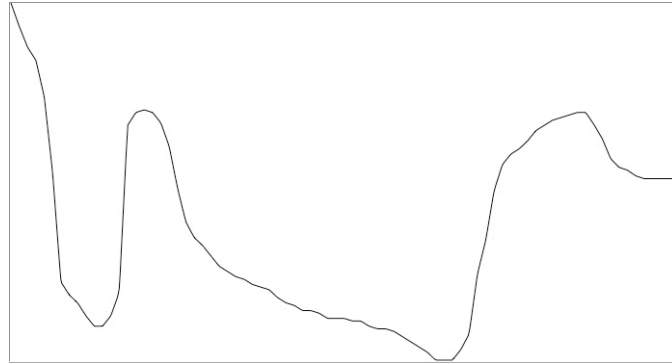


Figure 2. Basic Envelope Shape

In order to exemplify the use of shapes I proceed to analyse the opening of the piece. *To Xáος!* starts with the pre-recorded sound of a stone thrown on rocks (ca. 3secs) granulated in realtime (Cue-1). The basic envelope is mapped to the Position of the pointer scrubbing through the soundfile, scaling the vertical axis to the total duration of the soundfile and the horizontal axis to last for 14 seconds. At the same time a secondary envelope (very similar but not identical) is applied to the Density of the grain cloud [9]. Additional curves are also used to shape the granulator's Amplitude and Rate (pitch).

The Santur plays immediately after the first bang and replies to the granulated stones (bar 4) while the gesture concludes, reaching the end of the envelope. In Cue-2 a different soundfile (again of a stone thrown on the rocks) is manipulated using a granular scrubber, mapping anew the basic envelope to the position of the pointer. Only this time the pitch parameter is different and the timescale smaller (12 sec.), resulting in a similar but faster gesture than in Cue-1. Still, the overall energy-shape of both gestures is quite close hopefully starting to develop an identifiable shape.

Figure 3. *To Xáος!* Opening.

The Santur replies again to the electronics (bar 8) and develops the melodic material. In Cue-3 a chunk of the live sound of the instrument is recorded, stored into a buffer and passed through two granulators with different rates. The grain-Density and pointer-Position is controlled by new envelope shapes that again resemble the basic but have different endings. Both processes develop simultaneously creating a harmonic field spanning over the next 20 seconds. Even though the timbre of the gesture is very different than the previous ones, the resulting texture shares some attributes with the previous schemes.

The piece, lasting circa 10mins in total, continues to unfold linearly in this way by repeatedly applying the envelopes to various parameters providing a means for thematic evolution in an effort to establish cause and effect relations and hopefully construct memorable musical statements that can stimulate the listener's interest.

Discussion

In the previous paragraphs I discussed how treating envelopes as musical motives may suggest a solution to the problem of unity when composing electroacoustic works, shaping time always differently on the surface but similarly in kernel and adding an additional level to the hierarchical organisation of the piece. I viewed the discourse from the composer's perspective. Another study could reveal whether the compositional mode facilitates the unfolding of the narrative from the listener's perspective.

Notes

1. I prefer the term breakpoint file to breakpoint function since I am thinking more in terms of curves drawn on a graphical oriented interface, and maybe stored as arrays of numbers within a file for example, than of mathematical functions.
2. Adopting Reti's terminology for defining the musical gesture (1978, 95).
3. The concept of envelope is used in a broad sense and should not be restricted to a simple ADSR model. It is preferable if viewed as a musical pattern related to the concept of variation.
4. The reason for choosing a programming language and not a sequencer to exemplify the use of envelopes is flexibility. A Digital Audio Workstation is a closed program designed for commercial use and even though it is an essential tool for editing and assembling musical gestures, it can be very restrictive when designing patterns and it is impossible to accomplish processes that fall outside the designers' intention. Restricting a composer's options may be beneficial in providing a certain form of direction and focus under a particular aesthetic. Nonetheless, as I have already argued, it is desirable to allow a significant degree of freedom and at the moment of writing these lines all sequencers provide a decent but restrictive way to structure a musical piece.
5. To quote Smalley (1993, 280) '...certainly, since thematic development became a preoccupation in Western art music, transformation has become a growth industry, associated as it is with notions of development and form, unity and coherence, indeed traditionally speaking, with the concept of the musical work'.
6. Especially within the field of computer-aided composition composers have widely used shapes to control various musical phenomena.
7. As was exemplified in an informal correspondence with the composer.
8. D'Esquivan has identified this issue in a personal correspondence.
9. The Density is defined as the number of grains per second. In Cue-1 the vertical axis of this envelope is scaled to 100. If we define the Fill Factor (FF) of the grain cloud to be the product of the Density and the Grain Duration, then with a fixed FF of 6 the minimum Grain Duration of this gesture is $6/100=0.06\text{sec}$. For a thorough investigation of the Microsound see Roads (2004).

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Biography

Born in Athens, Greece. He has recently completed a PhD in electroacoustic composition at the Sonic Arts Research Centre and currently awaits the summer.

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