Composing from spectromorphological vocabulary: proposed application, pedagogy and metadata

Manuella Blackburn

Novars Research Centre, The University of Manchester, Coupland Street, M13 9PL, UK

manuella@manuella.co.uk

Abstract

Denis Smalley's concept of *Spectromorphology* (1997) provides the listener of electroacoustic music with thorough and accessible sets of vocabulary to describe sound events, structures and spaces. Traditional means of describing Western art music are usually inadequate in this regard, since we are dealing with music that is not note-based and often lacking a representation equivalent.

The use of this descriptive tool need not stop here. Fortunately, and often unconsciously for the composer, it does not, since all composers create music that is spectromorphological with or without an awareness of its presence at work.

In a reversal of conventional practice, spectromorphology can be approached from an alternate angle that views the vocabulary as the informer upon sound material choice and creation. In this reversal, vocabulary no longer functions descriptively; instead the vocabulary precedes the composition, directing the path the composer takes within a piece. This new application is an attempt at systemization and an effort to (partly) remedy the seemingly endless choice of possibilities we are faced with when beginning a new work.

The author also envisions a number of advancements for the future use of this tool. Composing from vocabulary has scope to be developed into a pedagogical tool. Using vocabulary sets and combinations as starting points for sound material creation is one example of how this methodology can be employed in an educational situation. A further look into the future sees spectromorphological vocabulary as a suitable way to tag sounds with metadata. This vocabulary seeks to build upon this approach, first implemented by Ricard and Herrera (2004) using Schaefferian typo-morphology for sound labeling and retrieval. Little research has looked beyond this retrieval stage. The use of more exoteric spectromorphological labels within a sound recall system may provide a number of approaches for the electroacoustic music composer to create new material and new sounds assembling strategies.

This paper presents these concepts and thoughts within the context of fixed media works. An outline of composition methodologies developed from spectromorphology is presented using examples from several works, highlighting how this language promotes stimulation of visual and sounding equivalents in the compositional process.

This new application undoubtedly raises a number of questions. If we can use spectromorphology to describe the internal functioning of sounds and entire work structures that we find to be rewarding, is it possible to re-use this language in the creation of future works? Is it possible to isolate the language we regard as 'successful'? In searching for a methodology that uses 'successful' language to generate sound material we expectedly run into issues of language subjectivity, and whether or not composer intuition is relinquished while working with such a scheme. Guiding the reader through these themes in works utilizing spectromorphological vocabulary will provide answers to these questions, while presenting a practical example of how one might implement these concepts.

1. Spectromorphology introduction

Since the development of spectromorphology as a descriptive tool based on aural perception (Smalley, 1997), its applications have so far remained in areas of analysis (Thorensen, 2007), visual representation and notational functions (Patton, 2007). This paper is concerned with an alternate application of spectromorphology, using its descriptive vocabulary to inform aspects of the compositional process in electroacoustic music. The research has focused primarily upon the creation of abstract sound material in fixed media works, providing the subject matter for the discussion that follows. The author makes several references to her compositional output to illuminate the ways in which vocabulary can be used.

2. Methodology outline

The research involved the exploration of spectromorphology categories outlined in diagrammatic vocabulary sets. These word-sets address qualities that sounds inherently possess, comprised from commonly used language. Application of the sets can occur individually, each the focus of a new piece, or in combinations, allowing investigation of vocabulary functionality as informers upon sound material. Through this vocabulary implementation, compositional strategies can be discovered and developed.

2.1 Preliminary note

The compositional strategies provided in the following text should be regarded as compositional aids rather than solutions or algorithmic processes. They present possible starting points for the development of sound materials, events and structures. These are then subject to other intuitive decision making processes. For purposes of discussing sounds and their assemblage, visual shapes and symbols are employed subjectively to illustrate points within the text. Some diagrams indicate 'snap-shots' of spectral space where time corresponds to the horizontal axis and frequency to the vertical. In these visualizations, shape corresponds to amplitude and timbre, while relative positioning of shapes corresponds to spectral occupancy.

2.2 Structural functions

In the first word-set (Figure 1) three compositional strategies are introduced that all use Smalley's structural functions vocabulary. The following examples were developed through my own compositional practice.

onsets	continuants	terminations
departure	passage	arrival
emergence	transition	disappearance
anacrusis	prolongation	closure
attack	maintenance	release
upbeat	statement	resolution
downbeat		plane

Figure 1: Structuring Processes, Denis Smalley (1997)

2.2.1. Vocabulary informing sound material choice

Using the word *emergence*, sounds were chosen on the basis of becoming more apparent over time, while when using *disappearance*, sounds that fulfilled this criteria were those that faded out over time (Figure 2). This process informed the selection of sounds to be recorded and those chosen from within a given sound library.
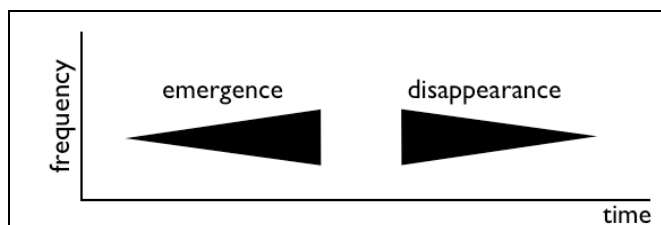

Figure 2: Visual equivalent of a disappearance and emergence.

2.2.2. Vocabulary informing sound sculpting

Vocabulary can also inform shaping and manipulation of single sounds. Choosing *attack*, *passage* and *release* can dictate the sculpting of a single sound through the accentuation of onset abruptness, (*attack*), duration extension (*passage*), and emphasis upon a 'letting go' of tension (*release*).

2.2.3. Vocabulary informing sound-unit creation

A third use of this vocabulary is in structure creation. *Attack*, *passage* and *release* can also be applied to three separate sounds assembled together to form a new shape, which I refer to as a 'sound unit' (Figure 3).
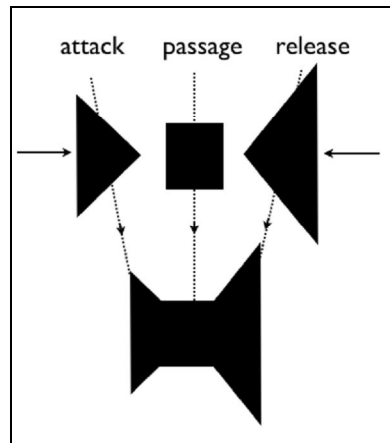
Figure 3. Sound unit construction

Sound units can be strung together to form longer phrase lengths called *morphological strings* (Smalley 1986*)*. In this process of extension some sounds exhibit dual functionality. Figure 4 demonstrates a *release* (c) doubling as a *termination* for the first sound unit (1) and as an *upbeat* (*onset*) for the second unit (2). The second unit's *termination* (e) would potentially provide the *onset* for a third unit and so on.
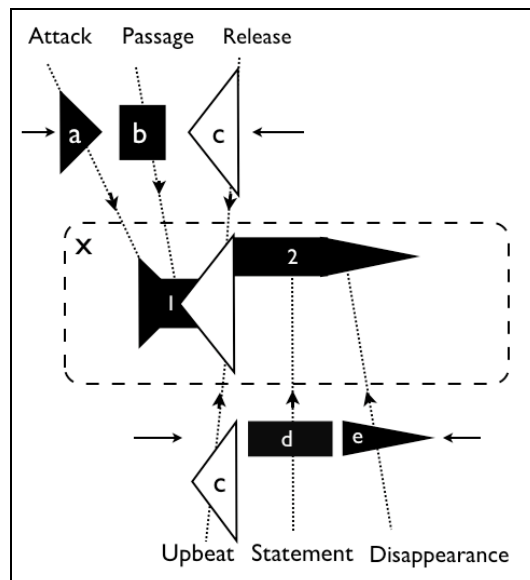

Figure 4. Morphological string created from two sound units and the dual functionality of sound 'c'

Box 'x' contains the resultant string of sound units. In addition to creating sound units and morphological strings, this strategy is applicable in the creation of phrases, sections and whole compositions. For example, my acousmatic work, *Kitchen Alchemy,* was composed entirely from sound units connected into *morphological strings*. Spectromorphology cannot alone account for decisions made in a finished composition, however the use of structural vocabulary based on onset, continuation and termination principles in outlining a framework can aid the definition of form and structure within a work.

2.3. Composing motions

Other word sets from spectromorphology have been successfully implemented using similar strategies as those outlined above. The *motions and growth* word-set (Figure 5) provides variations on how vocabulary may inform sound construction.
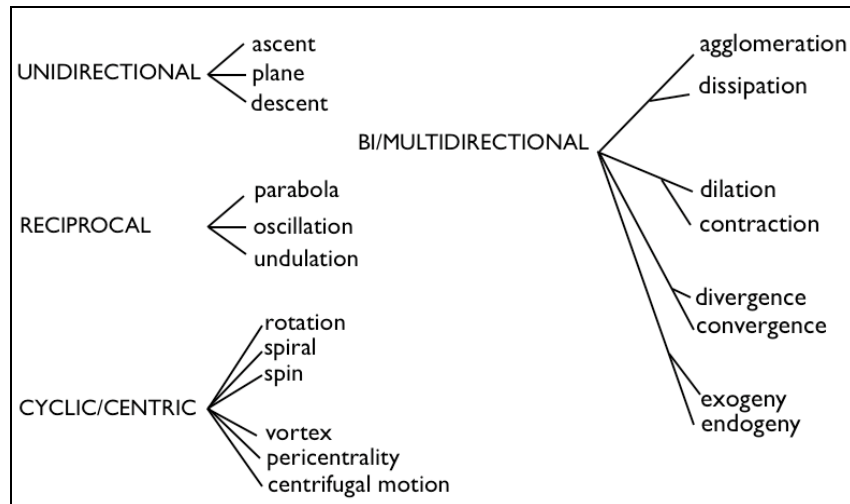
Figure 5: Motion and Growth Processes, Denis Smalley (1997)

For example, *descent*, *plane* and *ascent* are composed from individual sounds while the concept of *bi/multi-directional* motion informs the composition of several motions placed together to sound simultaneous (Figure 6). The difference in these two examples is significant for the division it illustrates when dealing with the larger collection of spectromorphological vocabulary. Words informing the creation of single sounds have been introduced in this paper, however there are many words that require multiple or 'composite' sounds working in conjunction with each other.
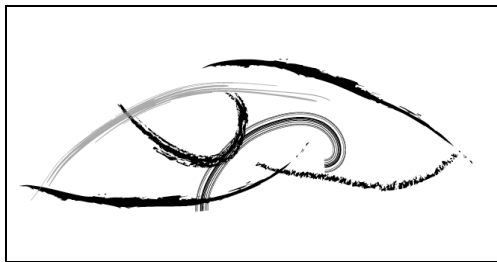

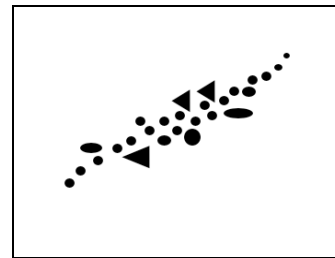Figure 6. Composite motion: *Multi-directional*

Figure 7. Composite texture: *Flocking*

Words requiring composite materials rely on several sounds co-existing in a given time frame. These words are often indicative of texture. For example the word *flocking* suggests many sounds moving in a particular direction (Figure 7). The flock may be a collection of different sounds or multiples of the same sound-type. *Texture motions* such as *turbulence, convolution* and *streaming* are examples of composite words. Creating motions and textures from composite words is a more challenging strategy to engage with. Since multiple sounds are subject to sculpting and shaping, more decision-making is inevitably involved.

2.4. Composing behaviours

The *behaviour* word-set presents vocabulary useful for informing sound material positioning and relationship construction between sound materials. Perceptually, pace is a byproduct of horizontal positioning and thus timing in a work can be controlled using these spectromorphological words.
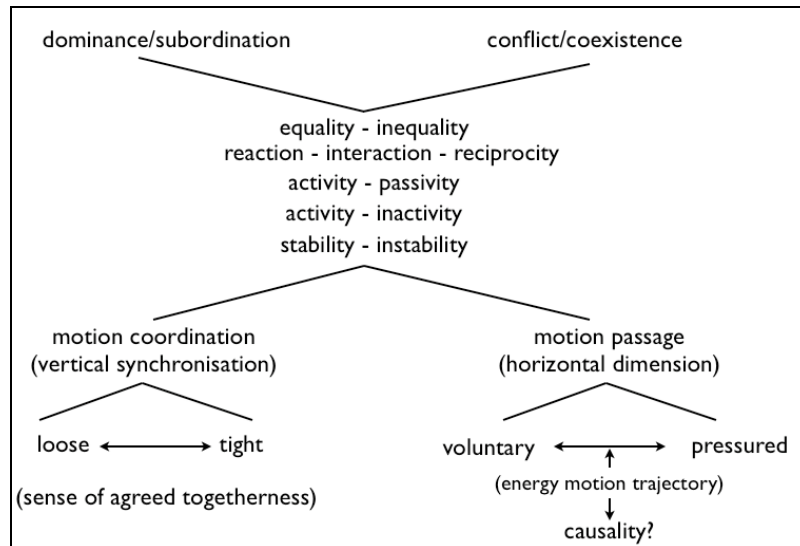
Figure 8. Behaviour, Denis Smalley (1997)

For example, *pressured* behaviour, requires initiation from a preceding event. This sound-to-sound contact is responsible for a sense of *causality* (Figure 9). Smalley describes this through the *voluntary-pressured continuum* (1997). Tightly packed motion passages, and variation in sequential spacing, "expresses how one context or event yields to the next."
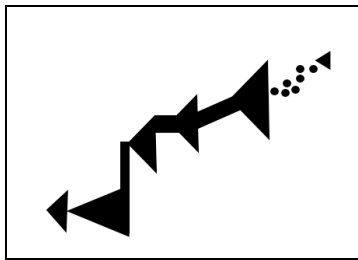

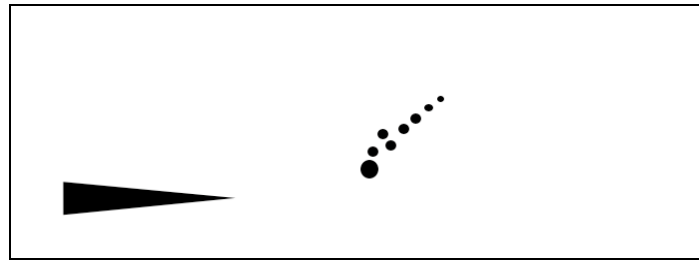Figure 9. Pressured behaviour   Figure 10. Voluntary behaviour

Perceptually, voluntary events occur independently of any causality or interaction and thus compositionally they require a greater degree of horizontal separation between events (Figure 10). Unlike the sound-to-sound contact exhibited by pressured behaviours, voluntarily occurring sounds require an absence of onset preparation, as this would suggest initiation from an external event.

3.Vocabulary appropriateness

The strategies outlined above present a selection of vocabulary I consider useful and appropriate for composing materials, events and structures. This selection is not definitive, as conclusions have been established only through my own practice-based research. It has been possible to isolate and identify functional vocabulary over less useful terms. Words more readily visualized ie. *spiral, flock, stream* and those with a clear associated physicality ie. *fly*, *drift*, *attack*, appear better suited for informing sound material creation. This identification is paralleled in our response when we listen to electroacoustic music. Often when listening, the more physical the sound, the more tangible it is in our minds eye.

Vocabulary appropriateness for providing starting points in sound material creation is also due to the various interpretations that one may develop in the creative process. Often a multitude of meaning and imagined instances can be generated from a single word. This variety transfers over, yielding diversity in the composed event.

3.1. Additional language:

The word sets from spectromorphology are not closed to additions. Within my research, extending the vocabulary has aided the creation of sound events often requiring a greater degree of detail. One example of this practice occurred in my work '*Origami*' which sought to emulate the behaviours and morphological aspects associated with animals and physical objects. In one instance, I aimed to aurally represent a dragonfly and its origami paper-shape equivalent using the additional adjectives such as buzzing, vibrating, darting, hovering, quick, erratic and irregular. These additions provided a concrete basis for the creation of this particular programmatic compositional style.

The ability to expand the vocabulary pool is particularly advantageous considering the flexibility it offers to other composers and students choosing to adopt such strategies within their own work. Additions can enable individuals to determine appropriate vocabulary and build their own custom-built language.

4. Current and future investigations

4.1 Pedagogy

Approaching spectromorphology from a compositional perspective suggests functionality suitable for educational situations. Few compositional aids, methods or structuring devices have been established for students inexperienced with the genre of electroacoustic music. Introducing spectromorphological vocabulary, as a means of sound material creation and composition, is a practice comparable to offering pitch-set theory or Schenkerian analysis to composition students as methodologies to begin a composition.

A trial of this application was implemented at the University of Manchester, UK. Composition students unfamiliar with electroacoustic music were presented with a collection of sounds, categorized as: 'starts', 'middles', and 'ends' (*onsets*, *continuants*, *terminations*). Following a discussion regarding the categorization of these sounds, students were asked to build their own 'sound units' using only the sounds provided.

By following this method, students developed a strong awareness of sound function due to the categorizations presented to them. A greater sensitivity for sound positioning was achieved through challenging the class to create structural variations using a restricted set of sound materials.

The structural functions vocabulary implemented in this case study established a starting point for electroacoustic music creation by introducing a fundamental concept of spectromorphology within the classroom situation.

Future advancements of this pedagogical tool would involve the introduction of other spectromorphological vocabulary to aid decision-making in composition.

4.2. Metadata

Soundfile metadata encapsulates information detailing the recording device settings used in capturing the sound, and automatically tags the file with duration, bit-depth and sample rate data. Further descriptive tags can be added to refer directly to a file, allowing quick and precise retrieval when searching for desired criteria. 'Spotmeta' and 'Punakea' are two software examples, which facilitate this process through manual data input.

Metadata tags and searches are commonplace in commercial media situations. For example, in film production, sound libraries of substantial size are scanned to obtain specific audio to marry with visuals. Rapid and efficient access is achieved through specific tagging and references to source material

4.2.1. Spectromorphological metadata

The concept of tagging sound material with spectromorphology's descriptive terminology can function within a variety of methodologies for electroacoustic music composition. For example, retrieval of high frequency sounds (tagged with spectral occupancy information) from a library can provide a starting point for the creation of a *canopy* in spectral space framing. Retrieval of *onset*, *continuant* and *termination* sounds would provide the composer with part-automated sound unit structures in an array of combinations, providing possibilities for further compositional activity. So far these examples remain as possibilities having arisen through speculation of spectromorphology's use in future compositional practices. Collaborative research with Dr Ricardo Climent has begun to develop possible retrieval systems for sound recall using Max MSP in conjunction with Mac OS X's Spotlight technology.

These generative processes are also ideally suited for live laptop music where sound material recycling and fast retrieval of specific sound types is essential. These ideas have been introduced into the *Splice Girls* live laptop duo where spectromorphological tagging ensures efficient recall for sounds on demand.

Ongoing and future development of this system aims to address and overcome several shortfalls. In particular, the challenge of ensuring all sounds within a library are appropriately tagged is a task of considerable scope and one that detracts time away from creative work. Automated labeling is a key requirement for the sustainability of this application.

4.2.2 Ricard and Herrera

To address the time-consuming process of labeling, Ricard and Herrera (2004) proposed an automated description scheme founded on the criteria of Schaefferian typology. They identified the unsuitability of commercial retrieval systems for abstract sound as these systems tended to be 'source-centred' and in response to this devised a system capable of automating labels based on a selection of Schaefferian typologies. In one example, a 'dynamic profile' label is assigned automatically once the sound has been subjected to an envelope module to detect variance in amplitude. Replacing Schaefferian typology labels with Smalley's spectromorphological vocabulary would provide a more accessible and relevant tagging scheme for compositional purposes. Devising a system capable of automating spectromorphological labels is an ambitious proposal and one involving a multitude of categorized vocabulary.

5.0 Conclusion

This paper has demonstrated a number of applications of spectromorphology that aid electroacoustic composition. Effectiveness of these applications and strategies is enhanced through the isolation of appropriate vocabulary on the basis of determining a word's evocation of visual and sounding phenomena. Implementing this vocabulary in this systematic approach can generate starting points for sound material choice and creation in compositional activity. Transferring the vocabulary to areas of pedagogy provides a teaching method for sound material construction, capable of fostering an awareness of sound functionality.

It is an evolving tool, open to modifications, expansion and further applications (including metadata). Due to this flexibility we are likely to see the language growing beyond our familiar vocabulary. It may become custom-designed to suit each individual's usage. Future additions of other word-sets can yield positive results and benefits for students and composers of electroacoustic music. However, there is a need for further research to identify the suitability of such vocabulary and strategies according to differing levels of experience.

The findings from this paper will lead to further investigation into the vocabulary's potential for determining sound interaction in mixed works (instruments and electroacoustic media), and decision-making in multi-channel composition using *spactiomorphology* (Smalley, 1997) and its associated vocabulary.

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