

Sound In Structure Applying Spectromorphological Concepts

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This paper departs from critical discussion of some issues emerging from the concepts and terminology used by Denis Smalley to outline the 'spectromorphological' approach to analysis of listening processes.

Smalley's writing is widely regarded as significant but, paradoxically, there has been relatively little analytical work in electroacoustic music built directly on his terminology and also little critical development of some of the questions raised by the work. A starting point for this discussion is the recognition that 'spectromorphology' constitutes neither analytical nor compositional method as such. Rather, it draws attention to the structural and behavioural characteristics of sounds, embracing the complex materials that can result from electroacoustic transformation, design and mixing processes. In Smalley's words, the concept of spectromorphology 'sets out spectral and morphological models and processes, and provides a framework for understanding structural relations and behaviours as experienced in the temporal flux of the music' (Smalley, 1997: 97)¹.

Precisely because of this, the terminology developed out of spectromorphological thinking presents the basis for a way of analysing and forming musical designs from the 'inside out', providing descriptive terms that can be applied to both the structural and functional aspects of sound shapes, their groupings and motion through time. The neologism *spectromorphology* itself acknowledges the combined interdependence and separability of the two parts of the term. A spectrum will always be expressed through a 'shape', whilst the dynamic shape of a sound will always carry spectral information. Another kind of concentric unity is implied in Smalley's view of spectromorphology, since the structural and behavioural aspects of sound are linked to a set of basic perceptually-derived organisational archetypes which in turn may be reflected in the processes and form bearing elements of music. Thus in compositional terms, the interdependence of spectrum and morphology takes a vastly expanded turn, since the abstraction and fusion of these two basic phenomena can allow them to be projected at levels of structural design, and not solely at the level of individual sonic objects. So, what we might think of as 'spectromorphological music' will attempt to draw a listener toward the shaping

¹ There are three linked papers, which trace the evolution of Smalley's ideas to date: Smalley (1981; 1986; 1997). The 1981 paper was published with a page missing. The relationship of the ideas to the work of Pierre Schaeffer is acknowledged at that early stage.

and development of sonic entities in ways that may not be correlated with the traditional idea of the musical 'note', and what Trevor Wishart has called the 'lattice' of discrete pitch, duration and timbral quanta.²

Although all sound and all music has spectromorphological features, I will be limiting this discussion to music in which the design and structure of music presents itself as one based primarily on a feeling for, in the words of Gérard Grisey (2001):

No longer composing with notes but with sounds;
No longer composing only sounds, but the difference that separates them ...;
Acting on these differences ... controlling the evolution (or non-evolution) of the sound and the speed of its evolution.

Yet in thinking about the experiential rewards of listening to electroacoustic music, I am drawn to make comparisons with the structural richness found within traditional tonal music. Without the gravitational force of tonality and the scope for a mix of play, ambiguity and certainty of structural meaning at different levels, should we fear that electroacoustic music skates around on some para-musical surface of gesture/texture, louds and softs, attacks and decays, highs and lows: in short, a generalised vocabulary of transparent rhetoric? Whilst it may be that the kinds of reductive methods so well suited to tonal music may not find appropriately formed materials in spectromorphological genres, it is in the nature of sophisticated music experience that the listener is rewarded with different levels and modes of structural articulation.

The spectromorphological view of music, by identifying and finding contact between aspects of structural description and structural function, provides a framework for unpacking and identifying ways in which the psychological richness and variability of focus of traditional music might find some expression through the seemingly infinite timbral and behavioural malleability of electroacoustic sound. It may be worth reminding ourselves of Leonard Meyer's general definition of functionalism: 'the implications which one musical event ... has for some other musical event either on its own hierarchic level or some other.' (Meyer 1994: 296). This points to the strength of a spectromorphological approach to music: that by following the dynamic life of a sound event, we may be able to form images of structure—initiation, tension, release—that may then imply other events *before* they happen, promoting engagement and connection with a discourse.

Two key elements of Smalley's approach are identified in this discussion:

1. *Structural function and function attribution.* It is one thing to have set of categories into which sounds might be sorted but, because sound has a number of parameters that define its features, ascribing musical function to these is not necessarily straightforward – no more so than with complex

² Discussed in Wishart (1996).

sound shapes lying outside the 'balanced' pitch/duration proportions traditionally contained within the 'note' as the lowest level unit in music. Smalley's work implies that higher order functions can be established through the behaviour and accumulation of lower order events such as clusters, strings and layers of sound-objects and that these in turn have overarching shapes (as say a process or texture) that contribute to the structural morphology of musical design.

2. *The notion of the continuum as a psychological framework for relatedness amongst materials.* The malleability of materials under electroacoustic technology means that the concept of a continuum is an appropriate archetype for describing the fluid way in which extremes of sonic design and identity can be connected at a fundamental level. Because it is also a transferable generic model for dynamic systems, evocation of the continuum as a structural force can allow listeners to engage in forming expectations about the way in which, say, a transformational sequence might develop or interpreting the relevance and significance of the injection of new material within a process as it evolves. The continuum model also allows the discourse of sonic transformation and development to be characterised at higher levels including motion toward notional 'goals' within families of transformational variants or the patterns that underpin the streaming and shaping of textures.

However, part of the difficulty in applying Smalley's ideas in analytical contexts is the free-ranging nature of the continuum as a construct, and its potential to be relevant at both micro and macro levels of structural function. For example a continuum might be implied in a short-term timbral transformation, or as a series of dislocated but perceptually related variants of a sound-object over an extended time scale. Naturally this can raise analytical dilemmas ... 'where are we situated within the range of possibilities?' and 'what might be the goals or points of emphasis?' The dialectic that can be created through twists and turns in the articulation of spectromorphological designs and the pluralities of structural function attribution that can result is a significant part of the richness and diversity of the musical possibilities offered by electroacoustic music. To this end the analytical examples presented in this paper are informed by a desire to clarify the ways in which spectromorphological continua can influence the perception of structural processes in musical contexts.

With the above points in mind, I want to suggest two archetypal catalysts of musical function within the spectromorphological frame:

Causative, expressed via

- continuity (implication of a continuous flow of energy, for example from attack to resonance)
- interactions (where sound events prompt each other)

Transformative, expressed via

- mutation (leading to changes in morphological design)
- variation (where a generative link is perceived between two or more sounds)

These are conditioned by ‘natural’ patterns of morphological archetypes, such as the way a sound might be ‘understood’ as having an initiatory function by virtue of a clearly perceived attack. The causative and the transformative might be regarded as the broad ‘rules of the game’ that help us orient our listening and make interpretations about structure in spectromorphologically-centred musical contexts and they are also interdependent. For example, it is possible to design sounds which are the result of imposing the dynamic profile one sound shape onto another—which I have called an idio-morphology, shaped by something outside of it: an exo-morphology. This kind of process may draw attention to the causative energy of one sound (the exo-) re-shaping the spectral colour of another (the idio-) yet may be shaped in a way that allows elements of the rhythmic articulation of the idio-morphology to progressively be revealed over time.³ Thus a process of transformative variation may be perceived through a form of causative interaction. The balance between them contributes to the interpretation of function attribution and meanings we might associate with that within a discourse, and if handled effectively can contribute to the effectiveness and richness of that discourse.⁴

It is this key potential to be able to separate as thematic ‘morphological’ seeds, causal energy profiles and spectral colour, that permit a spectromorphological way of thinking to deal with sound identity and interaction at a range of musical levels. In different ways, the opening moments of the following works demonstrate this kind of morphological ‘seed’ approach: McKinnon *Horizont im Ohr* (1998), Grisey *Partiels* (1975), Smalley *Pentes* (1974), Teruggi *Xatys* (1988). Clearly, each of these pieces begins with extremely interesting spectromorphological ‘seeds’, possessing the generative stimuli and tensions within the mix of and interaction between sound shapes that are capable of generating larger forms. The gestural behaviour of sound as a reflection of generating energy *per se*, can itself invest sounds with structural significance. For example in the opening section of Smalley’s *Pentes*, we are presented with a sequence of complex attack-resonance statements that accrue into explosive gestures. From the outset, the apparent motivating energies of these materials project essentially a causal relationship: iterative and granular resonances flow in the wake of clusters of initiating energy impulses. Yet these are not straightforward ‘realistic’ cause and effect energies. From the second phrase and its consequent (8” - 39”) the granular resonances already appear to accrue their

³ Young (2002).

⁴ Smalley (1993) has also pointed to the fact that transformation requires a *base* identity which is the ‘source’ of the transformational ‘argument’: the nature of a mutational sequence for instance has certain characteristics because, say, we perceive that some initial sound ‘stuff’ has some new forces acting on it—which are of course implying some new causal relationship.

own sustaining energy with a rising and falling dynamic pattern and the growth in high frequency spectral content. The low frequency pulses that flow out of the explosive gesture at 58” are self-sustaining from that point, and continue independently of the interjecting gesture at 1’14” and suggest a fused motivating energy with granular resonance thrown out of the explosion, particularly as their energy grows toward the next explosive gesture at 1’44”. Causative ‘play’ of this kind, where perception can shift between explanation of material as either resonant ‘trails’ of sound or as accrual of textural energy, brings about a transformation of the apparent contexts of materials shifting their role in the discourse from one of energy dissipation, or consequence, to one of energy growth, or initiation.

Very much in the vein of that short analysis, one important aspect of Smalley’s articulation of the spectromorphological approach to composition is in structural function attribution. Smalley’s function types are couched within the frame of onset-continuation-termination—a model which corresponds to the dynamic life of natural sound events (broadly corresponding to the attack / attack-decay / graduated continuant morphological archetypes). Since spectromorphologically-centred listening focuses on the spectral ‘life’ of sound, it is proposed that the ‘images’ of motion that form for us may be extrapolated to higher organisational/behavioural levels. Smalley (1997: 114) proposes that ‘During listening we attempt to predict the directionality implied in spectral change’. In other words if we can locate and ‘abstract’ spectromorphological motion within individual sound objects, these might serve as models for higher-level structural designs. The following are sketched Smalley, 1997: 115):

<u>Onsets</u>	<u>Continuants</u>	<u>Terminations</u>
departure	passage	arrival
emergence	transition	disappearance
anacrusis	prolongation	closure
attack	maintenance	release
upbeat	statement	resolution
downbeat		plane

A range of descriptive terms are attached to these as examples of the way categories of structural function might be arrived at. In emphasising what must be the provisional and open nature of these descriptions, Smalley proposes that the attribution of function is:

1. not normally the product of continuous reasoned enquiry
2. an incomplete process, subject to revision in the experience of a musical flow
3. potentially complex or ambiguous
4. subject to imprecision of temporal borders between events.

At least in part these conditions relate to the actual sonic complexity of spectromorphological data as it is found in electroacoustic music. Attention may shift between focus on gestural and textural levels, spectral or morphological/rhythmic detail. Indeed the compositional process may involve

elements of striking a balance between structural clarity and a level of musical and intellectual richness that requires repeated listening to appreciate a depth and richness of discourse.

The 'continuum' structures that underpin many of the polar oppositions found in Smalley's discussion of what he terms motion and growth processes, imply that we orient ourselves within this either through extrinsic knowledge, or through the evolving context of the work. The language used to characterise these is poised in a way that may either invite metaphorical interpretation (where allowing, say, environmentally-occurring phenomena may be conceived as analogies or models) or emphasise the potential for more abstract, even geometric patterning to inform the musical fabric. But they also are a convenient open-ended models for dynamic processes onto which it may be difficult to project likely goals—the types and processes of motion need not be seen through to a complete or closed, 'logical' end point.⁵ The implication of structural function generally arises from dynamic situations and evolving contexts. An attack does not necessarily imply structural function on its own, though it might imply structural articulation, and the manner in which it resolves or opens out onto a steady state sound or resonance may provide seeds for higher articulations.

Two compositions: *Base Metals* and *Haulie*

To conclude this discussion, I will discuss two works which demonstrate the potential to apply notions of function attribution from small to large scale levels in spectromorphologically-centred electroacoustic music: *Base Metals* (2000) by Smalley, and *Haulie* (2002) by Mario Mary.

Base Metals presents a sharply articulated attack-resonance morphology at the outset, which heralds a core structural motivation of the work—attacks initiating inharmonic resonances. The work presents shifting perspectives on this basic model. Attacks initiate resonance which then 'find' their own energy, drifting and merging. Within the nearly 14 minutes duration of *Base Metals*, attacks are concentrated in the first and last thirds of the piece. Their structural function is linked to instigation of resonance, and therefore the initiation of spectral fields. But there are varying qualities and emphases in the attacks. The opening, for instance, is an extremely sharp, seemingly edited-in attack, with no apparent 'klang' tone, and a feature of the way the work unfolds in the first four minutes is also the way energy is also injected into the spectral continuity with delta-shaped attacks and surges rather than abrupt onsets. This sets up a kind of sound initiation continuum, with slowly shifting continuous spectra given different forms of injections of energy. In the section 2'03" – 3'11", the attacks and surges initiate energy, ergo spectral content, but the persistent presence of the falling resonant noise streams that feature in this short example creates a carefully restrained prolongation which continues beyond the bright attack at the end of that section.

⁵ As in Smalley's four qualifying statements above.

The attacks in *Base Metals* are relatively sparsely spread, leading Theodoros Lotis (2003: 259) to assert that ‘... although they [the attacks] mark and divide the structure, they are almost insignificant.’ However, I would argue that the wide spacing over time of the attacks draws attention to them not just as structural markers (in itself a significant feature), but draws attention to their function as onsets of new spectral colour and vehicles for climactic emphasis. For example, consider the series of attacks/energy surges from 9’42” – 11’00”, where these new rushes of energy spin off to initiate several new streams of spectral colour. The concentration of attacks in the first and last thirds of work, encourages a listener to anticipate their return, heightening their role as points of structural arrival, release and initiation.

The various forms of attack/energy surge in *Base Metals* provides an essentially causative model for the function of those morphologies within the structure. And their sparse placement gives them a long term formal role as we are drawn into the slow-motion shaping of the spectral fields unfolding out of them. Yet the varying nature of the attacks demonstrates a transformative function which, again, is exposed by their spread out placement. This is also underlined by the way in which injections of energy through attacks can be shaped into resonance, such as the pulsed decays at 4’20”, 7’25’ and 9’42”, encouraging for the listener a sense that the phenomenon of the attack and its attendant release of energy is something fluid, but integral to the way pitched resonances form.

There are other salient features of this work, such as the pitch foci and progression of spectral fields, that there is not scope here to discuss. Yet the essential spirit of *Base Metals* appears to me to lie in the way in which attacks and other energy-rushes are paced, withheld and projected, both as an evolving ‘argument’ in their own terms, as well as their dramatic interactions with continuous sounds. This attack-resonance model of structural function derives from that foundational morphology. In tune with this reading of *Base Metals*, emphasising the transitory nature of sound, Grisey (1987: 269) sums up the idea in which function attribution derives from core properties of sound, but writ large: ‘...What would bring us to a better definition of sound would be the knowledge of the energy which inhabits it and of the network of correlations which govern all its parameters. ... *object and process are analogous. The sound object is only a process which has been contracted, the process nothing more than a dilated sound object.*’ [Italics in original].

Mario Mary’s *Haulie* (2002) presents a different perspective on the use of attack models. A feature of this work is the pervasive presence of attack morphologies, both as initiatory gestures and embedded in iteration-based textures. Continuous inharmonic resonances are also woven into the texture, and the relative constancy of attacks layered over resonance produces a perception of morphological ‘fields’—strata of distinct morphological identity. The results in a certain tension through the tendency of the attacks to engender an awareness of causative energy, yet energy which is not always perceptually related to the

resonant field. The very opening gesture is interestingly structured to present ambiguous source-cause information, with a sharp naturalistic 'metallic' attack that is perceived as almost synchronous with a short, but distinctly continuous metallic 'scrape'. The inharmonic resonance that flows out of this composite gesture retains a causative link with the initial attack (whose influence on this gesture has been obscured through the gestural strength, and spatial motion, of the 'scrape') which is confirmed if one cuts out the 'scrape' and edits the attack and resonance portions together. Similar kinds of complex attack resonance are also presented early in the work at 17" and 2'55".

Points where the morphological fields intersect to suggest more cause and effect gestural relationships can be found at 3'00"-3'55" and 5'35"-6'20". Musically there present some of the most viscerally engaging rhythmic moments in the work, but they also serve as points of structural release, and the tensions inherent in the overlapping of morphological fields finds coherent gestural fusion.

Both of these works evoke the nature of the continuum as a construct linking musical functions. For example, in *Haulie*, sound impulses are articulated in a range of ways, but it is not always possible to state with certainty which might be a definitive attack, if we were looking for some sort of generative connection. The opening gesture, although gesturally 'raw-realistic' provides an ambiguous impulse-continuity derived morphological seed, heralding an initial perception that there are parallel energy streams in the piece. We hear these as articulations of a broad class of impulse (energy-rush) figures say as 'crescendo –pulse-decay (iteration)'. And while the crescendo and impulse trails allow these figures to be nested within the continuity of the sustained sound, we are able to locate and hold a place for them as a generic group. So we have a notion of a continuum of attacks, and a notion of a continuum between attack and resonance. In *Base Metals*, the opening attack establishes rather 'classically' the essence of the attack-resonance argument for the work. The use of extended time scales as a device to dislocate the synergy of attack and resonance in the work stretches this model across the whole work. This elongation of time encourages a listener to 'search' for traces and hints of initiating energy in the piece. So at one level we have a catalogue of attacks, but we also have a continuum of energy release and growth which contributes greatly to the way expectations form in response to the musical argument.

Summary

Smalley's linking of basic morphological archetypes to structural function offers a powerful insight into new dimensions on organic musical processes.

Electroacoustic resources provide the ideal sound manipulation and analysis tools for the realisation of this. In fact because electroacoustic sound has such an infinite palette, there may be new morphological hybrids and technology-originated sounds that might inform other models of structural function. For example processes of rupture, interleaving at micro levels or forms of

electroacoustic signal degradation could form coherently defined events both within specific sound objects and as structurally significant processes.

However, whilst the spectromorphological terms proposed by Smalley are broad and comprehensive, there are also linguistic problems associated with analysis of electroacoustic music in this way. The terminology can (erroneously, in my view) be taken as prescriptive, even authoritarian (am I the first teacher to have found an undergraduate class respond this way)? And although Smalley acknowledges the significance of the sense and meaning of sounds from an extrinsic source identity and environmental perspective (and uses them in his works) spectromorphological terminology is just that: descriptions of sound structures and behaviours which, in themselves do not incorporate the immediacy and salient impact of recognizing the source of a powerful sonic icon, or even a metallic object being struck. The language that is required can become cumbersome and difficult when we are confronted with sound materials that perceptually remain close to the surface of real-world objects (which is, paradoxically after all, the place where we are conditioned to an internalization of the morphological archetypes)⁶. Trevor Wishart's outline of natural sound morphology (Wishart, 1996: 182ff) which sketches archetypes of physical processes as a means of understanding a wide range of sound events, provides a further framework for developing this kind of thought, and any reading of spectromorphology as a key to Smalley's musical thinking is almost certainly not complete without considering his view of sonic referentialism.⁷ Nevertheless, the metaphorical approach to analytical terminology is not complete in itself. After all, metaphorical descriptors mean incomplete descriptions of events whose best description may lie in the sheer unmediated experience of them—this intangibility of the essence of electroacoustic materials makes them both irresistibly exciting as sonic encounters, yet perhaps un-analysable as experiential phenomena. But more pragmatically, even a brief survey of electroacoustic repertoire of the last ten years makes it clear that there are many ways to integrate the referential with the abstract. One of the key challenges of spectromorphologically-based music (which may be electroacoustically or instrumentally-realised) is in defining models we might develop to effectively reduce and encapsulate the kinds of sonic complexity we can experience as a result of composers working and thinking in this way. Of course, complex description within an analytical frame does not necessarily assist with the understanding of music that has complex surface features. Only through focused analytical work will the core mechanisms of the spectromorphological approach to music be clarified.

A last thought: one of Smalley's contentions in his initial paper (Smalley, 1981) was that ... 'practice precedes successful theory'. I think most composers of

⁶ My own resorting to the description of a component in the opening sound in *Haulie*, above, as a 'scrape' is an example of how easily one turns to the convenience of anecdotal description for the sake of succinctness.

⁷ Smalley (1992).

electroacoustic music would tend to agree with that—life can be satisfying enough to be propelled solely by making music. But there is a point where successful practice must inevitably be gathered up into theoretical consolidation. In following the reasoning and constructs of spectromorphological approach to listening, particularly the organic (bottom-up) approach to inking morphological types with the attribution of structural function and growth processes, we have a mechanism to steer towards a comprehension of some new perspectives on musical meaning and its structural depths.

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