CHAPTER EIGHT

‘Losing touch?’: the human performer and electronics

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Preface

For millennia sound and music have been products of mechanical action, extended in scope through mechanical technology. By harnessing the power of string, wind and solid objects, humans have sought greater range of sonic expression through direct bodily action. Electricity and electronic technology have allowed (even encouraged) the rupture of these relationships of body to object to sound, replacing them with a range of options from the entirely cerebral to the totally immersive (Emmerson, 1995) . What is it to be ‘live’ in electroacoustic music?

Since the inception of the electroacoustic music field in the decade after the Second World War so-called ‘mixed’ electroacoustic music (instruments and tape), ‘live’ electronic music (using processing of sound produced by a performer) and more recently ‘real-time’ computer music have all attempted to reconcile some aspects of these ruptures of human cause and effect (Emmerson, 1994b; 1998). The advent of the Internet extends this still further; now we can have apparently ‘live’ music in a virtual space performed by composer/performers to an audience neither of which has physical boundaries. Indeed the distinction of composer, performer and audience may cease.

This chapter examines some key approaches to this evolution of the last fifty years; some see it as a problem to be solved, others as an opportunity to be exploited. There are no definitive answers.

Introduction

A motivation to write this chapter comes as I see a conflict emerging within electroacoustic music. On the one hand we have the clean, smooth surfaces of an increasingly sophisticated genre based historically on developments from *musique concrète* and the French tradition.[1]

In this approach, stunning accuracy and clarity create quite extraordinarily detailed sound images and landscapes. There is often a strongly synaesthesic component – or at least a tendency to invite the listener into 'apparently very real' spaces (albeit ones that might exist only in dreams!). The medium is transparent, how the sounds have been created, stored and are presented to the audience should in no way intrude between the intentions of the composer and the listener.

This approach stands in a very uneasy relationship with genres stressing an often noisy bricolage, sometimes improvised, often 'urban' in feel, dense, industrial and often lacking in 'real space' perspective (that is, depth). Sometimes, too, the 'sound' of the medium is overtly part of the presentation – whether vinyl, analogue or eight-bit.

The second of these approaches has, to an extent, baffled the followers of the first. It was assumed that improved sound quality, extended processing possibilities including realistic 'sense of space' algorithms, would lead inevitably towards a technical Nirvana where synthetic and concrete, virtual and real, would be seamlessly manipulatable. A rejection of such a path and its glittering prizes was seen as perverse, even Luddite. It is, in part, to such thinkers that this chapter is addressed.

'Indicative fields' (Smalley, 1992)

My first task is to examine in detail an article which I believe to encapsulate brilliantly a tradition of electroacoustic working which has become dominant within much of the acousmatic music developed from the French tradition.[2] Denis Smalley's article 'The Listening Imagination: Listening in the Electroacoustic Era' (Smalley, 1992) extends classical Schaefferian (Schaeffer, 1966; Chion, 1983) thinking into a coherent examination of the relation of sound to human experience – a move away from an over puritan abstraction towards a rehabilitation of the real world and its attributes.[3] While such relations had been true in practice (within this particular tradition) for many years, the article appears to explain at a stroke why certain sound types have specific functions within electroacoustic music of this genre.

I shall then propose a substantial extension to these ideas in an attempt to see why some radical alternatives seem to be so incomprehensible within the model. It may be that such an extension is untenable and that a newer paradigm may be needed.

We must first review the outline of Smalley's position. I will concentrate on his idea of 'indicative fields'.

> Nine fields are identified. Three are archetypal: gesture, utterance and behaviour. These fields are original universals. Human utterance and the consequences of gesture have traditionally provided the sounding models for music. The behaviour-field is concerned with sounding relationships in space and time, which can be considered analogous to certain modes of human relationship, observed relationships among things or objects, or human-object relations. The six remaining fields are energy, motion, object/substance, environment, vision and space (Smalley, 1992, p. 521).

In the succeeding elaboration in this article, Smalley consistently relates several of these fields to the human body:

> Broadly defined, human gesture is concerned with movement of the body and limbs for a wide variety of practical and expressive reasons (Smalley, 1992, p. 523).

> Utterance is the second archetypal indicative field, and like the gesture-field it is directly linked to the human body (Smalley, 1992, p. 525).

Behaviour is not specifically related to the human body but is nonetheless very much grounded in the individual's understanding of a solid physical (mechanical) universe. He states:

> It may refer to human behaviour deduced from the utterance-network, to relationships in and among the networks of object/substance, environment or vision. The fields of energy, motion and space are inevitably strongly implicated (Smalley, 1992, p. 526).

He goes on to examine this field (behaviour) under three subheadings: *dominance/subordination*, *conflict/coexistence* and *causality*. The first two pairs of oppositions almost suggest a sentience (a consciousness) behind the metaphor of description. While it is true that primordial forces in the universe can show conflict, coexistence, dominance or subordination there is a sense in which these terms are profoundly rooted in our observations of the behaviour of objects around us. This is reinforced in the notion of *causality* which

> although it exhibits attributes of the two paired oppositions, needs separate consideration. Causality in this context does not refer narrowly to physical gesture. It is more concerned with one sound acting upon another, either causing the second event to occur or instigating change in an ongoing sound (Smalley, 1992, p. 527).

The energy-field 'is associated with the creation and release of tension which, as we know, is at the source of the gesture-field.' (Smalley, 1992, p. 528). The term 'tension' is specifically a mechanical attribute (much present in muscular energy). He continues:

> The energy-field depends on the motion-field … Since motion is integral to temporal experience all types of non-musical motions can have musical counterparts (Smalley, 1992, p. 528).

Object/substance is self-evidently a physical metaphor:

> actual sounding materials can be used, simulated or alluded to … stone, glass, ceramics, woods, metals, skins, etc., which can be subject to gestural play … objectness can be deduced from types of motion that suggest analogies with the motion of objects … objectness can be attributed to morphologies without reference to real materials as long as there is some semblance of a plausible gestural origin (Smalley, 1992, p. 529).

The next field – that of *environment* – is in the first instance interpreted literally. Smalley refers to human and animal utterance and to the 'sounding objects and textures of the environment'. It is precisely here that I shall argue (below) for a 'Trojan horse' kind of reappraisal which may spread out into the other indicative fields and networks. The penultimate field is that of *vision*.

> Every field discussed so far contributes to the visual indicative network. It is true to say that vision is at the very basis of the gesture-field, and that the energy motion trajectory is unimaginable without its visual correlations (Smalley, 1992, p. 530).

What he describes as a consequent 'weaker, voluntary, associative synaesthesia which will vary in consciousness and activity among listeners' (Smalley, 1992, p. 530) is once again inextricably a product of a sensory appreciation of the physical world (sight).

The final field discussed is the *space-field*. This he divides into three aspects. The first two are traditional notions of space with physical dimension: those of composition (the 'sound image' of the piece as composed); the second that of performance and public presentation. The third aspect 'concerns the affective interpretation of space – how the listener experiences and feels about space' (Smalley, 1992, p. 531). It is this third 'psychological' space which we will re-engage and develop here also.

This emphasis may be said to be 'Piagetian': the idea that human development is rooted in the physical senses and that we have evolved primarily to explore through these senses (Piaget, 1969). This paradigm remained unassailable until the advent of recording, telecommunications and electronic synthesis. It must now be re-examined.

The initial impact of recording in the last part of the nineteenth century was thought of as profound and yet some of the consequences are only just becoming apparent; the telephone dislocated in space the

cause of sound from its perception, to which recording added dislocation of time.[4] In the early part of the twentieth century the first synthesis removed the need for the mechanical causality[5] of sound altogether. These three dislocations effectively modified all the standard relationships of body to sound – it did not replace them altogether, but extended and challenged them.

This challenge has taken some time to develop. At first, the new media of recording, communication and sound synthesis remained strongly integrated within the prevailing 'physical music' paradigm. Recording and music telecommunication aimed at ever higher 'fidelity' with each technical improvement – fidelity to an idealised recreation of concert hall experience. Even synthesis remained within this performance tradition, more often than not basing its models on existing musical instruments and performance practice within traditional (physical instrument) ensembles.[6]

The transition from recreation to creation with this new technology which started in the 1920s and 1930s was to gather momentum in the period after stabilisation in Europe from about 1948. The classical rivalry of *musique concrète* and *elektronische Musik* addresses two of these dislocations directly: the French group turning the turntable (and the act of recording) around into a creative and productive force, the German group idealising the synthetic power of the new technology; while both groups came under the umbrella of institutions of our third dislocation – radio, articulating the need for a new kind of diffusion of a music 'which could only be heard over loudspeakers'.[7]

Causality

How do I *know* that the cause of the sound I have just heard is a 'bang on a can'? There are two components. The generalisation of my immediate experience to others. If I have experience of sound production for myself then I can deduce the causes of sounds even when invisible. This is learnt in early childhood; the voice is recognised immediately, followed by an increasingly wide vocabulary of sounds.

But there is also an entire class of sounds to which I cannot have regular access as (physical) producer: environmental sounds in the broadest sense. Some are 'natural', whether inorganic (wind, water, thunder) or from other life-forms (bird, animal), while some are 'cultural' and human-made (street and urban sounds, electrical motors, building sounds, construction sounds etc.). Of course, some of the properties of these sounds can be related to those we know and have learnt to make

ourselves (they are simply 'larger' versions), but others we need to learn through other means.

The philosopher Braithwaite discusses how we come to understand the *cause* of an event. He distinguishes what he calls 'regular concomitances' ('a concomitance of properties in the same thing or event' (Braithwaite, 1968, p. 308)) from *regular sequences*, *regular simultaneities* and *regular precedences*. Given the spatio-temporal continuity of the former it is easier to grant the status of 'cause' to the relation – 'I hit an object and it sounds'. We know and can perceive the continuity Braithwaite alludes to. The evidence for causality is sufficiently high for us to make the assertion.

But in the latter group the relation is looser. Perhaps we are observing at a distance – maybe even acousmatically. But in this group we may not have direct access via other senses; we *observe* and make judgements. Braithwaite asserts a particularly empirical philosopher's position: 'Scientific laws will be taken as asserting no more (and no less) than the *de facto* generalizations that they include' (Braithwaite, 1968, p. 10). The basis for us assuming the relation (for us sound, but for him anything) 'A causes B' will be the observation of persistent regularities and our generalisations from them. We can never be *absolutely sure* about any such causal relation; but we gain sufficient knowledge to be 'happy' with the statement: 'Lightning causes thunder'.

This second group then suggests less certainty concerning the origin of sounds. Modern science has supplied the causal explanation linking lightning to thunder, but it required other information – not immediately available to a lay observer and itself the result of scientific enquiry into the behaviour of gases – to make the link secure. These larger chains initially rest on repeated observation ('thunder always follows lightning') and generalisation rather than immediate tactile knowledge.

My object here is not to pursue an investigative programme in philosophy but to facilitate a shift in focus from examining the causalities of the physical world which have directed our 'Darwinian' evolution to those which include the dislocated experiences described above including most importantly those whose immediate source is the loudspeaker.

Learning involves consistency. The same action must produce the same result. In the world of physically produced sound this enables increasing nuance to be learnt. Crude distinctions are learnt in early childhood – I hit harder to produce a louder sound. Then as objects become more specific, a musical instrument for example, the effects may be more subtle. I begin to feel – I need not be able to express it in words – the changes that minute differences in breath pressure, embouchure, finger position etc., bring about as I painstakingly practice an instrument. In so far as the new media involve reproduction of our

existing experience (or possible experience) there is little problem. The best electronic musical interfaces ('controllers') preserve and even extend what F. Richard Moore (1988) has described as 'control intimacy' – a useful notion which combines consistency of behaviour with sensitivity – and it should not be necessary to use a highly energetic gesture to produce a 'just noticeable difference' in a sound quality.

We learn quickly to decode the origins of physically produced sound and its surrogates on radio, television and in recorded form. But once the medium becomes the tool of production rather than reproduction the matter changes radically.

Extending indicative fields?

There are two fundamental points to be made which may be read clearly in the above summary of Denis Smalley's exposition. One has been highlighted already: the firm embedding of his thesis within a primarily and dominantly physical universe. This world certainly has 'agencies' for action which operate within (most of) the indicative fields but which do not, as agencies, possess a 'culture'.

In this view the human body has learnt about sounds first through interacting physically with the world to produce sound or second, through hearing sound produced elsewhere but of assumed mechanical origin.[8] Whereas I will not suggest that this will disappear there are two developments which alter fundamentally this mechanical learning paradigm: the ubiquitous loudspeaker present in many young human lives from birth[9] and the presence in the immediate environment of sounds produced electronically.

But more subtly and less overtly stated, Smalley's 'indicative fields' idea appears to remain firmly within the nature side of a binary nature-culture paradigm; that is, the relationship appears to be between a learning 'I' and a physical world 'out there'. This is idealised into an assumed learning curve which seems to ignore that the very subject under discussion – electroacoustic music (or at least acousmatic sound) – is itself present in the very environment in which these archetypes are being learnt. The least we must do is to examine the effects of this cultural dimension; one that is not at all absolute but exists in a 'real' and developing time and space. In what way does this influence or alter the 'mechanical' (primordial) idealised model? We may have to extend this idea to include more 'cultural' fields.[10]

This transformation is paralleled in the move away from 'nature-as-opposed-to-culture' approaches within ecology, with the emergence of

integrated models which see not a binary divide of urban and rural but a complex interdependence. While this chapter will not claim to have presented such a holistic theory, I wish to suggest this paradigmatic shift as necessary to our understanding of the acousmatic world.

New objects and substances

Just as in the physical world we saw the relationship between sounds we could produce ourselves and 'large' sounds of the environment, so in the new acousmatic universe we have sounds which we appear to be able to make ourselves and those beyond our comprehension.

For example, a particular type of electronic sound was typical of the first generation of computer games. The simple morphology and spectral type was in part a product simply of economy – computing power was not to be wasted on unnecessarily complex sound production. But such sounds gained an immediate social dimension: they always had a precise semiotic function with respect to the game they 'inhabited', indicating simple moves or more complex outcomes. The ubiquity of such games added another level of signification: the sounds entered the urban soundscape for both the individual and the collective memory.

The strong link of such sounds to function we know (or are taught) is arbitrary; any sound might have been chosen,[11] there is no physical causality involved. Yet there appears to be (as above) 'regular sequence', an action on screen produces a sounding result – every time. While superficially similar, and allowing the same kind of learning as for the physical object or instrument, the effect on memory may be fundamentally different.

While Smalley (following Schaeffer) might hear a mechanically produced sound that indicates (even remotely) 'metallic substance hit with great force in a vast space', the indicators for our computer game sound when similarly lifted out of its accustomed context cannot be articulated in quite the same way. Such a sound might, using the existing indicative field indicators, be classed as a 'remote' or even 'dislocated' surrogate with respect to several of them. That it might not be related even remotely to physical sounding models would make it (in Smalley's terms) 'unviable'.[12]

But the sound is not heard 'in abstract' if included in a composition. Indicative fields seem to leap into operation unannounced – we need not actively engage them (although we can choose to concentrate on a chosen field). In this case the field suggested cannot but have a real-time dimension. A first descriptive response might be 'Space Invaders level 2,

annihilation sound'; this is a generalisation of the experience 'this sound is similar to that which always occurs at a particular point while playing Space Invaders'. This apparently resembles the phrase (in description of a 'metallic sound') 'this sound is similar to that which always occurs when I hit a metallic object with great force' but is, of course, much more context specific.

A first field indicator described this way (assuming such an extension to the original idea of indicative field is accepted) then leads to additional indicators which may also be clearly shared experiences and not merely autobiographical.[13] For example, aspects of the sound may indicate the particular 'space' in which the game was most often played, the machine and feel of the controls, joysticks, physical posture and gestures. These are, of course, considerably more context and history-specific than the generalised fields drawn from experiencing the sounds of the physical world, but have sufficient persistence to have been assimilated into sonic memory with these specific connotations.

It might even be that such fields come into operation to a greater extent when the 'primordial' ones (as described by Smalley) prove unhelpful. Leigh Landy reports an example of what might be the result of this emergence of context-specific fields which have the power to act retrospectively:

> It was in the early 80s that a small group of "punks" … attended an electronic music concert in which a couple of Gottfried Michael Koenig's electronic pieces from the 60s were performed. These works are highly original. They are also pretty loud. The "punks" were in ecstasy and most attending … after their initial surprise, finally understood why (Landy, 1991, p. 165).

Koenig's electronic pieces are often generated using what is known as 'non-standard synthesis' including forms of algorithmic composition, usually involving the direct generation of waveforms according to stochastic laws.[14] In many ways the resulting sounds and structures could not be further from the sounding models referred to by Smalley[15] and appear to inhabit a space without real dimensions, flat and alienated. And yet at a different level they can appear to 'refer to' and model the stochastic processes of urban existence – loud, noisy and arbitrary. And, as Murray Schafer has pointed out, such soundscapes are increasingly devoid of perspective and subtlety, becoming increasingly flat and monochrome.

> The hi-fi soundscape is one in which discrete sounds can be heard more clearly because of the low ambient noise level … In the hi-fi soundscape, sounds overlap less frequently; there is perspective – foreground and background … In a lo-fi soundscape individual

> acoustic signals are obscured in an overdense population of sounds. The pellucid sound – a footstep in the snow, a church bell across the valley … is masked by broadband noise. Perspective is lost. On a downtown street corner of the modern city there is no distance; there is only presence. There is crosstalk on all channels (Schafer, 1977, p. 43).

It is perhaps in this strange way that algorithmic composition may sneak into our discussion. This is perhaps an area most remote from the view of the acousmatic so eloquently articulated through the idea of the indicative field. In the first instance any such compositional 'system' was seen as anathema to the ear-based approach of the Schaefferian tradition.[16] The use of, for example, chaotic or fractal generation procedures often created crude results through naïve mapping procedures from number to sound. I do not intend here to attempt a rehabilitation of these.[17] However, that is to ignore the integration of certain algorithmic procedures into our everyday world. We *hear* the results of deterministic yet chaotic processes all around us: from control systems in buildings to computer noises, to the resulting 'noise' of the World Wide Web. These are steadily becoming their own 'indicative fields'.[18] An algorithmic process of generation may then – unexpectedly, without necessarily the intention of the composer – relate to a 'sounding model' in some process in the real world.

In a profound sense, this was predicted by Iannis Xenakis whose works move to and fro across what appears to be a divide between those having a clear sonic metaphor in the real world (the 'mass sounds' of *Pithoprakta*, the arborescences of *Cendrées*) to those apparently embedded firmly in mathematical abstraction[19] (the *ST* series or *Nomos Alpha*) (Xenakis, 1992). As a believer in the 'deep' relationship of science, mathematics and other symbolic systems to music he has never accepted this divide.

> The artist-conceptor will have to be knowledgeable and inventive in such varied domains as mathematics, logic, physics, chemistry, biology, genetics, paleontology (for the evolution of forms), the human sciences and history … Moreover, the time has come to establish a new science of "general morphology" which would treat these forms and architectures within these diverse disciplines … The backdrop for this new science should be the real condensations of intelligence; in other words, an abstract approach, free from anecdotes of our senses and habits (Xenakis, 1985, p. 3).

As we become more aware of the industrial and information processes that surround us and regulate our every moment such abstractions may 'discover' ever more concrete manifestations. We begin to observe – more precisely to hear – such processes around us. New *kinds* of

sounding models emerge based on the complexities (even, literally, the chaos) of urban life. Thus a new generation of composers may see an apparent lack of perspective *as the new perspective*.

But the newcomer is potentially invading old territory also. If the youngest of listeners learns a wide variety of 'instrumental' sounds only from the presets of a synthesiser, the sounding models from which they originate may cease to be learnt. Here a very different kind of process may be at work. The ear quickly learns to differentiate by sound alone: we soon realise to our surprise that this is a classic case of 'reduced listening'. The relation of the verbal phrase 'bowed string' to an actual waveform emanating from a loudspeaker may be retained but based upon an entirely different experience. The user may never have experienced a bowed string demonstrated to his/her aural, visual and tactile senses. The 'old' route – verbal description of physical phenomenon is applied to sound produced – is replaced by a conventional (that is, agreed) label (of the 'preset'). Such labels will, of course, remain reasonably close to those originally given through physical observation for a long time to come – at least until 'bowed strings' have disappeared! But the degree of arbitrariness of these labels may be seen in their progressive removal from the known and familiar ('bowed string', 'flute') through the vaguely known ('shakuhachi') to the 'joke sound effect' ('Mount St Helens').[20]

The user has no means of knowing that this is what we have previously described as 'reduced listening', indeed the phrase becomes progressively meaningless. The synthesiser might become the sole source of the sound produced; not just of the one sound but the potentially infinite many. Schaeffer's language is further inadequate to describe this object as it ceases in his terms to 'be' an instrument at all.[21] Such experiences leap over the phenomenological reduction demanded by Schaeffer straight into the world of directly perceived timbre: a 'flute' is a 'flute' is a 'flute' – that is, not necessarily a sound produced by a flute.

Ideas and technology as possible fields

In conclusion to this part of the discussion we have to face up to the possibility that we may slowly but steadily move away from physical agency as the basis for learning the indicative fields used for the interpretation of acousmatic sound and music. If this is the case then other 'fields', mapped in a more fragile way to the experiences of the industrial, information and urban soundscapes may emerge. For example, the 'ideas' of stochastics, chaos and noise have already found their

real-world expressions. I do not mean that stochastic, noisy and chaotic algorithms in composition will suddenly gain greater comprehensibility (they may or may not) but that these aspects of the soundscape may, without us necessarily being conscious of their presence, form associations of the type described in Smalley's discussion. And finally, technology itself, may become a reference field, drawn attention to as a crucial signifier; the acousmatic veil torn down and the transparent means of production and dissemination become the subject of the discourse.

Live electronic music?

In Emmerson (1994a) I discussed the relationship of two terms which I felt had become dangerously confused. The term 'real-time' had been introduced into music through computer applications to refer to near instantaneous processes. These could refer to sound synthesis, sound modification or sound diffusion. Progressively any electroacoustic performance which involved such resources 'on stage' was described as 'real-time'.

This description absorbed within its generality the older term 'live electronic', used first for the treatment of acoustic instruments using the analogue resources of an earlier era.[22] This strand of work maintained the human performer firmly in the centre of focus – most usually performing an acoustic instrument (or voice) for modification, but also possibly playing an electronic instrument. The members of the Stockhausen ensemble in the 1960s, for example, would treat 'live' the sounds of the electronium, other synthesisers such as the EMS Synthi AKS, or use short-wave radios as instruments.

There was also what the French termed 'mixed' music, combining instrument (or voice) and electroacoustic sounds (originally 'on tape'). Here the focus was balanced between the fixed performer (albeit with some limited mobility through amplification and sound projection) and the usually multi-speaker electroacoustic diffusion. These two approaches – 'live electronic' and 'mixed' – could, of course, be combined.

But another completely different approach to the use of technology in concert performance concerns using the calculating power of the computer to generate musical material ('events') during the performance. Such an approach was made radically easier following the advent of Midi in the early 1980s. Simple events (often just 'notes') could be specified easily and rules for their sequence and combination defined and applied with sufficient speed for the process to appear instantaneous. With more sophisticated interfaces emerging throughout the 1980s

and 1990s this has led to the development of *interactive* performance and composition systems in which performer and machine (or even machine and machine) can respond to each other 'spontaneously'[23] on the concert platform. These systems are all referred to as 'real-time' – but not all of them are 'live'.

For some of these systems the audience can have no idea what 'cause' has resulted in what musical 'effect'. The loss of appreciation of human agency within the sound world loses our immediate sense of the 'live'. But before we see how the extension of indicative fields (above) might effect our sense of human presence I want to review the first decades of live electronic and mixed music in terms of the relationships between the human performer and the sounding result.

In many ways the instrument is an extension of the body; instrumental gestures are extensions of vocal and physical gestures. The relationship to dance, work and the rhythms of everyday life has never been far beneath the surface of music – even a music such as western art concert music which has moved steadily away from body rhythm towards more esoteric concerns.

These are the origins of a major tension within contemporary organology: the instruments we have today are the product of a mechanical technology largely finalised by the mid-nineteenth century. The twentieth-century western musical world has seen an unprecedented expansion in 'permissible' sound typology even before the advent of electronics into the mainstream. We may observe this in several ways within the tradition: the extension of both harmony and timbral complexity in the first part of the century, in tandem with the extension of instrumentation to include, most notably, new percussion instruments. While the first wave of this expansion was based on existing performance practice, a renewed interest in the period after 1950 led in some quarters to pressure to develop new performance practices: so-called 'extended techniques'. This has remained a relatively underdeveloped field. Wind instrument multiphonics, for example, have some universally agreed specifications, yet the dream of 'extending' all instruments has hardly been realised.[24] The invention of entirely new instruments has been a further stage in this development but has remained firmly embedded within an 'experimental' tradition, producing no long-lasting new inventions.[25]

The contribution of mixed electroacoustic music to this development is important – and has shown up some of the inherent difficulties (even contradictions) in this enterprise. A classic 'acousmatic' style is usually severely disjunctive with the tradition from which western instrumentation emerged. Pitch is seen as a subset of timbre and not

necessarily an important one at that. Harmonic development is often replaced by more complex *timbral* relationships. The first step we might observe in trying to overcome this incompatibility is towards treating the instrument as 'sounding body', exciting its resonances and eliciting other sounds through a variety of techniques, most of which we might describe as 'extended'. In short to re-create it as a source of *objets sonores* to complement in quality those which have been pre-prepared in the electroacoustic part. Ironically, the causal link which the listener may have – instrumental gesture to sound – may be broken; the extraordinary sounds created from our 'familiar' instrument may not *seem* to come from it. The instrument aspires to the condition of the acousmatic.

But this is the nub of the problem; the instrumental sound remains in practice anchored to the instrument. It is impossible to diffuse the amplified instrumental sound in the same manner as the electroacoustic sounds. The composer is often unsure whether to try to 'free' the sound from source, to let it separate and have its own life – as that would undermine the vestiges of its relation to the live presence – or to leave it ambiguously stationary. Hence the live performer sometimes has the uneasy feel of a persistently real and recognisable intruder into a dream.

Conversely, there are composers who have attempted a rapprochement from the other side. The reintroduction of an 'instrumental' gestural world into the electroacoustic part is also a possibility. This is seen by some who espouse the acousmatic cause as a betrayal of the ideals of the medium. The tape hints at being a mere substitute 'accompaniment'. This approach has often resulted in apparent 'super-instruments', virtuosic and ghostly counterparts to the live performer who interact with an apparently superhuman (and sometimes robotic) force. Within this approach the live instrumental part is often more traditionally composed and a clearer anchor 'centre stage' with which the electroacoustic part takes issue and acts as 'surrounding' – itself often more clearly anchored[26] – without overt diffusion around the space.

A perfect balance of the two has rarely succeeded yet an early example remains a universally acclaimed exception. Stockhausen's *Kontakte* combines piano and percussion with electroacoustic sound. The instrumentation continues the composer's preoccupation with the continuum between pitch and noise. Of all instrumental families the percussion group has least reliance upon pitch within its enormous timbral range. The piano, due to its polyphony and pedal control of resonance, can create such densities of pitched sounds that more complex objects emerge. As John Dack points out:

> *Kontakte* presents intricate networks of relationships whereby differences between instrumental and electroacoustic practice and theory can appear simultaneously to conflict and support each other (Dack, 1998, p. 86).

The instrumental parts and the electroacoustic part in those sections of the work when it is most in 'contact' with the instrumental sound world articulate an apparently improvisatory and complex flux and exchange, maintaining the non-metric rhythms and density characteristic of the 'modern' music of the period. Thus, that both the live instrumental and the acousmatic parts aspire in some senses to the other results in the contact intended: the very opening gesture in which a metal beater is drawn in a circular gesture upon the surface of a tam-tam creating a sound which blends in with a similar (though extended) sound on tape is a paradigm example. The tape 'emerges' from the live.

The 'live electronic' field had as many subdivisions. The processing of acoustic instrumental and vocal sounds in performance may be divided into two: time and frequency domain. The two may be combined. The relationship of performer to sounding result is at issue here. The situation for the listener is very different for solo (or small group) than ensemble performance. For the small group the relation of loudspeaker sound to original (if absolutely no element is pre-recorded) is usually quite clear; if time delays are used the delay times are (for technical reasons) usually within short-term and always within medium-term memory. Frequency domain changes were clearly subtractive (filtering) or the generation of somewhat predictable side-bands (amplitude and frequency modulation). In all these cases the performer's gestural contour was usually preserved. There was rarely any acousmatic dislocation. An exception involved re-enveloping and extension of the sound; a sound without its attack often loses cues for recognition, delayed or extended in other ways it can lose a degree of its source bonding.[27] In the transition to digital processing techniques little changed in the first generation – experimental music had in general moved away from live electronic music towards real-time interactivity (without the acoustic sound of the live performer) in the early 1980s. The advent in the late 1980s of fast real-time processing of both the sounds and 'events' of live performance has moved towards healing the breach – especially as processes such as those developed by Miller Puckette, Cort Lippe and Zack Settel become available at more modest cost.[28] A final discussion concerns *interface* – the human–computer relationship.

Interfaces

The need for human–computer interfaces more sensitive to the needs of performers is emerging as the most important new field of research. Two approaches have emerged in the final years of the century: devices which track and measure physical action (sometimes known as 'controllers') and those which analyse the sound produced in performance through processes such as pitch and envelope tracking, real-time spectral analysis and measurement of noise components; the results of this analysis are converted into a suitable format for the control of sound production or processing.

The first group has existed since the earliest developments in electronic music (a keyboard is a simple controller). Notwithstanding the impetus given to this development by Midi and the subsequent development of, for example, guitar, wind, string, piano and percussion Midi-controllers, the limitations of the Midi protocol itself has frustrated their further development (F. Richard Moore, 1988).

The second group had to wait (at least for wider dissemination outside of research organisations) for the speed and power of the computers of the 1990s. Such real-time analysis processes came even more quickly up against the timing and information density limits of the Midi standard and most such systems use Midi only at the final stage of output.[29] The target of either of these two approaches[30] was the same: to control a versatile synthesis and sound processing system.

But an interesting divide has emerged in research into new interface design. One approach retains tactile feedback to the performer through strings and membranes under tension, spring-loaded paddles and joysticks, objects of familiar or newly developed elastic and plastic solids. Transducers 'read' this interaction from within the device. Another group avoids such elastic feedback while preserving tactility: measuring pressure, velocity or direction for example via transducer pads built into other objects, such as gloves, clothing, chairs, the floor. The performer may only partly be aware of the action taking place (perhaps through a change in the sound).

But there is also the possibility of remote sensors which never come into contact with the performer, using ultrasound or light beam systems[31] to detect proximity or movement. In addition, biophysical interfaces, which have remained on the fringes of experimental music throughout both analogue and digital developments, may yet move to the forefront of music interface technology.[32]

Extending the 'live'?

My own definitions of 'the live' have, as with Smalley's 'indicative fields', been anchored firmly in the domain of the physical. My definitions have related strongly to just those 'Piagetian' developments alluded to in my discussion of those fields. The apprehension of live presence was taken to be the product of a mechanical causality in which I could somehow 'work out' that there was live agency in the production of something I had just heard. Furthermore I associated that live agency with a specific role within the music, continuously informing its continuity through gestures I could *hear* as part of or extensions of the human repertoire of sound production. Occasionally this strongly realist position could be extended: a human could perhaps surrealistically 'play' a thunderstorm, where an instrumental gesture could be perceived in articulation or other aspects of the sound's evolution. But the smallest of anchors had to remain to the possibility of human causality in a physical sense. I rejected, therefore, actions such as triggering preset algorithms or soundfiles as being 'live' in this sense.

But I must now perform the same critical functions upon this supposition that I did earlier for indicative fields. In a universe of loudspeakers and urban 'noise' I can no longer simply assume that a child learns through audio-mechanical means alone to recognise human presence. But I am going to argue for a modification to these views in a very different way.

Loudspeakers today are most often used to project yet further evidence of human presence into every aspect of our lives. The ever present background music, talk and news creates an ideal community around us which we believe to be 'live'. The paradox for the composer could not be greater. The loudspeaker is the predominant communicator of the age: the telephone, the computer loudspeaker in addition to the radio and television. And most material heard through it indicates some aspects of human presence – whether alienated, fake or (even) real.

The reassertion of humanity over such new soundscapes has come in unexpected ways. Let us generalise the desire for live aspects to remain in music making to the desire to have a reflection of ourselves as real sentient beings somehow 'within the music'. In some cases we rejoice in the community of the performance, in others we revel at the virtuosity, feel challenged by the possibility of human error – with a hint of the voyeur when catastrophe strikes. In all circumstances the live performer was 'another one of us' even though glorified and separated the other side of a theatrical proscenium. This entire argument existed within the

mechanical/physical universe I have continuously alluded to. The soundscape over which humans claimed control was acoustic.

How then has an equivalent demand for recognition of human presence been articulated in our electroacoustic (and largely acousmatic) world? Attali has identified this ubiquitous pseudo-socialisation:

> It ['background noise'][33] slips into the growing spaces of activity void of meaning and relations, into the organisation of everyday life … everywhere, it signifies the presence of a power that needs no flag or symbol: musical repetition confirms the presence of repetitive consumption, of the flow of noises as ersatz sociality (Attali, 1985, p. 111).

To date we have been faced with an overwhelming lack of influence over what we have received through the loudspeaker. And herein lies the first assertion of human action: *choice*.

The very technology that brought us the dislocation of recording from live performance has now enabled us to shift the focus: I am asserting the possibility of 'playing' the loudspeakers. This might seem no different from the activites of every electroacoustic composer who revels in the use of an 'orchestra of loudspeakers'. But here the materials of the 'play' come from those forming experiences which surround us. At its crudest 'channel hopping' is the most primitive assertion of this choice which has as its increasingly sophisticated offspring the areas now known as 'plunderphonics'[34] and the more experimental 'turntablism' of the club DJs.[35] The act of wilful change and choice is often quite vicious in its application. The original recordings which are the material of this new music may have been constructed with due respect to language, melodic shape, balance and 'beautiful sound'; but as the subject of these arts of collage the material is ruptured from its pretence at 'representing a performance', hacked up and fragmented with deliberate disregard for these original niceties, while preserving just enough of them to allow a degree of identification with their human origin. It is almost a revenge by the artist against the previous lack of control over the ubiquity of the loudspeaker, a reassertion of creativity and authorship.

> Therefore, in the final analysis, to listen to music in the network of composition is to rewrite it: "to put music into operation, to draw it towards an unknown praxis," as Roland Barthes writes in a fine text on Beethoven. The listener is the operator. Composition, then, beyond the realm of music, calls into question the distinction between worker and consumer … (Attali, 1985, p. 135).

In like manner a shift in listening habits towards 'sampling' the music at venues[36] shows another aspect of this shift to 'listener as creator (or at

least controller) of experience'. The increase in interest throughout the arts in sound installations, site-specific artworks and environments also shifts responsibility substantially towards the individual visitor for the final experience. The introduction of interactive technologies also gives further power away from the 'author'.

Thus once again we see not a simple extension of the idea of 'the live in the music' – deduced as we have seen from our knowledge of the physical universe – but a shift of focus now that the loudspeaker has become the source of new experiences. We no longer assert our human presence only through hitting, scraping and blowing the objects around us, but through reasserting our power over the new medium – and using *it* as source.

To do this we need clearly to perceive that the medium *is* the medium, that is far from making it transparent (as our acousmatic artists have previously advocated) quite the opposite is the case. For anyone to show you that constructive power has been 'regained' over the loudspeaker, you must clearly recognise the sources as those associated with the loudspeaker with all its connotations. We draw attention to it; it must be recognisably an artefact.

Recognisable recordings are but one obvious and controversial possibility. But then so are some of the more obvious techniques of the medium: looping has been with us since the dawn of *musique concrète* – from *sillon fermé* through the tape loop to the byte-specific definitions in the digital sampler. In addition that actual quality of the medium may be highlighted: vinyl itself has qualities of bandwidth, audio compression and surface noise which may be recognised – even when finally mastered in the highest quality digital format. To paraphrase Roland Barthes (1977) the 'grain of the voice' – which gives it such characteristics and personality – has become the 'grain of the recording' with which we now assert our independent choice and creativity.

Conclusion

The assertion of human presence within music produced by and through technology will take many different forms as humans become increasingly alienated from purely physical sound production. We have examined two streams within this process. Some will carry on representing humanity within the music when produced – the inherited role of the human performer on stage for us to hear. The 'amplification' of human gesture made possible with the new interfaces may create distorted giants of unreal proportion – but we may recognise them at least.[37] But

second, we have seen the possibility of a music of technology with the clear imprint of the human *will* rather than the human *presence*. As composer, performer and listener distinctions can blur, choice and construction within the act of listening become the act of composition itself. When this is repeated on each occasion we may see it as an essentially live and sentient activity.

This writer, at least, hopes that the two approaches will not lose touch with each other.

Notes

1. Though purists note that the idealised notions of *écoute reduite* and *objet sonore* have given way to a more liberal approach to including the sound origins.
2. Especially (interestingly) outside France itself; for example, Canada (both the Quebec French tradition and the World Soundscape Project group (Vancouver)), Sweden, the UK, and many offshoots.
3. The article does not address the 'real world'/synthetic divide *within the music* (see Wishart, 1986), but how we relate the spectromorphology of *any* sound to a possible *indicative field* (q.v.).
4. The mixed metaphor – 'dislocation of time' – is significant; the mapping of time onto space is a characteristic of western modernism.
5. Except that of the loudspeaker to which we shall return.
6. This generalisation must not detract from the extraordinary exceptions of the Theremin, aspects of the *Ondes Martenot* and other early experimental interfaces; nonetheless the overall paradigm remained firmly based on the keyboard model. The *Telharmonium*, too, was heard by telephone – another premonition of contemporary distribution.
7. The title of a series of radio broadcasts by Stockhausen on the WDR (Cologne) 1964–66: 'Kennen Sie Musik, die man nur am Lautsprecher hören kann?' which reviewed electroacoustic music from several traditions, published as Stockhausen (1971).
8. Of course Smalley refers often to apprehension of sounds produced synthetically (electronically); but throughout the indicative fields and networks discussion he refers almost exclusively to the world through physical/mechanical metaphors.
9. Or before, from playing music to women in pregnancy to contact transducers which transmit stress reducing pseudo-heart beats.
10. As a first stage in establishing a continuum of natural and cultural fields, perhaps.
11. Although a closer hearing reveals that many are remote surrogates of real physical sounds – sometimes of games of previous eras.
12. He writes: 'Many a listener's problem can be related either to the loss of tangibility created by the severance of direct gestural ties, or to the difficulties in comprehending the remoteness of new surrogacy' (Smalley, 1986, p. 83).

13. A field can only exist if shared amongst a large community of understanding.
14. The *Funktion* series, for example.
15. And are certainly extremely remote in sound quality from the post-concrète genre referred to in the opening paragraphs above.
16. Schaeffer referred to the composers to enter the GRM from 1957 as 'This generation, visibly liberated from their serial straight jackets' (Schaeffer, 1973, p. 31).
17. Partly victims of the 1980s obsession in some quarters with event-based algorithms following the invention of the Midi protocol.
18. I am crudely lumping several together here which will surely become more clearly differentiated in future.
19. That is not to say the mathematical abstraction *could* not be related to processes in the real world just that it does not *sound* like it. I am arguing here that this distinction is fluid.
20. I remind the reader I refer to synthesiser preset labels in these points. 'Mount St Helens' was a sound effect preset on the DX7 synthesiser, a landmark in the evolution of named presets. Interestingly younger users may no longer understand the volcanic reference.
21. An instrument being precisely that which gives coherence and identity to a group of sound objects (Schaeffer, 1966, chapter 13).
22. There was an explosion of such work in the 1960s although precursors in the USA (Cage most notably) can be dated back to the early 1940s.
23. The evolving 'Voyager' project of trombonist/composer George Lewis is a case in point.
24. A series from the University of California Press, 'The new instrumentation', included volumes on double bass, flute, trombone, clarinet and guitar.
25. That is not to underestimate the influence of these usually one-off devices on attitudes to timbral composition and performance practice.
26. There is a possible paradox here. The 'apparent' instrument (on tape) may need to be more definitely anchored in order that spatial movement within it may more clearly be heard. Javier Alvarez's *Papalotl* (piano and tape) is a good example.
27. The guitar feedback techniques of Jimi Hendrix are a case in point.
28. The MAX/MSP environment is but the first and has already led to an explosion of possibilities in this field. For a discussion of such an environment from the view of an improvising group see Casserley (1998).
29. In recent interfaces from both Steim (Amsterdam) and MIT (Cambridge, Mass.) the internal resolution of the tracking far exceeds the Midi bandwidth. The advent of such as real-time C-Sound may see the end of Midi within such systems.
30. A combination of both approaches (performance action and signal analysis) has been used in the some devices.
31. Interfaces developed for special needs performers and composers have pioneered combinations of these approaches. In the UK, the Drake Music Project, for example, has made extensive use of these.
32. The systems of David Rosenboom and Alvin Lucier are well documented cases in point. These are sometimes erroneously described as 'biofeedback' processes – some are, some are not. They use biophysical controllers to control an outside system.

33. Attali heads the section 'Background Noise', but it is clear throughout the chapter that he refers to background music *as noise* in this sense.
34. See Chris Cutler's contribution to the present volume (Chapter 4).
35. Robin Rimbaud ('Scanner') with *Spring Heel Jack* on nine turntables (ICA, London, 20 March 1999), for example.
36. In the sense of moving between spaces, listening for a while, moving on and being sociable. The term 'concert hall' is no longer applicable to these small 'club venues' which are often taken over for such presentations.
37. From Galileo to D'Arcy Thompson (1961), engineers have pointed out that we cannot simply ignore *absolute* size when we scale the proportions of a model. The bones and muscles of a human scaled to twice the size would not function effectively. Fleas can jump many times their height while elephants cannot even jump.

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