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“Pulse, metre, rhythm in electro-acoustic music”

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# Pulse, metre, rhythm in electro-acoustic music

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## Background – Unease

At various times in the last sixty years (and increasingly in the last twenty) the introduction of rhythmic (or metrical) elements into electroacoustic music has caused a certain unease, even disquiet – sometimes stated in words, sometimes in other music, and sometimes left unstated ... When I was at City University, London in the 1980s I was privileged to supervise research students working in the electroacoustic studio: Alejandro Viñao (Argentina), Javier Alvarez (Mexico) and Julio D'Escrivan (Venezuela). Their work became in many ways a critique of the relationship of pulse (and rhythm) to modernism in general, and within electroacoustic music in particular. In fact some of their work was accused of being a kind of 'electronic karaoke' (definitely a negative connotation!). As Alejandro Viñao expressed it -

“Computer control of the electroacoustic environment makes it possible to formulate new pulse-based lines, polyphonies and resulting forms, reopening the chapter of pulse, rhythm and repetition which Europeans had 'declared' obsolete in the modernist 1950s. ... experimenting with new ideas derived from a multiplicity of sources (other cultures and the reformulation of Latin American rhythms) as well as those pulses and rhythms which can only be generated by computer ....” (Viñao 1989, p.42)

## The Dance

In my article 'From *Dance!* To "Dance"' (Emmerson 2001) the title is intended to summarise the relationship of music which is an overt invitation (even a demand!) 'to dance' and one which is a more distanced and disembodied *representation* of, or *reference* to, dance or those who dance. In the case of 'mixed' music (music for instruments or voices with electroacoustic part – once known as 'tape') we see two approaches to reconciling the live and the studio components (see Emmerson 2007 for a more extended discussion). On the one hand we can hear the instrument 'aspiring to the condition of the acousmatic' – extended and amplified, played in such a way as to generate the widest possible range of sonic qualities – such that the audience may even 'lose' the source/cause in the mix. On the other hand the electroacoustic part might 'aspire to the condition of the instrumental'. Here it mimics shapes and gestures more clearly related to the instrumental performance tradition and engages the instrument on its own territory, perhaps extending it but never losing that anchor in the familiar. It is this latter approach that the three composers mentioned above embraced with the strong influence of their particular Latin American traditions – albeit with a degree of ambiguous playfulness, here expressed (in somewhat European terms) by Javier Alvarez describing his work *Papalotl as* -

“... a work where the listener was constantly struggling to understand simple pulses, yet never entirely fulfilling his desire. Imagine for a moment that you are trying to dance a waltz and as soon as you are in step, the music is changed to a polka, and as soon as you've readjusted a faster waltz appears, and so on ...” (Alvarez 1989, p.222)  
This notion seems remarkably close to some of the rhythmic devices of the neo-classical Stravinsky.

## Back to Basic Definitions

Text books do not always agree on basic definitions but I will work on the basis of the simple version:

*Pulse* - a regular sequence of beats;

*Metre* - the grouping of beats into patterns, marked by stronger and weaker beats;

*Rhythm* - a particular sequence of sound events perceived in time.

Justin London's approach to defining metre starts off positioning it in an essentially ecological position, at a much more primeval level –

“... meter is not fundamentally musical in its origin. Rather, meter is a musically particular form of *entrainment* or *attunement*, a synchronization of some aspect of our biological activity with regularly recurring events in the environment. Meter is more, however, than just a bottom up, stimulus driven form of attending. Metric behaviors are also learned - they are rehearsed and practiced.” (London 2004, p.4)

He goes on to cite Jeff Pressing's work on modelling of such behaviours in what he calls *rhythmogenesis* – “*Musical rhythm arises from the evolved cognitive capacity to form and use predictive models of events* - specifically, predictions of the timing of anticipated future events.” (Jeff Pressing (2002), cited in London 2004, p.5) We therefore enter a world of *prediction* and the rhythmic aspect of 'frustrated expectation' which Leonard Meyer believed was at the basis of much musical argument and hence meaning (Meyer 1956). Many writers have claimed that the best musical arguments have just the right balance of frustration and fulfillment – neither too obvious nor too difficult in their predictability – to maintain attention and interest.

## Technology and Memory

For Pierre Schaeffer the *sillon fermé* (closed groove) was by definition 78bpm, a pulse of period  $60/78 = 0.77s$  (more or less: +/- a degree of controlled varispeed possible on both record and playback). His subsequent notion of the *objet sonore* is directly related to this duration but not for mechanical reasons - both are roughly in the psychological middle<sup>1</sup> of the *metric window*<sup>2</sup>, which describes limits as to what is perceived as metre. At one extreme we have the 'fast' end. A period (T) = 100ms (corresponding to a frequency of 10 Hz, 600bpm) is about the fastest repetition we perceive as pulse; anything faster<sup>3</sup> blends into timbral continuity (pitched if regular/periodic, noisier if more irregular/asperiodic). At the other we have the slowest perceivable pulse periods of T = about 5 to 6s (a frequency of about 0.2 Hz, 10-12bpm), beyond which our memory 'fails' to construct any regularity. Here we move to phrase length memory and eventually to memories of form (which must involve long term memory). This is shown summarised in Figure 1; whilst the second transition is well known from Stockhausen's *Kontakte*, the first is not fully understood.

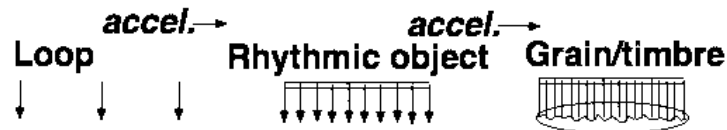


Figure 1: Transitions: Loop – Rhythmic object – Timbre

## Chicken <> Egg

This can be seen as an example of a kind of Darwinian evolution. A mechanical constraint 'locks' with something in the perception system. i.e. if this had not been the case it would not have 'worked' and hence not survived. Then when technological boundaries dissolve, psychological ones remain, demonstrated by the fact that Schaeffer's *sillon fermé* is of very similar length to Steve Reich's "*Come out to show them*" (even though the tape loop is not technically so constrained). Then later the tape loop's replacement with digital memory only became realistic when it matched up to these lengths sufficiently easily (both technically and economically)<sup>4</sup>; even when digital memory became much cheaper the idea of the 'sample' remained in practice related to the *event*, an instrumental note, a percussion hit, an *objet sonore*, extended at most to a short sequence of such events – a *rhythmic motif*<sup>5</sup>.

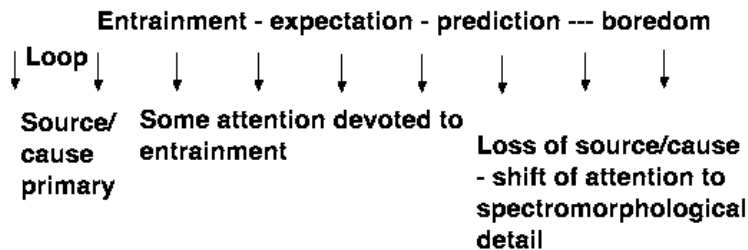


Figure 2: Attention – Entrainment – Boredom

## Entrainment, Distraction, Boredom

Pulse has a special effect on our attention. This is known as *entrainment* - the attention system holds information in short term memory, if repeated this is used to 'predict' the next event - thus 'listen' is replaced by 'listen out for'. But expectation takes up some attention bandwidth – it is possible we will be less attentive to other passing detail. Two conditions might cause the entrainment to collapse. At the top end of the time scale beyond a repetition period of 5-6s this does not hold, entrainment collapses and we have *distraction*. More local detailed attention may then take over; rhythmic pattern can give way to following spectromorphological detail. Also when something becomes too predictable we have *boredom* – attention may even switch away from the audio stream (Figure 2). Rhythmic music works with these patterns of expectation and frustration; I suggest that we devote 'attention bandwidth' to such patterns in rhythm, their trajectories and changes. What I am speculating needs further empirical

<sup>1</sup> Using a simple powers of 2 (logarithmic) scale, 800ms is the mid point between 100ms and 6400ms (see later).

<sup>2</sup> Note the ambiguity typical of the literature. We loosely refer to 'meters' of (e.g.) quarter (crotchet) = 60 when these are more properly 'pulse speeds'.

<sup>3</sup> With a transitional region about 10-16Hz – from about 16Hz the sensation of pitch is generally clear.

<sup>4</sup> With a strong psychological component; an early sampler, the Fairlight CMI (Australia 1979) cost (at the time) UK£15,000 for eight voices of each just under 1s sample length at high quality.

<sup>5</sup> For example the much sampled 'amen break'.

work, but if our attention is finite this means that less is therefore available for the detailed contemplation of instant by instant spectral detail and timbral change. However, some rhythmic groupings may return to an integrated ‘object’ status - usually at high energy and tempo – they are ‘too fast’ (approaching the limit of the metric window - see above). The attention then returns to a holistic view of the ‘rhythmic-timbral’ object (Figure 1).

### The Ambiguous Event

There are two (closely related) meanings of the term ‘event’:

- (1) an identifiable change in a given quality, taking place at a specifiable time (with duration not considered);
- (2) a sonic unit, assumed to be relatively short in duration<sup>6</sup>, which has a clear identity. The time of occurrence is usually clear and noticeable.

There is ambiguity in both uses of the term – nothing is technically instantaneous, and what is identifiable (‘noticeable’) depends on attention, learning and cultural significance as much as acoustics. In addition *the onset may - or may not - ‘mark’ the time of occurrence of an event in perception* (Figure 3).

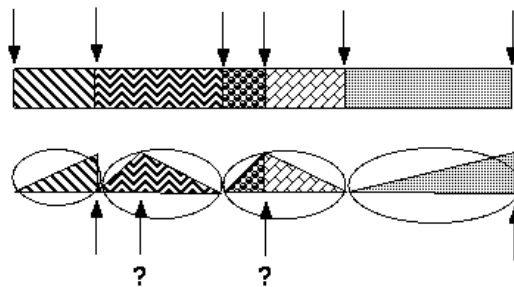


Figure 3: ambiguous meanings of the term ‘event’

Midi made the idea of event explicit in its ‘note on/off’ definitions which are identifiable changes in pitch and/or velocity (effectively amplitude). But this may not be reflected in the sound as perceived – a midi event is not the same as a sound event.

### Looping and Repetition

Looping and repetition have had many functions that clearly overlap. We start with loss of recognition and identity of source: both Pierre Schaeffer and Steve Reich noticed (and exploited) the apparent shift in perceptual focus away from source/cause towards colour/shape. But the results are different: Schaeffer discovers an early form of *écoute réduite* through the repetition of the *sillon fermé* and does not develop its rhythmic implications. While minimalism more than hints at a relationship to ecstatic mesmeric repetition, itself related to limb movement synchronisation and entrainment (usually through dance or its surrogates). This is at the root of its antagonism to modernism: Stockhausen rejected periodicity as a reflection of synchronised marching (Cott 1974, p.28) while Trevor Wishart heard regular repetition as the metaphor for an industrial machine and hence imprisonment of the human body and spirit (Wishart 1978, 1992, 1996). Recording allows manipulation of performed time; a performance gesture may be transformed but retain a link to (possible) cause. In the acousmatic area this was discouraged – generally seen as intrusive, the (real) performer was ‘bracketed out’ as part of the acousmatic fiction. But this was clearly not the case in much of the music referred to here which alludes to, quotes or draws from elements of dance.

But something has changed since these early discussions. The advent of post-dance music electronica or ‘IDM’ shows both similarities but also profound differences. I have already suggested that in these 1980s works (which sought an accommodation with rhythm) the electroacoustic part ‘aspired to the condition of the instrumental’ – that is, their origin lay in an only slightly remote surrogate of the *live instrumental performance gesture*. In the interim, these had been ‘technologised’ through sequencer software into the profoundly pulse based dance and techno world. Thus by the 1990s a two layered surrogate was at work – on top of and much more immediate than ‘live instrumental performance gesture’ was the gesture world of ‘electronically produced (dance) music’, leaping out from, and demanding independence from the first; in fact the relationship between the two layers was increasingly tenuous, and in many cases the earlier more fundamental level was almost completely obscured. In this environment the phrase ‘impossible performance’ ceases to be an oxymoron - the impossible animal can be imagined and created<sup>7</sup>. As we switch focus from ‘body performance’ to ‘machine performance’ the question dissolves: there must be sufficient relationship to performance as we have previously known it to allow us to relate to it, yet it can behave in extreme manners. For example in much recent experimental electronica, the ‘drum kit’ is played at impossible speeds, flies

<sup>6</sup> Certainly able to be caught within short term memory.

<sup>7</sup> True of the earlier composers, too (see the Viñao quote above) but here all parameters are freed to work to the extremes (space, speed, filter settings and other timbral changes) with only tenuous relationship to human capability.

free of any rooted existence<sup>8</sup>. It cannot be envisaged literally except as a surreal entity – an ‘impossible animal’, maybe a robot.

### Challenge

Perceptions of rhythm and metre do not only grow out from music practice; they are part of a greater continuity of periodic and non-periodic perceptions of the world within which the body sits. We need a better understanding of the sonic ‘marking’ of time in general; one sensitive to the significance of timbre, affordance and social practice; one which accounts for the changes that technology has brought about. We perceive the action of machines – mechanical or electronic – superimposed on, and interacting with, the results of millenia of perceptions of diurnal rhythms, seasons, ourselves and other living creatures.

### Music examples

Pierre Schaeffer: *Etude pathétique* (1948) [on *Pierre Schaeffer – l’œuvre musicale intégrale*, INA.GRM: INA C 1006-1009 (1990)]

Steve Reich: *Come Out* (1966) [on *Early Works*, Elektra Nonesuch 979 169-2 (1987)]

Trevor Wishart: *Red Bird* (1977) [on *Red Bird – Anticredos*, October Music: Oct 001 (1992)]

Javier Alvarez: *Papalotl* (1987) [on *Papalotl - Transformaciones Exoticas*, Saydisc: CD-SDL 390 (1992)]

Autechre: *Garbage* (1995) [on *Garbage*, Warp: WAP58CD (1995)]

Squarepusher: *Greenways Trajectory* (2001) [on *Go Plastic*, Warp: WARPCD85 (2001)]

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<sup>8</sup> For example works by Autechre (1995) and Squarepusher (2001).