Giving Voice to the Inaudible: Perception and Non-perception in Iannis Xenakis' Late Electroacoustic Music

Christopher Haworth
Sonic Arts Research Centre,
School of Creative Arts,
Queen's University Belfast.
chaworth01@qub.ac.uk

In Makis Solomos, (ed.), Proceedings of the international Symposium *Xenakis. La Musique Électroacoustique / Xenakis. The Electroacoustic Music* (Université Paris 8, May 2012).

ABSTRACT

This paper considers the nature of 'imperceptibility' in Iannis Xenakis' computer music by placing it in dialogue with the more widely recognised 'unplayable' aspects of his acoustic music. Pieces such as *Herma (1961)* and *Eonta (1963-64)* stage a struggle between performer and score; 'the Work' is comprised of presences and absences, sound and unsound, perception and non-perception, with neither being subordinate to the other. But Xenakis' computer music has received criticism, both for exceeding and for not reaching the supposed 'requirements' of the human ear. This paper asks why the status of non-sound should shift as we cross mediums. The question is handled in terms of discourses, particularly those pertaining to what is called 'music' and what 'material'. The author argues that Xenakis' works with Dynamic Stochastic Synthesis, and his 'unity of timescales' concept, illuminate *via transgression* a hierarchy of different rules and discourse-types that act upon and structure musical space in advance. Finally, the implications for authorship are also considered.

1. INTRODUCTION

In *Kafka: Towards A Minor Literature*, Deleuze and Guattari present a reading of Kafka as a "minor" writer. Assigning 'minority' status to Kafka immediately makes it clear that the notion is not to be understood in its more common sense. 'Minority' cannot denote 'lesser', or 'overlooked' histories when their study concerns an author regarded to be one of the great novelists of the modern age. Clearly a certain dissonance is being sought; or engineered perhaps, between, on the one hand, canonization and capital 'h' history; and on the other, outsiderdom, resistance, and complication. We learn that minor history is not directed at 'becoming-major': at raising the status of an author who has been overlooked by 'major' history only to correct or replace the dominant account with a more accurate one. And nor is it to be seen as simply denoting a resistance to canonization, an anti-art position that refuses to be assimilated into the official story. Minority always stands in a particular relation to the majority, operating upon it from inside rather than refusing or effacing it. The operation, Deleuze and Guattari tell us, is the 'becoming-minor', wherein the primary discourses that govern the reading of an author or a history – whether they be genre categories, theoretical interpretations and so on – are complicated by a reading that 'traverses' the text, dismantling its authoritative meaning. And because the priorities that comprise this majority always exert power and dominion upon it, the becoming-minor is political. It is, in Deleuze and Guattari words, the becoming of everybody against the analytic fact of nobody (Deleuze & Guattari 2004, p.106). Fracturing the hierarchies that structure

and unify a discourse, the minority acts, not as resistance but as a kind of infection, or agent inside the host body, that deterritorializes its structured unity in order to split apart and expand the territory. It is a "continuous variation… an amplitude that continually over-steps the representative threshold of the majoritarian standard, by excess or default" (Deleuze & Guattari 2004, p.106).

This complex notion of minority informs the reading of Iannis Xenakis that I present in this paper. It is a useful critical tool, because, on the one hand, there are few histories of 20th Century music that would omit the story of the great European composer whose legacy can be summed up by Messiaen's simple exclamation to "be Greek, be a mathematician, be an architect, and out of it all, to make music!" Xenakis is part of the canon of late modernity, not a footnote to the major story but one of its architects. His interests in chaos, game theory and probability have been hugely influential to the extent that they are now fairly common compositional devices. Yet, on the other hand, there are elements of his activities that are resistant to the majority field in which they participate; points of friction that have never been fully assimilated into the dominant histories. My paper will consider this friction as it pertains to Xenakis' computer music, showing how hs work problematises the scientific, technological and aesthetic discourses that comprise the major field of computer music research. For instance, one of the reasons Xenakis might be considered an outsider in this field is that he applied the same sorts of principles to the sound signal as he did to other variables in his compositions, thereby creating a music where nothing is given in advance. For this reason he has been seen as a purveyor of 'non-standard sound synthesis'. These techniques are minoritarian by definition, the category 'non-standard' only acquiring meaning in relief of the 'standard' approach whereby synthesis is based upon known acoustical or perceptual models. But, as I will show in this paper, it is these very discursive categories, though supposedly autonomous and independent, that act to manage and organize the space they delimit. Whether in the name of aesthetics, nature or perception, the area of possibility is to a certain degree defined in advance by a discourse prescribing what constitutes music and what material, what art and what practice, standard and non-standard etc. Xenakis' computer music illuminates the perceptual, aesthetic, and technical priorities that underwrite these seemingly innocuous categories by its very refusal to adhere to them; they emerge in relief through the music's transgression. And since perhaps the ultimate refusal any music can enact is a refusal of sound itself, I will be paying specific attention to the nature of "imperceptibility" in Xenakis' music, showing how a shift in the ontological status of the same object – the not heard – can be seen when we compare its presence / non-presence in his acoustic music to that of his electronic music.

2. UNITY OF TIMESCALES

In the chapter on Time, Space and Music in Formalized Music, Xenakis sketches a formal model of music as a lattice of different timescales. Ascending in size, these are the microstructure, the ministructure, the mesostructure and the macrostructure, which correspond to timbre, note, polyrhythm-and-melodic-scales, and form, respectively. Xenakis is not the first to conceive of music in terms of simple divisions of time. Stockhausen's 1959 article, 'How Time Passes', had already outlined "a new morphology of musical time" which considered the dimensions of sounds and music in a similarly quantitive way (Stockhausen 1957). Yet Xenakis' molecularisation of music is different, for in this paragraph he is proposing a model of composition in which no element would be considered separately, and thus, arguably, none would be favoured over another. He writes: "It is a question of beginning with any form whatsoever of an elementary wave, and with

each repetition, of having it undergo small deformations according to certain densities of probabilities. The result of these deformations is perceptible on all levels" (Xenakis 1992, p.266). Evident here is a radical mathematical formalism, of which much has been said already. But since, as Adorno showed, no formalism can be considered apolitical, it helps also to consider his terminology. His replacement of the standard musical descriptors with a neutral order of magnitude acts as a *democratisation* of music's elements, resisting the hierarchical structure of the score and offering instead a series, distributed according to size and separated according to perceptual discrimination. Thus timbre, the score's silent attribute, becomes first in the distribution, and we work our way all the way up to form, the largest.

An ideological target of this formal democratisation is hinted at in Xenakis' 1954 article, 'The Crisis of Serial Music'. In it, he criticises the deterministic causality of serialism on the grounds of audience comprehension. He writes: "the enormous complexity *prevents the audience from following* the intertwining of the lines and has as its macroscopic effect an irrational and fortuitous dispersion of sounds over the whole extent of the sonic spectrum" (Xenakis 1992, p.8). For Xenakis, serialism is oppressive, totalitarian even. The audience is effectively given an impossible task, which is to comprehend a "polyphonic, linear system" when what one 'really' hears is surface or mass - a chaos of notes in various registers. This can sound like a conservative criticism until one considers Xenakis' solution, which is not to render the music *less* complex but rather to loosen the grip on unity and formal determinism. In short, he emancipates excess and complexity, simply by allowing it be heard as such. The density effect that serialism seems to expect the listener to penetrate somehow, discriminating between and remembering individual elements, *is* the sonic reality of the music. And this primordial quality can be better served by abandoning the latter's "tautological unity" and thinking in terms of masses, collisions, densities. Sheer sonic thrill is prioritised, and the ensuing work of composition becomes a question, not of systems but of process. Disregarding serialism's "ideological nonsense" - to use Xenakis' words - the question becomes: what methods may be appropriate to create such densities? The score becomes a site for deterritorialization, for the systematisation that inhibits serialism is bound up in its obedience to the laws of the score and the chromatic scale. On the limitations of the score, Xenakis writes: "the musical scale is a convention which circumscribes the area of potentiality and permits construction within those limits in its own particular symmetry" (Xenakis 1992, p.132). Its quantized intervals are de-quantized and its boundaries crossed by the smooth straight lines and parabolas of *Metastasis (1954)* and *Pithoprakta (1955-56)* (see figure 1 & 2).

Figure 1. Score to *Metastasis (1954)*

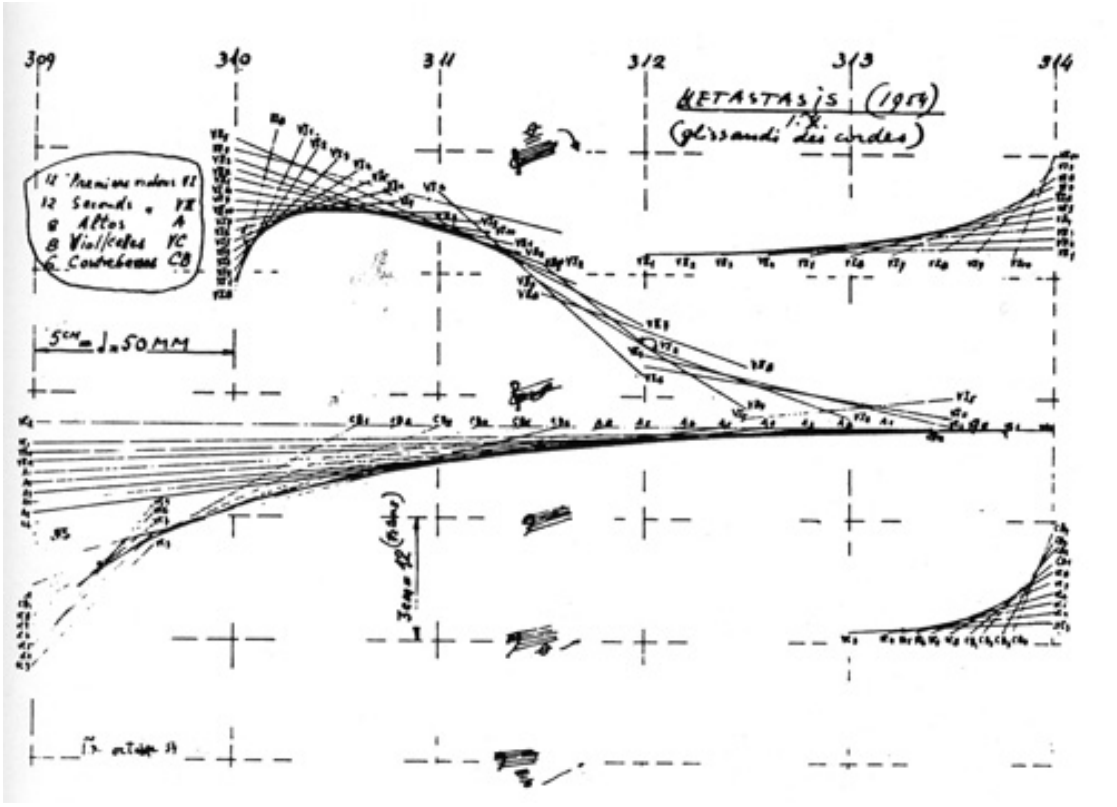
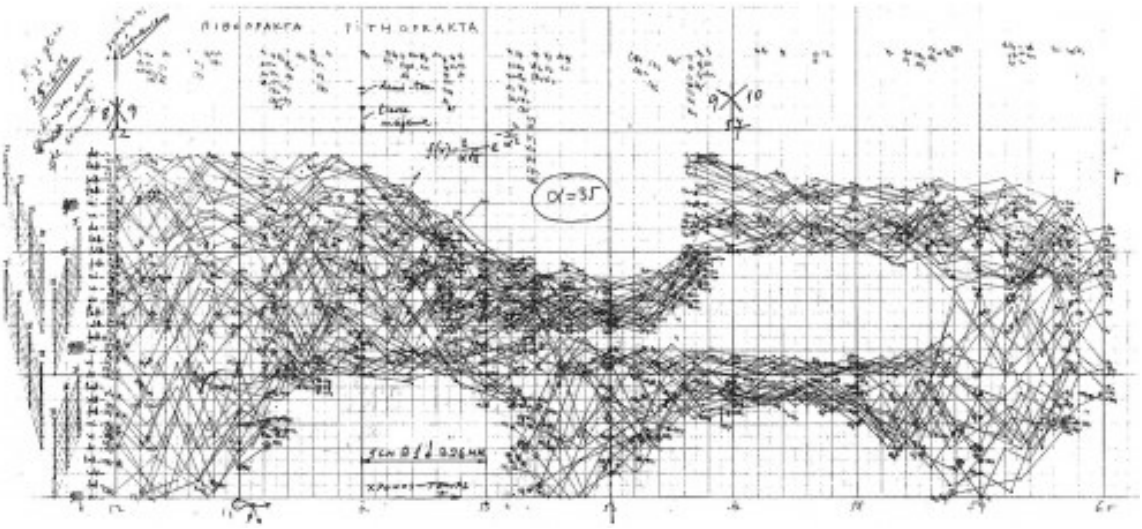


Figure 2. Score to *Pithoprakta (1955-56)*

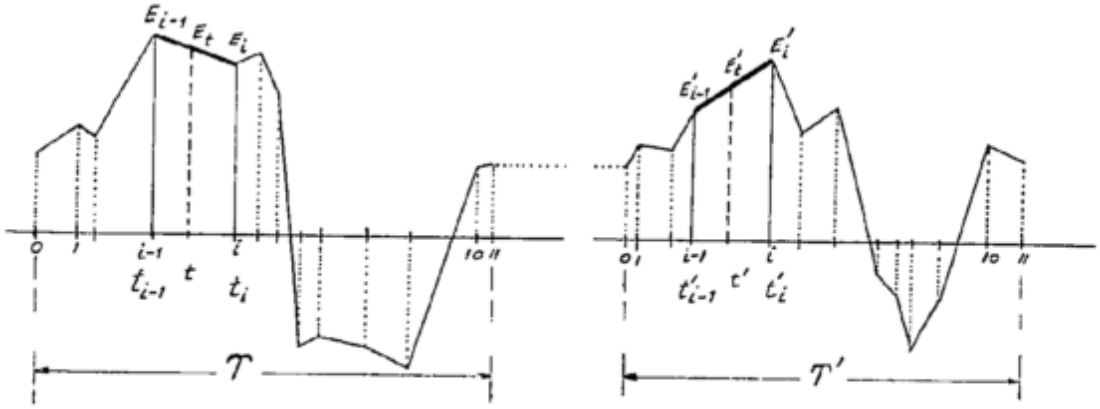
Pithoprakta (1955-56), mesures 52-59 : graphique de Xenakis
Source : Iannis Xenakis, *Musique. Architecture*, Tournai, Casterman, 1976, p. 167



3. AESTHETICISED IMPERCEPTIBILITY

Xenakis' resistance to serialism is grounded in the listener's experience. He roots his aesthetics in the sonic encounter, prising complexity away from more elitist formalisms whose symmetries and forms require specialised listening techniques, score reading, and extraordinary feats of memory to be comprehended. For this reason it seems curious that the same criticism could be levelled back at Xenakis. But in 'Music and Computers' Pierre Schaeffer does just that, reproaching the composer for ignoring perception in his use of mathematical functions. He writes: "Xenakis has not taken the trouble to verify the relationships which might exist between *mathematical production of sonic objects and their authentic musical perception… w*ithout a phenomenology, and without the distinction that Xenakis has never been able to establish between sign and signal, there is no means whatsoever of warding off dreamers who wish to invent combinations of parameters without concern for *characteristic features*" (Schaeffer 1971). One of the targets of Schaeffer's critique is Xenakis' work with Dynamic Stochastic Synthesis, which we sketched earlier.[1] In Dynamic Stochastic Synthesis, sound is not derived from a pre-defined acoustical or perceptual model but is 'invented' using probabilities. Specifically, with each repetition of a simple wave, the instantaneous time and amplitude positions are calculated anew using Brownian motion. Although an abstract model, for no naturally occurring acoustic vibration behaves in this way, it would be wrong to see Brownian motion as being just any arbitrary mathematical function transformed into sound pressure. It is exceptionally well-suited to generating time-varying waveforms. Since each repetition is a variable deformation of the last, the relative periodicity or aperiodicity of the wave depends upon the step size of the iteration. Large moment-to-moment time and amplitude deviations will result in something close to white noise, whereas small deviations approach a simple wave. But the bounded space inbetween these extremes produces a 'living' waveform with continuous flux in amplitude and pitch, thereby escaping what Xenakis deemed to be the 'static' timbres of classic electronic oscillators.

Figure 3. Abscissa of the polygon's summits from (Xenakis 1992, p.290)



[1] Shaeffer writes, "…modern linguistics would seem, at first sight, to be much more closely connected with musical language than is the kinetic theory of gas'" (Schaeffer 1971)

Schaeffer's criticism of Xenakis stems from the fact that, irrespective of the rhetoric about extending the space of invention using computers and allowing the composers hand to stretch to timbre composition, if the ear cannot discern the subtleties of the design then they are effectively 'not there'. If at first this seems related to Xenakis' critique of serialism then we must remember that it was not the 'authentic perception' that was at issue there. Rather, it was the ideology, the limits imposed, the hierarchies established, and the subjugation of the listener. Xenakis' acoustic music did not shrink Serialism's complexity down to within perceptible limits; it *aestheticised* imperceptibility, making excess and overabundance the feature of the work. In this way, free stochastic music replaces serialisms faulty aesthetic of the beautiful with an aesthetics of the sublime: the fearful, dynamical sublime that Kant found in nature. (Incidentally, this reading is of course given colour by Xenakis' vivid accounts of great crowds, demonstrations, war and violence; the contrary pleasure he found in violent, dangerous situations.) Now, this aesthetic is most palpable in the near-unplayable aspects of Xenakis' work, such as in *Herma (1961)* and *Eonta (1963-64)*, where we encounter a tension between the score on one side and its imperfect, impossible realisation on the other. Here, imperceptibility takes on a dual role, as the performer's human inability to faultlessly render the work is met with our own inability to fully comprehend it. It is as though a virtuality, over and in excess of the sounding fact coexists with it, which means that the 'work' itself lies somewhere between, in the interstice between virtual and actual sound. By this I do not mean to invoke Jean Molino's semiotics and the triparte analysis. It is to say that the gap between the score that is written on the page and its fallible, yet extraordinary, realisation is hypostatized; made manifest as tension, or incongruity. One is reminded of Slavoj Žižek's reading of Schumann's *Humoreske (Op. 20, 1839)*, the keyboard work in which a melody is written into the score with the specific direction that it not be played. In the piece, which is a series of variations on a theme, the theme itself is only audible to the 'inner ear' of the pianist. Žižek writes: 'the right and left hand piano lines do not relate to each other directly, that is to say, their relationship is not that of an immediate mirroring: in order to account for their interconnection we are thus compelled to (re)construct a third, "virtual" intermediate level (melodic line) which, for structural reasons, cannot be played' (Žižek 2006, p.366).

Must this aesthetics of imperceptibility be reserved for Xenakis' acoustic music, where a theatrical dimension is provided by the dual between performer and score? Or do different rules and discourses govern the composition of music as does that of material? In most forms of music, sound is given from outside; whether in the form of a violin, or a sound recording of a bell, the raw material is manipulated and moulded into a composition. It is as though, by composing *the* sound, rather than *with* sound, Xenakis severs music's bind with nature, creating a music that is wholly artifice. It is unsurprising, therefore, that it is in the name of nature that criticisms of non-standard sound synthesis have been made. Schaeffer calls Xenakis a 'dreamer' because his ideas overreach the perceptual realities of audition. To borrow a current buzzword in sonic studies, retaining the implicit criticism of sound art that it contains, Schaeffer reproaches the "non-cochlearity" of Xenakis' compositions. So whilst music as a socio-cultural phenomenon succumbs to the incessant flux of history, for Schaeffer the human subject and the physiology of the ear are constants, they persist. Now it is tempting to stop here, for we could take this immutable subjectivity as just another pre-given, fixed system that Xenakis' music resists. But, recalling Delueze and Guattari, minority never takes the form of simple resistance: it is conceived as a destabilising movement, a deterritorialization of the very model from which it derives force. So whilst Schaeffer's critique seems to suggest Xenakis was ignorant to the capabilities and limitations of the human ear, we find that both composers were in fact extremely attentive to emerging research in music perception and psychoacoustics; their thought is rooted in audition and the

mechanics of the auditory system. As we shall see, their divergence is not scientific but ideological. They disagree on what perception is and can be, not how it functions.

3. TIMBRE

We know very that, as listeners, we can imagine unheard melodies; but is it possible to imagine unheard timbres? Might Xenakis have heard dynamic stochastic synthesis in his 'inner-ear' before he implemented it, or was the model purely abstract? It has been shown that so-called called Western pitch-centricism derives from the latter's starring role in our music, where pitch and rhythm are governed by laws of right and wrong, and timbre by the nebulous factors of taste and judgement (Fales 2002, p.56). For instance, pitch is easier both to remember and to image than timbre, meaning that the implication of pitch that the performer of the aforementioned 'Humoreske' holds in mind is a stronger cue than the implication of timbre would be. Popularly conceived, timbre is the condition of sound rather than its morphology: the violin's violin-ness, the trumpet's trumpet-ness. It is static, immutable: what a sound *is,* opposed to what it *does* (Fales 2002, p.58). And whilst we are far from being deaf to timbre, just how much of the quality of sound is consciously attended to and retained after hearing has been the subject of much psychological and aesthetic interest. Cornelia Fales posits a distinction between phenomenal consciousness and reflective consciousness, the former denoting qualia - the 'what it feels like' of consciousness - and the latter denoting the ability to reflect on and articulate that experience. Those facets of experience that fall only in the former category are no less immediate than other realms of experience; it is just that they are often hazy and hard to discriminate from other qualities. Musicologists and theorists of timbrally rich music such as rock and electronic dance music often cite this haziness as a key quality of the music. Theodor Grayck argues that it contributes to Rock Music's unique 'play again' quality, whereas Simon Reynolds locates electronic dance music's specific 'nowness' in its focus on timbral nuance and manipulation (Gracyk 1996; Reynolds 1999). But although these accounts are appealing, they leave no space for the capacitity of music to alter our perceptions, to open up new realms of experience. Can listeners not learn – through art - to attend to these elements, becoming better at remembering, imaging, and describing timbre?

Ii is clear from Schaeffer's criticism of Xenakis that he is not sympathetic to this view. Perception is absolutely anterior and art must be shaped to fit it or else be consigned to the invisible field of "pure theory and of dreams" (Schaeffer 1971). But writing about the impasse of harmonic analysis and the recourse to Fourier mathematics in music, Xenakis expresses a telling counter-argument to this prevailing wisdom. He writes: "it is… natural to think that the disruptions in music in the last 60 years tend to prove once again that music and its "rules" are socio-cultural and historical conditionings, and hence modifiable" (Xenakis 1992, p.243). These modifiable "conditionings" he cites as our mental structures, our tools and materials, and – crucially – our perceptions. Thus, art – the "disruptions" – has the ability to precede and create perception. It is an idea he returns to in the dialogues with Varga, where he speculates that we may be deaf and blind because we see and hear in only one way. "In order to think differently, perhaps (art) could change the structure of our brain" (Varga 1996). In his acknowledgement of the historicity of perception, and the all-important role of art in this temporality, Xenakis echoes Walter Benjamin. Benjamin noted that "the manner in which human sense perception is organized, the medium in which it is accomplished, is determined not only by nature but by historical circumstances as well" (Benjamin 1999, p.435). (Benjamin himself echoed Marx, who in 1844 noted that, "the forming of the five senses is a labour of the whole history of the world down to the present." (Marx 1959, p.46)) The "deepening of apperception" that art achieves "makes analyzable

things which had hitherto floated along unnoticed in the broad stream of perception" (Benjamin 1999, p.435). So whilst art cannot extend the mechanics of the ear and the eye, it does have the capacity to bring unconscious elements forward, rendering distinct what was once a haze.

We now see why Xenakis so focused his energies on the realisation of new timbres in his computer music. It seems that timbre moreso than other perceptual attributes of sound, and sound moreso than other sensory modalities, is predominantly pre-attentive, but that listeners can, with instruction, learn to bring these unconscious elements to the fore (Fales 2005). Xenakis' computer music enacts a deepening of apperception by zooming in on the micro-level fluctuations of orchestral instruments: the transient elements of musical sounds that, paradoxically, contribute to their salience. Until Meyer-Eppler's acoustic analysis studies, these "tiny, second order variations" were not available for examination (Xenakis 1992, p.244). Like the camera lens, which opened up a different world than was previously available to the naked eye - a world of "entirely new structural formations" (Benjamin 1999, p.435) - Meyer-Eppler and the technologies of the WDR studio had opened up a new world of miniature temporal forms. By abstracting them, and making them the structuring principle of his works - particularly in *Gendy3 (1991)* and *S.709 (1994)* - Xenakis extends the range of our perceptions down to this molecular level. The subtle morphology of timbre that all sounds undergo is exaggerated by a constantly evolving micro-form, and the effect of its artifice is that it brings these near-imperceptible elements into the domain of our attention, where previously they had been unattended, unknown.

4. CONCLUSION

We have seen that Xenakis' refused to adhere to a music / materials schema, where sound is the pre-ordained natural fact a composer composes *with* rather than creates *ex nihilo*. By transgression, the unity of timescales model illuminates a hierarchy of different rules and discourse-types which act upon and structure musical space in advance. This we illustrated by considering the two different faces of the same thing - imperceptibility – that are brought into focus by comparing Xenakis' acoustic and electronic music. An altogether different study might consider the same question in terms of authorship. For whereas I am not, strictly speaking, free to take a sequence of notes from *Eonta* without eliciting questions of plagiarism, appropriation and so on, nobody's authorship would restrict me from using the sound of cicadas in one of my compositions. Though the latter may *evoke* Xenakian associations in quite the same way as a line from *Eonta* does (perhaps moreso), as a natural, non-artistic agent, the material itself transcends authorship. It is almost as though non-standard sound synthesis, derided for its speculative deviations from acoustical or perceptual models, takes its place alongside natural sound all the same: as liberated musical material, free as birdsong. Perhaps this is the real achievement, the creation of a second nature; Xenakis did liken his "composition out of nothing" to the big bang, after all. On the other hand, if we accept the holistic unity of timescales, then surely we must ask whether it is right to draw a line between what is a sound *technique* and what is the work itself. More and more we hear Dynamic Stochastic Synthesis being used as a regular synthesis technique in modern digital music composition. Modifications, improvements, perceptually-coded versions and others have been presented to computer music conferences, some speculating on ways in which Xenakis may have "better" implemented his stochastic synthesis. My intention is not to question the ethics of this operation, it is only to highlight the complications and contradictions that arise from composing sound-itself. If we are to truly perceive an agency in sound then it seems we must, for the moment, let go of formal autonomy and allow the conceptual and the technological into our appreciation of the

work. My own feeling is that Xenakis encouraged this technico-conceptual aesthetics, deliberately letting 'the machine' be heard in his work. Consider the abrupt shifts in the 12 movements of *Gendy3* for instance; the periods of long stasis in the piece that appear devoid of any coherent artistic organisation, as though a cut could have come much earlier! Or else consider the gritty, quantized quality of *S.709* that sounds like a time-lapse of individual gestures, pure data being made to pass at the rate of *sound* rather than that of event. The technology is not hidden behind the acousmatic curtain here, it is pushed front and centre. To again imbue this with the modern jargon of non-cochlearity, we could say that the work's dialogue with the technologised world outside it comes into view through the problem of timbre-composition, of composition at the threshold of audibility. Or we can put it in Xenakian terms, in which case we might say that our *present* inability to perceive an agency in sound 'in-time' shifts attention to the 'outside-time' domains of sound technologies and the mathematico-philosophical concepts that drive the work. Whichever we choose, it is important that we include temporality in our definitions. Nothing is fixed. For, as Xenakis' said on being asked about the physical dexterities of his workabilities of his performers in relation to the physical dexterities his work requires, "what is limitation today may not be so tomorrow" (Varga 2005, p.65).

5. REFERENCES

Benjamin, W., 1999. *Illuminations* New ed., Pimlico.

Deleuze, G. & Guattari, F., 2004. *A thousand plateaus*, Continuum International Publishing Group.

Fales, C., 2005. Short-Circuiting Perceptual Systems: Timbre in Ambient and Techno Music. In *Wired For Sound: Engineering And Technologies In Sonic Cultures*. Wesleyan University Press.

Fales, C., 2002. The Paradox of Timbre. *Ethnomusicology*, 46(1), pp.56–95.

Gracyk, T., 1996. *Rhythm and Noise: An Aesthetics of Rock*, Duke University Press.

Marx, K., 1959. *Economic & Philosophic Manuscripts of 1844*, Moscow: Progress Publishers.

Reynolds, S., 1999. *Generation Ecstasy : Into the World of Techno and Rave Culture* 1st ed., Routledge.

Schaeffer, P., 1971. Music and Computers. In *Music and Technology*. Stockholm Meeting. La Revue Musicale, pp. 57–92.

Stockhausen, K., 1957. .....How Time Passes..... *Die Reihe*, 3, pp.10 – 41.

Varga, B.A., 1996. *Conversations With Iannis Xenakis*, Faber & Faber.

Xenakis, I., 1992. *Formalized music: thought and mathematics in composition*, Pendragon Press.

Žižek, S., 2006. *The parallax view*, MIT Press.