

# **When Art, Science and Technology meet: the Strength, the Dilemma or the Curse of Electroacoustic Music?**

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## **ABSTRACT**

**This paper discusses some implications to electroacoustic music composition and reception of the connections of the genre with science and technology. It is argued that the cross-disciplinary nature of the electroacoustic context opens up a path for the appropriation of concepts that reinforce but paradoxically deny the dichotomy objective versus subjective, when the influence of Cartesian dualism in musical thought has already been identified and criticised within traditional western musical thinking. A misplaced emphasis on the separation between subject and object that assumedly characterises scientific methodologies is discussed as the root of a general disregard for the reception end of the compositional process. This separation is also identified with the fragmentation of the holistic musician into performer or composer, and electroacoustic media are suggested as a possible basis for reversing this process and facilitating a different ethos. It is suggested that electroacoustic media provide a unique substratum for the emergence of new ways of making, experiencing and thinking about music. However, it remains to be seen if the genre will evolve towards some sort of ‘classical music of the future’ or merely an idiosyncratic form of the mid-late twentieth and early twenty-first centuries.**

**KEYWORDS: electroacoustic music, music composition, music reception, cross-disciplinarity, epistemology, music theory.**

## 1. Introduction

'Daughter: Daddy, what is an instinct?

Father: An instinct, my dear, is an explanatory principle.

D: But what does it explain?

F: Anything - almost anything at all. Anything you want it to explain.

D: Don't be silly. It doesn't explain gravity.

F: No. But that is because nobody wants an instinct to explain gravity. If they did, it would explain it. We could simply say that the moon has an instinct whose strength varies inversely as the square of the distance

D: But that's nonsense, Daddy.

F: Yes, surely. But it was you who mentioned "instinct", not I.

D: All right - but then what does explain gravity?

F: Nothing, my dear, because gravity is an explanatory principle.

D: Oh.

D: Do you mean that you cannot use one explanatory principle to explain another?

multitude of mathematical models and technological tools employed by the composers.

Indeed, the exploration of the sonic universe opened up by electronic and computer technology involves a reformulation of what constitutes a *musical problem*. This exploration is no longer a purely musical problem within a frame of thought that places scientific and artistic activities as opposing poles: it is made possible exactly by07ltitude cal tools e

## 2. Objective versus Subjective

The introduction of electronic technology in the compositional scene in the early fifties is generally assumed as part of a process of conscious rejection of established musical models. The parametrical thinking developed by the post-war generation of composers may be viewed as an alternative to a musical tradition that is paradoxically perpetuated through this same thinking, which emphasises self-referential conceptions of music and a disregard for the distinction between poietics and esthetics, accompanied by the mystification of composers and the role of notation. Unfortunately, the electroacoustic musical scene inherits several of these ideas and is strongly influenced by this 'traditional' ethos.

A typical example is analysis. Despite the existence of several schemes for the notation of electroacoustic music, the usual objection to the analysis of the genre is the lack of standard scores. Musical analysis has been traditionally occupied with the exploration of structure understood in terms of compositional ideas and techniques that can be grasped from a score, and despite having been contested by the broader musicological community,<sup>3</sup> this conception is still widely accepted within the electroacoustic musical community. Stroppa (1984) concludes that 'works [that] have been conceived for tape alone are at present impossible to transcribe and analyse'. Unfortunately, this view seems to be changing only slowly. Which circumstances might give rise to such pessimistic prospects?

From the usual analytical perspective, the lack of standardised scores is merely the most apparent hindrance to the analysis of electroacoustic music. The examination of scores relies on an underlying conceptual framework, which is the basis for the existence of a notational procedure, and is tacit common-knowledge within the musical community. This framework comprises contextually determined modes of perceiving and describing musical features, and reveals aesthetic judgements that correspond to a particular conception of musicality. Additionally, it provides the background against which analytical

questions arise, and against which they are justified. The analyst who approaches an electroacoustic piece faces not only the usual lack of scores or other visual aids, but basically the absence of a widely agreed-upon conceptual framework. The occasional scores produced in electroacoustic composition lack such a background, thus not being comparable to conventional musical scores.

Views of analysis based on the examination of a score are tacitly linked with a Cartesian-derived conception of objectivity. The measurability provided by spatial, and therefore timeless, descriptions of sonic and musical features agrees with the separation between subject and object that assumedly characterises scientific methodologies. This state of affairs is clearly paradoxical, inasmuch as the experience of music is psychological. Indeed, analysis of electroacoustic music has been largely approached from a seemingly outmoded perspective that combines 'the worst attributes of nineteenth century ideology and naïve scientific positivism' (Cook & Everist, 1999, pp. x-xi). Interestingly, misinterpretations of scientific notions can be occasionally identified within the literature supported on a view of analysis as a quasi-scientific discipline.<sup>4</sup>

The reliance upon a score as a common-ground upon which music can be discussed is linked with the idea that analyses ought to be legitimised through the verification of their accuracy.<sup>5</sup> However, when a piece of analytical work must be verified, a parallel with scientific experimentation is drawn, and a mechanistic view of music is implied. The scientific method comprises general steps of observation, hypothesis formation and testing, aiming at predicting the behaviour of a system being studied under conditions other than the ones of the observation stage. The central tenet of the method is the complete separation between the experimenter - the subject - and the system - the object: the experimenter must not interact with the system in ways that may alter its behaviour by introducing uncontrollable variables.

The separation between object and subject hypothetically assures the repeatability of any experiment in science. Paradoxically, it was exactly the early age of atomic research that brought to the fore the inevitable active role of the experimenter, who designs the experiment and thus determines the nature of the observations.<sup>6</sup> Indeed, the physicist Fritjof Capra suggests:

In transcending the Cartesian division [between subject and object], modern physics has not only invalidated the classical ideal of an objective description of nature but has also challenged the myth of a value-free science. The patterns scientists observe in nature are intimately connected with the patterns of their minds; with their concepts, thoughts and values. Thus the scientific results they obtain and the technological applications they investigate will be conditioned by their frame of mind. Although much of their detailed research will not depend explicitly on their value system, the larger paradigm within which this research is pursued will never be value-free. (Capra, 1983, p.77)

The idea of paradigm discussed by Kuhn (1970) is applicable not only to science, but to any branch of knowledge: paradigms are conceptual frameworks that 'relate facts, select facts, and make us see facts in a certain light' (Gregory, 1974). Indeed, Kuhn's concept of paradigm (and scientific revolution) provides the basis for Jauss' theory of reception, which suggests 'literary investigation as an analogous undertaking to procedures in the natural sciences' (Holub, 1984, p.1). In particular, where music is concerned, Jauss' project of a 'historiography that will play a mediating role between past and present' (*ibid.* p.58) invites an examination of 'the points of intersection of synchronic and a particular sort of diachronic history, and to treat each juncture as of equal epistemological importance' (Everist, 1999). Unfortunately, given that paradigms 'serve not only to relate facts' but can 'make facts and questions respectable' (Gregory, 1974), this equality of epistemological importance seems most desirable if not utopian, once the minds and intellects involved are mostly part of 'multi-million pound institutional investments such as our national universities [which] are integral to the reproduction of on-going social formations and are

thus at the forefront of cultural guardianship ... and ideological control' (Jenkins, 1991, pp.20-1).

The separation between subject and object within musical analysis is clearly a paradox: the nature of the musical experience is perceptual, and, therefore, subjective. From an epistemological perspective, musical descriptions can be objective only in the sense that the conceptual framework that underlies the description is intersubjective, i.e. can be shared by different individualities. Indeed, the repeatability of scientific experiments is guaranteed by the intersubjective nature of the scientific paradigms. 'It is the recognition of this - the growing awareness that an analysis is integral to its subject and object - that has called into question the implicitly scientific basis of music analysis as a discipline' (Samson, 1999). However, it is only in the absence of the score, the hypothetical frontier

merely provides an acceptable substitute within a view of music that is based on ill-adapted mechanistic conceptions.<sup>8</sup> 'Obviously a text, as notated, is not actually the musical work: music exists as sounds, it fills time rather than space ... the notated version is no more than a source of advice or instructions for recreating the music' (Boorman, 1999). Nevertheless, from a mechanistic perspective the score purports to translate into image that which eludes the assumed objective reality of vision: what can be seen can be measured. It is apparently a peculiarity that our culture places so much reliance upon vision, to the detriment of hearing, which is the sense that is least affected by social constraints. Acoustic isolation is only achieved with special preparation for special purposes, in contrast with the routine organisation of space and its division into living or working units. Perhaps the predominant emphasis on the visual is linked also with the fact that what is seen can be more easily controlled than what is heard.

Interestingly, science itself does not always work in the realm of the visible. Indeed, Bateson reminds us that science may be viewed as:

*a way of perceiving*

ideological and methodological possibilities and constraints - that provide the adequate background for their evaluation. From an epistemological perspective, objectivity really makes sense only if conceptualised in terms of intersubjectivity. The integration of disciplines within the electroacoustic compositional scene suggests the need for a parallel motion within analytical thinking. Indeed, electroacoustic media provide a unique context in which art, science and technology fuse into a substratum for the emergence of new ways of making, experiencing and thinking about music.

### **3. Notation and the Fragmentation of the Musical Experience**

Although little is known about the origins of musical notation in various cultures, it has been strongly suggested that word literacy long preceded music literacy.<sup>9</sup> Based on archaeological and ethnological studies, the existence of more widely involving functions for music in earlier times has been hypothesised: other than the composer-performer-audience triad, progressively established throughout centuries of western music, probably more collective modes of music production, akin to improvisation and to the music-making of the so-called primitive cultures.<sup>10</sup> The need to preserve and transmit a musical culture, the most basic motivation for the development of notation, certainly took longer to emerge within contexts in which music was endowed with more socially participatory or ritualistic character.<sup>11</sup>

It has been found that earlier notational directives, such as those developed in

Notation has served the purpose of providing a general chart to be filled in by the player.<sup>15</sup>

Although the interpretation of any written register does suggest facets of the thinking that produced it, some contextual knowledge is paradoxically required. Signs and marks possess a conventional character that determines their interpretation according to a whole range of unwritten ideas. These ideas consist of directives transmitted through teaching, and are often common knowledge within the context. 'One does not simply read black marks on paper but meaningful signs' (Goehr, 1992, p.35). The understanding of the ideograms found in certain eastern languages illustrates this problem. Students of these languages must eventually acknowledge the necessity to delve into the intricacies of the culture to which the language belongs. However, interpretations comply with the perspective of the interpreter.

Conventional musical notation, for instance, spans several historical periods and different geographical locations. Despite all the modifications introduced to this scheme throughout centuries,<sup>16</sup> when conventional musical notation is used to produce a score, common knowledge is omitted to favour the specification of that which is different and new, perhaps even idiosyncratic. New signs have been introduced to refer to extended playing techniques and novel musical ideas.<sup>17</sup> The scheme has also been modified in attempts to make it suitable for the transcription of oral musics.<sup>18</sup> Nevertheless, the continuous changes and modifications imposed on conventional musical notation cannot be compared in depth to the explosion of notational schemes in the twentieth century. Cage (1969) is a well-known collection of examples that illustrate this situation. The contextual knowledge necessary for the interpretation of some contemporary scores is occasionally reduced to one composer's own system, or perhaps even confined to what the composer provides as key to accompany a single composition.

The advent of written registers for music certainly allowed increasing degrees of

complexity and organisation in musical structuring. However, at least in the western world, it also contributed to the over-specialisation of musical activities. In the West notation evolved from the original idea of preservation of the musical culture to become an invaluable aid for developing musical thoughts as well as a potential hindrance to this same development. The original function of notation was to serve as an *aide-mémoire* to the musician.<sup>19</sup> However, musicians progressively became composers or performers, and notation evolved from *aide-mémoire* to a means for composers to impose on the performer their individual conceptions.

The idea of prescriptive notation<sup>20</sup> is directly connected with the fragmentation of the musician into two separate entities that play distinct roles in the process of music-making. 'From the early nineteenth century onward, composers have tried to impose a greater level of precision on the performer'.<sup>21</sup> It might be suggested that a human need for control expressed itself in the tendency to ascribe a prescriptive intention to a merely descriptive tool.<sup>22</sup> Description was interpreted and used as a means for prescription, being finally equated with imposition. The need to register the musical practices of the West seems to have coexisted with - and eventually been dominated by - the need to organise the very practices. A thin and easily crossed line divides idea and ideology, organisation and control. As Trevor Wishart puts it, 'ever since the Ancient Egyptians developed pictures into a viable form of hieroglyphic notation, our world has been dominated by a class of scribes, capable of mastering and hence capable, or deemed capable, of controlling what was to be written down and stored in the historical record'.<sup>23</sup>

In a humorous analogy, Rosemboom (1993) compares the relationship composer-performer to the position of the observational astronomer involved in searching for extra-terrestrial intelligence. In this analogy, the performer supposedly looks for a message without conception of what it might be. However, Rosemboom connects this assumedly



Nevertheless,

today we have to be aware that ... aesthetic categories are categories of a cultural reality of the last two centuries, grown in Europe. But in spite of all hopes of some, this cultural reality is no aspect or offspring of nature but one of a grown and dynamically developing cultural reality. When we visit a concert or talk or reflect upon music we do it in the frame or the patterns of our own traditional cultural discourse, that was developed in the 18<sup>th</sup> and 19<sup>th</sup> centuries. In those times almost the complete interest was focused on a sort of music to which one had given the name or the title '*Tonkunst*'. And that meant the difference from the low music of street ballads, that is to say to the then not yet declared '*Folkmusic*' ('*Volksmusik*'). The musical art - '*Tonkunst*' - was looked upon - and that is significant - as being in contrast to non-European music. Forgotten were our one- or two- million years of genetic past that is not yet history. Instead we were fascinated by a discourse not older than some centuries behind which lay two thousand years at the most. (Reinecke, 1993)

Paradoxically, in integrating composition and performance into a more embracing activity, electroacoustic composition opens up a path for reversal of the fragmentation of the musical experience. The duality composer versus performer is negated. Musical knowledge is once again transmitted orally, and the central need for a notational scheme is connected with teaching purposes. The iconoclastic function of the acousmatic curtain may be at work, denying the listener an object of fetish. Additionally, computer-based music technology becomes progressively cheaper and more widespread, which may be proved to be mostly an encouragement to the non-professional musician.

On the other hand, it is certain that music technology is not necessarily or directly equated with creativity. It is also obvious that tape composition as a direct medium between composer and listener does not guarantee either a more accessible art or a more open musical community. Additionally, the contemporary problems related with the use of communication technology must be also considered, once computer-based technology is pivotal in electroacoustic composition. The use of such technology as substitute for real-life interaction may suggest gloomy prospects of a future without face-to-face communal activities, not to mention the issue of possible listener alienation through the perception of







they believe to understand, they perceive really only a dead mould which they guard tenaciously as their unquestionable possession and which is lost precisely in that moment that it becomes a possession: an indifferent show piece, neutralized and robbed of its own critical substance. ... the true basis of meaning in the composition is no less hidden from the radio-trained listener in an early Beethoven sonata than in a Schoenberg quartet, which at least reminds him that his sky does not consist entirely of clouds with silver linings upon whose radiance he can forever feast his eyes. (Adorno, 1973, p.9)

Adorno criticises the notion of an *objet d'art* that is indeed merely an object of fetish within a socio-economical order dictated by commercial profit, emphasising the ontological basis of music composition and an ontological level of musical meaning. From this perspective, there are several aspects of the electroacoustic context that suggest new avenues for Music. As discussed earlier, the context is strongly cross-disciplinary, and the electroacoustic community is marked by a distinct international character, despite the historical connections of the genre with western (European, mostly) musical traditions. Additionally, a plurality of compositional styles is paralleled by widespread research into new instrumentation that allows progressively more direct gestural input, providing, perhaps, the basis for the development of new modes of improvisation. The electroacoustic context possesses the seeds for the realisation of a more holistic idea of Music. From a critical perspective, it is preferable to imagine a musical future with progressively less use of music technology for the vulgar exploitation of the *kitsch*:

... from Muzak which can be generated in real-time from synthetic and sampled sounds complete with algorithmic control of 'expressive timing', to perfect recreations of historical performances through computer analysis of earlier recordings, to a virtual reality Karaoke in which I can be the soloist. (Emmerson, 1997)

From an ontological perspective, it is appropriate to view the context, particularly the compositional scene, as transitional in connection with the contemporary dichotomy specialisation versus integration. Contemporary western life seems to be

characterised by an apparently paradoxical coexistence between trends towards opposite directions. Knowledge is fragmented into a multitude of specialised areas and 'specialisms', at the same time that cross-disciplinarity becomes more and more widespread. At a more global level, the disintegration of national states into sub-areas that hypothetically reflect ethnic and cultural divisions is paralleled by a globalisation enabled by powerful and continually improved communications means. 'The post-modern world is a connected world in which everyone lives in isolation' (Richard, 1994). Fischman (1994) identifies a

... trend towards fragmentation of the standard values in Western Society (this latter analogous to standardization in industrial mass production), bringing with it greater individualism and customization in every field of activity. After three hundred years of consistent massification, society is actually reversing this trend.

Concerning music composition and appreciation, it makes sense to argue that 'if demassification is taking place, then it is important to address the problem of audiences from a new perspective; ... this would imply achieving an 'optimal' - rather than a 'maximal' - size of audience' (*ibid.*). However, it seems that pluralism tends to manifest itself as a combination of exclusivism, on the one hand, and surrender to habit, on the other hand. Fragmentation of values and pluralism do not correlate directly with freedom of thought and expression; on the contrary, this sort of fragmentation resembles better some form of pathology: a whole that is broken down into parts that do not relate with each other.

The integration of disciplines that takes place within the electroacoustic context might hold the key for the advent of refreshing attitudes towards music, but it can not prevent the perpetuation of deeply seated ways of a society that pledges openness but simultaneously thrives in exploiting the mystique created around individuals and groups - determined by ethnic, geographical, socio-economic or professional classes.

The debate on the complexity/simplicity of music, for instance, is immaterial when the issue at stake is more essential than fashioned judgements on the accessibility of a musical composition. Such considerations possess patronising undertones, when 'the public intelligence deserves more credit than it is given by those who are worried about the alienation of 'esoteric' composers and argue that music should be administered in acceptable doses of immediacy' (Fischman, 1994). Similarly, arguments on the 'quality' - good versus bad - of a musical piece <sup>31</sup> may reduce a complex matter to sweeping generalisations of the likes of 'dilettantes are in control of the medium; artists without anything significant to say, technologists without any real reason to use the technology'. <sup>32</sup>

The development of an intelligent listening is an integral component of the development of critical attitude, which is indeed a personal matter that concerns both artist and public and is not a function exclusively of familiarisation with cultural values. Critical thinking cannot be developed through training based on the repetition of previously established protocols, but rather through the inspection of the bases upon which models and patterns are founded. Training *per se* does not guarantee an understanding of these bases that is necessary for true creativity - creative activity - to take place. When Education is viewed purely as a passing on of information, aiming at producing individuals with know-how to perform specific functions within the established social structure, the development of critical thinking is relegated a secondary position of mere -perhaps undesirable - by-product of more inquisitive minds: '[we] may win degrees , may have a series of letters after [our] name and land a very good job; but then what?' (Krishnamurti, 1986, p.93). What follows naturally is the question: 'What is the point of it all if in the process [our] mind becomes dull, weary, stupid?' (*ibid.*).

In particular, where musical education is concerned, lack of critical thinking correlates with an acceptance of paradoxical criteria that are inadequate

terms of mechanistic objectification of the compositional processes,<sup>34</sup> underlying the genre are novel ways of outlining what music is, and, perhaps more importantly, *what music can be*. We might be now developing the bases of the ‘classical music of the future’, to use a paraphrase of Orton (1992), but it remains to be seen if we are only dealing with an idiosyncratic form of the mid-late twentieth and early twenty-first centuries .

## References

- Adorno, T. W. (1973). *Philosophy of Modern Music*. London: Sheed & Ward.
- Bateson, G. (1972). *Steps to an Ecology of Mind*. New York: Ballantine Books.
- Bateson, G. (1980). *Mind and Nature. A Necessary Unity*. New York: Bantam Books.
- Bennett, R. (1996). *Fortissimo!* Cambridge: Cambridge University Press.
- Bohlman, P. V. (1999). Ontologies of music. In N. Cook & M. Everist (eds.) *Rethinking Music*. Oxford: Oxford University Press.
- Boorman, S. (1999). The musical text. In N. Cook & M. Everist (eds.) *Rethinking Music*. Oxford: Oxford University Press.
- Cage, J. (1969). *Notations*. New York: Something Else Press.
- Capra, F. (1983). *The Turning Point. Science, Society and the Rising Culture*. London: Flamingo.
- Chambers, E. K. (1994). The computer music world view: Sketch of an Ethnomusicological and Aesthetical Approach. In *Proceedings of the 1994 International Computer Music Conference*. International Computer Music Association.
- Cogan, R. (1984).

Everist, M. (1999). Reception theories, canonic discourses and musical value. In N. Cook & M. Everist (eds.) *Rethinking Music*. Oxford: Oxford University Press.

Ferreira, G. M. d. S. (2000). *A Perceptual Approach to the Analysis of Electroacoustic Music*. D.Phil thesis. Heslington, York: University of York.

Fischman, R. (1994). Music for the masses. *Journal of New Music Research* 23(3): 245-64.

Goehr, L. (1992). *The Imaginary Museum of Musical Works. An Essay in the Philosophy of Music*. Oxford: Clarendon Press.

Gregory, R. L. (1974). 'Choosing a paradigm for perception'. In E. C. Carterette & M. P. Friedman (eds.) *Handbook of Perception* (v.1 pp.255-283). London: Academic Press.

Hargreaves, D., North, A. (1997). Experimental aesthetics and everyday music listening. In D. Hargreaves & A. North (eds.) *The Social Psychology of Music*. Oxford: Oxford University Press.

Pressing, J. (1994). Novelty, progress and research method in computer music composition'. In *Proceedings of the 1994 International Computer Music Conference*. International Computer Music Association.

Rastall, R. (1983). *The Notation of Western Music*. London: J. M. Dent & Sons Ltd.

Read, G. (1969). *Music Notation*. Boston: Allyn & Bacon Inc.

Reinecke, H. P. (1993). Cybernetics and musical consciousness. *International Review of Aesthetics and Sociology of Music* 24(1): 13-22.

Richard, D. M. (1994). Computer music and the post-modern: a case of schizophrenia. *Computer Music Journal* 18(4): 26-34.

Rosenboom, D. (1993). Music notation and the search for extra-terrestrial intelligence. *Leonardo* 26(4): 273-4.

Russell, P. A. (1997). Musical tastes and society. In D. Hargreaves & A. North (eds.) *The Social Psychology of Music*



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<sup>33</sup> Bennett (1996), p.98.

<sup>34</sup> Chambers (1994).