

Iannis Xenakis's writing and outside-time musical structures

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Background in music theory and analysis. With his theory of *outside-time musical structures* (first referred to in *Musiques formelles* of 1963) Xenakis embarked on a project to show that what most composers consider to be the most important element of music, is actually subordinate. Time in music, he said, is not everything (see Xenakis 1992: 192). What Xenakis explored most was not the nature of time, but what is independent of it. A melody is an *inside-time* structure, in the sense that it cannot be constructed (or conceived) without time-ordering its pitches. What does *not* belong to time is the scale a melody is based on.

Background in cultural studies. Xenakis's theory of outside-time structures was a first step towards a General Harmony, which was, among others, a means of overcoming the impasses of serialism (see Xenakis 1994: 39-43). He showed that serial techniques are solely preoccupied with inside-time manipulations. On the other hand, he also indicated that outside-time structures could not possibly be *removed* from any musical language. In other words, harmony could not possibly be removed from any melody. The French philosopher Jacques Derrida has demonstrated the relationship between scale (or harmony) and melody, as analogous to that of writing and speech (Derrida 1997: 214). In both cases there is a dual opposition: harmony/melody and writing/speech. Thus, in both cases one term is privileged over the other: inside- over outside-time for the serialists and speech over writing for classical metaphysics.

Aims. The aim of this paper is to reveal the non-temporal in Xenakis's theory. This exploration serves to unveil certain aspects discussed more thoroughly through a deconstructive approach. The deconstructive is demonstrated in the classification of musical structures and aims partly at showing the nature of time in Xenakis's theory.

Main contribution. Xenakis developed his theory of outside-time structures throughout most of his writings. But the direction of this development was not entirely clear. The most enigmatic characteristic is that he alternated between a tripartite distinction: a) outside-time, b) temporal, c) inside-time, and a dualistic one that omits the middle term. As Solomos has indicated (2004: 126-7), Xenakis talked essentially about two types of structures; although such an observation is true, it does not explore the occasional inclusion of the temporal category. This paper traces Xenakis's theory and explores the nature of time in relation to Xenakis's two opposed categories. By indicating the outside-time aspect of the total chromatic, Xenakis revealed the possibility of a *usurpation* similar to the one Derrida indicated in relation to writing. Note that the aim of this paper is not to establish a philosophical background of Xenakis's theory. Rather, we intend to unveil the deconstructive functions in the classification of musical structures according to their temporal aspect. This includes Xenakis's own view, especially in the case of musical scales. The serialists subordinated the scale, but did not manage to disengage from it: for Xenakis it would be impossible to get rid of the outside-time structure.

Implications. The notions of symmetry and periodicity are fundamental in Xenakis's Sieve Theory, a method for the generation of outside-time structures – ultimately, pitch-scales. The impossibility of removing the outside-time structure may inform a general approach to music analysis that might indicate outside-time aspects of a structure (such as the symmetric relations between different forms of the series), or inside-time structural aspects (such as the permutations of intervals in scales).

The theory of outside-time musical structures is not a theory among others. Xenakis's approach to composition includes tools borrowed from scientific areas and developed according to his philosophy of music and practical compositional matters. On another level, all his theoretical tools (Stochastics, Sieve Theory, etc) fall into the scope of his general view on composition that is partly concerned with unveiling the nature of time in

music. This is a theory that describes musical structures, including his specialised theories, music perception (from a psycho-physiological standpoint) and analysis, and shows a general underlying abstract thinking. Therefore, it is a theory in an indirect sense, a *metatheory* of composition.

The metatheory of outside-time structures is a matter of a general response to the question of the nature of time in music: 'what

remains of music once one removes time'? (Xenakis 1976: 211). The theory, in its typical form, outlines three categories of musical structures: a) *outside-time*, b) *temporal*, and c) *inside-time*.¹ The first category is a reply to the above question; while the inside-time structure is the actual composition, the outside-time category refers to structures that remain independent of time. As regards to the temporal category, Xenakis frequently made clear that this is a much simpler category and that time (in music) is a 'blank blackboard' where structures or architectures are inscribed into.

Outside-time structures

'Symbolic Music' (1963) is Xenakis's first major publication concerning the matter (1992: 155-77). The temporal algebra remains situated between the outside and the inside. Xenakis makes clear that this category (temporal) serves only as a means of rendering the music perceptible. More specifically, the temporal category is occupied by time as such; however, time itself is not viewed simplistically. This is the period just after the completion of *Herma* where he first employed logical functions, which later led to the development of his Sieve Theory. At the beginning of this period Xenakis started to introduce considerations that undermine the classical view of the importance of time in music.

In 'Symbolic Music' Xenakis demonstrates his views by introducing Piaget's research on the child's perception of time.

Three events are distinguished; the time intervals are distinguished; and independence between the sonic events and the time intervals is recognized. An *algebra outside-time* is thus admitted for sonic events, and a secondary *temporal algebra* exists for temporal intervals; the two algebras are otherwise identical. [...] Finally, one-to-one correspondences are admitted between algebraic functions outside-time and temporal algebraic functions. They may constitute an algebra in-time (Xenakis 1992: 160).

This structure which time is furnished with is given by durations² or time intervals that are marked by the sonic events (sections of time). Since durations may be compared with

each other and expressed according to a unit, algebraic functions can be applied on these durations as well. Therefore, the set of durations is a commutative group, in which the order of appearance is not significant. This fact renders temporal intervals themselves outside of time. With durations of course, Xenakis does not imply pure time-flow but metric time. The *discreteness* of metric time allows for the temporal intervals to be handled, analysed, or perceived as outside-time entities. Thus, the first category is shown to include the three more obvious properties of sound: pitch, intensity, and duration.

[M]ost musical analysis and construction may be based on: 1. the study of an entity, the sonic event, which, according to our temporary assumption groups three characteristics, pitch, intensity, and duration, and which possesses a *structure outside-time*; 2. the study of another simpler entity, time, which possesses a *temporal structure*; and 3. the correspondence between the structure outside-time and the temporal structure; the *structure in-time* (Xenakis 1992: 160-1).

On the one hand, metric time is shown to be subordinate to outside-time structures, but on the other hand, temporal intervals are privileged and assigned to the first category. What places the set of durations or the temporal structure outside of time is essentially the presence of commutativity. In this sense, the outside-time and the temporal are both *ordered structures*.³ The sonic events on the one hand and durations on the other belong to two different categories that share an almost identical algebra; in the first case this algebra refers to the structure of the sonic events themselves, and in the second to the time-intervals that are designated by these events. Thus temporal intervals as such are part of a secondary structure, as they are issued from the sonic entities. In both cases, structure is defined as the relations and operations *between* the elements (sonic events or temporal distances).

Besides these logical relations and operations outside-time, we have seen that we may obtain classes (*T* classes) issuing from the sonic symbolization that defines the distances or intervals on the axis of time. The role of time is again defined in a new

way. It serves primarily as a crucible, mold, or space in which are inscribed the classes whose relations one must *decipher*. Time is in some ways equivalent to the area of a sheet of paper or a blackboard. It is only in a secondary sense that it may be considered as carrying generic elements (temporal distances) and relations or operations between these elements (temporal algebra) (Xenakis 1992: 173).

There are two remarks here that relate to the nature and position of time in Xenakis's theory. On the one hand, there is a temporal structure, which time is furnished with, and it is found in the set of temporal intervals as generic elements and the relations between these elements. On the other, time itself functions as a space of inscription or as a blackboard where sonic events are inscribed into as symbols that form part of the outside-time structure; this structure is found in the relations and operations between these sonic symbols. This second remark will be discussed later on.

In this way, time is shown to be something more than just a set of elements with a commutative group structure. It must be clarified that what Xenakis subordinates at this stage is not time as such, but precisely this set of elements, or the temporal structure that time *possesses* (and of course this structure is not everything about time as such). Therefore, it is the temporal structure that is in proximity with the outside-time one, in the sense that the two share a common algebra. Time as such remains a medium that renders structures perceptible.

The positioning of the temporal as a medium between outside- and inside-time structures serves to distinguish the two opposed poles in Xenakis's formation. In 1965 he proceeds to a more simplified distinction:

We have to distinguish between two natures: inside-time and outside-time. That which can be thought of without changing from the before and the after is outside-time. Traditional modes are partially outside-time, the logical relations and operations applied on classes of sounds, intervals, characters... are also outside-time. Those whose discourse contains the before or the after, are inside-time. The serial order is inside-time, a traditional melody too. All music, in its outside-time nature,

can be rendered instantaneously, flat. Its inside-time nature is the relation of its outside-time nature with time. As sonorous reality, there is no pure outside-time music: there is pure inside-time music, it is rhythm in its pure form (Xenakis 1994: 68).

With the 'before' and the 'after' Xenakis refers to the commutativity of the elements of an outside-time structure. This dual opposition can be exemplified in the relation between scale and melody. This is because the arrangement of the degrees of a scale is not temporal but ordered. Therefore, on the outside-time side we have the notes of a scale or a mode that appear from the lower to the higher. (Intervals are outside-time in the sense that they can be compared in terms of their size.) On the other side, we have melody or the series, as an ordering of these elements. In the same way that a melody is based on a scale or mode, the series is based on the total chromatic. Xenakis brings back his critique of serialism – this time under the light of his general compositional theory and not Stochastics. This, however, will lead to a much more complicated discussion and it will be developed in his following writings.

Although Xenakis presents a dual opposition of inside and outside, time is still included here: it is clearly a catalyst, necessary for bringing music into life – in terms of perception, that is. The inside-time is the *relation* of the outside-time with time. This reveals another aspect of the position of time in the classification. There is no temporal category here and, as he had mentioned previously, the temporal and the outside-time algebras are identical; therefore, in this dualistic distinction the temporal structure would also be outside time.

We see that since the second category of the theory collapses to the first, the notion of time is included in relation to the third category. Recall that in the preceding demonstration the third category derives from the correspondence of the outside-time with the *temporal* structure, whereas now from the relation of the outside-time nature with *time*. This reveals that for Xenakis there seem to be two different lines of thought when he places time in relation to the other two categories; and this is shown by the fact that the 'middle'

category is related to the other two in two different ways. On the one hand, time is (in a secondary sense) included in the outside-time category as their corresponding algebras are identical; on the other, it is shown to be 'rhythm in its pure form'.

Pure inside-time music can be conceived only in the total absence of outside-time structure. Of course, for Xenakis there is no music that lacks outside-time structures. The movement of thought in the two articles can be seen in the gestures that Xenakis makes in relation to the middle category. From an entity that is *simpler* than the sonic event itself, to *pure* inside-time music; or from a view that has time as *metric* to another that has time as *rhythm* in a much more general sense than metre. This movement does not imply that he abandoned the older view in favour of the new one. It is a movement between two lines of thought that are not mutually exclusive (although at the same time still independent). Distinguishing between two different aspects of the role of time in his schema, serves at demonstrating the natures of the two extreme poles. As a 'temporary assumption' then, time participates in both the outside and the inside time categories. By assigning the temporal in the middle category Xenakis made clear that, contrary to the classical view, time includes an outside-time aspect; and by identifying pure inside-time music with pure rhythm, he indicated time as being disentangled from outside-time structures.

Although Xenakis presents his classification from different viewpoints at different times, it remains clear that he insists on the importance of the outside-time structure of music. Inside-time structures always remain as the second term of the dualistic approach that he occasionally tends to suggest. More importantly, these two terms offer Xenakis the possibility to approach the temporal category, or time, from two different points of view. There are therefore two ways of thinking, which are based upon two opposed tendencies (outside/inside) that rarely seem to be stabilised in a formulation, although always involved in it.

In 1968 Xenakis demonstrated a slightly differentiated classification in 'A note' in *La*

Revue Musicale, where he talks about two categories but with a 'triple correction':

- a) in the outside-time, time is included,
- b) the temporal is reduced to the ordering,
- c) the 'realisation', the 'execution', that is the actualisation, is a play that makes a) and b) pass into the instantaneous, the present which, being evanescent, does not exist (Xenakis 1969: 51).

This is an obvious remark about metric time and what Xenakis considers to be included in the outside-time is precisely this metric time as a set of elements that has an ordered structure. Pure rhythm or pure time has no place in this formulation and certainly the instantaneous or the present is not related directly to this purity. He makes a gesture of overturning an old way of thinking and suggests a new one where tenses 'interpenetrate'; this can be thought only in terms of commutative time-intervals, which then form entities outside of time.

In 1976 (in Xenakis's thesis defense) his theory is mentioned in order for Xenakis to clarify that his view does not necessarily imply a reversible time. This clarification is, importantly enough, a way to distinguish between the two natures of time, which also reflect the polarity of outside/inside. Reversibility is for him simply one among the several outside-time permutations that temporal intervals can undergo. It is clearly a matter of distinguishing between metric time and pure temporal flow.

[W]hen I talk about time intervals, they are commutative. This is to say that I can take time intervals now or later and commute them with other time intervals. But the individual instants which make up these time intervals are not reversible (Xenakis 1985: 69).

The idea of reversibility is for Xenakis related to the non-temporal; what is temporal is by definition irreversible. In that case, what escapes us is related to real time as opposed to metric. The two lines of thought are clarified further on:

There are some orders which can be outside of time. Now, if I apply this idea to time, I can still obtain these orders, but not in real time, meaning in the temporal flow, because this flow is never reversible. I can obtain

them in a fictitious time which is based on memory (Xenakis 1985: 71).

Memory serves here as a means of thinking about time abstractly and enables man to perceive time and the composer to work with time intervals: 'There is the temporal flow, which is an immediate given, and then there is metrics, which is a construction man makes upon time' (1985: 97). The time instants and the effect they have on memory is, for Xenakis, an important remark, as it is a starting point for his elaboration of the outside-time aspect of time. This will substitute the paradigm borrowed from Piaget. We will explore this in the following section, in relation to the idea of the *trace*.

Outside-time structures as writing

As early as the first statement of his theory Xenakis referred to the temporal as related to the category of outside-time structures. We will use the relationship between time and outside-time structures in order to unveil the character of the latter as writing. For Xenakis time is, as we have already pointed out, a 'space of inscription'. There are several references that have time as a white 'sheet of paper' or as a 'blank blackboard'. This metaphor should be studied more thoroughly. The temporal has been shown from two opposed angles that place it in both poles of the dichotomy of outside/inside. It can be shown that these two aspects of time also function in a way that disturbs this dichotomy, which is not different from the one of writing/speech. For this reason, Jacques Derrida's exploration of writing is useful; primarily because Derrida equates the relationship of the scale (for Xenakis the primary outside-time paradigm) and the origins of music with the one of writing and speech: 'The chromatic, the *scale* [gamme], is to the origin of art what writing is to speech. (And one will reflect on the fact that *gamma* is also the name of Greek letter introduced to the system of literal musical notation)' (Derrida 1997: 214).

The third term

It is clear that Xenakis's formulation as a binary opposition 'with a triple correction', involves a 'third' term in the way that Derrida

has shown (see Derrida 2001: 5). This third term participates in both sides of the polarity. Participating in both categories, the temporal is a mediator between the two. This is a consequence of the heterogeneous nature time has for Xenakis: metric time and temporal flux, a manmade construction and an immediate given. Heterogeneity does not allow time to be a stable part of the schema, and this is why it is occasionally excluded from Xenakis's writings, or phrased differently, or viewed from different angles. Time is the element that resists systematisation and therefore, more than just being a mediator, it escapes integration into the system.

The temporal belongs neither to the outside-nor to the inside-time; but on one hand it possesses a structure that belongs to the former and on the other hand its irreversibility places it with the latter. Derrida talks of the 'third' in a way that brings light to this discussion: 'It is at the same time, the place where the system constitutes itself, and where this constitution is threatened by the heterogeneous' (2001: 5). The temporal, as the third term, obscures the limits of what is outside and what inside. What is obvious from Xenakis's writings, is that ordered structures (including temporal ones) are outside time while time as such remains pure; inside time then are the outside-time structures when affected by the catalytic action of time. But more than a catalyst, time is the function that renders the outside-time perceptible, in other words inside-time.

The critique of serialism

The idea of the scale is central in any discussion on the matter. A scale is a well-ordered set, an object outside time. Having this observation as a starting point, we can re-formulate Xenakis's criterion for his evaluation of serialism's compositional practice. Xenakis points out a progressive degradation of outside-time structures which is 'the most characteristic fact about the evolution of Western European music' (1992: 193). Xenakis's first theoretical endeavour was his famous manifesto against serialism, 'La crise de la musique sérielle' of 1955 (see Xenakis 1994: 39).

General harmony. This critique is also included in his theory of outside-time structures, ten years later. The starting point of his argument is precisely the placing of the tempered chromatic scale outside of time:

[The tempered chromatic scale] is for music what the invention of natural numbers is for mathematics and it permits the most fertile generalisation and abstraction. Without being conscious of its universal theoretical value, Bach with his *Well-Tempered Clavier* was already showing the *neutrality* of this scale, since it served as a support for modulations of tonal and polyphonic constructions. But only after two centuries, through a deviating course, music in its totality and its flesh breaks decisively from tonal functions. It then confronts the void of the neutrality of the tempered chromatic scale and, with Schönberg for example, regresses and falls back to more archaic positions. It does not yet acquire the scientific awareness of the *totally ordered structure* that this privileged scale comprises. Today, we can affirm with the twenty-five centuries of musical evolution, that we arrive at a universal formulation concerning the perception of pitch, which is the following:

The totality of melodic intervals is equipped with a group structure with addition as the law of composition (Xenakis 1994: 69).

The tempered chromatic is then a landmark in the history of music that went unnoticed. Of course this does not mean that outside-time structures did not exist before or that they were necessarily poorer. On the contrary, the chromatic is a neutral structure, much poorer itself than, say, the diatonic scale or Byzantine and ancient Greek modes, which have a differentiated structure. By corresponding the chromatic with the set of natural numbers Xenakis did not merely show that a new structure as such was discovered; what actually happened, for him, is an opening up of possibilities for constructing new structures, e.g. scales, with mathematical tools, such as Set Theory. Under the scope of such possibilities Xenakis conceived (at around the same time) his Sieve Theory, which was eventually developed exclusively towards the construction of pitch scales. He acknowledges of course that it was in France that the outside-time category was reintroduced, both

in the domain of pitch and of rhythm; this was done by Debussy with the invention of the whole-tone scale and Messiaen with his modes of limited transpositions and non-retrogradable rhythms.

In 'Towards a Metamusic' Xenakis reminds us of the suggestion he made in 1955: the introduction of probabilities and a 'massive' conception of sound that would include serialism's linear thought merely as a particular case. He then goes on to pose the question whether this suggestion itself implied a general harmony, only in order to reply: 'no, not yet' (FM 182). This harmony, provided by his theory of outside-time structures, is seen not in a traditional sense of the homophonic or contrapuntal style. A truly general harmony must be able to include, potentially, all types of musical structures of the past and present, all styles and personal languages.

Magma. In serial music, which is based on a time-ordering of all pitches of the chromatic scale, it is impossible to discern between structures and their temporal manifestations. Serial music remains for Xenakis 'a somewhat confused magma of temporal and outside-time structures, for no one has yet thought of unraveling them' (1992: 193). What needs to be unraveled then is essentially the outside-time structure from its temporal manifestation (instantaneous becomingness). In the case of the pitch organisation of a serial composition, these two elements are the chromatic scale, which is placed outside time, and the series, which is inside time. What Xenakis means when he says 'temporal' here is not metric time. It should be remembered that metric time refers to the ordered set of durations, of temporal intervals, which is a commutative group and which is outside time. What he talks about here is the element of pitch, without taking into account any durations pitches might be associated with. Therefore, 'temporal' stands here for the inside-time ordering of the twelve pitch-classes; thus the 'magma' Xenakis refers to consists of the outside- and the inside-time categories.

As we have mentioned earlier, for Xenakis, apart from 'pure rhythm', there is no pure inside-time music. Outside-time structures do

exist (e.g. the total chromatic in the case of a serial composition) and are just *perceived* in time: 'Polyphony has driven this category [of outside-time structures] back into the subconscious of musicians of the European occident, but has not completely removed it; that would have been impossible' (Xenakis 1992: 208). The magma that serial music is then, should be a natural and an expected one. What he actually points at, is the neglecting of the outside-time that is responsible for the degradation of music. It is a matter of a *confused* magma where the two categories are in a disproportioned, unbalanced relationship; Xenakis's suggestion then should be seen not as disentangling the two categories, but that the outside-time category should be given more attention, as it is always already there. It is therefore not a matter of reintroducing it, but taking into account its existence, noticing the possibilities it offers in composition and the effects it has in musical perception. Its consequences, it seems for Xenakis, are at work no matter whether we acknowledge it or not.

The temporal as outside-time

The temporal element in the series is then the ordering of the pitch-classes, as an inside-time structure. This clarification is important to be made in order to understand how the polarity of outside/inside functions for Xenakis in serial music. For this purpose, we will compare the idea of the scale (outside-time) and that of the rhythmic sequence (temporal). In his final article on Time ('Concerning Time, Space and Music' – 1981) Xenakis focuses on the temporal and its relation to the outside-time. He demonstrates the outside-time aspect of time, leaving the temporal flux (which would place structures inside time) as the other element where music participates.

1. We perceive temporal events.
2. Thanks to separability, these events can be assimilated to *landmark points* in the flux of time, points which are instantaneously hauled up outside of time because of their *trace* in our memory.
3. The comparison of the *landmark points* allows us to assign to them distances, intervals, durations. A distance, translated spatially, can be considered as the displacement, the step, the jump from one

point to another, a nontemporal jump, a spatial distance.

4. It is possible to repeat, to link together these steps in a chain.
5. There are two possible orientations in iteration, one by accumulation of steps, the other by a de-accumulation (Xenakis 1992: 264-5; the author italicises only 'landmark points').

This formulation concerns temporal structures when placed outside of time. His final publication then is concerned only with the middle category in its outside-time aspect.

Messiaen's non-retrogradable rhythms are shown by Xenakis to belong to the outside-time category. There are two elements involved in temporal structures: the time-instants and the temporal intervals between them. If we correspond the time-instants and the temporal intervals with the pitches and pitch-intervals of a scale, it can be shown that, as Xenakis often said, the temporal structure (rhythmic sequence) is simpler than the outside-time structure (scale). In the case of the scale there are two possible ways of ordering: pitches are placed from the lower to the higher; and pitch-intervals are expressed as multiples of a unit and arranged from the smaller to the larger (or commuted). Neither of these two ways of arranging include the 'before' and the 'after'. In the case of a rhythmic sequence though, there is only one way of doing so: while you can compare the sizes of temporal intervals, commute them, or arrange them from the smaller to the larger, time instants are not commutative, not reversible; they belong to time, to pure temporal flow. This is due to the heterogeneity of time: a rhythmic sequence has a part that is outside-time (temporal intervals) and another that is inside-time (time-instants). Therefore, a reordering of the pitches of a scale is inside time; in a rhythmic sequence this would be inconceivable, as time instants are fixed to the flow of time.

Outside-time as supplement

The metaphor for writing Xenakis frequently used is not aimed at suggesting that music functions as language. Nonetheless, the idea of the symbol might suggest a similarity with language, that in conjunction with the idea of writing can lead to an analogy between the

dichotomy outside/inside and writing/speech; furthermore, it can be explored in relation to the deconstructive as unveiled by Derrida and his reading of the passages relevant to music in Rousseau's *The Essay on the Origin of Languages*. In *Of Grammatology*, published in the same year as 'Towards a Metamusic', Derrida argues for an analogy of the histories of language and music (that is, the histories of the two as read in Rousseau). There he focuses on the degradation of music that Rousseau considered to have taken place. According to this idea, there is an originary separation between speech and music. For Rousseau it is obvious that song is the origin of music and that itself derives from speech. For him, music and song grew apart; it is a case of a degradation caused by the forgetting of the origin of music.

Although we are not attempting an interpretation of Rousseau's views on the matter, there is an interesting analogy between his treatment of the opposition melody/harmony and Xenakis's view of harmony as being outside of time and melody inside. The two obviously privilege the opposite side of a dichotomy, which seems to be the same for both: melody versus harmony. Harmony, independent of any other qualities such as time and rhythm, stands on its own; also, it is for both a 'rational science'. But for Rousseau harmony is the cause for music's degradation: music should be united with speech, with the inflections and accent of the spoken language. The comparison here is useful for two purposes: first, to show the intention on Xenakis's part to demolish the classical view that has time as the essence of music, and secondly in order to see how the idea of supplementarity, shown in relation to Rousseau's view, affects Xenakis's.

Derrida has shown that, for Rousseau, music grew as a supplement to the unity of speech and song; supplement alludes here to the idea of writing in relation to speech. 'The growth of music, the desolating separation of song and speech, has the form of writing as "dangerous supplement": calculation and grammaticality, *loss of energy and substitution*. The history of music is parallel to the history of the language, its evil is in essence graphic' (Derrida 1997: 214). The

'graphic' element of music is described as 'grammaticality' or as the 'rational science of intervals' that is alien to and the supplement of the natural song-as-presence. As with writing, the 'science of intervals' is located outside the full presence of the song, which is considered by Rousseau united with the inflections of the voice in speech. It would be superfluous to indicate here the obvious analogy between song being inside time, and harmony (calculation of intervals) being outside time.

Symmetry

Series. Xenakis's scientific approach stands at the antipode of what Derrida is preoccupied with in reference to Rousseau's degradation of music. It is, for him, precisely too much emphasis on melody that has caused the degradation of music. It is interesting here to see how the deconstructive works when privileging harmony over melody; or in the case of serialism, the (chromatic) scale over the series. No matter how Xenakis might have phrased his critique over the years, it can be shown that the 'magma' he pointed at is essentially issued by the series itself; and this is due to the structural difference between a melody and the series. Although according to Xenakis's theory both the series and melody are inside-time structures, the two are not identical. For Xenakis, the degradation he referred to, did not escape the attention of the Viennese school:

[A]tonalism [...] abandoned all outside-time structure. This was endorsed by the dogmatic suppression of the Viennese school, who accepted only the ultimate total time ordering of the tempered chromatic scale. Of the four forms of the series, only the inversion of the intervals is related to an outside-time structure. Naturally the loss was felt, consciously or not, and symmetric relations between intervals were *grafted* onto the chromatic total in the choice of the notes of the series, but these always remained in the in-time category. Since then the situation has barely changed in the music of the post-Webernians. This degradation [...] has led to an unparalleled excrescence of temporal and in-time structures (Xenakis 1992: 193-4; italics added).

This is an obvious reference to Webern, who revealed serialism's potential, mainly discovering symmetrical relations between different forms of the tone-row. Symmetry is par excellence a geometrical phenomenon and therefore belongs to the outside-time category. And for Xenakis, this is the outside-time element that was *grafted* onto the process of constructing an inside-time structure, the series, in order for the serial technique to recover from its degradation. But this *possibility* for symmetry was already included in dodecaphonism's potential. The tone-row cannot be reduced to a mere succession of elements; its four forms might stand in such a relation to each other that can reveal correspondences and symmetries much more profound than vertical or horizontal reflections. The impasse was dealt with by revealing certain aspects of the interior of the series that can inform the structural principle of the composition, and not by imposing symmetrical forms from outside. There are here the two characteristics of the supplement: symmetry *substitutes* the mere time-ordering of the pitch-classes; and at the same time it *adds* itself as a structural principle. Xenakis's theory fails to see symmetry, an outside-time characteristic, as deriving from an inside-time structure; it is a case of a much more profound magma, where distinguishing the two categories is never straightforward. We can now see this way of thinking according to the logic of the supplement, which 'would have it that the outside be inside, that the other and the lack come to add themselves as a plus that replaces a minus, that what adds itself to something takes the place of a default in the thing, that the default, as the outside of the inside, should be already within the inside' (Derrida 1997: 215).⁴

Xenakis's privileging of outside-time structures is a method intended to establish the foundations of a general harmony. On the other hand, Derrida's method (and not strategy in a teleological sense) is to distance oneself from the binary opposition and allow for any deconstructive functions, without privileging one or the other side. Derrida has demonstrated the deconstructive in the function of harmony in relation to melody. According to the logic of the supplement

'there is already harmony within melody' (Derrida 1997: 212). Writing, as the supplement of speech, allows for *spacing* (the becoming-space of time and the becoming-time of space) (see Derrida 1997: 68) and elements are put in distance from each other (intervals). In the same way that punctuation is an act of inscribing into space, the function of harmony is parallel to that of writing as spacing. Outside-time structures, or the rational science of intervals, follow the same logic. Interval here is the nonpresent, the unperceived.

Non-retrogradable rhythms. The idea of symmetry, as the outside-time element in a structure, is also found in the case of non-retrogradable rhythms. Their placing outside of time by Xenakis raises the question of whether there are rhythmic sequences that, as the scales, are wholly or partially outside of time. As we have shown when comparing it with the scale, a rhythmic sequence possesses a temporal structure (the set of temporal intervals placed outside of time) and an inside-time aspect (the time-instants). Generalising therefore, all rhythmic sequences possess an outside-time aspect. In the discussion on the reversibility of time, Xenakis made his view clear: real time is not reversible. There, he also uses symmetry as an example for a state of order (as opposed to states of disorder in his stochastic music). Furthermore, for Xenakis symmetry does not entail reversibility of time, 'because there can be order in non-temporal things' (Xenakis 1985: 70). In non-retrogradable rhythms you cannot reverse the inside-time order of the successive intervals. But reversing is only one among the several reorderings or permutations that can be applied inside time; symmetry merely limits the inside-time operations that one could apply to such a structure. In this sense, the set of temporal intervals does not need symmetry in order to be thought of as an outside-time structure. It remains then that symmetry must be related to the other element of a rhythmic sequence: time instants themselves. Symmetry stands as an additional outside-time element, apart from the set of temporal intervals; non-retrogradable rhythms are therefore shown to be outside time by relating symmetry, which is a geometrical, non-temporal phenomenon,

to their inside-time aspect. And as this symmetry does not imply reversibility of time (which is in any case impossible) the time instants are both outside time (as part of a symmetrical construction) and inside time by definition. As with the case of the series, symmetry is found to operate as a supplement; the idea of supplementarity is precisely found in this broaching of an inside-time structure (or the inside-time aspect of a temporal structure) with a non-temporal element.

Spacing

In the opening of 'Symbolic Music', Xenakis talked about a certain *amnesia* (see Xenakis 1992: 155). That is, the forgetting of the origin of musical structures, such as the scales, modes and rhythms that personal languages and styles are built on. Although this is not an explicit metaphor for writing, it can be seen as an attempt of abstracting the originary elements of musical structures. Let us take once more the example of the scale, disregarding the cadential and hierarchical relationships between its elements (in other words, its origins). The elements of a scale neither refer to something other than themselves, nor are they present to themselves; they are defined *in relation* to each other. If the notion of the trace is relevant to temporal structures, it must also be relevant to outside-time ones. The interval constitutes both the difference between the elements and the deferral of the elements' definition. The difference between the elements is seen as a simple consequence of the (abstract) hierarchy that governs a totally ordered structure: elements are arranged from the lower to the higher, or from the smaller to the larger; in other words, there is a spatial distance between them. At the same time, each one element, as a 'landmark point' in our memory, is not defined until it is compared with the others; in other words, the assigning of spatial distances is deferred until we relate the *trace* of each one element with the others.

Pitch intervals can be seen as parallel to temporal intervals. Both a scale and a rhythmic sequence can be thought of as points on a straight line (the straight line of natural numbers in the former case and time

in the latter). Thus the comparison between the two can be seen even more abstractly: points refer either to pitches or to time-instants and the intervals between two successive points refer either to pitch-intervals or to temporal intervals. The inside-time placing of the scale is carried out by the time-ordering of the points (as in a melody or a series), whereas the inside-time aspect of a rhythmic sequence stems from the fact that its points are fixed to the temporal flow. In the case of the rhythmic sequence therefore, the points are always inside time and the intervals outside of time ('nontemporal jumps'). But what has been said about elements or points can also be said about intervals. If intervals are perceived as multiples of unit, the idea of the trace defers the assigning of this unit to any interval until it is compared with another. The scale, as both a set of discrete elements and a succession of intervals, is itself conditioned by the function of writing as spacing: the becoming-space of time and the becoming-time of space. The non-distinction of the becoming-space and the becoming-time implies the impossibility of this other distinction between the (outside-time) set of points and the (inside-time) succession of intervals. It is a case of *différance*: 'of discontinuity and of discreteness, of the diversion and the reserve of what does not appear' (Derrida 1997: 69).

The representation as points on a straight line is essential in Xenakis's definition of a sieve (see Xenakis 1992: 268); this is his own 'solution to the problems of outside-time structures' (preface to *Jonchaies*). His development of Sieve Theory is driven by the 'question of symmetries (spatial identities) and periodicities (identities in time)' (1992: 268). Outside-time structures (sieves) are constructed and conceived as multiplicities of inside-time identities (periodicities). In the case of the series, an outside-time characteristic (symmetry) is achieved by the inside-time ordering of the twelve pitch-classes; similarly, in the case of his sieves an inside-time property (periodicity) is at work in an outside-time structure.

References

- Derrida, J. (1997). *Of Grammatology*. Baltimore: Johns Hopkins University Press.
- Derrida, J.; Ferraris, M. (2001). *A Taste for the Secret*. Cambridge: Polity Press in association with Blackwell.
- Flint, E. R. (1989). An investigation of real time as evidenced by the structural and formal multiplicities in Iannis Xenakis' *Psappha*. PhD diss., University of Maryland and College Park.
- Solomos, M. (2004). Xenakis' Thought through his Writings. *Journal of New Music Research* 33/2: 125-36.
- Squibbs, R. (1996). An Analytical Approach to the Music of Iannis Xenakis: Studies of Recent Works', PhD diss., Yale University.
- Xenakis, I. (1969). Une note. *Revue Musicale* 265-6: 51.
- Xenakis, I. (1976). *Musique. Architecture*. Tournai: Casterman.
- Xenakis, I. (1985). *Arts/Sciences: Alloys. The Thesis Defense of Iannis Xenakis*. Trans. by Sharon Kanach. Stuyvesant, New York: Pendragon Press.
- Xenakis, I. (1992). *Formalized Music: Thought and Mathematics in Composition*. Ed. by Sharon Kanach. Stuyvesant, New York: Pendragon Press.
- Xenakis, I. (1994). *Kéleütha (Ecrits)*. Ed. by Alain Galliani, preface by Benoît Gibson. Paris: L'Arche.
- Zaplitny, M. (1975). Conversation with Iannis Xenakis. *Perspectives of New Music* 14/1: 86-103.

⁴ It is not our intention to show Xenakis's approach as similar to Derrida's, as there is no evidence that he was aware of the latter's work (Derrida was working on these themes at around the same time). What is important here though is the logic of supplementarity and of incompleteness of an account on the matter (which is also reflected in that Xenakis had not written any complete treatise on outside-time structures).

¹ Following the practice Squibbs (1996) and Flint (1989), we will use the term *inside-time*, instead of Xenakis's *in-time*, as a more obvious antonym to *outside-time*.

² It should be noted that here the idea of duration is here used in its elementary sense of 'time-value'; and not in the sense philosopher Henri Bergson used it.

³ Xenakis defined ordered structures as follows: '[T]otally ordered structure' means that] given three elements of one set, you are able to put one of them in between the other two. [...] Whenever you can do this with all the elements of the set, then this set, you can say, is an ordered set. It has a totally ordered structure because you can arrange all the elements into a room full of the other elements. You can say that the set is higher in pitch, or later in time, or use some comparative adjective: bigger, larger, smaller' (Zaplitny 1975: 97).