ANALYSIS OF IANNIS XENAKIS'S "POUR LA PAIX" FOR A CAPPELLA MIXED CHOIR

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Abstract

Iannis Xenakis's "Pour la paix" was composed after Françoise Xenakis's texts in 1981 in four different versions (I for unaccompanied mixed choir - II for mixed choir, four narrators and tape - III for four narrators and tape - IV for tape only). The present paper attempts an analysis of the version for a cappella choir. The analysis focuses mainly on the pitch structure of the piece, i.e. on the modification of the pitch material (certain pitches, pitch classes, intervals or scales) through the piece's ten parts and on the correlation between the resultant pitch formations. An attempt towards the explanation of Xenakis's choices is made through either the use of the sieve theory (which was thoroughly exploited by the composer at that period) or the use of the pitch class set theory. The paper also includes analytical remarks about the piece's morphological design, the rhythmical structure, the evolution of the musical texture and the setting of the text.

Keywords: Iannis Xenakis, Pour la paix, sieve theory, vocal music.

1. Introduction

Iannis Xenakis's "Pour la paix" ("For peace") was composed after Françoise Xenakis's texts in 1981, during a mature and prolific creative period. The work exists in four different versions, all authorized by the composer for autonomous performance: I for unaccompanied mixed choir, II for mixed choir, four narrators and tape, III for four narrators and tape and IV for tape only. The texts refer to the atrocities of incessant wars and to the unnecessary anguish and suffering they cause through the story of two childhood friends that become soldiers in enemy camps. The nostalgia of their common happy memories elevates them above the horrors of the war, but does not prevent their inevitable death from a grenade explosion. The texts are spoken by the four narrators between and during the musical sequences, which are sung by an unaccompanied eight-voice mixed choir. The work's third version includes additional sound events composed on the UPIC system and recorded on tape, while the first version excludes the narrators' spoken texts and consists of the choral sequences only. Certain sequences are wordless (they contain vocal phonemes), others repeat important keywords of the spoken text (*chacal, mourir, pleureront les morts* - trnsl.: *jackal, die, mourn the dead*), while others set on music a poetic text by Françoise Xenakis (also used in "Nekuïa"), that functions as the "leitmotiv" of the work:

"*Écoute le vent dans le haut des arbres, le vent qui décoiffe les morts, casques roulés au loin, le vent qui caresse les visages et décoiffe les cheveux*" ("Listen to the wind passing through the trees, the wind that ruffles the hair of the dead, their helmets rolling away, the wind that caresses the face and ruffles the hair").

The present paper attempts an analysis of the first version for a cappella choir. The analysis focuses mainly on the pitch structure of the piece, i.e. on what Xenakis called "outside-time structure" (Xenakis 1992, 192), but also comments on the musical texture and the relation between music and the meaning of the text. Other analytical references to this work are included in monographs or papers written by Frisius (1986, 2003), Bardot (1999), Halbreich (1993) and Di Scipio (2001).

At this point, a short reference to the sieve theory would be useful as a background for the analysis. *Sieve theory* is the study of the internal symmetries of a series of points either constructed intuitively, given by observation, or invented completely from moduli of repetition (Xenakis 1992: 276). The theory can create abstract mathematical structures that can be applied to every musical parameter that can be quantized (pitch, time-points, density, loudness, etc); most commonly it creates complex scales with considerably large periodicity. An elementary sieve x_n is the residual class *n* modulo *x*, i.e. a periodic series of numbers, where *x* denotes the period of the repetition and *n* the series' point of departure[1]. A complex sieve is constructed as an aggregate of set theory operations (union, intersection, complementation or simultaneous combinations of these) between elementary sieves[2]. Transformations (*metabolae*) of the sieves are also possible through either the change of indices of the moduli, or through transformations of the logical operations using the laws of logic and mathematics or arbitrarily. Considerable research has been conducted on the use of sieve theory in Xenakis's works and on its relation to other theories of musical structure[3].

Although Xenakis had a thorough knowledge of the theory and its application to musical "outside-time" structure since the early 60's, he did not use it systematically in his compositions until the second half of the 70's and during the 80's. A significant number of major works from that period (e.g. *Aïs, Orkos, Kompoi, Nekuïa, À R.*, etc) incorporate the use of the theory in their structural aspects, mainly in the scales they use.

2. Analysis of "Pour la paix"

2.1. Morphological issues

The piece consists of ten choral sequences which follow a certain incremental plan in relation to the number of voices they implement. Also, in relation to the text, three sequences contain the poetic text, three other keywords and the remaining four phonemes.

Sequence 1: SA in unison (1 voice). Text: *Écoute le vent…*
Sequence 2: SA (2 voices). Text: *Écoute le vent…*
Sequence 3: SATB (8 voices). Text: *chacal*
Sequence 4: SATB (8 voices). Text: phonemes

Sequence 5: SA (4 voices). Text: phonemes
Sequence 6: SATB (8 voices). Text: phonemes, *HaHaHa…*

Sequence 7: SA (2 voices). Text: *Écoute le vent…*
Sequence 8: SA (4 voices). Text: *mourir*, phonemes
Sequence 9: SATB (8 voices). Text: phonemes
Sequence 10: SATB (8 voices). Text: *pleureront les morts* (S), phonemes (ATB)

Following the fluctuation of the polyphony, the whole piece can be organized into a symmetric tri-partite morphological structure: A (sequences 1-4), B (sequences 5-6) and C (sequences 7-10). Within each section the number of voices increases (multiplied by 2 or 4) until it reaches a polyphony of 8 voices, which is kept until the end of the section. This symmetrical morphological design is congruent with the structural design, since the outer parts contain dynamically evolving definite pitch structures while the middle part contains static pitch structures combined with indefinite pitch elements (e.g. glissandos, laughter, noises).

2.2. Structural elements

The work's pitch structure is a result of various transformations of two structural pitch elements: a basic pitch class set and a basic 12-note scale with a 20-semitone ambitus.

The set is encountered for the first time in the piece's first sequence, sung by the sopranos and altos in unison, and it consists of the pitches G-Ab-C#-D. The set's prime form is [0,1,6,7] and it is transpositionally and inversionally symmetrical. An interesting property of this set is that it can be constructed by two perfect fourth intervals (D-G and G#-C#) one tritone apart.

The scale appears in full for the first time in the third sequence and it contains the following pitches: Eb2, F2, G2, Ab2, Bb2, D3, E3, F#3, A3, B3, C4, Eb4, F4, G4, Ab4, Bb4, C#5, D5, E5, F#5, G#5, A5. At first sight, the scale seems entirely non-periodic. However, after comparing the contents of its lower part (Eb2 - C4) and its upper part (Eb4 - A) and after adding two omitted pitches in the lower part (C#3, G#3) and extending the upper part (addition of B5), a two-octave scale emerges (fig. 1) that spans the full range of the mixed choir (Eb2 - B5).

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[1] For example, sieve 4_2 (residual class 2 modulo 4) is the number series: 2, 6, 10, 14, 18, …

[2] For example, the major scale, which is 12-semitone periodic, can be expressed as a sieve using logical set operations that involve only the elementary sieves 3_m and 4_n (m=0-2, n=0-3), since 12 is the smallest common multiple of 3 and 4 (which are coprime). The resultant sieve would be: $(\overline{3}_2 \cap 4_0) \cup (\overline{3}_1 \cap 4_1) \cup (3_2 \cap 4_2) \cup (\overline{3}_0 \cap 4_3)$.

[3] Representative papers have been written, among others, by Solomos (1997, analysis of *Nomos Alpha*), Gibson (2001, presentation of the theory) and Squibbs (2003, combines sieve theory with set theory in his analysis of *À R.*).

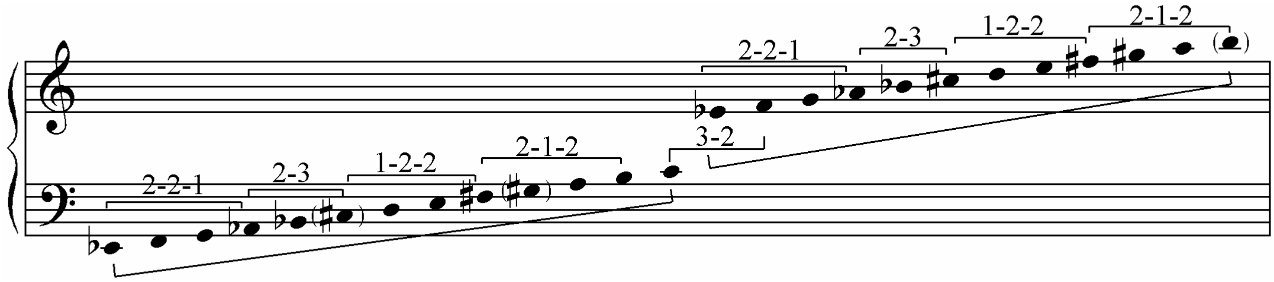

Figure 1: Intervallic properties of the basic scale

An attempt towards the representation of the scale as a sieve function will be made in this paragraph. The scale's upper part (treble clef in fig. 1) has a range of 20 semitones (Eb4 - B5) and its pitches can be grouped within four conjunct tetrachords, i.e. groups of pitches spanning a perfect fourth interval. These four tetrachords have different intervallic content: Eb-F-G-Ab (2-2-1, major), Ab-Bb-C# (2-3, pentatonic), C#-D-E-F# (1-2-2, phrygian), F#-G#-A-B (2-1-2, minor). Moreover, the inner intervallic combinations include nearly all the possible tetrachords containing the intervals of semitone, tone and minor third (excluding only the possible combinations with two semitones; the 3-2 pentatonic combination is also part of the overall scale and occurs in the intersection between the two scale groups). This grouping yields a periodicity of 5 semitones (interval class of perfect fourth) and divides the scale into four juxtaposed parts of equal length. So, considering the semitone as the sieve's background step and point 0 to be the first note of the scale (Eb4), points 0, 5, 10, 15 and 20 (pitches Eb, Ab, C#, F# and B) belong to the residual class 0 modulo 5 (5_0). The remaining pitches can be expressed using the set theory operations of union ($\cup$) and intersection ($\cap$) of corresponding classes 0-4 modulo 5 and classes 0-3 modulo 4, since each pitch of the scale comprises a unique intersection of certain indices of the two sieve functions (see fig. 2). The modulo 4 function was chosen for the sieve because 4 is the quotient of the division of 20 (the number describing the scale's range in semitone steps) by 5. Also, 20 is the lowest common multiple of 4 and 5.

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semitone points       00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20
scale members         ●     ○     ○  ●     ○        ●  ○     ○     ●     ○  ○     ●
sieve 5_0             |              |              |              |              |
sieve 5_1                |              |              |              |
sieve 5_2                   |              |              |              |
sieve 5_3                      |              |              |              |
sieve 5_4                         |              |              |              |
sieve 4_0             |           |           |           |           |           |
sieve 4_1                |           |           |           |           |
sieve 4_2                   |           |           |           |           |
sieve 4_3                      |           |           |           |           |
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Figure 2: Sieve functions of the scale

The above rationale yields the following function as a representation of the scale:

$$5_0 \cup (4_2 \cap 5_2) \cup (4_0 \cap 5_4) \cup (4_3 \cap 5_2) \cup (4_3 \cap 5_1) \cup (4_1 \cap 5_3) \cup (4_1 \cap 5_2) \cup (4_2 \cap 5_3)$$

The disjunct juxtaposition of two instances of the above scale (fig. 3, the pitches in parentheses don't belong to the sieve function) creates the *basic scale* of the work. The distance between the two instances is 4 semitone steps (B3-Eb4), something that underpins the coherence of the pitch structure, 4 and 5 being the modulo operators of the sieves. However, there are two pitches, namely C#2 and F#3 that are not actually used in the piece, thus creating an overall scale that is not periodic. Also, the overall scale incorporates certain pitches not included in the sieve function: the middle C4 that functions as a bridge between the two disjunct scales and a pair of symmetrically positioned pitches near the extreme points of the scale -E2 and Bb5- that are frequently used in the piece instead of their neighbors Eb2 and B5. A possible explanation for this deviation could be that Eb2 and B5 are outside the normal range of the mixed choir. It will be useful for the last part of the analysis to observe the intervallic content of the bridge between the scale's two sections: the conjunct segment B-C-Eb is the trichord [0,1,4]. Last but not least, the two basic pitch structures, the set [0,1,6,7] and the 12-note scale relate in the following ways: a) the set is included in the scale and b) they both are the outcome of transpositional or/and transformational processes based on the perfect fourth interval.

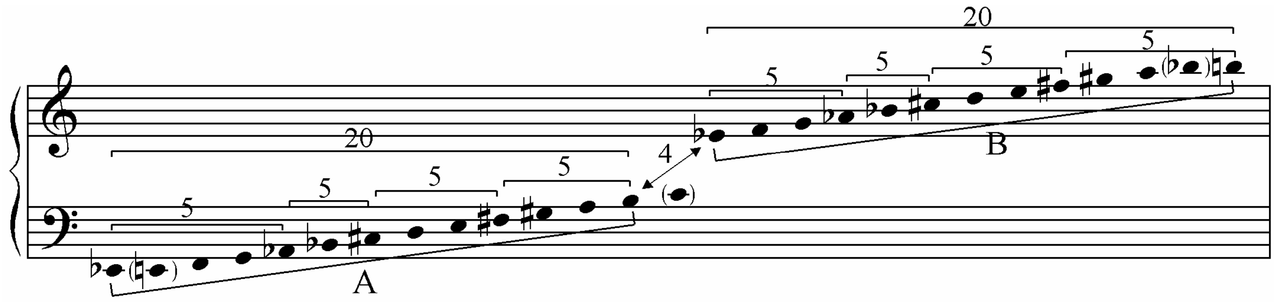

Figure 3: Basic 12-note scale spanning the ambitus of the mixed choir

2.3. Structural evolution of the piece

The two aforementioned structural elements are involved in a consecutive transformational process through the work's sequences. These transformations (or "*metabolae*" in Xenakis's terms) of the pitch material are a focal point in the understanding of the evolution of the work and are the study subject of this chapter.

Section A (sequences 1-4) incorporates a gradual increase of polyphony and uses almost exclusively the basic structural elements mentioned in the previous chapter.

Sequence 1 contains only the pitches of the set [0,1,6,7] (sang by the sopranos and altos in unison) in a non-periodic sequence of 8^{th}-notes. The lower note G of the set is emphasized, since it begins and ends the sequence.

Figure 4: Pitch structure of Sequence 1

In ***sequence 2*** the sopranos sing the same pitches as before, but within a 16^{th}-note rhythmical grid. The altos use a five-note diatonic scale (A-C-D-E-F) not included in the two basic structures. An interesting structural property of the scale's pitches is that they can be arranged as a chain of perfect fourths provided that the lowest pitch G of the basic set is also included (the augmented fourth is avoided by the omission of B in the alto scale): E-A-D-**G**-C-F. The union of these structures yields a superset of the original set: [**0**,**1**,2,5,**6**,**7**,10].

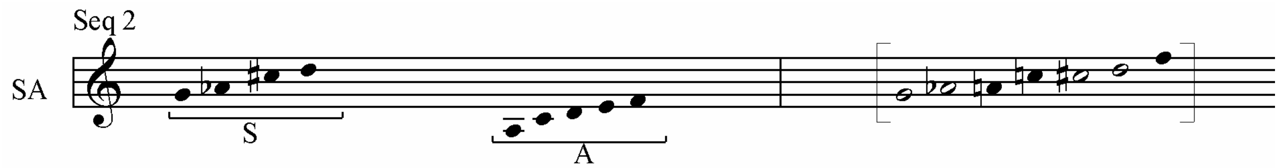

Figure 5: Pitch structure of Sequence 2

In ***sequence 3*** all the pitches of the basic scale are used for the first time, and no other pitches occur (the E2 in the bass part has been included in the basic scale, see ch. 2.2). The initial eight-voice sonority is prolonged through a scalar motion in all voices up to the last bar of the sequence, and all the pitches of the final eight-voice sonority are just one step lower in the basic scale from the pitches of the initial sonority.

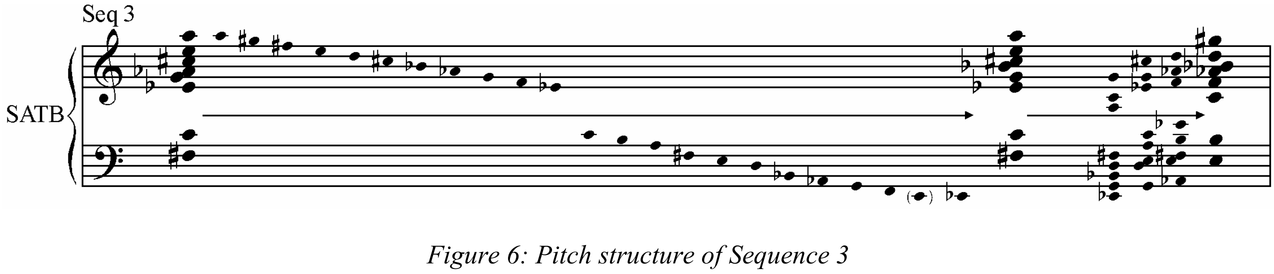

Figure 6: Pitch structure of Sequence 3

Sequence 4 concludes the first section of the symmetrical morphological structure with the continuous use of the basic scale in all voices and in its entire ambitus (the bass part always includes E2 instead of Eb2). Two choral groups are formed - male and female voices - each group having homophonic texture. Both groups coincide rhythmically near the end of the sequence to form the final eight-voice sonority, which consists entirely of pitches from the basic scale.

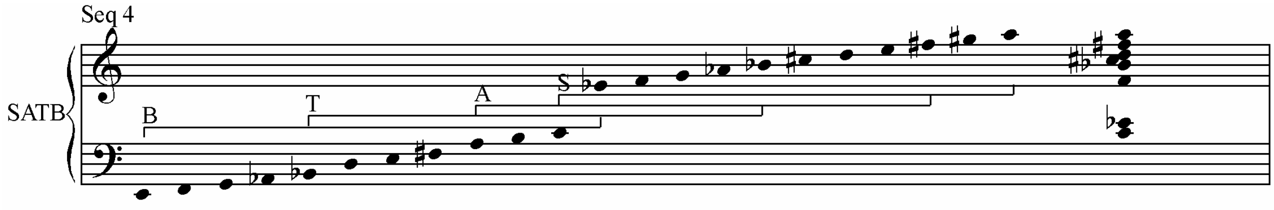

Figure 7: Pitch structure of Sequence 4

Section B (sequences 5-6) is less strict in the use of the structural elements. The structural ambiguity is created mainly by the continuous use of broad glissandi in both sequences and by short indefinite pitch segments in sequence 6. The incremental process regarding the number of used voices still applies. Also, both sequences are wordless (only phonemes are used).

Sequence 5 starts with a F# diminished 7th chord and leads through glissandos to the sonority D-E-A-Bb. All pitches belong to the basic scale (Bb has been included in the basic scale, although it comprises a transformation of the sieve function, see ch. 2.2). The overall pitch material (excluding the initial diminished chord) of the sequence can be expressed using set theory as [0,1,5,6,7], which is a five-note transposed superset of the basic set.

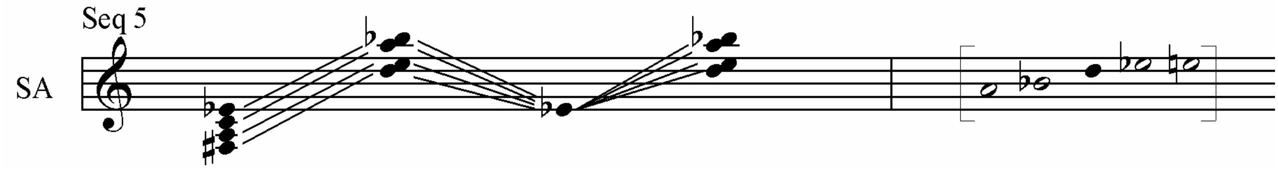

Figure 8: Pitch structure of Sequence 5

Sequence 6 introduces indefinite pitch elements combined with broad glissandos. The definite pitches come from the basic scale except for the last definite sonority (G2-D3-F4-G4-E5-F#5) which includes F4. The transition from pitch formation D-E-A-Bb to F-G-E-F# (see fig. 9) functions as a structural modulation and the female segment of the final sonority (E-F-F#-G) can be expressed using set theory as [0,1,2,3].

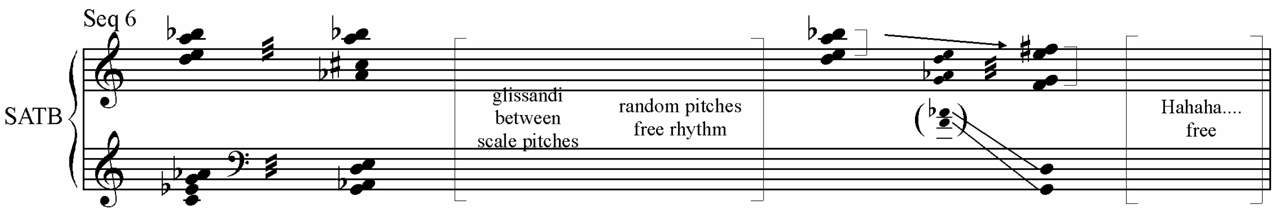

Figure 9: Pitch structure of Sequence 6

Section C (sequences 7-10) returns to definite pitch structures and texts, but it uses transformational mixtures of the initial structural material together with new elements (mainly in sequence 10), which are structurally coherent with the initial ones. The number of voices increases through the piece's four final sequences, following an incremental procedure similarly with section A.

In ***sequence 7*** the sopranos return to the basic pitch set (G-Ab-C#-D) while the altos use a pitch cell consisting of C-C#-D. This return coincides with the recapitulation of the poetic text, which was not used since the two initial sequences. Pitches G and D are emphasized by forming the final sonority and the union of the two pitch cells yields the set [0,1,5,6,7] in its non-transposed form.

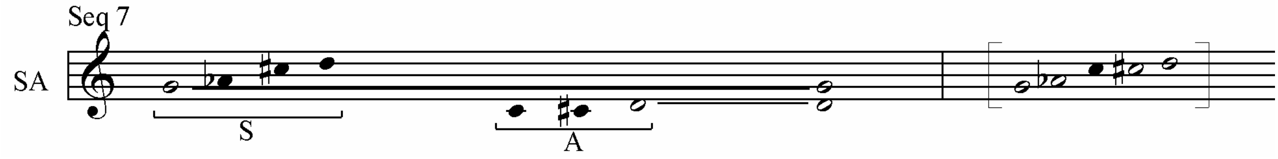

Figure 10: Pitch structure of Sequence 7

Sequence 8 can be divided in two segments, each one cadencing to an unambiguous sonority - the first segment's final sonority is E4-G5 and the second segment's A4-D5-F5-G5. This sequence does not use the basic scale and its pitch structure is built around four pitches (shown in white noteheads in fig. 11) which interrelate through the perfect fourth interval: E-A-D-G. Also, two-voice and three-voice parallel motions of perfect fourths and perfect fifths are present in the structural reduction. The soprano part comprises of the pitches D#4-E4-F5-F#5-G5 and the alto part of G#3-A3-D#4-E4-C5-C#5-D5. The first collection yields the chromatic set [0,1,2,3,4], a subset of which was used as the conclusion of sequence 6 (subset [0,1,3,4] is also used at the beginning of the sequence by the sopranos). Also, the aggregate of pitches yields the full chromatic scale except from classes B and Bb. The omission of B was also a feature of the second sequence, which was also based on a structural chain of perfect fourths.

Figure 11: Pitch structure of Sequence 8

Sequence 9 creates a climax by introducing each voice separately in ascending order and maintaining the voice's activity until the end of the sequence while at the same time increasing the overall dynamic level from mezzo forte to triple fortissimo. The final eight-voice sonority consists of G2-C3-F3-A3-D#4-G#4-Db5-A5. All pitches belong to the basic scale of the piece except for the three lower ones (G-C-F), which are connected through perfect fourth intervals. Another similar set of three pitches with a perfect fourth distance between them occurs in the final sonority (D#-G#-Db), the two sets being apart by a major third (interval class 4). An interesting feature of this structure is the omission of B (which would introduce an augmented fourth), in congruence with the structure of sequences 2 and 8.

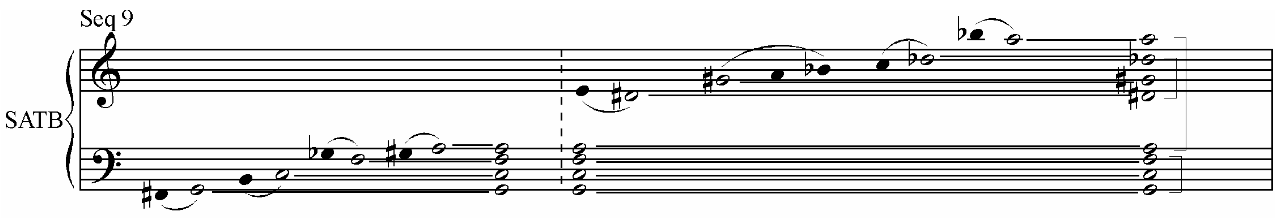

Figure 12: Pitch structure of Sequence 9

Sequence 10 is structurally different from the other nine sequences because it makes no use of either the basic set or the basic scale. The soprano part includes the pitch cell F-Gb-A-Bb and sets the text "*pleureront les morts*", while the other voices sing phonemes in a homophonic texture that consists of the pitches G#-B-C-Db-Eb-F-G-A#-B-C-D#-F#-G-A-B-C#-D (see fig. 13). The composer denotes structurally rather than texturally this sequence's antithesis with the others by creating a new scale, which is, most likely, the result of *metabolae* of the initial sieve's parameters. Instead of a mathematical description of these metabolae and of the resultant scale, a subset-component analysis will be pursued. The soprano part yields the tetrachord [0,1,4,5], which resembles the basic set, but has a smaller inner interval. The scale can be produced by the juxtaposition of two trichords a and b (a=[0,1,4] and b=[0,2,4]), whose common interval is the major third (interval class 4). Comparing the inner structures of the piece's basic scale and this sequence's scale, one observes that their main structural difference lies on their fundamental constructing interval: the juxtaposition of perfect fourths (ic 5) creates the basic scale, while of major thirds (ic 4) creates the final scale. An interesting point is that 5 and 4 are the numbers used for the sieve function of the basic scale. Finally, the set [0,1,4] in this identical position (B-C-D#) was used as a bridge between the two similar sections of the basic scale (see ch. 2.2).

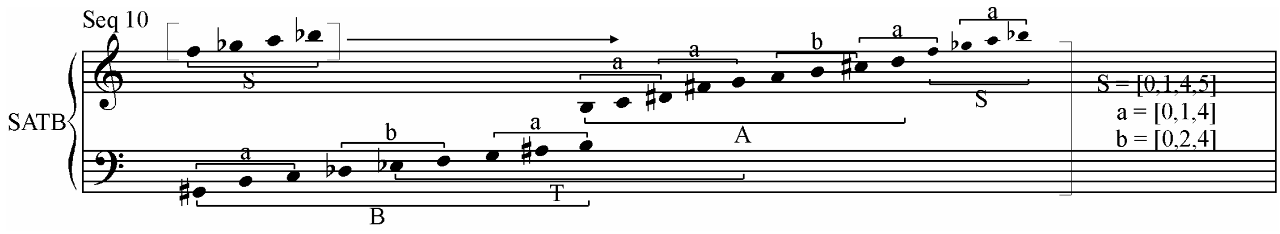

Figure 13: Pitch structure of Sequence 10

2.4. Musical texture - other issues

This paper will not pursue a detailed investigation of the rhythmic structure of the work, which possibly relates to some extent to the application of sieve functions to an 8^{th}-note, 16^{th}-note or 32^{nd}-note background metrical grid. Regarding the musical texture, it can be observed that the homophonic textures prevail in the majority of the piece's sequences, although polyphonic textures are also used. Although the piece is written for an eight-voice choir, the number of rhythmically independent vocal groups is never more than two (except only from sequence 9, where there are considerably more independent vocal parts). This feature creates - depending on the number of voices involved - musical textures that range from subtle two-voice polyphonies to thick multi-octave sound masses[4]. The complexity of the musical texture follows an incremental plan, analogous to the tri-partite morphological design.

No apparent lyrical elements, for example in the form of broad melodic lines, are present in the piece. As is well known, the composer had renounced lyricism during the 1989 conversation with Varga (Varga 2004, p. 85)[5]. However, compared to other pieces by the composer, this one involves relatively simple, transparent lines that refer to a kind of Xenakian lyricism - if such a term is permissible.

Also, as the 1989 conversation with Varga reveals (Varga 2004, p. 221), Xenakis intentionally implemented indirect programmatic elements in this piece, like for example sound effects that give the impression of a grenade detonating[6]. However, these concrete-music references are absent in the a cappella version of the work (the UPIC part is included in versions II, III and IV). The composer's intention to convey the meaning of the text through music[7] may justify the evolution of the structural material during the course of the piece. A possible instance of such an attitude could be the introduction of a new scale in sequence 10 to denote the dramatic turn in the story, where both characters have died and there is only "mourning for the dead".

3. Conclusions

This analysis projects a coherent unified structure for the piece, with the perfect fourth interval being the main unifying element. This interval (ic 5) is omni-present in the piece's sequences, either as structural part of the basic scale or as distance between structural pitches or set members. The significance of the perfect fourth has been emphasized by Xenakis in both his writings[8] and his interviews[9]. In his "Towards a Metamusic" chapter of *Formalized Music* he seeks the origin of scale systems through ancient Greek music and byzantine music and concludes that (p. 189): "*The scale order is the product of a combinatorial method - indeed of a gigantic montage (harmony) - by iterative juxtapositions of organisms that are already strongly differentiated, the tetrachords and their derivatives*". The conjunction of various types of tetrachords, i.e. note groups included in perfect fourth intervals, is the basic scale-constructing procedure used in *Pour la Paix*. Also, in *Conversations with Varga* (p. 188), he says that he studied Javanese music and specifically the *pelog* scale, which is based on a strong linking of two perfect fourth intervals in such a way as to create leading tones, i.e. notes that tend to move by semitones. This relates directly to the basic set of *Pour la Paix* (G-Ab-C#-D or [0,1,6,7]), which possesses such an internal structure. The structural significance of the perfect fourth in this particular piece is underlined through the avoidance of the inclusion of pitch class B in the piece's structures (more evidently in sequences 2, 8 and 9) in order to avoid a structural augmented fourth. However, equally interesting is the deliberate use of opposite structural elements in certain segments of the piece - e.g. the scale of sequence 10 which is based on ic 4, the augmented 4^{ths} in sequence 5, the diatonic five-note scale of sequence 2 - in order to create contrast and variety.

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[4] A detailed study of similar textures in *Mists* (1980) and *À R.*(1987) can be found in Squibbs' paper (2003, pp. 121-131).

[5] Xenakis: "I lack lyricism. Maybe life killed it in me; maybe I was born without it. I don't know".

[6] A detailed study of musical and extra-musical elements in Xenakis' music can be found in Frisius' paper (2003).

[7] In particular, the issue of death in the music of Xenakis is the study subject of Di Scipio's paper (2001).

[8] *Formalized Music*, ch. VII - "Towards a Metamusic", pp. 180-200.

[9] *Conversations with Varga*, pp. 188-189.

These remarks about the perfect fourth tetrachords and the leading tones and their use in the music of Java also relate to the semi-mobile set structure that this analysis suggests. This set structure has constant outer parts (semitones) and a floating inner part (semitone to perfect fourth - interval classes 1 to 5), yielding a group of affiliated tetrachords. The group's most prominent and most common member is the *basic set* [0,1,6,7] of the piece. The group consists of the following tetrachords:

[0,1,2,3] (seq 6,8)
[0,1, 3,4] (seq 8)
[0,1, 4,5] (seq 10)
[0,1, 5,6] (seq 5,7)
[0,1, 6,7] *basic set* (seq 1,2,7)

Certain supersets of these sets are also in use: [0,1,2,3,4] (seq 8), [0,1,5,6,7] (seq 5,7) and [0,1,2,5,6,7,10] (seq 2).

Finally, it ought to be mentioned that the present structural analysis cannot convey to its reader the full technical or aesthetic quality of the musical surface and the considerable level of musical detail that exists in every bar of the piece. Perhaps the analyst's most prominent conclusion would be that Xenakis manipulates intuitively the piece's structural pitch material. Each sequence demonstrates an inductive and logical transition between pitch structures through rational transformations of the two fundamental elements. However, the composers stays clear of any serial or pre-compositional procedure that would determine the evolution of the piece and uses his rational methodology only to create "outside-time" structures. Every single structural procedure or element, from complex sieve functions and multi-octave periodic scales to single structural interval or pitch cells, is used only to serve the piece's aesthetic target. This unique combination of rationality and instinct guide the composer during his struggle (as he describes the compositional process) with his musical or extra-musical material and lend to his music both structural coherence and - most importantly - aesthetic profoundness and dramatic quality.

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