Iannis Xenakis' *XAS* for Saxophone Quartet: Three Analytical Excursions

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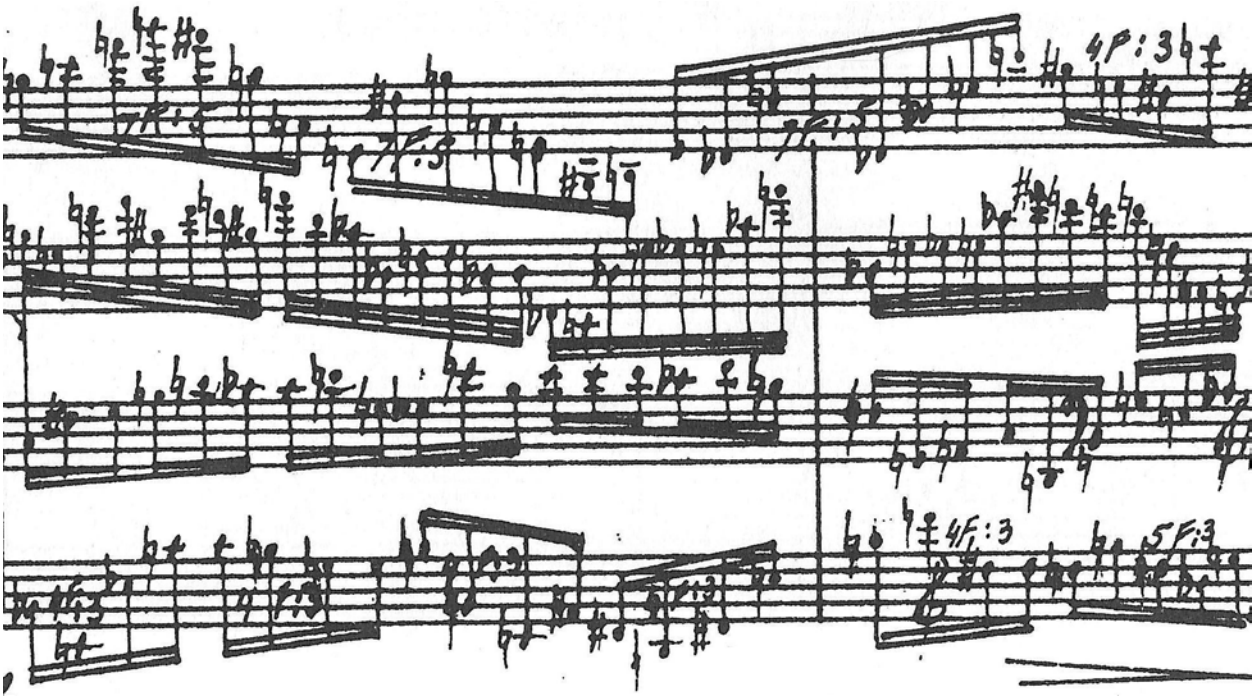


Introduction

The music of Iannis Xenakis, like that of many of the European modernist composers who first came to prominence in the 1950s, has been subject to a strange historiographical fate. On the one hand, the radical innovations of composers such as Berio, Boulez, Ligeti, and Stockhausen have constituted the main event in most stories of music in the postwar years, often overshadowing the many compositional currents whose links with the conventions of the common-practice period remained strong. At the same time, the role allotted to these composers in the standard narrative is hardly a flattering one: each is represented with a single and often atypical work meant to demonstrate some heady theoretical conceit (Boulez, infallibly, with his *Structures 1a*), with the overall picture being one of intense but rather fruitless experimentation trailing off somewhere in the 60s, when the historical baton is handed off to American minimalism. It's often forgotten that Boulez himself quickly disavowed the most radical forms of integral serialism as a compositional cul-de-sac, and that Berio, Ligeti, and Xenakis had made influential critiques of serialism and its limitations long before similar attacks were voiced on the other side of the Atlantic. The later works of the "zero hour" modernists, from roughly 1970 onward, complicate the historical picture with their various brands of "post-serialism," each quite distinct from the minimalist and neo-tonal styles that are typically seen as the representative musical movements of the late 20th century.

This is especially true of Iannis Xenakis, whose music is often cited as the *ne plus ultra* of the postwar synthesis of music and mathematics. Xenakis' works from the 50s and 60s sought to "musicalize" such mathematical constructs as probability theory and symbolic logic. Though based on very different premises than the music of Boulez and Stockhausen, Xenakis' early compositions share some audible features with contemporaneous serial works, such as an

emphatically atonal and non-motivic pitch organization, a frequently "pointillistic" dispersion of tones across a maximally distended pitch space, and a floating, aperiodic sense of time.

Starting in the 1970s, however, much of Xenakis' music took on a remarkably different character. Many of his later works are suffused with a clear rhythmic pulse, whether subtle or throbbing; likewise, in the dimension of pitch, scalar formations of a distinct but non-traditional variety shimmer though the torrid surface of his musical textures. These tendencies coexist in his later music with the jagged gestural topography of his earlier works. As Paul Griffiths writes, "From the mismatch of timbres, the abrasiveness of the sound, comes his music's power—from that and from the paring of materials to the bare essentials of pulsation, insistent note repetition, and textural contrast."[1] The 1987 composition *XAØ,* for saxophone quartet, serves as an excellent example of these aspects of Xenakis' late style. In three analytical excursions, I will attempt to trace the structural processes at work in this music, with the intention of illuminating the connections between compositional facture and audible phenomena, poetics and aesthetics.

Excursion 1: Sieve theory and scale formation

This audible patterning of pitch and rhythm in many of Xenakis' later works is largely the product of his theoretical invention of "sieves" (*cribles*), which allow for the creation of complex, periodically repeating integer relations of varying length. The appeal of sieves for Xenakis is that they offer a generic structuring mechanism than can be applied to any quantifiable parameter—similar to the all-purpose function of the row in integral serialism—but the degree of periodicity can be freely determined by the composer, allowing for modulation between patterns of varying "surface-level" audibility. Thus, for example, multiple complex

[1] Paul Griffiths, *Modern Music and After* (New York: Oxford University Press, 1995), 240.

pitch sieves with partially overlapping content could give way to a single sieve which includes all the common pitches. Xenakis also used sieves to create strongly periodic rhythmic structures in several percussion pieces from the late 1960s on, such as *Persephassa* (1969), *Psappha* (1976), and *Pléïades* (1977). Although it was just one of the many precompositional techniques developed by Xenakis over the course of his career, sieve theory was unique among these in its potential for generating audible periodic structures of pitch and rhythmic organization.

Measures 50-53 present an unusually clear projection of one of Xenakis' synthetic scales, very likely the product of pitch sieves. The score of these measures, and the scale that underlies them, are given in Figure 1. Several features of this scale are noteworthy, if relatively obvious. First, the scale is symmetrical around the central interval of G#3-C4. Considered note-to-note, it consists only of intervals of 1, 3, and 4 semitones, containing 6, 2, and 5 of each, respectively. (This intervallic content, which is featured in a number of Xenakis's sieve-based compositions, evokes for James Harley "Javanese modal resonances" and a "pelog sheen" in certain passages in *XAS.*[2]) Three of the pitches—F3, D#4, and Eb5—sound only once each, and are put in parentheses to indicate their fuzzy membership in the scale. It is interesting to note that F3 and D#4, though anomalous in terms of frequency of appearance, fit perfectly into the symmetrical scheme, suggesting they are likely not so fortuitous, after all. Finally, the scale fills out pitch-class space with very little redundancy, suggesting that Xenakis wanted the scale to be both intervallically consistent (this quality being characteristic of scales and modes as they are generally understood) and all-inclusive with regard to pitch-class. Presumably, Xenakis was sufficiently in control of sieve theory to be able to "program" it in order to get from this particular pair of precompositional desiderata to a concrete result.

[2] James Harley, *Xenakis: His Life in Music* (New York: Routledge, 2004), 189-90.

The sonorities in measures 50-53 are formed by each of the voices moving up and down in parallel motion through the scale. Thus we hear in this passage both the distinctive contour of the scale and the harmonic relations implied by it. The set class content of these sonorities is shown in Figure 2. As would be expected, the limited interval content of the scale is reproduced in these harmonies, which can all be reduced to [0148], [0157], or [0158]. There are two exceptions in this example: first, the penultimate sonority belongs to the trichordal set class [048], which is of course a subset of [0148]. Second, and more significantly, the fifth from last harmony, in addition to standing out as the highest in pitch space, introduces the "alien" set class [0167]. Thus, the high E-flat noted above as an anomaly in the otherwise neat symmetry of the scale is not glossed, but highlighted in both voicing and pitch-class content—though not, it should be noted, in duration.

Excursion 2: Quantifying textural variation

In order to examine how Xenakis uses texture as an element of formal dynamism, I have focused on measures 50-66 of *XAZ*. This passage is striking on account of rapid variation of the dominant pulse and the rhythmic interrelation of the voices. Although most of the textures introduced here have been heard before, they now appear as if telescoped into each other in a sort of "textural stretto." To be sure, the piece as a whole is characterized by the free and sometimes sudden juxtaposition of heterogeneous material, but the temporal proximity of such juxtapositions in these measures is extreme. As I hope to show, the rapid, prismatic succession of textures in these measures, though bewildering in effect, is in fact an excellent example of the calculated chaos that is so characteristic of Xenakis' music. In analyzing this passage, I am guided by Wallace Berry's formulation of *textural rhythm* as an element of formal dynamism. As Berry writes, "Just as tonal, melodic, and harmonic events (changes) express in qualities (of

extent of change) and pacing what we can describe as 'tonal rhythm,' 'melodic rhythm,' and 'harmonic rhythm,' so the changes in texture are expressive, *in timing and in the nature of the change*, of what is properly termed *textural rhythm*…. Textural stasis, progression, recession, and variation are *basic* in the functional processes by which forms are shaped, and by which expressive functional events are projected."[3]

The idea of texture as a musical parameter is, of course, a thorny one. Texture is at once the most visceral and immediate of musical qualities, and the most complex and analytically slippery. Any number of factors could conceivably enter into the determination of texture. Berry concentrates primarily on the vertical dimension of texture, quantifying the density of simultaneities by measuring the span between their outermost pitches and the number of pitches enclosed in this span. For the analysis of this passage, however, I have decided to focus on the horizontal dimension of texture. Using a measurement I call *event density*, I attempt to characterize textures by the relative perceived number of events (note attacks) occurring per unit of time. For a given textural block, I count the number of total events, then divide it by the number of instruments (four), then divide that quotient again by the duration of the passage, measured in quarter notes. Thus, the event density number for a given texture expresses the average number of note attacks taking place per quarter note beat in any voice. Perhaps more helpfully, the event density number can be used to directly compare textures and quantify an otherwise fuzzy sense of "more or less" in the level of activity between successive passages of music.

Alongside the event density, I note for each texture whether the interrelation of the voices is homorhythmic or heterorhythmic. In textures of more than two voices, these two categories are

[3] Wallace Berry, *Structural Functions in Music* (New York: Dover, 1976), 201, 241.

clearly insufficient: take, for example, a three voice texture in which two voices are homorhythmically related while the third is independent. Within the music under consideration, however, this is essentially a binary distinction: in a given texture, all four voices are rhythmically identical or rhythmically independent.

A chart representing event density over time in measures 50-66 is shown in Figure 3. The individual textures that comprise these measures, along with their respective event density numbers and rhythmic interrelations, are given in Figure 4. A few significant observations can be made on the basis of this data. First, the total span may be reasonably parsed into two halves, with the split point located between textures five and six. The first half is itself bipartite, consisting of the lengthy opening texture of the relatively low event density of 3.2 and a plateau of rapidly varying textures (two through five) with relatively similar event densities ranging from 6.3 to 7.8. The second half continues this rapid pace of textural alteration, while simultaneously introducing the most radical discrepancies in event density between consecutive textures. The plotting of the various levels of musical activity in these measures suggests a compositional (though not necessarily conscious) design that is as ordered and intentional as the individual textures are themselves chaotic and random. One could argue that these textures become the formal cells of a macro-level organization analogous to the conventional relationship between single notes and melodic structure or chords and harmonic progression. If so, this aspect of *XAS* relates the piece back to Xenakis' early work *Achorripsis* (1956-57), in which cells representing various densities of attack and timbral types are organized with the help of stochastic theory.

Excursion 3: Pitch space mapping

Finally, in this third excursion, I would like to focus on two striking chordal passages in which the predominantly stepwise projection of the scale is supplanted by jagged, angular leaps among the voices, creating a markedly different articulation of pitch space. Harley calls attention to these two passages in his brief analysis, suggesting that they are independent of the main pitch sieve and thus "apparently constructed with an ear for intervallic content and registral mixture." He also states that these passages present "a set of harmonies…presented in various orderings."[4]

The first such passage occurs in measures 31-33. Aurally, this progression of 11 sonorities presents a rather straightforward alternation of low and high chords, all of equal rhythmic value. Figure 5a represents this pattern in the up and down zigzag of its lines. This chart, however, represents an idealization of the actual instrumental voicing: the upper line traces not the soprano saxophone, but whatever instrument happens to be playing the uppermost pitch in a given sonority, and so on for the other lines. Although this kind of representation arguably jibes well with our hearing, which may not be able to distinguish which instrument is playing what, it is worthwhile to compare this chart with a second one, which tracks each instrument individually and thus accounts for the numerous voice crossings that take place in this passage.

Looking at figure 5b gives us a very different sense of what's happening in this passage. Voice crossings appear to gradually undermine the tidy picture of figure 5a. With the single exception of chord 4, voice crossings take place only on odd-numbered (low) chords. The first crossing takes place in chord 3, when the inner voices cross by a semitone. From here on, the voice crossing on odd-numbered chords becomes more extreme, culminating in chord 9, in

[4] Harley, 189.

which the baritone saxophone is the uppermost voice. The voice crossings in this passage have potentially significant psychological ramifications for the instrumentalists, in that their individual parts diverge to varying degrees from the gestalt shape of the total figure.

A second, lengthier chordal passage is found in measures 73-80. Compared to measures 31-32, the situation here is considerably more complex: there are twice as many total chords (22 instead of 11), the chords are no longer rhythmically equivalent (varying, with the exception of the final chord, from eighth-note to half-note in length), and, most significantly, the overall exploitation of pitch space exhibits no simple pattern. In terms of voicing, however, this passage is much simpler than its counterpart, the only instance of voice crossing taking place between soprano and alto in chord 17. Figure 6a represents this passage without taking account of durational difference between chords, while Figure 6b charts duration but loses the specificity of chord numbers along the horizontal axis.[5] From the more abstract visualization of the first figure, we can get an overview of the pitch space contour of the passage: the chords in the first half are both generally lower in register and more open in voicing, though the difference between the first and second halves in both these respects is perhaps not so great as to strike the listener, and is certainly not of an order of salience comparable to the chordal passage in measures 31-32. Another distinguishing feature of these measures is the recycling of chord forms, as indicated in Figure 6a by the use of corresponding shapes around the chords that appear more than once. Seven of the 11 chords in the second half of the progression are recycled from the first half, suggesting that a certain degree of audible redundancy was part of the compositional design of this passage. That the very first chord, which also happens to be the highest and most closely

[5] Two tables are unfortunately necessary due to problems with Word.

voiced, recurs near the midway point at chord 13 and in the penultimate position at chord 21 also seems formally significant.

A quick glance at Figure 6b allows us to compare chord voicings with duration, though there seems to be no conspicuous relationship here. The maximal pitch space expansion at chord 8 is seen here to be durationally emphasized, but this correlation (or an inverse correlation between close pitch space articulation and short durational value) is not extensively corroborated elsewhere in the passage.

Conclusion

Though these three analytical excursions remain unintegrated into an overarching account of the form of *XAQ*, I hope to have shown how Xenakis balances simplicity and complexity on various levels of structure in creating highly sophisticated and expressive music. The next step in such an analytical project would be to synthesize a number of analytical approaches, including the three used in this paper, in order to do justice to the micro-level organization and, ultimately, to explain how the numerous formal cells are integrated into a dynamic totality.

Figure 1: Measures 50-53 and the scale they project

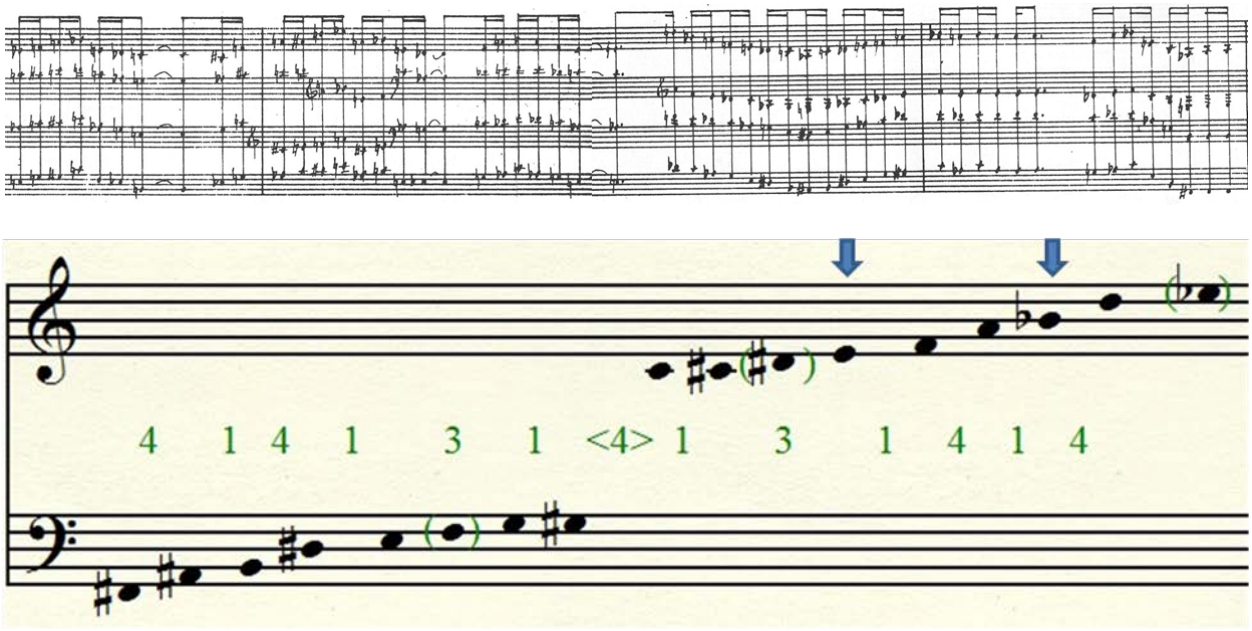


Figure 2: Set classes in mm. 50-51

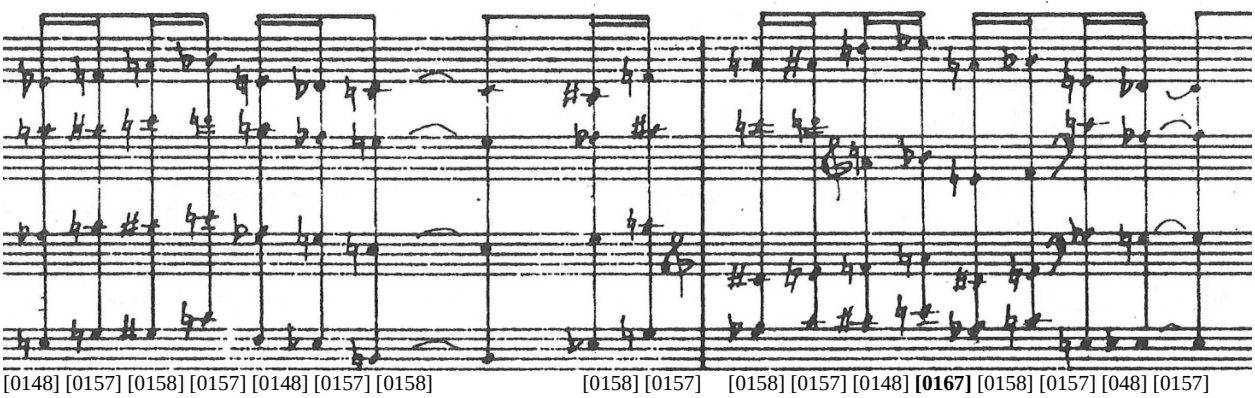


Figure 3: Event density of measures 50-66 charted over time

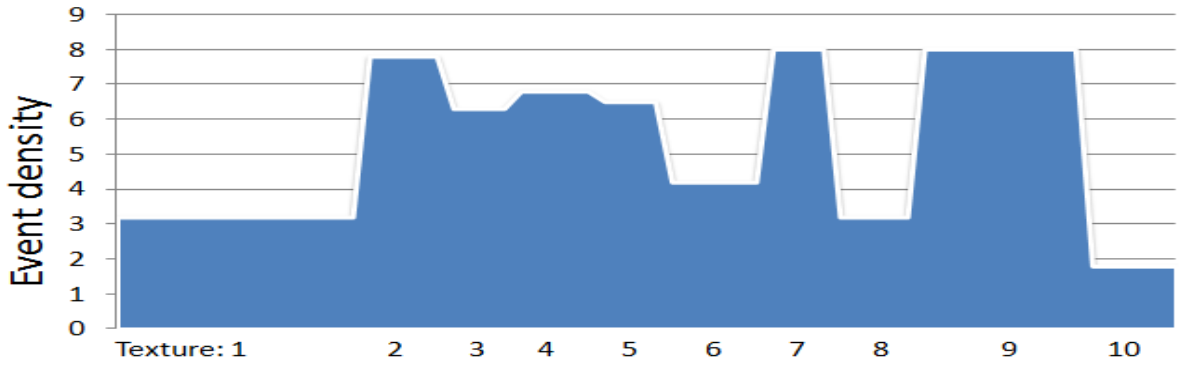
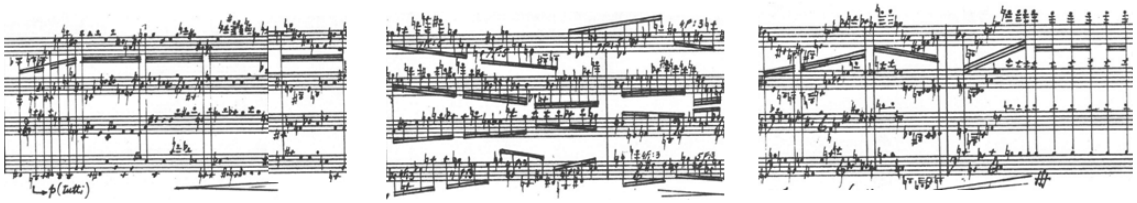


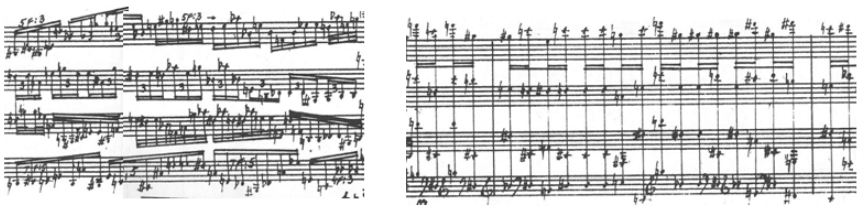
Figure 4: Textural breakdown of measures 50-66

Texture 1: Homorhythmic (3.2)

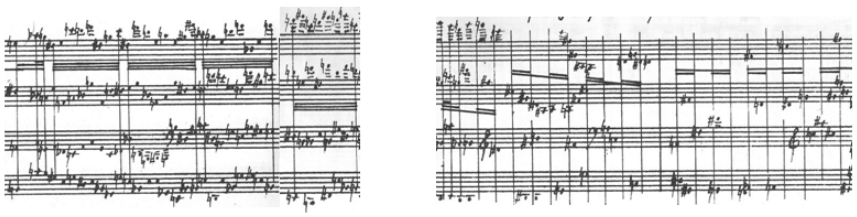
Texture 2: Homorhythmic (7.8) Texture 3: Heterorhythmic (6.3) Texture 4: Homorhythmic (6.8)



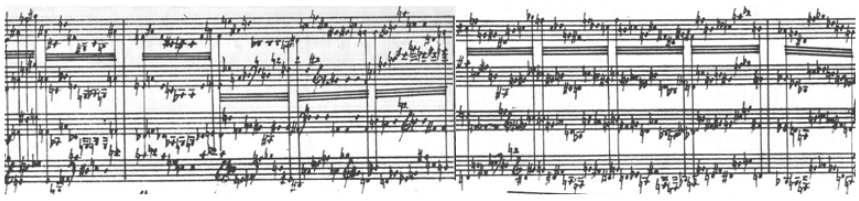
Texture 5: Heterorhythmic (6.5) Texture 6: Homorhythmic (4.2)



Texture 7: Homorhythmic (8) Texture 8: Heterorhythmic (3.2)



Texture 9: Homorhythmic (8)



Texture 10: Homorhythic (1.8)

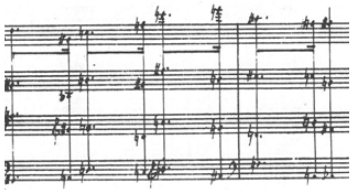


Figure 5a: Chords in measures 31-32 ("virtual" voicings)

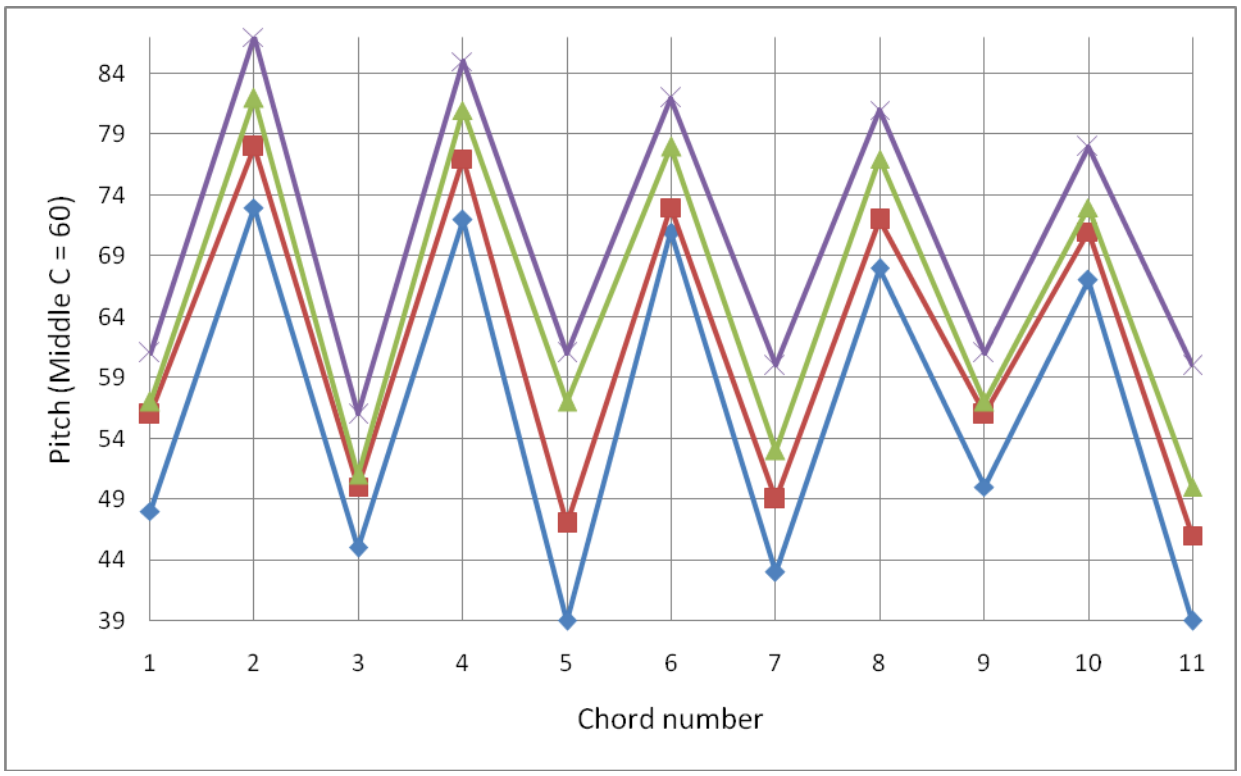


Figure 5b: Chords in measures 31-32 ("real" voicings)

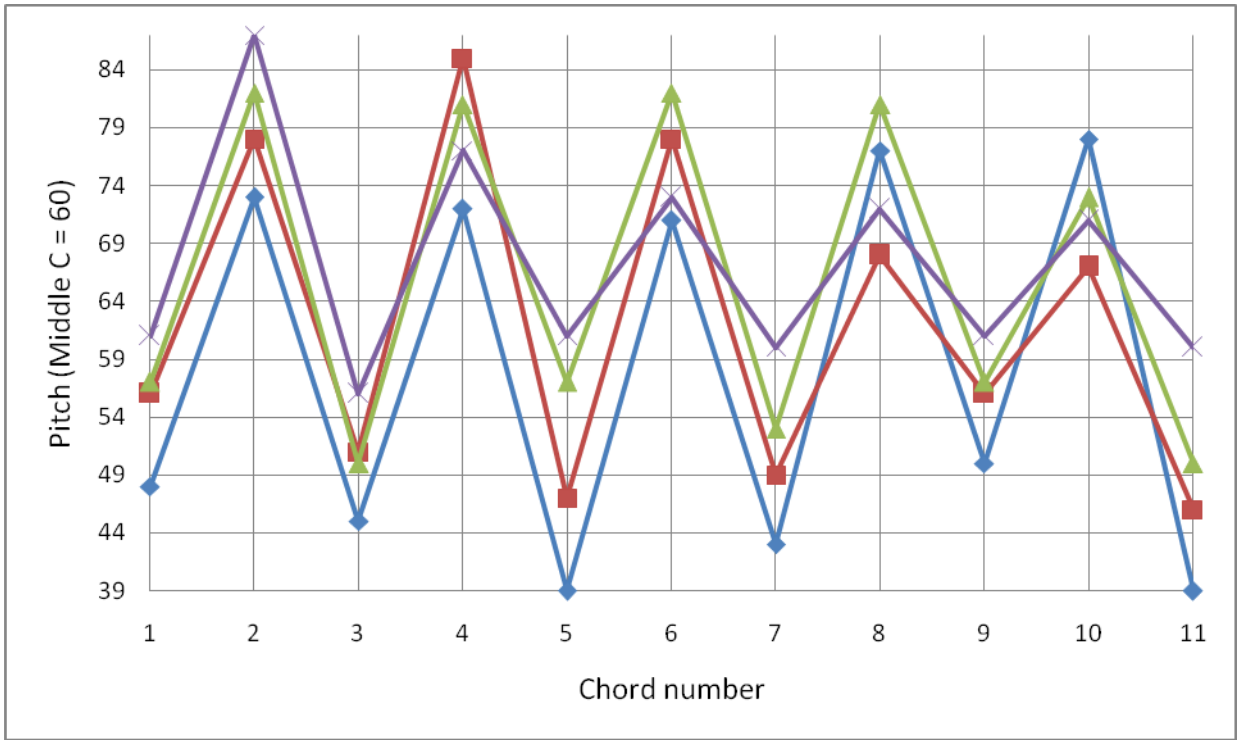


Figure 6a: Chords in measures 73-80, durationally equivalent

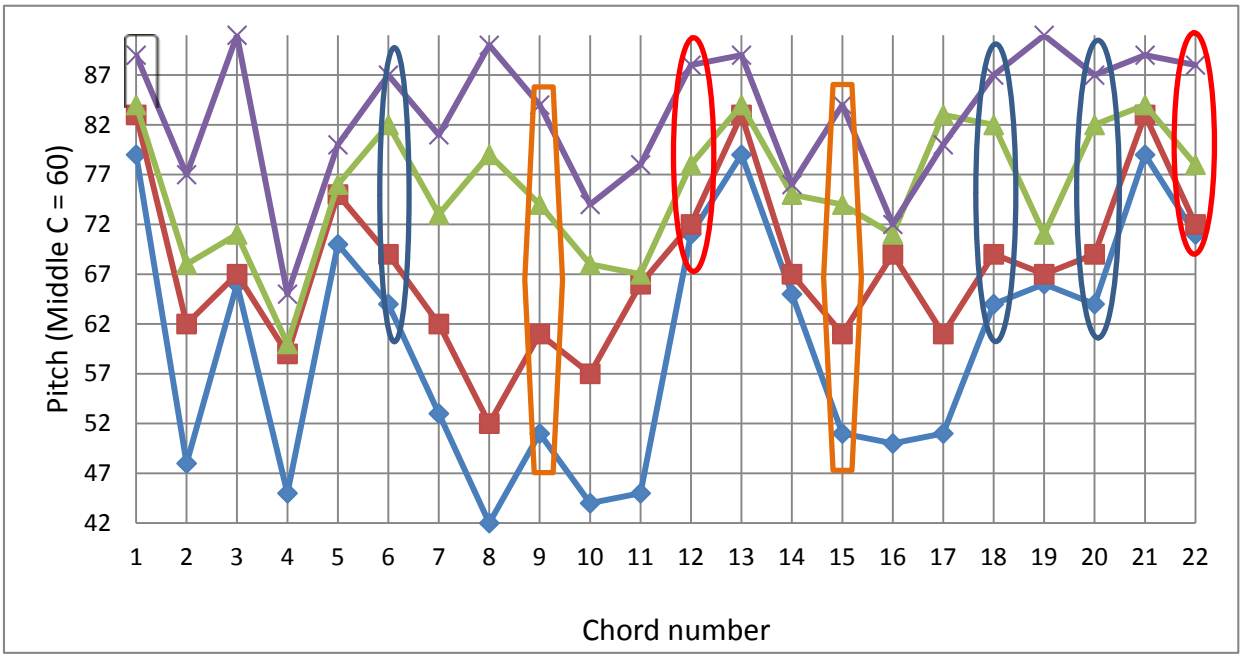


Figure 6b: Chords in measures 73-80, durationally proportional