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DETERMINISM, ALEATORISM AND TRADITION: THE RELATIONSHIP BETWEEN THE ANALYSIS AND COMPOSITIONAL TECHNIQUE OF SELECTED MUSIC FROM 1954-64

A Thesis in Two Volumes

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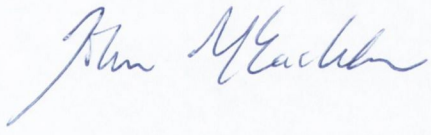

SUMMARY

During the period under consideration in this study, serious music was concerned with a fundamental reassessment of compositional technique and aesthetics. Various different and sometimes opposing techniques were developed at the time, and each of these was often cast as the one true way forward, despite the parallel existence of the others. Today we can perhaps group most of these together under the label 'modernist'; we can certainly say that composers of today are still learning from or reacting to this rich period, so that they tend to categorise current music into 'modern' or 'post-modern'.

The music of the leading composers in the 1950s-60s was characterised by each one's 'trademark' technique, which in each case here was the most innovative aspect, but not the sum total of their overall technique. These personalised techniques often appear to form a barrier for the listener, as they may lead to (or appear to lead to) a music that includes important but inaudible structures. This in turn poses a problem for the role of analysis: whether to address these with a substantial account of how the music was assembled, or whether to address the heard structures.

The approach here is to investigate both structures separately, then to comment upon the relationship between them, and finally to draw general conclusions.

Four composers are chosen: Boulez, Carter, Lutoslawski and Xenakis. One piece from each is considered, respectively they are: *Bourreaux de solitude*, from *Le Marteau sans maître*, the Variations for Orchestra, the String Quartet, and *Pithoprakta*. For each piece, two separate investigations are made: an analysis of the structures that may be heard by an experienced listener without in-depth technical knowledge, and an enquiry into the compositional technique employed by the composer. The two investigations cover the same music from different angles of view, and these are then related in a shorter, third discussion.

The main findings are that the techniques may be so elaborate as to 'randomise' the harmonic and/or gestural surface of the music, but that this in itself is not necessarily a complete barrier to comprehension, as the ear can listen statistically to harmonically complex textures, so long as the randomisation does not fully equalise all harmonic properties, and so long as other musical parameters provide grouping structures.

The case for separate consideration of a 'listening grammar' and a 'compositional grammar' is argued on the grounds that this approach clarifies the goals of analysis and enriches the overall view of music of this period.

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INTRODUCTION

The analysis of music has two main objectives: one is to define the processes that drive the piece for the listener, the other is to define the processes that went into its creation. These processes may occasionally be the same thing, but at certain periods of musical history there has been something of a divergence between the two. Many examples of this exist from the renaissance, when the eyes and ears of God were felt to be in the audience; there was no aesthetic objection to including in the music structural features which would be lost even on the educated listener. Consider for example canon cancrizans, where one might say that time's arrow is treated as if it went backwards as well as forwards—not a problem for the supernatural audience. Consider also another discipline: architecture usually included complex decoration on the roofs of churches, where only the eyes of God could appreciate the detail; even the cruciform layout of churches is best seen by air, which was obviously not a consideration at the time. Bach did not anticipate any mortal dissection of his music, but the many hidden numerologies and calendrical references (which analysts have brought to light) were nonetheless included "for the glory of God." Few analyses would omit to mention the existence of such relationships, yet their significance may be extremely slight for the listener. The 1950s-60s was another such period of divergence, though from a different philosophical background. In reaction to the turmoil of the two world wars and the explosive developments in society, technology, etc, art and music moved towards abstraction and complexity. This was already quite evident from the 1910s onward, so by the late 1940s there was a strongly felt need to codify once more the technical bases for music. Some leading composers felt that it was their responsibility to take the divided history of twentieth-century music and set

it to rights with a single technique that would stand as a template for the music of the future (reminiscent of architecture's 'International Style').

In their search for this technique/template many composers came up with separate, individual solutions, so that what one now finds is a number of strands of thought, each offering its own vision of the future for music. One such strand was serialism, which took Webern's technique as the starting point and made it clear that the contributions of Stravinsky or Bartók were merely interesting asides on the path of history. Boulez's book *Boulez on Music Today* refers, despite the title, to his own personal technique; the brief mentions of other composers are of Webern and Berg (pp. 71-3), in the context of pitch series of complete or partial symmetry, which he then develops into discussion of his own music once more. In the first chapter Boulez implied that he was central in the evolution of music:

> A discussion of musical technique in general terms is an ambitious enough project: a thorough examination of this subject in the course of a single small book is almost foolhardy. . . however, I would like to give a fairly complete survey, and to try to clarify the present state of research . . .[1]

Nowhere does he say explicitly that the book is only about his own technique, though it is. It is as if his is *the* music of the present.

Xenakis had no less a project in mind with his Stochastic technique, which he presented to the world as the solution to the conflict between serialism's extreme complexity and the traditional musical goals of unity and coherence:

> As a result of the impasse in serial music, as well as other causes, I originated in 1954 a music constructed from the principle of indeterminism; two years later I named it "Stochastic Music." The laws of the calculus of probabilities entered composition through musical necessity.[2]

He cited parallel developments in mathematics, physics and philosophy, where the simple determinism of the nineteenth century was replaced by a widening of the

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[1] Pierre Boulez, *Boulez on Music Today*, translated by Susan Bradshaw and Richard Rodney Bennett (London: Faber, 1971), 35.

[2] Iannis Xenakis, *Formalized Music, Thought and Mathematics in Composition* (London: Indiana University Press, 1971), 8.

definition of logic to include the newer understanding of the workings and central role of chance. Carter was less egocentric in his claims; nevertheless he underwent a personal revolution in his style which owed much of its aesthetic justification to developments in other arts, notably literature. He felt that music had to take on board the kind of multi-layering of meaning and material that one finds in James Joyce's work;[3] something more than the accretion of layers in the music of Ives. Lutoslawski also felt the complexity of serialism to be problematic,[4] and set about creating a personal strategy to counteract those problems, resulting in a technique of some considerable elegance and individuality. Thus the historical overview (which it is surely time to have) rests on the strong parallel development of compositional techniques on the one hand, and of musical forms, for want of a better term, on the other, both of which went through a period of rapidly increasing complexity at this time, far greater than in music before or since. One must wonder at the true nature of the interaction of the two.

In effect, the music of this period often has two structures, one behind the other: there is the composer's battery of technique(s), which evolve anew for each piece, and in so doing tend to retain a separate elegance of form from the other structure—the perceived form of the piece.

Because of the dual nature of music of this period, it is necessary to be wary of confusing the two traditional goals of analysis: they cannot be so freely mixed

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[3] 'Carter's rhythmic and formal discoveries spring from his fascination with the phenomenon of musical time, and his dissatisfaction with the simple approach to it in much twentieth-century music. Indeed his thinking about musical time has been influenced less by recent music than by the novels of Joyce, Proust and Mann, the poetry of Hart Crane and St John Perse, the films of Eisenstein and Cocteau.' David Schiff, *The Music of Elliott Carter* (New York: Eulenberg, 1983), 23.

Also Carter himself writes (on his first and second quartets): 'Each presents a different version of humanly experienced time as the two imagined by Thomas Mann in "By the Ocean of Time,". . . The difference, aside from that of their time-scales, might be compared to the types of continuities found in Mann's own writings . . . characters maintain their characterised identities with some revelatory changes throughout a work, while in the Joseph novels, each character is an exemplification of an archetype whose various other incarnations are constantly referred to (as Joyce does in another way in *Finnegans Wake*).' Elliott Carter, *The Writings of Elliott Carter,* Edited by Else and Kurt Stone (London: Indiana University Press, 1977), 274-5.

[4] 'I went through a period of alienation far more strongly at the beginning of the 'fifties, when almost the whole of the new generation wrote what is generally known as post-Webernian music. Since I had absolutely nothing in common with that music, I felt extremely lonely and isolated'. Tadeusz Kaczynski, *Conversations with Witold Lutoslawski* (London: Chester, 1984), 142.

together here, and I believe it is necessary to treat them separately. That is why the chapters are divided into two main headings: Analysis, based crucially upon the perceived and cognised experience, and Technique, which is not necessarily so.

Fred Lerdahl contrasts these two structures also, by calling them the 'listening grammar' and the 'compositional grammar'; he claims that for the listener "comprehension pertains to the listening grammar rather than the compositional grammar."[5] Speaking of Boulez's music, he says:

> Boulez's *Le Marteau sans maître* (1954) was widely hailed as a masterpiece of post-war serialism. Yet nobody could figure out, much less hear, how the piece was serial. . . . Koblyakov (1977) at last determined that it was indeed serial, though in an idiosyncratic way. In the interim listeners made what sense they could of the piece in ways unrelated to its construction. Nor has Koblyakov's decipherment subsequently changed how the piece is heard. . . . The story is, or should be, disturbing. There is a huge gap here between compositional system and cognized result. How can this be?[6]

though he also says:

> The situation exists not only for *Le Marteau* but for much of contemporary music. I could have illustrated just as well with works by Babbitt, Carter, Nono, Stockhausen or Xenakis. This gap (between compositional system and cognized result) is a fundamental problem of contemporary music.[7]

He speaks of the 'compositional grammar' that "generated both the events of the piece and their (serial) organisation." While the 'listening grammar' is "more or less unconsciously employed by auditors, (it) generates mental representations of the music." Furthermore, it comprises "the 'heard structure' of the piece."[8]

Lerdahl argues this further:

> One might suppose that the impenetrability of *Le Marteau's* serial organization is due to insufficient exposure. After all, the piece was innovative; listeners must become accustomed to novel stimuli. Such was the traditional defence of new art in the face of incomprehension. One might refine this view by pointing out that there is little repetition in *Le Marteau*. The lack of redundancy perhaps overwhelms the listener's processing capacities.

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[5] Fred Lerdahl, "Cognitive Constraints on Compositional Systems," *Contemporary Music Review* 6 (no. 2 1992): 99.
[6] Ibid. 97.
[7] Ibid. 100.
[8] Ibid. 99.

> Comprehensibility, then, is arguably a consequence both of the degree of conditioning to the materials and of the number and variety of events per unit time.
>
> But this explanation is inadequate. For one thing, competent listeners to *Le Marteau*, even after many hearings, still cannot begin to hear its serial organization.[9]

My intention in the first part of each chapter is therefore to establish what structures the auditor is likely to perceive and cognise from listening to the music without specialised knowledge of technique. The object is to uncover a set of syntactical relations in the music that is not in conflict with the listener's experience. For this part of the work I am in sympathy with Wallace Berry when he states:

> I believe a great deal of understanding of musical process, in its essential terms, to be accessible to the involved layman or amateur. Indeed, many of the most persuasive factors in musical effect and function are delineative of shapes and processes that can be demonstrated, given necessary theoretical and analytical calculations, relatively simply. A related view holds that many of music's most immediate and compelling strengths derive from the shaped actions of elements of primitive substance and effect (e.g. those of dynamic changes, or timbral differences). Nevertheless, the thorough analysis of all the elements of structure in their confluent and contiguous operations at all relevant hierarchical levels is an issue of sophistication and complexity—and one that must constitute a significant and essential part of the competence and experience of the professional musician.[10]

Therefore my first analytical procedure seeks to grasp the more obvious shaping forces, such as macro-rhythmic outline, timbre or dynamic, before going into further detail, which includes harmonic function where applicable. In order to respect the time dimension, the analyses follow the music as it unfolds, in order, as Berry puts it, "to determine *within which parameters contributive actions occur*."[11] For that reason the analyses take the musical parameters together, but from time to time focus on one (or a group) according to which one (or group) is providing the main line of development at that time. The purpose of this procedure is to find some evidence of a listener's pathway through the piece, and to indicate which aspects of the music furnish this, in order to give a view of the structures that can exist for the listener without specialised knowledge. Therefore it need not be a fully comprehensive analysis, and may deal with only a portion of a work, since the primary function here

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[9] Ibid., 97-8.

[10] Wallace Berry, *Structural Functions in Music* (New Jersey: Prentice-Hall, 1976), 3.

[11] Ibid. 5. The italics are his.

is to posit a structure or elements of structure that can later be compared to the findings of the second procedure. I should further state here that 'specialised knowledge' must include knowledge of other scholarship, therefore the majority of references to other writings on the works will be found in the second section. Thus my analytical viewpoint is in sympathy with what Adorno has to say:

> Analysis, therefore, means much the same as the recognition of the way in which the specific, sustaining structural idea of a piece of music realises itself; and such a concept of analysis would need essentially to be derived from each work anew.[12]

In this respect my methodology may appear resistant to formalising. I have analysed somewhat heuristically, finding the means of analysis suggested by the grammar apparent to me in each piece. All parameters are considered potentially for their contribution to the structures in the piece, and the hegemony of pitch over other parameters, which is often stated by analysts (Harvey and Bernard, for example) seems to me a prejudicial condition which I will not impose unless the music itself demands it.

My second analytical procedure deals with the issue of technique, discussing the well-known and the less obvious technical traits of each composer. The purpose here is to establish an overview of the 'compositional grammar' for the piece under consideration, and to set the scene for the third section of each chapter, where the two sets of findings are compared or contrasted in order to discover the distance or the degree of integration between them. Throughout both analytical procedures I refer to the first one as the 'analysis' and the second one as 'technique', though in truth both are analytical in nature. This is done primarily for ease of reference, and secondarily to reflect a personal belief that the main structures in a work are the ones that can be perceived by the 'experienced listener'. I must stress, however that the technique sections mostly cover elements in the music that are audible also, and that it is therefore above all a question of angle of view.

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[12] Theodore Adorno, "On the Problems of Musical Analysis." *Music Analysis* 1 (no. 2 1982): 184-5.

I take the term 'experienced listener' from the characterisation proposed by Lerdahl and Jackendoff, of 'naive', 'experienced', and 'perfect' listeners. As David Harvey puts it:

> Whilst assuming that an experienced listener is well-versed in the style of a work being considered, and that it is would not be unnatural to expect such a subject to reflect on music he has heard (perhaps even to the extent of studying a score!), and that this reflection is an essential part of coming to a structural understanding, however intuitive, of a piece, the techniques developed will also take into account the nature of the experience of music 'in time', reflecting the provisionality of structural judgements made in a hearing in progress.[13]

For the purposes of this study the 'experienced listener' in question is myself. This makes the research subjective, at least for the first part of each chapter. The reader is invited to read and listen along with the commentaries, and hopefully s/he will concur with the findings. The majority (i.e., the technical discussions) of each chapter retains considerable objectivity, discussing verifiable facts, with a little conjecture, about the construction of the music. When it comes to the discussion of pitch structures I adhere to the numerical style of Forte in describing chords in their prime form, and intervals usually numbering six (there are exceptions where it seems appropriate from the music to describe intervals as 'major seventh' and so forth). I am particularly convinced by the argument that chords share properties discernible only through their interval vectors. I do not, however, adhere to the entirety of Forte's procedures, in two areas: superset-subset relations, which to me seem too numerous to display structuring potential, and segmentations. I share Harvey's cautiousness on the latter.[14] As a compensating move I frequently examine statistically large numbers of chords to find out which are of importance to the composer.

As a composer myself, I take the position that analysis serves one or both of these two purposes: to elucidate the composer's technique (or grammar), and also to consider the audible structure (listening grammar) in itself.[15] Where it happens that

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[13] David I Harvey, *The Later Music of Elliott Carter: A Study in Music Theory and Analysis* (New York: Garland, 1989), 46.

[14] See Harvey, 42.

[15] I am aware that this is unfashionable, analysis 'for its own sake' is well established.

the two are essentially one, that makes the job easier. Those analyses which don't address one or the other clearly, usually have to be read with the question 'which of the two structures is under discussion here?' in mind. Boulez said:

> I have often been asked about my own works: 'Can you give us the series?' Or, "Can you give us the principle?' What use would that be? Far the most important thing is to observe the existence of points shared by different structures, and to mark the different areas of a work composed of such-and-such characteristics; to see how, in one section, certain features are avoided only to be concentrated in a future development; to follow, for instance, the interferences that may arise between forms or structures. That is the fruitful kind of analysis and quite as important as searching for the 'why' and the 'how' of a work.[16]

which may indicate that he is interested in the dialogue between the two structures, and certainly not fixated on one or the other alone.

This study deals with a single work or part of a work from four important figures from the period 1954-1964: Boulez, Carter, Lutoslawski and Xenakis. The pieces are: Carter's Variations for Orchestra (1953-5), Boulez's *Le Marteau sans maître* (1953-5) (Universal 1954, revised 1957), Xenakis' *Pithoprakta* (1955-6) and Lutoslawski's String Quartet (1964). These pieces were picked in order to provide a contrast in techniques, ranging from strict determinism (in Boulez's case) to limited aleatoricism (Lutoslawski), with Xenakis providing another position on the influence of chance procedures (and especially the philosophical context for using chance) in music, but with the proviso that no freedom is transferred to the performer. Carter's technique, placed in the context of these others, seems to act as a 'control': that in spite of a range of important innovations concerning rhythm and pitch, there is an element of the traditional behind his musical construction, concerned as it is here with utilising straightforward themes.

A key element in choosing these composers was their own awareness of the inherent risks in elaborating a technique with its own compelling structure, which then differs (in part or in whole) from the heard structure. Boulez states:

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[16] Pierre Boulez, "On Musical Analysis" from *Orientations: Collected Writings*, Edited Jean-Jacques Nattiez, Translated Martin Cooper (London: Faber, 1986), 117.

> I think that no work can be valid when its technique is not flexible enough or has become such a major concern that it gets in the way of aesthetic considerations. It can only become valid when technical preoccupations are transformed into aesthetic aim—into 'expression', to use the simple word and avoid jargon. As long as expression is held back, halted or paralysed by an inflexible technique that is itself trying to work out its identity, the work will not be satisfactory. I have often said that preoccupation with technique and preoccupation with aesthetics are like two mirrors. Invention passes from one to the other like an image that is perpetually reflected between two parallel mirrors. That is why I absolutely insist that the two mirrors should be present, should be in parallel, and should have equal importance.[17]

while when Bálint András Varga said to Xenakis:

> You have your theories and you subject your material to processes in accordance with those theories. What interests me is the extent to which you're prepared to forget about the theory if what comes out fails to satisfy your ear.

Xenakis replied:

> Yes, well I try to do so all the time. I've always endeavoured to adjust the one to the other right from the very beginning. When I used programmes to produce music like ST/4, ST/10 or ST/48, the output sometimes lacked interest. So I had to change (sic). I reserved that freedom for myself. Other composers, like Barbaud, have acted differently. He did some programmes using serial principles and declared: The machine gave me that so I have to respect it. This is totally wrong, because it was he who gave the machine the rule.[18]

Somewhat nationalistically, Carter states:

> In Europe the search for emancipated musical discourse has been much more closely associated with the twelve-tone system than in the Unites States. There it has . . . applied serial methods to other dimensions besides that of pitch. As a method of discovering new possibilities of momentary and unexpected sound effects, this exercise is useful. At its best it resembles the turning of a musical kaleidoscope that shuffles at random patterns of sound which may or may not fall into interesting patterns—the burden of reading meaning and of finding interest in these rests with the listener and not the composer. . . . But the recent European school seems to have become occupied with pattern alone, hoping somehow that interest and meaning would emerge. This ordering according to the random application of number systems seems wasteful because it produces so many useless possibilities, like the monkeys at typewriters.
>
> In the United States, the tendency has been to start with a co-ordinating principle having to do with techniques of listening or to begin with our experience of time and not some arbitrary numerological formula.[19]

While Lutoslawski is categorical on the primacy of the heard result:

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[17] Pierre Boulez: *Conversations With Célestin Deliège* (London: Eulenberg, 1976), 59.

[18] Bálint András Varga, *Conversations with Iannis Xenakis* (London: Faber, 1996), 201.

[19] Elliott Carter, "A Further Step (1958)", from *The Writings of Elliott Carter*, 191.

> the only thing which is important and pertinent in a musical work is that which can help to produce a definite result as it is perceived. Thus, for instance, all elaborate methods of organizing musical material can only be of value in that they produce a particular experience for the listener. . . . I am thus on my guard against all experiments which would lead to a purely mathematical beauty in the arrangement of elements of a musical work.[20]

and:

> To my mind a piece of music should not be read but listened to. I cannot agree with those who limit their contact with music to the study of the score, often without even bothering to listen to the music itself. In one of his books, René Leibovitz describes this way of experiencing music as the most rewarding one. The study of the score is for me a mere substitute, though it provides a certain amount of information which listening to the score cannot give. The study of a score acquaints us with various features of a piece of music, its good and bad points, but it doesn't constitute the essence of musical understanding.[21]

A primary concern of this thesis is the question of flexibility: that the technique displays some 'give' to allow for the expressive demands of the musical material in hand. How successful each of them was is one of the matters under consideration in the body of this thesis.

One can take each composer's 'trademark' technique, and see four isolated individuals: Boulez, integral serialism; Lutoslawski, limited aleatorism; Xenakis, stochastic generation of sound-masses; Carter, metric modulation and stratification. One can also connect them by lining them up from determinism to chance: Boulez, Carter, Xenakis, Lutoslawski. One can list them according to their approach to derivation of material, i.e., degree of randomisation of material from origin to end product, that is, use of theme (if any) and degree of abstraction in the transformations it undergoes: Carter, Lutoslawski, Boulez, Xenakis. In the second list the imaginary space between each is wide. In the first it is narrow.

It is evident that I have avoided minimalism, free improvisation, and many conceptual avenues of music current or incipient in this period, which could widen the ranges of the lists much further. This is partly because of where my personal sympathies lie, and partly in order to set some practical limits on the scope of the

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[20] Ove Nordwall (ed.), *Lutoslawski*, trans. Christopher Gibbs, Krzysztof Klinger and George Simpson (Stockholm: Edition Wilhelm Hansen, 1968), 122.
[21] Kaczynski, 125.

study. The chosen pieces all share a surface level of complexity, and all set extreme challenges to analysis (of both types), and this, together with the composers' own stated commitment to technical flexibility, forms a loose conceptual boundary which excludes those avenues.

Ultimately the overview here will attempt to provide a rounded picture that serves to illustrate the exceptional broadness and fertility of this period in music history, to explore general connections between these composers, and also to begin the process of demystifying some of the complexity, at least in the pieces under discussion.

CHAPTER 1

BOULEZ: 'BOURREAUX DE SOLITUDE' FROM *LE MARTEAU SANS MAÎTRE*

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Analysis

This analysis will address the 'listening grammar' of the piece. The main areas of interest in the analysis therefore, are not questions concerning the serial structure, which falls under the technical heading below; but rather the pursuit of audible shaping forces, which may or may not lend the piece some dynamic process(es) in time.[22] The analysis falls into two sub-headings: general outline and detailed analysis.

In the general outline the piece is divided in two ways; firstly into three sections, and secondly into phrases within those sections. The definition of what constitutes a phrase will require some discussion in this sub-heading.

In the detailed analysis the first section of the piece is dealt with in more detail, with the definition of a perceptible process defined by a number of musical parameters.[23] Discussion of the second and third sections is more cursory, dealing with the presence or absence of processes of hierarchisisation.

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22 This term, unavoidably, has two meanings: the everyday musical sense comprising ***p***, ***f***, *crescendo* etc; and the general meaning which describes a passage as evolving towards some kind of goal, or having an accretion of tension. Here the general meaning is intended. The opposite is stasis.

23 This term is used in this thesis to describe any one of the five fundamental parts of music: Pitch (including harmony), Time (including rhythm), Timbre, Articulation and Intensity. It can also be enlarged to comprise a derived or secondary parameter, in contrast to others operating at the same time, e.g. register may be discussed as one 'parameter' (as it is a function of pitch only) independently of what takes place at the same time in the realm of 'harmony', a separate pitch function.

General outline

The piece extends for 94 bars which vary from $^{3}_{16}$ to $^{3}_{4}$, although $^{3}_{4}$ and $^{2}_{4}$ are the most frequently occurring. There are five pitched instruments: flute in G, xylorimba, vibraphone, guitar, viola, plus a singer (alto) and unpitched percussion, maracas. The movement can be divided broadly into three sections thus: 1) bars 1-24. 2) bars 25-74. 3) bars 75-94. These are clearly audible divisions effected by tempo changes and pauses, occurring at the ends of bars 20, 22, 24; and later at 74, 78, and 91 (at the beginnings, in this case). The tempo indication are:

Assez Lent	mm ♪ = 112	(bars 1 to 20)
Tempo poco più Lento	mm ♪ = 104	
Ancora più Lento	mm ♪ = 96	(bars 23-4)
Tempo 1	mm ♪ = 112	(bars 25-74)
Meno Lento	mm ♪ = 120	(bars 75-8)
Ancora Meno Lento	mm ♪ = 132	(bars 79-90)
Tempo 1		(bars 91-4)

My division of the piece into three large sections relates to these indications, so the outer sections contain various breaks, where pauses disrupt the musical flow, whilst in contrast, the long middle section is heard as a continuous succession of entries in a comparatively evenly paced rhythmic environment.

Apart from the points where pauses are indicated, there are other moments of repose in the first section, so that I further divide this section into 'phrases' thus: bars 1-5; 6-13; 13-20; 21-22; 23-24. In a similar way, the third section has more sub-divisions than the pauses show. Thus: 75-78, 79-84, 85-90, and 91-94.

In general, these boundaries are defined by a selection from the following musical aspects:

1) textural thinning (usually reducing to one part, whereas elsewhere, parts 'pile up' to large totals) in the pitched instruments (and voice),

2) localised rhythmic inactivity,

3) continuous breathing (in the voice or flute part) or bowing (in the viola part),

4) silent breaks (i.e. pauses or rests) and

5) tempo changes. Actual examples appear below under detailed analysis.

Divisions in the central section will be referred to as sub-phrases, owing to the fact that the textural changes which set them apart are slighter than those which define the phrases of the outer sections, as aspects 4 and 5 (the most obvious ones) are not in evidence here.

A basic understanding of the shape of the piece from the above observations is this: it is roughly symmetrical, with a heavily weighted central section (it consists of about half of the piece) in which events unfold without heavily stressed resting points. Surrounding this section are two smaller sections, each of which extends for roughly one quarter of the piece.

This means that, as the piece presents itself, there is a sense of partition (phrase) and repose in the outer portions, while in the middle there is constant flow, even a sense of progression. That feeling is heightened, or perhaps brought into being, by the presence of the contrasting outer sections.

The presence of the singer and other factors to be dealt with below, weight the central section as the most important. Of the other two, the first is privileged above the last, being the longer and containing some of the singer's part, which the final section does not.

It needs to be said that the singer lends weight to those passages where she is present for a number of reasons. Obviously one might say that the presence of a text adds an extra layer to the complexity of the whole, which none of the instruments can match. But as I am concerned primarily with the structural articulation,[24] i.e., the way in which the music expresses its shapes etc, this extra-musical consideration on its

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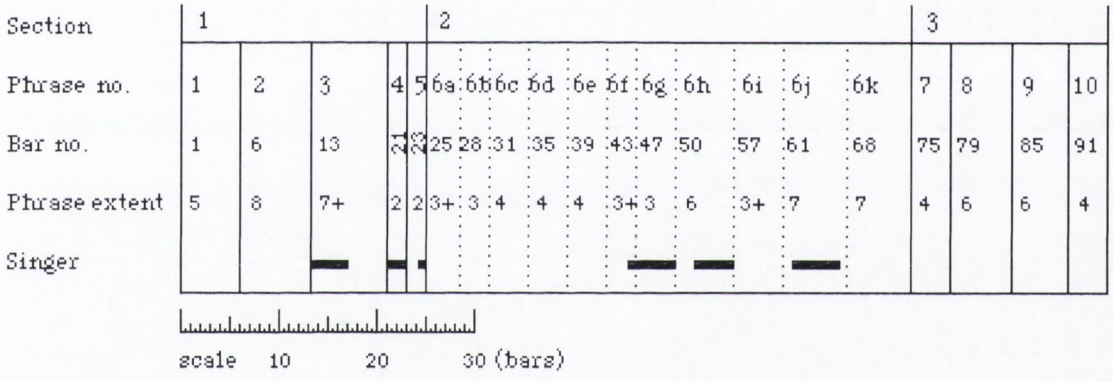
[24] A broad term connoting many of the goals of analysis: it implies the question of 'how does the structure articulate itself?' and the answer must come from evidence of coherence in the musical fabric. The structures under scrutiny can be very local, or sectional, or at the broadest, global.

own would not make her presence *structurally* significant. However, the chief reason for her presence lending weight is, paradoxically, her absence: the other members of the ensemble are never absent for more than say, three bars, whereas there are vast sections where the singer is silent. Her presence does more than enrich the texture; more importantly, she brings with her a new mode of expression: her entries are whole phrases in themselves, therefore she is a unifying element in a context where other entries are brief, providing an environment of *Klangfarbenmelodie*. Finally (it will be shown below), her presence triggers, and/or is associated with, important structural points; she is in direct dialogue with the gestural scheme of the piece.

The sections, with their weighting conferred by the singer, can be shown thus:



(note that bars *appear* equal in length here, for convenience)

Fig. B. 1.

So far I have only considered two shaping factors: time flow (as manifested by tempi and points of repose), and the presence of the singer. The parameters of dynamic and mode of attack (e.g. >, ***sfz***, etc) do not, for most of the piece, contribute to the overall shaping of the piece, as there are twelve dynamics (***pp***, ***pp***', ***p***, ***p***', ***mp***, ***mp***', ***mf***, ***mf***', ***f***, ***f***', ***ff***, ***ff***'),[25] which are distributed fairly evenly throughout any one phrase or sub-phrase. In a general outline, therefore, they are not included as a shaping force

[25] The indication ' signifies the intermediate steps between dynamics, marked in the score by a variety of accents from sfz to tenuto. A thirteenth indication, ppp, appears constantly in the percussion for reasons covered under technique. The pitched instruments are limited to the twelve mentioned here.

(there is detailed consideration below of whether or not they contribute structurally in a segment of the piece).

Register and rhythmic coordination

The next parameter for consideration is register. Figures **B. 2**. and **B. 3**. show all the notes of the piece considered in their phrases or sub-phrases. From this, a clear registral process emerges for section one, changing gradually from a wide compass to the minor third of phrase 5. Note that register is tied to density so this section moves from a texture where up to eight notes of different pitches sound at the same time (e.g., bar 4) to the two-part texture of the fifth phrase.[26] A clear registral process, however, can not be ascribed to the other two sections.

A limited manifestation of registral manipulation exists in the second section where for a large part of the movement the bass register is avoided (from phrase 4, section 1 to sub-phrase 6h of section 2). When the bass notes reappear they provide a gentle sensation of return, although the other musical parameters are not aligned to present this as though it were very significant. The fact that the pitch F# of bars 4, 5 and 6 returns in 56 and 57, and that it is simultaneously struck with G# in bars 6 and 56, both occurring at moments of repose between phrases/sub-phrases, does ensure that this connection can nevertheless be made (the use of the compound ninth assists perception of the connection without a need for perfect pitch). To attempt to discern a similar registral process in the third section is, I believe, futile.

There are weak aural indications of another simpler process for the third section in a parameter that is not manipulated in the other sections, except on the very local level (i.e. within a single phrase shape). The process in question concerns the establishment of coordinated entry points and their potential for breaking away from

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[26] Density here means the number of parts at that moment in time, it is preferable to terms such as 'two-part texture' since it avoids the connotation of part-writing, which would be inapplicable here.

the prevailing phrase structure (which generally 'absorbs' such multiple entries into a mêlée of solitary entries and entries of varying densities from 2 to 4, within any given phrase). For this listener, this is a weak process, a less vital shaping factor than the phrase structure, yet it is the next most audible shaping principle.

The last four phrases of the piece each contain a prominent coordinated attack of five or more notes (see **fig. B. 2**., volume two). Due to a) height in register, b) the coordination itself (hence textural density) and c) staggered decays, each of these multiple entries is felt as the focal point in its phrase. In all but the last phrase division, despite this privilege, they are integrated into the surrounding phrase by virtue of the presence of other dual and triple entries in close proximity. This process culminates in the final bar, where a five-note attack is heard in isolation. For this is to be regarded as the unambiguous goal of a process, it would be desirable to have movement from a state a) where coordinated attacks are integrated into the language of the phrase, to a state b), the fully isolated multiple entry. This kind of clarity is, unfortunately, lacking; which weakens ones perception of the process. Nevertheless it is an important design feature of this section, possibly the most important, and so while I do not give it a lot of attention under the present heading, which is concerned with 'listening grammar', it is discussed more fully under the technique heading.

As yet there is one parameter that remains unconsidered: harmonic syntax,[27] which here manifests itself most audibly in the form of pitch repetition. Despite its obvious twelve-tone character, pitches frequently repeat at the exact same register. This gives a sequence of aural links that tend to bind the music, both within and across phrase boundaries. It will be considered in the context of the piece, in the detailed analysis below. Note: the word repetition will be used to signify a repetition of a pitch without octave transposition, therefore the reappearance of a pitch class in a new register does not count as 'repetition' in the following discussion.

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[27] The syntax can be defined as the set of limiting factors or 'rules' that operate in order to lend a texture a comprehensible consistency. Elsewhere the term may be applied to parameters other than pitch.

Detailed analysis

The first objective of this detailed analysis is to highlight the aural evidence for the phrase divisions as given in Figures **B. 1**, **2** and **3**. It is not practicable to validate each phrase boundary, so a selection will be made.

The opening section can be dealt with in detail, discussing issues that it throws into prominence as they arise. Regarding the other two sections, the issues found already in the general outline will be further elucidated.

The phrase shapes at the beginning of the piece exemplify, to some extent, the language of the whole piece. This is therefore where we start.

In bar 1 there are eight pitched attacks, the maracas have four, making twelve moments of entry. The first, second, fourth, sixth and seventh attacks have density 1, the fifth and eighth have density 2, and the third attack has density 3. The maracas provide a rhythmic complement to the activity of the pitched instruments to give a resultant rhythm of twelve semiquavers (as at **fig. B. 5.** below).[28] The most striking overall impression from this bar is of an accretion of texture as notes enter and are held. The texture can be summarized thus: at the outset there is density 1, with the next pitched attack this increases to 2, and with the next, a triple entry, to 5, and so on. Thus there is a sense of 'textural bulge'. The densities of bar 1 are: 1, 2, 5, 6, 7, 7, 5, 6, 5, 3, 1, as each pitch entry or decay occurs (see **fig. B. 4**.). This 'bulge' effect makes the music of bar 1 stand apart to an extent as a sub-unit (similar to the sub-phrases of Section 2), as the pitch events dictate an overall swell and decay of density. However, as the maracas have four attacks in bar 2 they act as a bridge to the next pitched entries, so it is not until bars 4 and 5, where no attacks occur for eight semiquavers, that a sense of repose impinges.

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[28] Generally for this thesis the term 'resultant rhythm' means the sum of all rhythms combined in any multipart texture.

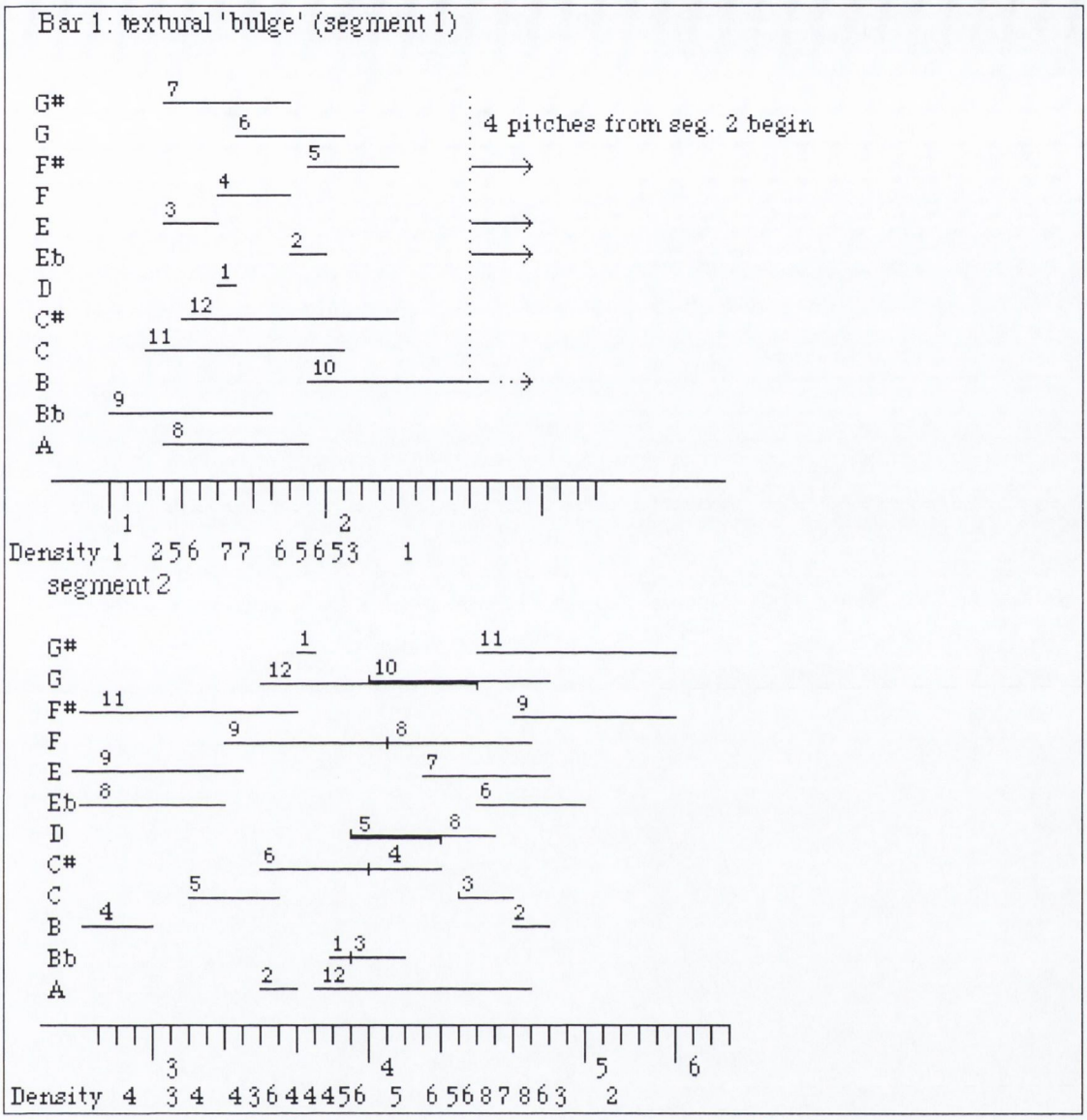

Fig. B. 4.

Segment 2, the textural bulge in bars 2 to 5, is less symmetrical in shape. It has the effect of reinforcing, while modifying, the essential textural qualities. The kinds of attack are again mixed together. The densities of attacks here are: 4, 1, 1, 3, 1, 1, 2, 2, 1, 1, 1, 2, 2. The array for bar 1 was 1, 1, 3, 1, 2, 1, 1, 2. Therefore one can also say that the kinds of attack are similarly distributed in both segments.[29]

[29] The technical reason for this becomes clear below, under 'Technique'.

Generally, for bars 1 to 12, one can identify four segments in this way, which are here divided into two phrases of two segments each. The segmentation of the whole piece in this way is illustrated in **fig. B. 2**. Of the three boundaries between them, two are bridged by the maracas (see bars 2 and 7-8), and stand therefore as sub-units, while the central one is considered a phrase boundary, as shown on **fig. B. 1**.[30] The third and fourth segments resemble the first and second respectively in their proportions: segments 1 and 3 have twelve notes while 2 and 4 have twenty-two. Furthermore, 1 and 3 extend for roughly five and four beats respectively, while 2 and 4 both extend for eight beats. Thus phrases 1 and 2 are similar in outline shape.

The registral deployment of pitch of the four segments respects approximately the same limits, distributed across the tessitura in a similar way. This reinforces the homogeneity of texture.

Harmony and texture in bars 1 to 24

Before going into the discussion of harmony, I will first define it as it applies in this thesis: it is used as an umbrella term comprising the disposition of pitch in the vertical or linear sense, or both together. The discussion of harmony in this thesis, although outside any tonal context, is usually in the context of functionality in one or both dimensions. Its definition can include non-deliberate and/or non-functional harmony. The subsets of harmony are:

1. Vertical sonority or vertical harmony: a self explanatory, purely descriptive term.
2. Linear interval content or linear harmony: noting the interval/s of a line, voice or melody.

In the section under consideration here, it is fruitless to seek any interval-type or chord-type that might be privileged. In bar 1, for example, twelve different pitches

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[30] Reason: the sharp contrast between the resultant rhythm before and after bar 5 (including the last beat of bar 4) and the lack of impulses within bar 5.

appear, and as there is a high degree of overlap in a short space of time, a huge multiplicity of note-relationships arise. For example, B^b, the first pitch sounds against C, A, E, G#, C#, F, D and G; i.e. eight intervals are created. The next note, C, has ten notes (discounting B^b as this combination has already been counted) sounding against it; similarly, the entire complex in bar 1 can be calculated in this way to give rise to 43 interval relationships. Statistically, they are distributed thus: [8,7,8,9,7,4]. Bearing in mind that every note has two possible ic1, ic2, ic3 etc partners except for ic6 where it only has one, this is a very even distribution. Despite this, the evidence from Boulez's writings strongly suggests that every note relationship for him counts as a derivative of his technique.

Alternatively, one may take the view that simultaneously struck notes create a stronger intervallic impression. There are three multiple entries in bar 1, giving rise to interval classes [4,5,1],[31] 3, and 5.

In segment 2 we get [5,5,4,2,1,3], [6,2,4], 4, 5, 4;

seg. 3 yields [2,4,6], 2, 2, 1;

seg. 4 yields [5,4,1], 6, 3, [3,4,5], 5, [2,4,2]. (see **fig. B. 2**.)

Thus ic1 appears four times, ic2 , seven times, ic3 four times, ic4 nine, ic5, eight, ic6, three. Here is it summarised into an interval vector: [4,7,4,9,8,3]; three interval classes are lightly stressed, in an all-interval context. Here there is some evidence that certain intervals are conferred a statistical privilege. The perception of this mild prioritisation is weakened further by extreme fracturing of the musical surface**. Fig. B. 4**. shows how, in bar 1, twelve different durations exist; this is a form of avoidance of repetition. Similarly, twelve different dynamics exist. These serve, on the local level, to prevent links from existing. So there is no support from other parameters for these 'repetitions'. In fact, I believe that the only way in which specific pitch contributes to audible links (and hence structure) is by the repetitions which occur at the same register (e.g. G, which is always in the tenor range for the first twelve bars).

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[31] Brackets indicate more than two notes, creating a complex of inter-relationships.

This is a feature of the whole movement. Harmony has in this piece been reduced to statistical distribution and the question of register-fixed repetition of pitch classes. In other words a given pitch has two options: it can be repeated, or it can stop sounding at that register. It rarely can be heard as 'going somewhere', i.e., belonging to a melody or motif. This sounds potentially limiting until one considers that up to twelve different pitches can sound simultaneously,[32] each confronted with this binary choice. So they can combine to create a very large number of possible developments. The voice, viola and flute (in diminishing order) occasionally create short lines that do give the effect of notes 'going somewhere'. (Ligeti has described a similar fixing of pitch in *Structures 1a* as "knots in the serial web").[33]

After this detailed analysis of the first section, I will go back and consider the implications of this harmonic language. For the time being, it may generally be stated that the pitch repetitions already evident in bars 1 to 12 (see **fig. B. 3.**, volume two) serve to reinforce the ways in which the two phrases resemble each other in structure.

The transition from the end of this passage to the singer's entry in bar 13 involves a complete transformation of texture. For three bars the texture is entirely monophonic, with only the flute actually joining the singer, for just one note (b. 13). In terms of what has gone before this is a radical step. It dismisses the previous level of complexity, and with it the resultant rhythms, which change from symmetrical, even division of time to asymmetrical. It also posits a new kind of phrase definition, one not dependent on the overlapping of entries. This degree of dependency of phrase definition on the principle of overlap can be borne out by listening to the guitar entry in bar 12: it is the first entry in the piece that does not overlap with the attack or sustain of another note in the piece. Nevertheless, it is connected to the end of phrase 2 by the vibraphone D which reaches towards it. In listening, the guitar note sounds like a pivot between the old and new states of texture, not belonging entirely to phrase

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[32] If guitar, violin and xylorimba play chords.

[33] György Ligeti, "Pierre Boulez: Entscheidung und Automatik in der Structure 1a," *Die Reihe,* no. 4 (1958), English translation in *Die Reihe* No. 4 (1960).

2, yet connected physically to it, while being at the same time a portent of the monophonic texture.

Another new feature brought in by the singer is a quasi-motivic concentration on interval-types, due purely to the simplicity of the texture.

As this phrase develops, the singer gives way to the entry of all the other instruments in bars 17 and 18. They take up the pitches touched on by the singer, thus repeating each one. They serve to draw the new monodic texture back into the prevailing texture from phrases 1 and 2, i.e., the procedure of overlapping entry reappears, as typified in **fig. B. 4.** At their peak, the overlaps reach the density of five notes. The decline tails off to density 1 in bar 20. It is interesting to note that from bar 17 to 20 there are no non-overlapping notes, so the association of instruments with this kind of articulation is unequivocally reaffirmed, which is important given the guitar entry in bar 12.

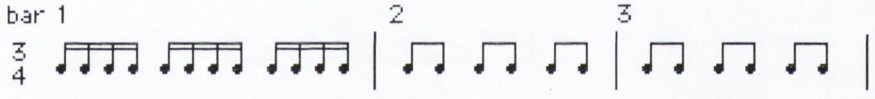

Fig. B. 5.

An essential feature of this overlapping texture is its accompanying resultant rhythm, which returns to the kinds of patterns associated with this texture from phrases 1 and 2. Generally, the subdivisions of the beat are fully articulated,[34] so that time is symmetrically divided, i.e. where any kind of subdivision—either , , or exists, it cannot be in isolation, but is surrounded by others of its type. This contrasts sharply with the asymmetrical divisions of time associated with the singer's first phrase: bars 14-18, so compare figure **B. 5**. to figure **B. 6**.

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[34] That is, stated. The term 'to articulate' is here synonymous with 'to state'. Elsewhere it also has the traditional musical meaning of mode or shape of attack.

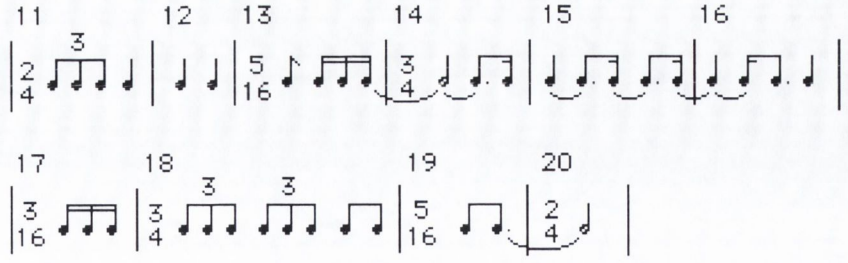

Fig. B. 6. Resultant rhythm

The fact that the overlapping texture of the instruments itself overlaps with the contrasting texture of the singer, coupled with the fact that the instrumental notes are all repetitions of the singer's, forces the perception of bars 13 to 20 as a single phrase—despite the disparity of texture.

Bars 21 to 22 consist of a short phrase that modifies the relationship between singer and ensemble. The ensemble no longer follows her lead, as the F# and B (in bar 22) of the singer are anticipated by the other instruments. Also, the ensemble sounds a note when the singer does not (A#). However, the singer's role is not completely changed, as her first note is not anticipated at all. The resultant rhythm, however, shows that the instrumental texture (of overlapping) has been modified to accommodate the asymmetry of the singer's part; thus she is not fully absorbed into the typical instrumental texture.

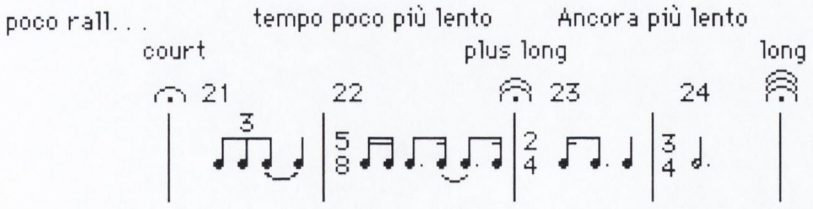

Fig. B. 7.

The next phrase, bars 23 and 24, goes further to remove the symmetrical division of time (since the last phrase included a triplet and two semiquavers—see **fig. B. 7**.).

Glancing at **fig. B. 3.** it can be seen that the last three phrases (of this section) present a clear registral process of reduction. This supports an overall process of

dissipation of energy, which governs this section. Alongside the reduction of registral space, there is the decrease in phrase length, the slowing of tempi and the increase in lengths of pauses or spaces between phrases. If one considers the harmonic parameters as defined above, i.e., the retention or loss of pitch classes, it can be seen how this also contributes to that process; which in itself confirms the idea that this form of 'harmony' is a useful structural element of the piece.

A detailed consideration of the harmonic process (register fixing of pitch) and whether it works in parallel with other parameters follows.

In phrases 1 and 2, the four segments will be considered separately, as this gives a more detailed view of the workings of the parameters—essential at the outset.

Register-fixed pitch repetition occurs at all levels: in other words, a single pitch may not appear fixed in a section, or else may appear fixed for a time within a phrase, thus consolidating the identity of that phrase and distinguishing it from surrounding phrases. Or a pitch may appear fixed in consecutive phrases, helping to associate the two, or it may reappear in many phrases, or for almost a whole section.

Within the first phrase there are eleven pitches which appear fixed in register (it should be borne in mind that the density and registral scope must be large to allow this, so in a way it is artificial to deal with the harmonic parameter separately, as here), these are G(3), B(2), C#(2), E(2), F#(2), G#(3), B^{b}(2), C(3), F(2), A(3), D#(2). It is important to note that the first segment contains no register repetition within itself, so that the second segment comes across strongly as being a 'further comment' on it, due to its fixed repetitions.

Looking at phrase 2 we can compare it for internal repetition. We find that ten pitches are fixed thus: B^{b}(2), C#(2), G(3), A(2), E^{b}(3), G#(3), D(3), F(4), B(3), E(3). Compared to phrase 1, then, there is a small decrease in the number of pitches affected, but the average number of actual repetitions increases. Once more, the first segment of the phrase (seg. 3) contains no internal repetition. However, this is overshadowed by the fact that this segment is itself repeating pitches from the previous phrase. Across the divisions between phrases 1 and 2 there is a prominent

set of reiterations: the notes F#, G#, C, F, and E appear in bars 4 and 5 as part of seg. 2, but are all repeated in bar 6 as part of seg. 3, thus closely binding the two. This is not to say that phrases 1 and 2 are heard as one phrase (they are not, for reasons concerning rhythm, dealt with above), but it does make the ear assume that phrase 2 is a development of material found in phrase 1. One can go further to show that between segments 2 and 3 there are seven repeated pitch classes thus: F#(2), G(3), C#(2)—but within seg. 2: G#(3), C(3), F(3), B(2), E(2). So it may be said that the harmonic bonds within phrases are (only) marginally stronger than the bonds across boundaries.

Within phrase 3 (when the voice enters) all but one of the pitches are repeated; so that despite the fewer number of notes being repeated (six in all), the impression of internal repetition is stronger here than ever before. So in phrase 3 the repetitions are: A(3), D(3), F(3), G#(3), C#(2), E(2). There are two other reasons why the impression of repetition is reinforced; they are i) the texture is less crowded (the voice contributes here) and ii) most of the activity is centred in one bar (18) where the ensemble reappears.

However, the links across the phrase boundary between phrases 2 and 3 are noticeably weaker than in the previous case, in contrast to the repetition within phrases. If one compares seg. 4 with phrase 3, only one note carries across: G#. This seems radical in the context of the piece so far, but two things must be remembered: the division between phrases 2 and 3 was not marked very well in terms of temporal separation owing to the 'pivot note' from the guitar, and the singer brings a completely new set of criteria with her—so the 'harmonic process' is supporting this fact.

As has been noted, the phrase boundaries become marked in the score by pauses, and phrase separation is heightened by changes in tempo from bar 20 onwards. The harmonic process supports this trend towards isolation and dissipation of energy. It does this by consolidating internal phrase repetition while reinforcing phrase separation; i.e., between the boundaries of phrases 3 and 4, and phrases 4 and 5 there are no common notes (see **fig. B. 2**.).

With the beginning of the next section in bar 25 a number of changes occur. The net effect of these is a sense of return to the texture of the opening bars, with some significant modifications. Noting Figures **B. 2**. and **B. 3**., it can be seen that there is a return to a wide registral space, and to a density similar to that at the opening—a significant difference is the lack of bass notes. Other elements which reinforce the similarity are: i) the return to tempo I, ii) the absence of the singer and iii) the return of typical ensemble/multipart texture. Figure **B. 4.** shows how close the textural procedure is. The resultant density shows a typical gradual expansion, with mostly high densities towards the middle of the phrase. At bar 31-2, where I postulate the end of sub-phrase 6b, the density reduces to 1 for a relatively lengthy period (i.e. long enough to register on the ear, unlike the point in bar 27 where density reduces to 2 for a fleeting moment). This demonstrates that the overlapping texture of flowing and ebbing densities has indeed returned.

The two significant changes are lack of bass register, and a new style of resultant rhythm. This is most significant as time is now being divided asymmetrically, which means that the voice has imposed an innovation upon the ensemble which has now 'stuck'. This is important as it allows the voice to re-enter the texture later on *without* causing a radical modification of texture. It has converted the ensemble to its mode of articulation.

As was noted in the general analysis, this section carries on without the kind of phrase boundary the first section has led the ear to expect. Nevertheless the sub-phrases are there, and can be demonstrated (see above) by the flow and ebb of the textural density, and, at other points by resultant rhythm. Without accounting in detail (in the manner of **fig. B. 4**.) their physical structure, I have provided in figures **B. 1.** and **B. 2**. the sub-phrases of this entire section. It is interesting to note that generally every second boundary is heard as more pronounced.

The harmonic language of this new opening (section 2) further enriches its function.[35] At the point in question, local pitch links with the previous section are very prominent. First, the two pitch classes E^b and C are clearly heard like an echo of the previous phrase (which consisted of these two notes played twice); this direct link precedes any knowledge of the return to broad register and texture. It is only as this phrase expands in register and density that the listener becomes aware of any sense of return. As it does so, more pitch classes from the previous section enter. The F# in b. 25 was heard in phrase 4, the E in phrase 3. However, the C# (in b. 25) decisively broadens the registral space, which then continues to expand until bar 28. One might posit the view that the reappearance of cross-boundary pitch-links itself foreshadows a resurgence of the characteristic energy from the opening, which was in danger of being completely exhausted at the end of section 1. Thus the harmony supports the structure.

A thorough examination of the remaining two sections along the lines of the previous one will not be attempted here. Figures **B. 2**. and **B. 3**. show the layout of sub-phrases as I have discovered them to be. The reasoning behind these divisions varies as before; for section two it relies on rhythmic repose and/or textural thinning, and for section three this list enlarges to include silence and tempo variation as with section one. My comments on structure from this point on will be an elaboration of the overall analysis, with detail serving only where necessary to substantiate a given analytical stance.

As far as process is concerned, the second section is remarkably static in comparison with the first. The fluctuations in density, texture and register are very local, creating the sub-phrase structure outlined in Figures **B. 1-3**.

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[35] In the music discussed here, harmony may only be the by-product of other shaping concerns or designing criteria. When it carries structural resonances beyond the musical space that it occupies, it is called functional harmony.

Dynamic process in section two

In the overall analysis the parameter of dynamic was discounted from consideration on the grounds that it was not deployed in a structurally supportive manner. To substantiate this view properly it would be necessary to undertake a complete survey of the dynamics employed throughout the piece. However, as we have already seen, the characteristic instrumental texture features 12-note groups that are tied to a 12-dynamic gamut. This means that wherever the pitch complement is full, all dynamic levels occur within a phrase or sub-phrase.[36] Consequently, where phrases of this kind follow one another it is very difficult to detect any overall shaping based solely on dynamics. Of course, where the pitch gamut is filtered, as it was in the third, fourth and fifth phrases, there is a limited opportunity for dynamic selection to occur. Looking at those phrases one detects a slight decline in dynamic intensities, a feature which supports the general shrinkage of register (etc) already noted. In the second section where the full instrumental texture returns, there is a feeling of re-immersion in the evenly distributed dynamic environment. So far, then, the changes in dynamic have been associated with the singer. In fact, in listening one detects that the next time the singer enters she is associated with further dynamic distortion (of the normative even distribution). This is not, as it was before, an immediate event. This time it is gradual and accumulative. There is an accretive sense of dynamic expansion. To investigate this satisfactorily it is necessary to examine every single dynamic over that period (31 bars). That is, sub-phrases 6a-f, of the second section. Figure **B. 8.** (see volume two) is a graph of all the dynamic values as they occur in this passage. An interpretation can be placed on this as follows.

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[36] Unless deviations are allowed from the linkage of pitch to dynamic; evidence from Wentzel and Winick exists that in fact 20% of dynamics in this part of the work do deviate slightly from the linkage. This will be discussed fully under Technique.

Before the singer's re-entry dynamic levels are low. Shortly after her entry, a series of prominent attacks occurs (in particular the five fortissimos). When the singer breaks off in bars 50, 51, 52, and 53, the graph declines in a pronounced manner. Then her re-entry brings new peaks. This time, when she rests the decline is much less apparent, but a slight decline exists. With her third entry there comes the greatest concentration of ***ff*** *sforzando* entries. Finally, in the last phrase of the section, it appears that no appreciable decline takes place. To summarize: her presence appears to pull up the dynamic level of the instruments each time, but at first this effect wears off when she is absent. Gradually, however, the instrumental dynamics 'support themselves'. In the context of the sub-phrases, where texture and density have established a pattern of flowing and ebbing, this dynamic distortion comes across as a significant re-interpretation of the material of the piece. It is of particular importance to note that this climactic build-up all precedes the return to the separated phrase structure common to sections 1 and 3.[37]

Thus we hear the singer in a new role: instead of interrupting the flow as she did in the first section, where she radically transformed the role of the instruments from an autonomous state to being mere respondents to the new texture brought about by her. This time, the instruments have had twenty bars in which to re-establish their autonomy, reinforced by the fact that they allow less of a suggestion of phrase breakage to exist and hence do not invite 'dissipation' and 'isolation'. They are also effectively 'inoculated' against her rhythmic asymmetry, in that they show that this form of rhythmic expression does not rule out a sense of continuing flow. When she reappears the instruments do not allow her to disrupt their flow; instead she is made to co-exist within that flow. There is no reduction of energy. With the process of establishing a climax, we observe the singer and the instruments working together on an equal footing to expand the expressive force of the music. Thus the relationship

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[37] This is achieved by the composer allowing himself three freedoms from the serial system: 12-note sets are allowed to appear in incomplete form, several sets are allowed to appear simultaneously (two together was the limit in section 1) and a small percentage of dynamics are allowed to stray from their allocated level. All of this, however, belongs below in the Technique section, where it receives proper attention.

between voice and instruments is transformed from the subservience and antagonism of one to the other to their working in tandem for a new process. Once this is achieved, the function of the third section is as an epilogue that balances the first and serves to remind us of how much the continuous flow of the middle section was a real transformation of the initial mode of expression.[38] The last section functions as a delayed confirmation of the dissipation of energy from the first section; as such it brings with it a sense of closure.

Technique in *Bourreaux de solitude*

Before the detailed examination of technique in *Bourreaux*, I will make some small reference to works by Boulez and others that lead up to *Le Marteau* historically.

To put *Le Marteau sans maitre* into the context of Boulez's output reveals some interesting points about his stylistic concerns and developments. The works leading up to *Le Marteau* are:

Livre pour quatuor	1948-9
Un coup des dés (chorus and Orchestra, project)	1950
Essais for percussion (withdrawn)	1950
Polyphonie X for 18 instruments (unpublished)	1950-51
Deux études for tape	1951-2
Structures Book I for two pianos	1951-2
Oubli signal lapidé for 12 voices (unpublished)	1952
Le Marteau sans maitre	1953-5

(source: Jameux, 370)

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[38] The word function should be explained: it can operate on two levels, local and global. Global function implies an event has significance for all of the piece; a final cadence (in tonal music) is an obvious example. Local function deals with the way in which neighbouring events interrelate. The word function always implies that an event has resonances beyond the time it occupies itself. Exploration of what form these resonances take is the exploration of function.

Those who have written on Boulez are generally agreed that the works of most relevance to stylistic evolution for this early part of his output are *Polyphonie X* and *Structures* Book I (Deliege and Jameux, among others).

Over the course of Boulez's oeuvre from the late 40s to the 60s, evolution in three areas has been noted:

1) a move from thematicism to athematicism;

2) the move towards serialisation of duration and other parameters; and

3) a development from 'classical' forms to unique forms (i.e. where each piece defines its own form) to 'open' forms (e.g. the third piano sonata).

The approach to thematicism begins in a relatively traditional way, with themes having a hierarchy from and ideal form outward to looser and looser derivations; but by the first piano sonata of 1946 "all the related forms are equidistant from an imaginary centre".[39] We will see that thematicism, in *Bourreaux de solitude*, is non-existent, except inasmuch as isomorphisms underpin some of the serial working-out in the composing process, and certain concerns govern interval size (see below).

Structures Ia embodies a turning point in the evolution of music generally, as it brought into being the true widening out of serial thinking into duration, attacks and dynamics. Thus the series becomes not just an ordering of pitches, but a series of proportions applicable to all sound parameters. For *Structures Ia*, Boulez borrows the pitch and duration series from Messiaen's *Mode de valeurs et d'intensité*. This introduces the destruction of continuity in melodic line, which we also experience in *Bourreaux*. It can be argued of course that it was Messiaen who therefore introduced this innovation to music. A detailed and enlightening presentation of the materials in

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[39] Gerald Bennett, "The Early Works" in *Pierre Boulez, A Symposium*, ed. William Glock (London: Eulenburg, 1986), 65.

Structures Ia and *Polyphonie X* can be found in two letters to John Cage, reprinted in *Orientations*.[40] According to Jameux, *Polyphonie X* was written after *Structures Ia*, and therefore this work merely expands the principle.[41]

Stockhausen was moving in the same direction at this time, and in his article "...how time passes..." (1957) he made a comprehensive and lucid presentation of serial thinking.[42] His actual application of such ideas goes back to 1951, with his piece *Kreuzspiel*. Another composer frequently cited for early and independent extension of the series is Milton Babbitt. In his Three Compositions for Piano of 1947, he associates patterns in rhythm with patterns in pitch. By 1948, he had developed the idea of a scale of twelve individual durations for his Composition for Twelve Instruments. The precise details of the procedures each of these composers followed differ markedly from each other, and also each evolved his technique from work to work, but it is remarkable that they appear to have made these discoveries independently, and that soon many other composers would join them for a brief time. These three composers also moved away from integral serialism in time, with Stockhausen in particular announcing a new technical or philosophical revolution every few years, yet the underlying concept of using the available totality of musical resources is one all three adhere to.

Le Marteau stands in an interesting place in relation to the development from fixed to open form. The interleaved ordering of the movements shows the sort of shuffling of blocks that foreshadows somewhat the procedures of the third piano sonata, where many alternate orderings of movements are possible. As such it represents the move away from a simple linear reading of structure in time,

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[40] Pierre Boulez, *Orientations*, ed, Jean-Jaques Nattiez (London: Faber, 1986), 122.

[41] Dominique Jameux, *Pierre Boulez*, trans. Susan Bradshaw (London: Faber, 1991), 48.

[42] Karlheinz Stockhausen, ". . . how time passes . . ." *Die Reihe* 3, (Pennsylvania, 1959).

attempting to enrich the relationships of adjacent materials, and to distance the related materials from one another.

We now move on to an exposition of the technical considerations *Bourreaux* proper. Three sources reveal a great deal here: *Boulez on Music Today*, *Zwei Kommentare zum Marteau sans Maitre von Pierre Boulez* (by Ulrich Siegele), and *A World of Harmony* (by Lev Koblyakov).[43] The sources will be considered in tandem as they are not in conflict.

The pitch, rhythm and dynamic material for the whole of *Le Marteau* is derived in some way from one series, called the general series (GS from here on). As is usual in serial music, there are four main forms of it, the O, I, R and IR. The GS is:

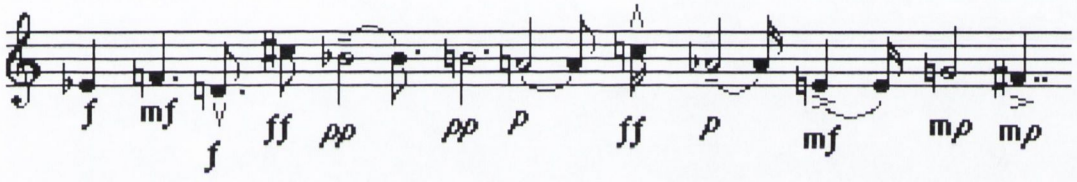

Fig. B. 9

However, in the *Bourreaux* cycle of movements the pitch order is not presented as it is in the series. All that is preserved is the relationship of pitches to durations and dynamic levels, which if one looks closely at the GS, is based on neighbour-note relations. That is, the pitch C has the shortest duration and loudest dynamic, then C# moves one step up in pitch and in duration, and down in dynamic, and so on. All of this is shown below in the *schema*, **fig B. 10**.

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[43] Pierre Boulez, *Boulez On Music Today*, translated by Susan Bradshaw and Richard Rodney Bennett (London: Faber, 1971).

Ulrich Siegele, *Zwei Kommentare zum Marteau sans Maitre von Pierre Boulez*, Tübingen Bieträge zur Musikwissenschaft 7 (Stuttgart: Hänssler Neuhausen, 1979).

Lev Koblyakov, *A World of Harmony* (London: Harwood, 1990).

Uncovering the *schema*

Here I shall explore the pitch, duration and dynamic associations as they appear in the piece. This follows Siegele's findings. In bar 1 all 12 pitches occur in this order:

B^b C E G# A C# F D G E^b B F# [44]

The 12 notes have 12 different durations and intensities, with the durations measured in semiquavers:

B^b	C	E	G#	A	C#	F	D	G	E^b	B	F#
9	11	3	7	8	12	4	1	6	2	10	5
ff‘	f‘	mp‘	pp‘	pp	f	mp	mf‘	p	mf	ff	p‘

The underlying order is thus: (for durations)

D	E^b	E	F	F#	G	G#	A	B^b	B	C	C#
1	2	3	4	5	6	7	8	9	10	11	12

(for intensities)

B^b	B	C	C#	D	E^b	E	F	F#	G	G#	A
ff‘	ff	f‘	f	mf‘	mf	mp‘	mp	p‘	p	pp‘	pp

Bars 2 to 5 use two 12-note arrangements. With their intensities and durations they can be shown thus:

G#	A	B^b	B	C	C#	D	E^b	E	F	F#	G
1	2	3	4	5	6	7	8	9	10	11	12
E	F	F#	G	G#	A	B^b	B	C	C#	D	E^b
ff‘	ff	f‘	f	mf‘	mf	mp‘	mp	p‘	p	pp‘	pp

and

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[44] Underline indicates simultaneously struck pitches.

B^b	B	C	C#	D	E^b	E	F	F#	G	G#	A
1	2	3	4	5	6	7	8	9	10	11	12
D	E^b	E	F	F#	G	G#	A	B^b	B	C	C#
ff‘	ff	f‘	f	mf‘	mf	mp‘	mp	p‘	p	pp‘	pp

These arrangements are derived from an overall *schema* which starts with durations and intensities arranged on one chromatic set:

C	C#	D	E^b	E	F	F#	G	G#	A	B^b	B
1	2	3	4	5	6	7	8	9	10	11	12
ff‘	ff	f‘	f	mf‘	mf	mp‘	mp	p‘	p	pp‘	pp

Another eleven arrangements are arrived at by circular permutation giving an overall *schema* of 12 arrangements. The durations for the second arrangement begin on C#, for the third D, the fourth E etc, i.e. moving up a chromatic scale. The intensities begin on B, B^b, A, G#. . . for the second, third, fourth etc arrangements; moving down a chromatic scale. The overall *schema* therefore looks like this:

C	C#	D	E^b	E	F	F#	G	G#	A	B^b	B	
1	2	3	4	5	6	7	8	9	10	11	12	(Arr. I)
ff‘	ff	f‘	f	mf‘	mf	mp‘	mp	p‘	p	pp‘	pp	
12	1	2	3	4	5	6	7	8	9	10	11	(Arr. II)
ff	f‘	f	mf‘	mf	mp‘	mp	p‘	p	pp‘	pp	ff‘	
11	12	1	2	3	4	5	6	7	8	9	10	(Arr. III)
f‘	f	mf‘	mf	mp‘	mp	p‘	p	pp‘	pp	ff‘	ff	
10	11	12	1	2	3	4	5	6	7	8	9	(Arr. IV)
f	mf‘	mf	mp‘	mp	p‘	p	pp‘	pp	ff‘	ff	f‘	
9	10	11	12	1	2	3	4	5	6	7	8	(Arr. V)
mf‘	mf	mp‘	mp	p‘	p	pp‘	pp	ff‘	ff	f‘	f	
8	9	10	11	12	1	2	3	4	5	6	7	(Arr.VI)
mf	mp‘	mp	p‘	p	pp‘	pp	ff‘	ff	f‘	f	mf‘	
7	8	9	10	11	12	1	2	3	4	5	6	(Arr. VII)
mp‘	mp	p‘	p	pp‘	pp	ff‘	ff	f‘	f	mf‘	mf	

6	7	8	9	10	11	12	1	2	3	4	5	(Arr. VIII)
mp	p‘	p	pp‘	pp	ff‘	ff	f‘	f	mf‘	mf	mp‘	
5	6	7	8	9	10	11	12	1	2	3	4	(Arr. IX)
p‘	p	pp‘	pp	ff‘	ff	f‘	f	mf‘	mf	mp‘	mp	
4	5	6	7	8	9	10	11	12	1	2	3	(Arr. X)
p	pp‘	pp	ff‘	ff	f‘	f	mf‘	mf	mp‘	mp	p‘	
3	4	5	6	7	8	9	10	11	12	1	2	(Arr. XI)
pp‘	pp	ff‘	ff	f‘	f	mf‘	mf	mp‘	mp	p‘	p	
2	3	4	5	6	7	8	9	10	11	12	1	(Arr. XII)
pp	ff‘	ff	f‘	f	mf‘	mf	mp‘	mp	p‘	p	pp‘	

Fig. B. 10.

The first bar uses arrangement III and the next two arrangements used are IX and XI respectively.

Hidden structures

Koblyakov reveals a further order of structure: he gives a list of 11 derived 'series' (see **fig B. 11**., volume two).[45] The whole of the *Bourreaux* cycle is derived from these. Each is named after its shortest duration. It is important to note that the *schema* information aspect of this is fixed, and also the pitch order, but we do not know if the pitch order was fixed before or during the composing out of the piece. Koblyakov appears to assume that it was, but has no evidence either way, because the sketches for *Le Marteau* are lost.[46]

What is also fixed in the 11 derived series is the loose temporal layout: i.e. the diphonous or polyphonous attacks, and the unpitched attacks (shown by the strokes),

[45] Koblyakov, 36.
[46] Ibid., see footnote 3, 2.

which percussion fills in. (I say loose because the order is fixed, but not the temporal spacing or tempo).

This set of derived series properly belongs to earlier parts of the *Bourreaux* cycle, but it is necessary to show it here, as a later set (see below) is derived from it and used in movement 6.

Koblyakov has deduced this set and shown how it applies.[47] I have puzzled over it to see how the pitch order aspect of it could possibly be derived from the GS, a point which Koblyakov doesn't mention (the schematic association of each pitch with a dynamic and duration is understood). I have made some original findings expanding upon Koblyakov, but in the absence of sketches, these are necessarily conjectural:

1) the derived series are neither transpositions or rotations of the GS, nor the I, R or IR forms.

2) If one examines the GS for internal symmetries, certain properties appear. The 12 pitches can be considered in three groups of four, and four groups of three; the following is revealed:

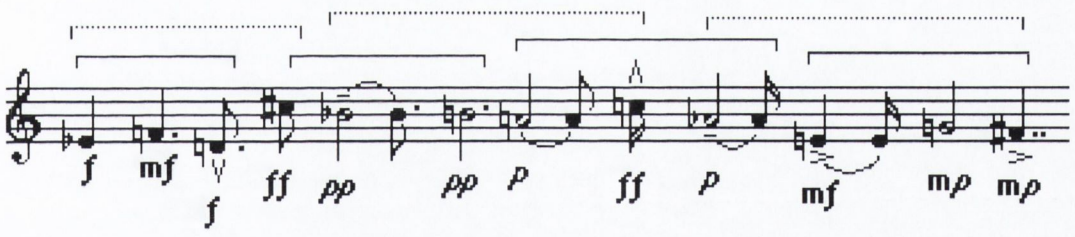

Fig. B. 12.

(O,1,2,4), (0,1,2,3), (0,1,2,4)i and
(0,1,3), (0,1,3), (0,1,4), (0,1,3)i
(Where i stands for inverted, and all sets are reduced to prime form for ease of structural comparison).

The derived series can be examined for similarities. Exploring the series in groups of three notes proves more fruitful (for this part of the work) than in groups of

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[47] Ibid., 35-8.

four. Boulez discusses more fully such symmetries in *Boulez on Music Today* (70-80).

The 'g' series yields the following: (0,1,3), (0,1,4), (0,1,3)i, (0,1,3) which is closely related to the GS (see **fig. B. 13**., volume two). The 'f#' can yield (0,1,3)i, (0,1,3), (0,1,4), (0,1,3)i (diphonous and triphonous sounds allow a number of possible orderings).

The 'f' series resembles a diminution of forms: (0,1,2), (0,1,2), (0,1,2), (0,1,2),[48] while the 'c#' takes the (0,1,4) and uses exclusively that.

The 'e^b' breaks down into (0,1,3), (0,1,3), (0,1,3), (0,1,3).

The other derived series are more heterogeneous, and some point to the principle of augmentation, or interval expansion (e.g. 'g#', 'b').[49] Derivations can range from closely related (as with 'g') and sharing symmetries, to entirely unrelated and asymmetrical. The first set is closer to the GS than the second set.

For the movement *Bourreaux de solitude*, another set of derived series is identified by Koblyakov, with certain relationships to the set from **fig. B. 11**. This new set is shown in figure **B. 14**. (see volume two).

What has happened is that the temporal structure of each series from the first list reappears here, but swapped about the pitch F#:

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[48] The diminution and augmentation of intervals in this way is discussed in *Boulez on Music Today*, 75.

[49] Boulez writes: "In conclusion, there are three distinct types of serial structure:
— totally symmetrical
— partially symmetrical
manifest isomorphic figures
concealed isomorphic figures
— totally asymmetrical
It is possible to pass from one to another of these families by means of altering the original . . . If I have dwelt at length on the structure of the series it is because it forms the basis of the entire organisation of series derived from it . . . In every serial system, there is a network of series which are priveleged in relation to an original series" *Boulez on Music Today*, 76.

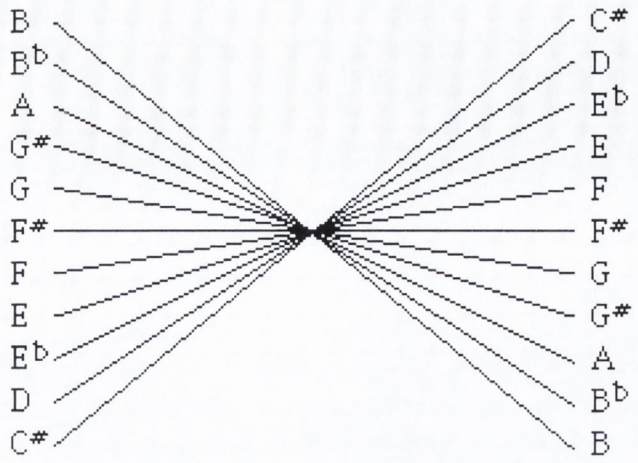

Fig. B. 15.

One could also claim that the pitch C is the point of symmetry; the correspondences would be the same. This is probably what Boulez had in mind, in fact, since C is the centre of symmetry in the *schema*. The ordering of durations and dynamics is still derived from the *schema*, as before. The inversion can be said to follow from the fact that the first set (**fig. B. 20**.) is derived from the O of the GS, whereas the second set is derived from the IR. An examination of these series in three-note groups does not yield any obvious relationships to the GS at all, other than the general observation that the pitch orderings are not related to the earlier 11 derived series, and that the intervals here are typically larger. (0,3,7), (0,2,5) and (0,2,6) are common here, which suggests avoidance of the semitone when compared to the previous set.

However, this new set is subject to further modifications before it appears in the music. These modifications are shown in **fig. B. 16**. (see volume two)

The temporal structures are all there, but have been swapped around among the series and subjected to rotations (it takes time to see this, observe the tag 'series by structures'). The arrangements from the *schema* have been retained; i.e. the durations/dynamics. Further changes are evident in the latter series, where less than twelve pitches may appear.

Because we don't know exactly how the derived series obtained their pitch orders, we cannot really be sure whether or not the pitch ordering is fixed *a priori*; what is evident is that pitch order is never regarded as wholly immutable—the transformations that the derived series undergo is evidence enough of that. Neither do the derived series dictate choice of register for a pitch. Therefore none of these observations negates the view that register fixing of pitch is an important structural element in the music, which is often supported at key points by temporal proximity of a note to its repetition, as found in the analysis, or the conclusional commentary below on how this relates to the technique *per se*. Also, it is probable that the principle of freedom to shape sound-block layout is at the root of the apparent freedom in pitch ordering.

Koblyakov has shown us that the derived series are structures that relate to one another for their basic shape. Qualities such as the disposition of diphonous or monodic or percussive attacks are considered and ordered at an intermediate stage in the compositional working, with most or all of the pitch decided in a 'prime' form. What is not yet decided (when these have been fixed) is the register for the pitches or, crucially, the order in which the derived series are used. By having freedom of choice in these two areas, Boulez can create passages by joining up these prefabricated structures. Furthermore, if he were to decide at a later stage to swap the actual pitches around in a derived series, there is no way that Koblyakov or anyone can deduce it (without the sketches). There is evidence in Boulez's writings to suggest these are his procedures. The evidence that he creates blocks of texture (which correspond to my 'segments') in a middle stage of the composing-out (after the *schema* but before the ordering and joining of the blocks themselves) is to be found in *Boulez on Music Today*, pp. 139-41.

> A last question arises in connection with the modes of linking the various structures, whether of the same or of different types; there are both end-to-end links and 'lap-joints',[50] in which the end of one structure overlaps the beginning of another. The control of structures will be

[50] Both types have been noted here, though not using the same terminology.

> purely local if they always observe the same mode of linking, that is to say, when they are fixed in place once and for all and are linked at both ends to other fixed structures.[51] It will be quite different in the case of mobile structures,[52] where one is dealing with the interlinking of entire families of elements. It is often said that relationships between mobile organisations are impossible to foresee in their entirety and that it would therefore be presumptuous to claim *foreknowledge* of their linking potential. . . . Considering the problem seriously, there is no doubt that, if they fulfil certain conditions, families of structures can be linked to others without each of the links needing to be precisely controlled. One has only to select a general criterion of linking which will eliminate all others. . . . The control operating within the structure itself will not need to act on the linking as well. To understand this, we must refer to the two definitions of pitch: absolute and relative pitch.[53] Suppose that a family of structures A is to be linked with a family B; if the absolute pitches used at the end of A are quite different from those of B, no linking can fail to be satisfactory since the terminal zone of each A will necessarily be complementary to the initial zone of each B.[54] This can be achieved quite simply by the use of defective series: the A structures will be based on defective series of a certain category, the B structures on defective series of a complementary category.[55]
>
> Although series of absolute pitches do not obey any particular law, care should be taken that at the moment of linking the relative pitches are fixed in a certain, immovable disposition of registers.[56] *Nodes* of register will be obtained in the area of structural linking, whereas *antinodes* of register will separate these within the structures.[57] Hence, mixed organisations of absolute and relative pitches may freely be created. If structure A makes use of a defective series having a certain number of notes in common with the defective series which characterises B, the common notes should have a fixed register, so as to create a partial node in the tessitura; the other notes are in no way tied down by this necessity, and may be disposed in any register. Thus A and B are controlled from within, and their joins cannot be other than satisfactory.

Indications also exist that he frequently creates an excess of such material only to pare it down to the interesting elements by a process of rejection.

> All of the works I write are essentially different facets of one central work, of one central concept. In any case I cannot easily detach myself from a particular musical universe; once I have set it in motion it has a tendency to become independent and to grow. . . . I cannot bring myself to let go of material that is still alive for me. The same thing happened with *Eclat*,

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[51] For fixed structure read derived series.

[52] For 'mobile structure' read 'sound-block', or 'segment', comprising multiple registers, with durations, rhythm and dynamics determined.

[53] By 'absolute pitch', he means pitch classes; 'relative pitch' means pitches distributed into the different registers in the 'mobile structure'. To clarify why he brings this up: he is saying that the fixed structure ('derived series' as in Koblyakov) is determined for its quasi-thematic form (or thematic potential), like a motif, which has not yet reached its final state because only general categories of order, grouping and pitch have been decided for it. Therefore it exists at a different level, a conceptual level, and its role cannot be confused with that of the 'mobile structure' (which actually appears in the piece) derived from it.

[54] This, nevertheless is rare in *Bourreaux*, and represents a trivial solution.

[55] 'defective series' denotes a series with 2,3,4 or 6 pitch classes instead of twelve (the twelve durations and dynamics are rotated around the pitches, which is why these numbers are the factors of twelve).

[56] This uncovers an intermediate stage in the construction.

[57] Analogous to the 'knots' observed by Ligeti. Ligeti, ibid.

> which began as a very small piece: in its present state it lasts twenty-five minutes. I have now composed a great deal more. . . [58]

This proliferation is not always retained:

> In my previous works the strict and inflexible framework offered practically no possibility of rejection. But composition is a positive act, though a positive act made up of an accumulation of determining rejections. During the previous period no one wanted to reject anything but to bring everything into play at each moment. In *Le Marteau sans Maître*, which came immediately afterwards, I adopted a point of view that was not the opposite, but much more flexible: I was able to eliminate certain factors at a given moment in the composition, and it is precisely this negative aspect that gives a work liveliness: suddenly the piece became individualised where otherwise there would be an undifferentiated overall structure. In *Le Marteau sans Maître* there is a highly differentiated structure arising from many positive aspects, but also from the element of rejection it imposes.[59]

Flexible use of the *schema*

Further important evidence of freedom of pitch ordering and of freedom in the application of the *schema* is revealed by Wayne C. Wentzel and Steven D. Winick. Wentzel reports on these findings in his article "Dynamic and Attack Associations in Boulez's *Le Marteau Sans Maître*."[60] According to Wentzel, Winick has shown that the pitch-duration associations which we expect from the *schema* are only partially fulfilled after what he terms the 'instrumental introduction'. In other words the *schema* is treated more flexibly. He gives the following information that shows exceptions to the alignment of pitch-duration to dynamic for each arrangement:

Arrange-ment	Total Pitches	Number that fit	percent	Do not fit
Arr. I	44	38	86%	6
Arr. II	42	36	85%	6
Arr. III	46	34	73%	12

[58] *Conversations With Célestin Deliège*, 50.
[59] Ibid., 66.
[60] Wayne C. Wentzel, "Dynamic and Attack Associations in Boulez's *Le Marteau sans maître*," *Perspectives of New Music* 29, no. 1 (1991): 142-70.

Arr. IV	54	42	77%	12
Arr. V	53	42	80%	11
Arr. VI	47	39	82%	8
Arr. VII	58	45	77%	12
Arr. VIII	46	33	71%	13
Arr. IX	46	36	78%	10
Arr. X	47	40	85%	7
Arr. XI	37	34	91%	3
Arr. XII	46	36	78%	10

Fig. B. 17.

The overall average percentage is 80%, and Wentzel concludes that these are deliberate composers' interventions, although he explores some which may be due to copying errors.

Wentzel goes on to furnish the following information with respect to the polyphony of arrangements:

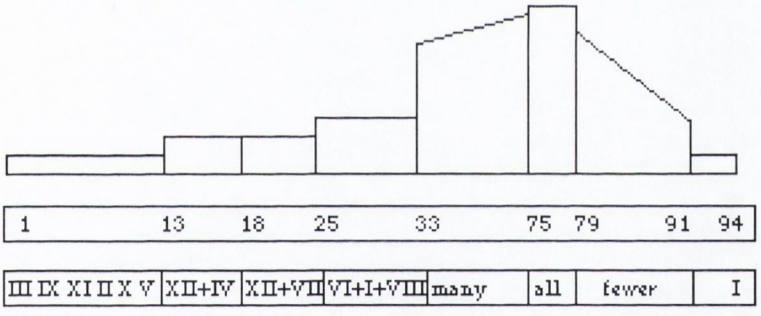


Fig. B. 18.

This shows how the arrangements appear at first one at a time, then two at a time, three at a time, and then leap into greater complexity before returning to just one.

Articulation in time

The following should be read in conjunction with **fig. B. 16**. Siegele furnishes the following details.

In bar 1 twelve time-points are articulated thus:

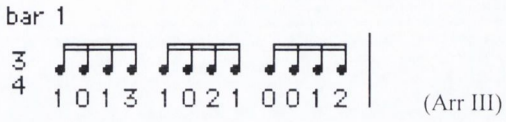


Fig. B. 19.

The numbers here refer to the number of pitched entries: zero indicates therefore the entries of the maracas, as all twelve time-points are actually articulated. (Note: the maracas are marked *ppp* and are therefore not part of the *schema*). This corresponds to the first derived series in **fig. B. 16**.

The next two twelve-note groups (see also **fig. B. 16**.) are articulated thus:

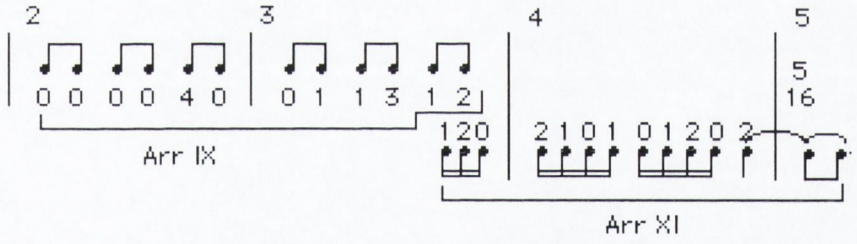


Fig. B. 20.

The first thing to note is their overlap, this promotes the perception of them as a unit (segment 2 in my analysis). In both cases there are twelve time-points due to the maracas. It should also be noted that where the second twelve-note group comes in, its time-points have become spaced out into quavers; however, there is no corresponding adjustment in the internal durations of the arrangements which remain measured in units of semiquavers according to the *schema*.

The fourth twelve-note group uses the 2nd arrangement of notes, durations and intensities. Its twelve time-points occur in quaver triplets thus:

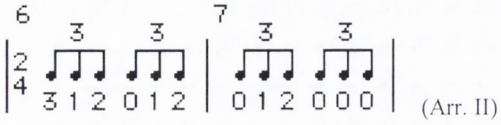
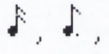


Fig. B. 21.

Expressing the durations of the arrangement is problematic where triplet divisions occur, since the original is set for semiquavers. This is especially true where durations such as  or etc are concerned. Instead, approximations are made: the durations of 2, 4, 6, 8 and 12 are accurate whilst the durations of 1, 5, 7 and 9 are approximate, and there are stronger deviations in the durations 3, 10 and 11. However, neither the expressed duration nor the intensities together leave any doubt that in this part the 2nd arrangement is used.[61]

Up to now the *regularity* of the time-points have changed from one group to the next, but have stayed constant within the twelve-note groups. In the 5th and 6th groups there are internal changes thus:

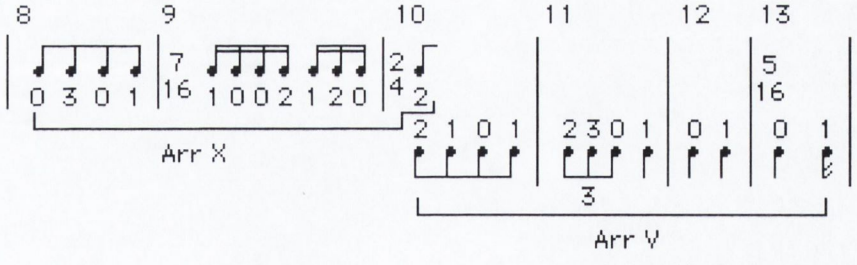


Fig. B. 22.

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[61] In his essay "Eventuellement." (translated as "Possibly. . ." in *Stocktakings from an Apprenticeship* (Oxford: Clarendon Press, 1991), 111-140) Boulez refers to 'irrational transformations' where triplets, quintuplets etc replace the original values.

According to Siegele,[62] the lack of an entry of any sort at the 6th time-point (where one might reasonably expect the maracas to fill in) enlarges the expressive scope of the technique: i.e., to render it flexible in order to accommodate the process of gradual disintegration of the rhythm, which he identifies with text illustration; the footsteps of the walker referred to in the text are paralleled in the technique itself.[63]

A distortion of the durations from the *schema* must take place at bar 11 where a triplet exists, bringing with it five pitches. As before, the values are approximated to be as near to their designated values as the triplet context will allow. Note that at the 6th time-point the vibraphone has a double entry on the notes C and D. The dynamic indication ***mp*** belongs to D. The dynamic ***mf*** belonging to C is missing from the score.

Modifications related to the singer's entry

Siegele points out that the vocal entry affects the compositional structure. The first line of the poem has eleven syllables. To allow the voice to use twelve notes, the third syllable has two notes while the rest have one. The twelve are divided by Siegele into two groups of seven and five syllables each. My analysis further divides the five into three-plus-two. His view derives from the line layout of the poem, not the audible divisions of time. He regards the technical decisions as depending more on text

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[62] Siegele writes: "the torment of loneliness is the central image of the poem. This image is the basis of the composition. Boulez says it himself when he speaks about these sudden alternations of definite and indefinite pitches 'that is for me, naturally symbolic like a clock, not a regular clock, but the percussion instrument gives a meaning to the tempo and the speed'. The beats of non-pitched percussion are the audible expression of the rests—which occur because of the absence of pitched entries. Therefore the alternation from pitched and non-pitched entries make the frame/grid of time-points perceptible in the same way as a clock—not a regular clock—the grid does not follow any uniform value. The irregularity resides not in the rhythm of the pitched entries (irregular though these are) nor in the non-pitched beats—but in the irregularity of the grid/frame of time-points. This irregularity mounts as the piece moves forward and the pitched entries become more perceptible."

[63] For an illuminating discussion on how many exceptions exist, and how they may have come into being, see Wentzel, 142-70.

criteria than any other musical basis. The notes of the voice can be given according to the two lines thus:

C	C#	D	E♭	E	F	F#	G	G#	A	B♭	B
	3	4		6	4?		3?	7?	12		
	ff‘	ff		f	mf‘		mp	p‘	p		
2		5		8	9						1
pp		f		mf	mp‘						pp‘

Fig. B. 23.

This is the XIIth arrangement. The question-marks signify divergences in the durations. According to the *schema*, F should have 7 semiquavers' duration, G# should have 10, and A should have 11. These notes all belong to the first line, which is voice alone. If one adds the 4 of F to the 3 of G# one totals 7—the number F should have had according to the *schema*. If one adds the 3 of G# to the preceding 4 of F and the 3 of C# which follows it one gets 10, the 'correct' total for G#. If one adds the 7 of A to the following 4 of D one gets the 11 that A should have. These notes partake thus in a kind of 'polyphony' for solo voice; in other words the fact that durations are shortened indicates a kind of metaphorical 'overlap'.

The pitch continuity is already reduced between the sixth twelve-note group to the voice's twelve-note group. Only six notes carry across: three from the first line (of the voice) and three from the second. Of these six register-fixed pitches (see instruments' parts, bars 17, 18, 19 and 20) only one is fixed in duration, B♭, which is the first note of the voice and is separated from the next vocal note by a semiquaver rest. Nevertheless, the second last note of the 6th group and the 2nd note of the voice's group have the same pitch, A, fixed in register and related in time.

The instruments produce the pitch continuity more prominently from now on. Their entries are grouped in accordance with the two lines of the voice. The relationship between the voice and instruments changes, however. The first group of

instruments (bar 17-20) comes after the first line of the voice. Only the last note of the voice and the first of the instruments enters together. By contrast, the second group of instruments (bars 21-24) come simultaneously with the second line of the voice.

The instruments make use of two arrangements here, the IVth and the VIIth. The actual number of entries is reduced step by step. On the twelve time-points of the IVth arrangement there are eleven entries. On the twelve time-points of the VIIth arrangement there are ten. The phrase structure divides these twenty-one entries asymmetrically as fourteen and seven so that the fourteen entries are all eleven of the IVth arrangement plus three of the VIIth, while the seven entries of the second 'half' are the remainder of the VIIth arrangement. Here are the time-points of the IVth and VIIth arrangements and the figures of their entry number:[64]

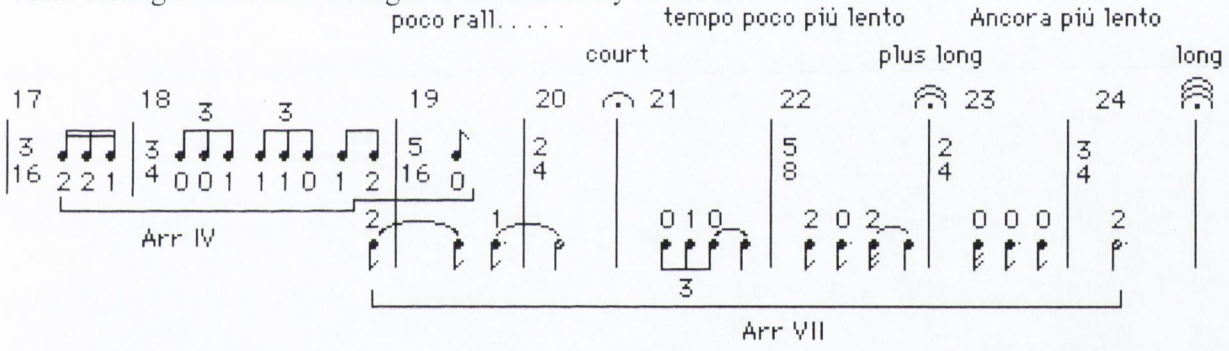

Fig. B. 24.

(This shows instrumental pitches only; the voice has a separate series already dealt with above, hence the time-points here do not tally with the resultant rhythm above, **fig. B.** 7.).

Siegele states that at this point the pitch ordering frees itself from the twelve-note system. That is to say that while the *schema* continues to operate, not all twelve pitches are obliged to appear. Instead the instruments derive their pitches solely from the vocal part. There is one irregularity in this, because the singer groups the 12 notes

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[64] According to Siegele, on the 6th and 12th time-points in the VIIth arrangement it appears that three notes enter. However on the 6th time-point the viola and xylorimba have the same note in the same register, duration and intensity—and this is also true of the 12th time-point vis. the viola and guitar: this is an instance of instrumental doubling for colouring and is not of significance to our understanding of the technique.

as 7 plus 5, whereas the instruments group them as 6 plus 6. What happens is that the B^{b} from the beginning of the voice's entry is not reiterated by the instruments until the next phrase.

The first group of instruments therefore uses the six notes of the voice excluding the B^{b}. This group has fourteen entries, eleven belonging to the IVth arrangement and three belonging to the VIIth. Five of the six notes are repeated so that the total of entries becomes eleven. Three other entries follow, belonging to the VIIth arrangement. The layout is as follows:

C	C#	D	E^{b}	E	F	F#	G	G#	A	B^{b}	B	
	3	4		6	(7)			(10)	(11)	12		voice: XIIth arr.
	ff‘	ff		f	mf‘			mp	p‘	p		
	11	12		2	3			6	7			insts: IVth arr.
	mf‘	mf		mp	p‘			pp	ff‘			
	11	12			3		6	7				repetitions:
	mf‘	mf			p‘			pp	ff‘			
				11				3	4			insts: VIIth arr.
			pp‘				f‘	f				

Fig. B. 25.

The instruments do not merely shadow the pitches of the voice but also adhere to the absolute registers of the vocal part. They are also frequently attached in time: for example, the C# of the viola enters simultaneously with the C# of the voice. The G# on the guitar and the F on the vibraphone enter while the same pitches are still sounding in the vocal part. There are other instances of this.

The pitches of the instrumental parts are never isolated from one another, they either follow directly or overlap with each other.

Therefore the voice brings about a number of modifications to the technique and the texture. The notes of the instruments have effectively surrendered their pitch structure, allowing it to be dictated by the vocal part. They allow numerous repetitions of the voice's pitches to occur.[65]

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[65] Siegele likens this repetition to an 'echo and response' which are the piece's technical correlation of the 'going away' in the text, as the wanderer and his steps recede.

The next line of text is divided into two phrases, of 3 and 2 entries. The next group of instruments uses these five notes and adds the B^b from the voice's first entry. The further repetitions allow the instruments to utilise the remainder of arrangement VII.

C	C#	D	E^b	E	F	F#	G	G#	A	B^b	B	
2			5			8	9				1	voice: XIIth arr.
pp			f‘		mf	mp‘			pp‘			
7			10			1	2			5	6	insts: VIIth arr.
mp			p			ff‘	ff			mf‘	mf	
						1						repetition
						ff‘						

Fig. B. 26.

In the second group of instrumental notes the number of entries is halved—in contrast to the last group. The echo effect is thus also halved. Of the six notes of the first group, two occur three times and the rest twice. Of the six notes of the second group one occurs twice and the rest once. Furthermore the temporal position of the instruments with respect to the voice has changed. The first group of instruments stops *after* the first line (of text), the second group *simultaneously* with the second line.

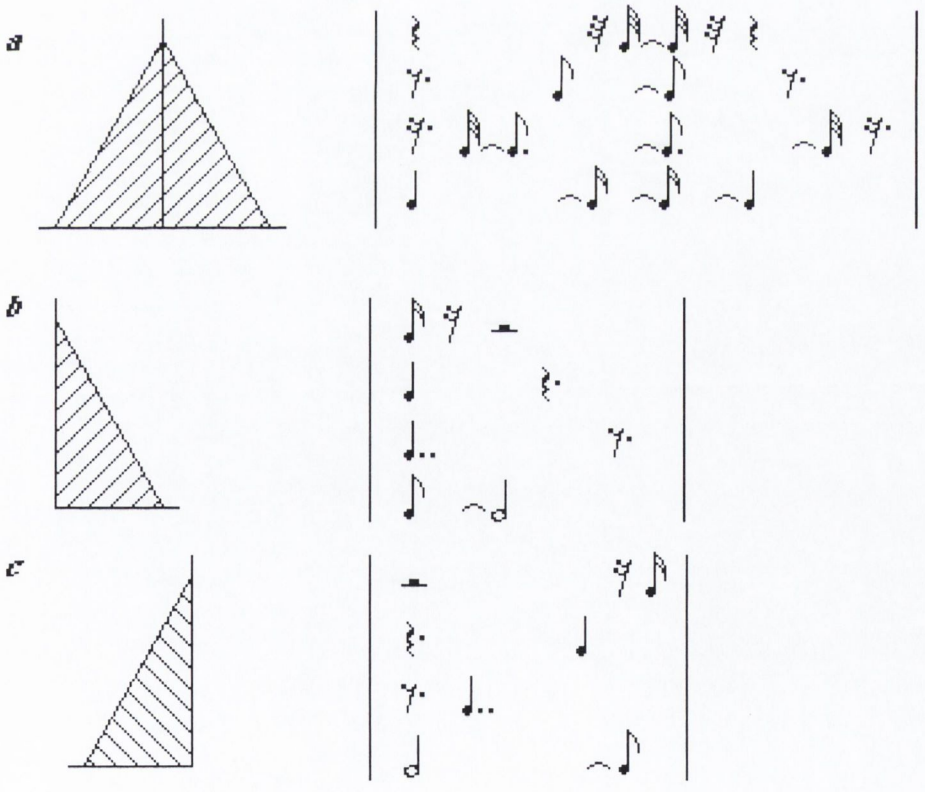
Control of sound-blocks

The derived series described by Koblyakov share essential limiting features: multiple entries are rarer than single entries or 'zero' entries, and the highest polyphonous attack density is four. However in the second section there are two instances of this density rising to five, the second of which is in the final sub-phrase. In the third section this aspect is further enlarged, as was noted briefly in the analysis. Bar 85 has

a seven-note entry, bar 87, a five-note entry, then bar 92 has a seven-note entry, and finally bar 94 ends the piece with another five-note entry. Of course, as the *schema* dictates duration, the points of decay are always staggered. These entries are deliberate manipulations of texture that demonstrate flexibility in regard to the usual conditions elsewhere. Boulez elaborates some of his thinking on this in *Boulez on Music Today*:

> It now remains to place these values in relation to each other, in other words, to distribute them within the field of duration defined by the longest value; when this operation is complete, a block of duration will thus have been formed, and a diagonal dimension will have been introduced, which cannot be confused with either the vertical or horizontal dimensions.[66]

He then discusses the various axes of symmetry and combinations of axes of symmetry obtainable, giving diagrams as follows:



[66] *Boulez on Music Today*, 55.

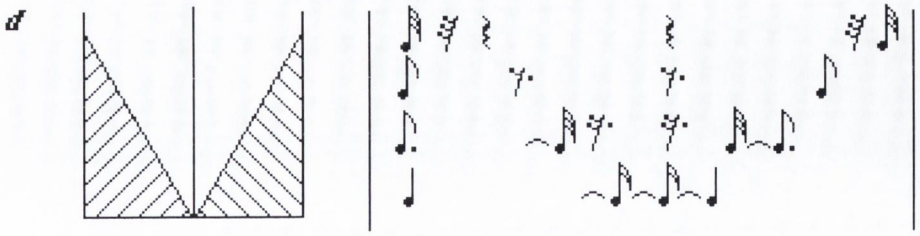


Fig. B. 27.

He also considers asymmetrical blocks, and describes these as 'more complex'.[67] It is evident, then, that he regards blocks *a* to *d* as simpler blocks. Therefore the purpose of the multiple entries is to bring the piece's end towards simpler blocks, away from the environment of more complex blocks, since the multiple entries of the third section correspond to block *b*. The first blocks of the piece correspond to block *a*, which as the most symmetrical and most simple structure, is placed above block *b*. A process of loosening of the symmetry after segment 1 was noted in my detailed analysis. (The only parameter considered here is duration, therefore the reader must not expect these triangular shapes to manifest themselves in the score or in **fig. B. 4**., where pitch governs the vertical dimension).

This concludes the technical discussion. I will now proceed to a consideration of technique and audible structure.

The relationship between the analysis and the technique

What follows is a consideration of the findings of the aural analysis and the technical analysis: if and how they agree, contradictions, and ultimately, how they relate. For example: the pitch-structures governing the technique are considered as groups under heading 2; so to what extent does this agree with phrase structure as defined under

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[67] Ibid., 57.

heading 1, or is this even required? And so on; in short: to what extent is technique integrated into the articulation as it strikes the listener? This is followed by a summary of the findings of the previous section. It will be more speculative in nature. Emphasis will be laid on the manipulation of musical parameters found in the technique, and the effects these have on the characteristic structures: texture and phrase at the local level, process and sectional hierarchy at the overall level.

This need not be a step-by-step comparison of the two above views; only important examples of contradiction or agreement need be given that facilitate a coherent view of what exactly the relationship is.

Bar 1 contains the first appearance of the serial scheme where pitch, duration and dynamic are linked according to ascending and descending values. All twelve values (in each parameter) occur and group themselves into a 'segment', as it is called in my analysis (segment = a less clearly defined passage than a 'phrase', also here it is taken to be half of a phrase). If primacy of this segment is intended to be heard distinctly, then it is compromised by the fact that the music continues to flow into bars 2, 3 and 4 before the first major point of repose occurs. This is reinforced by the fact that the maracas' quavers in bar 2 belong to the twelve time-points of the second twelve-note group (according to the technical view) while the pitches from the first twelve-note group are still sounding.

It must, however, be noted that the last twelve-note arrangement heard is the primary one in the source *schema*, although the first one is not. This is an example of a technical decision taken for its intellectual satisfaction, but not, as far as I am concerned, relevant to the listener's experience. Taking the first four segments together it has been shown that they roughly fall into a regular pattern:

Phrase	1		2	
segment	1	2	3	4
	one 12-note group	two 12-note groups	one 12-note group	two 12-note groups

Fig. B. 28.

This shows that there is a broad agreement between phrase structure and twelve-note groupings. The situation has not arisen where boundaries of series and phrase are inconsistent, except to the extent that two groups are fused. This, in itself, clearly allows variety in the perceived lengths of phrases.

Returning to the *schema*, it appears that the arrangement used in the four segments are respectively III, IX, XI, II, X and V. This does not adhere to any numerical pattern, which tempts one to believe that no system of regulation exists for this ordering. This presumably gives Boulez the freedom to experiment with various orderings of the 'pre-fabricated' structures. Being extracted from the *schema* guarantees variety of duration and dynamic for each pitch. There is therefore a kind of guaranteed dislocation of continuity in those parameters. Perhaps the avoidance of adjacent arrangements (in the *schema*) appearing side by side in the passage is a further precaution for this dislocation.

It is important to bear in mind that the pre-compositional establishment of the *schema* is a useful tool guaranteeing that unwanted aural connections do not seep into the organised, unconnected texture.

The consistent dislocation provided by the use of the *schema* allows the elements of textural shaping (i.e. overall density and register within a phrase) and pitch retention to become the central issues for the listener, which indeed was apparent in the analysis. It is the evolution of these and the connections (cross-references) within and across phrase boundaries that becomes the material for discourse and development.

Rhythm also avoids creating unwanted local connections—despite its not being governed by the *schema*.[68] By creating resultant patterns which are total (as at **fig. B. 5**.) within arrangements and changing them from one arrangement to the next he is at once avoiding any 'motivic' shaping and marking the boundaries between arrangements. Where overlaps occur (during segments 2 and 4) a sense of textural and temporal flow overrides any sense of actual borderline or change. When the rhythm does adopt more rapid changes of rate (i.e. the 5th and 6th arrangements have five separate rates) this has the effect of destabilising the flow, effectively forming a transition into the further rhythmic dislocation introduced by the singer, where resultant rhythms are no longer total.[69]

Timbre is another parameter not apparently regulated by the *schema*. However we do know that Boulez made the selection of timbres as though they were on a graduated scale similar to the scales of duration, dynamic and pitch. The timbres proceed from the singer in order of quality of sustain and other connections.[70] For broad outlines of timbre across the whole work, see Jameux p. 286.[71]

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[68] Resultant rhythm. That is, as distinct from duration, which is governed by the schema. Also note that the existence of 12 time-points indicates an oblique adherence to the series.

[69] 'total rhythm' is a term I use to denote constant even division of the pulse—Boulez calls this 'symmetrical ordering of time'.

[70] Boulez sets this forth thus: "As a start I would point out that all these instruments have a medium pitch register, an important consideration since they are to accompany a contralto voice. If I chose a flute, it was an alto flute, a fourth lower than an ordinary flute and with a more veiled tone; in the same way I chose the viola for my stringed instrument, half-way between its more brilliant neighbours. Both guitar and vibraphone have a very 'central' pitch range, and the only exception is the higher pitched xylophone. The percussion instruments that I selected are also medium pitched except for the gong and the tam-tams, which are used only right at the end in a low register. . . The link between the flute and the voice is simple: the performer's breath, and the fact that both are monodic 'instruments' The flute and the viola - when it is played with the bow - also have this monodic character in common. On the other hand if the viola is plucked it has a link with the guitar, whose plucked strings have a longer response than those of the viola. This resonance forms a link between the guitar and the vibraphone, an instrument based on the protracted vibration of metal bars when struck. When the bars of the vibraphone are damped, they are directly related to the wooden bars of the xylophone, which have no resonance when struck. We have thus established a chain linking each instrument to the next by a feature common to both. Let us look at it again: voice - flute, breath; flute - viola, monody; viola - guitar, plucked strings; guitar - vibraphone, long resonance; vibraphone - xylophone, struck bars of metal or wood."
Pierre Boulez, *Orientations, Collected Writings*. Edited Jean-Jacques Nattiez (London: Faber, 1986), 339-40.

[71] Dominique Jameux, *Pierre Boulez* (London, Faber: 1991).

How timbre operates in relation to durations and intensities would make a fascinating line of investigation beyond the scope of this chapter. That is, to see if particular instruments are statistically 'favoured' dynamically over others, as the pitched instruments are over the percussion.

It should be said that while evidence does not exist of strict regulating systems (comparable to the *schema*) that govern resultant rhythm, timbre, pitch order, arrangement order, density or register, that is not to say that these elements are left to chance. They are the less obviously regulated elements of the composer's technique (including intuitive decisions).

My analysis has found that the most important elements of the music as far as progression is concerned are textural shape (i.e. an ensemble of register and density) and register pitch fixing. In *Boulez on Music Today* (pp. 55-58), Boulez shows how he sets about creating a shaped block from the diverse durations which exist in his textures. His examples are not very close to the types of structure which occur in *Bourreaux de Solitude*, but the essential element common to both is his concern with deliberate control of overall shape (for comparison, see **fig. B. 4**.) thus the analysis and his writings indicate that this aspect is tightly controlled, though not, it would appear, by any numerical regulating system analogous to the *schema*.

If one takes into account the occurrence of pitch fixing and its importance to the development of the movement, one begins to see why the durational bocks in this music are not easily reducible to the types of patterns shown in *Boulez on Music Today*.[72] If, as I assert in my analysis, the placing in time of a pitch repetition is directly connected to its strength as a link, then the time lapse between a pitch and its repetition becomes a vital shaping factor that the composer seeks to control. If pitches that are always tied to the durations need to be placed near their previous entry, this can overrule the precise shaping control of the duration sound-block. Distortions may have occurred which the composer was happy to allow in order to maintain a

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[72] *Boulez on Music Today*, 56-7.

satisfactory development in the realm of pitch. It is only possible to state this as a conjecture, as the sketches no longer exist. To clarify the above, take for example segments 1 and 2 (phrase 1). The first 12-note arrangement is separated (i.e. does not overlap with) from the next. This (and by dint of its being the first 'block' in the piece) allows it to be distributed in such a way as to yield a symmetrical bulge in the densities (as noted in my analysis). As soon as the next block begins (B, E, F#, D#,—bar 2) the distribution of densities along similar lines is ruled out (because four pitches enter simultaneously)—the figures are given in my analysis—it is clear however that these pitches are placed and chosen because they reiterate three of the most recent pitches from the previous twelve-note group and therefore create the link that attaches segments 1 and 2. I cannot prove that this shows pitch retention overruling textural shape, since who is to say that the varying densities of segment 2, however irregular, were not decided upon first. But so long as the *schema* links pitch and duration, there must be a cross-effect between the control of pitch repetition and of sound-block layout.

Moving on to the next phrase, where the voice enters, a new complexity enters into the technique; a 'polyphony' of series arises. In other words, the voice has one arrangement distributed in three consecutive phrases (of my analysis) while the instruments that also play during these phrases have two arrangements. Thus the voice introduces arrangement XII, the instruments then overlay this with notes from arrangements IV and VII. The complexity of the polyphony of series rises to the centre of the movement and falls back to one at the end (as shown by Wentzel). A parallel rise and fall can not be felt in parameters involving texture or rhythm, i.e., this is a feature which gives the technique an autonomous elegance, but scarcely impinges on the 'listening grammar'. What does impinge are the occasions where series are only partly presented (as at the first vocal entry), and deviations from the *schema* which allow certain dynamics to cluster together (as shown on the analysis of the singer's entries in second section).

The gestural evolution of the piece most obvious to the ear is the paring down of register, density and pitch variety (i.e. not all twelve pitches occur in each phrase, as they did in phrases 1 and 2). Along with that there is the dissipation of rhythmic momentum, which is effected in two ways, actual slowing of tempi, increasing asymmetry of rhythm.

None of this is demanded in any sense by the *schema*; in fact the reduction of pitches seems to go against the grain here inasmuch as one wonders what is the real significance of the *schema* if it can be ignored in this selective way. Parallel to this development is the conflict between arrangements and phrases—in the 3rd, 4th and 5th phrases the voice has just one arrangement, the instruments have two distributed across the phrases. This contrasts markedly with the previous linear alignment of arrangement and phrase. There are two straightforward reasons for this: the overlap of series of the voice and instruments and the extreme shortness of the 4th and 5th phrases. Wayne C. Wentzel shows how the polyphony of arrangements is taken much further in the central section, and how the *schema* itself receives more flexible treatment.

Before exploring the implications of this any further, another factor must be mentioned: the adherence to time-points noted in the technical heading above. It is very tempting to regard these as a catch-all unifying element. That is, while pitch variety and distribution may change, one may be reassured that each arrangement is supported by the existence of twelve time-points. However, just where this element of cohesion is needed most (i.e. when the *schema* drops the use of twelve separate pitches) it is itself masked by the simultaneous presentation of two arrangements, with their time-points enmeshed.

Thus a contrast has emerged between the arrangement/phrase relationship in the first two phrases, and the same relationship in the next three phrases. There is therefore a sense of the technical resources for the piece becoming more flexible as the shape of the piece evolves. The instrumental arrangements are limited in pitch in response to the notes of the singer, while the singer herself introduces a full linear

statement of an arrangement. (The latter point is a manifestation of the fact that the singer introduces a concentration upon the linear/horizontal dimension that contrasts utterly with the complex block texture of the instrumental opening).

The evolution of the first section of the piece is concerned with the concentration upon pitch repetition and increasing isolation of the phrases. This is brought about by reducing the number of different pitches—simply omitting sections of the arrangement—and by temporal and rhythmic control. It is of singular importance to note that the use of arrangements overlapping allows a further concentration of note repetitions that would not be possible otherwise. This is therefore an example of a compositional decision made during the process of composition that overrides the pre-compositional structure—namely the *schema*. As such it is quite apparent to the ear that something that radically questions the opening texture has emerged. A simplification of the musical surface occurs, enacted in the compositional process by a sharp reduction in density, register and pitch choice. Of course, what we are witnessing is the composer manipulating his material in order to develop it in a satisfactory and meaningful direction. As such it is a further instance of his technique. But there are two distinct phases of that technique: the 1st puts in place the basic material and controls it for the sake of its own integrity, the 2nd phase involves 'bending the rules'; further changes for the sake of meaningful discourse. The later polyphony of arrangements is a further example of this.

The crux of the issue under consideration here is whether or not the technique that puts the primary material in place permits enough further manipulation of that material to allow a lengthy, coherent evolution to take place. Or will the technique prove so rigid that it becomes necessary to abandon the material in the course of the movement, or to dismantle it to such an extent that it becomes pointless to have had it in the first place? Neither of these extreme situations arises here, but is there a hint of

the latter where he begins with a chain of arrangements and later allows them to overlap and restricts the total pitch content?[73]

It is apparent from the score that the *schema* is never fully abandoned, although it is complicated by superposition of several arrangements simultaneously during the central part of the movement, as well as a (large) minority of inexplicable departures from the strict *schema*tic alignment of pitch, duration and dynamic. This is dealt with in greater detail by Wentzel, and the possibility of a combination of composer's interventions and copying errors is explored by him.[74]

Is this flexibility meaningfully reflected in the analysis? i.e.: does the musical material continue to develop a process that justifies the continuance of the music? My analysis shows that the process of dissipation and isolation of the first section is reversed at the outset of the second section, with a return to the instrumental texture of the opening, modified rhythmically. The listener's probable response to this is to hear the next passage in a way which is coloured by an expectation for this process to reappear. If it does not, a sense of contrast and variety is felt and the music continues to evolve. If it does, that pathway will have received confirmation and a strong sense of closure will exist. As the music takes the former path, its continued effectiveness depends upon its ability to set up a strong process alternative to the one from section 1.

Since the analysis for the second section contains evidence of a satisfactory alternative process in the production, maintenance (singer's entry) and heightening (climax) of a new sense of flow in the piece, these conditions are fulfilled. The final section explores a third avenue which has been present but latent in the other sections: evolution in sound-block layout. The intended goal here (the clarity of which I would question) is simultaneous entry of parts to effect a rhythmic brake on the music.

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[73] The ear gives the answer: the impression of over-exceptional modification of material is prevented by the continued application of duration/dynamic/pitch links. Thus the 'flavour' imparted by the schema binds the piece at this point.

[74] Wentzel, 149-154.

To summarize: we have seen that the serial techniques Boulez employs have the effect of eradicating a lot of the traditional linking systems by which music operated in the past. i.e., motivic referentiality, rhythmic referentiality, reference of timbre, dynamic continuity and, for large parts of this movement, phrase shaping. Consequently it throws into prominence pitch retention, which, in the absence of the other forms of referentiality, takes on a greater significance for propelling the piece forward. It does this without support from the other parameters (except for dynamics), but supported by register, density and phrase length—the remaining important shaping factors. Thus his techniques which are new to music throw up new modes of structural articulation, as well as throwing out a lot of the old. The analysis of harmony, in terms of interval relationships and pitch fixing, relies on statistical counting of events, and for section two the analysis of dynamics worked the same way; even register, locally, has a statistical quality. Therefore I cannot deny that the surface detail of the music is largely randomised, as Lerdahl has said. Lerdahl would say that this forms a cognitive constraint for the listener, but I would not agree with this. My belief is that one can listen statistically, just as one can observe the overall shape of a breaking wave, despite the stochastic quality of each drop's trajectory.

CHAPTER 2

CARTER: VARIATIONS FOR ORCHESTRA

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Analysis

This chapter deals with the first two sections of Elliott Carter's Variations for Orchestra: the Introduction and Theme. In the commentaries the premise is to follow the piece through as it would be experienced in real time by the listener, in order to establish a 'listening grammar'. Therefore the events are categorised as they are established from moment to moment, and gestures and relationships are presented as constantly evolving, rather than static. This requires that the reader follow the text with the score and a recording in order to judge the validity of what is said. However, to simplify the task I will preview the commentary briefly: in the sections marked 'Introduction' and 'Theme' in the score of the Variations for Orchestra there is an interplay of three strands of material; which are called here 'element 1', 'element 2' and 'element 3', and abbreviated to **E1**, **E2** and **E3**. In listening to the Introduction it soon becomes evident that the three elements have clear and separate identities, defined by internal consistency of motivic shape, range of rhythmic value,[75] texture and sometimes timbre, yet they are each very flexible in their details, so that none has a definitive statement form (corresponding for example to '1st subject' etc. in Sonanta Form). Furthermore, the elements interact with one another as if in a dramatic way: i.e., rhythm or registral agitation (which can be defined by accentuation, regular/irregular values, extremes/non-extremes of register, change/stasis of linear contour) in one element sometimes appears to exert a pressure on another element which may then 'react' by modifying its degree of agitation.

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[75] For more detailed discussion of how this is achieved, see below under 'Stratification' in the 'Technique' section of this chapter.

In the course of the Theme section, **E1** and **E2** become more stable, and consequently will be dealt with as a pair. **E3** has somewhat divergent goals, and is dealt with separately. **E2** is also referred to as the 'theme', while the term 'Theme' may be used for the section as a whole. This is because **E2** presents material which *is* the theme of the piece, yet it is situated in the timbre and rhythmic range of **E2**, and is therefore heard as a further development of that element.

As this analysis is a detailed discussion of just the Introduction and Theme section of the work, it will not consider the relationships that exist between this section and the rest of the work. Robert Allen Beckstrom deals with this in a thesis which deals with the work as a whole and in context with the twentieth-century history of orchestral variations. Beckstrom shows that the theme is made up of thirds and sixths combining with stepwise motion, and goes on to describe the further development in the variations thus:

> The general tendency is either a direct presentation of the theme, or a departure by abstracting a cellular aspect of the theme. Most abstractions involve countering major or minor thirds with stepwise motion and filling chromatic sets.[76]

By direct presentation he means quoting whole from the theme's phrases, allowing free transposition and rhythmic transformation. For a detailed account of which variations feature which parts of the theme or ritornellos I recommend the reader to Beckstrom's thesis.

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[76] Robert Allen Beckstrom, "Analysis of Elliott Carter's Variations for Orchestra (1955)" (Ph.D Dissertation, University of California Los Angeles, 1983), 10. Another thesis that deals with the Variations as a whole is Bruce McBean's: "Elliott Carter: Variations for Orchestra" (M.M. Thesis University of Michigan, 1963), while Willam C. Pflugradt deals with the variation process in the First Strng Quartet and the Variations for Orchestra in "Elliott Carter and the Variation Process" (PhD Diss., Indiana University, 1984).

Analytical commentary on the Introduction

In the first three bars three chords are sounded. They are highly differentiated by timbre, register and density (occurring in winds, strings and brass respectively). They are associated, however, by being overlapped in time. The harp provides a fourth timbre, but is presenting material that is dependent on the brass. The next striking event is a rising and falling linear motif in the woodwinds (Bar 7), this is element 1, or **E1**. It falls twice as slowly as it rises. Its initial rhythm is perceived as a speeding-up of events, since it occurs at a rate of 2:3 of the previous motion from chord to chord in the first three bars. During its slow fall, **E2** enters (b. 10), this is always played by strings; it is characterised by strong forte interjections which are always leaping and angular in contour. The brass chord that immediately follows this is another strand of material, since it refers back to the opening.[77]

The two elements thus overlap, although not in a markedly dramatic way. It becomes apparent later that their overlaps will affect their nature, but this has not happened yet.

E1, in its slow fall from bars 10 to 16 is unaffected by the forceful entry of **E2**. The fact that **E2**'s second burst occurs while **E1** is *holding* a single unchanging dyad gives a strong sense that **E1** is unaffected (for the time being) by the energy burst of **E2**.

E1 from bars 7 to 16 has a well-balanced shape, with decelerating durations in its descent, and shorter durations in its ascent, so rhythm and contour are allied to lend it a dynamic quality. The appearance of the pitch E three times in this element aids the sense of balance by giving harmonic points of reference.

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[77] I have not given this an 'element' number, since it has no linear aspect. It refers back to the opening in this respect, although here it is supplying an harmonic backdrop for the foreground events.

These aspects lend a degree of stability and coherence to the introduction of widely diverse elements which is taking place. As soon as **E2** has had its statement **E1** 'reclaims' the foreground with D^b on the oboes. The entry of **E2** seems to create a metrical distortion in **E1**, it is temporarily pushed into the background, and holds its notes for seven beats rather than four.

In bar 15 the brass instruments enter with a new strand of material, **E3**. This causes another pause in **E1** as it returns to the background. **E1** is less masked here because **E3**'s dynamic level is lower than **E2**'s. Thus we see that **E1** is distorted by the interjections of the other two elements, but it is always there. This is and will continue to be important, since **E1** acts as a connecting thread throughout the introduction. This same element will continue through the Theme, where it is transferred to the strings.

Oboes give the second rise of **E1**, which during bars 17, 18 and 19 re-establish minim movement for this material. Instead of a corresponding slow fall, there is a leap back to the E, which pre-empts the possibility of stepwise descent. Note that the first fall was made up of these pitches: A, A^b, G^b, E, while the second fall is made up of A^b and E; thus it can be regarded as a shortened version, since it repeats pitches from its model.

As well as the linear elements 1, 2 and 3, there are two instances of static chords in bars 11 and 14, where the brass follows **E2**.

Bar 20 represents a new level of complexity, as the rising of **E1** coincides with the developed re-entry of **E2**, slower and at a new density. This climactic statement of **E2** ends in bar 24, while **E1** ceases to climb just one beat before, and falls a semitone just one beat after. In other words they are not taking turns to make a significant gesture, they are doing so at the same time. The paradigmatic rise and fall of **E1** appears to have been warped by the existence of two entries of **E2** very close to each other: i.e., in bar 25 the upper line (**E1**) only has time to fall once (to F) before the re-entry of **E2** and its consequent rise (to B^b).

The new slow speed of **E2** in bar 20 appears to change the characteristic rising speed (minims) of **E1** to dotted minims, with the plateau note having four as usual. Its pattern of rising and falling appears to be completely disrupted at bar 26 (the B^b) and subsequent bars, in response to **E2**.

Thus one can say that **E1** has a limited integrity (of shape, meter and pitch) which is easily swamped in response to what is going on around it (the other elements).

E1 is a constant presence, while the others take it in turns to combine with it, so it is fruitful to continue the analysis of the music in terms of its apparent reactions to the entries of the other elements.

For the next passage, a pattern begins to emerge, **E1** has been rising and falling as if in response to the energetic bursts from the other elements. Now we can say that **E1** begins to react in more predictable ways than before: entries of **E3** become associated with descent in **E1**, whereas entries of **E2** become associated with ascent. One can even say that **E1** needs **E2** for it to rise, since the absence of **E2** becomes associated with descent in **E1**. This is described in the following commentary.

In bar 29 **E3** enters once more, broadening the range of inter-relationships. For the duration of this entry of **E3**, **E1** descends in an accelerating rhythm. Previously, **E3** was not associated with descent in **E1**; however, it did coincide with a trough in **E1**.

With the re-entry of **E2** in bars 31-2 **E1** leaps a compound minor third, as if in an extreme reaction, but since this entry of **E2** is short, this high note becomes a plateau of just five quavers' duration. After this, **E1** falls by a minor sixth in the presence of **E3**, reinforcing this material's association with declining reactions from **E1**. Then **E2** reappears, bringing a short rise, but as **E3** is present (at this stage) everywhere except on the beats which **E2** inhabits, **E1** soon falls. Another leap of a compound minor third occurs in b in bar 34, coinciding with a lull in **E3**, and just pre-empting a dramatic re-appearance of **E2**.

So far, **E1** has leapt like this twice; there is a notable similarity with what the other elements are doing, since at these points **E2** enters with a rising gesture that stops **E3**. Thus the positive energy quotient of **E2** overpowers the negative energy quotient of **E3**, and this fact is reflected in the amenability of **E1**.

The appearance of **E2** in bars 36 and 37 consists of two crotchets separated by two crotchets' rest during which **E3** is ever present. This is broadly similar to the balance of forces for its appearance in bar 33; then, **E1** reacted by moving up and back down quickly—there was no time allowed for a 'plateau' note, which has become part of the accumulated character of **E1**. Here in bar 36 there is a fall of a tritone and a rise of a 4th; similarly one can attribute the changes in direction to the effective presence of two opposing forces. However the rise of a 4th occurs during the predominance of **E3**, the fall occurred after **E2**, so the roles can be said to be becoming less rigid. At this point there is perhaps a role reversal, since **E2** is now moving in downward motion, whilst in **E3** there is a fall and rise (in bar 36) which shadows the shape of **E1** (see **fig. C. 1.**). It is precisely as **E2** falls for the first time in these 10 bars that **E3** makes its most decisive upward sweep.

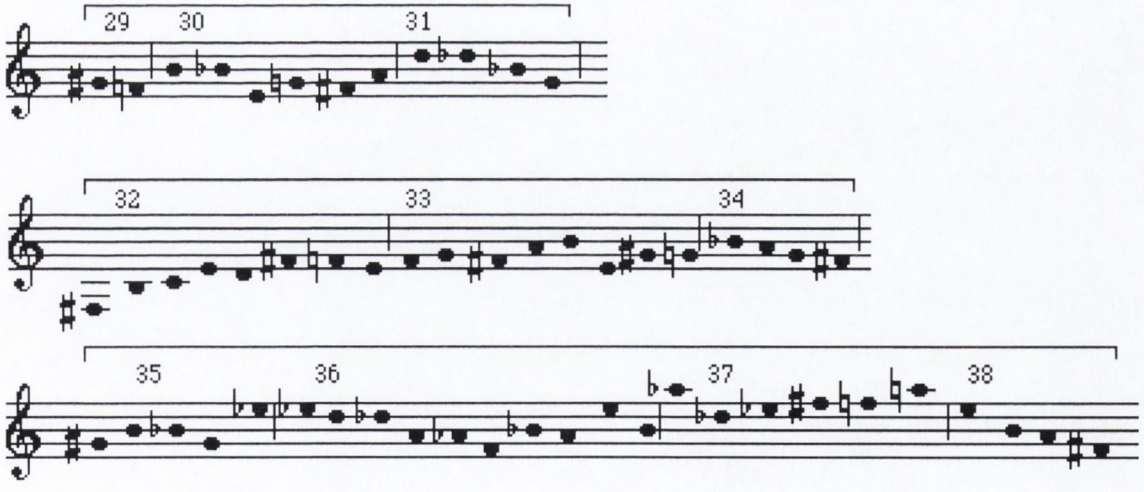

Fig. C. 1. E3 upper line contour, bars 29-38

In bars 37 and 38 **E2** has become a spent force, as it is reduced to two very slight entries, the second of which is pizzicato (and may even not be perceived as belonging to **E2**); while elements 1 and 3 go on to press for further heights in terms of their registers and dynamics (**E1** reaches B^{b}, not higher but as high as it has ever been—**E3** reaches A, a minor ninth below this—an upper limit for this element).

A fall in **E3** in bar 38, A-E-B-A-F#, is followed by **E1**'s descent, which together effect the end of the climax.

General commentary on the Theme section

In bar 40 two solo violins take over **E1**. They adopt the pitches F#/A# by overlap from the woodwinds. Their first action is to leap up a compound minor third. As elements 2 and 3 have, by now, both spent themselves this rise is not in its old context of reflecting climactic energy from elsewhere. It is marked ***pp***, tranquillo, and the metric context returns to the long values originally associated with this element. This makes a satisfyingly fresh use of familiar material.

After its rise, **E1** becomes very systematic and hence unaffected by the presence or absence of other elements in the texture. Metrically it moves in units of 5 beats' duration (oblivious of the $^{4}_{4}$ metre which is introduced for the lower strings material, which I will be calling the theme, this is not the same thing as the 'Theme' which designates this entire section).[78] **E1** descends systematically thus: C#, C, B, A, G, E (then up to) F#, F, E^{b}, C, (up to) D, C#, B, A, G, E (up to) F#, F, E^{b}, etc. It continues throughout the theme, transferred to other instruments.

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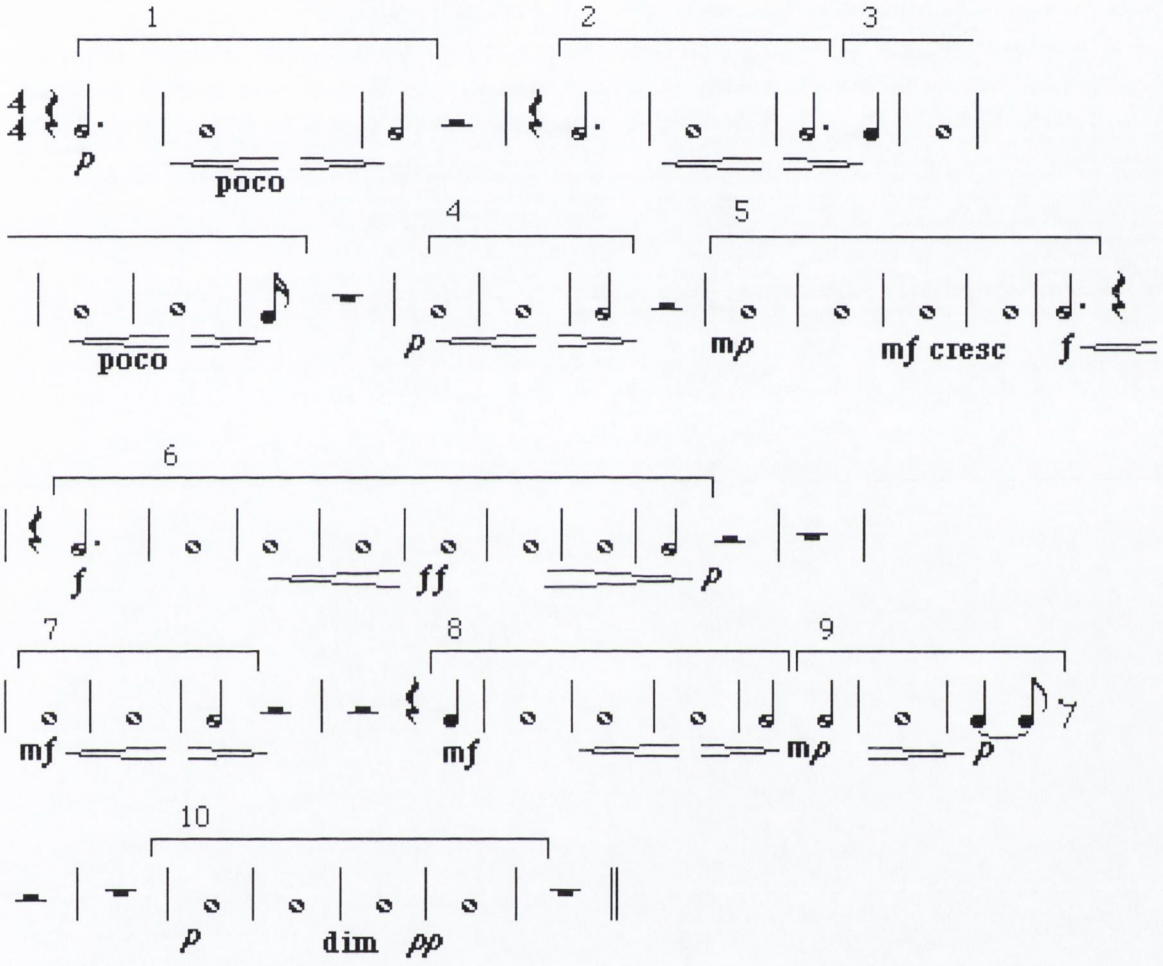
[78] The listener is not necessarily aware that they are entering a phase of the work so definitive as the 'Theme' in a traditional Theme and Variations, and it seems from the very existence and nature of the Introduction that Carter is subverting the norms of this form. In any case what is at issue here is how it articulates itself, irrespective of labels, and the Theme area clearly picks up E1, but places it in the background relative to the String material which is quite traditionally melodic and merits the label 'theme'.

Despite its apparent aloofness in character, element 1 interacts with the theme, for example in bar 49, where it places a beat between the end of the string theme and the beginning of the brass theme; however, it is the others which align themselves to accommodate it.[79]

The theme is unfolded in a developmental way thus:



(The rhythms shown are indicative only of the extent of each phrase and include the lower parts)

Fig. C. 2. Phrase layout of the theme in 'Theme' section

There are ten phrases. I have included dynamics since they offer a key to the entire Theme section; the dramatic layout of the section is governed by the theme,

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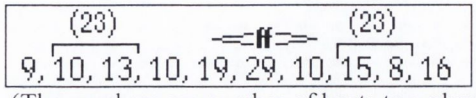
[79] Another way of saying this is that the **E1** is now inflexible in rhythm and interval qualities, so when interaction between elements is attempted, it is the other elements which 'give way', i.e. change rhythmically to accommodate **E1**.

following a single *crescendo—decrescendo* shape whose apex occurs in bar 68 where the ***ff*** is.

As well as the dynamic shape, the sequence of phrase lengths can be seen to support this shape:



(The numbers are number of beats to a phrase)

Fig. C. 3.

Register and Density

From phrases 1 to 6 (i.e. approaching the climax) a consistent trend of climbing occurs in the top register, while in the bass, every second phrase delves lower (the 1st, 3rd and 5th) until phrase 6 where the lowest note possible occurs. This is laid out clearly in **fig. C. 5.** (see volume two). After phrase 6 there is a general, though not systematic, descent (i.e., each phrase is lower than the previous with the exception of phrase 9) in the upper register; while in the bass the low registers are avoided for three phrases. They reappear in phrase 10 with the same set of low notes as before: A, F#, E^{b}, with the omission of low E. This omission points to the basic idea that this phrase must respect the limit set by the climactic phrase.

To throw more light on the overview of the theme it is helpful to examine the varying densities (i.e., number of voices) of elements 2 and 3 to see how they support the analytical picture being built up.

phr. 1: 1→2→3	phr. 6: 4
phr. 2: 4	phr. 7: 2→3
phr. 3: 3→4 (→5)	phr. 8: 2→3
phr. 4: 5 (→4)	phr. 9: 3
phr. 5: 1→3→4	phr. 10:1→→4→3→4→3→

Fig. C. 4. density, **E2**

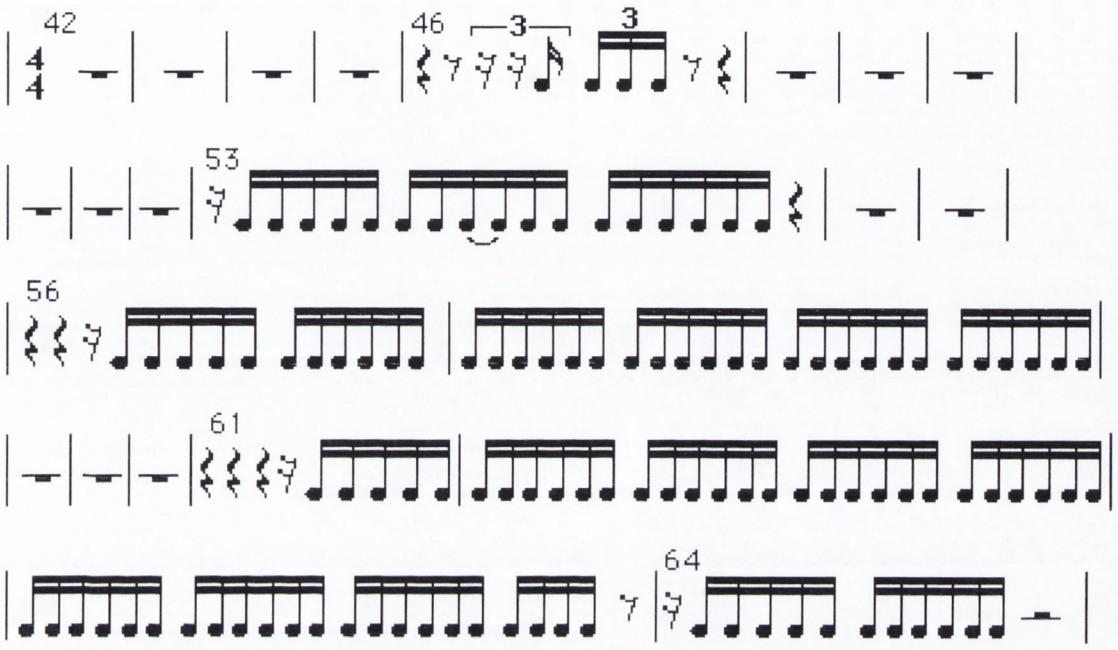
Other parameters (phrase length, register) have given the impression of an expansion towards phrase 6 and a subsequent shrinkage. Density does not mirror this precisely, but follows a pattern that is not in conflict with it. This includes a logical development from 1 to 5 in the first four phrases. Approaching phrase 6 a second development from 1 to 4 is promulgated, while after the climax the density generally hovers around 3 (the 4 of phrase 10 is heard in the context of ***pp***, and is thus not as weighty as appears above).

E3 in the Theme section—overview

In the Introduction, E3 built up to a climax through increases in phrase length, registral width and density. In the Theme it is cut back to a very short, solo entry for its first statement, and then progressively regains *some* of its gestural weight, through each reappearance. It is transferred from muted (often ff, cuivré) brass (in the Introduction, and first statement here) to woodwind, and consequently sounds less forceful here. As it 'recovers', in each longer appearance it gains in textural weight, expanding in density and register. Each of **E3**'s entries in the Theme section is

separated by entries from **E2**, and it is often the case that **E3** breaks off abruptly and is 'interrupted' by **E2**.[80]

It makes four appearances before bar 64, which is where **E2** comes to phrase 6.



(For a complete picture of rhythmic relationships see **fig. C. 22.**)

Fig. C. 6. E3, first four entries in the Theme section

Their lengths and the lengths of gaps between them can be given values thus:

(11) [18] ½ [25½] 3 [11] 6 [15] 9+2

(According to beats)

Fig. C. 7. E3, phrase lengths for first four entries

After **E2**'s climax in bar 68, this semiquaver material recedes in importance for a time, however, it does undergo two important transformations which are gesturally opening in nature: a temporary transfer to strings in bars 71 (which occurs,

[80] This relates to Carter's aesthetic preoccupation with the presentation of parallel independent developments commonly seen in cinema.

significantly, after phrase 6) and the change from repeated pitches to quaver-semiquaver rhythm. This is **E3** in a new guise, and as such it functions in a new way: it now occurs simultaneously to **E2**, whereas before it always waited for the gaps between statements of **E2**. Once the modified rhythm of **E3** has set this precedent, the semiquaver version also appears freely over **E2**. This all occurs after **E2** has begun to recede from its climax. Thus phrase 6 is a turning point for **E2** and is associated with a turning point for **E3**. Furthermore, having cooperated in an orderly fashion of alternate entries with the same broad goal, they then break out of this pattern, becoming non-cooperative—allowing entries to overlap more as if to reinforce a new divergence of aims. The four phrases of **E3** expand in register as they approach phrase 6 of **E2**; after phrase 6 the **E3** material is transferred to strings and continues expanding in the upper register (see **fig. C. 8.**, register in **E3**, volume two). In five subsequent entries however, the upper limit of F3 is respected, until the final push of **E3** at the end of the Theme.

In the sixth appearance of **E3**, it transforms itself to the quaver-semiquaver material, which carries on over **E2**.[81]

In general, the Theme section is quite stable, with many features which suggest repose or partial closure. The shape of **E2**, the descent of **E1** and the repeated note character of **E3** in its semiquaver form all tend towards this closure, whereas the introduction of the new rhythm in **E3** is provocative. Thus one can say that **E3** partially mirrors the opening-closing shape of **E2**, but with substantial reservations: i) continued expansion in its 5th and 6th entries, ii) upward sweeps in the 7th, iii) outward movement at the end of the 8th and iv) the final sweep at the 11th entry. These keep **E3** more open in character than **E2**. In contrast to this, the densities of **E3** may be said to join the drive towards the climactic region established by **E1/2**. (phrase 4 of **E3** roughly coincides with phrase 6 of **E2**). Density here indicates a partial

[81] It becomes apparent in the first variation why E3 is so provocative in nature while E1 and E2 are more 'closing' here; E3 becomes the primary material for variation there.

agreement with the goals of **E1/2** until phrase 6 (of **E3**), where it becomes more independent, asserting a textural counterpoint.

phr. 1:
phr. 2: 1, 2, 3
phr. 3: 1, 3, 4→5 (6)→4
phr. 4: 3, 5, 2, 3, 5, 6, 8(r), 8, 7, 4
phr. 5: (tc) 1, 2, 3, 5, (tc) 3, 7, 6
phr. 6: 3, 6, (8), 5, (rc) 2, 3, 2, 1, 2
phr. 7: 2, 3, 1
phr. 8: 4(tc), 1(tc), 5, 6(tc), 3→7
phr. 9: 2(4), 2
phr. 10:2, 4
phr. 11:3, 5, 7, 5, 4, 3 →to var 1

(r = rests, tc = timbre changes, rc = rhythm changes)

Fig. C. 9. density, **E3**

However, the strength of density alone as a definer of gestural aims is compromised in this element by the rapidity with which it fluctuates, so to some extent it forfeits its ability to express large scale aims of the Theme section. The peak for densities occurs in phrase 4, which is shortly before the peak in **E2** (note that exact correspondence between phrase numbers does not exist from element to element). The first peak for register (another one occurring just as the next section begins) comes at the end of the fifth entry of **E3**, in bar 72^4. Density in this element relates not just to large-scale aims; each individual phrase is essentially defined by the changes in density. Furthermore, in **E3** density and register are tied together in one respect, since changes in registral width are effected by increases or decreases in the number of parts, as was the case for **E3** in the Introduction.

E3 in the Theme section—detailed commentary

It was noted above that **E3** undergoes two transformations in the course of the Theme (that is, apart from the transformations of timbre and weight at the beginning of the section), these are a temporary transfer to strings in bar 71, and a transformation of rhythm in bar 76 from constant semiquavers to alternating quaver-semiquaver rhythm.

If we take the upper lines of **E3** in the Introduction, we find a complex array of possible shapes and interval sizes; but certain factors are stable: intervals smaller than a tritone are by far the preferred size range, the wider rising intervals are usually marked with a crescendo to *f*, these are usually followed by falling minor seconds. (This is evident from **fig. C. 1**).

A closer examination of the nature of **E3** in the Theme shows that these stable factors now undergo constant evolution from phrase to phrase. The first two appearances of **E3** are very much in keeping with its motivic shape from the Introduction. The first (horn, bar 46), sounds every bit like a remnant which inexplicably appears here in the Theme, giving an impression that boundaries between sections are fluid.

The second appearance retains a marked degree of that motivic shape due to note repetition, the rising fifth and falling minor second (as at the very first appearance of E3 in bar 16). There is just a hint of development in the overall tessitura of the first bassoon's entry. There is still a characteristic balance of the static (repeated notes) and mobile qualities which E3 had in the Introduction.

The third appearance develops more rapidly; it has markedly fewer note repetitions, and consequently more of the mobile figures. The majority of minor seconds are rising here. Rapid climbing of overall tessitura is confirmed here (the material is no longer bound by the registral limits if the brass section).

The fourth phrase does not expand so rapidly upwards (the previous rate of expansion would soon lead beyond the ranges of these instruments); it begins and

ends with the repeated note figures. It makes a feature of widening and thickening the textural space, incorporating the greatest density, and continues the expansion through the phrase to a new upper limit. It returns to a balanced combination of the two types of motion, repetition and registral leaping, using the leaping motion to to shift the upper limit of this material to new heights. This re-contextualises the leaping figures, which sounded novel in isolation in phrase 3, but here have a clear functional interaction with the repetition of notes. The way in which **E3** shrinks in register and number of parts in bar 64, while repeating notes in twos and threes as chords, is directly reminiscent of its climactic figuration in bars 37-8 (Introduction). This association lends this figure a feeling of high tension—supported by its reaching for the high E and by the ***mf<ff*** dynamic.

The fifth entry can almost only develop by adding new timbre, which it does with the strings in bar 71, but it also makes more prominent use of the rising minor second. The flutes then push the upper register again (with use of the rare rising major sixth), to F3 in bar 73. The material which starts in the first desk of the first violins with a new type of shape is a cross between the note-repetition type and the registrally mobile type. However, it is heard chiefly as a self-limited version of the mobile type. In other words, its ability to explore progressively higher registers is curtailed by note repetition (e.g. A-B^{b} and A-A# top line, 3rd and 4th beats) and the fact that the entries unfold downwards (and not upwards) as the texture thickens. This limitation of pitch range has its culmination in the downbeat of bar 73 where the violins sweep up to a high E3 (through a ***p*** crescendo-ing to ***mf***) which is itself simply a repeat of the goal of the fourth phrase, rather than setting out a fresh goal. The second violins then carry on with a note-repetition at a lower level, serving to give a flavour of the registral shrinkage which might imply a phrase ending similar to the previous one. The woodwinds return on the next beat to add repeated chords with a wider and thicker texture, reaching beyond the E limit with their high F. Thus the marked ineffectuality of the strings' **E3** phrase is belatedly repudiated by the return of the wind timbres. However this material's capacity for significant further development has been

impaired by the equivocal nature of the strings' gesture. The return of this material to wind timbres for the remainder of the section reinforces, albeit retrospectively, this impression of equivocation.

The next entry just two bars later repeats the rising wind gesture perhaps in order to confirm that this sort of development has reached an end for the time being, and then leads straight into the tranformation of rhythm in bar 75. This is by far the most radical thing to happen to **E3**, so much so that one might at this point be inclined to regard it as simply the appearance of new material. However, close listening and analysis will show that the linear intervals are much the same as before, and note repetition is also present in abundance, though in alternation. (This point is examined more fully below under Technique, Mosaic Texture).

In the remainder of the section, the appearances of **E3** show a fragmentation and separating-out of the by now familiar contrasting elements of note repetition (static) and registrally active movement (mobile), alongside a total of two appearances of the transformed version of the material. The separation of these qualities has the effect of making each appear rather aimless, since they depend on one another for the establishment and movement of textural goals, thus these aspects of the element become redundant, and it is only the transformed material which carries on into the next variation. The mobile material is employed for one final upward sweep, however, which transcends the registral limit of F3 by a semitone, in the final semiquaver of the Theme section.

Alternation and overlap of E2 and E3

There is a complex inter-relationship between **E3** and **E2** in the Theme section, shown schematically by **fig. C. 10.** It was already referred to how the two elements chiefly take turns, this contributes to the sense of stability which marks the Theme out in contrast to the Introduction. However, the relationship breaks down progressively after the climactic centre, and the transformed version of **E3** is most complicit in this new disorder. This is a prominent exemplar of what Beckstrom calls "divergent simultaneous flow."[82] It is central to the enrichment of discourse that Carter aims for, and is vital to the freeing up of variation structure itself which the piece as a whole exemplifies.

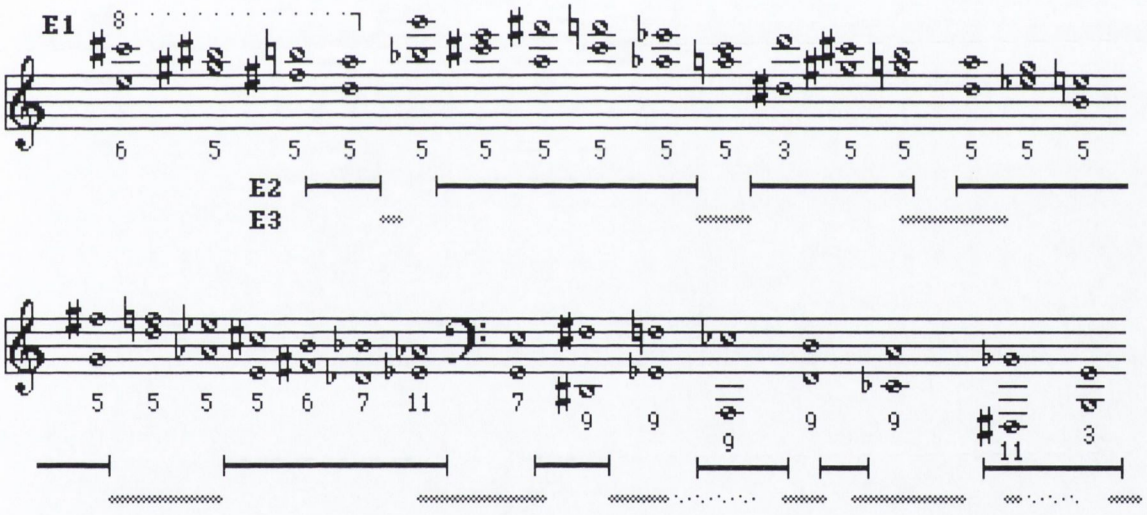


Fig. C. 10. Interaction of the three elements

It is also very clear from this diagram that **E3** is more active after the climax of **E2** and the registral hiatus of **E1**.

Beckstrom states:

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[82] Beckstrom, 57-64.

> Carter fashions a sense of continuation between the musical sections by using one of two methods. Either he blurs the line dividing one section from another with overlapping material or he presents a section as the consequent of its predecessor.[83]

He finds as I do that E1's excited state in the Introduction and calm state in the Theme is an example of the antecedent-consequent presentation, while the emergence of a new form of E3 is an example of the first kind.

Gestural overview and harmonic syntax of E1/2 in the Theme

Overview

There are several processes concerning E1 and E2 together which come to light in this examination of the Theme section. Firstly there is the linear contour of the 'theme' itself, that is, the upper line in the E2 material. This becomes organised into phrases which display a limited set of two generic characteristics, despite a lack of precise repetition of motif. The other two processes concern vertical harmony. The first of these involves the total number of semitones in the vertical dimension at any given moment: this appears to change according to the functional tendencies of the linear and rhythmic shape in the theme. The second harmonic process (which occasionally acts independently of the first) concerns the characteristic vertical sonority at phrase endings. A pattern emerges of phrases ending with a prominence of perfect fourths and fifths, or alternately ending with thirds and sixths in the final vertical sonority. The occurrence of fourths/fifths becomes associated with repose, while that of thirds/sixths becomes associated with dynamism. This aspext appears below under 'Referential Sonority'. Another aspect which contributes to the gestural path of the

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[83] Ibid., 15.

piece is the timbre of the theme material, which alternates between string and brass, but in a way which counterpoints alternation of musical materials.

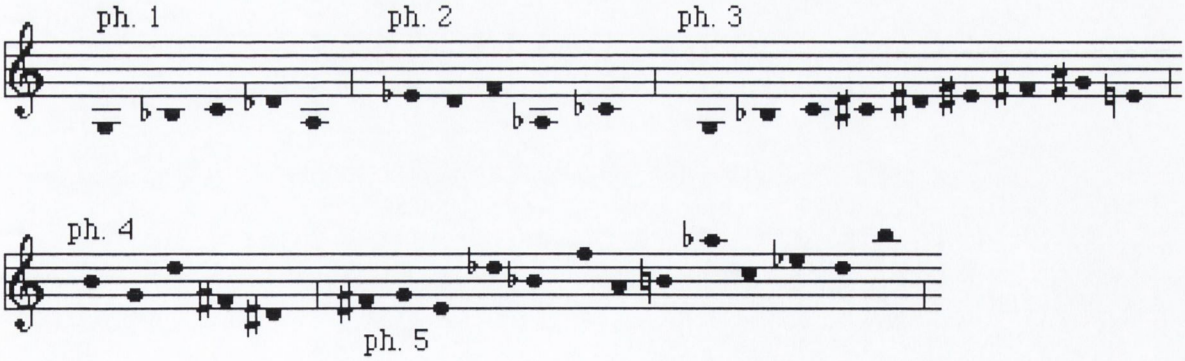
At the beginning of the theme section, the knowledge of the roles of the elements as they were in the Introduction colours the listener's expectations. As we pass from the Introduction to the Theme (which fact is only evident to the score reader, except inasmuch as the textures modify themselves), **E1** and **E3** retain their identity more completely than **E2**. Firstly, they can be understood as harmonically close to their counterparts. **E1** in the Introduction consists of dyads (usually in rhythmic unison) featuring pc sets (0,4), (0,5), (0,7), (0,9), which reappear faithfully in the Theme, with the addition of (0,11) (for a fuller account, see under the heading Ritornello A, in the Technique section of this chapter). **E3** preserves its characteristic speed, and again has a marked similarity of contour and harmonic content. But each of these elements also makes a significant turn in character: in **E1** this is brought about by the change in timbre, and more importantly, a rhythmic transformation from irregular to regular, while in **E3** there is a timbre/articulation change from muted, staccato brass to woodwinds and strings, marked *leggero* (sic).

E1 was previously heard (in the Introduction) to evolve from a state of relative calm (associated with rhythmic regularity and motivic stability) to one of increasing frenzy, in response to the presence (and development) of the other two elements, both inherently much more dramatic. Once it is laid bare in bar 39 it is able to re-assert its static nature. Owing to the duration of the dyads in bars 37-40, it is not able to do this until the strings take over, changing the durations from $2^1/_2$, 2 and 3 beats, to $6^1/_2$ and 5 beats (see score bars 39-43). Thus the strings take on the role of reinterpreting this material. It involves more than restoring the material to an original state, since timbre and motivic shape are new. In fact, since it is reduced to downward motion in five-beat units for several bars, one hears this material as reaching a hitherto unexpressed level of stasis. In this way the material completely transcends its previous function, while maintaining its identity. This reduction in energy permits it to become an

accompaniment for **E2** when that element appears in bar 44. This completes its change in function from having built and been at the centre of the climactic events to being a kind of answering commentary to **E2**, which now becomes the centre of drama and attention. But as I have already outlined, **E3** develops in its interjections to become more and more prominent, and eventually forms the starting point for Variation 1.

E2 reappears in bar 44, in an entirely new form, the theme. Rhythmic regularity is combined for the first time with a multipart texture capable of conveying chordal sonorities.[84] Nevertheless I regard this as part of **E2**, and not as something new, because it initially keeps within the rhythmic pulse range of **E2** and retains the string timbre, but the transformations which it undergoes are more profound than those for the other elements. Also, the new level of stasis set by **E1** might be thought of as affecting **E2** to justify its transformation, in a continuation of the cross-influence of elements seen in the Introduction.

I will proceed with a consideration of the first aspect of harmonic syntax, as demonstrated by the **E1/2** complex. To clarify the descriptions of this section the pitches of the theme are shown in isolation in **fig. C. 11.**



[84] **E3** has had up to 7-note vertical sonorities before, but in a rhythmically unstable context, built up as the coincidence of disparate registers and timbres (e.g. bar 37). The only substantial example of this kind of texture in the Introduction is the four-part string passage of bars 20 to 24, but this also stands apart as it is purely homorhythmic and thus lacks the contrapuntal freedom of the present texture. It is thus heard as an extension of the monophonic texture of the string material.

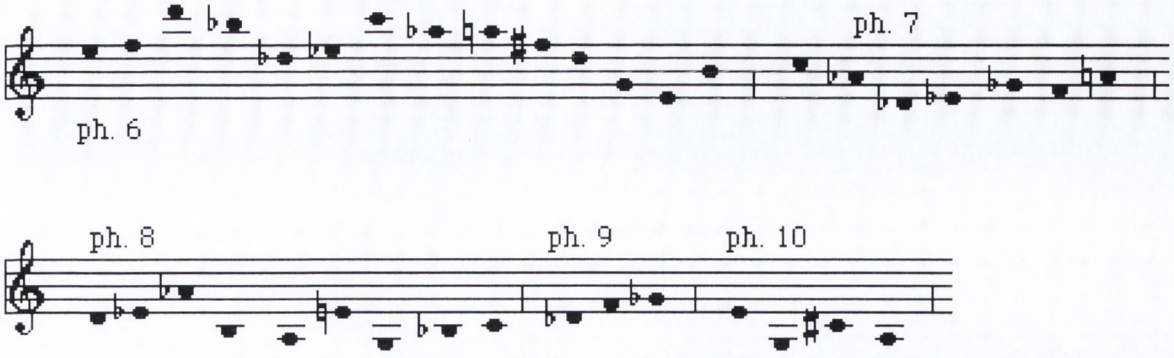


Fig. C. 11. pitches of the theme

Harmonic syntax

The rhythmic placing of the strings' **E2** interacts with the background **E1** to provide a resultant rhythm:

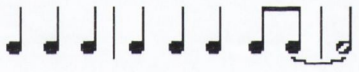


Fig. C. 12.

which is pushing forward in nature, hence dynamic. However, **E2** (the theme) can be considered on its own, yielding:

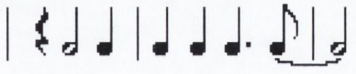


Fig. C. 13.

—a shape with a slowing down at the end, positing a tendency towards stasis. Thus a rhythmic counterpoint exists where two static elements combine to furnish a more dynamic totality.

The harmonic content traces a path that follows this dynamism/stasis shaping of **E2**. The principal harmonic quality of which the ear is aware here is the presence of semitone relationships, these rise and fall in number, mirroring the other shaping forces. Considering elements 1 and 2 combined, the first sonority is D^{b}-F#-B. When the violins and violas enter on G and F, bringing the first crotchet motion in the Theme, they create two semitone relationships. These notes are sustained when the first violins continue with the rising motif B^{b}, C, D^{b}; creating these semitone relationships: B^{b}-B-C, and with the bass on D^{b}, D^{b}-C (and, when the bass and violins swap, C-D^{b}). Thus on the second note of the melody (B^{b}), three semitone relationships exist, G-F#-F, and B-B^{b}, on the third the B-B^{b} ceases and is replaced by D^{b}-C and C-B, making four semitone relationships. The next beat, D^{b} in the melody, rearranges the C and D^{b} so that they are heard as a minor ninth; and one's awareness of this relationship is enhanced by the movement of the bass part. At this point the top parts (**E1**) shift and remove the G-F#, the F#-F, and the C-D, replacing them with D^{b}-D—a net loss of semitone relationships. the decline continues when the melody moves on to A and the violas move to E, erasing all semitone relationships. Perhaps this phrase, being the opening melodic idea of the Theme supported with well-placed chordal sonorities, is the place where the harmonic syntax for the section is espoused; if so, it promulgates correspondences between rhythmic movement and semitone relationships, and rhythmic repose with the absence or diminution of same.

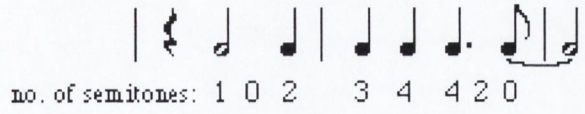


Fig. C. 14.

It should also be noted that rising motion in the melody is here associated with increase in semitone relationship content, while falling is associated with decrease. Therefore the syntax comprises a complex of parameters, with harmony, texture, rhythm and contour working together.

The next two phrases are a pair that occur one after the other without a pause large enough for **E3** to appear (note that **E3** has climaxed and is now reduced). The rhythmic counterpoint of **E1** continues to operate, placing a movement of this element on the second beat of bar 48.

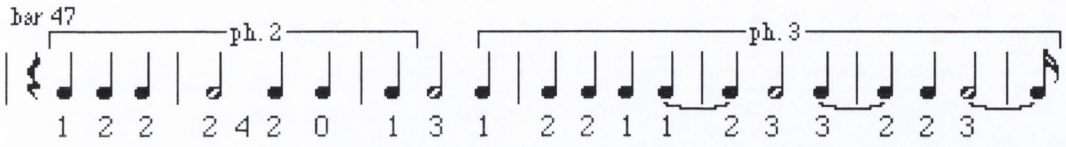


Fig. C. 15.

These two phrases adhere to the ground rules of the syntax, where rising melody implies increased semitone relationships, and falling melody decreased semitone relationships. In bar 47, where the strings enter with E^{b} and G^{b}, together with the upper solo violins they form a tetrachord containing one semitone relationship, G^{b}-G. The cellos and basses enter, adding two new notes, to create a second semitone relationship, E-E^{b}. The melody then shifts down by a semitone, losing this relationship, although it is replaced it with C#-D (see cellos). The melody then rises by a minor third together with all the other parts to form a new six-note chord containing the relationship F-F#-G, maintaining the total number of semitone relationships. Next the top pair of violins moves to increase the total number to four: D#-E-F-F#,—the melody sustains its F through this increase, so it is associated with a feeling of increased semitone tension. When the melody drops to A^{b}, the number of real parts drops to five for two beats, which reduces the harmony, and at the same time other parts move, reducing the total number of semitone relationships to two (E-F-F#). A harmony change occurs under the A^{b} as it did under the F, this time however, it reduces the semitone relationship total to nil, and it is only when the melody rises again to B natural (C^{b} in score) that one semitone relationship is generated (A#-B). Under the B natural, the basses and cellos move, again rearranging the harmony; they increase the semitone relationship total to three: C#-C-B and E-E^{b}.

So far the essentials of the syntax have remained remarkably constant, while in specifics there has been room for a great deal of change: for example, in melodic shape which has become more angular in the second phrase, and in the level of semitone-loading, which has not fallen at the end of the second phrase, but instead wavers more on the local level, in response to the rising and falling melody.

Focusing on the presence or absence of semitone relationships may smack of crudity, but it is not my intention to claim that this is of paramount importance in itself, but rather to highlight one way in which harmony can be said to be functioning in ensemble with other parameters (rhythm, melodic contour, etc.). It would be impractical here to examine every phrase from every possible angle in terms of sonority, but I believe I have pinpointed one of the key factors actually functioning to establish a consistent syntax.

This aspect of the syntax, if we observe the harmony and the melodic contour together, now evolves to extend beyond phrase boundaries, and serves to build a larger unit consisting of phrases 1-4.

For phrase three I will point out just a few of the striking examples of harmonic syntax (and how it continues to develop). I have shown already that these three phrases are part of a continuous process of registral expansion; a stepwise and hence highly audible process takes place between phrases 1 and 2 (B^{b}-C-D^{b} . . . E^{b}-F) which is pushed further in phrase 3 (F#-G#); at the same time phrase 3 functions to summarise the progress of 1 and 2, recapitulating their notes in one long rising melody.

The harmony changes in terms of number of semitone relationships yielded the figures 1, 2, 2, 1, 1, 2, 3, 3, 2, 2, 3. At first glance, having the three semitone relationships at the end seems incongruous, but in fact, this reflects the overall melodic drive of this phrase, which is upwards and hence counteracts the local drop in the melody. Also, at the end of this phrase the number of real parts is increasing from five to seven. In function, then, this phrase is open ended and pushing towards the central climax. It may also be suggested, though tentatively, that the fourth phrase

takes this openness as its starting point and closes it back down, as its harmonic profile, defined in semitone relationships, is 3, 5, 3, 2, 4, 3, 3, 1. This view is supported by the fact that phrases 1 and 3 show striking similarities in melodic shape, and phrases 2 and 4 form a satisfying pair with their skipping characteristic. Thus the four form a satisfying whole (note also that the register ceases to expand in the bass region in phrase 4) which suggests a feeling that a subsection has, to some extent, closed. There is also an alternation of motivic type and of timbre contributing to a sense of these phrases forming a unit. This is dealt with below (see **fig. C. 16.**)

It is therefore appropriate that in order for the Theme to continue meaningfully, some new gesture is needed to dispel this closure. This happens in the next two bars, where elements 3 and 2 occur against one another by overlap—destroying their previous alternating relationship which contributed greatly to the perception of the first four phrases as a set. This 5th phrase of **E2** is also of the skipping 3rds and 6ths type, which neatly confounds any subconscious expectation that the alternation of types would continue.

That phrase 5 is strongly developmental in function is borne out by its length. At nineteen beats it is nearly twice the length of all previous phrases (whose average length was eleven). It is articulated in two uneven halves of seven and twelve beats' length, by the violas holding the melody for seven beats and being superseded by the violins (in bar 59) for the rest. Both of these halves end with a high semitone relationship total and a leap upwards in the melody. This forward pushing and unresolved ending is reinforced in the violin half by a crescendo (all parts) through the phrase and the marking *f* < over the last note. This serves to leave the issue of further climax hanging in the balance.

After its fifth phrase the theme is absent for ten beats rather than the usual three or four, this allows **E3** in its 4th appearance to take the foreground, perhaps to allow a re-contextualisation and reconciliation of its dual nature to be impressed upon the listener (see above under **E3** heading). When the 6th phrase of the theme begins, the dynamic and registral levels are pushed to the next level as suggested by the trends of

five previous phrases (see registral and dynamic examples, figures **C. 2.** and **C. 5.**), giving the sense of smooth continued development which must at some stage arrive at an upper limit—a climax. There are two beats that are central to the climax, in bar 68 where the strings reach a fortissimo and the trumpets and trombones join in and take over the theme material. From that point on the theme recedes in register and dynamics. It is interesting to note that this point of transfer occurs on the 17th and 18th beats of this phrase. The previous phrase's melody extended for 18 beats, so there is a sense in which the the possibilities for further and further extension along with wider register and higher dynamics are cut off together—it might be considerably less effective, in other words, if the theme rose further and for longer than it does before being turned around. The fact that the turning point is marked by a timbre transfer is also highly significant: from the opening there has been a dialogue between string and brass conveying this material.

motivic type	A---------->	B--------->	A---------->	B-------->
timbre	string	string	brass	brass

Fig. C. 16. phrases 1-4

An alternation of motivic shape interlocks with an independent alternation of timbre.

The fifth phrase proceeds with motivic type B breaking the alternation, while at the same time the possibility of timbre alternation is upset, since here the brass and strings are blended (although in fact strings convey the melody line—a partial continuity of alternation pattern). In phrase 6 the strings begin, again with motive type B, and half way through the brass takes over, using some blending in transit, but completely taking over:

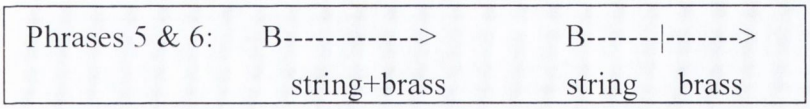


Fig. C. 17.

This returns the swap that occurred in the second and third phrases. It also perhaps implies that the tendency towards rapid development, or even breakdown, of order which is displayed in phrase 5 of the theme is further supported by timbre confusion.

Although motives are never established as actual shapes which recur, the material is clearly divided into melodic types: in the first four phrases I have identified 2 types: type A moves upward by steps and nearly always has a falling major third at the phrase end. Type B proceeds mostly by skips of 3rds and 6ths and occasional 5ths. This type goes on to be developed in phrases 5 and 6, the main development being the use of ascending 6ths, since descending 6ths were the only ones used in phrases 2 and 4. This allows high register to be opened up at a greater rate. In phrase 5 (which I have already said falls into two halves) the first half has two 6ths, one rising followed by a qualifying falling one. This creates a far less tense shape than that of the second half where there are two rising major 6ths, the second one higher than the first. This makes more manifest the connection between phrases 5 and 6 already noted in terms of phrase length.

Although a survey of the semitone relationship totals of phrase 6 does not reveal anything strikingly new, the procedure in relation to rising and falling melody being tied to rising and falling totals is maintained. Thus it may be said that this parameter—semitone loading—is not developed further for the climax, but maintained. This is in keeping with the density which remains at 6(4+2) (adding theme and **E1**). What *does*, however, give a feeling of harmonic intensification is the use of rests in bars 66 and 67 where firstly the bass drops out, then the alto follows,

then they both reappear together with a new registral depth being reached (in fact the lowest note in the Theme)—this is associated with the second leap of a major 6th in the melody and prefigures the climactic re-entry of the trumpets. This has a marked local effect on the semitone relationship totals as inevitably it must. Thus on the second beat of bar 66 there are three semitone relationships (A-A^{b}, B-B^{b}, A-B^{b}) on the next harmony change in the lower parts (upper parts change but there are still three semitone relationships). The bass drops out and the number of semitone relationships reduces to two (C-B, C-D^{b}). On the first beat of bar 67 the altos disappear and the violas and violins move to create a four-part sonority with the **E1** duo. This has *no* semitone relationships. When the missing parts return they create a six-part sonority with three semitone relationships (E-E^{b}, A^{b}-G, G-F#). The climax coincides with a narrowing of register and a reduction of semitone relationship totals. It might be thought that Carter is not controlling the semitone relationships here to achieve this sequence of events, but that the rests make a reduction of semitone relationship loading inevitable. This is tenable to a degree, but when the parts return they do so on pitches which create all three semitone relationships, so in fact we move from a minimum (zero) total to a maximum, which might never have happened had this been left to chance.

E1's registral hiatus

At this point in the piece, **E1** undergoes some radical changes concerning durations and register. There is a likelihood that these may seem on paper to be major; the durations of held intervals in **E1** extends from five to eleven beats (see duration numbers in **fig. C. 10.**), and even more drastically the material suddenly disappears from the treble register and reappears in the bass register, only to carry on as before with the same interval sequence (now in nine-beat durations). However, the

perception of **E1** has actually been steadily receding into the background since about the latter part of the theme's phrase 5, where their registers meet and swap. Thus throughout phrase 6 **E1** has to a large extent been integrated into the theme/**E1** complex (the two have always operated together in terms of harmony and rhythm wherever the theme has occurred). Therefore when the registral hiatus occurs, it goes virtually unnoticed (supported by the dynamic markings for **E1** which is ***pp*** *sempre* except for ***p*** during the climactic phrase—*not* after). Furthermore, the moment of transfer of register is not marked or emphasised in any way; it occurs, in fact as **E3** is falling away on the strings, about to be re-absorbed into winds. Therefore attention is drawn elsewhere. This development in **E1** is in many ways of secondary importance. One might even suppose that the jump in register occurs only to guarantee that we can hear **E1** (in the background) since if it continued through that octave it would perhaps be completely lost among the phrases of the theme. As it is it moves to the bottom of the texture, forming the bass line of the theme/**E1** complex; thus being registrally exposed until the end of the Theme. The registral hiatus is not the only development in **E1**; detailed attention to the contour of the top line reveals that there is a loose consistency of direction and interval content which is broken at bar 68 where the horns have **E1**. The contour has lost its tendency to move upwards by a minor 3rd from time to time, instead falling steadily in steps. While this is happening, the durations are augmenting. Perhaps this partial disintegration of consistency is in some way a response to the heightened tension of the climax with which it directly coincides.

When **E1** moves into the bass register it returns to steady durations (taking on a slower speed of nine-beat units; not ignoring the development of augmentation) and uses some upward motion (E-F#) to restore the missing contour.

Referential sonority

Another harmonic issue not hitherto mentioned but significant, is that of sonority, in particular at phrase endings. In phrase 1 of the theme the final sonority contains a perfect fourth between the bass and tenor, with a perfect fifth in the **E1** duo; with phrase 2 there are three semitone relationships coinciding with a preponderance of thirds—which (together with 6ths) usually occur when the phrase is in motion. This is in keeping with the fact that phrase 3 follows with no break in the resultant rhythm between elements 1 and the theme so that the next point of rhythmic/harmonic repose is the end of phrase 3. Here there are three sets of perfect 5ths in lower, middle and upper registers. Phrase 4 ends likewise with three sets of 4ths. Phrase 5 ends in a state of agitation (dynamic, registral, melodic and in terms of semitone loading) which is supported by a lack of 4ths or 5ths, again the sonority is mainly 3rds/6ths based. Phrase 6 however ends by way of a registral and dynamic falling off, and again the three pairs all project perfect 4ths. Thus the syntax extends to intervallic layout of chords, which can operate, if it chooses to, independently of semitone-relationship loading (which it does most noticeably here at the end of phrase 6 where there are three semitone relationships; this perhaps being the one thing which allows the movement to remain open, as an overbearing ensemble of closing factors would be detrimental to the continuance of the music).

The sixth phrase has, by virtue of its length, the longest continual descent of a melody line (high A down to E a compound fourth below). It occurs over twelve beats (including the turn to B natural at the end) and is thus a very substantial counterweight to the first half of phrase 6: in fact it is functioning in response to the combined tension of phrase 5 and half of phrase 6. As such it attempts to halt the developmental energy of these two segments.

In bar 73 phrase 7 of the theme begins—again there is a slight overlap with **E3**'s last phrase but not so much as to obscure any individual notes. The violas have the

melody (marked [A], ***mf*** cantabile) which is motivic type B. Significant by now is that this material avoids the interval of a major 6th, associated with rapid development. In doing so it comes close to resembling motivic type A (also associated with stability).

Harmonically it is possible to consider phrases 7, 8, 9 and 10 together. All of them are severely limited in terms of semitone relationship loading. True, the texture is usually in five parts rather than the six of the earlier phrases. However one must consider that five parts can provide up to four semitone relationships if ever required. So one can surmise that the intention is to provide a long passage of harmonic stability to counterbalance the build to the climax of phrase 6.

The patterns already observed in the first six phrases imply a number of goals which if fulfilled will provide a satisfactory sense of closure. These are:

1) perfect 4th/5th sonorities

2) semitone relationship total either low or nil and

3) descending shape in the melody.

Listening to each phrase ending in turn reveals:

Phrase 7

The sonority is thirds related, with one semitone relationship combined with rising shape in bars 74 and 75, giving the local impression of leaving a great deal open. However, in the global context one is very much aware that the short phrase length and the narrower register as well as the low semitone loading gives this phrase the impression of heading towards closure. The local gesture of rising motion etc. at the end serves only to provide a local link across to the next phrase: i.e., the feeling that this phrase has been broken off (the fact that the last note is a crotchet contributes directly to this, since longer held last notes have been the rule for this material).

Phrase 8

The melodic contour rises at its end, but goes into 4ths sonority with two semitone relationships; consequently it is unresolved. Also it is a longer phrase, followed

quickly by the next phrase. Again, in the overall context phrase 8 descends within itself and in comparison with previous phrases.

Phrase 9

The horns provide a 5ths sonority, but again in a chord loaded with semitone relationships. The whole of phrase 9 is shaped upwards, therefore unresolved, but descending in the global context which is easily perceived because phrases 8 and 9 are scarcely separated in time.

Phrase 10

This continues global descent, and restores falling motion. It refers to the falling major 6th of phrase 8 and before. The final fall is of a major 3rd and hence associated with earlier shape in phrases 1 and 3. Note also that this is the *same* major 3rd, C#-A from phrase 1. Finally in bar 88 the theme moves to a 6ths sonority which allows a zero semitone-relationship loading, and this chord is actually a transposition of the same zero loaded chord heard at the end of phrase 1.

Essentially the theme and element 1 have swapped function and have thus been integrated into a single complex.

Thus in phrase 10 all of the pitch requirements for closure are combined, together with dynamics, phrase lengths and register.

The use of pitches from phrase 1 in phrases 8, 9 and 10 is also thought-provoking. It is my belief that these too contribute on a subtle background level to a feeling of restored stability.

In summary, the last four phrases of the theme are four attempts at closure, each one being progressively nearer (although 9 is locally provocative) and awaiting phrase 10 to put all of the disparate requirements together.

Compositional technique in the Introduction and Theme

General overview

A discussion of Carter's compositional technique can not stem from a single central concept as it does in the case of Boulez and his application of serialism, because Carter does not tie the parameters together into a set of overarching principles in the way that Boulez does. Instead, the discussion of Carter's technique falls into a number of headings corresponding to separate musical areas. The scholarly sources on Carter's technique, including his own writings, point one in three distinct directions, giving rise to the following headings to be used in this chapter:

Mosaic Texture

Rhythm/Time

The time screen, stratification and metric modulation

Harmonic Method

The last category appears equally applicable to any composer, but it is treated by Carter in a highly personalised way. Before examining each of the categories as they apply in the Variations, it is useful to include a little background on how these

techniques began to take shape in Carter's music immediately before the composition of the Variations.

In "Music and the Time Screen" Carter gives the starting point for explorations of two phenomena in his music: metric modulation and mosaic texture (it will be evident on closer examination that the term 'tempo modulation', used by Schiff, is a more accurate description for the process, but 'metric modulation' has taken hold in the bulk of scholarship on Carter).[84] He cites 1945 as the time when he turned from 'populist style' (when he wrote music similar in style to Aaron Copland) and began "a reassessment of musical materials in the hope of finding a way of expressing what seemed to be more important matters—or at least more personal ones." By 1948/9 he had written *Eight Etudes and a Fantasy* for woodwind quartet and six of the *Eight Pieces for Timpani* which illustrate a preoccupation with the "minimal needs for worthwhile musical communication."

This reassessment of texture is illustrated in the 7th, 3rd and 4th Etudes: the pitch content in the 7th and 3rd was pared back to a single note in no. 7, and a single D major triad in no. 3. In no. 7 the study generates the musical discourse from tone colour of the four instruments and their eleven possible combinations, and from various types of attack from soft to incisive; in no. 3 the discourse is generated from changes in tone colour and emphasis of different parts of the chord.

The pitch content of the 4th Etude is much freer than in nos. 3 and 7, but the motivic content is nonetheless very restricted, being allowed only to take the form of a rising semitone in quavers, always followed by a rest or rests.

The first two cases (reminiscent of Ligeti's early piano pieces 'Musica Ricercata') neatly put the problem of harmony and pitch selection to one side while allowing the composer to elevate the importance of rhythm, dynamic and mode of attack as the only shaping forces. It is my contention that these Etudes point to the importance of the shaping potential of non-pitch parameters in Carter's subsequent music and

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[84] Elliott Carter, *The Writings of Elliott Carter,* Edited by Else and Kurt Stone (London: Indiana University Press, 1977), 343.

justifies a detailed examination of such considerations as part of any examination of his compositional technique.

The 4th Etude is the most interesting of these as a pointer to his technical preoccupations at the time. This Etude is an exemplary instance of texture as compositional material. The essential feature of mosaic textures is that there must be an instantly recognisable feature or set of features that recur frequently. Also the texture usually involves more than one or two instruments, in order to exploit the plasticity of the material. These aspects (mosaic texture and non-pitch shaping) will be dealt with below in specific reference to the Variations for Orchestra.[85] Carter himself made the connection between the structure of Etude IV and a 'mosaic', in "The Time Dimension in Music" (originally a talk given at the University of Texas, Austin) he wrote:

> This seemed to me to create a very interesting structure which I had never heard used before in music—a structure very similar to that of the parquet floor on which we are standing. You see, it is made of small blocks of wood—all of the same dimension.[86]

Metric modulation is a phenomenon which also appeared during this period of reassessment and has been a regular feature of his music ever since. In the Variations there are a number of rhythmic practices (of which metric modulation is just one example). Carter says:

> . . . with my 'Cello Sonata (1948), a whole collection of rhythmic practices began to be developed. Ultimately these were to expand the basic divisions and groupings of regular pulses to include polyrhythmic patterns and rubato, shaped into several methods of continuous change.[87]

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[85] I have taken the term 'Mosaic Texture' from David Schiff, *The Music of Elliott Carter* (London: Eulenberg, 1983), 58. Further justification of the validity of applying the term 'mosaic' to elements within the Variations is found where Carter applies the term to the Allegro Scorrevole section of his 1st String Quartet. See "Music and the Time Screen," *The Writings of Elliott Carter*, 350-351.

[86] "The Time Dimension in Music," ibid., 245.

[87] "Music and the Time Screen," ibid., 347. For more detail on this, see also Jonathan Bernard: "The Evolution of Elliott Carter's Rhythmic Practice." *Perspectives of New Music* 26, no. 2 (Summer 1988), 164-203. This is a detailed examination of Carter's rhythmic practices in the cello sonata, and the first and second string quartets.

He illustrates the idea of metric modulation with a passage from 'Canaries', one of the eight pieces for timpani, see **fig C. 18**., volume 2.

The effect in this extract is that the left hand has a steady pulsed alternation of B and E while the right hand has a graduated increase in tempo.[88] Rosemary Small has dealt with the Timpani pieces in detail in her thesis *Eight Pieces for Four Timpani*.[89]

The wider area of tempo as a structural element in Carter's music has been considered by Fredrick Dietzmann Geissler in a thesis entitled "Considerations of Tempo as a Structural Basis in Selected Works by Elliott Carter." This thesis links the evolution of metric modulation through nine of Carter's works, including the Eight Etudes, The Cello Sonata and the Variations for Orchestra.[90]

The use of metrically independent rhythms notated together allows for great independence of simultaneous strands of material, and freedom to overlap material from section to section while other events create contrasts which justify the perception of a new section. It is important to note that the point of this independence is not necessarily to create uncoordination for the sake of freedom—as it might be in aleatory music—but to enrich the possibilities for a subtler level of motivic interaction. He says:

> It should be obvious that the idea of allowing four (as in the case of the quartet) or two (as in the double concerto) different streams of music to be heard together in any one of the possible uncoordinated ways that have been used either by Ives or by others in recent years will, from the point of view I am describing here, produce a form of entropy, a degrading of the possibilities of communication, which to me have ever to be revitalized and sharpened. Furthermore, while such works as mine do not always receive performances that present clearly all the material, their relationships and expressive intentions, still, these are there in the score, and performers and listeners can gradually come to recognize them after successive performances.[91]

In dealing with the place of harmony and pitch selection in his music, in 'A Further Step' (1958), Carter says:

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[88] Geary Larrick Discusses metric modulation in the Timpani pieces as a whole in: "Elliott Carter and His Timpani Pieces." *NACWPI Journal* 36, 2 (Winter 1987-88), 22-5.

[89] Rosemary Small, "Eight Pieces for Four Timpani: Descriptive and Interpretative Analysis." (DMA diss., University of Hartford, 1987).

[90] Fredrick Dietzmann Geissler, "Considerations of Tempo as a Structural Basis in Selected Orchestral Works of Elliott Carter." (Part 2 of DMA diss., Cornell University, 1974).

[91] Ibid., 353.

> But today—as befits an art whose formative dimension is time—the techniques of continuity and contrast, of qualities and types of motion, of the formation and development of a musical idea or event, and in general the various kinds of cause and effect patterns that can be suggested in musical flow, occupy the attention of composers more than harmony or other matters all of which now become simply details in a larger kind of concern. . . . In this view, no item, no unifying principle or method of continuity is self-evident or considered a given part of musical process, but all are considered in the light of the whole and included or worked over so as to be able to fit the general scheme.[92]

Speaking more specifically of harmony, Carter wrote in 1960:

> Q. Does your music have any harmonic plan?
> A. A chord, a vertical group of pitches either simultaneously sounded or arpeggiated, like a motif, is a combination to be more or less clearly remembered and related to previous and future chords heard in the same work. Whether the composer is conscious of it or not, a field of cooperation with its principles of motion and of interaction is stated or suggested at the beginning of any work . . . once established . . . new aspects are revealed . . . (and) contrasting types emerge as the work goes along.[93]

Also speaking of harmony he says:

> A work whose world is not clearly defined loses a great deal of possible power and interest; . . . This extension of the traditional methods of coherence can rarely be attained nowadays solely by intuition, I think, because of the vast number of musical means, new and old, that we know.[94]

He goes on to describe a process of harmonic language used in his first string quartet (1951), where one of the all-interval tetrachords is used to link interval types together:

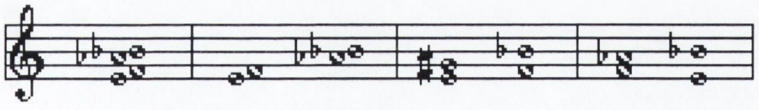

Fig. C. 19.

Thus ic1 is linked to ic2

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[92] Richard Goldman, "The Music of Elliot Carter," *Musical Quarterly,* 43 (1957), 151.
[93] "Shop Talk by an American Composer. " *The Writings of Elliott Carter*, 204.
[94] Ibid., 204.

ic4 is linked to ic5

ic3 is linked to ic6

> This chord is not used at every moment of the work but occurs frequently enough, especially in important places, to function, I hope, as a formative factor. It is presented in various kinds of part writing and interval combination, the number of notes is increased and diminished in it, in ways familiar to all of you.[95]

There are two principles that have operated in the harmonic technique of Carter's music since the mid-1940s: the use of large chords (often of all twelve notes) from which contrasting subset chords of smaller cardinality are extracted,[96] their contrasting nature usually supported by partitioning in timbre, tempo and registral spacing,[97] and the use of 'source-chords' from which can be extracted various intervals for their colour and contrasting potential (Schiff cites the First String Quartet (1951) as an example here). In order to codify his own methods, Carter compiled his 'Harmony Book' from 1963-1967,[98] in which he listed all the possible chords, noting their interval content and internal symmetries, if any. However, this undertaking postdates the composition of the Variations for Orchestra, and so the harmonic technique for the Variations is more likely to show points in common with the First String Quartet.

For more detail on how Carter handles pitch structure (and metric modulation) in the String Quartet there are ten theses listed in Doering (see 'String Quartet' in his index). The String Quartets have attracted the most interest from analysts, far more than the Variations for Orchestra.

I will now proceed to deal with the above techniques as they arise in the Introduction and Theme of the Variations for Orchestra.

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[95] Ibid., 199.

[96] Cardinality means the number of members in a set. Therefore it can be distinct from the term 'density'.

[97] This applies to the Concerto for Orchestra, the Third String Quartet and A Symphony of Three Orchestras, for example. For detailed accounts of these procedures see Schiff, 60-70.

[98] See William T. Doering, *Elliott Carter, A Bio-Bibliography* (London: Greenwood Press, 1993).

Mosaic texture

The strand of material known in my analysis as Element 3 (**E3**) falls into this category. The reasons why this strand does, while elements 1 and 2 do not, are as follows. Element 3 has:

i) a constant rhythmic value on every appearance (Nb, the quaver of bars 15/16 actually equals in speed the semiquavers of bar 29);

ii) freedom to dart from monophonic to multipart textures very rapidly; or viewed another way, each instrument is free to come and go independently and abruptly;

iii) a limited repertoire of intervals in the linear dimension: all intervals are less than or equal to 0,7 (close position) in width, with certain intervals being prioritised within this set;

iv) a freer repertoire of intervals in the vertical dimension.

Now while **E1** and **E2** often adhere to condition (iii), sometimes (ii), or even (i); they do not sound like mosaic textures, which require the constant presence of all the conditions combined. This plus the fact that element 3 is made up of the smallest rhythmic division found in the music.

To examine **E3** in more detail one must look at its pitch content. The eventual point of doing this is to see how tightly it is bound by internal rules, and by corollary how it stands apart from other elements in the piece.

Observations on the first two entries of **E3**: bar 15 and bars 29-31

Pitch-repetition is a strong feature of this material from the outset. Very often a change from the repeated pitch involves an initial leap of ic3, independent of the fact that the entries are staggered relative to one another. Subsequent leaps tend to be bigger, and final turns at the ends of entries are often of ic1.

In bars 15-16 there are six moments when the lines change pitch, therefore one can count six linear intervals. Similarly, in bars 29-31 there are a further twenty-five linear intervals. One can add all the intervals used in the different lines (not therefore including vertical pitch combinations) in order to examine if any are privileged in this material at the outset.

Bs. 15-16:[99] B^b trpt 1: (ic)**3-5-1**; B^b trpt 2: **3-2-1**
Bs. 29-31: hn 1: **4-3-1-3-5-1**; hn 2: **4**; hn 3: **4-2-4-1**; hn 4: **1-1**; B^b trpt 1: **3-6-1**; B^b tprt 2: **3-6-1**; trb 1: **3-1**; trb 2: **3**; b.trb: **2**
Together this gives an interval vector: [10,3,8,3*,2,2] each one out of 31 moves.
(* counting the unison horns as one interval movement)

Here one can clearly see that ic1 and ic3 are quite heavily prioritised—this is a feature which will reappear in the examination of harmony and pitch selection later on. This fact, combined with characteristic linear shapes and size of interval (that no interval greater than (0,7) is used), lends a tight control to the character of this material.

Vertically, there are a number of important facts to note. The 1st phrase furnishes one trichord 0,1,5 [100110] and three dyads ic4, ic3 and ic5. The sum of all vertical intervals is therefore [101220]. The second phrase has many more parts, furnishing:

trichord	0,1,5	[100110]	dyad	2	[. 1 .. ..]
dyad	0,4	[. . .1 ..]	tetrachord	0,1,5,6	[200121]
pentachord	0,1,4,5,7	[212221]	dyad	0,1,4,6	[111111]
"	0,1,3,4,6	[223111]	"	0,1,2,6	[210111]
dyad	3	[. .1 .. .]			
Sum:		[9,7,8,8,7,5]			

So the vertical combinations result in fairly even distribution of intervals, in contrast to the linear material.[100] Above I referred to Carter's comments about the use of the all-interval tetrachord in his string quartet:

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[99] For the notated version, see also **fig. C. 13**. Below under harmonic method.
[100] However, it will be shown below that the lines can be shown to derive from the all-interval tetrachord and its near 'family', see under harmonic method.

> This chord is not used at every moment of the work but occurs frequently enough, especially in important places, to function, I hope, as a formative factor . . . the number of notes is increased and diminished in it, in ways familiar to all of you.

the observed harmonies here have a number of features relating closely to the above: note the use of the all-interval tetrachord at the most climactic moment of these two phrases; it is possible to view (and I believe Carter did so when he wrote these bars) this moment as being led up to and away from by other harmonies which are modified versions of that chord. Or in other words he is adumbrating the clarity and balanced interval content of that chord.

Thus:

0,1,5 is a subset of 0,1,4,5,8.

0,1,3,4,6 is a superset of 0,1,4,6.

The 3 tetrachords 0,1,5,6; 0,1,4,6; 0,1,2,6 all share 0,1,6 as a common subset.

Many other links could be enumerated.

Another important way in which the mosaic texture identifies itself is the use of characteristic direction at certain points. By this I mean that the linear tendencies already mentioned (fall of ic3, rise of ic5/6, ultimate fall of ic1) are roughly mirrored by lower and inner lines, which have some rising ic3s and use the ic1 for the final move. This creates a compellingly controlled voice-leading character to the texture as a whole.

Indeed, this feature could be said to be indispensable to the definition of mosaic texture, since along with characteristic 'rules' for linear shaping, there must be a resulting shape with a logic of its own if the analogy from visual mosaic is to mean anything.

The next appearance of **E3** in bar 32 (phrase 3) sees the material evolving further. Most of the essential features, timbre, rhythm, speed and contour, remain the same. However, already some aspects are developing: previously, individual lines tended to begin with repeated notes. Here this is reduced to a minimum; the first two entries of

the phrase as a whole have repeated notes, which gives the material a more restless feel relative to the first two phrases. The use of mirroring ic1 movement in the upper and lower lines (e.g. horns' 3rd and 4th notes) is not restricted to the phrase climax, but occurs more often. This promotes a restless effect, since the 'climactic gesture' is now ubiquitous.

Another way of understanding the relationship of the lines of this phrase with the previous phrases is to view the hn 2 entry as being a version of the very first trumpet entry, and the trpt entry of bar 29, with the initial ic3 removed; i.e., with the first set of repeated notes lopped off. What remains then resembles closely the contours of earlier phrases. A similar comparison can be found for trpt 1's line (bar 32), and for hn 1 in bar 33. This kind of isomorphic comparison can be justified by the mosaic concept; that fragments broken irregularly will still contain the tell-tale repertoire of repeating units despite the fact that orders of events can be juggled and pieces may be missing.

Fig. C. 20. in volume two details all the isomorphisms of the first four entries of the mosaic texture.

Returning to the vertical sonorities of phrase 3 (bar 32), they are as follows:

dyad	0,3	[..1...]	dyad	0,4	[...1..]
dyad	0,5	[....1.]	dyad	0,5	[....1.]
trichord	0,2,7	[010020]	trichord	0,2,5	[011010]
tetrachord	0,1,6,7	[200022]	dyad	0,5	[....1.]
tetrachord	0,2,4,7	[021120]	dyad	0,2	[.1....]
tetrachord	0,2,5,7	[021030]	dyad	0,4	[...1..]
Sum: [2,7,4,3,13,2]					

This reveals a new set of emphases, on ic2 and ic5. The chords 0,2,7; 0,1,6,7; 0,2,4,7; 0,2,5,7; and 0,2,5 all make ic2 and ic5 prominent.

The vertical sonorities of this phrase have veered away from harmonic equality—it might be argued that this is a reflection of its developmental or unsettled character, observed in its linear variety.

The sum of linear ics for this phrase is [10,5,2,2,2,0], which shows a marked preference for ic1 and ic2. This is a product of greater use of lower-part contours (see appendix, **Fig. C. 20.**) and of more general use of the i.c 1 mirror gesture referred to earlier.

The next subphrase (bars 33 and 34) marks something of a return to the character of phrases 1 and 2: observe how the horns, trumpets and trombones all feature the 'mirror' ic1 gesture in upper and lower parts. The vertical sonorities of this subphrase are as follows:

pentachord	0,1,3,6,8	[122131]
dyad	0,3	[..1...]
pentachord		
plus dyad	0,1,3,6,7 + 0,5	[212122]/[....1.], [101]
	or 0,1,3,4,6,7,9	[336333]
tetrachord	0,1,2,6	[210111]
pentachord	0,2,4,5,8	[122311]
tetrachord		
plus dyad	0,1,3,7 + 0,4	[111111]/[...1..], [1]
	or	[224232]
dyad	0,3	[..3...]
dyad	0,5	[....1.]
Sum of intervals:		[9,10,16,10,12,8]
(Quite an even distribution, some stress on ic3).		

This is a marked return to interval equality, with one all-interval tetrachord appearing at a stressed point in the trumpets/trombone group. Other chords such as 0,1,3,6,8, 0,1,3,6,7 and 0,2,4,5,8 are close relatives of the all-interval tetrachord, with 0,1,3,6,7 being an obvious superset.[102] 0,1,2,6 is a modified version of the a.i.t, with one note moved.

An interesting comparison of linear content is seen for this phrase in **fig. C. 20.** (see appendix), while a summation of linear interval content will yield the vector [942541], which is similar in some ways to previous linear ic sums:

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[101] The instrumentation allows these divisions, which throw light on the chord derivations.

[102] In fact, David Harvey points out that it is a combination of both forms of the a.i.t. (Harvey, 219).

phrase 1	[212010] - out of 6
phrase 2	[825412] - out of 22
(these 2 previously given together as [10,3,7,4,2,2])	
phrase 3	[10,5,2,2,2,0] - out of 21
phrase 4	[942541] - out of 25

Together these show that ic1 is always by far the preferred interval, while other intervals such as ic2, ic3 and ic4 can become common for one phrase, yet be less common in the next phrase, thus:

ic3 in phs 1 and 2
ic2 in ph 3
ic4 in ph 4

These facts are a result of i) the choice of contours (e.g. the third phrase preferred the lower line contour, utilising ic1 and ic2 the most) and ii) variation of real interval size when following established contours, e.g. the third phrase trumpet C - E - E^b - F follows phrase 3 horn E^b - G - F# - A but the last interval is compressed from ic3 to ic2.

We now have quite a satisfactory view of the internal consistency of mosaic texture. There are one or two features that were passed over while considering the pitch aspects of the material. Notably:

i) this material is confined to brass in the Introduction, but within that group there are two subgroups operating, 4 horns against the trumpets and trombones (2 + 2). They work in alternation at first, and later combine for larger gestures.

ii) I have not dealt here with registral compass. A glance at the score (bars 15-16, bars 28-33[1]) shows that for the first three appearances the register is kept within a narrow compass. This is easily done since the structure of the material has built-in limits as already detailed. The fourth appearance widens the bass region while keeping the upper levels well within earlier ambits. My analysis has already shown how the register of this material responds and contributes to dynamic processes which work across whole sections, and involve the three elements inter-dependently; therefore, from a technical standpoint, one can postulate that the material was designed in order

to have the flexibility to follow the needs of pre-determined structures. This flexibility is really at the heart of 'mosaic' texture as a principle, since the material lends itself to expansion in several dimensions either separately or together: extent in time, width in register, and density of parts, while timbre and dynamic level are adaptable parameters. Thus the material can be very forceful or very calm, or move from one to the other, with very little risk of losing its sense of identity in the listener's ear. Without showing it here in the same level of detail it is possible to state that the material of **E3** continues to display many of the same features as found heretofore; an examination of the score from bar 35 onwards quickly shows how the three contours furnish the majority of further shapes, while essential principles such as note repetition (which returns strongly in bars 35 to 38, for example) and constant semiquaver rhythms, along with the 'mirror' ic1 gesture for local endings, remain.

When **E3** transfers to woodwind instruments in the Theme some of its aspects change. In its contours, leaping is used in about equal measure with stepwise motion in order to furnish more rapid ascent or descent, while, as if to counterbalance this new fluidity, the option of repeated notes is used more frequently. However, harmony and linear interval repertoire continue to resemble closely previous models.

The rhythmic transformation in bar 76 is by far the most radical change for the material; and as such constitutes a moment where I asked myself "is this really a continuation of the same material?"—despite the fact that the ear intuitively had already decided that it was. Because of this, I provide a close examination of the first example of the transformed material in **fig. C. 21.** (see volume two).

Here are the changed aspects:

1) the even semiquaver rhythm is abandoned;

2) the entries tend to last for approx. 6 beats—previously around 4 was the maximum;

3) actual note repetition is no longer used;

Here are the similarities:

1) the new rhythm is also a constantly repeating unit;

2) the entries are still capable of ending abruptly—note the availability of the dactylic weak stress;

3) note repetition is present, though in a disguised form; e.g. D^{b}-C-D^{b}-C;

The linear interval content is:

top line	[21, 0,17,3,1,0]
middle line	[7, 7, 6, 2,0,0]
bottom line	[11, 3,12,4,0,0]
sum	[39,10,35,9,1,0]

As with earlier manifestations of this material, here one can see emphases on ic1 and ic3, with the middle line also using a lot of ic2, indicating its strong relatedness to the lower part contour referred to earlier. The general rule of almost exclusive use of close position leaps (i.e. ic4 will appear as a major 3rd but not as a minor 6th etc) is adhered to.

A prominent change that does occur in the linear dimension is the extreme scarcity of ic5 and absence of ic6, which constitute an intensification of a principle already observed earlier.

The vertical sonorities are as follows:

dyads: ic3, ic5, ic3, ic5, ic5,
then trichords: 0,3,7 [001110], 0,3,6 [002001], 0,1,5 [100110],
0,3,7 [001110], 0,2,5 [011010], 0,2,5 [011010],
0,2,6 [010101], 0,2,5 [011010], 0,2,5 [011010],
0,2,7 [010020], 0,2,5 [011010], 0,3,7 [001110].
then dyads: 2, 5, 3, 5, 3, 5, 4
followed by a period of monophony,
then dyads: 2, 2, 4, 5, 2, 1, 4, 4, 2, 1, 5.
The sum of vertical sonorities: [3, 12, 14, 9, 19, 2]

ic5 becomes very frequent here (usually as a perfect 4th in close position, sometimes perfect 5th), while ic1 is very rare. This is very similar to the vertical analysis from bar 32. Thus the linear and vertical interval content, though strikingly independent from each other, have strong precedents in this material's earlier phrases.

Rhythm/time

With regard to the reassessment of his rhythmic technique; this appears at its most complex in chamber pieces such as the string quartets, since for orchestral textures there is a far greater danger of loss of rhythmic accuracy emanating from the players. Carter confirmed this:

> The complete change of aim and direction, amounting to a private revolution in musical thought, which went on through all these years in my chamber music, hardly found its way into my orchestral music until the two concertos [referring to the Double concerto for harp and piano (1961) and the Piano Concerto (1965)]. There was good reason for this decision since I was—and am still—made painfully aware with each orchestral rehearsal that the type of writing found in almost every measure of my chamber music could never come out under American orchestral conditions that I know or imagine.[103]

Certain terms have become current in the discussion of Carter's music: 'time screen', 'metric modulation' and 'stratification' are three that refer to rhythmic aspects in his music.

'Time screen', the most esoteric term, refers to the fact that for a composer time is analogous to a canvas for a painter, in the sense that what is put on the canvas can convey depth, which is not a real property of the flat surface. In the same way the composer can convey a psychological impression of the passage of time which works independently of the chronometric time during which the work takes place. Carter uses the term in this general sense.[104] Schiff, on the other hand, usefully enlarges the term:

> Every work is based on an ordered articulation of its 'time screen', which is the sum of its rhythmic activity. The boundaries of this screen are the fastest and slowest tempi to be used in a piece; these are determined by the nature of the instruments and ensembles deployed.[105]

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[103] "The Orchestral Composer's Point of View." *The Writings of Elliott Carter*, 291.
[104] See "Music and the Time Screen," ibid., 343.
[105] Schiff, 34.

However, as used by Carter, the term is a general one which acts as a portmanteau word for 'metric modulation', 'stratification', 'mosaic' and other concepts such as the interplay of strata already dealt with to some extent above.

From a purely technical viewpoint one can examine the rhythmic language and use of rhythm and time in order to see what is achieved and how effective it is.

Stratification is the first of these issues to arise in the piece. The first four bars set out three chords which are differentiated in timbre, density and register (I leave the question of harmony aside for the present). This will establish the pattern of stratification for the remainder of the Introduction and Theme (and by implication, the whole work; the process of differentiation and how it is broken down and neutralised in the Variations as a whole is outlined in Schiff, 174-190.

As observed in my analysis, the woodwind carries the **E1** material for the Introduction which switches to violin solos at the beginning of the Theme. This is mostly conveyed in duets, always homophonic, legato, and in long rhythmic values, which as the analysis showed, can quicken in response to surrounding activity. Generally, stratification has been observed in detail in my analysis where I used the terms **E1**, **E2** and **E3**; therefore I am concerned here with showing just a few examples of where and how it operates, and with observing Carter's technical approach. The differentiation of musical character is achieved through an ensemble of musical parameters, of which rhythm is just one; again, examples of how that is done were furnished in the analysis, so an examination of the rhythmic values of the strata alone will serve here to illustrate the technical question of how Carter manipulates time, for separation *and* interaction of elements. The use of metric modulation is an aspect of this interplay of strata, since it allows one strand of material to accelerate or decelerate (i.e. change its functional implications) while another strand can continue without changing speed (or function, though it is free to respond later).

Looking at the graph in **fig. C. 22.** (see volume two) one notices that in the introduction the speeds of the different elements are fluid: it was stated earlier that **E3** has very little change of rate, while **E1** and **E2** are quite elastic. However, the most

striking and obvious fact is that the three elements are 1) slow, 2) moderate and 3) fast, and that this basic relationship is maintained throughout the Introduction despite much detailed change of rate—especially in **E1**, and it is easily observed in the Theme also, where the elements 1 and 2 become much more regular in speed.

In effect, they occupy three independent ranges of speed. What precisely these are can be defined:

E3 simply exists in three forms: 1) held chords in bars 3, 11 and 14; 2) mosaic texture which first appears as ♪=486, and 3) in every subsequent appearance ♪ = 540; the closeness of these two values can be read as an attempt at making the two speeds identical within the constraints of the surrounding textures and the constraint of writing for orchestra.

In **E1** the quickest values occur during the Introduction: ♩ or ♪♪ =135. This element treats that speed as an upper limit, reserved for the moments of greatest tension. The frequency of various values can be best observed in tabulated form:

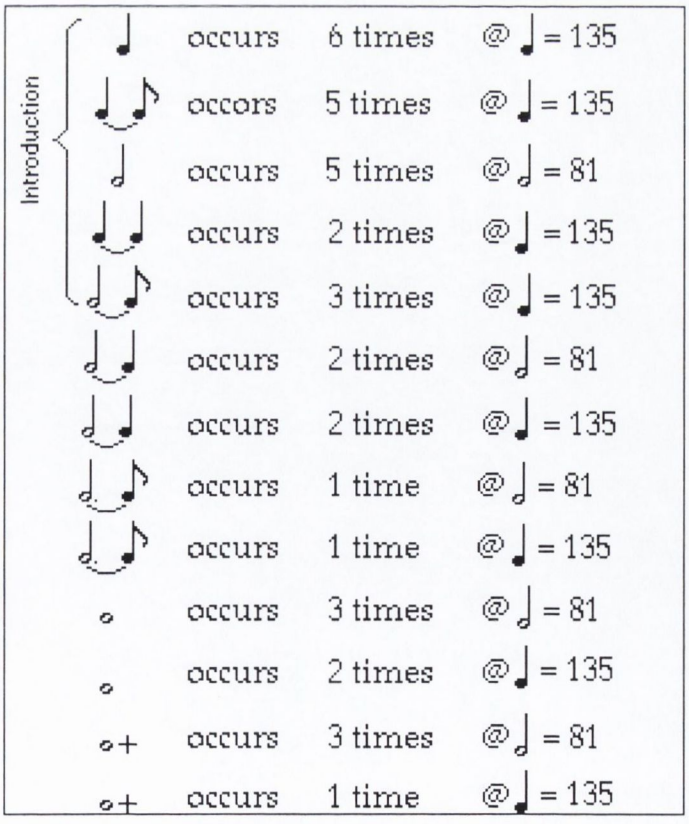


Fig. C. 23. stratification of rhythm

Which gives 18 values of or shorter, and 18 values of or longer, implying that longer values greatly predominate since they take up much more time. In the Theme the long values become the only values (the stratification moves to a purer state):

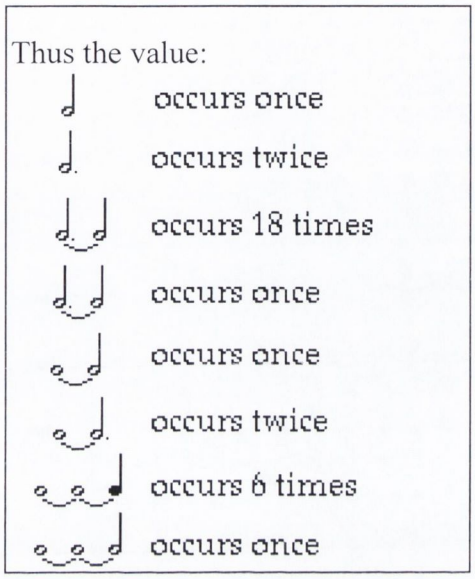


Fig. C. 24.

E2 exists at = 324, generally moving steadily in quavers, with some held notes (e.g. bar 14). It also exists at = 270 (b.22), at = 405 (b.26) and = 135 (bars 34, 37 and 38). Therefore it is within the range of pulses from 135 per minute to 405 per minute (this applies to the Introduction). During the Theme, **E2** generally moves in crotchet values, at 90 per minute, with no shorter values, and some longer (up to dotted crotchet, which is rare), with the final note (six of these crotchet beats long) standing out as an exception.

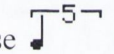
In conclusion, in the Introduction a total stratification exists in that elements 1, 2 and 3 each have separate and distinct ranges of speed: **E1**, c25 to 135 pulses per minute (ppm), **E2**, 135 to 405 ppm and **E3** at 486 and 540 ppm. **E2** does break into

the range of **E1** in bar 14, but at this point **E1** is keeping at much slower speeds (see bar 14 on **fig. C. 22.**).[106]

E3 is limited to 486 and 540 ppm when the mosaic texture is active; however, my analysis included some held chords in **E3**, which occur before the mosaic texture enters; these are anomalous with the strata system. One may theorize that their function is to establish characteristic vertical sonorities for the mosaic texture before the stratification process actually emerges. Once the stratification is established such chords cease to occur.

As the analysis found, timbre also aids the stratification of material, but not across the broader structure, since there are many occasions when two timbre groups share material belonging in one rhythmic and motivic stratum.

There are two examples of metric modulation in these two sections (there are many more in the Variations as a whole):

1) bars 20 to 24: **E2** promulgates a new pulse  where = 270, against the general = 54, and by bar 24 **E1** has had to adjust to values derived from = 270 (though not allowing actual quavers, which would take it outside its range).

2) from bars 37/38 to 46: **E3** is constant at 540 ppm while the other elements change their notation; **E2** moves from = 270 to = 90.

The most long ranging of these metric modulations is the second one (forming a bridge from the Introduction to the Theme), since **E3** clearly exists at the same rate for most of the Introduction and Theme while **E1** and **E2** have separate rates for the Introduction and for the Theme.

The first metric modulation is more localised in effect, for while **E2** is an agent of change in the notation of pulse at bars 21-22, there is no single goal achieved by it. At the time where it is directly evident, bars 20 to 24 inclusive (see **fig. C. 22.**), only **E1** is present, but while **E1** did have a set pulse in bars 7 to 12, this has already

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[106] Lerdahl points out that "Complicated rhythms can cancel as well as create structure. An interesting case is Carter's practise of establishing two or more simultaneous tempos. Each such tempo corresponds to a single metrical level, or pulsation, but usually does not evoke a hierarchy of strong and weak beats. . . . Musical cognition has a bias for hierarchical organisation." Lerdahl, "Cognitive Constraints on Compositional Systems," 106. I don't believe that this is a serious problem in the Variations.

become somewhat submerged by the creation of an unpredictable sequence of values from ties in bars 13 to 19, so **E2** is unable to act as a bridge for a meaningful change of pulse in **E1**, which continues with further unpredictable tied values; these tend to become shorter and tenser approaching the climax (which could have been achieved without the notational change). The effect of the change in **E2** upon itself is to allow a more flexible approach to pulse ratios, but does not facilitate any direct process of acceleration or ritardation.

It is, in fact, the independence of goals being pursued by the elements that detracts from the structural importance of the metric modulation, so we see here stratification working against metric modulation, where we might usually see them as corroborative techniques, since both aim to facilitate the avoidance of coordinated movement.

Harmonic method

Two of Carter's statements relating to harmony were quoted above:

> . . . a field of cooperation with its principles of motion and of interaction is stated or suggested at the beginning of any work. . .

and

> This chord is not used at every moment of the work but occurs frequently enough, especially in important places, to function, I hope, as a formative factor. It is presented in various kinds of part writing and interval combination, the number of notes is increased and diminished in it, in ways familiar to all of you.

Together these two ideas furnish the starting point for an exploration of Carter's use of harmony. The first point suggests that a close look at the harmony of the opening will be crucial to understanding the language of the rest of the piece; while the second point gives us a key to the kind of manipulations we may expect: i.e. that

subset/superset relations play an important part in the harmonic method and hence analysis.

In the second bar the strings hold a six-note chord. This chord is 6-Z12, 0,1,2,4,6,7. Its interval vector is [332232] which is the most evenly balanced in interval content of all 27 possible six-note chords.

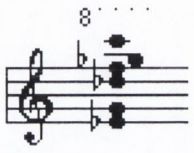

Fig. C. 25.

The contiguous intervals reading upwards are: 4-6-4-1-6, so it is quite likely that Carter seeks to rebalance the vector which is weak in these intervals. This chord, together with the dyad in bar 1 and the tetrachord in bar 3 forms a twelve-note set spread across the musical space. The six (complement) notes from bars 1 and 3 form 6-Z41, a different six-note chord whose vector is also [332232]. We see that Carter's research into chordal qualities had advanced to a certain stage already, and that interval equality is a primary technical harmonic issue. These bars demonstrate a partitioning of the registral space, with woodwind in the centre, strings very high and brass in the lowest position. This exact order is not maintained in the music that follows, but the three elements do generally continue to stay out of one another's registral space. The very high C of the string chord is a limit which is only breached at the start of the Theme section. We see control of upper register tightly controlled, in all the strands of material, in such a way as to create and release tension.

Equality of intervals can be epitomised in the analysis of tetrachords, since only chords of four notes have exactly six interval relationships, and as there are six intervals, excluding inversions, only tetrachords can achieve complete interval equality. As this is clearly a central technical concern, I will give the tetrachord a special position in this discussion of harmony. In effect I wish to fashion a 'lens'

through which to examine the music.[107] Chords of three to six notes are here scrutinised in terms of their proximity to the all-interval tetrachords 4-Z15 and 4-Z29. We may also expect some material to diverge from equality, to assert in harmony the process of stratification. Some examples of this will appear below. Exploration along these lines follows naturally from what is known about the First String Quartet.

In music composed *after* the Variations, Carter explored the ordered use of *all* possible trichords (most clearly demonstrated in his Piano Concerto (1964)), while still later works have derived harmonic structure from the orderly use of all possible tetrachords. These developments are paralleled in the gradual compilation of his 'Harmony Book', where Carter numbered and analysed all possible chords of 3 to 8 notes.[108] But since he started the Harmony Book in 1963, we should not expect to find such a thorough pan-chordal language, yet we can reasonably examine the music for pre-cursors to that approach, as well as developments from the pan-intervallic language of the earlier string quartet.

In the harmony of the string quartet (1951), a rich chord selection existed which included many related sonorities. Schiff (p.64) gives an example from the beginning of this piece, showing instances of the all-interval tetrachord 0,1,4,6.[109] It is evident from these opening bars that a selection of other sonorities are also permitted. For these, Schiff postulates a collection of chords related to 0,1,4,6, created by moving one pitch class while the other three remain in place thus:

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[107] A precedent for this kind of procedure may be found in Jonathan Bernard's use of trichords in the analysis of Varèse's music. See Jonathan W. Bernard, *The Music of Edgard Varèse* (London: Yale University Press, 1987).

[108] These are listed up to the six-note chords in Schiff, 324-5.

[109] There are two distinct forms of the all-interval tetrachord, 0,1,4,6 and 0,1,3,7, of which Carter here chose only the first. According to Schiff, he was reluctant to use the second form at first "because of its strongly tonal feeling; but it came into play in the Second Quartet and Double Concerto."

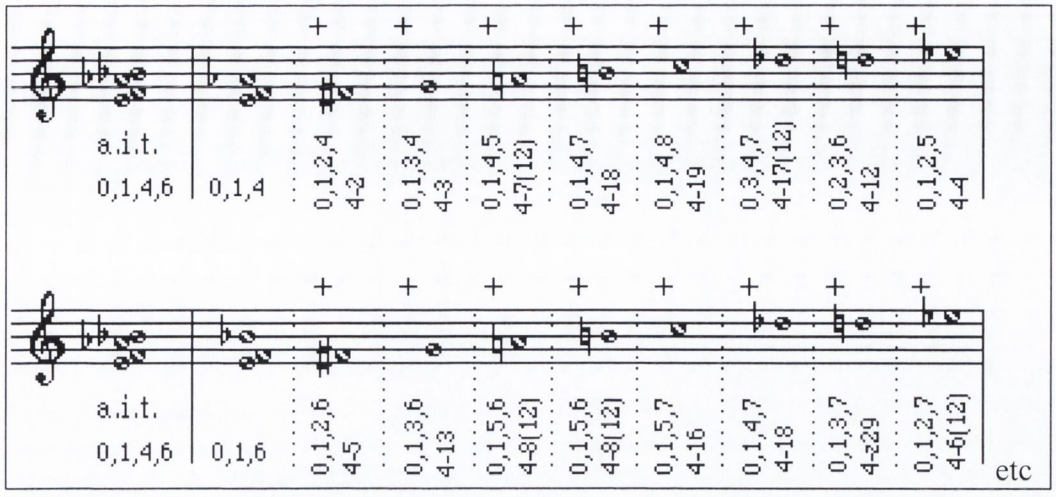


Fig. C. 26.

The above is the first 16 such chords; there are 16 more, a total of 32, which I will simply summarise: of the 29 possible tetrachords (see Forte p. 179) 24 are produced in this way (taking account of the fact that several of the 32 are duplicate pairs). This means that it is possible to construe connections out of nearly any succession of four-note segmentations.

Accepting that there is a wide variety of tetrachord types at all times in the string quartet, and that 0,1,4,6 does in fact occupy a central function, one can posit a family of related chords based on similarity of interval vector: so as the all-interval tetrachord acquires its place due to its interval vector [111111]. One can place other tetrachords in terms of proximity to vectoral equality, i.e. a vector of [112011] is one step from the a.i.t., while [004002] is four steps away. The family of immediate interest is therefore those of one step distance, of which there are nine. I will call them Related Chords; (R) for short. **Fig. C. 27.** (see volume two) gives the full list of tetrachords and the members of (R). These are:

4-4 [211110]	4-12 [112101]	4-16 [110121]
4-5 [210111]	4-13 [112011]	4-18 [102111]
4-11 [121110]	4-14 [111120]	4-27 [012111]

This is an important observation which will be of use as an analytical tool later.

If we take **E3** as an example of material, how is the pitch choice controlled? Already it has been noted that the horizontal pitch selection is more tightly controlled than vertical. Interval size (in the horizontal dimension) is limited and certain contours recur. The frequent use of note repetition makes the horizontal harmony more easily perceived than in other textures, while the mosaic aspect of entry/exit for different parts makes the vertical harmony less prominent in perception. So I examine horizontal pitch selection first. I refer again to the first phrases of **E3**:

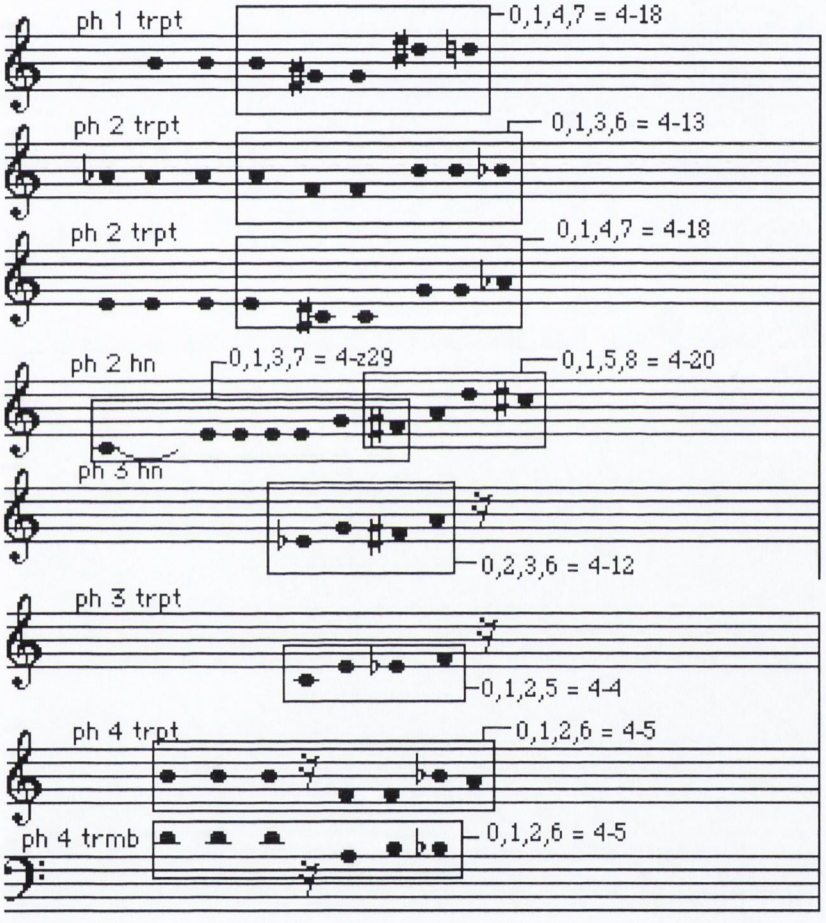


Fig. C. 28. linear sets in E3

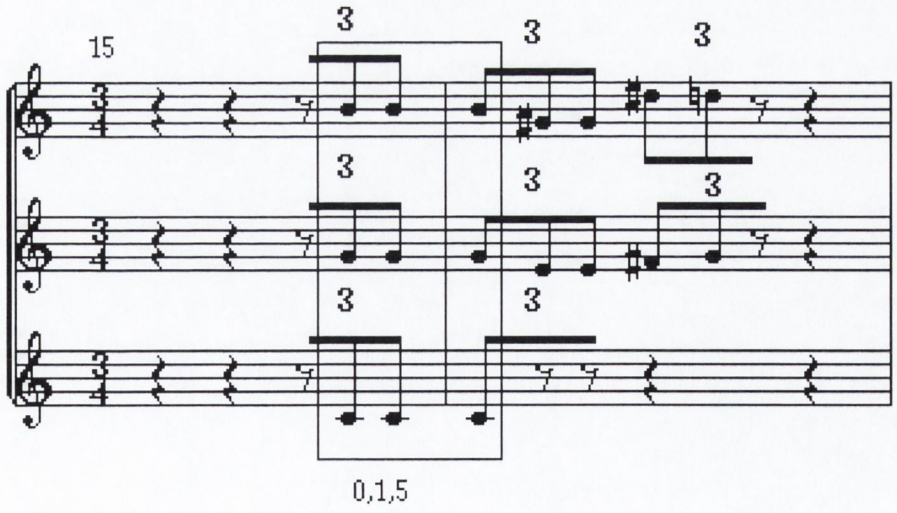
The resulting tetrachords are:

0,1,4,7 (4-18)	0,1,3,6 (4-13)	0,1,4,7 (4-18)
0,1,3,7 (4-z29)	0,1,5,8 (4-20(12))	0,2,3,6 (4-12)
0,1,2,5 (4-4)	0,1,2,6 (4-5)	0,1,2,6 (4-5)

and the prevalence of members of (R) is striking.

In the consideration of mosaic texture above, I enumerated the vertical sonorities and analysed them to show how they contributed to the definition of mosaic texture; I dealt with them in a general way to do this, frequently summing the interval content to examine the typical bias or harmonic colour a passage or phrase has. Here I must go over the same ground but this time in order to examine the harmonic language. I hope the reader will bear with the necessary duplication of lists of sonorities which this entails.

When considering subset and superset relationships, one must be aware of the complex web of cross-relations which exist, since any five-note chord has five tetrachord subsets and ten trichord subsets; while each tetrachord has eight pentachord supersets and four trichord subsets, and any trichord has nine tetrachord supersets and thirty-six pentachord supersets. Therefore to make observations relevant to compositional procedure, one must look for clues to narrow down the wide choice when seeking the relevant cross-relationships. The simplest way to do this is to consider chord layout as a factor in subset/superset relations.



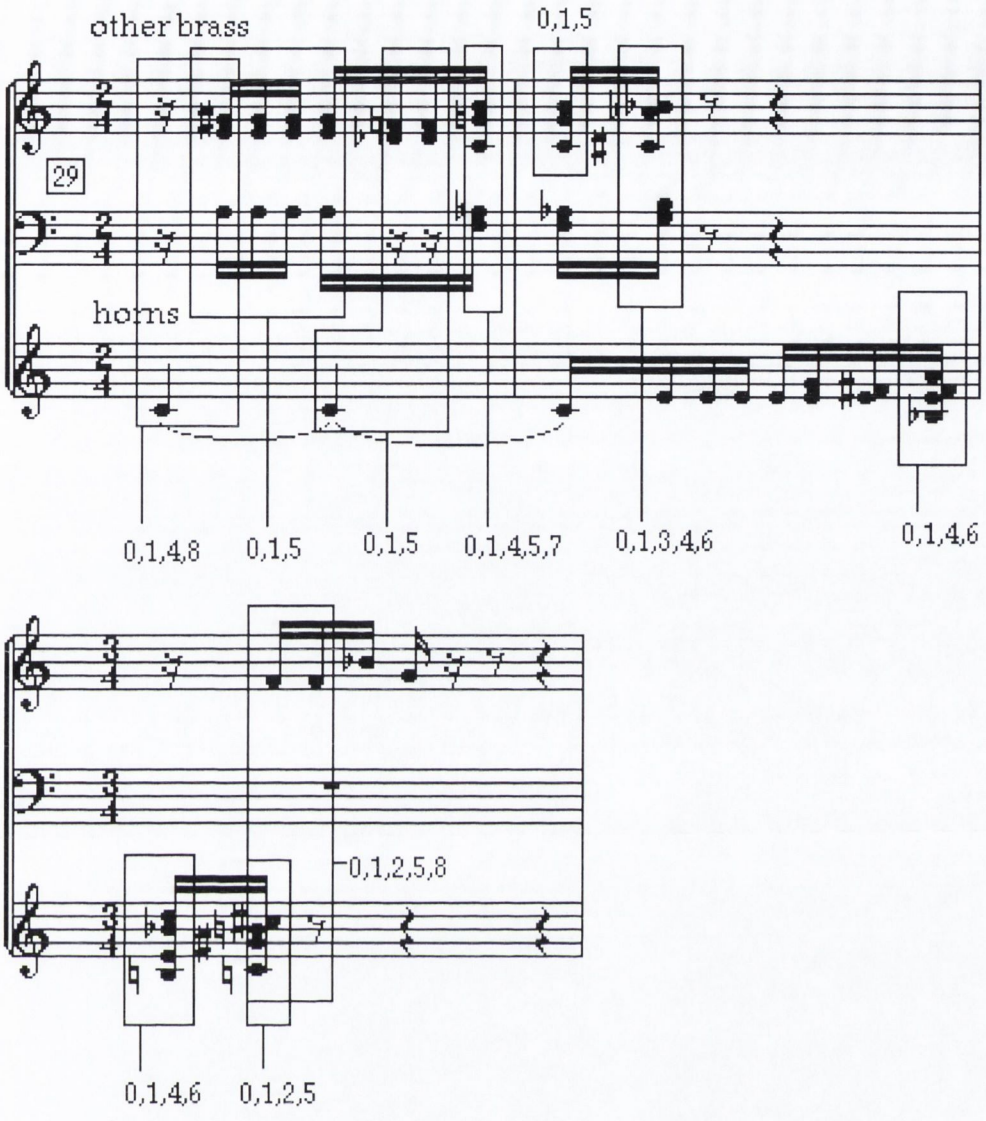


Fig. C. 29. vertical sets in **E3**

It appears from the above examples of **E3** that the initial chord of 0,1,5 (3-4) in bar 15 is related to much of what follows: the layout of this chord promotes its perception as a subset of 0,1,4,8 (4-19) in b. 29. Even the dyads in bar 16 (0,4 and 0,5) show derivation from 0,1,5 by their actual size. Bar 29 continues with 0,1,5 in another form, followed by 0,1,4,5,7 (5-z18) which contains another 0,1,5 in the upper parts, now in its original layout. The next chord, 0,1,3,4,6 (5-10) marks a change, since it does not contain 0,1,5, though it is clearly a superset of 4-z15 (0,1,4,6), which comes twice shortly after. The last tetrachord above is 4-5, a member of (R).

The next phrase changes harmonic ambience once again; in the above section on mosaic texture I showed how a new group of tetrachords was used here, with greater emphasis on ic5 and ic2. These intervals were also used to derive a lot of the dyads and trichords. This shows that **E3** is not strictly adhering at all times to a single group or family of chords, yet each phrase as a unit shows a high degree of internal harmonic consistency.

The fourth phrase showed a return to a more even distribution of intervals, with the other a.i.t 4-z29 (0,1,3,7) appearing once:

pentachord 0,1,3,6,8	[122131]	⊃ 0,1,3,6[110]
ic3	[..1....]	
heptachord 0,1,3,6,7 + 0,5	[212122]/[336333]	⊃ 0,1,3,6
tetrachord 0,1,2,6	[210111]	
pentachord 0,2,4,5,8	[122311]	⊃ 0,2,5,8
tetrachord 0,1,3,7 + 0,4	[111111]/[224232]	⊃ 0,1,4,7, 0,2,5,8 etc
ic3	[..1...]	
ic5	[....1.]	

0,1,3,6 is a subset of the first two chords here; like it, the two largest chords accentuate ic3, combined with emphasis of near even interval distribution. As such it is redolent of the subgroup of tetrachords which contain two ic3s.

Thus far **E3** has revealed a close affinity with the set of tetrachords (R) in three out of four phrases. In the third phrase it broke away from those sonorities in the vertical analysis, though not altogether in the linear analysis.

Next I will turn to other strands of material: assuming that it is most revealing to choose material forcefully or prominently stated, and/or material described by the composer as 'Theme' or 'Ritornello'.[111]

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[110] the sign '⊃' reads 'has as a subset'. The opposite '⊂' reads as 'is a subset of'.

[111] The assumption is made because these materials are very likely to have been composed first, before being set into their eventual place alongside other materials, and is therefore likely to provide clues for the rest.

Ritornello A

This is given in full by Schiff, p 177. It begins thus:

C# B# B A G E F# F E^{b} C D C# B. . .

Ritornello A is a kind of chromatic descending line with a method of stating the steps which avoids excessive use of ic1. The beginning is an exception, forming actual chromaticism before making it latent. Thus for example G - E - F# - F - E^{b} contains the pitches G, F#, F, E, E^{b} in their descending order, but shuffled slightly in time. In addition some of the steps are occasionally omitted: e.g. B^{b} and A^{b} in the last seven notes.

To segment this material into four-note or other groups is difficult to justify as the rhythmically and intervallically even nature of the descent (and the overall directional constancy) makes it exist as a seamless continuum which functions as a background constant for foreground material. The material reappears throughout the Variations as a whole and is only varied in respect of speed (see Schiff pp.177-8). However, if one does segment it into tetrachords for comparison with other material, one inevitably deduces a limited set of tetrachords.

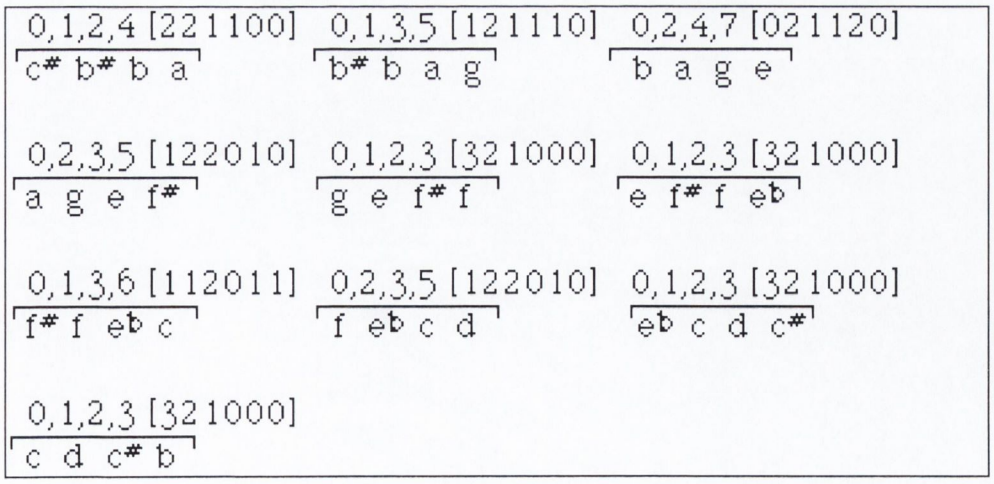

Fig. C. 30. Ritornello A, segmented in tetrachords

Out of ten segmentations four are 0,1,2,3 which reveal directly their chromatic-scale derivation. The concentration of 0,1,2,3 segments increases as Ritornello A continues. 0,2,3,5 occurred twice, and its frequency increases also. Three of the segments are not obvious derivations of chromatic descent, though they clearly are derived from whole- and half-step motion. Two of these belong to (R). Thus on the whole the chromatic construction of this material creates strict, but not complete, harmonic unity.

Ritornello A, in its appearance during the Theme, promotes a clear, seperate identity in another way. Each note is doubled underneath giving a succession of intervals. For the whole of the Theme, they are as follows: M6, M3, p4, p5, M6, m3, M6, p4, p5, m3, M7, p4, M3, p5, M3, p4, M7, m3, p5, M6, p4, M6, p4, M6, m3, M7, d5, M6, M6, M3, M3. That gives a clear bias towards certain intervals, and excludes m2, M2, m6 and m7:[112]

m3	M3	p4	d5	p5	m6	M6	m7	M7
4	5	5	1	4	0	8	0	2

returning to ic form we also see a clear selection process in the summation: [2,0,12,5,9,1]. My analysis took the view that the material which we call here Ritornello A is a part of the longer strand known as **E1**. This is supported by the fact that a similar kind of interval bias exists in **E1** during the Introduction, with a prevalence of thirds, sixths, fourths and fifths. We find a certain harmonic homogeneity, but somewhat statistical in its definition.

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[112] Unusually here I use the eleven intervals, by their tonal names. This is in order to give a fuller picture which is particularly workable and desirable here. In this I am following Schiff. Actual size is part of the stratification process, since (for example) the mosaic texture, **E3**, generally keeps linear intervals within a span of six semitones. Equally the intervals here exist in a certain range which is larger. But one cannot say that this stratification is as rigorous as the rhythmic one, or that examples are ubiquitous.

Ritornello B

Ritornello B provides a far more complex case for consideration: its linear shape consists of these interval classes: 1-3-5-2-3-5-3-4-3-3-3, which can be expressed in the sum [116120], i.e. ic3 is a very prominent feature; however the leavening of five other interval classes provides a rich source for the derivation of tetrachords. The same cautious note from Ritornello A needs to be struck: Ritornello B is expressed in a single sweeping phrase, in even divisions of time. It does not therefore promote any single segmentation—with one interesting exception. The corollary of this is that it may therefore be treated as a source for a large set of equally valid derivatives. As for the exception: in bar 26 (p.6, see score) the brass section selects and sustains certain pitches from the Ritornello (some anticipated, some entering together with it) forming two actual vertical tetrachords: 0,1,4,7 and 0,1,3,7. That is, a member of (R) and (S) followed by an all-interval tetrachord. These are the only tetrachords abstracted by Carter in a vertical form from the Ritornello. It might be argued that the relationship between the a.i.t. and its close relative(s) is being pointed to, though more precise definition of the function here is elusive, since neither is rhythmically or dynamically proiritised much above the other, and the voice leading which produces them is not especially forceful, since the outer pitches are the same in both chords.

Proceeding to other derived tetrachords, one can infer 9 subsets by taking the 12 pitches in the given order thus:

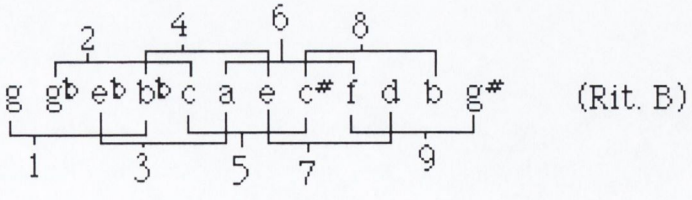

Fig. C. 31.

they are:

1) 0,3,4,7	4-17(12)	[102210] (3)
2) 0,2,5,8	4-27 (S), (R)	[012111] (3)
3) 0,2,3,6	4-12 (S), (R)	[112101] (3)
4) 0,1,3,7	4-z29 (a.i.t - (R))	[111111]
5) 0,3,4,7	4-17(12)	[102210] (3)
6) 0,3,5,8	4-26(12)	[012120] (3)
7) 0,1,3,4	4-13	[212100] (3)
8) 0,2,3,6	4-12 (S), (R)	[112101] (3)
9) 0,3,6,9	4-28(3)	[004002] (3)

While members of (R) and (S) are common, what is most striking is the grouping which I call (3), i.e. eight of the derived tetrachords feature two or more ic3s and are members of this group. This perhaps trivial finding reflects the linear prevalence of ic3 already noted above.

While investigating the structure of Ritornello B another way of looking at it suggested itself, the possibility that it was generated from 3 interlocking 0,3,6,9 tetrachords thus:

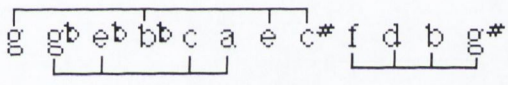

Fig. C. 32.

This may very well be an illusion resulting from the use of the 12 different notes, which will always divide into 3 'diminished sevenths'; however, two of these tetrachords certainly do stand out.

The frequency of ic3 which creates the features noted above, shows some structural similarity with **E3**'s material at bar 76.

As with Ritornello A, Ritornello B will return in later variations, those which are not under discussion here. It should be noted, nevertheless, that the pitch material of these two lines will reappear unchanged, but in greatly changed surroundings. Just as Ritornello A was a logical part of **E1**, it can be shown that Ritornello B is a logical part of **E2**, as the analysis found. The first linear statement of **E2** occurs in bars 13-15, and it displays a clear relatedness to Ritornello B in its frequency of ic3 (as M6s). The

next statement of **E2** is in bars 20-24, just before Ritornello B's forceful entry. Here we find twenty vertical tetrachords (with one trichord), in the following array:

- - A - - - - A - - A - A - - A A - A A A

where A represents the all-interval tetrachord. The others, represented by dashes, are mostly members of (R). This conforms with the two vertical chords presented during Ritornello B. Thus Carter places a linear idea (Ritornello B) with a strong ic3 loading into a vertical context of interval-equality. (Bars 20-24 are discussed in more detail below under the heading 'Texture N').

Theme

I will examine the whole of the Theme in the usual ways: firstly let us consider the linear ics as they occur; they are: 3-2-1-4-6-1-3-3-3-4-3-2-1-2-2-1-2-4-5-4-5-4-3-3-1-3-3-3-5-4-2-3-4-3-1-3-5-1-3-4-3-2-3-4-1-3-4-5-3-5-1-4-5-2-3-1-4-5-1-5-3-2-5-3-3-2-1-4-1-2-3-6-4.

giving a sum: [13, 11, 23, 14, 10, 2]. Now this does show a striking affinity with Rit. B (again reinforcing the link through **E2**) with the larger number of ic3 and the generally even balance between ic1, ic2, ic4 and ic5, and an extreme scarcity of 6. However, ic3 is not as pervasive as it was in Ritornello B.

Secondly, I will segment the Theme into tetrachords. Although it does not promote this kind of segmentation from its own rhythm, it is the most reliable way of obtaining a working comparison with other material. There are no straightforward transpositions or transformations of material connecting the Theme to other strands so far mentioned, and this segmentation offers the most thorough and comprehensible cross comparison available. I therefore treat it as I did the Ritornello, taking the notes of the Theme and examining all possible contiguous four-note groups.

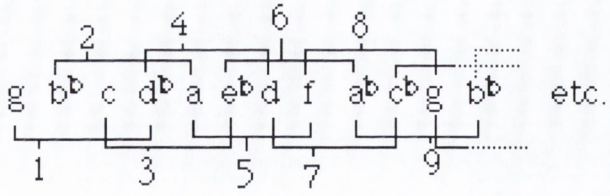

Fig. C. 33.

The derived tetrachords, in order, are as follows:

4-13 [112011], 4-3 [212100], 4-12 [112101], 4-5 [210111], 4-z29 [111111], 4-13 [112011], 4-28 [004002], 4-12 [112101], 4-3 [212100], 4-4 [211110], 4-13 [112011], 4-10 [122010], 4-11 [121110], 4-11 [121110], 4-10 [122010], 4-2 [221100], 4-22 [021120], 4-17 [102210], 4-26 [012120], 4-20 [101220], 4-7 [201210], 4-7 [201210], 4-3 [212100], 4-13 [112011], 4-28 [004002], 4-18 [102111], 4-19 [101310], 4-5 [210111], 4-12 [112101], 4-3 [212100], 4-17 [102210], 4-z29 [111111], 4-3 [212100], 4-4 [211110], 4-13 [112011], 4-13 [112011], 4-z29 [111111], 4-17 [102210], 4-4 [211110], 4-10 [122010], 4-14 [111120], 4-18 [102111], 4-12 [112101], 4-z29 [111111], 4-14 [111120], 4-10 [122010], 4-26 [012120], 4-20 [101220], 4-19 [101310], 4-4 [211110], 4-14 [111120], 4-23 [021030], 4-11 [121110], 4-12 [112101], 4-17 [102210], 4-z29 [111111], 4-9 [200022], 4-18 [102111], 4-z29 [111111], 4-14 [111120], 4-22 [021120], 4-13 [112011], 4-27 [012111], 4-13 [112011], 4-14 [111120], 4-8 [200121], 4-4 [211110], 4-1 [321000], 4-13 [112011], 4-27 [012111].

This can be summarized statistically:

tetrachord	amount	(R)	(3)
4-1	- 1		
4-2	- 1		
4-3	----- 5		•
4-4	----- 5	•	
4-5	-- 2	•	
4-6	0		
4-7	-- 2		
4-8	- 1		
4-9	- 1		
4-10	---- 4		•
4-11	--- 3	•	
4-12	----- 5	•	•
4-13	--------- 9	•	•
4-14	----- 5	•	
4-z15 (a.i.t)	0!	•	
4-16	0	•	
4-17	---- 4		•
4-18	--- 3		•
4-19	-- 2		
4-20	-- 2		
4-21	0		
4-22	-- 2		
4-23	- 1		
4-24	0		
4-25	0		
4-26	-- 2		•
4-27	-- 2	•	•

4-28	-- 2		•
4-z29 (a.i.t)	------ 6	•	
Totals	70	37	36

Fig. C. 34.

What comes out of this survey is a variety and freedom of tetrachord choice, which might be called a multi-chordal language, as a precursor to the more all-embracing pan-chordal approach in later works; yet within this a marked preference for members of (R) and (3) is expressed. There is a partial avoidance of certain sets, notably 4-21 to 4-28, those with a lack of ic1. There also appears to be a partial avoidance of those sets with two or more ic1, 4-1 to 4-9, with the exception of 4-3 and 4-4, the (R) and (3) members. Thus it appears as if sets are excluded if they are excessively dissonant, or unequal in interval combination, or excessively consonant, with exceptions made for (R) and (3) members which happen to fall into those categories. Two sets are therefore particularly striking for their absence, 4-z15 and 4-16.

I will now investigate the vertical combinations in the Theme, restricting it for now to **E2**, despite the presence of **E1**. The sonorities are as follows:

[Bar 44]	0,2,6			[010101]
[bar 45]	0,2,5,8	4-27	(M)	[012111] (R)(3)
	0,1,5,7	4-16		[110121] (R)
	0,1,5,7	4-16		[110121] (R)
	0,3,7			[001110]
[bar 47]	0,2,3,5	4-10		[122010] (3)
	0,1,3,5	4-11		[121110] (R)
[bar 48]	0,2,3,7	4-14	(M)	[111120] (R)
	0,1,3			[111000]
	0,2,4			[020100]
[bar 49]	0,1,3,5	4-11		[121110] (R)
	0,3,4,7	4-17	(M)	[102210] (3)
	0,3,7			[001110]
[bar 50]	0,3,5,8	4-26	(M)	[012120] (3)
	0,3,7			[001110]
	0,2,5			[011010]
	0,3,7			[001110]
[bar 51]	0,1,5			[100110]
	0,1,4,5	4-7		[201210]
	0,1,5,8	4-20	(M)	[101220]
[bar 52]	0,3,5,8	4-26	(M)	[012120] (3)

	0,1,3,6	4-13		[112011] (R)(3)
	0,1,5,8	4-20	(M)	[101220]
[bar 54]	0,2,4,6,9	5-34		[032221]
	0,1,4,5,7	5-z18		[212221]
	0,1,2,4,8	5-13		[221311]
[bar 55]	0,1,2,6,8	5-15		[220222]
	0,1,6,7	4-9		[200022]
	0,2,5,7	4-23		[021030]
[bar 57]	0,2,5			[011010]
	0,1,4,7	4-18	(M)	[102111] (R)(3)
	0,2,3,6	4-12		[112101] (R)(3)
[bar 58]	0,2,4,8	4-24		[020301]
	0,2,4,7	4-22	(M)	[021120]
	0,1,2,3	4-1		[321000]
[bar59]	0,2,3,5	4-10		[122010] (3)
	0,1,5,6	4-8		[200121]
	0,1,3,6	4-13		[112011] (R)(3)
	0,2,3,6	4-12		[112101] (R)(3)
[bar 60]	0,1,4			[101100]
	0,1,4,5	4-7		[201210]
	0,2,4,8	4-24		[020301]
	0,2,6,8	4-25		[020202]
[bar 61]	0,2,3,6	4-12		[112101] (R)(3)
	0,2,3,6	4-12		[112101] (R)(3)
[bar 64]	0,3,4,7	4-17		[102210] (3)
	0,1,5,7	4-16		[110121] (R)
[bar 65]	0,1,4,8	4-19		[101310]
	0,1,4,5	4-7		[201210]
[bar 66]	0,1,2,3	4-1		[321000]
	0,1,6			[100011]
[bar 67]	0,1,4,5	4-7		[201210]
	0,1,4,8	4-19		[101310]
[bar 68]	0,2,3,6	4-12		[112101] (R)(3)
	0,2,3,5	4-10		[122010] (3)
[bar 69]	0,1,3,4	4-3		[212100] (3)
	0,1,4,7	4-18	(M)	[102111] (R)(3)
[bar 70]	0,1,4,8	4-19		[101310]
	0,1,3,6	4-13		[112011] (R)(3)
	0,1,6,7	4-9		[200022]
	0,3,5,8	4-26	(M)	[012120] (3)
[bar 71]	0,1,5,6	4-8		[200121]
(the sonorities continue as trichords)				

Fig. C. 35.

One observes here that there is a multi-chordal language operating again, but the preferred tetrachords here are not those of the linear Theme, and there are certain chords appearing here which were avoided in the linear material. A full picture for comparison can be gained by presenting a graph:

tetrachord	amount	(R)	(3)
4-1	-- 2		
4-2	0		
4-3	-1		•
4-4	0	•	
4-5	0	•	
4-6	0		
4-7	---- 4		
4-8	-- 2		
4-9	-- 2		
4-10	--- 3		•
4-11	-- 2	•	
4-12	----- 5	•	•
4-13	---- 4	•	•
4-14	- 1	•	
4-z15 (a.i.t)	0!	•	
4-16	--- 3	•	
4-17	-- 2		•
4-18	-- 2		•
4-19	--- 3		
4-20	-- 2		
4-21	0		
4-22	- 1		
4-23	- 1		
4-24	-- 2		
4-25	- 1		
4-26	--- 3		•
4-27	- 1	•	•
4-28	0		•
4-z29 (a.i.t)	0!	•	
Totals	47	18	20

Fig. C. 36.

So where the linear sets produced members of (R) and (3) over 50% of the time, here they both appear considerably under 50% of the time. Both graphs share a bulge towards the centre, for chords 4-7 to -20, with the omission of 4-z15. The linear domain had a preference for 4-z29, while the vertical completely avoids both forms of the all-interval tetrachord. The vertical collection has proportionately more in the area 4-20 to -27 reflecting my analytical observation of the use of sonorities lacking ic1.

An objection might be raised that the non-inclusion of **E1** in this appraisal distorts the findings; however, I am concerned here with stratification, thus the derivation of **E2** alone, as I was with Ritornelli A and B. Also, below I will give some consideration to the **E2/1** complex as a source of material.

It is worthy of note that related chords often follow each other. This is perhaps a by-product of oblique contrapuntal motion, which is a constant texture here, and this

provides logical links which defuse some of the aural complexity of a multi-chordal language.

I will now address the issue of non-localised reference of sonority, both within and across phrase boundaries; for this I will refer to **E2** and the **E2/E1** complex alternately. For evidence of cross reference I examine the sonorities which seem to promote themselves aurally, which turn out to be phrase endings, phrase beginnings and dynamic climaxes:

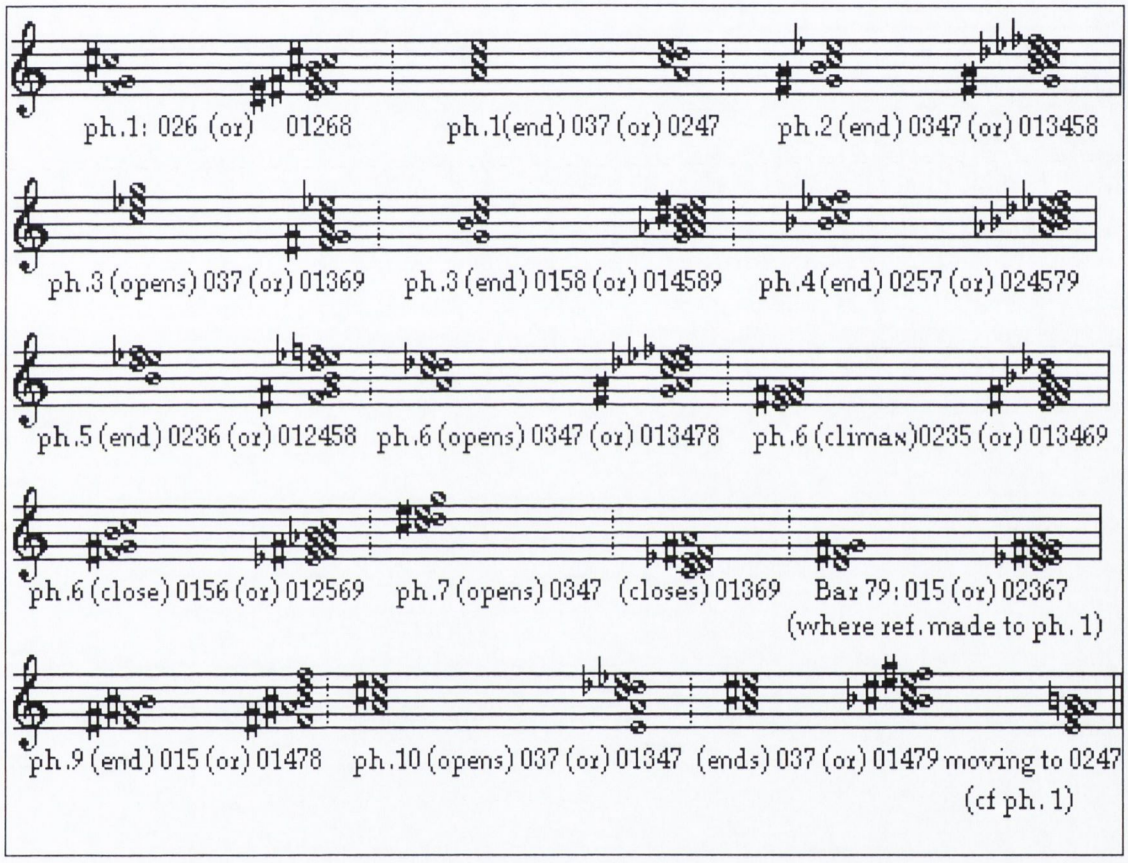

Fig. C. 37. privileged harmonies

The main finding here is that a hitherto unnoticed harmonic field is asserting itself, with 0,3,7 appearing to determine the chief cross-references. This chord is featured in the prime form 0,3,7; and in inversion, 0,4,7; and as a subset of larger chords a total of 15 times (not counting twice where it is in **E2** and hence also in **E2/1**). Note that 0,3,7 never actually appears completely without a 'clothing' of **E1**, yet it is often very

audible as a controlling factor, where **E2** is reduced to three notes and textural and timbral aspects distance **E1**. One can postulate a new family of tetrachords: those containing 0,3,7, which are: 4-14, 4-17, 4-18, 4-19, 4-20, 4-22, 4-26, 4-27, 4-z29. (I call this family (M), where M stands for major/minor, after the traditional 0,3,7 and 0,4,7 chords). With this observation one can go back over the chart of all vertical sonorities in **E2**, and quickly count the tetrachords from this family, a total of 11, and can conclude that they do not have a defining role to the same extent as sets (3) or (R), despite their structural weight shown above.

Conclusions can be drawn from all the considerations of the Theme section thus far. Comparing the chart of frequency for vertical tetrachords with that of the linear Theme proper one finds:

Vertical	Linear
use of 21 *different* chords	use of 23 *different* chords
18/46 ε (R), = 39%	37/70 ε (R), > 51%
20/46 ε (3), > 43%	36/70 ε (3), > 51%
0 appearences of a.i.t.	6 appearences of a.i.t. (4-z29 only)

So one can say that generally there is a similarity of multi-chordal consistency, with a noticeable deviation of about the same size on frequencies of (R) and (3) members, the former being enhanced further by a.i.t. distribution. In addition, the linear Theme showed an avoidance of tetrachords from the extremes of the range ([2.....] and [0.....]), while in the vertical collection there is a similar avoidance, with slightly less of the first kind and more of the second.

With the emergence of the importance of the 0,3,7 trichord, and the possibility that a family of tetrachords can be built around it, immediately the question of triadic links between tetrachords in general arises. The main fact to bear in mind is that each trichord can have nine and only nine supersets—so there is no trichord which is common to the array of tetrachords from either collection. Therefore, this kind of observation only appears fruitful when the music promotes a specific triadic subset as it did with 0,3,7. There is one candidate from previous material, as I have wondered if

0,3,6 formed a hidden source, and looking at Rit. B there is evidence to support this. Now there are only five distinct supersets of 0,3,6 because some derived supersets turn out to be inversionally equivalent pairs; so owing to the spread of different chords in the linear Theme members of this family are rarer, but are they privileged? It turns out that there are 21 of them in 70 cases, thus 21/70 = 30%; now one would expect a random sample of tetrachords to reflect the proportion of members (5) to the 29 possible types, i.e. 5/29 = 17%, so it seems there is some (weak) compositional preference operating here.

Texture N, a specific instance of **E2**

Thus far, various examples of important materials have been examined for their interval content, with the findings showing a range of approaches from quite tightly interconnected (the Mosaic texture) to very heterogeneous, and a question hangs over the findings, namely: are there any passages showing a very tight degree of control, vindicating the importance of those relationships thus far highlighted? Almost surprisingly, the answer is yes, for there is a passage in the Introduction where four-part homophonic texture (rare in itself as a texture in the piece) occurs: bars 20-24 in **E2**, which furnish a series of 21 simultaneous attacks, as 20 tetrachords and one trichord, with **E1** continuing in the background with some important material (to be examined below). The chords are as follows:

1) 0,1,4,8 4-19	2) 0,2,3,6 4-12	3) 0,1,4,6* 4-z15
4) 0,1,3,6 4-13	5) 0,3,6 3-10	6) 0,2,3,5 4-10
7) 0,2,5,8 4-27	8) 0,1,3,7* 4-z29	9) 0,1,4,6* 4-z15
10) 0,1,4,7 4-18	11) 0,1,4,6* 4-z15	12) 0,2,4,8 4-24
13) 0,1,4,6* 4-z15	14) 0,1,3,5 4-11	15) 0,1,4,7 4-18
16) 0,1,4,6* 4-z15	17) 0,1,4,6* 4-z15	18) 0,1,6,7 4-9
19) 0,1,4,6* 4-z15	20) 0,1,4,6* 4-z15	21) 0,1,4,6* 4-z15

This is where harmony is at its *most* homogeneous for the portion of the piece under discussion. All-interval tetrachords occur in 10 out of 20 cases (the 21st being a trichord.), six others are (R) members.

Twelve-note aspects of the harmony

The examination of harmony has treated the elements separately for the most part. What of the totality of harmony in the piece? Robert Stewart claims to find some serial aspects in the piece,[113] in spite of Carter's own statement in 1960 when asked "do you use the twelve-tone system?"

> Some critics have said that I do, but since I have never analyzed my works from this point of view, I cannot say. I assume that if I am not conscious of it, I do not.[114]

Stewart presents two examples: taking the opening bars 1-3, as noted already here, they consist of a twelve-note set: A, E, E^b, G, D^b, F, G^b, C, B^b, D, A^b, B, (reading the simultaneously struck notes upwards). He compares this with a later statement (bars 31-7) in the 1st violins: A#, B, D, G, F, G#, C#, E, C, E^b, F#, A, which he calls simply 'an inversion'. It is not.

Then he writes:

> After the double statement of the theme the remainder of the Theme continues with the presentation of melodic statements of different notes using motives from the ritornello and/or theme. The first of these melodic statements reveals an interesting grouping of notes based on the inversion of the Ritornello transposed to D (violas bs. 57-61).

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[113] Robert Stewart, "Serial Aspects of Elliott Carter's Variations for Orchestra," *Music Review* 34, no. 1 (1973): 62-5.

[114] "Shop Talk by an American Composer," *The Writings of Elliott Carter*. 206.

He then gives Ritornello B: G, G^b, E^b, B^b, C, A, E, C#, F, D, B, G#, and the melodic statement of bs. 57-61: F#, G, E, D^b, B^b, F, A, B, A^b, C, E^b, D. He states that the last four notes here are a retrograde of the first four in Ritornello B, but they are not. The view that this is based on Ritornello B by conventional R / I / IR relationships appears to be specious. He adds: "throughout the score most of the important melodic material as well as accompaniment figures, are structured on ten- to twelve-note segments bearing motivic relationships to the theme and/or Ritornello," which he does not substantiate, and does not in any case constitute evidence of 'serial aspects'.

Beckstrom finds evidence of twelve-note thinking in the theme: for example, the first two phrases of the theme fill the chromatic scale from G to F minus E.[115]

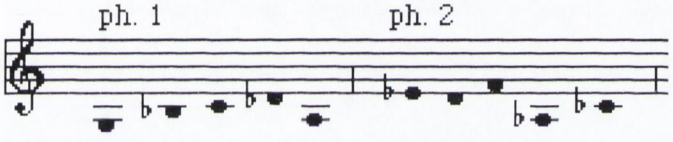

Fig. C. 38.

Furthermore the final notes A^b-C^b of phrase two complete a chromatic set for phrase 1. Beckstrom points out that phrase 3 continues the chromatic expansion, and again the final note (E) fills a missing point in the chromatic scale. This seems to follow a general principle of seeking a 'fresh note' at important points, but the remaining phrases can not be analysed so neatly. What *can* be shown is that ten- eleven- and twelve-note sets appear frequently in the overall texture, and that co-temporal elements loosely respect the principle of set complementarity. For example, from the clarinet entries in bar 10 to the 2nd clarinet of bar 12 (excluding the harp F which carries over from earlier) we find the following twelve-note set: cl. [C#, G#], strings [D], brass chord [C, A, F, B^b, E, B], cl. [D#, F#], G. This included entries of all three

[115] Beckstrom, 10.

elements, avoiding any intersection of sets. One can extract countless examples of ten- to twelve-note sets in this fashion, but more often than not one or two of the set will appear twice, in different octaves and even elements, so in fact there is not a strict observance of disjunction of sets across the three elements. Nor is the rule of avoiding octaves, common to serial music and much free atonality, strictly followed. One can merely state that such rules apply to the majority of entries, and that the twelve pitch-classes appear with equal or near-equal frequency. In the Introduction we do not find areas where a subset of the twelve is prolonged or witheld such as to give an impression of a referential chord or scale (e.g. the octatonic set). This is a relatively straightforward, non-rigorous kind of counterpoint, loosely supporting the stratification process. It consists in the majority of instances of a simple avoidance of unwanted harmonic integration. This localised freedom must assist Carter in maintaining control of the vertical harmonic content of combined elements. It was found in the analysis that the total harmonic content of the Theme appears to be controlled with respect to the number of semitone relationships at a given moment; that this number relates broadly to the increase/decrease in tension implied in the other parameters. The existence of particular intervallic characteristics in the separate elements co-exists with this control of overall harmony, and this poses a compositional challenge similar to the traditional requirements of counterpoint. In a sense there are conflicting structures, but each element allows flexibility by being a little loosely defined (as evidenced in the somewhat statistical nature of their individual harmonic definition), yet clearly retaining its identity.

At the very end of the Theme these twelve-note 'rules' are relaxed so as to allow a diatonic set to emerge from a ten-note set: from bars 84-8 the pitches D#, C, E, A, C#, G, F#, B^{b}, D are all employed in mildly dissonant formations (dealt with in the analysis) (the tenth, B, is held back until b. 88), but the remarkable aspect in this passage is the presence of the notes A, C# and E repeated through three octaves, and the final chord in bar 88 which removes all semitone relationships: B, G, E, A. The timbre stratification contributes to one's awareness of the consonant rather than the

dissonant, since within each of the two contributing strands (**E1** and **E2**) all sonorities avoid semitone relationships.

Conclusions on technique

Time

Aside from his harmonic technique, some concluding remarks are needed concerning his use of stratification and tempo modulation. From even the broadest and simplest view, it is evident that Carter has greatly enriched and developed the existing notation of time to allow written coordination of elements which retain maximal independence or non-coordination for the listener, and also allow for other devices such as the accelerando and ritardando variations.

One might enter the usual caveat at this point and mention that this does not mean that he has entirely solved the difficulties of notation (or of performance!) of such devices—Gardner Read[116] certainly objects to arithmetical inconsistencies in some of his notation—but even with the more modest techniques of rhythmic independence employed in the Introduction and Theme, tied to registral and timbre independence, he achieves a very marked illusion of musical independence where required.

What is important is that Carter has pushed out the boundaries on achievable, controlled non-coordination (in contrast to Lutoslawski's solution to this problem, which admits limited loss of the composer's control), but at the same time retaining the use of all other possibilities, from orchestral tutti to this outer boundary, and thus has at his command a wider continuum stretching from tutti to non-coordinated

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[116] See Gardner Read, *Modern Rhythmic Notation* (London: Gollancz, 1980), 46-9.

movement (the richer options lying not at these extremes) than other composers before him.

Harmony

A general principle seems to operate, that where surface features are most plain, there one finds harmonic language most homogeneous; whether that is the sweeping Ritornello B with its 0,3,6,9 construction, Ritornello A with its winding chromaticism, or texture N which has the purest homophony in the piece and tends towards a distilled a.i.t. language. Where textures/elements are more interactive and hence developmental, the harmonic derivation is least strictly observed (or else structures are more dissolved and elusive to analysis). All of this indicates clearly that harmony is integral but also subordinate to the gestural evolution of the piece. A further point can be drawn, that dynamic and changing textural states are associated with intervallic heterogeneity (such as the Theme, where (R) and (3) and other tetrachords are present, while a.i.t.s are avoided), while elements associated with lack of development, or which proceed unaffected by surrounding elements, retain a more homogeneous harmony.

Nevertheless, it must be admitted that there is an absence of rigour about how these differences are followed and implemented, which allows one to conclude that harmony here is not derived from a fully worked-out grammar of pitch selection.

One can ask a number of questions that Carter invites from his own writings:

Q: is there a specific controlling sonority acting to unify the whole piece?

A: no, however the a.i.t.s exist as ideal states, and other sonorities appear to be included by dint of their similarity or dissimilarity to these.

Q: does the opening sonority act as a source for either a) pitch specific connections or b) derived chords?

A: the first sonority of the piece is a perfect fifth a-e; so no chords can be derived without extra pitches. The analysis showed some pitch specific links arising from the upper E, and an unrelated instance of pitch linkage across the Theme, but in general pitch specificity is rare and somewhat localised, not operating across large scale passages or across boundaries. The majority of passages investigated showed no pitch linkage. The second bar has a six-note chord, which embodies the principle of interval equality as much as it can. This is not a kind of 'mother chord' containing a crucial set of chord derivatives such as one finds elsewhere in Carter's works, but in terms of intervals it is can be regarded as a 'source chord'.

Finally one can say that pre-compositional harmonic work has not sought to impose an *a priori* harmonic unity on the piece. This is not to say that pre-compositional harmonic work is weak or that local needs completely determine harmonic structures, but clearly harmony is dealt with as just *one* of the shaping forces, along with dynamics, density, register, timbre and rhythm. Thus this piece is closest in practise to the sentiments Carter expressed in *The Music of Elliott Carter* (Schiff) dating from 1957 (also quoted above):

> But today—as befits an art whose formative dimension is time—the techniques of continuity and contrast, of qualities and types of motion, of the formation and development of a musical idea or event, and in general the various kinds of cause and effect patterns that can be suggested in musical flow, occupy the attention of composers more than harmony or other matters all of which now become simply details in a larger kind of concern . . . In this view, no item, no unifying principle or method of continuity is self-evident or considered a given part of musical process, but all are considered in the light of the whole and included or worked over so as to be able to fit the general scheme.

In terms of Carter's own evolution of technique, we can say that the Variations stand between the clear pan-intervallic harmony of the First String Quartet and the clear pan-chordal language of works from the mid-1960s onward. There appears to be a concern with the incorporation of many chord types which is competing with a concern to encourage interval equality, a force that logically limits available chord types. Furthermore, the stratification process, so clear in the case of his rhythmic practice here, is not always as well defined, in the harmonic sphere, in terms of

separation. When he develops the pan-chordal approach in later works, he can achieve the same overall interval variety without it constricting the chordal variety, and the stratification process is also strengthened. So the Variations is a transitional work in Carter's output, utilising a pan-intervallic and multi-chordal language. That is not to say that it is deserving of less attention from listeners or analysts, since taken on its own terms it is a very satisfactory work, rather the lack of analytical attention it has received is probably a result of its position in his output, and the concomitant necessity for a statistical approach to his harmony.

The relationship between the analysis and the technique

The separation of Carter's music into two headings, technique versus analysis (of 'listening grammar'), is less tenable than in the case of Boulez, since it is clear that Boulez created elaborate *a priori* systems and structures in the course of writing his music, and certain procedures are adhered to strictly as the music is written. So in effect there are two structures, each of which must retain its own 'elegance'. With Carter—especially in this piece—there is a more fluent approach: technique has a more integral relationship with the composition, with little evidence of any kind, of twin structures potentially in opposition. Because of this I will limit my discussion here to remarks of a general nature.

Nevertheless, there clearly are *a priori* structures. One can, for instance, extrapolate that some form of precursor to the Harmony Book existed before and during the writing of this piece, since there is clearly an awareness of the full gamut of possible 3- 4- and 5-note chords, and a clear desire to employ most of them at some stage. Of course this is not the kind of order which permeates any kind of

prefabricated structure through to the actual piece, any more than the possession of a dictionary leads to a particular style of novel, but it is fair to say that from this piece and from other sources that Carter consistently exhibits a desire to include a very wide selection of harmonic ingredients (indeed in many other later pieces an all-inclusive system, e.g. the use of the all-triad hexachord and all of its subsets, in the Piano Concerto). Thus one can discern here a guiding principle of near-total variety, and while this is not the same as an *a priori* structure, it is an ideal that exerts a pressure for the sake of its own elegance. However, as with stratification, he does not create the extreme possibility in order to use it *per se*, but to stretch the continuum as used by previous composers out further. Thus while a lot of the passages display an almost worrying (to the analyst) chordal variety, this certainly does not preclude homogeneous passages such as texture N from existing.

Clearly the two principles that I have identified, of expanding rhythm to allow maximal non-coordination, and expanding harmony to allow maximal variety of sonority, point in the direction of disunity/chaos and are thus potentially threatening to the issue of musical unity. In a sense there is a single principle of universality, i.e. of a universe capable of the broadest inclusion, which is an *a priori* construct which exists across a range of Carter's musical output. One must consider whether this principle ever threatens the coherence of the music as the listener receives it.

My ultimate conclusions about this are not always demonstrable within the scope of this study, so I present them as speculative matter and invite the reader to differ if s/he so feels. Nonetheless I proceed from the data given above. In discussing what exactly constitutes a desirable level of coherence one operates with a number of norms, consciously or otherwise, so I will endeavour to signpost these wherever they seem to be assumed.

The heightened level of stratification in the piece causes no structural weaknesses as far as this listener is concerned, from my analysis it is clear that the new levels of gestural complexity are a worthwhile development in technique, especially as they are heard to operate the full range of possibilities from disinterested co-existence to

dramatically dovetailed climactic gestures (for example the Theme's three elements on the one hand, and the Introduction's climax on the other), with the same basic material. Thus the composer's own personal rhythmic technique exhibits complete flexibility and subordination to his creative plan. It might be noted that the system of rhythmic independence is limited here, as Carter points out, because of the limitations set by orchestral writing as distinct from chamber music, and I feel that there might be more difficulty in appraising the contribution of stratification in the first string quartet, for example, but that is not a matter for concern here.

Regarding harmony/pitch selection, here I have experienced difficulty in following the composer's precise intentions. The comprehensive variety of sonorities used threatens coherence of harmonic function.

Let us consider a summary of the findings from the Technique heading:

E3 linear 1st 4 phrases	8 out of 9 ε (R), and 1 a.i.t.; very homogeneous.
E3 vertical, bars 15 - 31	0,1,5 generates material until b. 30, turning to 4-z15 and (R).
E3 vertical, next phrase	All ε (R) or supersets of same.
Rit. A. (**E1**) linear	tied to chromaticism: thus mostly 4-1.
Rit. A vertical	preferences for ic3 and ic5.
Rit. B. linear only	8 out of 9 derived tetrachords ε (3) and 1 a.i.t., 4-z29.
Rit. B. vertical	a.i.t. extracted and held.
Theme (**E2**) linear	great inclusivity: only 6 out of 29 tetrachords absent, though there was distinct bias to ε (R) and ε (3). also avoidance of 4-z15.
Theme vertical	great inclusivity: similar sets to linear findings. avoidance of a.i.t.s.
Theme vertical, prominent points	0,3,7 and derived (M) family appears privileged.
Texture N (**E2**)	a.i.t. in 10 out of 20 chords. 9 out of 10 are a.i.t. 4-z15. 6 are ε (R).

The same data can be tabulated thus:

Prevalence of a.i.t.s -z15 |-z29	Important instances of a.i.t.s	Prevaln. of (R) members	Prevaln. of (3) members	Prevaln. of (M) / 0,3,7.	tie-in of 0,1,5	prevaln. of 4-1	H or h
Texture N	Texture N	Text. N					H
Rit.B vertical	Rit.B linear	Rit.B vert.	Rit.B lin.&vert.			H	
E3 vertical	**E3** vertical	**E3** lin. & vert.	Rit. A vertical		**E3** vertical		H
Theme linear		Theme linear	Theme linear				h
		Theme vertical	Theme vertical	Theme vertical			h
						Rit.A lin.	H
(where H stand for homogeneity and h for heterogeneity)							

Now as far as a coherent view of the harmony is concerned, there is one aspect that gives some difficulty: the apparent lack of discrimination in the above table, e.g. why should all the material display a prevalence of (R) chords, (except Ritornello A, linear), yet the (M) chords only become apparent in the Theme's vertical language, at prominent points, and not in the linear dimension. Also, why should the Theme isolate its language by this quirk while simultaneously sharing other common points such as (R) membership? There are many similar puzzles when considering the above data. The fundamental source of these apparent contradictions is the aforementioned principle of inclusivity, allied probably to a technique which was partly in development through trial and error.

On the other hand, the degree of control of all materials is exemplified by the integration of the short bursts of important materials such as Ritornello A and B into their surrounding element. This is achieved not only by the use of timbre, registral and rhythmic stratification, but is supported by harmony, even where the linear and vertical qualities of the material differ, and textural qualities work against it (e.g. **E2** in double notes, bars 13-15, tetrachords, bars 20-24, and Rit. B, in unison, bars 26-

28). So even if we criticise the harmony for challenging comprehensibility, this is not because of any lack of control on the composer's part. One may question the aesthetic choices underpinning the work, but not the quality of their implementation.

In conclusion, this piece represents a developmental step in Carter's career between the pan-intervallic language of his First String Quartet (and before that the pan-diatonic language of his cello sonata) and the mature pan-chordal language of the post-Harmony Book period, and that perhaps, in the overall context of the ouevre, certain insecurities exist with respect to the later refinement of stratification, which in later works tends much more to include the harmonic dimension. However, one should guard against allowing acceptance of this view to belittle the achievement of the Variations, which is a hugely complex, refined and integrated structure in itself.

CHAPTER 3

LUTOSLAWSKI: THE STRING QUARTET

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Analysis

General introduction

Lutoslawski's string quartet is a piece lasting some twenty-three to twenty-four minutes. It is in two movements, an 'Introductory Movement' and a 'Main Movement'. The two movements run *attacca*, and therefore, in terms of the 'listening grammar', it will appear as one movement unless there is some contrast between the two. In fact, the contrast is not immediately obvious, as both movements are very sectional on the surface, and tempi are many and varied. But there is a contrast that is clearly audible, involving the interaction of materials, which is treated differently in each movement, and there are also some very obvious gestures acting as 'clues' to the bipartite structure. So there is some deliberate ambiguity about whether or not it is in two movements, and where exactly the moment lies where we realise the change from first to second movement; this posits a more obviously interdependent relationship than pertains in most multi-movement works, and the words 'Introductory' and 'Main' may be seen to further imply a single movement in two sections.

The way in which the first and second movements relate may be the single most striking aspect of the string quartet for the listener: in the first, an impression is created of many ideas being suggested but not allowed to develop. Instead there is a strong sense of the frustration or loss of potential (for development). Some textures are thwarted by interruption of others, and some have such in-built stasis that they are limited in development potential. The use of interruption is forcefully brought to the

listener's attention by the tendency for a great deal of contrast/episodic change in texture, and by the repeated octave Cs which function as a boundary between some of the sections in the first movement. The second movement begins as if it were continuing the episodic nature of the first, but it soon becomes clear that at last the possibility for extended passages developing from a limited set of ideas is being realised. Furthermore the second movement has a clear climactic trajectory which dominates the movement and determines a set of hierarchical functions for the various sections of this movement.

The second movement retains some of the episodic qualities of the first and is heard as a direct continuation, but the perceived difference in the length of time of individual sections and the realisation of large-scale gesture (the climax) justifies the designation of a separate movement. The second movement benefits greatly from being set against the 1st, since the 1st builds up in the listener a considerable desire for events shaped as they are in the second. We will also see that the Introductory movement features extremely tight control of motivic variety, which itself becomes an issue in the listening grammar; the number of motifs for each 'texture' is gradually increased towards a point near the centre, and thereafter retreats. Out of this grows an abstract (that is, not motif-dependent) question of 'gestural weighting', which takes in a selection of those parameters which can range from simple to complex. These are considered in the analysis of the first movement.

The Introductory Movement is shorter (8'29") than the Main one (15'04").[117] I will generally deal in minutes and seconds here since the score does not have barlines for the most part. At times I will refer to page numbers, from the Chester edition (also known as Edition Wilhelm Hansen). I will define in advance some terms that will recur frequently: separate sections in the music in the Introductory Movement are denoted by $T_1/T_2/T_3$ . . .; in the Main Movement these become $S_1/S_2/S_3$ . . . This is

[117] These figures relate to the LaSalle Quartet recording, Deutsche Grammophon CD 423245-2.

because in the first movement sectional borders are defined by radical changes in texture, while in the second movement texture becomes much more fluid and no longer defines the sections. As I am concerned here with arriving at a 'listening grammar' for the piece, I have determined where these borders are from listening to the music rather than from looking at the score. However, in the first movement they often correspond to Lutoslawski's own numbered divisions, which are rehearsal marks. In the context of the formal layout of the piece, he also refers to 'mobiles' (after Calder's sculptures), but does not set out to identify for the player or listener where these begin and end.[118]

The first major section of the analysis is a commentary on the Textures and Sections that traces the musical material largely in terms of broad shaping parameters (texture, register, motif etc), while the second major section is a closer examination of harmonic syntax in the Introductory movement, and of harmonic syntax and rate of (harmonic) change in one section of the second movement. The first analytical section is intended to identify the gestural path of the piece and to define to some extent the function of each passage. At times, even this level of detail may be reserved for the second section, leaving the first merely to cover description and extent of events: a necessary task for clarity here, even when purely taxonomical.

Broad structures

Fig. L. 1. (see volume two) is a diagram of the piece which sketches the extent of sections, and some of their inter-relationships as they strike the listener. In **fig. L. 1.** there are three kinds of border: the double line (giving three large sections in movement 1), the solid single line, denoting striking changes in material, often confirmed by a silent pause or a gesture of finality, and the dotted line, which

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[118] See the composer's introduction to the score: "Some Remarks Concerning the Interpretation of my String Quartet," Witold Lutoslawski, String Quartet (Edition Wilhelm Hansen, 1964).

corresponds to a subtler shift in the hierarchy of (often superimposed) materials. All types of border are clearly audible, and the hierarchy among them is helpful to the analysis.

Examining the lengths of continuous texture it is evident that the first movement embodies a gradual, non-linear, transformation of extent. This process is continued seamlessly in the second movement. It is already clear that the Cs have a central function for the way the piece is heard, and seen in this light their erosion and disappearance at the end of the Introductory Movement must also signal the movement boundary. In **fig. L. 1.**, another possible way of dividing the piece is shown by the letters A-F, which designate groups of sections which have points in common, or else have some limited sense of roundedness.

Motif and materials

Other writers have considered the string quartet largely in terms of pitch and rhythm, dealing with these domains separately. In so doing, they have made some broad conclusions that are of value. However, the findings of each writer including myself all differ to some degree. Because of this I will deal with the other writings here, and will not refer to them during my commentaries, as this would be to disrupt the flow with a confusing number of differing views.

Adrian Thomas discusses motif chiefly in terms of rhythm, although the subject of pitch arises incidentally when using the term 'Repetitious Short Notes' (see below). His main findings are that:

> The principal unifying device employed in the 'Kwartet' is rhythmic and motivic transformation.[119]

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[119] Adrian Thomas, "Rhythmic Articulation in the Music of Witold Lutoslawski 1956-65" (MA Dissertation, University of Cardiff, 1971), 86.

And that:

> . . . in the 'kwartet', Lutoslawski uses this technique as the binding factor, with the rhythmic and motivic ideas being gradually transmuted and alluded to in the course of the work.[120]

He cautions that:

> So intricately related are the different ideas that to describe their progress through the work would involve nothing short of transcribing the score whole.[121]

He then finds two main categories of motif "as indefinite as 'Repetitious Short Notes' and 'Long Note Plus'" (RSN and LNP) he asserts that the first category, if taken together with the first sound-block of the second movement, is "the pool for all the rhythmic motifs for the entire work."[122]

Put this way, the piece can easily be shown to have myriad cross-relationships at a very basic order of organisation, but while the discussion is often illuminating, I find these categories too loose. While everything in the work can be related to them, this view does not help this listener to hear the work as motivically unified. My analysis, on the other hand, generally focuses on the immense motivic variety in the work.

It is probable that Thomas has identified something of relevance to an understanding of Lutoslawski's working methods for elaborating material, but they are not necessarily placed there as part of the listening grammar.

Lutoslawski himself says:

> I'm certainly not refraining from the use of motif. It exists not only where it can be clearly heard but also within layers played *ad libitum*. A layer of this kind consists usually of a bundle of parts playing variations on the same motif. . . .This fact helps to identify individual sound surfaces, and I don't think that the motif has been quite eliminated from my technique of composition. It is perhaps somewhat hidden away and plays a different role. . . . If I said that I'm not refraining from the use of motif, I was stressing the fact that motifs do indeed exist within particular layers. But it certainly doesn't mean that I'm continuing to develop the principle of the motif as found in classical music. This isn't the case, because there is no motif connection between the very short refrain, employing a few notes only, which we find in the monologue for first violin, and any other part of the Quartet. The connection between various

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[120] Ibid., 87.
[121] Ibid., 87.
[122] Ibid., 87.

> sections, parts or elements within the form is of a different order entirely and doesn't depend on the motif.[123]

Certainly, Thomas has noted correctly that the semiquaver or demisemiquaver figuration is common, and also that pitch repetition is, but under the technique heading I find that the reason for the latter is related chiefly to what I call 'grid' and 'partitioning' techniques; while the use of short notes is something which loosely binds the work in the manner of stylistic consistency rather than motivic unity.

John Selleck, in an article that deals only with the first movement,[124] finds four types of pitch material (which he discusses separately from the rhythmic elements), essentially his categories are very simple:

1) material using only ic1 and ic6
2) use of all interval classes
3) use of the octave
4) use of quarter-tones.

His rhythmic categories are somewhat loose; he notes that "no definite metric serves to organize durational units into motivic hierarchies",[125] therefore all descriptions of rhythm reduce to 'long-short' or 'slow-fast'. These develop out into l-s-l, s-l-s, l-s-s-s . . ., s-s-s . . . l, and so forth. When classifying pitch material he avoids the use of the word 'motif' and cautions that when discussing the rhythmic motifs there is no hierarchy: "the effect is of a stochastic or pseudo-random distribution".[126] This means

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123 Tadeusz Kaczynski, *Conversations with Witold Lutoslawski* (London: Chester, 1984), 16. For other interviews with Lutoslawski, see also the following: John Casken, "Conversations with Lutosławski." *Musical Times* 27 (1986): 208-209; Irina Nikolska, *Conversations with Witold Lutoslawski*. Trans. Valery Yerokhin (Stockholm: Melos, En Musiktidskrift 1994); Grzegorz Michalski, "An Interview with Witold Lutosławski." *Polish Music* 23, no. 2/3 (1988): 3-22 and Douglas Rust, "Conversations with Witold Lutosławski." *Musical Quarterly* 79, no. 1 (Spring 1995): 207-223.

124 John Selleck, "Pitch and Duration as Textural Elements in Lutoslawski's String Quartet," *Perspectives of New Music* 13 (spring-summer 1975): 150-61.

125 Ibid., 151.

126 Ibid., 151.

that (for example) in a single passage made up of short-long-short there is no one set of absolute values which defines the shape.

Stucky defines the pitch material more precisely. He posits two very important motivic types which he calls x and y.[127] Material which consists of rows of two or more neighbouring semitones (0,1,2 . . .) he calls x, and material which is derived from a 0,1,7 set is called y. y relates, but does not fully correspond, to Selleck's first pitch category. When he turns to the second movement, he posits two further types, a and b. The first stands for linear material based on (0,2,7) and the second (0,1,4). He avoids the Forte system however, describing a as "arpeggiated fourth-chords", for example. He classifies the use of the quarter-tone as "consistent with x", since it is always used in succession with a tempered quarter-tone neighbour; that is, the quarter-tone is not used for its potential to create exotic new intervals other than itself. He regards material that does not fall into these categories as "extraneous". This appears to include the octave Cs and the music of T_7 (see below). The definition of x extends to T_9, which is analysed as a gapped x structure with re-ordering: take F-F#-G-G#-A, remove G to get F-F#-G#-A, and allow re-orderings such as A-F#-G#-F to form interlocking ic3s.

Although to my way of thinking such a view stands on the brink of making the music conform to the analysis instead of the other way around, Stucky, by his methods, highlights what is a tightness in the compositional technique and musical thinking. This is exemplified by Stucky's view of S_1 where the registral limits of the entire section form a y (see ex. 29 p. 24 of Stucky), even though the local materials here can only be categorised as fixed pitch or *glissando*. All of the scholarship on the quartet points up the stylistic unity of the piece, and addresses some of the issues

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[127] Steven Stucky, "The String Quartet of Witold Lutoslawski" (Vol I of MFA Dissertation, Cornell University, 1973), 15.

relating to compositional grammar. Only Stucky gets to the question of listening grammar to any great degree, with his discussion of overall form (pp. 36-60).[128]

Introductory Movement, commentary on the 'Textures'

Group A, T_1 — T_{1a}

T_1. A series of separately bowed pitches without vibrato, from 1st(?) violin only.[129] It opens with a repeat of a single rising semitone motif, pointing to the fact that the semitone forms the material for this texture—nearly every pitch is preceded by one at a semitone-derived interval, except for some preceded by tritone. The first appearance of T_1 has a climax near the centre: the pitches have an arch shape, rising to a high point, then falling. The highest point is approached with an acceleration of rhythm, and departed from with a slowing of rhythmic activity.

T_2 is a short burst of scorrevole-type material, from the same violin. Here we hear continuous running of pitches at a constant pulse for the first time, contrasting sharply with T_1's tentative, rhythmically unsteady environment. However it is bound by the same harmonic principle of semitone and tritone movement, giving a sense of association with T_1.

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128 Other writers who have dealt less fully with the quartet include: Peter Gülke, "Lutosławskis Streichquartett als Kammermusikwerk." In *Colloquium Musica Cameralis Brno 1971*, 243-249; Joachim Hansberger, "Begrenzte Aleatorik: Das Streichquartett Witold Lutosławskis." *Musica* 25 (1971): 248-257; Christian Martin Schmidt, "Witold Lutosławski: Streichquartett." In *Die Musik der sechziger Jahre: Zwölf Versuche*, ed. Rudolf Stephan. Mainz: Veröffentlichungen des Instituts für Neue Musik und Musikerzeihung Darmstadt (vol. 12), 1972 , 154-162; Leszek Polony, "Struktura procesu dźwiękowego w 'Kwartecie smyczkowym' Witolda Lutosławskiego." In *Zeszyt Naukowy Akademie Muzyczne Kraków: Materiały z sesji naukowej 1975*. Cracow: Państwowa Wyższa Szkoła Muzyczna, 1975, 67-83 and Schiller, Henryk. "Kwartet smyczkowy Witolda Lutosławskiego." *Res Facta* 2 (1968): 15-29.

129 From listening alone, it is, of course not possible to know if this is 1st or 2nd.

T_{1a}. A return of T_1: at first it is more vigorous, being louder and faster than at its earlier appearance. This time it has a less clear outline, since it avoids the arch shape, though it does begin with an inverted arch, whose lowest portion is associated with the fastest and loudest part. This upsets any norms that might have been set by T_1. It may be derived by the abstract means of inversion, but this relationship is not obvious to the listener, as pitch and rhythm *details* are different. The slowing down as pitches rise suggests a true reversal of the previous pattern (or inversion). After this the arch shape is abandoned—repeated pitch groups become common, suggesting (together with decrescendo) a desire to drop the subject and make the listener await fresh material, thus functioning as a limited local closure. However, the highest pitch of T_{1a} is amongst the final pitches, giving an inherent imbalance which also throws closure into question.

So there is a local gestural closure implied by the three-part shape (T_1-T_2-T_{1a}), and by repetition occurring at the start and the very end, but simultaneously there is a sense that more is to come and that one *needs* more on a larger structural level.

Group B, T_3 — T_6

T_3. This takes up the 'odd' material of T_{1a}—the long held note—and develops a multipart section on it. There is thus a bare minimum of relatedness between T_3 and T_1, since the vast majority of T_1 was concerned with short separate articulations. Here, long bowings, with crescendi ending in accents make up the texture, with some staccato bowing also. The main feature here is pitch repetition, giving a strong sense of a slowing of the rate of change, implying a larger scale for the following events. This repetition has been prepared by the manner in which T_{1a} ended.

At first there is only one motif of what often sounds like two pitches, for twelve seconds, repeated several times.[130] This gives a sense of stasis, as well as the aforementioned sense of greater scale. This, plus the fact that this is the first multipart

[130] There is a quarter-tone difference between the pitches which is often unclear on the recording.

texture, makes it sound very much like the real beginning. There is a new interval in the harmonic scheme here, as the notes of the motif are a quarter-tone apart.

T_3 goes on to expand its collection of pitches, opening up the registers as it does so, thickening the harmonic texture as new pitches come in. It should be noted that this widening of registers is very wide: the cello goes to very near the bottom of its register and the violin goes nearly as high as its previous highest note.

T_4 cuts across T_3 (a phrase which will appear many more times), that is to say that immediately the solo violin (which plays T_4) enters the others stop.

Again harmony is static here since pitches are repeated a great deal; one is aware of four pitches furnishing two semitone relationships and one tritone, so there is relatedness to T_1. However, the primary sensation is of new material appearing yet again, wiping away T_3 with a change of mode of expression, since T_3 featured graduation of pitch and dynamic, while this texture features opposition of pitches with a fixed dynamic and energetic rhythm.

The opening set of pitches of T_4 is expanded only after five repetitions of the highest, reflecting the way in which T_{1a} was erased. One feels at this stage that repeated pitches have a quasi-cadential function.

The next texture is very clearly related to T_1, but develops it into a multipart version, so I call it T_1+. It is joined to T_4 by the fact that it starts from the same pitch as was repeated at the end of T_4, but one hears it nonetheless as a new beginning of T_1 due to the re-introduction of the gapped rhythm, the drop in dynamic from *f* to *p*, and the fact that it then breaks away from the limited collection of pitches of T_4, re-introducing the semitone step language of T_1 (T_4 had leaps only). T_1+ starts at the slow speed, with gaps, of its earlier appearance, giving the effect of dissipating/cancelling the energy from T_4. It is immediately apparent that this is a developing version of T_1 (hence the label T_1+), since there are important differences of structure: gaps in register are more common, neighbouring semitones being absent

(that is, minor 9ths or major 7ths are the norm); thus it ranges over a wider tessitura and has a more disjunct feel. It goes on developing by the introduction of a second instrument (also violin), which necessitates an increase in speed irrespective of textural thickening. Despite the instability brought by this thickening (with independent rhythm), a sense of stasis eventually encroaches as one gradually notices that the pitches are becoming fixed in place and hence are recurring. This stasis is of a subtler order than in T_4, since there is still rhythmic development by virtue of the independence of the two instruments in time, and also since the number of pitches is far greater.

T_5 evolves out of T_1+, i.e. there is an overlap of old and new elements. The new element is nevertheless completely new, and it completely takes over after a short period of overlap. This becomes a more explicitly static texture, with pronounced repetitions, though again there is a sense of rhythmic freedom and hence changing relationships. It involves all four instruments, and a variety of motifs/rhythms as well as a width of tessitura give it a surface complexity which opposes the harmonic stasis. However, the presence of long-held notes and the more explicit repetitions make T_5 more static overall than the preceding T_1+ and T_4.

The next event consists of a *fortissimo* pair of low Cs from the cello which cuts across T_5, causing all if its activity to cease at once. This is followed by a short gesture, T_6, consisting of a loud descending passage, related in rhythm and articulation to T_2, but with new aspects: it is completely unidirectional, multipart, and features note repetition to a degree greater than T_2. These differences are sufficient to make its relationship with T_2 rather subtle. The function of this short and simple gesture is as a partial cadence for all that has gone before. Including the low C, one has just heard a gathering of the registral limits, since the descending line commences from a note on violin 1 higher than any from before. A sense of cadence is kept partial by the rhythmic pause between the Cs and the descent, and the fact that the descent only goes as far as middle $E^{\flat}$. Also, the increase in speed and dynamic implies

development, to some extent. The material of T_6 once more uses semitone steps and their derivatives for its harmony. The Cs which return in expanded form immediately after T_6 help to close off this section and reinforce the cadential feel. (see **fig L.1**.).

To summarize this section (groups A *and* B, see **fig L.1**.): the piece opens with a great deal of rapid surface change, featuring dynamic motivic shape, but this promise is avoided and/or frustrated in following textures, since in each case so far, the perception of stasis (pitch and motivic) encroaches on an ever-lengthening scale. T_6, were it not for the Cs, appears somewhat to give up on further development for the piece. (This is meant in the sense of rhetorical discourse, not in a sense of compositional weakness).

Group C, T_7 — T_{14+1}

The following group of textures to the end of the first movement often returns to the repeated Cs, always ***f*** or louder, often jumping through four octaves between the instruments. This (apart from seeming obsessional as a gesture) casts an extraordinary tension across the remainder of movement 1, since the Cs have been associated with cadence and with sectional borders (since they are never truly attached to other textures, and frequently associate themselves with pauses); yet the textures continue to grow in complexity, extent and dynamic variety. One perceives this in two ways: on the one hand it sounds as if the development of new and interesting textures is being held back, interrupted, shortened or heavily questioned, on the other hand the function of the Cs themselves is broken down, as they rearrange their weight and extent on each appearance, and sheer repetition of pitch and motif itself begins to demand change and thus transforms its function from structural downbeat to upbeat. There is a great release in movement 2 when finally it is allowed to proceed without this quasi-cadential impediment.

The end of group B was an arch of Cs:

Group C begins with an inverted arch of Cs:

which is a more open form, in terms of function.

T_7 is (in terms of motif) new to the ears, as previous textures were. But whereas many subtle harmonic links occurred in previous cases, here we hear, for the *first* time, the generation of linear motifs from major and minor thirds. As B introduced quarter tones, C introduces thirds, while retaining also semitone- and tritone-derived sonorities.[131] T_7 has some deeper similarities with the more complex of earlier textures; there is a limited repertoire of actual pitches; or more correctly, it exhibits the use of register fixed pitches (as did T_4 and later part of T_1+ and T_5). This is only fully perceived by the listener after some time, since there are many different fixtures at various registers. A feeling of complexity and newness is gradually replaced by a realisation of encroaching stasis. However T_7 is the least static sounding of all these.

There is a real sense in T_7 of cyclical energy owing to the pitch shape moving up and down in waves, while rhythmic values cooperate to produce a feeling that the speeds are also changing in waves (i.e. increasing and decreasing gradually); at the same time textural thickening and thinning also occur in surges.[132] Often the changes appear to coincide to produce rushing upward or falling downward effects (and hence

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[131] Other intervals may also occur as by-products of temporal independence, though linear interval repertoire is strictly derived from limited sets.

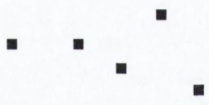
[132] The four instruments are organised with (fixed) independent time signatures so that the cello is the slowest in terms of rhythmic unit, and va, vn 2 and vn 1 are each respectively quicker. By speeds changing, I mean that slowing and and speeding effects are created by the interpolation of rests into the basic pattern of each part.

the cyclical feeling) which makes for an impression of development. The register pitch fixing is also very short-term here, aiding the effect.

As well as rising and falling, there are two distinct points in T_7 where convergence of pitch occurs, that is, two outer lines are heard to move in contrary motion to a single point. These are associated with slowing down and thinning, the second one ends T_7, just before the Cs' return.

T_8 consists of long-held pitches played non vibrato, plus more rapid skipping figures consisting of two notes, these often a tritone apart, which recalls T_4 somewhat in harmony and texture. It makes a very gradual descent in its upper register, coupled with some decrease in dynamic level. There is thus a sense of retreat and encroaching calm, in contrast to T_7's waves of energy (it having ended on one of its waves' crests). It should be noted that a lot of the apparent descent is somewhat illusory, as it is effected by changes in the frequency with which registers appear, as the instruments pursue independent rhythmic goals, as well as actual pitch descent introduced slowly in each instrument.

The Cs now restate themselves, this time in an expanding wedge shape:



This might be read as signalling development to come (an interesting idea—that the Cs are a gossipy comment on the events around them).

T_9 is the most complex subsection so far, though one of the shortest. It is a compound texture made up of eight distinct elements: 1) dynamically shaped (espressivo) legato lines usually ending in *tremolo*s or trills, 2) stepwise rising *pizz.* motifs, 3) quicker *pizzicato* rising in leaps of a third, 4) rapid falling notes (staccato) in pairs of the same pitch, 5) the same device in a rising direction, 6) isolated single note *tremolo*s, 7) *pizz.* chords strummed, and 8) *pizz.* motifs combining rising and

falling. This texture has the effect of being the expressive centre of this section, and of the movement. This is because a very rich interplay of different elements exists, with no trace of harmonic stasis or unidirectional overall movement; in every parameter a freedom is allowed to a degree forbidden in other passages (including the remainder of movement 1). Thus is one made to feel that T_9 fulfills the potential richness of the piece so far, which was held back (the relatively short extent of this texture creates an imbalance only resolved by longer and more varied textures of movement 2).

This level of interaction of elements was fleetingly hinted at occasionally before: e.g. where T_1+ overlaps with T_5 (for about 3 seconds), within T_5 itself where a certain heterogeneity of texture is built in by virtue of the material having two distinct contrasting motifs, and to some extent in T_8 where two elements (which could be regarded as a single one with a head-motif and a tail-motif which contrast) make for a certain motivic richness. All other textures have consisted of one and only one motif, albeit sometimes contrapuntally independent.

In fact it is worth at this point summarising this progression:

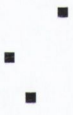
T_1 and T_2	The motif is essentially the single note, detached, forming monophonic texture.
T_3	3-note motif, at quarter-tone interval, polyphonic.
T_4	4-note motif, monophonic.
T_1+	begins as T_1 but expands to polyphonic.
T_5	4-note motif in viola, 5-note in violins (based on (0,1,2,3)).
T_6	related to T_2, but polyphonic.
T_7	motif of 3- or 4-note arpeggio, polyphonic, with only one motif.
T_8	head and tail motif giving rise to some polyphony of texture as well as of parts. Further simplified by unidirection of parts.
T_9	great polyphony of motifs, motifs consisting of 8 to 10 notes.

So, broadly, it proceeds from simple to complex on several levels, monophony to polyphony, short motifs to longer ones, and single motif to polyphony of motif.

To return to the commentary: T_9 is interrupted by the Cs, which come as a single pair, then a pause, then an arch like the first with an extra pair attached:

T_{10} is a return to simpler textures, where all (three in this case) instruments have the same kind of material. There are two parts to the material: a quick demisemiquaver semitone-based head motif, and longer held pitches. The texture is introduced by the head motif only, in four separate bursts, then a polyphony of motifs occurs so that sometimes one hears the held notes against the head motif, and at other times against other held notes. The harmony is derived (as often before) from semitone steps, contrasting thus with T_9 (which was derived from 3rds and 6ths). Also sometimes the whole tone interval becomes noticeable (after first appearing as two semitone steps). T_{10} occurs in high registers only and is limited in tessitura.

This is interrupted by Cs, a short burst in three registral positions:



giving a sense of incompleteness where four positions was usual, thus appearing as an open version, and, as it is shorter, allowing T_{11} to be closer in time to T_{10}, which helps to make Textures 10 and 11 a pair.

T_{11} opens as a low-registered relative of T_{10}, and remains in a narrow register for long periods. This seems to counterbalance T_{10} gesturally. The important differences are: it has an overall dynamic shape which opens and closes, created by: rising pitch, increasing and decreasing rhythmic activity, and rising and falling dynamics. The actual melodic material is different, being slower and richer in tone, and using quarter-tones, thus deriving semitones and three-quarter tones as well as whole tones as it develops.

Like T_{10}, T_{11} develops a tendency to a polyphony of motifs, as long, greatly drawn-out versions of the motif here coincide with quicker versions on a different instrument. Though again, overall register is limited (less than in T_{10}).

T_{11} is interrupted by Cs, this time just two pairs, thus one less than the last appearance—so more upbeat in implication. They occupy very little time, since they have no silence before or after, but are joined in time to the textures before and after. This increases the sense that the Cs are becoming more integrated with their surroundings.

T_{12} is gesturally uncomplicated, as it consists of single long-held pitches, which enter and overlap as the four instruments introduce them. There is one motif, but polyphony of parts. These begin in the very high register and fall as lower pitches appear under one another. The initial simplicity of motif is made *slightly* more complicated after a few entries, as long pitches are sometimes preceded by one, and sometimes two, much shorter pitches which step up or down onto them. Broadly this texture resembles T_8 in shape, but without the tritone skipping figure. It can also be related to T_6 in its descent and tight semitone harmony (that is, that it begins with (0,1,2)-derived groups, as does T_6, though not T_8). This gradually changes, however, to more open clusters which consist of whole tones with perhaps one semitone present (giving, for example, chords such as (0,1,3), (0,1,5), and (0,1,3,5)).

This texture ends when a single pair of Cs cuts across it, the highest of the four positions in which we have heard the Cs, this is the shortest possible burst of Cs, (if we assume that a single iteration of C would not make the relationship to the other bursts manifest) and is closest in time to its surrounding textures. So the Cs are melting gradually into their surrounding textures.

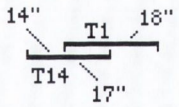
T_{13} follows on immediately. It consists of alternating areas of calm and activity. The calm areas are very close in register and sonority to the latter part of T_{12} (though no longer committed to descent) while the more active areas have a different

harmony, built from tritone-plus-semitone chords (thus related to T_8 and T_4). T_{13} opens with a statement of the active type. This is characterised by increasing time values and dynamics which swell to a climax, and then recede by the reverse process of decreasing values and dynamics. At the point where activity dies down, one may regard an area of calm as existing. These points usually relate harmonically to T_{12}. T_{13} unfolds with a sense of separate phrases (unlike many other textures e.g. T_{12}). There are four areas of climactic activity, and each reaches a greater sense of climax than the last through its use of increasingly active rhythm and greater dynamic and registral extremes.

The end of T_{13} is brought about by the last of the climaxes leading directly into a climactic statement of the Cs, i.e. one which is very long, unrelenting in rhythm and agitated in its choices of tessitura.

A small silence follows before T_{14+1}, enough to give the impression that T_{13} is attached to the Cs while T_{14+1} sounds separate.

The fourteenth texture is called T_{14+1} in **fig. L. 1.** because it consists of two textures overlapping. T_{14} consists of *pizzicato* four-note figures sounding as a quick triplet followed by a main note from the cello and viola, together with a two-note rising figure in the violins. After about 14 seconds the cello changes to *arco* with what is clearly T_1 material; separate short notes with irregularly timed silences between, though it is in a lower register with a different outline of melodic shape. It obeys the same harmonic conditions as T_1, and uses two arching outlines at first, followed by a rising shape which leads to a widening wedge where more than three octaves are covered in three notes. The degree of overlap of the two textures is what compels me to list it as one subsection despite its separable nature. The amount of overlap is approximately 17 seconds on the present recording; all of the dimensions can be shown thus:



however this is something of a departure from the clear definition of subsections by texture, and indeed this foreshadows the second movement where subsections are no longer defined clearly by texture, but by resting points. (Much smaller amounts of overlap did occur earlier in the 1st movement as noted above).

Movement 1 ends with a repeated three-note figure in rising semitones which occurs high, in close position at first, then widens downwards twice, where first one semitone expands to a minor 9th, and then the figure becomes two minor 9ths; thus we hear the upper note (unchanged) sounding as a limit for the register. The gesture of repeating a pitch (especially an upper pitch) has been established already (since T_{1a}) as a signal for the end of a section.

Although the 1st movement has a mostly episodic shape with non-repetition of gesture; i.e. the unfolding of many new textures with little self-reference as its defining characteristic, one can group the textures into various categories according to their simplicity of pitch structure or motif or gesture. A diagram can be constructed (see **fig. L. 2**., volume two) which shows each texture and a number of categories it falls into. This makes it a little clearer how the textures can cross-relate at subtle levels of structure and function when the outer features such as articulation or rhythmic activity can be contrasting. For example, from the diagram it is clear that T_6 and T_{12} are similar in their order of complexity and gestural shape though actual articulation separates them. Thus they are similar in function and weighting. A note of caution though: some very obvious elements are not considered here (such as rhythm, speed, extent, articulation); this diagram seeks to elucidate the subtler links, while surface features do not work to unify the piece in the same way.

I should define more precisely what I mean by weighting. Essentially this refers to the gestural importance of a section/texture which I take to be the amount of information per unit of time. Simple gestures (in whatever parameter) have lesser

amounts of information, while complex ones have greater information content. For example a line which descends using a repeating pitch pattern or cycle has little new information once it is established, despite exploring new pitches as it descends (the new pitches ensure that it has some). Indeed, information could be itself defined as change, and what is at issue is the rate of change. The darker areas on the diagram are those with higher information content and hence greater weighting. The diagram shows for example, as might be expected, T_9 to have the greatest weighting. Thus a relevant hierarchy of the textures is easily read here.

The development of gesture and texture as far as T_9 was summarised above. A development proceeding from simplicity to complexity was observed in the domains of texture, motif and density. It is worth stating explicitly that T_9 stands out from the others in a radical way, because the new levels of complexity are introduced one at a time[133] from T_1 to T_8 while from T_8 to T_9 there is an explosive multiplication of motifs and surface detail. From T_{10} to T_{14+1} there is return to simpler states; these all feature less surface complexity than T_9, and even less than T_8. In no way do they attempt to better T_9, neither do they attempt an adjacent level of complexity; they are content to occupy the level set by T_8. This confirms T_9 as the most expressive and most highly developed texture, the centrepiece and climax of the first movement. The last texture of the movement features a turn towards greater complexity with the superposition of two textures over a long period of transfer. This foreshadows the language of the next movement, where combination and recombination of textures becomes an agent for development.

[133] with some reversal of the developmental steps—to avoid predictability.

Main Movement, commentary on the 'Sections'

Group D, S_1 — S_3

In the second movement the textures do not consistently define sectional boundaries in the way they did before, so in this part of the analysis I will use S_1, to denote Section 1, S_2 to denote Section 2 etc

The dotted lines in **fig. L. 1.** have a slightly different meaning in this movement, because there is more fluidity and cross-relatedness in the musical material. In the first movement they denoted the interruptions of the octave Cs, except for the case of T_2 which is related to and surrounded by T_1. In this movement they denote resting points or changes in texture, without a sense of break in the primary motivic material. The hard lines do represent such breaks, despite the complex cross-references which can exist between (often non-adjacent) sections.

S_1 is a very unified section based on energetic *tremolo* where pitch changes only very gradually, so initially one hears a single pitch sustained through forceful entries on four instruments, which begin with repeated sharp attacks at irregular time intervals. This pitch is challenged harmonically by a second pitch a semitone lower, which begins a widening process whereby the lower register is opened up while the upper note remains recognisable as the initial note. The lower pitches are always in a state of *glissando* either up or down. The downward semitone expansion halts after a distance of a 4th is reached, and the upper limit becomes changeable, also expanding by semitones.

While *glissando* is heard mainly in combination with the *tremolo*, or at least covered by *tremolo* from the majority of players, there is a point towards the end where ascending non-*tremolo glissando* takes over the upper parts, weakening the dominance of *tremolo* articulation.

Rhythmic activity is mostly ruled by the rate of bowing *tremolo*, which is fixed, though other articulations involving *accelerandi*, *ritardandi* and uneven pairs of notes (trochee rhythms) also exist.[134] The main thing to note about rhythm is that the perceived rate of change is a highly dynamic element since greater registral ground is covered in roughly the same amount of time when the registral ambit of a *glissando* widens. Immense surface variety is managed through the non-alignment of the four instruments while they pursue equal goals in unequal time. The upper expansion ceases when it covers a tritone and the lower limit then begins to rise to a new point. This becomes a new lower limit and the upper limit then falls to unison on a point a semitone higher than the initial unison of the section. There is thus a strong sense of completeness about this rather symmetrical section, with just the raising of pitch from first to last to prevent a full sense of closure. A small silence follows before the next section.

S_2 is bound by a unity of texture similar to those in the 1st movement; S_1 also had this kind of unity, i.e. strict limitation of articulation. In S_1 there was constant *tremolo* bowing and almost constant *glissando* of the *tremolo* (and some derived related effects: *glissando* (without *tremolo*), staccato bowings). In S_2 there is just one mode of note production, *pizzicato*.

Before going into details of motivic shape etc, the most striking fact about S_2 is that it falls into two subsections, of 27" and 91". These are very clearly the main subsections since a process of registral shrinkage from a wide opening span occurs over the first 27 seconds resulting in a concentration on the central register together with a decrease in rhythmic activity. In contrast the second subsection gradually opens out in register and some increase in rhythmic activity is felt. More pitch-fixing is heard here than in the first subsection, and this can be regarded as prolonging the section to achieve an overall more opening shape for S_2.

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[134] For more detailed discussion of the rhythm here, see 'Aleatory technique and local rhythmic organisation' in the discussion of technique below.

The first subsection has a marked final gesture, two clear forceful *pizzicati* standing below the central narrow collection (where the texture as a whole has collapsed to) in pitch, and standing apart in dynamic level. These cut across the activity of the central collection, signalling its end, but themselves being the first in a group of rising motifs that launch the second subsection. Thus there is a clear point of intersection with a double function of sealing off one portion and beginning a new one.

The harmonic ambience of the first subsection is remarkable: while the vertical harmony is heavily semitone loaded to a degree frequently experienced earlier in the piece, there is simultaneously an awareness of a new type of linear interval relationship with (remarkable) absence of semitone or tritone; pitches derived from (0,2,7). this gives the section a pronounced sense of harmonic development over the piece as a whole, and prevents the feeling that this is going over the ground covered by T_7, the last section built solely from *pizzicato*.

The contradiction between vertical and linear harmony is made manifest by each instrument being thrown occasionally into dynamic relief so that (0,2,7) pitches are heard to emerge from a semitone loaded background.

In the second subsection there is a (greater than usual) process of acceleration in rhythm. Overall registral goals exist, but they are less linear here, so the process of rhythmic variety takes over to direct the musical evolution.[135] Within the texture *accelerandi* occur in different ways, sometimes one instrument has an *accelerando*, while the others have similar rapid values (and quieter dynamics), sometimes three or four instruments accelerate together (though not in rhythmic unison) creating a more definite sense of increase. Sometimes *ritardandi* are evident, operating in the opposite way to *accelerandi* but the ear focuses more on the latter as they are the more dynamic (in terms of structure) and are supported by the widening registral shape.

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[135] The rhythmic variety includes harmonic rhythm, see under 'Harmonic syntax: rate of change'.

1'28"-1'52" cello *accel.*
2'06" cello *accel.*
2'16" viola *accel.*
2'23" all insts *accel.*
2'36" final *accel.*—vns + va.

The above list indicates the *accelerandi* which sound as the main ones, others exist but have a less commanding aural presence. The most prominent are the underlined ones. The actual range of speeds from slow to fast is not very large.

Overall there is registral expansion through the subsection, with some long-term reference pitches operating to bridge the moments where the expansion temporarily reverses (chiefly at 2'06" - 2'23").

The harmonic language retains the properties described for the first subsection, though some modifications occur. This will be examined in more detail in the analysis of harmonic syntax below.

S_2 ends with its widest registral expansion, the final sound is the cello slowing and descending to its lowest note (for the section). Again a section ends with a gesture of some finality.

Thus far the second movement has retained the sense of separateness between sections, which was set up by the first movement. The chief differences noticeable so far are: 1) presence of four instruments almost constantly (continuing the trend from end of 1st movement), 2) greater extent and development of sections, 3) the absence of the Cs, 4) a sense of rounding off of sections rather than interruption. The chief similarity thus far is the limited extent of motif and linear interval repertoire; each texture is bound by one kind of articulation. However, the trend of expanding and developing motif (which was evident from T_9 on) continues here.

With S_3 we hear a return of *glissandi* and *tremolo* articulations (from S_1), but they are not working towards goals in the same way as they did there. This is a new adaptation for these articulations and does not function as a return. The operation of

accented *tremolo* is one example of why I say this: in S_1 it is the articulation associated with pushing out or closing the register (changing the limits), while in S_3 it is associated solely with marking the goal of the registral descent (setting the limits). This is a more developmental relationship than in previous cases from movement 1, where T_1 material returned to round off sections.

In S_3 there are five distinct statements (marked ⁞ in **fig. L. 1.**) before a more continuous and extensive sixth subsection occurs. Each of the five statements consists of *glissandi* leading to forte *tremolo* on repeated notes (closely related at this point to S_1). The four instruments arrive independently at their *tremolo* so there is a sense of overlapped replacement of one articulation by the other. they also cease separately, giving a ragged ending effect between subsections.

The main gestural developments that make this *contrast* with S_1 are: 1) *glissando* as an opening sound, 2) the predominance of *glissandi* over *tremolo*, 3) wide extremes of register, 4) clear *separation* of *gliss.* and *tremolo* (in S_1 they were combined often), 5) direction of *gliss*: in S_1 these were at their clearest when ascending, at the start here, all *glissandi* are descending, 6) The arrival of pitch limit as a four-note chord rather than a unison, 7) here *glissandi* may change direction before settling on a limit, and lastly, as already noted, 8) the existence of silences between the bursts of activity, and 9) the staggering of the endings of pitches.

These five statements seem very similar in gesture over a 31" period despite many changes in speed and direction of the *glissandi*, and some fluctuations of length of each —this is because the vertical harmony is unified: each ending chord is of the same type: (0,1,6,7).

The sixth statement is a radical development from the five earlier ones: we immediately hear a return to the kind of pitch fixing restriction last heard in S_1, which creates the expectation of a longer section. We also hear new articulations; a combination of *sul pont*, *glissando* and *tremolo*. In this sense we regain the *glissando-tremolo* combination of S_1, but with a new element added, which throws a large number of uncontrolled upper partials into relief. The most important aspect of this

section by far is the fact that the first violin has material which stands apart from the other three in gesture and articulation, that is, it uses harmonics and *glissando* combined (and not *sul pont*); and harmonics and *tremolo* combined, and does *not* restrict itself in pitch to the extent that the others do. Rhythm is also treated in a more complex way, and all of these factors give the impression of a leader in the texture with the other three being a homogeneous supporting texture.

The most obvious development in this subsection occurs (after c51") when two short solo bursts of *arco normale* material occur within the general texture. Gradually each instrument has little bursts like this which take over by becoming more frequent until the entire texture is transformed (to this type), which is effectively a new texture (though a continuation of section by dint of the transfer). This, and the leader-plus-accompaniment texture, are new kinds of evolution for the whole piece, as for the first time we hear significant developments of the role of texture. It no longer concludes, dies or is interrupted; it can evolve to another state.[136] This new material relates back to T_{10} in its motivic shape and harmonic structure (it has a completely new dynamic shape: pp<f>pp). The two textures do not simply transfer by overlap, they have a more meaningful dialogue: the second texture differs with its forceful dynamic character and unstable register, and these characteristics elicit a reaction whereby the first texture itself becomes unstable in register. This is the first significant example of textural overlap resulting in, and relating to, actual development of texture. Furthermore, the 'lead' character of the violin is abandoned many seconds before the second texture arrives, so that for a while the accompaniment texture takes over, and it is the accompaniment texture that develops.

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[136] This is felt as evolution because of the rhythmic inclusion of the new by the old. In this way it is different to T14+1, for example, where an air of non-interaction existed, despite considerable superposition.

Group E, S_4 — S_{6b}

Sections 4, 5, 6 and 6a are all shorter than S_3, and less internally consistent than Sections 1, 2 or 3. This allows them to explore areas of development (to be discussed below) that do not conflict with S_{6b}, which does have the kind of internal consistency/simplicity of the earlier sections. S_{6b} will take its clear, directional texture to a new climactic level, without having been upstaged by similar gestures in the immediately preceding sections.

S_4 is a little like Sections 1 or 2 in that it has a rounded, somewhat self-contained shape, with a pronounced ending gesture including some upbeat implications. An important development, however, is its polyphony of motifs: there are two contrasting elements in the texture, rising *pizzicato* in the cello and viola, and falling figures in the violins. The *pizzicati* are a recombination of earlier elements: they have an *accelerando* similar to that of S_2 (but none of S_2's harmony), their harmony is made up of quarter-tones and tritones, and they have occasional *glissandi* of a tritone, as heard in S_3.[137] The violins' figure also uses quarter-tones, and tritone *glissandi*, but all falling. One also hears a four-note *pizzicato* chord on the cello which signals the start of S_4 and completes the ending gesture. This chord will reappear, always *pizzicato*, at section boundaries, and thus becomes a predictable signal for textural change.

S_4 is very limited in choice of register and pitch, consequently development potential is also very limited. An exception occurs just at the end where the cello rises above its usual limit. This creates a paradoxical double function for the end of S_4, since the new pitches constitute an opening towards the next section, and simultaneously a satisfactory sealing off of the continuity inherent in pitch fixing.

The use of *glissandi* in S_4 forms a link with Sections 1 and 3, while *pizzicato* recalls S_2 (reinforced by rhythmic similarities), so one must acknowledge S_4 as a

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[137] There are no *pizz.* indications in the score, the recording has *pizzicato*. This is an error in the published score.

development from these sections, though in no sense a return (the previous context of frequent appearance of ever unrelated textures, built up in movement 1, made any glimpse of earlier material seem primarily to function as a return). The materials developed are the *pizzicato* element (which here combines rhythm from S_2 with pitch structure similar to that in S_3) and the *glissando*, which here is more than ever exposed in the texture and united in its pitch aims.

S_5 can be broken down into four distinct subsections. The first (described above) rearranges the *arco* material from S_3 and superimposes a new, forceful motif in violin and cello. The new motif is fragmentary, appearing in just a few short bursts. The second subsection uses descending *glissandi* in the violins which relate back to Sections 1, 3 and 4 (*glissando* is beginning to act as across boundaries, binding the entire movement, something absent from movement 1). The viola and cello have some *glissandi* also, but present mainly a new ascending, forceful, *ritardando* element. This element combines aspects from before, including the sort of separate bowing, rests, and *ritardandi*, which we heard in S_1.

The third subsection is the most energetic of all, achieving a gestural climax concentrating in a small time-frame a superposition of six elements all gathered from recent subsections (and hence, some of them relating back across the movement). These are: 1) the rising quarter-tone *pizzicato accel.* from S_4; 2) the T_{10} material which underpinned the first subsection of S_5; 3) the *flautando* quarter-tone material from S_4; 4) the falling *gliss*; 5) the forceful motif from the first subsection; and 6) the separate bow, *ritardando* material from the second subsection.

The fourth subsection is a development of the *pizzicato* chord. This has a certain inevitability as we feel to some extent that it is the only element left undeveloped thus far in S_5. All four instruments become involved. There is a very distinct feeling of constriction of freedom here, as the chord's pitches, which we have heard (on the cello) as boundary material, are repeated across the instruments. They function a little

like the Cs as a gesture that negates development. There is then one change of chord, and the new chord is given similar repetitive treatment.

S_6 is an anti-climactic one which re-interprets two familiar elements: the T_{10} material and the descending *glissando*. These are weakened (compared to earlier appearances) by being low in dynamic level, and (in the case of the *glissando*) having a narrow scope of register and a slow rate of change. This seems anti-climactic for these two reasons, and because of its lack of motivic polyphony and extreme height (and narrowness) of register, all of which contrasts greatly with the immediately preceding passages.

S_{6a} arrives abruptly, cutting across S_6 with a completely different motif, which contrasts in every way; as it is forceful in dynamic, in the middle register, and busier in rhythm. The relationship of S_6 and S_{6a} is rather like adjacent textures in movement 1, many of which cut across previous textures without allowing any sense of arrival or finishing gesture. It is as if the accelerating development of S_5 coupled with the exhaustion of the boundary gesture has led to a state where this movement's discourse of sections, with their build-up, climax, and partial closure leading to the next section, has gone as far as it can (with the gestural climax of the third subsection's polyphony of motif) for the moment. The result is a collapse back to the more primitive type of discourse of the first movement.

The short subsection format of S_5, with its accumulation of motivic elements which leads to the climactic polyphony of motifs recalls the method by which T_9 achieved its status as the climax of movement 1; without the more commonly used ways of pointing up a climax (reserved for later, S_{6b}). With its greater use of motivic development, however, it would be better still to class this as a separate method again.

S_{6a} begins to reclaim the energy and tension dissipated in the textures of S_5 and S_6. It does this by degrees: to begin with, in its first subsection of twelve seconds,

there is only one motif.[138] Then a change of texture is effected, without any loss of flow (a single demisemiquaver speed and a rapid overlap of the textures elides the two subsections). The important feature here is that there are now two elements to the texture, restoring polyphony of motif. There is a clear hierarchy of these elements, as one consists of two-note alternating *tremolo* (resembling the accompaniment texture of S_3 without *sul pont.*) and the other is a louder, separately bowed figure with variable rhythm, which is clearly the leading element. This subsection reaches a climax by widening in register throughout its fourteen seconds and by broadening out its rhythm with a considerable *ritardando*. There is a very gradual transfer from the *tremolo* to the lead material in all the accompanying instruments so that just towards the climax, all are playing the lead material. This transfer is itself aiding the climactic gesture as it consists of a shift from the less prominent element to the main one. However, there are qualifying aspects of significance: the *ritardando* is a climax-defeating gesture, and as it occurs, register fixing of pitch becomes very noticeable: the harmonic rhythm has slowed down. (Pitch-fixing was not absent before, it rarely is in this movement, but rapid change of pitch sets was employed at the earlier part of this subsection.) Just as this climax might die back (it has not done so yet, as it ends with longer held notes on the widest available position within the fixed set), it is pushed to a further height, with the beginning of the next subsection, constituting a wide leap up and down in top and bottom parts.

I should mention the relatedness of materials between that leading to this climax (end of subsection 2) and that of S_5: the opening materials of S_5 and S_{6a} are clearly related, as they are all from the T_{10} group of material.[139] In S_5, however, there are two instruments on two different sets of pitches (using sets of 6 and 5 different pitches, 11 out of the possible 12), but at the start of S_{6a}, four instruments on a single set of four

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[138] On the cello only at first, with the other three joining in independently. This is actually derived from the T6 material (itself with a long history through the piece as T10 etc) but the radical changes in rhythmic drive, force of dynamic and concentration of register of all instruments into a (0,1,2,3) space, coupled with the absence of *glissandi*, makes this appear as almost completely new.

[139] Characterised by winding through 3,4,5 or 6 notes in (0,1,2,3...) close formation where only steps of a major or minor second are permitted.

pitches present a much more clearly focused version of the material. Then with the new element of S_5 we hear a (0,1,2) set expanded from close position to allow major 7th and minor 9th leaps, with separate bowings. This evolved to the *ritardando* separate bow material of subsection 2 of S_5, where viola and cello had eight pitches, one set each (of (0,1,2,7)); later in S_{6a} this same material is presented on four instruments, but all on the one four-note set ((0,1,2,6) on this occasion). Again the process of focusing onto smaller sets is heard.

In S_{6a} there is also the *tremolo* material which gives the impression of rapid change as it has many (fixed) pitches to choose from: viola, and the two violins have three different dyads - giving the set (0,1,2,6,7,8), with register not fixed, allowing octave shifts to create changes in harmonic balance. This material has its precursor in S_3 where it was played *sul pont.* and constructed from exactly the same elements: three interlocking dyads forming (0,1,2,6,7,8). Again the latter is the more focused because the S_3 prototype often allowed *glissando* and *tremolo* combined, and the *sul pont.* also throws the ear off the actual pitch at times; so the S_{6a} version is a clearer version (and is possibly more focused in its handling of register also). So a process of re-using materials from various places in the recent past and simplifying them is evident. This is a bit like development in reverse. By being simplified they allow for more concentrated or forceful expression of aims. The materials always appear in new combinations too, so there is rarely a strong sense of recognition of familiar elements; the predominant aural impression is of forward momentum in the musical discourse.

The second subsection of S_{6a} begins with wide outer limits. These are not maintained constantly in this subsection, but are restated once towards the end of it. This subsection therefore gives the impression of partially maintaining the climactic gesture with a plateau (this will become an important feature of the main climax later). It also fulfils the other kind of climax; the progress from one motif to two, to many superimposed (as used in movement 1). The pitch fixing of the earlier subsections is less evident here, the outer limits appear fixed by dint of their unchanged restatement, but within the texture there is a motif that appears in all

instruments which uses many non-fixed pitches and many different intervals—a remarkable motif in the context of the piece up to this point.

It is evident through the piece up to this point that two significant types of climactic gesture are possible: the model from movement 1 is a progression from motivic simplicity and pitch-fixing to motivic complexity and pitch freedom. This type has occurred in movement 1, and in S_4 of movement 2, and in S_{6a} thus far (though this is a peculiar case requiring further comment). The second model has operated at the local level on occasion and will operate in the main climax of S_{6b}. It is a progression from local pitch flexibility towards greater pitch fixing and stasis, and is supported by more traditional climactic elements of registral expansion, dynamic crescendo and rhythmic broadening.

The climax of S_{6a}, which operates from 6'34" to 7'18" combines characteristics of both these climactic types.[140] Type 1 is not supported as clearly by register and dynamic, but achieves its sense of importance by thickening of texture and increase of surface activity, and hence of rhythmic features (including increase in harmonic rhythm).

S_{6b}, the long climax from 7'18" to 9'09", has two distinct phases. 7'18" to 7'52" (34") is a climax in register and dynamic of unparalleled extremity, leading to a registral high point (four different notes, one per instrument) at 7'52", which is then maintained as a plateau, to 9'09", where pitch is fixed, dynamic is very strong (though allowed to diminish greatly in the latter part), and rhythmic activity goes through a *ritardando* of hitherto unparalleled extremity. At 7'18" we hear a limited central set of pitches fluctuating together in a manner reminiscent of the beginnings of climax at 5'34" (S_5's gestural climax) and 6'34" (S_{6a}'s climax) so it is becoming a familiar gesture associated with a following climax.[141]

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[140] and as such represents perhaps a *transfer* of method of climax from types 1 to type 2.

[141] The set is distributed as follows: vn 1, vn 2, and cello: c# d#, va: d e (f). Again a tight (0,1,2,3,4) group is heard with linear occurrences of the major second rising and falling. So although the motif for each individual bears no resemblance to T10, the overall sound is strikingly similar.

The central set widens out gradually at first with the addition of a single pitch. New pitches are accumulated (at semitones intervals) on top of the texture while the lower part retains its level, thus a vertical cross section will show a (0,1,2,3,4,5,6...) set expanding upwards. The texture thickens by the use of double stops in all instruments. In this way, for a time at least, while vertical space expands by semitone steps and thickens at the same time, gaps are not allowed to develop.

When gaps do become inevitable, semitone relationships expand as minor ninths so that reading upwards in the texture one gets: C#,D#,E,F,F#,G,G#,A,A#,B,C,D,E. After about twenty seconds a sudden expansion is effected by the cello, which plunges down a compound fourth followed closely by extreme upward leaps in the other instruments. At this point pitches are fixed in register for some time, but one doesn't get a sense of stasis as there are very many, with a lot of surface figuration.

The next development is a quick transfer from the multiple stops in rapid rhythm to a combination of *tremolando* and *glissando* that we have never heard before, but at the same time there is a familiarity in the bowing and accent patterns within this, and a vertical harmonic complexity that links this to the multiple stop texture (note: some of the slides begin on notes fixed in registral position by the previous twelve-note chord, which helps create the link). The sliding *tremolandi* all begin and end independently, but very closely in time so that they are perceived as a single gesture. A remarkable aspect of this gesture is the lack of bass; the cello had helped to create a thick and wide climactic area, but sacrifices the bass area to join the others in the upward slide.

They all arrive closely in time to create a chord identical in structure to the *pizzicato* punctuation chord of sections 4 and 5. This link is not very obvious though, as there is the most extreme possible difference of register between the earlier appearances and this, and the pitches are now transposed. This chord was also heard at the end of the first movement where it combined upper and lower registers. It therefore signals important structural points across the piece (for those who perceive

the link, at whatever level). On this occasion it operates locally as well, it is related to the vertical structures of the multiple stop chords.

(Recall that the hard lines of **fig. L. 1.** refer to worthwhile large divisions of the piece. They indicate the fact that smaller subsections interact, interrelate, and build large sections in a coherent and interestingly variegated way, something very definitely limited in the first movement. So, despite a lot of detail in my description, I should advise the reader not to lose sight of the idea that, for example, everything in S_5 belongs together and does have a separate identity to S_1, though also some relatedness exists at time across these boundaries. The relatedness is not of a sort easily tabulated into ABA-type formal descriptions).

Group F, S_7 — S_{10}

The pace of events from S_7 to the end is markedly slower than all of the preceding sections (and of movement 1). The plateau featured an exceptionally broad *ritardando* which was the start of a large anti-climactic area which includes the remainder of the piece. This slower pacing permeates all levels of structure: firstly; local rhythmic figuration—typically very slow throughout sections 7 to 12 (a slight resurgence of smaller values occurring in S_8, but pitch fixing and decrescendo maintain the anti-climactic function), secondly, harmonic rhythm is very much slowed by the device of pitch fixing which is allowed to operate over whole sections (e.g. S_{7a} where pitches recur fixed in the same register for 120"), and thirdly, the typical length of time for which a texture may prevail becomes broader. (Reflected on **fig. L. 1.**, which shows no broken lines at this point, indicating a lack of surface variety when compared to events before S_7.)

S_7 begins with the entry of the three lower instruments under an existing long-held pitch, which was the highest of the four forming S_{6b}'s plateau. The four instruments now form a long-held non-vibrato chord: C#-E^{b}-G^{b}-G#, which after some

internal repetition of pitch gradually changes itself: at any one time one of the four instruments changes its pitch. Thus any two adjacent chords have three notes in common. The initial chord is very wide in register: the top note is a limit for the entire string quartet, the bottom is the cello's low C# (the lowest limit for all of the piece bar the Cs of movement 1).

The chords after that are narrower than this: the cello moves up over two octaves with its first change, the first violin down just less than two octaves. The first chord is simultaneously struck by all four, which strongly integrates the top note into the new section; the borderline would have sounded as a join otherwise.

At this stage surface rhythm has become very simple, with the changes occurring at equal time intervals, and no two adjacent changes occurring in the same instrument. The harmonic rate of change is therefore even and very slow; this is an opportunity for pure harmony to move to the fore as the principal shaping element. It does so in the most forceful way available; that is, each change brings about a chord which contrasts as much as possible with the previous one.

Generally, throughout S_7 the upper register falls from the great height to very nearly the bottom of the violin register, a decline of nearly four octaves. The opposite collapse of register in the bass cannot operate in a similar way, but the lower register falls somewhat, in small leaps after the early rise, settling on a position still one and a half octaves above the low C#.

S_{7a} is so called because it begins with a simultaneous attack on a long held pitch in the four instruments, and is very slow in its harmonic rhythm; frequently, though not always, featuring long held pitches. However, in its earlier parts there are many other surface features that distinguish it from S_7; it has a motif of two parts: initially there are alternating pitches in a close area (e.g. F-E-F#-E-F-E), then a long and slow downward *glissando* of a 6th or 7th (major or minor). To counteract this increased level of surface variety, the harmonic rate of change actually slows, with much pitch-fixing; more than was usual in S_7 despite its method of retaining three out of four pitches.

The main feature of S_{7a} is of pitch constantly descending from F# down to the G below middle C with *glissandi* which are gradual though variable in speed. This G is a fixed limit while the upper limit gradually falls by semitone until a final A^b is reached, which, unlike all previous limits, does not fall to the G. The upper activity, as described above, alternates or weaves between three pitches each a semitone apart. The four instruments all use similar pitch ordering, but with independent rhythm (though based upon the same pulse tempo). The result is that a great variety of vertical harmony may occur,[142] but is strictly bound by a simple governing principle (akin to a kaleidoscope). The section is devised so that the low limit G becomes noticed from time to time by dint of all four meeting there fleetingly—with some holding it for a long time while waiting for the others. As a result of this there are gaps in the activity in the upper pitch area, and the section divides into three long phrases: 10'44"-11'56", 11'56"-12'15", 12'15"-12'46". That is what is heard from the LaSalle recording. As it sounds in this recording, a number of different harmonic effects occur where a) all instruments are concerned with upper limit (alternating) material, on (0,1,2) sets; b) some are concerned with such a set but one or two have begun to *glissando* creating a wider resultant set, and importantly, new harmonic colouring; and c) all are sliding down to G or have reached it.

As the section continues a sense of broadening of the pitch collections occurs so that the up*per se*t may be 0,1,2 at first, but this cardinality expands (0,1,2,3...) as the lower limit falls so that vertical harmony can increasingly allow whole-tones and wider intervals to be noticed, while the frequency of semitones falls. Thus the harmony subtly, slowly and transiently evolves.

S_{7b} consists of S_{7a} material transformed and simplified so that there are three superimposed *glissandi* of differing speeds, arriving on a final tritone. This section has a different lower limit to S_{7a}, but we cannot know this until the limit is breached. There appears to be some relationship in S_{7a} and S_{7b} to S_1, but this is mainly in underlying structure rather than in the surface discourse of the music. That is,

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[142] when combined with the descending *gliss.*

important surface differences of articulation and rate of change (mainly; there are others) prevent clarity of thematic relatedness.

The function of S_{7b} is to break the pitch limits of S_{7a} in a way which is within the gestural frame of reference set up by S_{7a}—in effect to lead it away gently from its own internal repetition, bring in change, and ease the passage to S_8 in a gradual way.

S_7 was tightly controlled and limited in its gesture and grammar so that it remained extremely simple in rhythm (melodic and harmonic) and very soft in dynamic. S_{7a} increased the surface tension and complexity by an increase in dynamic and tone and a far greater variety in rhythm. Pitch limits offset this increase somewhat. S_{7b} breaks these limits and allows S_8 to increase the motivic and expressive potential still further. Therefore S_{7a}, S_{7b} and S_8 move forwards from the main anti-climax at the end of S_{6a}, as if an expressive summit was followed by a sheer drop from which one can only gradually ascend (further descent, if it were attempted, might seem comical), rather than a series of gradually less excitable textures to a complete close. As a result, Sections 7 to 10 seem opening in function at the local level, and only in the context of the piece as a whole can it be felt as a satisfactory way to end the piece.

S_8 increases the complexity in the usual way by allowing a greater heterogeneity (or polyphony) of motivic elements. Pitch freedom exists, but is used sparingly together with large blocks of time where pitches are few in number and fixed in place. The first motif here is monophonic *pizzicato* (using a minor ninth and a tritone—recalling T_1), then two more elements take over immediately, both of which use fixing of pitch. *Pizzicato* in two instruments keeps a link with the last element, and a bowed *tremolo* on a single pitch creates a link with S_3, but not with anything from the first movement. These elements are subject to a *ritardando* that decreases their complexity, as their details become more easily assimilated, and then immediately a

longer, multi-instrument version of the opening pitch gesture enters,[143] which widens the register and increases the expressive weight, by combining the first element with the bowed *tremolo* (now itself moveable in pitch) and this polyphonic version of itself. This opening out gesture is only momentary, yielding quickly to a longer passage where pitch fixing returns; this last subsection of S_8 is a combination of three elements, two fixed in pitch: 1) a continuation of the bowed *tremolo* repeated note; fixed, though now a harmonic, 2) a repeating three-note motif, very high and quiet, but clearly a simplified relative of T_{10}, which has been developed extensively in this movement,[144] 3) the third element is free in pitch and comes in only after the other two have established themselves. This sounds clearly as a leading element with the others as accompaniment. The rhythm of this element recalls T_1 quite strongly, and some of its intervallic language does so too.

This multiple-element texture with its reminder of T_1 is the highest state of organisation the final area (Sections 7 to 10) reaches; like T_9 in the first movement it is surrounded by simpler textures. S_9 and S_{10} never allow themselves such a level of complexity. Thus S_7-S_{10} contains a local climax of the kind described in the first movement. It is gestural, and is not necessarily supported by registral height or width, nor (particularly here) by weighty dynamics.

The complexity of this latter part of S_8 doesn't challenge the levels reached in any other climactic area, though it is more complex than certain supporting textures. Thus there is no sense in which S_8 promises development, rather it confirms the feeling that the piece has done most of its developing long since; this is helped of course by the element which recalled T_1.

S_9 consists only of descending *glissandi* from a single note with asymmetry of rhythm and some polyphony of parts. Only two instruments are involved. Although this is high in register (and recalls S_6 by dint of motivic similarity), it all occurs below

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[143] One which relates to T1 in harmony and hence is free in pitch choice.

[144] In fact, the S6a appearance is the one closest to this, in simplicity of pitch order and lack of polyphony, yet the height and softness is in great contrast to S6a's version.

most of the area which S_8 occupied, so when S_{10} arrives with a return to this higher register it sounds as if S_{10} has taken up where S_8 left off. It is not just a matter of register, the beginning of S_{10} uses a rising minor ninth *pizzicato* that recalls the figure which began the second wave of S_8, using some identical pitch-classes.

This rising minor ninth of S_{10} is followed directly by the other three instruments playing descending demisemiquaver material, which closely resembles the material of T_2 from movement 1, though here it is harmonically and gesturally very static, as it has a limited set of pitches and no real trajectory (again, due to pitch repetition). By contrast T_2 and T_6 had local and medium term direction; this has little of either due to pitch repetition. S_{10} then goes into its final phase: still in demisemiquavers, the violins have a three note figure of a falling tone and rising semitone; this is a significant change in direction, as it introduces and area of rising semitone material. All of the instruments except cello now have a motif identical in pitch and similar in rhythm that rises in semitones and falls for one semitone at the end. This sounds like a logical extension of the first phase coupled with the three note turning point; promoted by the dynamic profile which follows the motivic contour.

The rising motif then alternates (in all, three times) with the turning figure, then becomes repeated, but losing part of itself each time: the final falling semitone is lost, then the initial rising notes are lost one at a time until just a rising tone A-B is heard repeating. While all of that erosion occurs, the cello enters with a solo of 41" which recalls T_1 in rhythm, though now in *pizzicato* and allowing some intervals not present in T_1.[145] One can say that the main gesture in the latter part of S_{10} is a simple pitch play where a model progression is stated, then restated minus its final note, which, after lengthy digression, the cello eventually provides. But this gesture is weakened by the fact that the cello is not the last sound, the A-B carries on just a little. So the piece does not have a strong local closure, if it can be said to close at all it is only in the

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[145] Note: the cello uses 6 pitches complementary to the pitches of the other players, as well as some of theirs, and saves the B^b to last, the same B^b subtracted from their rising motif.

weakest sense. However the global gestural shape of the movement implies that this is a valid place to end. Perhaps this, coupled with the subtle local harmonic completion, adds up to an effective but very subtle close.

The fact that the three accompanying instruments carry on just a little after the cello has provided this missing pitch is not only a weakening of closure, it is also an example of the 'mobile' character that permeates the work: the idea that, as in sculpture, the spatial relationships of separate elements are not fixed, but can get out of phase a little, which in this music is represented by the temporal looseness of the score which allows slightly differing performance results. Having said that, this instance is not a true by-product of some kind of actual looseness, since the essential feature of the accompaniment going on after the solo is clearly the only possible reading of the score.[146] Presumably the issue of the final degree of closure was *not* something Lutoslawski wanted to leave to chance, yet the deterministic ending, paradoxically, sounds out of phase. This looks like a case of having one's cake and eating it, suggesting that the temporal looseness is not something to be trusted at important points in the music, or, at any rate, it is just a small aspect within the armoury of technical resources. There are many examples of this in the piece, and the whole question of what exactly is furnished by the temporal technique is examined below.

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[146] This is clear from the score: the cello reaches the Bb and then is requested to signal to the others, who then finish the cycle that they are on.

The next section will look at the function of harmony and other parameters (register, pacing, dynamics, etc) in selected passages, in order to investigate:

1) general harmonic language, both linear and vertical;

2) the harmony of local structures and how harmony relates to the setting up of phrases, sentences or sections;

3) in some instances, the harmony across sectional boundaries to see how it supports the existing view (from the Commentaries) of the structure.

At this stage of the investigation parts of the score are analysed closely, to determine whether in fact a harmonic and/or rhythmic syntax is operating to produce the local effects observed in the Commentaries. Therefore a selection of Textures and Sections are re-examined, still from the listener's point of view rather than the composer's, to see how the music articulates itself in time.

Harmonic syntax: Textures 1-9

Group A, T_1 — T_{1a}

The commentary contained some detail of the opening of the first movement: harmony was heard to be derived from the semitone and occasional tritone. In further detail I now add the following. In T_1 the semitone provides the following possibilities, in order of appearance:

a) rising semitone,
b) rising minor ninth, [-between (b) and (c) the falling tritone occurs]
c) falling semitone,
d) falling minor ninth, [after (d) the rising tritone occurs]
e) falling major seventh.

All of these, plus repeating pitch, provide the entire intervallic grammar of T_1. We can note the complete absence of the rising major seventh, and the absence of compound intervals except for minor ninth.

A summation of the intervals gives the following:

No. of rising semitones:	6
" " falling " :	14
" " falling tritones:	1
" " rising " :	1
" " rising min. ninths:	4
" " falling " " :	1

Which shows how rising is achieved more by the challenging/expressive minor ninth, while falling is effected more often by the semitone.

If we examine the events in T_2 we see the same linear harmonic ingredients as T_1, but with a new approach to rhythm and articulation (the slur) and tessitura (no wide arches, everything achieved within a compound fourth). T_2 is also set apart from T_1 by the long pause and the widest difference in register (a compound minor ninth). These surface differences provide a strong contrast, despite the obvious harmonic links between T_1 and T_2.

Returning to T_1: there is no serial procedure to the pitch selection. Eleven of the twelve possible pitches are encountered with even distribution. Note, however, that T_1 avoids the pitch B, while T_2 employs it fleetingly near its end, so there is some division of the 12-note space into 11 + 1. One cannot make great claims that this harmonic point is hugely significant, as the single B is unstressed in nearly every possible way. The next texture uses B a great deal, in a context of limited pitch selection, so the dividing process is taken advantage of further, across different sections.

Group B, T_3 — T_6

For the understanding of the syntax of T_3 rhythm must be considered, since this is the first multipart texture in the piece. It shows aspects typical of Lutoslawski's handling of rhythm for the rest of the piece. What is notated is a collection of pitches and durations all precise in meaning along very traditional lines, but with an absence of barlines and, more importantly, of vertical coordination in the score. This is not just a

product of layout, but is guaranteed by the frequent addition of one imprecise element: a paused rest, which (in T_3) always appears in brackets. If one assumes that this sign always means the same thing to each player, and that 𝅘𝅥𝅯 = 𝅘𝅥𝅯 for each, then it is possible to arrive at an idealised form of what will occur: this is shown in **fig. L. 3.** (see volume two).

This diagram give a more focused view of which harmonies are possible, and which are most likely. Although in performance there is a variety of actual possible harmonies, they must all fit into a limited set due to pitch repetition. The diagram shows how the first three pitches persist for 47 𝅘𝅥𝅯 units, and then within 11 𝅘𝅥𝅯's the seven new pitches replace these. I identify three phases accordingly: phase 1 where only the three pitches are heard, phase 2, the transition to new pitches (and there are eight here), and phase 3, where the transition is complete and the eight new p.c.'s repeat for a period.

Three parts limited to the same three pitches (as at phase 1 here) can only combine in a few ways, in fact only seven positions are distinctly different in harmony.[147] Predictably, we will get (and do) more dyads than anything else. As regards rhythmic alignment, according to the idealised version simultaneous attack is limited to two occasions. There are pause signs over every second rest, and they serve at least three purposes: a) making the 3-note motif separate from its (varied) repetitions, b) to prevent the existence of a definitive temporal version of the section (this is common to most of the piece) and c) to avoid a common pulsation. Incidentally (b) implies also that the idealised version is not meant to be performed. Notice how each has a nearly equal number of paused rests of the same types, which helps the realisation to avoid a huge departure from the idealised version (something Lutoslawski himself must, I feel, have constructed at some stage in the writing). Also, the resultant rhythm shows that when the paused *quaver* rests exist (during the first 47 𝅘𝅥𝅯's approx.) the frequency of events is slower.[148] When the pitches change and

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[147] For the fullest explanation: 3 unisons are possible, xxx, yyy, zzz, 13 dyads such as xxy, xyy etc all boil down to 3 harmonies; xy, xz, yz, and one triad xyz, hence seven.

[148] That is shown as RR in **fig L. 3**.

multiply, and the tessitura widens massively, it is enhanced by use of the shorter paused value (semiquaver), allowing the resultant rhythm to have more compactly spaced events.

One can look at the harmony of the idealised version and say: "this is the kind of harmonic ambience he intends", but one can't say: "chord B following chord A leads deliberately to chord C". The harmony is, of necessity, kaleidoscopic. That is, it obeys a kind of floating symmetry (the pitch/motif repetition), having no clear boundaries other than the starting sound, and having no decisive ordered function. To put it another way: three or four layers of material can slide laterally in relation to one another creating a large variety of results (which can not be precisely predicted) from a minimum of motif and pitch ingredients.

The idealised version helps to determine the proportions and extent of the development of tessitura areas, which is one of the key aspects here. Looking at **fig. L. 3.** it is clear that there are three phases: 1) the very narrow 47 𝅘𝅥𝅯 passage followed by 2) a period of rapid change in tessitura and harmony, taking c.22 𝅘𝅥𝅯 , then 3) a less animated period difficult to quantify in 𝅘𝅥𝅯's because of the ten seconds given to vn.1 before it interrupts, but certainly greater than the middle period and around the same length as the first phase. The third phase has a final expansion in the bass, then uses the entire tessitura revealed so far, in a freer way for each individual part, but with no further expansion or new pitches.

Various vertical combinations can be extracted from **fig. L. 3.**, and these are shown at **fig. L. 4.** (see volume two). The interaction of linear intervals and vertical combinations is what is important here: note that the linear intervals include the quarter-tone for phase 1, but after this all of the linear intervals are limited to semitone and tritone exclusively, while vertically the harmony covers a wider collection of intervals, ranging from highly dissonant [0,1,2] to more consonant possibilities such as [0,2,7], via the middle ground of [0,1,3], [0,1,5] etc Note the absence of tritone in the vertical sonorities. I conclude that the effect being sought is one of a dichotomy of the linear and vertical realms to support the primacy of the linear over the vertical,

since the effect is one of tight linear control (copperfastened by repetition) against loosely controlled vertical events. The deliberate absence of the vertical tritone, and even the very broad range of trichords, shows a careful compositional selection behind the apparent looseness.

Before moving on to T_4, it is useful to summarise T's 1-3: linear harmony has remained very tightly controlled in all of the piece so far, with only the intervals semitone, tritone and quarter-tone employed, with compound derivatives occurring in T_1, T_2 and in the latter part of T_3. The perfect fifth also occurs in T_3 as a by-product of repetition of the three-note motif. This is a subtle way of bringing in a new interval, and not a compositional oversight.

Vertical harmony is new to the piece at T_3, and begins in a very limited fashion when all three instruments have the same three pitches, but as tessitura expands *radically*, so too does the vertical harmonic palette of the piece. One must suspect that T_3 is a paradigm for the harmonic language of the piece as a whole. The strict motivic and dynamic limits hold back the development here, leaving richer possibilities for later.

T_4 is again purely linear at first; what is worth noting is that it picks up on the use of the perfect fifth, uses it more prominently within the motif, adds the perfect fourth also, and retains the semitone and tritone from T_3, and uses also the major seventh and minor ninth. It combines the repetitive pitch-fixing nature of T_3 with the monody from Ts 1 and 2, picking up the new interval and its inversion; so it represents a minimal advancement of the musical discourse.

Note that T_4 uses the pitches F#, G, B and C, while T_3 uses G#, D, C# | D#, A, | F, E, B^b —their complement. This separates out the neighbouring textures harmonically.

The linear dimension was dealt with in sufficient detail above in my general analysis for most of the first movement; however I will look briefly at the implied vertical harmony of T_1+ which follows T_4 (with pitches fixed in register, the linear

repetition of notes gives rise to a very audible 'field' which can be discussed as a vertical structure):

Violin 1 has: G#, A B^b, B, Vn 2: G, F#, F, and Va: E, D#, D, C#. So each instrument now has a [0,1,2] or [0,1,2,3] set resulting in 11 different pitches [0,1,2...10] of which the complement is C. This comes in on the cello with the grand octave statement (discussed above). At this point we can say that complementary sets are audibly operating, as observed twice before (the first instance being difficult to discern), and are a deliberate feature of the compositional technique.[149] The linear intervals here are again minor ninths and major sevenths; some are compound, allowing wide tessitura to combine with pitch fixing, with furtherance of the harmonic palette to be examined below.

	$\underline{T_1+}$	$\underline{T_5}$
vn 1:	G#, A, B^b, B,	G, A, A#, B
vn 2:	G, F#, F,	F, F#, G, A
va:	E, D#, D, C#.	C#, D, E

Looking at p. 4 of the score, taken harmonically, it appears to be unified into one texture, since most of the pitch collections remain similarly divided according to instrument (see the above list), yet on closer analysis the page falls into T_1+, (which refers back to T_1), and T_5 which looks forward. This is because mode of articulation has defined motif (and therefore texture) more forcefully than linear harmonic content, due here to its strict limitation and striking contrast.

Fig. L. 5. (in volume two) shows all of page four in an idealised version (following the same reasoning as for **fig. L. 3.**). It exposes several points clearly: three phases (shown by thick vertical lines) are marked out; T_1+, the overlap of Ts 1+ and 5, and T_5 itself. As before, this version can only guide us through the kinds of facts bound to emerge in a realisation, and must not be taken for the true score. The first of these is that phase 1 consists mainly of single pitches; it is rare that one is likely to

[149] The instances are: 1) within T2 (end), 2) T3's use of B in the light of T1's avoidance of it.

hear chords here. Dyads are fairly common, and those noted here cover all types [0,1], [0,2] etc with the remarkable exception of the tritone (tying in with T_3's interval content). As the music progresses to T_5 a gradual shift towards three-part texture occurs, coupled with a concentration of the register as extreme pitches become transposed by octave towards the centre of the pitch-space, where most of phases 2 and 3 takes place. When the last phase is established, some new homogeneity of the vertical harmony is evident, with a notable frequency of [0,1,5] and [0,1,6], often on the longer rhythmic values (see **fig. L. 5.**). The linear harmony changes subtly through the phases also, despite the retention of most of the pitch/instrument partitioning: as some major 7ths and minor 9ths collapse to semitone by transposing occasional pitches by octave; and some minor 3rds and major 2nds appear. As before, these are introduced as by-products of repetition of motivic cells.

Where the motivic character is most scattered in every sense (angularity and distance of line, irregularity and gapped nature of the rhythm),[150] the resultant harmony shares in this (including vertical and resultant linear sonorities), and as it gradually reins in these scattered aspects (losing the rhythmic gaps, narrowing the interval size, and allowing larger pauses in resultant rhythm), becoming more focused, so the harmony combs out some of its heterogeneity (also allowing more tritones), preferring [0,1,5] and [0,1,6] over other chords.

So harmony evolves here in tandem with texture, and the process of overlap (also seen in T_3) allows this to be gradual. Overlap is not just the overlap of one texture plus another; with three lines it is a kind of weave effect, gradual to the ears:

[150] Incidentally, this is why it is related to T_1. I like to think of the motif as the single note, each separated from the other by intervallic angularity, distance and unpredictable timing, as at T_1.

The rhythmic freedom of the paused rest gives an effect of independent pulses which always promotes the perception of line, important in phase 1 (however, as it goes on, registral enmeshing/overlap goes strongly against this); and it makes it impossible to predict or set the exact sequence of vertical sounds. But what we can expect to happen in a faithful realisation can be predicted in the broader categories, including: general register, density of vertical sounds, the types of vertical sonority in broad divisions such as the phase, and even a certain amount of harmonic function: e.g. the [0,1,5] coinciding with the longer held values[151]—this is assured by the association of pitch and duration despite the rhythmic independence.

T_6. All of the instruments proceed by semitones or minor 9ths, each taking all or most of the following set of pitches: B, B^b, A, G#, G, F#, F, E, D#, a nine-note set whose complement is D, C#, C, again the C of the octaves gesture, which appears again after T_6. The great majority of linear intervals here are falling. Each instrument has four or five phrases, and within each phrase only descending motion occurs. The first chord is [0,1,2], and the music is constructed similarly to T_3, with paused rests. One can hear (and see from the score) that [0,1,2] and [0,1] form the majority of vertical sounds.

Group C, T_7 — T_{14+1}

I have counted T_7 as belonging to a separate section ('group') of the first movement. The main reason for this was the appearance and prominence of thirds (major and minor) in the linear material. Closer inspection of T_5, in the present chapter, showed some limited use of minor thirds, so T_7 could be said to be picking this thread up for

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[151] Harmonic function here means that harmony is not incidental, but is part of a musical discourse. i.e. there can be no doubt that the harmony is planned (and capable of being planned). But is it musically logical and coherent? and is it perceptible at some level? Harmonic function in tonal music means a hierarchy of chords within a key comprising two related dimensions: proximity to a centre, and strength. We don't expect a centre in non-tonal music, but relationships of strength and weakness do occur, and oppositions can be exploited through intervallic content and p.c. content. That is function, in this context.

development.[152] Nevertheless the sectional view still stands, since the thirds in T_5 are secondary to other intervals, and T_6 which intervenes, is a substantial return to the stricter intervallic language which eschewed thirds. T_6 is a marshalling point, with its descending motion sealing off registers quasi-cadentially. The harmony supports this by returning to the simple state of T_2. The major 3rds in T_7 are entirely new, as it is only the minor 3rd which appeared in T_5.

T_7 is scored in a more traditional manner, obviating the need for an idealised re-scoring. The reader is referred to the score. Those vertical sonorities which are simultaneously struck can be annotated into the score: see **fig. L. 6.** (see volume two). [0,1,4,6] appears at the outset, a remarkable choice for the first four-note sonority of the piece, since it is the all-interval tetrachord. Thereafter simultaneous striking of two or more pitches is largely avoided. Various dyads occur, with no particular hierarchy. There is one triad, significantly, it is [0,1,4]. One hears, however, a harmonic ambience, especially in the rhythmically dense areas, and this can only be elucidated by extrapolating the sets of pitches as at **fig. L. 7**. (in volume two).

The harmony can be seen to adhere to one constant rule: that all pitches except C occur, the complementary division of the pitch space appears as it did earlier. Rhythm and harmony are tied in together so that where rhythmic saturation or near saturation occurs,[153] a set of eleven notes is most likely to be heard within a single bar. Elsewhere it will take two or more bars for all eleven to appear. Also, where near saturation occurs (bars 1, 8, 12, 16, 42) the linear writing is most likely to use thirds-derived intervals (thirds-derived intervals are in the majority in T_7, and other intervals become very rare at the points of near saturation). Pitches tend to be fixed in register for longish periods, 3 or 4 bars being not uncommon (the exception is bar 1 where the pitches all migrate by octave more quickly). This helps the projection of large 3rds-

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[152] My using the terms 'major third' or 'minor third' rather than [0,3,]/[0,4] reflects the common association which these intervals have as 'consonant', which is Lutoslawski's reason for selecting these here, in opposition to other textures exploiting 'dissonant' intervals.

[153] Rhythmic saturation is where no rests occur, throughout the parts: i.e. it provides the densest possible rhythm without further division of the standard rhythmic sub-unit.

derived chords (see bracketed chords in **fig. L. 7.**). Even where the bracketed chord is a cluster (e.g. bar 16), the linear intervals are mostly thirds. Thus the chord can be said to be a superposition of thirds-derived chords on a common register. Also, it is evident that major and minor thirds typically mix together, producing an array of diatonic sounding subsets, and explaining also the relative frequency of the perfect fifth in the linear writing here.

In relation to what went before in the piece, T_7 demonstrates some developments: first, the control of interval types of the linear writing relaxes here a great deal. The statistical preference for an interval promotes that interval, but all the other intervals are allowed. Second, the vertical harmony is somewhat more fixed by dint of the rhythmic change—the traditional scoring and lack of paused rests allow a more certain harmonic analysis, though with the caveat that the pulses are again in fact mostly independent because of the complex polymetric texture, and that performance is bound to be somewhat inexact with the level of difficulty this presents. The vertical harmony, due to pitch fixing, as before, presents a kind of ambient harmony which can be traced through **fig. L. 7.** The most notable feature of all of these changes from previous areas to T_7 is that they allow more rapid change of the pitch fixtures, with the composer safer in the knowledge that he will get what he wants. The greater freedom of linear harmony is a compensating movement against the loosening of rhythmic freedom, which protects against T_7 sounding like a sudden shift in style.

The important conclusion is that my observation in general analysis of the cyclical energy and wave-like motion (see Commentary, Group C), while obvious in rhythmic saturation and registral movement, is also supported by the harmonic contrasts (of spread chords and tight chords) and the observation that this is the least static texture so far is supported by the frequency with which pitch register fixing changes.

T_8 brings us to a possible criticism of the technique; the performed version on the LaSalle recording corresponds rather too closely to the idealised version (**fig. L. 8.**

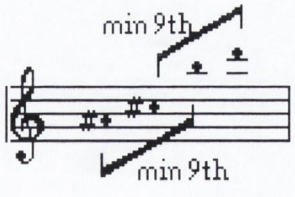
volume two). However, independence of pulse still occurs. It is written so that coordination of the long note chords is gradually lost even without the pauses, so in that sense one feels a certain amount of cheating is going on: not able to rely on the method of pauses to create vertical looseness, he writes it into the set durations of the music! This somewhat obviates the need for pauses, or reduces them to one purpose, to give independence of pulse.

The linear writing of T_8 can be related back to T_1 and T_4, long non vibrato notes combining with semiquavers, working in semitone and tritone derived intervals, now allowing perfect fifth and major ninth/minor seventh to arise as by-products. The vertical harmony here is bound up with the linear writing by dint of almost total fixing of pitches in register: the whole of T_8 descends through a single 11-note chord (see ex. 2, under Technique / Pitch). This grid is a register-fixed resource which in theory allows every kind of three-note subset, but is here constructed to favour the appearance of [0,1,6] as different registral areas are highlighted. Oddly, there are three pitches there that are allowed one octave transposition each: B, G and C#. T_8 sounds like a retreat in development from T_7 for the reason that the grid writing is fixed throughout the texture, whereas T_7 uses grid writing at a much more local level, plus T_7 features four different rhythmic speeds, T_8 having just two. This retreat was felt and remarked upon in the commentary. (The definition of grid writing is more fully explored below under Technique, for now it can be defined as a set of register-fixed pitches, giving a certain harmonic ambience, which the texture articulates. It is reminiscent of an alberti accompaniment which provides very localised rhythmic movement independent of a slower harmonic rhythm). T_8 is a further example of the 11/1 harmonic partition.

Before going on to T_9, the concept of grid writing needs a little further discussion: Strictly speaking T_8 is not the first example of fixed grid writing, T_6 has all of its pitches fixed in register. Now that grid writing has been explicitly named as a technique, one can ascribe it partially to all of the textures apart from T_1. But in each case it varies in its treatment, mainly according to two criteria: 1) frequency of grid

change and 2) cardinality of grid chord. The next most important aspects are 3) registral disposition and 4) harmonic quality. The composer is free as to motivic shape, rhythm, tempo etc The positive aspects of the technique are: a) to help to unify the linear and vertical harmony, b) it acts as a minimum guarantee that vertical events will fall into certain predictable configurations despite the apparent lack of control caused by the pulse independence and moderate indeterminacy. For a fuller discussion of the applications of grid writing see below under Compositional Technique / Grid Writing and also under Pitch.

Going on to T_9, with **fig. L. 9.** (volume two) we see further use of the 11/1 division, where C is the singular note. Vn 1 always has the pitches A, F#, G#, F only; not fixed in register, but sometimes with octave transposition. The grid idea exists in a limited way in that register fixed repetitions do occur, but the octave transpositions are fairly frequent. Vn 2 and Va each have the four notes A#, C#, B, D,[154] —an identical set type to Vn 1 and identically spaced. The cello has the remaining three pitches: E, G, D#, in a similar spacing, together giving two sets of [0,1,3,4] and one of [0,1,4]. This allows many linear instances of [0,1,4] or [0,1,3,4], or to put it another way, minor 3rds, minor 7ths and some major 3rds. The minor 9th is avoided, though its presence is felt in the line as it appears often every second note, e.g.:



(actual vn 2 pitches)

The technique is more reminiscent of T_1+, where each instrument has a limited set of pitches, but overall contraction of the registral space occurs by octave transpositions (never over more than one), and do not happen too rapidly. An important result of this is that the initial registral spacing allows the separate sets to be

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[154] never together in time.

heard, then once they are established they move towards one another and become harder to hear. When they cross or overlap they are very hard to hear (though not completely submerged, since the actual rhythm and density are quite sparse), this is what was called 'enmeshing' in T_1+, and could be called that here. This can be seen clearly in **fig. L. 10.** (in volume 2). The summations of the pitch continuum are somewhat notional, as intermediate stages could be abstracted also, but they serve to show how wide register is used at the start, then transpositions serve to concentrate the pitch space and lose the clarity of the separate sets, then a third stage is approached when the sets move apart towards the end of T_9 (It is also interesting to note how sums 4 and 5 correspond to sums 2 and 1 respectively). Thus T_9 has a symmetrical underlying plan, which subtly, but audibly, helps to bind the section together, where on the surface it is highly differentiated and appears 'through-composed'.

Fig. L. 10. shows how the opening disposition of the three sets operates and changes and returns, but note particularly that many samples could be taken which show a point in transition between any two summations, so what **fig. L. 10.** reveals is a hidden structure and indeed an aspect of Lutoslawski's technique, which will be examined in detail below.

As for overall harmony: if one looks at p.11 of the score (r.m. 7),[155] i.e. T_9, at a glance the reader may think it is extremely busy, but a great deal of the detail on this page is actually cues for the players, showing them what is happening in another part. The idealised version (**fig. L. 9.**) exposes clearly how thin the texture really is, and how the majority of the harmony is two-part. This allows the linear intervals to dominate the overall harmonic feel, especially given the limited pitch resources of each instrumental part.

The vertical harmony is nonetheless quite complex and varied, as one can extrapolate a wide collection of three- and four-note chords, that are not stated

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[155] The abbreviation 'r.m.' stands for rehearsal mark, very useful for quick identification of passages separated in this way in the score. The music usually can be heard to make some kind of change at a new r.m., so they often correspond to 'subsections'.

explicitly but are unavoidably heard (virtual chords, perhaps), due to long held notes against shorter values, or pitches repeating until an association of three or four together is built up. All such chords must be subsets of the summations (or local grids), and the linear intervals provide all the points of intersection of these sets. There is thus a perception of 3-, 4- or 5-note sonorities which is an aural illusion, since the actual density is rarely more than two, and the linear material creates this illusion by localised repetition and independent rhythm, and thus provides intervals which we hear as part of the harmony, but are only present in a linear form.

Nearly all of the four-note segmentations which I have made contain ic3 twice, and a lot of them are supersets of [0,3,6]. This arises directly from the internal structure of the summations, in a similar manner to T_8's grid which promoted instances of [0,1,6].

An important observation to be made of T_9 is the way in which [0,1] is hidden or suppressed, so that other intervals (a wide collection, but centred on [0,2], [0,3] and [0,4]) can speak more clearly, picking up on the harmonic ambience of T_7 as well as its rapidity of grid change.

Two things have arisen: first, the linear writing, when it is built up in a thin texture and allowing quasi-motivic pitch repetition, dictates the harmonic ambience, and serves once again the predominance of the linear over the vertical. Second, one can posit a continuance of the progression of intervals observed earlier in Ts 1 to 5:
T_6 - a re-statement of T_1's adherence to [0,1]
T_7 - new ics [0,3] and [0,4] (foreshadowed in T_5)
T_8 - re-combination of [0,1] and [0,6] from T_1, now explicitly as [0,1,6].
T_9 - *combines* the intervals of T_7 and T_8.

Thus the harmonic scheme takes the relatively simple form of gradually revealing different interval types, especially, though not exclusively, in the linear domain. We also see how the enlargement of the interval repertoire, and the relaxation of the strictness with which it is enforced, supports the gestural and motivic development observed in the commentary, with motivic richness (T_9), rhythmic variety and

registral freedom all going hand in hand with harmonic evolution and expansion, and rapidity of turnover of registral fixing of pitches.

Harmonic syntax: rate of change in Section 2

For the second movement I will restrict the analysis of syntax to Section 2 only. This is done for reasons of scale and brevity in this study, and allows a more insightful level of detail. This will throw more useful light on Lutoslawski's methods and results regarding the micro-structures, than a more abbreviated discussion of a greater number of sections would, as that would be close to repeating the work of the Commentaries.

Fig. L. 13. (see volume two) shows the linear structure for the pitch material of S_2. For nearly all of this subsection each instrument adheres to a set of three pitches, generally fixed in register, with some movement from a wider position to a narrow centre. The ending 'signal' from the viola, which is below the central position, breaks from its set of three (D-G-A); and the opening demisemiquaver gesture also excepts itself from the linear sets for each instrument. However, both of these outer gestures mostly adhere to the first 12-note grid shown, that is, all but four pitches (ringed in **fig. L. 9.**) which are registrally extreme, are to be found in the same position in the first grid.

The main feature, therefore, is an initial registral explosion followed by very gradual shrinkage to a concentrated central register, with the viola 'signal' breaking this pattern. As we saw in earlier textures from movement 1, the linear intervals are naturally promoted where the grid is widest (and here dynamics are allowed to help project different lines at different times—which did not occur in the passages examined earlier), but are obscured from hearing as the register narrows. Here this is reinforced by the loss of one pitch each, for grid 3, then two pitches for all but first violin, for grid 4. By grid 2 the pitches are in as narrow a range as possible: i.e. a

contiguous set of 12, each a semitone apart; and for grids 3 and 4 the pitches shed are from the top and bottom so that each of these is a close semitone cluster also.

Regarding actual vertical sonorities: for any twelve note grid divided as this is into four three-note linear sets, there are eighty-one (3X3X3X3) possible four-note vertical chords. If one reduces these to the 29 tetrachords 'allowed' by Forte, one can look at the statistical spread and deduce preferred intervals:

1	- - - - (4)	321000	12 / 8/ 4/000
2	- - - - - - - - (8)	221100	16/16/ 8/ 8/00
3	- - - - - - - - (8)	212100	16/ 8/16/ 8/00
4			
5	- - - - - - - - (8)	210111	16/ 8/0/8/8/8
6			
7	- - - - (4)	201210	8/ 0/ 4/ 8/4/0
8			
9	- - (2)	200022	4/ 0/ 0/ 0/4/4
10	- (1)	122010	1/ 2/ 2/ 0/1/0
11			
12	- - - - - - - - - - - - - - - (15)	112101	15/15/30/15/0/15
13			
14			
15			
16			
17	- - - - (4)	102210	4/ 0/ 8/ 8/4/0
18	- - - - - - - - - (9)	102111	9/ 0/18/9/9/9
19	- - - - - - - (7)	101310	7/0/ 7/21/7/0
20			
21			
22			
23			
24	- - - - (4)	020301	0/8/ 0/12/0/4
25	- - - - (4)	020202	0/8/ 0/ 8/0/8
26			
27			
28	- - - (3)	004002	0/0/12/0/0/6
29			
		Totals:	108/73/109/86/37/54

Fig. L. 11.

The selection of *chords* appears curiously skewed. However, specific intervals are not significantly preferred as a result of this (the 29 possible four-note chords show the following interval frequencies if one of each is examined: 31/31/31/31/31/18, so the only significant oddity is the relative scarcity of ic5.)

R.m. 14 displays the kind of partitioning seen before in phase 3 of T_3, T_1+, T_5, and T_9, except here it is in its purest form: i.e. all twelve pitches are employed, and

the 12 notes are divided into four equal three-note sets, each set made up of the same basic trichord [0,2,7]. This 'pure state' evolves in the following subsections thus:

r.m. 15: vc/v1: [0,1,2], v2/va: [0,1,6] (still 4 x 3-note sets)
r.m. 16: v1/v2/vc: [0,2,7], va: [0,2], leaving v1 free to bring in [01,2]
r.m. 17: v1/v2/vc: [0,2,7], va: [0,5], (12th pitch added to v2)
r.m. 18: v1/v2/vc: [0,2,7], va: [0,1,5], then v1/v2/va break from their sets to present d-f# dyad, a foreshadow of r.m. 19.
r.m. 19: v2/va: [01,5], v1: [0,2,5], vc: [0,1,6]
r.m. 20: v1: [0,1,2], v2: [0,2,7], vc: [0,1,6] va: [0,1,6] *and* [0,1,5] (same pitches as v2 in r.m.19)
r.m. 21: v1/v1/vc: [0,2,7], va: [0,1,5]
r.m. 22: v1: [0,1,5] v2/vc: [0,1,4], va: [0,1,6]
r.m. 23: v1/va: [0,1,6], v2/vc: [0,2,7] (va carrying same pitches from previous r.m.)

This shows that the linear writing has evolved to a greater level of complexity than was evident in all of the first movement, and that the techniques of grid and motivic intervallic reserve continue to be used, now in a richer but not uncontrolled form.

[0,2,7] sets produce only ic2 and ic5 in any linearisation. Similarly: [0,2,5] produces ics 2, 3 and 5
[0,1,6] produces ics 1, 5 and 6
[0,1,5] produces ics 1, 4 and 5
[0,1,4] produces ics 1, 3 and 4
[0,1,2] produces ics 1 and 2 only.

All of this means that we can deduce the following for linear intervallic preferences:

	ic1	ic2	ic3	ic4	ic5	ic6
r.m. 14		**X**			**X**	
r.m. 15	**X**	**X**			**X**	**X**
r.m. 16	*x*	**X**			**X**	
r.m. 17	*x*	**X**			**X**	
r.m. 18	*x*	**X**		*x*	**X**	
r.m. 19	**X**	**X**	*x*	*x*	**X**	*x*
r.m. 20	**X**	**X**	*x*	*x*	**X**	**X**
r.m. 21	**X**	**X**		*x*	**X**	
r.m. 22	**X**		**X**	*x*	**X**	*x*
r.m. 23	**X**	**X**			**X**	**X**

Fig. L. 12.

The *x* indicates lesser frequency, e.g. where an ic appears in just one triad among four.

This 'triadic' system in the linear domain has produced a situation of overwhelming statistical weighting towards ic5, some lesser weighting for ic1 and ic2, rarity of ic6 and extreme rarity of ic3 and ic4. It also shows how ic2 and ic5 are constant features, with other intervals 'latching onto' them and disappearing again. Had Lutoslawski so desired, he could have limited the linear interval selection to just two intervals (ic2 and ic5), by simply devising a new 4 X [0,2,7] partitioning of the 12 notes for each subsection (r.m.). So there is no doubt that at this point in the piece he seeks a pan-intervallic linear language, with statistical weighting towards selected intervals.[156] Thus we have seen the control of linear intervals evolve: loosening from, say, the rigours of T_1 with its strict adherence to two interval types, to this state, and this has worked in tandem with the motivic control, also loosening as we go through the piece. Yet it is also clear how slowly he ekes out the various stages of evolution along the way.

Fig. L. 13. also points up certain analytical issues: register begins in r.m. 14 with a rapid widening gesture, followed by a gradual collapse over r.m. 14 to a tight central area. The viola gestures (which can be seen as a prefiguring of r.m. 15 since the viola pitches are common to both subsections) break out of these registral limits, and in r.m. 15 each instrument works its way upwards through a circular permutation of its three pcs, creating a general impression of regaining some of the register lost in r.m. 14. (but only in the treble). In r.m. 16, the upper position is higher than in r.m. 15, regaining the E from r.m. 14. Now the bass moves down by circular permutation of the cello part, but the bass will not make a really significant move until r.m. 19. Meanwhile in r.m.s 17-18 the upper register is heard to fall, and then rise to a new high at the start of r.m. 18. Within r.m. 18 all the parts collapse once more. No very significant rise is felt in the upper register until r.m. 23, the very end of S_2. The bass, having expanded at r.m. 19 by a large margin, never makes a significant move until

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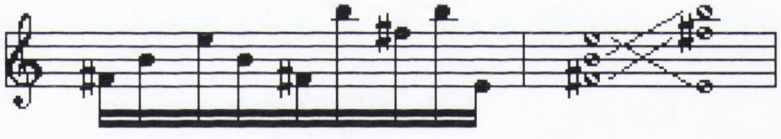
[156] This reminds us of aspects of Carter's harmonic language, despite the difference noted earlier with the more limited intervallic material.

the final gestures of r.m. 23 also, so r.m. 23 as a whole is characterised by expansion in both directions from a tight central area—broadly the opposite to r.m. 14 in shape.

Fig. L. 13. also sheds some light on the basic grid technique of this section. The concept of grid writing was useful in T_8 and and in many other textures, but in T_7 and T_9 the definition was stretched to allow gradual octave transposition of pitches, creating a multiplicity of notional grids. At this stage of the piece, it is no longer really helpful, and it is better to speak of partitioning of the 12-space into 4 X 3-note sets (or, occasionally into 3:3:4:2).[157] Nevertheless, the octave transposing is still conducted in a gradual manner, perhaps for ease of perception, and therefore to maintain the identification of a set with transposed versions of itself. e.g.

this shows one transposition in a relatively long time.



this type of line is avoided.

Fig. L. 14.

This is best described as stepwise octave transposition (i.e. the octave transposition occurs generally in one pc at a time and through one octave at a time). Also, there are still areas where the grid of fully fixed pitches is the best description for the working of the music. As at the start of r.m. 14 where partitioning is not yet established, but a grid can be seen to operate, giving the following grid or 'superchord':

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[157] Fuller discussion of the technique behind this exists below under Technique / Partitioning.

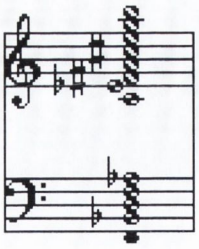


Fig. L. 15.

notice that the grid is arranged in thirds, linking S2 initially with T_7, the last *pizzicato* area. At the end of r.m. 23 we get another thirds arranged grid:

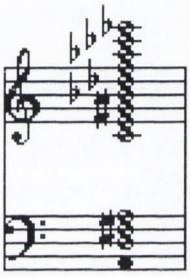


Fig. L. 16.

One can begin to classify the pitch/texture orderings in a number of different but related ways: 1) fully fixed grid; examples are T_8 and T_3 where almost no octave shifts occurred and there is no need for partitioning (partitioning combined with full pitch fixing would produce a completely rigid pitch arrangement). 2) Moving grid; e.g., grid writing as at T_8 but periodically shifting pitches to create new grids, T_7 is an example. 3) partitioning + stepwise 8va transposition—as at S2 and also T9. 4) Free pitch selection; usually in monody, as at T_1 and T_2. But for a more detailed examination of the various uses of grid writing, see the chapter on technique below.

This section (S_2) exhibits the most flexible grid writing heard thus far in the piece. The main developments here are in the area of rate of change, since this section combines octave transposition and grid shifts in a more discursive manner than before. What results is an environment which has increased the ways in which it is possible to be unpredictable. This is reflected particularly in the way that the rate of change changes, which I will examine presently. Lutoslawski achieves this by the

relatively simple means of allowing the sequence of r.m.s to sound motivically unified and physically attached (in time). Each r.m. has a new grid, and within the grid a great deal of octave transposition takes place, partitioning of the grid (or 12-note superchord) is the better description for this. The important point to bear in mind is that r.m.s no longer define textural or large sectional boundaries. Instead, they relate to harmonic changes within a single section.

In seeking to measure objectively the rates of change one immediately confronts once more the problem of the nature of the score: in this section the free timing is achieved not only by paused rests, but by *accelerandi* and *ritardandi* marked into the score on an individual basis for each player. This increases the range for the possible outcome, consequently one can't arrive at an idealised version in the same way as before. One is forced to take the view that, in an overall sense, the accels and rits cancel each other out, and that by calculating data without them one still comes up with useful analytical conclusions. I think this will become evident below.

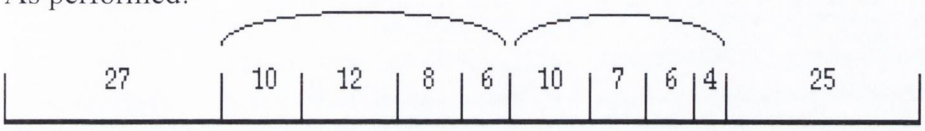
The first investigation concerns the proportional lengths of the r.m.s. By taking the tempo indication given in the score: ca 7♩/sec, one can measure the expected extent of each subsection. One can also measure the same subsections on a recording (here again I will refer to the LaSalle Quartet's recording). The findings seem to validate the point about useful data, as the proportions are respected, though actual timings in the recording are slower than as calculated from the score. Here are the results:

	Length as defined by the score (disregarding rits & accels)	Length as performed by the LaSalle Quartet
r.m. 14	25.5"	27"
r.m. 15	6"	10"
r.m. 16	8.5"	12"
r.m. 17	5+"	8"
r.m. 18	5"	6"
r.m. 19	7"	10"
r.m. 20	5.5"	7"
r.m. 21	4"	6"
r.m. 22	3.5"	4"
r.m. 23	25.5"	25"

Fig. L 17.

This shows clearly how the section is organised into two periods of increasing tension, within two outer blocks of greater extent (which have opposite, complementary registral gestures as noted above). The second period is smaller and therefore more tense than the first.

As performed:



as scored:

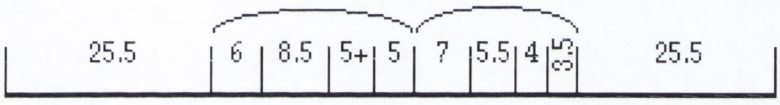


Fig. L. 18.

This diagram shows graphically how this deliberate shape is achieved. And how it exists both on the score and in this performance.

The global rate of change, as defined by r.m. boundaries, changes in a balanced yet dynamic way.

I will now go on to assess local rate of change for this passage: to do this it is necessary to define change and create, as it were, a formula—to turn it into quantities.

The following method of analysis is appropriate to this texture because this is the first texture with such complex resources for changing rate harmonic change, and because an idealised re-scoring would be too unreliable, so this is an alternative way of revealing the structures.

As I am interested primarily in local harmonic change, I will disregard most of the surface figuration, and focus on the places where the grid undergoes any kind of transformation (there are very many of these), which, in effect means I am abstracting the harmonic changes. Some of these will be very slight: e.g., changes in inversion of a three-note set; but each has an appropriate quantity assigned to it.

Here is the formula, a quantity theory of pitch change valency:

a) Each second in the music will be examined for pitch change. This will give data for what goes on from second to second, but not *within* any second. This approximation is necessary in order to avoid an unworkable amount of calculation and data.

b) Background activity will be given a value of 1, so that at moments of harmonic stasis we are reminded that surface figuration goes on.

c) Where a pitch drops out, a value of 2 will be assigned.

d) Where a pitch enters, a value of 3 will be assigned.

e) For a change (+ or -) in density of 1, a value of 3 will be assigned.

f) For changes that involve outer register, a value of 3 will be added.

One may feel that other types of change should be taken into consideration, such as extra points where the texture drops to monody or silence, etc, but in the interests of keeping the system simple, the above rules will suffice. The results appear on figure **L. 19**. The letters HRC stand for harmonic rate of change, and where the numbers derived for HRC change greatly from moment to moment, that is where the rate of change changes; this is an aspect of music which many theorists (not just myself) feel is central to effective musical discourse, and it is often related to information theory. In plain language, boredom can set in where change is plentiful but constant. It is less likely to if the rate of change changes.

A note of caution on the subject of density: the *real* density only varies from one to four, but with the grid writing an illusory sense of density is felt, reflecting the number of different pitches available in the texture. I call this virtual density.

Another point that might seem overlooked is the interval content of the chords: i.e. that when a chord changes position it seems to be given the same HRC value as when it is replaced by a completely different chord. However, in this music the overall interval content is the same in many places; because the harmony uses all 12 pcs so often, therefore changes of interval content generally occur together with changes in virtual density. This receives recognition in my existing system.

The results are calculated for each second (as derived from the score, not the recording). I will give an example:

	sec.#1	sec.#2	sec.#3	sec.#4	sec.#5	sec.#6	sec.#7
background	1	1	1	1	1	1	1
dropouts	4	4	2	4	4	2	4
entries	54	6	6	6	3	0	0
density	12	0	3	0	3	3	6
register	21	6	3	3	3	3	6
Totals	90	17	15	13	14	9	17

Fig. L. 20.

Commentary on **Fig. L. 19.**

R.m. subsections are marked here by the vertical lines joining the staves. The HRC is the main point of this diagram. Changes in register and chord composition are noted carefully. Quite a complex picture emerges, which shows how the harmonic handling is constantly developing, each r.m. tends to have distinct registral and HRC characteristics. r.m. 14 has a radical opening, scoring 90 (in its HRC total) and then dropping quite rapidly to a state of calm. Most of the other r.m.s share the bias, having most change at their opening, for obvious reasons, but all follow subtly individual courses thereafter. Only the last r.m. has a similar stretch of stasis to r.m. 14. To calculate moments of greatest change in the rate of change, consecutive figures must be contrasted. Thus the most radical changes are heard not simply where the biggest numbers are, but where the greatest numerical differences occur. e.g.: r.m. 15 enters at 59, preceded by 1, giving a *difference* of 58. This is greater than the effect at r.m. 21, which enters at 83, but preceded by 36 we get the difference: 83 - 36 = 47. The first and last r.m.s show the greatest internal change in rate of change. The fact that r.m.s 15 to 23 weren't separated out in the same way as r.m. 14 in the General Analysis is also reflected here in the difference figures. Listening should confirm that after r.m. 15, r.m.s 21 and 23 are the most separable, aurally.

The general finding is that the data gleaned in this way very much supports (and enriches) the aural impression: that a solid distinction between change and stasis within r.m. 14 and associated with r.m. boundaries exists initially, but becomes gradually softened so that the boundaries become less clear from r.m. 15. The overall rate of change increases and becomes more generalised, yet retains some of the typical shape of r.m. 14. So it is a paradigmatic statement which is developed and varies in subsequent r.m.'s. The variety of length and of HRC for each r.m. (as shown) is a crucial part of this picture.

The fundamental point about the HRC is that it never becomes predictable, yet it manages to have some underlying coherent principles and a discursive development of same. It manages to do this while surface activity does many other things also; i.e. it allows coherence and development on foreground and background levels, giving depth to the musical fabric.

I now move on to a consideration of the compositional technique *per se*. Much has been said in this analysis which spills into that area, but to focus in on technique properly and abstract it for its own special consideration is essential.

Compositional technique in the string quartet

Before going into a detailed examination of technique in the string quartet, I will first consider some of the works leading up to it, with reference to those techniques that are important in the quartet.

Lutoslawski's String Quartet comes not at an early or particularly transitional phase of the composer's development, as is more the case with the other three composers in this thesis. Therefore, in order to place the work in the context of his development of technique, one has to consider works going back about eight years. Lutoslawski's oeuvre, even by 1964, comprises many pieces varying in weight, length and importance. There are various 'functional' works—occasional pieces and even some cabaret songs in a popular idiom best described as 'actors' songs', which he wrote under the pseudonym Derwid.[156] So it is the major works that are of interest, these are as follows:

Five Songs	soprano and piano	1956-7 (orch. version 1958)
Musique funèbre	string orchestra	1954-8
Three Postludes	orchestra	1958-63
Jeux vénitiens	chamber orch.	1960-61
Trois poèmes d'Henri Michaux	chorus and orch.	1961-3
String Quartet		1964

Charles Bodman Rae very usefully divides Lutoslawski's output of major works into style periods as follows:

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[156] See Charles Bodman Rae, *The Music of Lutoslawski* (London: Omnibus, 1999), 306-311.

1945-56	functional music and formalism
1956-60	sound language and harmony
1960-68	chance and polyphony

(There are other periods from earlier and later that are not included here.)

The labels for these periods refer to the technical and aesthetic interests that dominate the music of each. In fact, the second two are the only ones that need concern us to introduce some of the technical preoccupations that relate to the structure of the String Quartet.

Rae identifies the Five Songs as "the first work in which Lutoslawski employed his harmonic vocabulary of twelve-note chords and chord-aggregates."[157] The twelve-note chords are single entities with internal consistencies or symmetries, while the chord aggregates are twelve note chords which naturally divide out into three four-note chords, or less commonly, four three-note chords. I will consider their relatedness to the quartet below. The types and numbers of twelve-note chord are many, as they are in the quartet, and it is in the Five Songs that Lutoslawski first experimented with such structures. Nevertheless, he did so comprehensively and with great control.[158] Rae takes the view that the evolution of harmonic technique was explosive in the 1956-60 period, and that after that it remains settled, while the next period is marked by experimentation and the acquiring of new techniques in the area of rhythm, with the discovery of limited aleatorism.

The *Musique funèbre* is marked by a development in linear harmonic control. He employs a twelve-note melody which is limited to interval classes 1 and 6, and the canonic use of this melody is devised so that the only adjacent intervals are 0, 5 and 6. This sort of strict control of sonority is something we will see in the quartet also, though he never returned to such organised use of what amounts to a series, since in

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[157] Rae, 57.

Musique funèbre he used all transpositions methodically.[159] *Musique funèbre* also exemplifies the tendency for the climax of the work to come at the point of the Golden Section; note that this piece is in memory of Bartók.

The Postludes marked something of a crisis for Lutoslawski, but not one of harmonic language per se. "Lutoslawski was searching for means of achieving harmonic blurring."[160] This was solved by "similar parts playing variants of the same intervallic cells and rhythmic motifs, but the composer ensures a result which is always harmonically out of synchronisation."[161] In fact, it is the technique referred to as 'bundling' (by Lutoslawski himself, and below) that he developed first in this work.

There is another technique relevant to the quartet which is first explored here: the use of a stubborn strand of material that arrests (or attempt to arrest) growth and development. In the quartet (as we have seen in the analysis) this is the appearance of the Cs in the first movement. In the Postludes a chord has a similar function (see Rae, 74 for more detail).

With the next style period and *Jeux vénetiens*, Lutoslawski's attention turned to the organisation of time. In fact at this point he was influenced by knowledge of John Cage's music. He was not attracted to the sound of his music so much as by the ideas of allowing freedom into the performance in order to achieve some extra rhythmic suppleness. (Which we can see he was already striving for with the invention of bundling.) He was also most definitely not attracted to the eastern philosophy underpinning much of Cage's thought. There was also an element of a reaction against the complexity that had come into music with the arrival of integral serialism. So with

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158 See Rae 57-66 for a fuller discussion.

159 More detail on this can be got from Rae, 67, and Lutoslawski's own article "Rhythm and the Organisation of Pitch in Composing Techniques Employing a Limited Element of Chance." *Polish Musicological Studies* 2 (1986): 37-53.

160 Rae, 73.

161 Ibid., 73.

Jeux vénetiens Lutoslawski introduced some of the notational devices that we also see in the quartet.

The *Trois poèmes d'Henri Michaux* explore a little further the issues already raised, twelve-note vertical structures, limited aleatorism in selected passages, with coordinated rhythm elsewhere and some examples of his trademark textures.[162] However, Rae notes that it is the String Quartet itself that actually uses controlled aleatorism to the greatest extent in his entire output.[163]

In the following detailed discussion of Lutoslawski's compositional technique in the string quartet I will take the major categories in order beginning with the greatest in scale and moving towards the smallest. i.e.: 1) overall form, 2) inter-sectional relationships, 3) textures, 4) pitch organisation, 5) aleatorism and local rhythmic structures.

Form

The 1st subjects to be dealt with are the organisation of form and texture. The guiding principle here is that pre-conceived structural archetypes control the macrostructure. This kind of procedure is regarded by many composers as dangerous—because it may constrict the natural tendencies of local material and result in unconvincing twists or distortions of the music; sounding at worst contrived and unconvincing, or as Tchaikovsky memorably put it, music with 'the seams showing'. In any case, this is what Lutoslawski does, organising textures and sections so that they serve a

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162 For a detailed exploration of these, see Martina Homma: "Aleatorischer Kontrapunkt, matière première, Harmonik und Rhythmik. Zum Entstehungsprozeß von Witold Lutoslawskis 'Trois poèmes d'Henri Michaux' für zwanzigstimmigen Chor und Orchester (1961-1963)." *Musiktheorie* 14, (1999, No. 1): 13-31.

163 Rae, 91.

macrorhythmic plan. This basic principle is already evident from my analysis and from other commentators upon his music. It manifests itself in four ways. In summary, these are:

1) end-accented form: this is the principle used by Lutoslawski in many works, notably the quartet and the second symphony, where two movements are laid out. The first is of lesser extent and weight than the second, and projects a sense of not allowing full completion or development of its ideas. The second then releases the pressure, gesturally, and is characterised by greater organic development and longer sections of more fulfilled dynamism. Here is Lutoslawski on the subject:

> . . . but the most important problem was the construction of a form which could then be used on my subsequent works. This form can be broadly defined in the following way: the whole consists of two movements, the first one less important than the second as its purpose is to introduce and to prepare, but not to fulfil. The first movement consists of a number of episodes separated by an element which is repeated in many variations. The second movement is more significant and its purpose is to complete or to fulfil. It's the main movement and as such doesn't consist of such episodes. I used this form for the first time in the Quartet. . .[164]

2) Offset midpoint climax: a self-explanatory concept; but in the quartet analysis two kinds were found, a climax of gestural richness (1st movement), and one of textural size, dynamic, and intensity (2nd movement).

3) Approach to climax: according to Stucky,[165] Lutoslawski's method of shortening subsections in order to tighten the drama is one he reserves for the approach to the climax in this (as I observed in the analysis) and other works, Therefore it is a pre-compositional structure, and a Lutoslawski trait.

4) Other pre-compositional decisions include the athematic nature of the material, and therefore the multi-sectional fabric, where motifs for the most part develop only within each section, and cease to be a mediating force for the whole. I hesitate to use the word episodic, since it might imply an aesthetic position of de-composition, which

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[164] Kaczynski, 12. A writer who uses this aspect as a starting-point for an investigation of Lutoslawski's entire oeuvre is Philippe Gantchoula in his analytical thesis *Hésitant-Direct: l'oeuvre de Witold Lutosławski*. Thesis (recherche en analyse), Paris Conservatoire, 1985.

[165] Steven Stucky, *Lutoslawski and His Music* (Cambridge 1981), 126-132.

is very clearly not one Lutoslawski is attempting, or interested in. Nonetheless this aspect may be problematic, as regards the coherence of the discourse.

Lutoslawski, on the String Quartet, said:

> I'm certainly not refraining from the use of motif. It exists not only where it can be clearly heard but also within layers played *ad libitum*. A layer of this kind consists usually of a bundle of parts playing variations on the same motif. . . .This fact helps to identify individual sound surfaces, and I don't think that the motif has been quite eliminated from my technique of composition. It is perhaps somewhat hidden away and plays a different role. . . . If I said that I'm not refraining from the use of motif, I was stressing the fact that motifs do indeed exist within particular layers. But it certainly doesn't mean that I'm continuing to develop the principle of the motif as found in classical music. This isn't the case, because there is no motif connection between the very short refrain, employing a few notes only, which we find in the monologue for first violin, and any other part of the Quartet. The connection between various sections, parts or elements within the form is of a different order entirely and doesn't depend on the motif.[166]

One might add various lesser aspects, but the important point is that the four above categories control, coordinate and supervise all other technical issues as they occur in the music. For instance, the whole subject of aleatory organisation of time is subordinate to them. (A general perception has arisen about Lutoslawski's music that aleatorism somehow governs his technique. This is simply not true. I will attempt to show below what its actual place is in the scheme of things. Lutoslawski himself has said on a number of occasions that aleatorism was his greatest technical innovation (that is, not his main technique). But elsewhere he has also said that he is not interested in relinquishing the traditional role of the composer. So the confusion is not really of his making, perhaps rather it is the result of a certain amount of superficial comment/understanding within the music community).[167]

Stucky discusses Lutoslawski's general procedure as depending upon expectation-resolution, or implication-realisation models of perception; thus he insists on retaining control over the musical experience, and creates closed forms. In my analysis I found that the quartet had a closed form in terms of macrostructure, but with certain reservations. Stucky says (and I agree with him) that: "the cellist finishes the work on

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[166] Kaczynski, 16.

[167] For another view on how the technique can be broken down and examined, see Fischer, Regine. *Studien zur Kompositionstechnik im Streichquartett von Witold Lutosławski*. Dissertation, Universität Köln, 1994.

an inconclusive note echoing the end of the first movement."[168] In any case, both of these points place him in a surprisingly conservative camp in his aesthetics, if one is to consider his reputation as a figure working with aleatory music.

As I move from the macro level gradually down to the local: Form, Texture, Pitch, Aleatory Technique; the techniques will sometimes overlap and integrate, and the discussion must follow that where necessary. The subject of time/rhythm comes under Form for large scale ordering, and Aleatory Technique for local rhythmic techniques.

Form was already extensively discussed in the analysis—see Introductory Remarks, Aural Analysis, **fig. L. 1.**, and the discussion of the two types of climax. The considerations of pre-compositional formal techniques above are all that need be added to this. Certain aspects of formal schematics also come below, under the next heading.

Texture

Some commentators have focused on texture in Lutoslawski's music, making the point that this is his greatest contribution to the music of the period within which he worked. This is reasonable, so long as one remembers Ligeti, Penderecki and Xenakis. But to describe his music, as Stephen Walsh does, as "texturally some of the most absorbing to have emerged from the 60s . . . whether it can stand its ground in terms of solid musical content—a point on which doubt has been expressed—remains to be seen,"[169] is perhaps to miss the degree of architectonic planning and cooperation between successive textures.

In many of his works Lutoslawski uses timbre in association with texture, allowing the possibilities of textural homophony and polyphony. He is limited here in

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[168] Stucky, *Lutoslawski and His Music*, 154.
[169] Ibid., 123.

this regard, though obviously the strings can create timbral contrasts with harmonics, *sul pont*, *pizzicato*, and other modes of articulation. But even without looking at timbre, examples of this polyphony of textures are easy to find.

In the detailed analysis I discuss T_3 as having in reality 3 distinct phases: these were articulated in the music by two clear and separate (in their pitch and registral construction) sub-textures which had a period of overlap. The same applies to T_1+ moving to T_5, and T_{14+1}. These are examples of 2-part polyphony of the textures. They show a necessary flexibility in the treatment of texture. I will endeavour to enumerate the various kinds of textural relationships in the quartet first, then list the various individual textural types (e.g. 'bundles', various grid types etc). (A lot of this has, in effect been looked at in detail in my analysis, where the motivic content of various textures divides them into types). The list of polyphonic procedures will be small due to the limit of having four instruments.

For all of the Introductory Movement the textures are of two fundamental kinds: a) those which have one basic texture throughout, and b) those which have two, overlapping in time. (Clearly, the possible number of superimposed textures is limited, with just four instrumentalists.) The second group further subdivides into those with just one basic motivic shape (T_3) and those with distinct motifs (T_1+ to T_5, and T_{14} to T_1). I will explore below how the individual textures can be further classified. First, a little more on the ways in which textures cross-relate, which is not limited to overlap, (b), and separation in time, (a).

Relationships of adjacent textures

Adjacent textures may or may not communicate. The main types of adjacent relationship are both called here 'disinterested', because they do not transfer motivic material across texture boundaries:

1) disinterested 'a': where they don't follow *attacca* and have no common elements.

2) Disinterested 'b': where they follow one another *attacca*, but appear complete in themselves, having no common elements (example: T_1 - T_3).

3) Interrupting: where they follow *attacca*, the second appearing to cut the first off before it can close, usually these have no common elements.

4) Quasi-developing: where they run *attacca* and there is a motivic or quasi-motivic link (example: end of T_4 which resembles and runs into the T_1+ which follows). Seen in this light,

5) overlapping polyphonic textures are simply the next logical step in this list of relationships. Already one sees a certain range and (limited) flexibility in the broader techniques, and this is a theme in this thesis: where techniques are more flexible there is more expressive scope.

The Main Movement enlarges on the possibilities, though not immediately, as S_1 (not given a rehearsal mark—as with opening of Introductory movement) is notably separate, simple and closed in gestural type. S_2 (r.m.s 14-23), despite the fact that it is composed of separate sections, each on a separate page, is again sealed off from its neighbours, and sufficiently homogeneous in itself to resist a classification of polyphony of texture; but in compositional technique, we are certainly on to something new (and this is a point of friction between the technique and the result, perhaps). The r.m.s here *are* structurally important sub-units, allowing a much greater freedom (of rate of change, registral goals, harmonic quality, as observed above), so a new relationship type is occurring, which one might call 'blended textures', where adjacent textures motivically blend in order to create longer sections with subtler internal variety. This is a significant enlargement of the flexibility in the domain of textural relationships, though it blurs the distinction between internal texture types (to be examined below) and textural cross-relationships.

Rehearsal marks 24-8 produce a new relationship for adjacent textures. They are a kind of model and sequence set—new within the context of this work so far, as this an ancient compositional device, and indeed, even here we can't help accepting it aurally as the most natural thing, and missing its novelty in its present context. The

relationship can be described as one step away from 'blended textures', since it is a succession of similar texture types just as in S_2, except here the adjacent textures are separated out in time. This is quite obvious to the ear, but the technique deserves scrutiny no matter how basic or traditional. The description 'model and sequence' is therefore how I will describe it. With r.m. 29, S_3 goes on by means of type 4, 'quasi developing', it is part of S_3, since the model and sequence set of five mobiles has played around extensively with the combinations of *glissando* and tremolando, and 29 begins with a new juxtaposition of these.[170] As r.m 29 continues into r.m.s 30 to 34, more developmental types of cross-relationship are used. There is a leader and accompaniment arrangement as noted in the analysis, but this apparently traditional situation is technically a hard-won development of existing textural relationships. The 'accompaniment' parts are an offshoot of one set of possibilities stated in the previous five mobiles, while the 1st violin's 'texture' is a splintered-off alternative set of possibilities, and these are superimposed. This therefore is a significant new form of polyphony of textures: 'splintered textures'. It uses contrasting timbres and great registral partitioning to aid this process. Another separate type of cross relationship is used during these same mobiles, where two very contrasting strands of material are intercut. The process begins in r.m. 32 with cello and 1st violin having inserts of a striking, new motif, which with longer and longer inserts involving all instruments, gradually (by the end of r.m. 34) becomes a new texture. It is important to realise that the resulting texture is a complete replacement of texture. This 'intercut' method is not as traditional as the model and sequence et al. It does have antecedents e.g., in the music of Stravinsky, and is a rather cinematic device too. With the use of three relationship types in quick succession, including a new type of textural polyphony, S_3 exemplifies the technical fluidity needed to make the main movement work within the end-accented formal scheme.

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[170] We are seeing how the technique works hard to mediate from rigidly different successive textures to communicating successive textures, with some surprisingly ordinary results of material development such as blended textures, model and sequence, and leader plus accompanying group.

This gives us the following adjacent texture relationships:

1) Disinterested 'a': where they don't follow *attacca* and have no common elements.

2) Disinterested 'b': where they follow one another *attacca*, but appear complete in themselves, having no common elements.

3) Interrupting: where they follow *attacca*, the second appearing to cut the first off before it can close, usually these have no common elements.

4) Quasi-developing: where they run *attacca* and there is a motivic or quasi-motivic link.

4a) As type 4, but non-*attacca*.

5) Overlapping textures: creating three distinct phases, with the vital period of overlap in the centre, which must be of significant length.

6) Blended textures: where adjacent textures run *attacca* and work in the same motivic types.

7) Model and sequence: a version of blended textures where the adjacent textures are separated out in time.

8) Splintered textures: the first texture suggests two variant development possibilities, the second uses both and superimposes them.

9) Intercut textures: passages of the second texture inserted into the first, then grow until entire the texture is converted to the second texture's material.

10) Developmental: where material is free to associate itself with adjacent or near adjacent textures and re-combine developmentally with other free elements (most of which by this point in the piece have been heard before, some are new).

Types 1, 2, 3, 4, 6, 7 and 10 all fall into category (A), that is, not a polyphony of textures. Types 5, 8 and 9 are in category (B), polyphony of texture. Types 8 and 9 only occur once each.

It is necessary also to show the frequency of each type, in order to garner a picture of which ones Lutoslawski favours for this piece, and to show the degree to which the two movements share surface qualities. However, the following does not

allow for the relationships of non-adjacent textures, which are particularly frequent and important in the main movement.

Introductory Movement	
Ts1-2:	type 4a.
Ts 2-1(2):	type 4a.
$T_1(2)$-T_3:	type 2.
within T_3:	type 5.
T_3-T_4:	type 3.
T_4-T_1+:	type 4.
T_1+-T_5:	type 5.
T_5-T_6:	type 3.
T_6-burst of Cs:	type 4 (Cs were heard as initial part of T_6).
Cs-T_7:	type 2.
T_7-Cs:	type 2.
Cs-T_8:	type 2.
T_8 -Cs:	type 1.
Cs-T_9:	type 2.
T_9-Cs:	type 1.
Cs-T_{10}:	type 1.
T_{10}-Cs:	type 2.
Cs-T_{11}:	type 1.
T_{11}-Cs:	type 1.
Cs-T_{12}:	type 1.
T_{12}-T_{13}:	type 10.
T_{13}-Cs:	type 2.
Cs-T_{14}:	type 1.
T_{14}-T_1:	type 5.
T_1-S_1:	type 2.

Main Movement		
S_1-S_2:	type 2.	
within S_2: r.m. 14-23:	type 6, nine times in a row.	
S_2-S_3:	type 2.	
within S_3: r.m. 24-28:	type 7, four times.	
r.m. 28-29:	type 8.	
r.m. 29-31:	type 8, twice.	
r.m. 31-32:	both type 8 and type 9 combined.	
r.m. 32-34:	type 9, one process.	
S_3-S_4:	type 2.	
S_4-S_5:	type 2 (but important recall of material from S_3).	
within S_5: r.m. 36-37:	type 2 (but important recall of material from 35).	
r.m. 37-38:	type 10.	
r.m. 38-39:	type 10.	
S_5-S_6:	type 2.	
within S_6: <u>within</u> r.m. 40 the change from S_6 to S_{6a} occurs:		type 3.
r.m. 40-41:		type 2.
r.m. 41-42:		type 10.

r.m. 42, internal textural change, moving into S_{6b}:	type 2.
r.m. 42, 2nd internal change,	type 10.
S_6-S_7:	type 4.
within S_7: r.m. 43-44: it's impossible to hear or see why Lutoslawski makes these separate r.m.s—no textural change .	
S_7-S_{7a}: type 4a.	
S_{7a}-S_{7b}: type 4a.	
S_{7b}-S_8: type 2.	
within S_8: r.m. 47 to numberless insert:	type 10.
numberless insert to 48:	type 6.
S_8-S_9: type 1.	
S_9-S_{10}: type 1.	
within S_{10}: r.m. 50-51: type 10.	

Frequency of occurrence of types:

Type	1	2	3	4	4a	5	6	7	8	9	10
Frequency	9	17	3	3	4	3	10	4	4	2	7

Fig. L. 21. (pp. 217-19)

Now types 1 to 4 are fractious in nature, they break up the musical surface and resist normative material development. Types 5 to 10 are more traditional and developmental in nature. The types used in the introductory movement again demonstrate its non-fulfilment of goals, noted in the analysis and in Lutoslawski's remarks. The main movement shows quite a preponderance of these types also, except for sections 2 to 6b, with type 2 occurring even within this area, at major boundaries. On the one hand this helps tie the Main Movement in with the Introductory Movement, but it also has the effect of making one wonder did the Main Movement truly fulfil all of the unresolved issues from there. Or, did development ever get sufficiently under way? The fact that this question can so clearly be asked is itself a troubling sign, given Lutoslawski's own claim that the main movement is meant to unequivocally develop those issues, and avoid episodic music.[171] Just below the

[171] Here, of course, one has to wonder what Lutoslawski means by saying the main movement is not episodic. He can hardly have missed the surface impression of the music. He must be intending the word episodic in its strongest sense: a sequence of interchangeable, entirely independent sections. Perhaps he is distancing himself from the chance-choice composers once more.

surface, there are links not shown by the above list: as mentioned, there is the possibility of important relationships across non-adjacent textures. These exist particularly during sections 1 to 6b, after which the piece retreats to a stage of evolution from the first movement. Tellingly, these are frequently motivic links which run through *alternate* sections (suggesting other cinematic techniques). They are mentioned above in my Detailed Analysis.

During the final period, Ss 7-10, there are more distant motivic links, echoes of material from much earlier in the piece, and doomed attempts at development. These are outweighed by the return to the tendency for successive unrelated sections.

Categories of texture

The textures themselves may now be categorised. There are many trademark textures in Lutoslawski's music.[172] I will elaborate my own observations on textural types. Stucky's categories (see footnote) are only tangentially related to my own.

The following categories arise when considering Lutoslawski's textural techniques in detail (when dealing specifically with this work):[173]

1. Bundles (and pitch bands)
2. Partitioning
3. Grid use

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[172] Stucky (125-6) lists five 'conventional types' for all of his music. They are:
1) The cantilena, almost exclusively strings and played ad libitum. Example: the funèbre section, r.m. no. 45.
2) 'monophonic polyphony', where each pitch stated melodically is sustained as harmony following its attack. This doesn't apply to the quartet, as too many players are needed.
3) The 'blurred toccata' style, a variant of the 'bundle' of which Lutoslawski speaks. Example: T_6. The bundle is where two or more instruments play the same melodic line heterophonically. The cantilena is a related texture type.
4) 'Mobiles', passages of collective ad libitum in which the parts contain discrete repeated fragments. The idea is that familiar fragments return in ever changing contexts. The quartet is full of examples of this kind of texture, T3 is a good exemplar.
5) 'Sound visions', blocks of harmonic and rhythmic stasis, generally reserved for dramatic situations. Example: r.m. 43.

[173] They are not textural *types*, because any one texture may be discussed under two or more of these categories.

4. Rhythmic alignment
5. Number of motifs
6. Number of parts
7. Free writing

The first four are Lutoslawski 'trademarks' (though others have used them), the other three apply to all music. The first three are specific to certain passages, while the other four apply to all of the piece.

I will define each one and mention examples of each. Pitch is necessarily part of the discussion, but only in the broadest terms of how it is deployed within the texture.

Bundles/bands

This textural category depends upon linear goals, where two or more instruments share a set of linear goals. The typical bundle is where two to four instruments have the same pitch selection and very similar motivic shapes. The purpose is simply to produce a heterophony where a single melodic idea is blurred. This technique relies to some extent upon aleatorism to enhance the blurring that it sets out to achieve, but the rhythm as it is written also supports this. These aspects will have to be discussed further below. Bands are a variant of bundles, where instead of a single central line being blurred, a pitch band of two or three adjacent semitones width is presented, again by means of a single motivic idea. Some examples: bundles - T_6, the *funèbre* passage, bands - T_{10}, S_1.

Partitioning

This textural feature is a localised form of pitch complementarity, and is referred to as such by Stucky and Rae (the term 'partitioning' is my own). The twelve notes of the

chromatic whole, or sometimes eleven, are divided among the instruments so that each has three or four pitch-classes of the twelve, and no pitches appear in two different instrumental lines. I prefer to avoid the term complementary in this instance, since the harmonic effect created is very often one of chromatic saturation, i.e. the twelve pitches all recur within very short time spans. In practice during the quartet, partitioning is used in a way which is allied to grid writing, as the pitches are regularly fixed locally in register. This technique is used to promote linear intervals and thereby to colour the harmonic ambience. Some examples: T_9, S_2.

Grid writing

The archetypal grid texture is where all pitches are fixed in register for the entire duration of that texture. T_6 is a perfect example of this kind. However, if such an approach were to reappear unchanged, it would quickly become enervating for the listener, so the technique becomes modified in many ways. The analysis has shown that the simpler types are not re-used, but that the grid is subject to change. It can therefore be said that this technique displays flexibility, and that logical modifications are developed for sound musical reasons.

I use the term 'grid' to describe a texture/pitch organising principle where the horizontal pitch selection is programmed, to some extent, due to the existence of a pre-formed vertical structure, or chord, which the texture articulates. This is a bit like the alberti bass of old, where one instrumental part could present three or four virtual lines by breaking a chord, thus enriching the harmony without overly thickening the texture. I use the term register fixed pitches to describe the members of the chord. And because the chord is only virtually present, I call it the grid rather than the chord. The basic condition of the texture is therefore repetition of pitch without octave transposition. The simplest grid type would be where all pitches are fixed in place throughout the duration of a texture. T_6 is a rare example of this type. Clearly the

musical potential for a single grid controlling a single passage is limited by the fact that a feeling of stasis will quickly set in, so Lutoslawski introduces the possibility of controlled octave transposition. Once pitches are allowed to depart from their fixtures in this way, one begins to erode the very concept of grid writing, nevertheless it has to be done for elementary musical reasons. If the transpositions become sufficiently free, then the grid ceases to exist. The essential grid quality is heard, however, at relatively rapid rates of change within the grid. The transposition of pitch doesn't always occur one octave at a time, but this is the procedure in most cases.

One sees therefore, that a continuum exists, from totally fixed grid to no properly discernible grid, but because it is a continuum one can't really list points on it without imposing artificial conditions, and there is no evidence in the music that these exist. It is possible to imagine the composer inventing a set of rules such as: "in this passage I will allow one octave transposition to each part, after 7 repetitions of each pitch; and in the next, 2 transpositions and 5 repetitions", and so on, but the evidence doesn't support this. Examining for example T_1+ (see **fig. L. 5.**), the various pitches repeat different amounts: the highest pitch, G (vn 2), occurs 4 times fixed in register before jumping down an octave. The more central pitch B, in the 1st vn occurs 7 times, and the lowest pitch E (viola) occurs only 3 times before jumping up the octave. The controlling principle, and the only one discernible to me, is the overall registral plan (a pre-decided goal) of the texture: T_1+ has a wedge shape: central pitches remain repeating throughout, while the outer pitches are the first to transpose, always inwardly, until a particular state is arrived at. Thus it has a single goal. Other textures display more complex registral plans, and therefore use more rapid internal changes in the grid. T_7, for example, is highly varied, because the outer registral limits shrink (to a tight band) and expand rapidly a number of times. Not only that, this texture has other registral features, such as avoidance of bass for a while, or avoidance of treble, to create areas of contrast. This necessitates rapid transpositions to the point where one almost begins to question whether a grid proper exists. I have come to conclude that the method used to direct the transpositions consists of having a starting grid, and

a little later on a target grid, or a series of target grids according to the amount of registral goal shifts. This is particularly evident in S_2 (see below, under 'Pitch').

So the registral morphologies dictate the selection of pitch for transposition. One has to suspect that Lutoslawski uses graphic plans in the early stages of composition, which may make for a pointed similarity to Xenakis' methods of planning textural change.

The positioning of the grid flexibility on the aforementioned continuum is difficult to make, but the number and type of overall registral changes is the best guide, along with listening for encroaching stasis.

Partitioning is a special application of grid writing. The grid can be partitioned, which means that it is made up of subsets of pitches which are specific to the instruments which play them. There is a vital point to be made about partition and non-partition: that where the instruments are free to take any of the 12 or 11 pitches the sense of stasis is allayed, whereas where partitioning occurs, each instrument is repeating 3 or 4 pitches, so the sense of repetition usually encroaches more rapidly. Similarly, where the partition subsets are interlocked in register the stasis is less apparent than where each subset has a clear registral area to itself.

One can posit the following ordering of textures according to their relative position on the continuum:

T_6	All pitches fixed.					
r.m. 47 (S_8)	"	"	"			
T_4	"	"	"	with one exception.		
T_5*	"	"	"	with one exception.		
T_3*	"	"	"	but a special rule applies.[174]		
T_{14}	"	"	"	- special rule applies.		
r.m 45 (S_{7a})	"	"	"	but slowly unfolding, hence slow rate of change, not stasis, is heard.		
r.m. 43 (S_7)	Mostly fixed (slow rate of change)					
T_{1+}*	"	"	"	"	"	"
S_4*	"	"	"	"	"	"
T_8	"	"	"	"	"	"
T_{10}	"	"	"	"	"	"

[174] which is that some pitches occur on the grid in more than one octave. For this to be a recognised situation it is necessary for the pitches to keep returning at all of the various octaves thereby avoiding a sense of departure from the earlier fixture.

T_{11}	" " " " " "
r.m. 46(S_{7b})	Medium rate of loss of fixture
S_1	" " " " " "
r.m.36(S_5)**	" " " " " "
T_9*	Rapid rate of change (simple overall reg.
r.m. 14(S_2)*	" " " " shape here)
r.m. 23(S_2)*	" " " "
T_7	" " " " (complex reg. shape here)
r.m.s 15-22	" " " " " " " " "

* denotes these textures use partitioning, the others do not. Notice that use of partitioning generally promotes stasis.
** denotes partition which is itself subject to some rearrangement.

Fig. L. 22.

There are those textures to which neither grid writing nor partitioning apply: T_1, T_2, T_{12}, T_{13}, and S_3* (uses partitioning at times in the three lower parts, however) are some of them.[175]

The above list includes all of the first movement, but not all of the second. One or two pertinent observations should suffice. If the list included every part of the piece it would still only be a general, somewhat subjective ordering. The points that can already be drawn are as follows: the sequence in which they appear is non-linear, i.e., the simpler types don't always occur earlier in the piece. Instead it is a pre-worked set of possibilities that are then fitted in to the music according to their expressive applicability to the planned structures. This shows composer control and foresight, but also an element of prefabrication; which can threaten to sound like blocks of pre-cast material arranged prettily beside one another to show off their contrasts. This can mean eschewing the potential for coherent long-term development. The reality in the piece, I think, is that Lutoslawski manages to work in a non-linear way *and* retain the developmental sense of forward motion, because he uses simpler types in the outer sections of the first movement, more complex types in the centre of the first movement, then in the second movement some even more complex types he has kept

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175 T13 possibly exists on the *fringe* of grid writing, this sensation can be achieved by having some pitch fixing from time to time in some parts, which does happen here.

in reserve. This will remind the reader of the conclusions reached in the analysis of the first movement, where linear harmonic content and motivic complexity were analysed in similar terms. In fact, those aspects of the music work together with the rate of change in the grid writing, seemingly as a unified technique complex. So this technique has displayed great flexibility (in terms of range of grid methods) and shows itself to be fully integrated into the surface musical discourse.

The perceptibility of the pitch fixing in a grid is also affected by the nature of the material that articulates it.[176] Each motif type has a slightly different effect, but the most important observations concern bundling and *glissandi*. These effects obscure the sensation of pitch fixing: *glissandi* because by its nature it questions the concepts of 'pitch' and 'fixture', and bundling because of the in-built opposition of neighbouring semitones; if a set of two or three notes a semitone apart are given non-constant reference, the tendency is to hear them as rival points on a line, and hence as movement, whether or not the texture is simply articulating a grid. The slower the speed of the motif, the more this illusion is felt. The *funèbre* section (r.m. 45) is an excellent example of this, and evidence of the fact that Lutoslawski decides to exploit this property of a bundled grid to the full.

Rhythmic alignment

T_7 (rehearsal mark 5), T_{12} (10) and T_{13} are all notated so that only one outcome is intended. These are not aleatory textures. The alignment is fixed. At rehearsal mark 43 (opening of S_7), the score is organised to show the outcome, but with a very limited freedom in rhythm. This is almost fully fixed alignment. A sliding scale of alignment operates from this towards greater freedom. The longer a texture goes on, the freer this alignment will be. But there is a limit, as Lutoslawski eschews any relinquishing

[176] As well as the more obvious aspect: the amount of repetitions.

of the role of composer. This will receive more attention below under 'aleatory technique'.

Number of motifs

The number of motifs within one texture has an obvious bearing on its quality—whether one thinks in terms of information loading, gestural weighting or expressive quality. This is a technical aspect, rather than an archetype. But it is clearly carefully considered as part of the design layout of the whole piece. See the analysis of the Introductory movement for full discussion of its importance. All sections/textures are involved.

Number of parts

The textures can also be categorised in terms of number of parts, ranging from one (opening monologue) to four (T_7 is the first of many examples). This has an obvious bearing on the complexity of the passage.

Free writing

This is an unashamedly catch-all category, to classify all those textures that do not display any of the archetypes above. The first three categories together apply in most of the piece, but a few instances of areas exist without bundling, partition, or grid. Examples: opening monologue, T_{12}, T_{13}. These have other 'rules' of their own which

allow them to blend into the piece. For instance, the opening monologue does so by limiting the articulation and choice of linear interval.

Often textures have a small amount of repetition of pitch which allies them to grid writing without the point of grid change being defined, so are these grid textures or free writing? This is, in fact, a moot point. All of the archetypes of texture display a masterly degree of flexibility, ranging from 'perfect examples' to 'technique modified to melting point', i.e. where the texture can nearly be described more usefully as 'free writing'. I will trace the bundle/band category to demonstrate this.

The first instance of the bundle is at T_6, and this is a strict version of the technique. A single linear idea (see score p. 5) running from a high B harmonic at the top of the violin's register down to middle D# is presented in the three instruments, but rhythmically written out of phase so that blurring, or bundling, occurs. The paused rests add to the blurring, because this element of uncertainty prevents the instruments from sharing a common pulsation. The next instance is T_{10}, and already a slight modification of the technique is apparent: (see score p. 14) the instruments do not really share the same pitches in the way that they did in T_6. Instead, there is a hint of the 'banding' of pitches. e.g. the first violin opens with G#-A-A^b, and plays about with these pitches, but the second violin uses G-G#-A, a semitone below instead, creating a 'band' from G to A^b. Furthermore, the viola joins in later, and this allows the band width to stretch further. Notice the first longer note in each part: Vn 1: E^b, Vn 2: D, Va: C#, so they are not presenting the same line, but a banded version of a similar line.

With S_1, the technique goes further. This section begins as a true bundle, i.e., all instruments are on the same pitch, but gradually by means of *glissandi* they diverge. This eventually produces a wider band than before. The fact that four instruments cannot present a true band of more than four adjacent semitones is somewhat overcome by the use of *glissandi* to further blur the pitch area. So the band here (in the middle of S_1) is wider than ever. The latter part of S_1 puts this process into reverse as the parts converge onto a central E.

At S_3 this technique reappears. It is now used as a starting point and immediately develops further than ever (see rehearsal mark 24). Target pitches or pitch bands are evident, where all four instruments aim to converge, but between these they are given a new level of freedom, in their *glissandi*, which can find independent routes towards these targets. Then they each find a resting pitch on which to end, and at this point any banding or bundling is forgotten. As S_3 goes on, less and less true banding is observed. Free writing, based on the same ideas, takes over. But it is important to stress how smoothly the transition from textural archetype to free writing is. No seams are showing!

Rehearsal mark 35 brings an important development in the history of this technique: the upper two voices together present a bundled line of one kind, while the lower two present a different one. This is the first polyphony of bundled lines. Another departure here is that the lower two voices operate in separate octaves. There is evidence in much of his music to suggest that Lutoslawski controls his textures with acoustics in mind. i.e., that it is common for him to space lower parts out to avoid muddiness where it is not desired. This spacing here can be regarded as either a further extension of the flexible technique, or as a pragmatic intervention by the composer.

In later passages (rehearsal marks 36, 37 and 38) motivic elements previously treated within bundles, become entirely free to interact with other elements—ones which don't have this association. At this point it make sense to regard the technique as having reached melting point. This does not prevent the possibility of a return to stricter adherence to the 'rules' later on.

There are other textures which fall under this category, but the important variants of type have all been mentioned.

Pitch selection

Overall, Lutoslawski has written very little chamber music, preferring (particularly since the *Jeux Venetiens* of 1960-61, i.e. in his mature period) large groups, and the chamber music which he has written frequently uses piano. This is not unconnected to his harmonic technique, which relies greatly on the frequent presentation of all or nearly all of the notes of the chromatic whole. So the string quartet, seen in this light, has to manage this technique with the constraint of only having four melody instruments to present the pitches.

Three aspects originate from this technique of twelve-note saturation: the narrow focus of motif, pitch fixing (grid writing), and partitioning.

Lutoslawski was clearly concerned with dodecaphony and serialism's surface harmonic complexity, and was dissatisfied with the results, finding these types of atonality rather grey. Many composers at this time were concerned with constructing series containing all possible intervals. Lutoslawski went in the opposite direction:

> One rule which it is possible to formulate about my experiments with twelve-note chords is that the fewer different intervals between neighbour [i.e. adjacent] notes the chord contains, the more characteristic the result is. If, for instance, you use all possible intervals in one chord, the final result is, in a way, faceless, something which has no character, which in colour is grey . . . I began with the elementary ones containing only one kind of interval between neighbour notes . . . Then I tried to find some simple but not elementary chords which would contain only two different intervals.[177]

Note that he is not talking about a series, but about a chord.[178] This brings us to another aspect of his harmony, his way of dealing with pitch, which is fundamental to understanding the technique; frequently a 'chord' is a pre-composed element that governs a texture (or part thereof). This is what I describe as a single grid (note that 'grid writing' usually involves the use of a sequence of grids rather than one alone). It also concerns partitions, since a basic chord governs such textures also. And it also

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177 Rae, 50. There is further discussion of Lutoslawski's general harmonic language in Homma's *Witold Lutoslawski. Zwölfton-Harmonik, Formbildung, "aleatorischer Kontrapunkt". Studien zum Gesamtwerk unter Einbeziehung der Skizzen* (Cologne, 1996).

178 But there is an inherent criticism of all-interval series as a resource.

turns our attention once more to the issue of chromatic saturation. Charles Bodman Rae deals with the various types of twelve-note chord that Lutoslawski constructs for all of his music. I recommend the reader to pages 49 to 74 of his book. With great clarity and detail Rae classifies the twelve-note chords constructed by Lutoslawski for various works.

Rae divides these 'chords' into two groups: those composed of two or three intervals (between neighbour notes), and those composed of chords (three four-note chords). Where the twelve-set is made up of chords, these chords are built up from major and minor thirds. He calls these chord-aggregates.

I would say that it is important to get away from using the word chord to describe the twelve-note superstructure (despite Lutoslawski's own use of it) since, as Rae points out: "twelve-note pitch organisation can be used to govern three dimensions of a musical score: the vertical plane (chords and harmony); the horizontal plane (lines and melody); and a plane tangential to chords and lines that can be described as 'oblique' (counterpoint and polyphony)."[179] I will therefore use the term 'superchord' to imply a kind of set theory relationship between this structure and the actual heard 'chords' of the music.

In the quartet the simplest examples can be found in the Introductory movement.

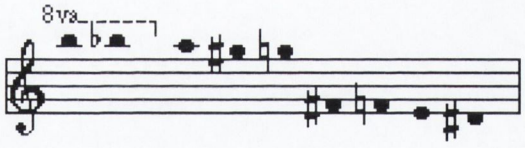

Fig. L. 23.[180]

T_6 (see ex. 1) is a clear example of the one-interval superchord (only ic1 and ic5 can produce twelve-note pitch structures on their own). Here ic1, as semitone and

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[179] Rae, 49.

[180] Diagonal presentation of the pitches should not be construed as meaningful, it is simply necessary where semitonal clusters occur. Vertical alignment is used in some of these examples, where visually possible.

minor ninth, is the only neighbour interval (ex. 1. shows the V.S. underpinning T_6). Rae finds vertical structures like this elsewhere in Lutoslawski's music. The ideal example would have all twelve pitches, and he often bunches the notes together in threes (e.g. semitone, semitone, minor ninth, semitone, semitone, minor ninth). Here there are only nine notes, though the relatedness of technique is obvious. One musn't forget that T_6 also serves as a simple example of 'bundle' technique.

To examine T_8, let us return to **fig. L. 8.** A reduction of the superchord in use can be abstracted:

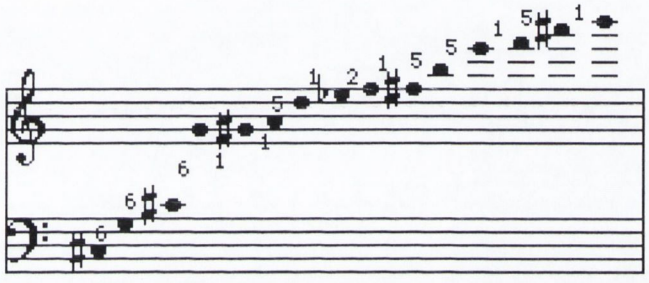

Fig. L. 24.

This is also an example of the first kind of organisation, where the neighbouring intervals are of few types, ic1, ic5 and ic6 (with a rogue instance of ic2, due to transposition of the note F down from a higher octave). It is worth noticing how the sort of neat ordering Rae leads us to expect is actually muddied here, because some pitches occur in two registers. If the notes C#, G, F and B did not change octave position a true superchord of the simplest type (i.e. using only two interval classes) could occur here. As it is, the technique of grid writing is already subject to intuitive adjustment by the composer. The superchord is modelled, as it were, on a basic type containing only ic1 and ic5. The unavailability of the pitch C due to the complementarity here is another reason for the 'irregularities'.

In T_7, at the start, there is a superchord lasting just less than one bar (see ex. 3); but it is of interest because, for the quartet, it is a rare example of a chord-aggregate (see Rae pp. 54-7).

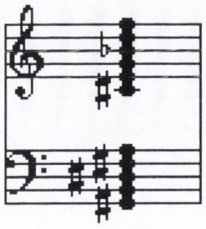

Fig. L. 25.

According to Rae, it is of significance whether the lower four-note chord contains the perfect fifth or the tritone. Another way of looking at the same notes, however, is to regard it as a superchord of the first kind, with just two interval classes ic3 and ic4. The fact that the note C is once again absent goes against the aggregate view. I suspect that Lutoslawski had not yet developed the aggregate idea at the time of writing the quartet. and that this point might even be a first glimpse of Lutoslawski deriving the chord aggregate system out of the intervallic system.

With T_1+ (see **fig. L. 5.**), for a long time the texture is organised according to a pitch structure which exhibits both a fixed grid and partitioning of the chromatic set (which here is 11 notes as C is kept in reserve). The fixed grid (superchord) is:

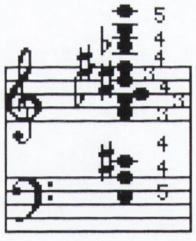

Fig. L. 26.

an almost symmetrical arrangement of ic3, ic4 and ic5. But only when the partitioning is considered, does ic1 (as major seventh and minor ninth) become evident, though its importance is very apparent to the listener:

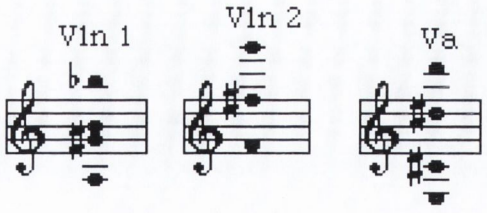

Fig. L. 27.

with this partitioning, ic1 is promoted much more than ic3, ic4, or ic5. This is due to two aspects of the music: a) the ratio of note to silence makes the texture sparse and promotes the linear over the vertical, and b) the aleatory writing gives the 3 sets independence in time, which promotes the separate perception of each. Thus the primacy of ic1 over the others is clearly audible. This brings us naturally to the question of partition, the how and why of its use. (Both questions have been addressed already, to some extent).

The partition method allows certain intervals to be promoted over others, and this is done by the selection of particular subsets of a larger structure with attention to their own composition and motivic application (for instance, the viola's subset seems to feature a major 6th, and a major ninth, but by presenting leaps of the D# down to the E, rather than the C#, ic1 can be further promoted). The other vital aspect which partition allows, is for changes to occur to the grid in a controlled and phased manner. In the case of T_1+ the pitches from the outer registers all gradually transpose inwards by an octave each time until the set is presented as a tight band of semitones with C missing and one larger interval at the bottom. So a simple gesture is chosen here, the nature and rate of change is controlled. The effect here is that certain characteristics are very clear at the outset, and gradually disappear into a different state, but the listener never hears a distinct moment of transition. This aural 'sleight-of-hand' is a key characteristic of Lutoslawski's music generally, and the quartet abounds with other examples. The fact that T_5 comes directly out of this with almost the same pitch positions and partition is another example of the pitch practises Lutoslawski favours.

The fresh motivic material in T_5 allows the harmonic link to operate independently of other parameters.

There are many more examples of partitioning in the piece, with phased changes of state being the destiny and purpose of each one, the composer varying the goals for each of them. The purpose can be summarised as making linear, as distinct from vertical, elements dominate the attention of the listener. Sometimes a very great disparity is experienced between linear and vertical harmony, as in S_2 (see Analysis) where linear intervals for some time are all consonances, in a vertical environment of total chromatic saturation. This produces what I fancy Carter would describe as an 'hallucinogenic state'[181]. It is significant that this occurs at the point in the piece where all twelve notes are allowed to come together for the first time (because of the separation of c from the others before). To see how this works practically, let us return to S_2:.

It is realistic to show the superchords at the start and end of a subsection, to show the degree and type of transformation effected. It is unnecessary to examine possible intermediate states except to say that in all cases the transformation is gradual, and always by stepwise octave transposition within an instrument.[182] In each case for S_2, the partitioning remains the same for each subsection. r.m. 14 begins with this superchord (which I will call a):

(see also **fig. L. 19.**)

Fig. L. 28.

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[181] Carter explicitly states that he is not interested in music with limited intervallic content in an atonal environment, he says the hallucinogenic state is of little interest.

[182] And it would be misleading, as far as technique is concerned, since the only possible method the composer could have used, in the context of lateral rhythmic freedom, was to have worked out the beginning and ending grids, but not the possible intermediate ones.

and ends with this one, b:

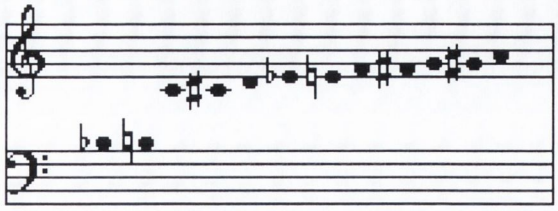

Fig. L. 29.

Reading upwards, the adjacent ics for superchord a are: 5 3 4 2 1 3 1 2 2 2 3, while those for b are: 1 1 1 1 1 1 1 1 1. All during the change from a to b the partition remains the same: 0,2,7 / 0,2,7 / 0,2,7 / 0,2,7. At b, the contrast between vertical and linear sonority is at the most extreme possible. At a it is much less so, despite the fact that all 12 pitches are present in both cases.

For the rest of S_2, these extremes are not pushed any further, which is virtually impossible in any case. Rather, parameters have been set out, and the rest of S_2 falls within them, finding interesting variations on how to express them. Some examples will suffice. I will omit the staff notation and give simply the figures for adjacent ics in the superchord and partitions (It is possible to follow this with **fig. L. 13.**). Rehearsal mark 15 takes superchord c, and transforms it (by the usual way) to d, which is higher in tessitura. All of r.m. 15 uses the partition: 0,1,2 / 0,1,6 / 0,1,6 / 0,1,2 (reading upwards; vc/va/v2/v1), and both c and d have: 1 1 1 1 1 1 1 1 1 1 1 for their adjacent ics. So r.m. 15 is extending and prolonging vertical conditions from superchord b, with new partition subsets (i.e., linear material) which now contrast less with the vertical domain. Rehearsal mark 16 gradually opens things back somewhat towards the state at superchord a, starting with superchord e: 4 1 1 1 1 1 1 2 1 and moving to superchord f: 2 2 1 2 1 5 2 3 2, using the partition: 0,2,7 / 0,2 / 0,2,7 / 0,2,7. The subsections go on, each finding a new twist within the stated parameters of r.m. 14, sometimes creating contrast just by cutting down the number of pitches to less

than 12 (r.m. 18), always taking new registral directions, until at r.m. 23, the final superchord looks like this:

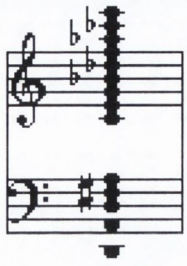

Fig. L. 30.

which is: 5 4 3 3 4 3 3 3 4 3 3 4, the most consonance-laden set of adjacent ics, and going just slightly beyond the level of superchord a. The partition here is: 0,2,7 / 0,1,6 / 0,2,7 / 0,1,6. This is a fusion of all the previous linear possibilities, within the parameters. So linear sonority and vertical sonority combine and re-combine but ultimately operate with independent goals. The similarity of this final superchord to the opening grid of T_7 (and others within) cannot go unremarked, as it is another superchord of thirds; and resembles a chord-aggregate (as defined by Rae).

In the piece as a whole, pitch operates to create contrasting areas of distinct motivic and intervallic make-up, in a linear sense more often than vertical, and I have already discussed in detail how this is achieved. The possible block-like nature of such an approach is greatly mitigated by the technique of phased ('sleight-of-hand') change. It has been shown in detail in the analysis of S_2 how the partitioned set can exploit different rates of change to achieve flexibility and variety of rate of change.

Other aspects of pitch organisation

There are also instances of long-term pitch references, with a chord or a motif occasionally being referred to across the piece. These have been noted and discussed in the analysis. This is not actually a very significant structural aspect of Lutoslawski's

pitch technique, in this writer's opinion. Short-term pitch reference, as between T_1+ and T_5 also occurs, and frequently. This is more important, as it widens the range of types of contact between adjacent textures.

Vertical harmony, *as it is realised*, and its application have already been discussed in the analysis, where it was found that a progression of intervals across the textures could be traced for the first movement, and that the vertical domain, though difficult to pin down and complex in its chopping and changing, in comparison with the linear, nevertheless displays clear compositional control and functionality, in the sense that contrasts of adjacent textures are set up by vertical ambience, as well as other musical factors. In the second movement, the presence of all twelve notes often prevents the clear perception of such a progression; and one can say that therefore functioning vertical harmony is an option, but not a necessity in Lutoslawski's technique. The purposefulness of linear harmonic content, at these points, intensifies in compensation (as seen in the analysis of S_2).

Aleatory technique and local rhythmic organisation

Stucky has used the heading "Microrhythmic organisation and the technique of limited aleatorism,"[183] this is a good indicator of how, when one examines it closely, it becomes clear that Lutoslawski is narrowly limiting the freedom in this technique.

(As I have suggested above, it is easy to pick up the impression that Lutoslawski's music is *defined* by this technique, that this is his chief contribution to music, and that presumably all of his music flows forth from this as a basic premise, but none of this is true, exactly. This impression circulates because this technique is a feature so specific to Lutoslawski, and it lends itself to discussion and exposition more readily

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[183] Stucky, *Lutoslawski and His Music*, 109.

than other techniques. As already shown above, it is just one from a broad technical armoury at his command).

The first thing to consider here is *how* this technique is applied. (in the analysis some consideration was already given to *what* the aleatory technique contributes to texture, and how it affects the harmonic grammar). As occurs with grid writing, bundled textures, and other pitch techniques, the application of aleatorism varies in its complexity, and also in the degree of temporal freedom achieved. All of the textures which are polyphonic, with a very few exceptions referred to above (see 'rhythmic alignment', under the heading 'Texture') employ some kind of aleatorism. Many show only slight variation in the method by which they achieve this.[184]

The freedom given here by the composer is always a freedom of vertical alignment, and rarely anything else. This is achieved by paused rests, paused notes, and sometimes changes in speed within the motifs: In T_9 (r.m. 7) *sostenuti* and *accelerandi* are used. In T_{11} the marks *con eccitazione* and *rilassare* also appear (presumably functioning as weaker forms of *sost.* and *accel.*). Clearly these methods are graduated degrees of freedom. The first, the paused rest, is the weakest in that it interferes least with the motivic material. This can be given by the composer with a fixed speed for the semiquaver (as he does: at the opening is written 'ca 5 /sec.') and very precisely notated in all aspects, so that only the length of the pause is at the performer's disposal (which is further implied by brackets around the pauses). The second, paused notes, first appears in T_8, over very long notes. As such, the interference with the motif is as little as possible, since the shorter notes are still strictly timed, and adjustments to longer notes are inherently perceived with less force. Rests are not paused in this texture, which is indicative of a typical caution Lutoslawski exerts when introducing these freedoms. With T_9, both earlier pause

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184 Aleatory counterpoint as a general topic (including the whole of Lutoslawski's oeuvre) has been dealt with by Danuta Kaszewska in *Technika aleatoryczna w utworach Witolda Lutosławskiego.* Master's Thesis. ód Państwowa Wyższa Szkoła Muzyczna, 1974. It is also touched on in this way in Doggett, J.C., *The development of certain processes in Witold Lutosławski's compositions after 1960, with particular reference to the post-1978 works.* Master's Thesis. Kingston University, 1986.

types occur, with the new *sost.* and *accel.* This represents a leap forward in terms of amount of freedom, giving greater freedom of possible vertical results, and allowing freedom of choice into the motif itself for the first time. Such freedom, though still limited hugely when compared to many composers, is pretty maximal for this piece. Textures 10 to 13 revoke these liberties, returning to strictly aligned, quasi-barred music. T_{14+1} returns some rhythmic uncertainty, with long silent pauses, their length indicated by 'ca 5"', or 'ca $1^1/_2$"'. The second movement uses all of these methods to allow freedom in time, and adds only *rit.* and *poco rit.* The effect of intensification of freedom is frequently achieved in strictly notated ways and by more tightly packed *sost.* and *accel.*[185] In the grand climax of the 2nd movement "*poco largo*" and "*PRESTO ca* 10𝅘𝅥𝅯/sec" are added to all of the other freedoms to compound the situation,[186] and this presumably makes it more difficult for Lutoslawski to genuinely anticipate the possible outcomes. But it is in line with the inevitable conclusion that he reserves greatest freedom for the climaxes, which is a very logical approach.

The physical layout of the score contributes to the achievement of independence: each part is written onto the page without alignment to the others, except for cues to start a section. In fact, Lutoslawski initially intended for no score to exist, just the parts!, but the LaSalle Quartet urged him to produce the present score, as a compromise. And it should be known that the working out of this was undertaken by his wife, Maria-Danuta. But to return to the intention of the composer, he wrote, in the score introduction (and this takes the form of a reply to queries from the quartet):

> Within certain points of time particular players perform their parts quite independently of each other. They have to decide separately about the length of pauses and about the way of treating ritenutos and *accelerando*s. However, similar material in different parts should be treated in a similar way. You wrote that you "must have a score so that each one knows what the other is doing and at what points events coincide". The point is that one of the basic techniques used in my piece is that, in many sections of the form, each particular player is supposed not to know what the others are doing, or, at least, to perform his part as if he were to hear nothing except that which he is playing himself. In such sections he must not bother about whether he is behind or ahead of the others. This problem simply does not exist because of measures which have been taken to prevent all

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185 The listener cannot tell exactly what is on the page. A speeding-up effect could be an *accelerando*, or it could be achieved by rhythmic notation only, by decreasing rhythmic values, for example.

186 Recall that ca 7𝅘𝅥𝅯/sec was the mark at the start of the main movement.

> undesirable consequences of such freedom. If each performer strictly follows the instructions written in the parts, nothing could happen that has not been foreseen by the composer. All possible lengthening or shortening of the duration of the sections as played by each particular performer cannot effect the final result in any decisive way.[187]

Another method not yet mentioned which allows freedom on a more macrorhythmic level is the repeated unit. A passage can have repeat bars around it with an instruction like: "repeat until you hear the cello *pizz.* then break off immediately," again this does not affect the motif, but it does have a strong bearing on the sense of pitch fixing and hence harmonic stasis. The signalling player (i.e. cello in my example) always has music of a set length, with only some paused rests, which means that Lutoslawski has more control then at first appears.

Thus the mechanics of the pulse independence are simple enough. But the aural effect of freedom is very much enhanced by his written rhythmic technique, which needs some explaining. Note first that there is a pronounced sleight of hand going on here: apart from the *rit.*s and *accel.*s, really very little is up to the performers, but thanks to the rhythmic nature of the material, we imagine (on hearing the piece) that the performers have far greater freedom than is in fact the case. This will become clear by example.

As Stucky points out, "the achievement of rhythmic complexity may be insured statistically through the application of simple arithmetic operations to the rhythm of the individual parts."[188] He gives this example: looking at the opening section of the second movement (all of S_1), each of the four instruments has 15 rhythmic periods (Stucky calls them 'phrases'). Their construction is determined according to two very different processes. All of the odd numbered periods are constructed of four bursts of semiquavers marked f , with one semiquaver rest between the 1st and second burst, and the 3rd and 4th, e.g.:

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[187] Witold Lutoslawski, "Some Remarks Concerning the Interpretation of my String Quartet" in the score of the String Quartet (Edition Wilhelm Hansen, 1964).

[188] Stucky, *Lutoslawski and His Music*, 111.

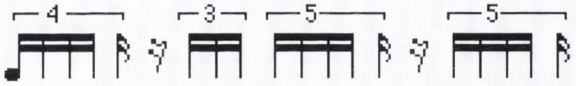

Fig. L. 31.

He uses the numbers 4 3 5 5, 5 4 6 6, 6 5 7 7, and 7 6 8 8 in this way to generate a field of highly complex sound whose overall length is equal in all parts (this only applies to the odd periods, note) These numbers are rotated twice through each instrument, as follows:

periods:	1 and 9	3 & 11	5 & 13	7 & 15
vn 1	4 3 5 5	5 4 6 6	6 5 7 7	7 6 8 8
vn 2	6 5 7 7	7 6 5 5	4 3 5 5	5 4 6 6
va	5 4 6 6	6 5 7 7	7 6 8 8	4 3 5 5
vc	7 6 8 8	4 3 5 5	5 4 6 6	6 5 7 7

because there are four instruments, there are four number groups, so that four different ones can be superimposed.

The seven even numbered periods are constructed of seven different rhythmic figures, constructed so that the four instruments play similar material at around the same time. The durations of each note range from demisemiquaver to dotted minim. See **fig. L. 32.**

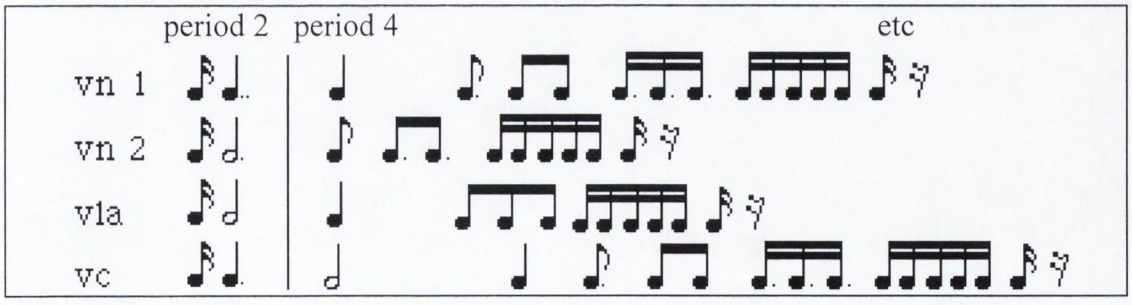

Fig. L. 32.

(Note that because of the unequal nature of the durations in period 1, the attacks in period 2 can not occur simultaneously, despite the vertical alignment I have used above).

An important point about this section is the fact that none of the paused rests or *rit.*s/*accel.*s are used, so only the basic arithmetic of the rhythm is responsible for the freedom here, plus the fact of the score's non-alignment, and the composer's stated intention that the players are to behave as if not listening to the others. And of course the rhythm in period 4 will be heard as if an *accel.* were written over each part.

I have so far been dealing with the *how* of the rhythmic technique, but what does all this give the composer and listener? What results from it is independence of pulse. This is a condition affecting the whole piece. The rhythmically aligned textures even imitate this effect with their polyrhythms. This condition immediately elevates the linear material above the vertical, as the ear is hearing lines operating rigidly in themselves, but fluidly with respect to their partners, like sliding transparencies on an overhead projector. A second result is that no two performances will be exactly the same in terms of the vertical sonority. This is a further devaluation of the vertical in favour of the linear. However, in very busy twelve-note textures from any composer, their is already an elevation of the linear over the vertical. It is often the case that the vertical is incidental. Often the vertical material is composed of the same elements as the linear, and hence is an expression of it. In dense and busy textures there is the difficulty of grasping the detail: Boulez describes some clear examples of the graspability of pitch and how it is limited: if a very complex chord is played very rapidly in the low bass of the piano he classifies this as 'noise', but if the same chord is sustained, the ear can separate out the elements and detect the harmonic colour.[189] So losing the vertical rhythmic predictability seems at first perhaps more radical than it should. All of these situations apply in this piece, but overall there is a more controlled relationship between the linear and vertical than often occurs in serial

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[189] *Boulez on Music Today*, 42.

music, with instances of linear content being a direct expression of the vertical, instances of the linear and vertical pursuing very independent goals, and instances of the two having purposely contrasted interval content. This range of possibilities comes about because of the motivic approach and the harmonic techniques of grid and partition.

Another question arising from the rhythmic freedom is: in what sense does the order in which we hear a group of sonorities actually matter?, since the sequential ordering of predictable sonorities cannot always itself be predicted. Again the natural reaction is: that is intolerable, as it would disrupt the logic of harmonic progression. But that logic is usually only very specific in tonal music, where for example IV -V - I is a cadential formula, with a radically different result if the chords are re-ordered. As one moves further and further into the modern idiom, for want of a better term, such precise functionality erodes. Referentiality of sonority can often only be analysed on the macro level, where chord types are segregated across a piece. Lutoslawski actually keeps more local control of vertical sonority than a great many of his contemporaries because of features such as the grid and bundle techniques. These could even be seen to be conservative moves by him to reverse some of the abstraction/complexity of his rhythmic techniques; this is certainly the case in comparison with Xenakis's approach to pitch selection. And of course performances of any music differ at some level. There is a basic *philosophical* nervousness about the idea that no two performances will be the same, as this, if the freedoms are sufficiently extended, results in the composer relinquishing his/her role as the decider, and not really replacing themselves by anyone else. Lutoslawski makes it clear in his own statements that he is not interested in this kind of situation, and by the extreme limit of the amount and types of freedoms demonstrated here. Notice that many of the rhythmic complexities in the sound which the listener might attribute to aleatorism have actually come about through programmed arithmetic layering, and could almost be scored traditionally, as in S_1. It is clear that he remains in control, one might say (non-empirically, I stress), to a 90% degree.

The Relationship between the analysis and the technique

One of the issues in the relating of the analytical and technical findings is this: do the sections that the listener hears match up with the sections as laid out in the score? The r.m. numbers are always indicative of some change in the technique, such as a new partitioning of the pitches coming into being. Yet they do not line up with my sections as numbered in the analysis. However this is a red herring really, since Lutoslawski refers to mobiles, but nowhere does he explicitly state that a mobile is defined visually by the rehearsal mark. It is clear that he intends, for example, S_2 to be a single mobile.[190] So the sections as heard do correspond to mobiles, and there is no conflict of technical and audible sectioning, as one can get in serially constructed music. Also there are small changes, usually audible, at every new r.m. number. So these lesser dividing points have some musical significance, but on a more localised scale.

Another vital question is: does the technique (as uncovered here) give the composer the sound impression he wants to be heard (as defined in the analysis)? There are many aspects to this; there is evidence, for instance, that in harmony, Lutoslawski has some referential sonorities which crop up across the piece. I have found that these do not stand out sufficiently to do a job of binding the music, because other signifiers such as motif, timbre etc often work against making the reference audible. The possible explanations are: a) this listener's ears are too coarse to be struck in the appropriate way. b) Lutoslawski misjudges the audibility of these features—a technical failure. c) He puts in such points for the musicologist, not the general

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[190] See the score remarks concerning particular sections: after giving the players special advice on how to execute the joins from r.m.s 14 to 17, he states: "the following sections are to played according to similar rules."

listener. (c) seems unlikely, when we read so many of Lutoslawski's statements stressing the desire for perceptibility of all his musical effects. The reader can agree with (a) or (b), but I can only agree with (b). One might for a moment think: what is wrong with elaborating different sounding material from the same source, isn't that how all composers work? But then the next point is: this is only really done to bind or unify a piece at some level, otherwise, why do it.

Another aspect of the relationship of analysis and technique concerns the control of harmony as textures evolve. For example: in Section 2, do the partitionings always contribute in a meaningful way, given the frequent compactness of tessitura, the similarity of timbre and constancy of chromatic saturation in many places? The answer is, not always, but very frequently, due to three musical aspects: dynamics, changes in tempo and pulse independence. There is a clear danger of the partitioning becoming inaudible and pointless, but those are the safeguards put in to counteract that tendency. At many points the density and register help also.

Then there is the question of rigidity or flexibility of the technique. There can be no doubt that a technique which is pursued for its own elegance as theory, and not for the perceived effect for the listener, is to be deplored. In composers of advanced experience such defects are never obvious, but rigidity in technique in the face of material which cries out for more flexible treatment is not unknown. In the technique chapter I have set out how certain techniques show variety in their application across the piece, and it is fascinating how many slightly different versions of a technique such as bundling or banding exist. This is a valid example of one order of flexibility, and I believe I have shown Lutoslawski's genius for creating variety with his technical archetypes. But there are some problems of rigidity if the relatedness of these textures is expressly denied on the surface by total motivic contrast, again, why *have* such relatedness (except to help produce a quantity of music), if it is not for the listener at some level. There are many points where motivic material and textural type agree, and sound logically connected, but there are many other points where they do not. For example, much of the demisemiquaver bundling material has a clear harmonic and

motivic similarity, e.g. during Sections 3 to 6, but equally there are examples where the connection seems overridden by strong factors such as registral unidirection and lack of audible context (T_6).

The listener forcefully notices a single *verklaufskurve* from S_3 to the end of the piece, which is brought about by three basic conditions: 1) interleaving of many motivic strands, 2) clear long-term registral progression, and 3) information loading—the build-up of rhythm and dynamic energy towards the climax and its opposite for the anticlimax (Sections 3 to 6 and Sections 4 to 7 respectively). It is clear that Lutoslawski is very capable of marshalling his technique with the above basics to create long-term relatedness and goals without compromising anything. But for the first movement and Sections 1-2 the first two of the above basics are suppressed except for within each texture, where they are extremely powerful. Now long-term planning in the form of a macro-scheme during T_1-S_2 exists, relying mainly on the information loading (a background order of structuring, since motifs contrast totally). But the composer's undeniable intention was for this to be extremely subtle in the listener's ear, until the music begins to express the main *verlaukskurve*. The result is perilously close to eleven and a half minutes of preamble followed by twelve-and-a-quarter minutes of the main subject matter. Had the subtle links been the only type, then the piece would exist in those terms, but so long as the motivic integration of Sections 3-10 happens, the listener notices in retrospect that the earlier part lacked something. For the first movement and Sections 1-2, highly localised repetition within mobiles, and great contrast of material outside the mobile boundary, makes them generally separate and disinterested in their neighbours. Macro-schemes (through extent of mobile,[191] information loading and harmonic planning) as shown in the analysis for these parts run the risk of being a composer's god-like hand forcing cooperation on disinterested neighbours.

This all amounts to a critique of Lutoslawski's music *and* the technique that lies behind it. As for the actual relationship of technique and analytical findings, these

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[191] i.e. the amount of seconds a texture occupies.

were integrated so successfully, that each stage in one has already been shown to have a parallel stage in the other. Rigidity and flexibility in the technique invariably come through in the music in a direct fashion. It could almost be said that the technique *is* the musical material and vice versa, which is why I am forced to comment in a way that amounts to a critique. On the positive side, one cannot but say that in his mature period Lutoslawski wrote a kind of music which was the product of his explorations in technique, and that these are always breathtaking in their clarity, simplicity, elegance and originality.

CHAPTER 4

XENAKIS: *PITHOPRAKTA*

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Analysis

This analysis falls into two sections: a General outline which is a brief survey of the whole piece, if and how it relates to itself as a single work; then a detailed examination of the 'inner workings' of the first major section of the piece. As before, the whole analysis takes the viewpoint of a listener seeking (heuristically) the 'listening grammar'.

General outline

On a first listening to this piece, one of the things the listener hears immediately is that the piece is strongly sectional: there are a number of large blocks of texture, or sections, which evolve in various ways and directions, and that when taken as blocks seem to have little in the way of cross-reference. They are relatively self-contained. The use of silences between the blocks of texture contributes greatly to this feeling. There are nevertheless a few striking cross-references through the sections. These will be referred to in due course, but first I must set forth my view of the sectional outline of the piece.

Fig. X. 1. (see volume two) shows a pictorial representation of the piece. Time is evenly spaced in this diagram, giving some immediate idea of the relative lengths of sections. It shows that there are four abundantly clear main sections to the piece, but as to their exact boundaries, there is room for some ambiguity. Listening and following this diagram, one can be in no doubt that from 0'00" to 2'12" is one

continuous evolving texture, to be called Section 1.[192] This is followed by a brief area (2'14"-2'30") of contrasting material, which will be called Section 1a. When another new material type begins at 2'30" I call it Section 2. It immediately contrasts so fundamentally with all previous sounds that by retrospective comparison the previous area belongs more to the first than the second section, hence the related terms S_1 and S_{1a}.

Section 2 initially appears rather monolithic; it eventually goes on to destabilise itself by degrees, and at 3'57" a considerable change of material (into S_{2a}) once again proposes an ambiguity of structure. By the same process as before, one may retrospectively class this as broadly falling within S_2, but S_{2a} retains the note of ambiguity. In fact S_{2a} falls into two smaller segments.

Between S_3 and S_4 there is even more blurring of boundaries, emphasised by four long silences, where material from S_3 is thinned out and transformed (there is more detail on this below); with S_{3a} and S_{4a} occurring before a definite section 4 is established at 7'33".[193] So all my 'a' sections represent not only small subsections, but structurally, areas of disturbance, disintegration and equivocation. The extent and degree of equivocation becomes progressively longer in each case.

As I regard the 'a' sections as dependent off-shoots of the numbered sections, I will now consider broadly each numbered section, so that the piece is treated as having four areas or supersections: 1+1a, 2+2a, 3+3a, and 4a+4.

Area 1+1a

This is a supersection with a clear goal: it has a strongly opening shape over fifty bars, and if one includes S_{1a}, there is a small sense of closing back. Therefore, on the whole, it has a climax-anticlimax shape, with priority given to the opening function.

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[192] The timing figures are derived from the recording by the *Orchestre National de L'O.R.T.F.* (Chant du Monde CD 278368).

[193] The placing of S4a before S4 seems strange at first, but the intention is to present all of the smaller (and more broken) sections as dependents of their main related sections. S4 is the main area, S4a is a small off-shoot, though it comes first in time.

However S_{1a} is quite opposed to S_1 in its basic material, it shares nothing with S_1 except for its appearance as a registral regression.

Area 2+2a

This starts out with a static, monolithic texture, which in the course of the passage is gradually transformed or broken down towards a soloistic texture.

Area 3+3a

Begins with a texture that presents frenetic activity across the range, creating a rhythmic and registral 'saturation' that is monolithic in another way. Again there is subtle transformation towards thinner textures, this time static in nature. This section ends with a pronounced feeling of discontinuity, due to the breakdown of material, and the interspersal of a number of long rests.

Section 4a

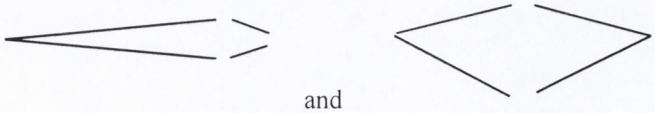
This section really sounds unlike S_4, and therefore perhaps deserves a truly separate description. Its quasi-autonomous nature is evinced by two things: its use of rising arch shapes and its peculiar material, which asserts independence from the rest of the piece. A gestural 'lifeline' connecting it to S_4 more than S_3 is the fact that it sounds like an upbeat gesture which calls out for more of something to come (for registral reasons). But the something that does come is not particularly concerned to relate to or resolve this.

Section 4

In common with S_1 but in contrast with S_2 and S_3, this section opens with a growing development from a limited texture towards a massive sound-block. This block closely resembles the monolith from S_2. Due to the fleeting nature of this reference, however, it does not earn the 'monolith' label. In fact, it has been re-contextualised as an intermediate point along an evolutionary path, in contrast to its previous radically unprepared presentation. It then moves on, without lingering, to a return towards the high register and soloistic textures whence it came.

After the initially monolithic character of S_2 and S_3 there is, in each case, much disruption of the continuity, with long silences and radical, though short-lived, changes of texture. This contrasts hugely with the monolithic areas. Thus there is a gestural lop-sidedness to these sections, with the weight well over to the first halves of the sections, and a gestural decay from order to confusion. In the case of S_3, there is greater decay or disruption of flow; perhaps to compensate for the monolithic texture, which is also larger than was the case in S_2 The material of the 'a' sections is interesting: S_{2a} and S_{3a} clearly derive their material directly from what just went before in the larger section, but S_{1a} and S_{4a} are little islands of unique material which only relate to their main sections in the broadest sense of antecedent-consequent, or upbeat-downbeat, without articulative or material resemblance.

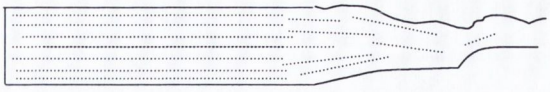
The first general observation to be made from this overview is of two kinds of climactic and dynamically shaped outer section:



and

opening and qualifying. departure and return.

With two inner sections of this kind:



monolith. . . . . .disintegration

This overview can be further enriched and evolved if we take on board two other points: (1) cross-reference, and (2) textural type.

The cross-references are actually a by-product of the textural typing. The cross-references from section to section occur perhaps because of the composer's wish to portray extremes of textural states. For instance, there is the extreme of rhythmic simplicity where one can clearly perceive pulse in a simple form (this applies to sections 2 and 3), then there is the extreme of texture where all parts hold pitches to produce a sustained sonority which is static so far as pulse, register or dynamics are concerned. In other words, he often pares down the vocabulary to concentrate upon one single aspect (be it pitch or rhythm), so that he can transform the texture in a phased way towards great complexity, the other extreme of texture. Alternatively, he may move from complexity to simplicity.

Seen in this way one can extrapolate the following plan for the piece:

S1+1a Complexity (with its own satisfactory internal shape) [cf S3]	S2+2a Simplicity breaks down to ~ complexity [cf S4] (unsure end)
S3+3a Complexity evolving back into ~ simplicity (unsure end)	S4a+4 complexity ~ simplicity ~ complexity ~ simplicity. (satisfactory internal shape)

This provides a unified overview with a sort of dialectical ground-plan, i.e. a play on the interaction of simplicity and complexity, which, since they are only two categories, must alternate, but with phased transformation vying with abrupt change a certain satisfactory discourse can be evolved. Note how S_4 appears as a summary of

the whole; although it does not fully resolve the fundamentally sectional and episodic nature of the whole piece.

In one respect the music is easy to analyse, that is that the parameters of density, register and dynamic generally work in parallel. On the other hand it is manifestly difficult because of the intense separation of material types from section to section.[194] Within each section there is no such problem, despite the changes within sections, because Xenakis' technique ensures very smoothly phased changes of state (this aspect will be dealt with below).

Cross-references

Within each large section material is unified, due mainly to the mode of articulation and general morphology of the material (this reminds one of the multi-sectional nature of Lutoslawski's string quartet, and how that is achieved). Traditional pitch aspects such as theme and harmony do not have a role, so timbre and broad textural contrasts take over the burden of referentiality. Most of the material avoids repetition across the sections, but there are a few exceptions. The most striking cross-reference occurs at S_4, 8'30"-8'41", where a wide cluster of relatively static held pitches is heard, and this recalls S_2 at 2'30"-3'40", (i.e. most of S_2). Even the way in which the textures become erased by moving pitches makes these points similar. There are important differences also: the pulsating *pizzicato* of repeated notes was an important element in S_2 and is absent in S_4, also, the moving pitch element is absent for most of S_2, but only entirely absent for two bars in S_4, and the weight and distribution of the two held clusters is quite different.[195] The next cross-reference, in order of clear audibility, is at the start of S_4, which bears a resemblance to S_{2a}, due to the use of *pizzicato* in combination with bowed *glissando*. The chief difference being S_{2a}'s sparsity against S_4's density.

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[194] If one takes the role of analysis to be seeking unity beneath surface diversity. One may need to question that assumption here.

[195] In fact, on the recording it sounds as if the basses continue gliss. articulation throughout, perhaps they have fallen a few bars behind!

Also S_4 has a more active and independent role for the *pizzicato*. The last noteworthy cross-reference again concerns S_4, this time at 8'11"-8'20". This sounds quite similar to S_3 at 4'37"-6'00".

All of the references have been relatively fleeting moments in S_4, which recall longer areas from earlier; and it is important to realise how they are all arrived at smoothly in the course of S_4, such that it retains its status as a separate section. This is because each contrasting mode of articulation is overlapped with, and emerges from, the previous one, making for continuous evolution so that one never gets the feeling of a sequence of references *per se*. Nonetheless, S_4 is remarkable for the number of textural changes occurring there in comparison with all previous sections, and it is perhaps a 'gestural summary' of the earlier sections.

Another important general point is the handling of the pitch spectrum. There are two basic categories: discrete and continuous. That is, that which uses the twelve notes of the chromatic scale, and that which slides freely through all possible frequencies. There is an important aesthetic aspect to this division, since Xenakis felt that one of the weaknesses of serialism was its strict adherence to the division of the octave by twelve.[196] Therefore one finds in *Pithoprakta* these two modes of pitching, operating separately at first. Thus S_1 uses the fixed frequencies, but S_{1a} uses only *glissandi*. Matossian likens the two approaches to particles and waves respectively.[197] S_2 then returns to the fixed-pitch state (very positively!), and the end of S_2 is brought about by a challenge from the sliding pitch state. S_{2a} is a confirmation of that state's re-assertion. S_3 then does something new by presenting the two states together simultaneously. The latter part of S_3 and S_{3a} and S_{4a} show the fixed-pitch state regaining ascendancy. S_4 then alternates the two states more freely than before; they grow out of one another without conflict. The states correspond to 'complexity' and

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[196] Nonetheless, he does not explore fixed microtones in this piece; the extremes of each gliss. are from the tempered system.

[197] Relating to how sub-atomic quanta such as photons and electrons can behave like waves or like particles depending on the conditions of the experiment which the observer has set up.

'simplicity' with the exception of S_1, which was classified as complex, though it belongs to the fixed state.

Commentary on Section 1

This detailed analysis deals only with bars 0-52 (Xenakis begins his bar numbering with zero). This will suffice to illustrate a few points on how the music is constructed. Later passages are dealt with in further detail under the Technique heading.

Beginning with bars 1 to 3; here there are just percussive noises, but they are shaped according to the same principles that govern all the durations of the piece. These bars contain 2 distinct groups of 'knocks'. I call them 'crowds' as this reflects their quality of hanging together loosely.[198] They come across in waves or surges of sound. They do this for two clear reasons; i) number of instruments and ii) durations. **Fig. X. 2**. (see volume two) shows the exact breakdown of durations between each successive time-point. Generally, the shorter durations lie towards the centre of a 'crowd', so there is a compression of events towards the centre. Secondly, the number of instruments is thinner at the edges of each crowd, reaching a maximum towards the centre. Note also that the two crowds are of different size and weight (in approximate proportion 2:1).

Going from bars 4 to 16 (where pitch enters) it is evident that there is really just one goal for this material: it is seeking to reconstitute itself into a crowd, from a separated, granular state which is established in bar 4 when solo knocks with large time gaps occur. Crowd status is, as I have implied, defined by the events of bars 1 and 2, by the number of instruments and the rhythmic pattern. A glance at the score or at **fig. X. 2**. shows how the number of instruments and the completion of the rhythmic complement are built up in a step-by-step manner, all the time in a 'random' rhythmic

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198 This also relates neatly to Xenakis' comments on actual crowds of demonstrators quoted below under Technique.

environment (i.e. highly asymmetrical, though planned). The main question that arises along here is this: when exactly is crowd status attained? There are three attempts at it, in bars 13, 14 and 15. From the score or diagram one can see that bar 15 restores sufficient numbers of instruments. With all the imperfections of performers' rhythm it is clear that this is when the proper sound will be attained. In practice, the moment of one's awareness of this goal being fulfilled is arrived at by stealth, since there is every likelihood that the listener will accept bar 14 or even 13 as a restoration of bars 1-2, which in part they are. Other composers no doubt do this kind of thing at times, but one is nonetheless tempted to point to this as an example of Xenakis' aesthetic obsession with phased transition between two states in radical opposition.

In any case, the remainder of the un-pitched events don't really add to or further this evolution, due to the arrival of pitched elements. That is, in bars 16 to 44 the role of the percussive element is modified to become a counterpoint to the dynamic evolution of the pitched elements.

Before going into that, there is one thing to be pointed out about the rhythm of this unpitched section, which is that at no point do the three divisions coincide on a beat; thus, for the listener, there is complete avoidance of a pulse.

When the pitched elements enter (see score reduction in volume two, **fig. X. 3**.), they soon change this aspect. Bars 19-20 allow the threes, fours and fives to coordinate twice. This adds greatly to a sense of rhythmic drive, since we are much more aware of the existence of cross-rhythms as opposed to the arhythmic effect of before.

In bar 16 the basses have *pizzicato* material E, E-F, F#, G-B^{b}-A, G#-B. If one follows the *pizzicato* material, one finds an approach to pitch material reminiscent of Carter (his Ritornello A),[199] which can be viewed as a skew-ways chromatic ascent: each pitch of a chromatic ascending scale occurs, but not quite in strict ascending order. It is quite apparent that Xenakis is using this *pizz.* material as a counterpoint to the *arco* material since it pursues its own independent aim (chromatic ascent), and

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[199] In fact similar procedures exist in Ligeti's (his 'Lamento Ostinato') and Varèse's music

does so in the pockets between the *arco* phrases. This goes on until bar 42 when the ascent reaches F#6 (in other words, a complete span of the strings' register), very close to the point where all of the strings adopt pitches and cease the percussive activity. This simple device of ascending *pizzicato* is tremendously effective in conjunction with the climax of the *arco* material in creating an effect of ever heightening tension and increasing complexity.

It is in considering the *arco* material that one approaches the most developmental aspect of this passage. Here one can hear an ensemble of parameters: register, density, duration (working in two ways) and dynamic; they work together, sometimes loosely, to create a drive towards maximal complexity and a rhythmic arrival point.[200]

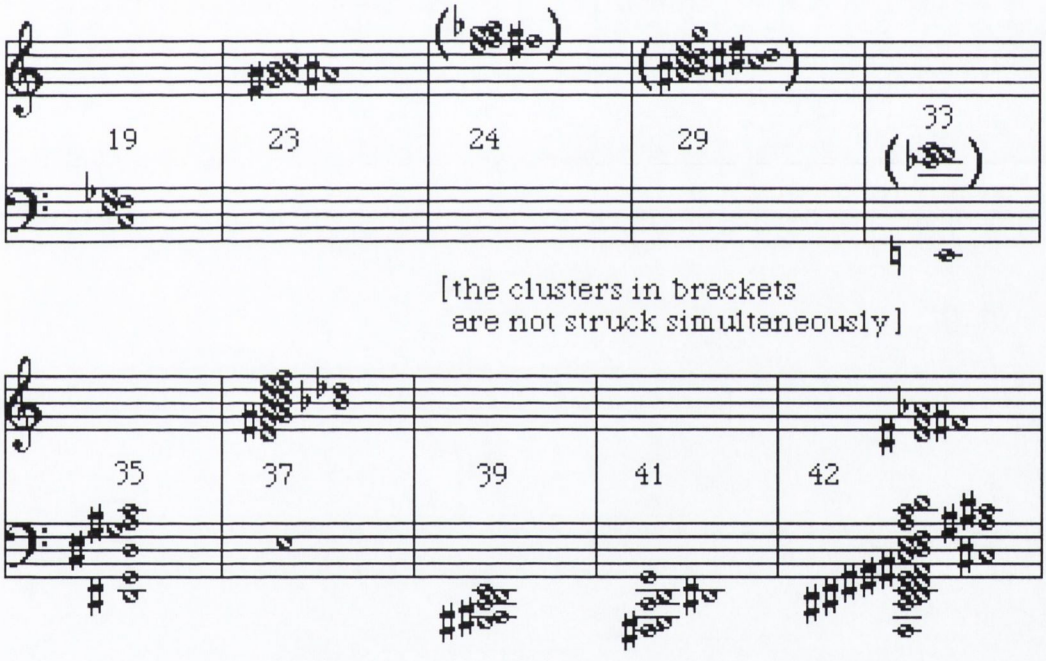

Fig. X. 4. upper clusters at phrase endings

I should point out that vertical sonority, density, dynamic and local rhythm pattern are, in effect, unified into a single block parameter by the nature of the technique, since all 46 strings have separate lines, all at forte. Each time the number

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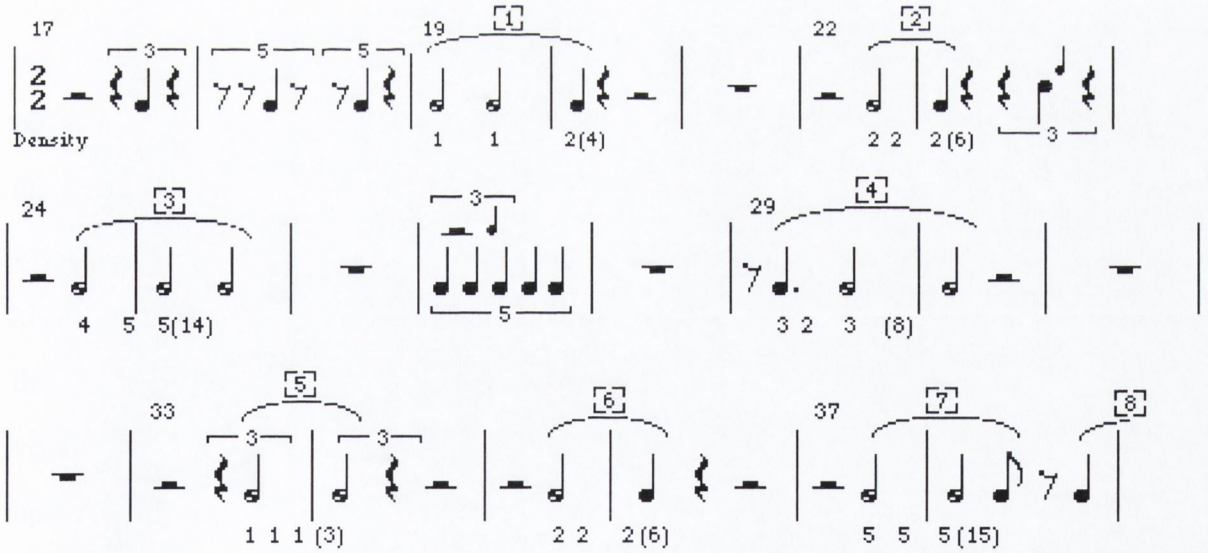
[200] I would define this term as a brief moment of time in music where dynamic (in the general sense) processes come to a point of focus, a 'structural downbeat', usually a point of rhythmic coordination. Musical materials that have been implying a particular outcome arrive at the expected outcome.

of players is increased, the dynamic and the density increase, while the rhythmic pattern remains at a constant (3 against 4 against 5). The vertical sonority is regulated so as to have no preferred chord-type *during* the phrases, but towards the end of each phrase there appears to be a bunching of notes into tight clusters (see **fig X. 4**.). There is occasional variation in this procedure whenever the phrase is located in the bass region; perhaps Xenakis does this to respect the acoustic properties of low notes. Rhythm is constant in the sense that there is never any local variation once a strand is established; once they start, the threes, fours and fives move on a continuous basis. There are the instances in bars 17, 23 and 27 where single pitches occur in relative isolation, but these are presented as separate pitches on different instruments, so in effect they conform to the aforementioned criterion; they are just the extreme case of a strand being established and disappearing instantly, standing apart as an independent strand of material. This makes for a clear parallel with the crowd/isolated event extremes in the un-pitched material.



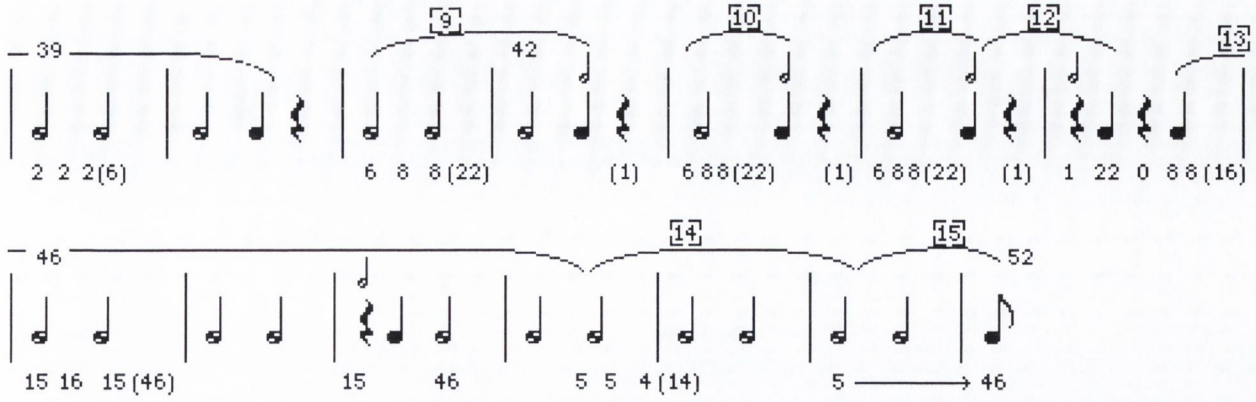


Fig. X. 5.

Those parameters which do form the dynamic, developmental side of the passage will be dealt with as I go through.

I have numbered the phrases 1 to 15 as on **fig. X. 5**. The first three phrases together form an initial outward progression. If we consider the densities (in phrase 1: four, in phrase 2: six, in phrase 3: fourteen), and the length of time each takes (2~ beats, 1 beat, 3 beats) we see an overall expansion of the material. A sense of heightening tension is also promulgated by the shortening of the gaps between phrases—the time lapse between events effectively telescopes. The register and directional shape also ties these three together. The first two phrases have similar expansion-contraction shapes, though in two dissimilar registral areas. The third is a kind of summation of those two areas, as it sweeps through both of them, expanding the scope in both directions. In internal shape it is very strongly upward with only very slight arching back at the top. The bass parts drop out to give the effect of strong upward drive.

After these three phrases there is a long gap of over six beats before the next (real) phrase. Taking the view that the parameters work together to shape the development, one might expect a long gap to imply a dissipation of the tension inherent in the first three phrases. The density (now down to 8) has decreased dramatically, the phrase length has just decreased slightly, the registral shape is still upward in tendency, with a lot less drive. It is more like the first, with an outward-

inward shape, yet it has taken on the width of phrase 3. Before phrase 5 there is another long gap over 6 beats, which is slightly more than the last time, and it continues the trend of dissipating energy in all parameters. Density shrinks to a minimum of 3, the register is substantially slimmer in width and lower in position than phrases 3 or 4—duration also is approaching a minimum for this material; one beat.

Phrase 6 seems to have a conflicting set of parameters: some tend towards dissipation, and others towards increase. The former are: phrase shape (pointing downwards), and upper register (which from phrase 5 has retreated). The latter are: density, up from 3 to 6, with corresponding lower register being re-explored, and the gap between phrases have shrunk here from 6+ (between phrases 4 and 5) to over 2 beats (between phrases 5 and 6). Because of this divergence of aural pointers, this phrase sounds ambiguous in function, and it is not until phrase 7 that its position is clarified.

Phrase 7 comes after another small gap, which allows one to group phrases 5, 6 and 7 together as a unit, on account of the increases in density and phrase duration across these three, and because there is now a strong sense of rebuilding towards the limits (heights) of the fourth phrase.

Phrase 8 furnishes a further retraction in terms of register and density, and has a distinctly un-dynamic internal shape as well. This is something of a Trojan horse, as some significant developments are brought in here. The length of this phrase is much longer than any previous one, and in fact foreshadows the last phrase of the passage, which makes a feature of longer phrases with virtually no gaps. This is the approach towards a saturation point in the complexity, so the registral retraction of this phrase is a preparation for the final climax.

Phrases 9, 10, 11 and 12 can be considered together, since the density is a constant 22 (as 6, 8, 8) with register having a simple course through these phrases. In the bass region, the lowest possible note, E, is visited regularly in each of the phrases, while in the upper parts phrase 9 reaches A5, and phrases 10, 11 and 12 reach E5, all

near G5, the limit set by phrase 7, but not exceeding it. Significantly it is phrase 13 which does this, touching G#5. These four phrases are thus perceived almost as one, however, the three breaks between are marked by moments where the density shrinks to one, giving the aural effect of a thread of connecting material being thrown across the gaps. These gaps are all of similar length, while the actual phrase lengths fluctuate: 4 (beats), 2, 2, 1. Because the relatedness of these phrases is so clear, the ear is secure in the feeling that they belong together; consequently the gaps, which are after all bridged, allow us to perceive the falling phrase lengths not as a reduction of overall potency, but as a tightening of overall tension. Thus in this context the reducing of phrase lengths is a positive factor supporting the drive to the climax. It is, in an almost non-pulsed environment, a rhythmic device of time compression.

Phrases 13, 14 and 15: with phrase 13 a massive shift in density occurs and the percussive element drops out (in bar 45), allowing the density of pitch elements to jump from 22 to 46. This doesn't sound quite as massive as it may seem, since the added 24 were all sounding their 'knocks' previously, so the true dynamic level does not appear to double. Nevertheless, this is a massive change in texture for the pitched elements and an 'explosive' one for the percussive element. My score reduction (**fig. X. 3**.) for the pitched elements is biased towards noticing harmonic content, but it must be stressed that the full score gives a truer impression of lines shooting about in all directions, with wide leaps on the surface of the texture. But the reduction I offer does reveal the audible fact that the texture has reached a kind of saturation point where wide register and thick cluster formations clog up the dynamic potential of this texture, making it quite static where density is constant. This is why there is a need for the extraordinary events in bars 48 and 51 where the texture discards large numbers of parts for very short moments (as between phrases 9 -12).

Let us consider the register and duration of phrase 13: the register produces a new upper limit, one which has held since phrase 7, whilst the duration adds weight to this phrase, since it is of more than 7 beats, making it nearly twice as long as phrase 8, the longest thus far. This, together with the saturation of texture produces a temporary

feeling of arrival, creating the impression that phrases 9 to 12 have been an upbeat to which this is the complement. Once the 7-beat phrase length has been set forth the music is free to define a new upbeat-downbeat pair, which it does through phrases 14 and 15.

Phrase 14 adopts the by-now-familiar device of pruning back the density (to 14: by approximately a third) and radically confining the register (to two out of five octaves) so that only cellos and basses play; this also reduces the dynamic level. This prepares the scene for a microcosmic version of the whole pitched passage (of 15 phrases) in bar 51 where the density slides from 5 to the maximum of 46, in the time of just two beats.

This extraordinary gesture briefly summarises all of Section 1, and seals it off with a massive coordinated attack in bar 52 which is followed by silence, marking the end of S_1.

Compositional technique in *Pithoprakta*

It is widely assumed that *Pithoprakta* is Xenakis's second opus and that *Metastaseis* the first, but in fact there were several earlier works that are no longer in the public domain. Some of these are in a tonal or modal style and do not throw much light on the techniques to be investigated here, but there are a few common points to be discussed.

To put some historical context before *Pithoprakta*, it is also useful to include architectural projects and published articles. Therefore here is a chronological list of his wide creative output leading up to *Pithoprakta*. It does not include everything, but just those things that relate somehow to this work.

Anastenaria	chorus and orchestra	c1952
Procession aux eaux claires	chorus and orchestra	1952-3
Sacrifice	chorus and orchestra	c1953
Metastaseis	orchestra	1953-4
Couvent de la Tourette	(architectural project)	1954
La crise de la musique serielle	(article)[201]	1955
Pithoprakta	string orch, wb + 2trbs	1955-6
Philips Pavilion	(architectural project)	1956
Probability Theory and Music	(article)[202]	1956

As an architect, Xenakis worked for Le Corbusier, a central figure of the International Modernist Style. Le Corbusier had invented a system of measurement called 'the modulor' based upon the proportions of the Golden Section (or Fibonacci

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[201] Iannis Xenakis, "La crise de la musique sérielle" in *Gravesaner Blätter* 1 (1955), 2-4.

[202] Iannis Xenakis, "Probability Theory and Music" in *Gravesaner Blätter* 6 (1956).

sequence), and upon the proportions of an average man (hand size, forearm size etc—the 'modulor man').[203] Matossian has commented on the use of the Golden Section in *Anastenaria*,[204] and indeed Varga notes that, for Xenakis, "Le Corbusier was a central figure in a change from interest in old art to interest in new."[205]

Works such as the first three listed above represent a bridge between earlier works that were attempts to re-create the sounds of ancient Greek and Byzantine music (an interest Xenakis was to return to obliquely later in dramatic works such as *Orestia* and *Medea Senecae*) and the modernist period that begins with *Metastaseis*. They might not be of great interest here except that Xenakis himself commented (of *Procession*): ". . . (the piece is) very tonal but the many different voices produce a mass phenomenon which was to play an important role in my music."[206] Varga himself described *Sacrifice* thus: "much more abstract than *Procession*, . . . It shows some of Messiaen's influence; glissandos also appear, and intervals smaller than semitones, which produce an effect Xenakis loves—the acoustic beat."[207] This effect in fact turns up once in *Pithoprakta*, when the two trombones appear (bars 172-183).

It is with *Metastaseis* that the more significant points arise. By this stage Xenakis was much more steeped in the musical culture surrounding his teacher Messiaen, and was aware of Boulez's music, among others. He always retained a certain distance

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203 A fuller discussion of the relationship between Xenakis's musical and architectural works, with particular reference to the mathematical underpinnings, the philosophical/aesthetic links between science and art, including the Golden Section can be found in the following study:
Baltensperger, André, *Iannis Xenakis und die Stochastische Musik: Komposition im Spannungsfeld von Architektur und Mathematik* (Zurich: Paul Haupt, 1995). There are also further explorations of this relationship in Xenakis's own book "Music. Architecture." *Music. Architecture*. (Tournai, Belgium, 1971).

204 Nouritza Matossian, *Xenakis* (London: Kahn and Averill, 1986), 50.

205 Balint Andras Varga, *Conversations with Iannis Xenakis* (London: Faber, 1996), 21. Other interviews (which reveal less of interest here) include: Richard Dufallo, "Interview with Xenakis" in *Trackings* (New York: Oxford University Press), 1989; Mario Bois, *Iannis Xenakis, The Man and his Music* (London: Boosey and Hawkes), 1967; and "Xenakis on Xenakis" in *Perspectives of New Music* 25/1-2 (Winter-Summer 1987): 16-63.

206 Varga, 29.

207 Ibid., 29.

from serialism, but in *Metastaseis* he actually takes some elements of serialism on board, linking intervals to durations, though the durations are derived from the Fibonacci sequence.[208] Obviously this is more to do with Messiaen than Boulez. Matossian writes:

> In this composition he was to combine some of the ideas he had assimilated in the past, as well as approaches to duration and rhythm, serialism, proportion in general and the modulor in particular. More surprising was his introduction of some concepts not previously elaborated in his early compositions; he innovated a new notion of mass sound which he defined musically in Metastaseis. It involved the notions of *mass*, *surface*, the *straight line* or *ruled surfaces* and *plan*. Since they appear not to have originated from his studies with Messiaen or his own musical investigations they may have been suggested during the preparatory period leading up to his involvement with architectural design during which he considered basic elements and aspects of architecture in a process of analysis and familiarisation.[209]

The instrumentation of Metastaseis reflects the mass-event thinking, as does the simple formal layout in three sections. These are completely opposed to the kind of expectations that serialism was propagating at the same time. Block-like organisation of the instrumentation is picked up again in *Pithoprakta* (see below). In fact "Xenakis mapped the timbral characters graphically and, further on in the process of planning out the work, he blocked out the sequence in colour so that the composition was given a detailed visual representation."[210] This organising of the sound-world onto graph paper was something Xenakis was to keep doing for the remainder of his creative years, and certainly includes *Pithoprakta*.

As Matossian mentions, the music of *Metastaseis* is linked to the architectural projects of 1954 and '56. The *Couvent de la Tourette* featured asymmetric window divisions that derived their visual rhythm from the Fibonacci sequence, while Xenakis himself makes the link between *Metastaseis* and the Philips Pavilion:

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[208] See Matossian, 60.

> Several years later, when the architect Le Corbusier, whose collaborator I was, asked me to suggest a design for the architecture of the Philips Pavilion in Brussels my inspiration was pin-pointed by the experiment with *Metastaseis*.[211]

So it is *Metastaseis* rather than *Pithoprakta* that has the more direct links to architecture. *Pithoprakta*, on the other hand heralds a new phase for Xenakis, where pure maths (albeit derived from his science/engineering background, and so related to architecture) becomes the focus of inspiration. It is the articles *La crise de musique serielle* and Probability Theory in Music that relate to this work. More details on all of these links can be gleaned from Varga, Matossian and Xenakis himself, in Formalized Music. Another useful source for more detailed consideration of works up to *Pithoprakta* and after (to 1969) taking in the wider historical context is Solomos's thesis *A propos des premières oeuvres (1953-69) de Iannis Xenakis*.[212]

Stochastic music: *Pithoprakta*

This is such a prevalent term in dealing with Xenakis' music that it is necessary first of all to explore what exactly Xenakis means when he uses it. The word derives from *stochos*, meaning goal:

> This law (the law of large numbers) implies an asymptotic evolution towards a stable state, towards a kind of goal, of *stochos*, whence comes the adjective "stochastic".[213]

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[209] Matossian, 56.
[210] Ibid., 61.
[211] Iannis Xenakis, *Formalized Music* (London: Indiana University Press 1971), 10.
[212] Makis Solomos, "A propos des premières oeuvres (1953-69) de Iannis Xenakis: Pour une approche historique de l'émergence du phénomène du son." Doctoral Dissertation (Paris: Université de Paris IV, 1993).
[213] Iannis Xenakis, *Formalized Music*, 4.

Later he writes:

> As a result of the impasse in serial music, as well as other causes, I originated in 1954 a music constructed from the principle of indeterminism; two years later I named it "Stochastic Music." The laws of the calculus of probabilities entered composition through musical necessity.[214]

He is referring specifically to the problem of deriving a method for creating sonic events which display localised randomness and globalised planning and goal achievement. He gives various examples of this from nature:

> But other paths also led to the same stochastic crossroads—first of all, natural events such as the collision of hail or rain with hard surfaces, or the song of cicadias in a summer field. These sonic events are made out of thousands of isolated sounds; this multitude of sounds, seen as a totality, is a new sonic event. This mass event is articulated and forms a plastic mould of time, which itself follows aleatory and stochastic laws.[215]

He then gives an example of a mass event that changes into another mass event: a crowd of protesters chanting in uniform rhythm, who then meet their enemy firing bullets on them:

> The perfect rhythm of the last slogan breaks up into a huge cluster of chaotic shouts, which also spreads to the tail . . . The statistical laws of these events, separated from their political or moral context, are the same as those of the cicadias or the rain. They are the laws of the passage from complete order to total disorder in a continuous or explosive manner. They are stochastic laws.[216]

This example, embodying the concept of making a seamless transition from complete order to chaos, is particularly relevant to *Pithoprakta*. Christopher Butchers (who transated chapters one to six of *Formalized Music*) elucidated it thus:

> It has been a philosophical and mathematical commonplace since . . . Bernouilli in 1713 that there is no absolute polarity between chance and determinism; that there is, rather, a continuous spectrum between pure chance at one end and pure determinism at the other; that both pure states are rare; and that it is, moreover, possible to argue with as rigorous a logic, with as extended a mathematics and with as fruitful results at the chance end of the spectrum

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[214] Ibid., 8.
[215] Ibid., 9.
[216] Ibid., 9.

> as at the deterministic end: to describe and manipulate degrees of disorder, or the movement from order to disorder and from disorder to order.[217]

Xenakis places stochastic music in the context of parallel developments in music, science and philosophy; beginning with the platonic assumption of causality, he writes: "for it is impossible for anything to come into being without cause (*Timaeus*)", which he sees as relating directly to music, physics and philosophy until the nineteenth century, after which statistical theory transformed the relationship of chance and logic. He points out that up until this time:

> The concepts of chance (*tyche*), disorder (*ataxia*), and disorganisation were considered the opposite and negation of reason (*logos*), order (*taxis*), and organisation (*systasis*). It is only recently that knowledge has been able to penetrate chance and has discovered how to separate its degrees—in other words to rationalise it progressively, without, however, succeeding in a definitive and total explanation of the problem of "pure chance."[218]

The principal aesthetic argument, therefore, is that the drift towards randomisation, which Xenakis sees as the main achievement of serialism, needed to be freed from the underlying determinism of serial technique, and to embrace more honestly its relationship with the randomising effect of complexity, while still being in a position to control overall forms, shapes and processes. There is also no resistance to total order (i.e., uniformity of rhythm, dynamics or texture), as is usually the case in serial music; it is merely one extreme on a continuum, with chaos at the other, all of which he regards as necessarily available to the composer.

One important point about the label "stochastic" is that Xenakis sometimes regards this as an umbrella term for his entire approach:

> an approach to musical composition which I have developed over several years. I call it "stochastic," in honour of probability theory, which has served as a logical framework and as a method of resolving the conflicts and knots encountered.[219]

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[217] Christopher Butchers, "The Random Arts: Xenakis, Mathematics and Music," *Tempo* 85 (1968), 2.
There are further considerations of the wider philosophical views of Xenakis in Daniel Charles's book, *La pensée de Xenakis* (Paris: Boosey & Hawkes, 1968).

[218] *Formalized Music*, 4.

[219] Ibid., 5.

At other times he uses the word to refer to the specific decisions involving probability. It is tempting to regard his technique as falling into two areas, the mathematically generated (stochastic) parts, and the more traditionally conceived and executed parts. Certainly that will be an area of interest for musicologists (including this study), but Xenakis doesn't stress the importance of any such dividing line (see pp. 22-3 of *Formalized Music*). I therefore consider his technique under two primary headings concerning firstly overtly mathematical technique and secondly more traditional aspects of technique. For more detail on the mathematical side I recommend the reader to close study of his first chapter in *Formalized Music*.

Mathematical aspects of Xenakis' technique

> I wrote Pithoprakta primarily for strings because it's easier to produce mass events and various timbres with them than with any other instrument. I also needed percussion effects. Instead of calling for a great many percussion players, which would have entailed organizational and other difficulties, I used the body of the instruments. It was that noise—the cloud of percussive sounds—that I transformed gradually, using statistical methods, into musical sounds. It's like dissolving one picture into another in film technique.
>
> The question then was how to dissolve from noise into another kind of sonority.
>
> Once again I was facing the problem of continuity, but from a statistical point of view. Instead of glissando I was working here with points sounds—pizzicato. That, then, is the beginning of Pithoprakta.
>
> As far as rhythms are concerned, there's no trace of the golden section; I applied probability theory almost exclusively.
>
> I spent many months studying and experimenting in order to be able to keep all that in hand and head. I wrote down parts separately, made diagrams to find the suitable parameters of the formulas. That is, first to understand the formulas, then to find the parameters which correspond to the output: music. The fact that we know a formula doesn't on its own ensure that it will achieve our aim. We have to work keeping an eye on the end result. In other works: I had to imagine how all that would sound. And that took a long time.
>
> I don't know if any composer has ever worked with probabilities as much as I have. That's strange. The reason composers don't use them, even if they're interested in them, is because they didn't receive the necessary education. . . . And I, in trying to control mass events, naturally reached determinism and indeterminism.[220]

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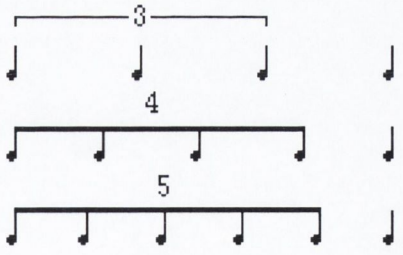
[220] Bálint Andras Varga, *Conversations With Iannis Xenakis* (London: Faber, 1996), 75-6.

In order to avoid the necessity of including a large amount of mathematical material, I am limiting the discussion of this aspect of Xenakis' technique to one example. This should be sufficient to give the reader a flavour of how he utilises the sophisticated mathematical laws of probability in *Pithoprakta*. For further mathematical detail I include an appendix giving the correlations between specific sections and specific kinds of random distribution.

Let us begin with duration, which is where he starts in his text *Formalized Music*. This the easiest example to explain since it concerns just one musical parameter. I will take for an example bars 7 to 10 of *Pithoprakta*, which consists of various durations without pitch (although there is some range of timbre, because larger instruments have a lower-sounding 'knock'). Some of what I have to say is my conjecture, since I have had to extract the meaning from a very difficult text.[221] I will indicate which ideas are mine, and which ideas can be directly attributed to Xenakis.

Looking at the score it is evident that Xenakis has chosen the superposition of three kinds of subdivision of the beat. This is a procedure that allows for an immense variety of durations, and it is adhered to as the generator for all durations throughout the work. My conjecture is that he has chosen this as an *a priori* device; this comes from a phase in the composition of the work which was prior even to the stochastic aspects shown below. Look for a moment at the rhythmic device in question:



Assuming immaculate accuracy from the performer we can analyse the exact sequence of durations within the beat by taking the lowest common multiple of 3, 4 and 5; which is 60:

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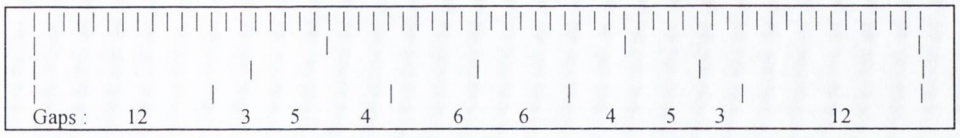
[221] Ibid., 12.



We now have a symmetrical array of durations ranging thus: 3, 4, 5, 6, 12, each appearing twice. As well as these durations, the music can avail of all possible derivatives of those figures: e.g. 15, (12+3), 8, (3+5) etc I have chosen for them the term 'units' or 'u'. So for example between the first and second sound there was an interval of 12u.

Looking at the bars in question (7 to 10), all possible intervals in duration can be measured in these units. Thus, (see also **fig. X. 2**.) durations observed: 40 / 16 / 48 / 24 / 12 / 36 / 24 / 12 / 60 / 10 / 6 / 12 / 12 / 15 / 25 / 8 / 42 / 6 (total = 401).

What we now have is an array of varying distances; we need a large sample, ideally a lot larger than this, because the next phase is to derive a secondary array by tabulating the findings thus:

Interval size.	No. observed	No. expected.
0 < 10	3 values	~6
10 < 20	7 "	~4
20 < 30	3 "	~2.5
30 < 40	1 "	~2
40 < 50	3 "	~1.5
50 < 60	0 "	~1
60 ≤	1 "	~1
(Total)	18	18

The 'expected' values are supposed to be derived from this equation:[222]

$$Px = \partial e^{-\partial x} \, dx$$

which gives the probabilities for all possible lengths when one knows the mean number of points placed at random on a straight line (the straight line represents time).

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[222] Ibid., 12.

∂ (delta) is the average which is expected for the length 401, let us say that we really expected the 18 points which we got, then our mean is 18/401 (= .0045)

We can now ask what is the probability of the occurrence of any interval value, for example, 6; by applying the equation:

$$P_6 = 0.0045e^{0.0045x6}\ d6 \qquad = \ 0.887897$$

The next step is to compute all the figures to discover what a random distribution for this mean density would look like. Although I made up my figures on the right hand side, I have tried to make them conform to the outline of an exponential distribution function. If my sample had been larger and the correct figures installed on the array, I would now have a mathematical justification for saying that the distribution of durations for this passage correlates roughly with randomness. It may seem odd, but Xenakis is not necessarily trying to make these time values fully equate to randomness, he is merely applying an objective criterion for assessing their nearness to randomness.

> If we now choose some points and compare them to a theoretical distribution obeying the above law or any other distribution, we can deduce the amount of chance included in our choice, or the more or less rigorous adaptation of our choice to the law of distribution, which can even be absolutely functional.[223]

There are further equations that can be applied in order to assess how near or far from random one's sample is. This is very significant, since Xenakis' compositional aim is not trivially to present us with random sounds; instead he is constructing an index of abstraction. If you imagine, for a moment, two extremes: totally even pulse with no rhythmic shape, on the one hand, and complete randomness at the other. Next imagine a piece which begins with the first state, but through introducing a little figuration at a time gradually becomes more elaborate. As the embroidering becomes richer and richer one moves further and further from any perception of musical pulse,

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[223] Ibid., 12.

with less and less internal reference, until one arrives at a complex rhythmic environment perhaps similar to the one in bars 7 to 10 here, where a complete asymmetry of time exists. Somewhere to the right of this on the index of abstraction is the realm of pure randomness. Xenakis' next procedure is to examine where on this index a particular set of durations lies. The formula Xenakis identifies is the χ^2 (khi squared) criterion of Pearson. He is now in a position to construct a sound that starts near one end of an index and gradually transforms until it resembles the opposite state. Xenakis gave the example (quoted above) of the political rally which changes from ordered chanting to chaotic shouts, due to the intervention of the enemy, involving a continuous progression across the index. In this way it will end up on the far right of the index. Such a transformation can be constructed for compositional purposes with the application of calculus and probability theory.

There are some choice examples of this kind of transformation in *Pithoprakta*. These are:

1) the disintegration of texture in S_2 from 3'41" to 3'56",

2) The gradual changes in texture in S_3 from 6'00" to 6'16" (up to the entry of trombones),

3) the erasure of held pitches in S_4 from 8'45" to 9'04".

There is also an example of this process in reverse: from the start of S_4 to 8'32" where disorder gives way to order as the held pitches take over.

A fundamental purpose of the application of this technique is to provide logical, easy-to-follow connections in sounds which are radically opposed. In the example of the political demonstrators the important thing is that there is no one moment in time where order switches to chaos, instead there is a smooth transformation along the index.

The compositional importance of all this is that it perhaps allows a coherent flow from moment to moment in the piece, while *at the same time* generating a maximal degree of surface abstraction. At times this results in staggeringly compelling soundscapes.

I will proceed to examine some of the more traditional techniques that Xenakis uses in this piece. While these do not necessarily have higher mathematics underpinning them, it is vital to consider them. Where possible, reference will still be made to the mathematical categories that they may belong to. I would agree with Paul Griffiths when he writes:

> As I have suggested, the procedures about which Xenakis has been most forthcoming as a theorist may not be those that the listener finds most important to him in understanding the work of Xenakis the composer. Further study of the latter . . . can only help in elucidating why it may be found to excite, to quote Xenakis quoting the *Timaeus* of Plato, 'a reasoned joy'.[224]

Other aspects of Xenakis' technique

Articulation/timbre

Fig. X. 6. (see volume two) shows Xenakis' technique of sectional differentiation. Each section and subsection has a separate set of articulations or timbres which sounds very dissimilar to every other set. Where an effect such as *pizzicato* occurs in two sections, it is surrounded by other effects (different in the two sections) and so does not serve to make a cross-reference. A very marked example of this is the 'knocking' sound, which in bars 1-15 is the only sound in the texture, but when it reappears at 139-167 it is extremely rare, and buried in a texture dominated by *col legno* and *pizz.* sounds. An important point is that **fig. X. 6**. also shows how it is the articulation/timbre of sounds which decides how the events *within* sections are heard. So for instance S_3 is heard mainly as a monolith from bars 122-171 because of a particular complex of effects exists for that time, after which change, or breakdown, is heard. Whereas S_4 shows a number of overlapping areas with separate effects

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[224] Paul Griffiths, "Xenakis, Logic and Disorder," *Musical Times* 116 (1975), 331.

dominating in each. It is the presentation of the articulations separately or together that decides whether the section is heard to fall into discrete textures or not.

A little note on the woodblock: this is unique in the timbres as it appears in all of the main sections, plus S_{3a}. It always occurs *close to* (before as well as after), and sometimes *at*, the moments where textural change is happening. It therefore avoids an obvious signalling function, but by the end of the piece it has accrued an association with change. Benoît Gibson also touches on these topics in his thesis: *Xenakis: Organisation de l'espace, techniques d'écriture, orchestration, 1954-1962.*[225]

Texture, including register

Already this chapter has touched on texture, in the analysis and above under Articulation/Timbre. To explore how Xenakis uses his technique to create and control texture is the purpose of this heading.

Section 1, as seen in the analysis, builds up texture in a relatively traditional way, by accumulating layers of different elements. Starting with unpitched sound, adding *pizz.*, then *arco*/downbow followed by *arco*/upbow. The most traditional aspect is the use of phrasing in the bowed material. Register is manipulated to create a climax by simple expansion, and also, more subtly, there is the registral process observed in the *pizzicato* element (see analysis for details).

S_{1a} takes over the wide pitch space from S_1 and with a completely new articulation shrinks it back, by an octave in both upper and lower registers—**fig. X. 7.** below shows the outline of registral limits at the end of S_1 and through S_{1a}. There is no interaction or dialogue or building up of elements here as there is only one

[225] Benoît Gibson, "Xenakis: Organisation de l'espace, techniques d'écriture, orchestration, 1954-1962." DEA Thesis (Paris: IRCAM, 1992).

element. Even the rhythmic system adhered to for all of S_1 undergoes a change, using 3s against 4s against 5s, but at a slower rate—exactly half of S_1's. So S_{1a} represents a completely separate textural type.

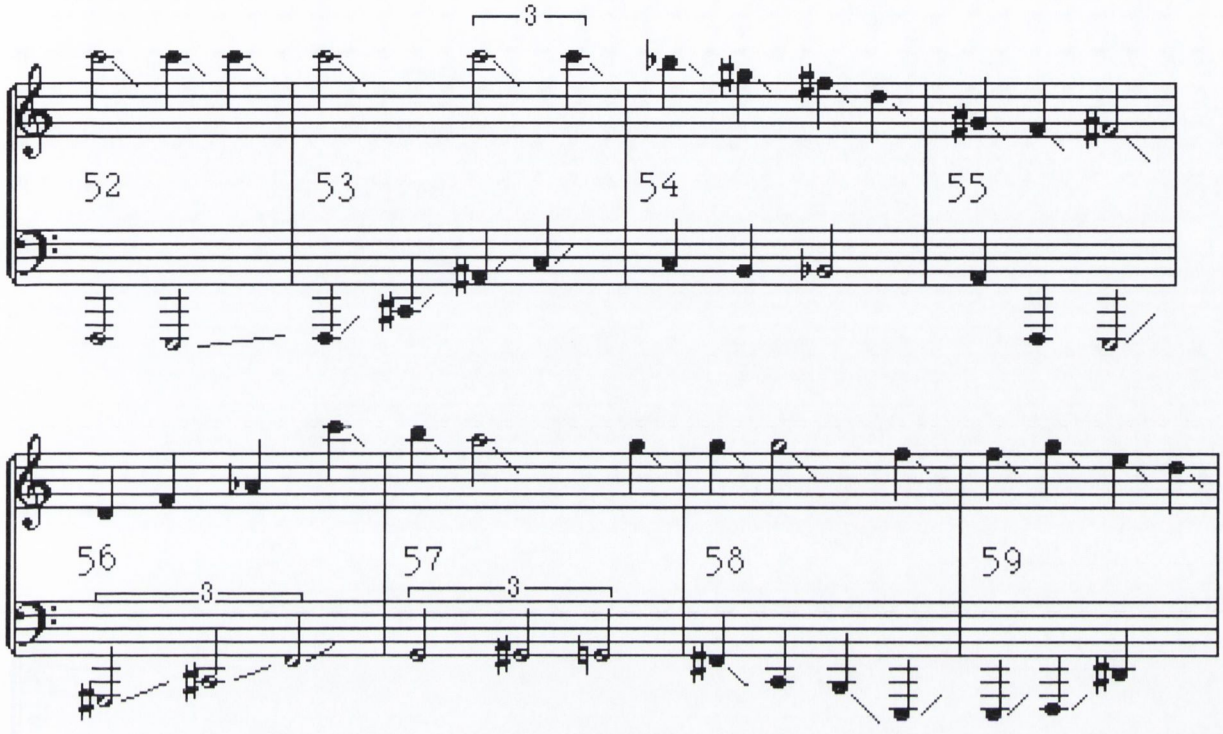
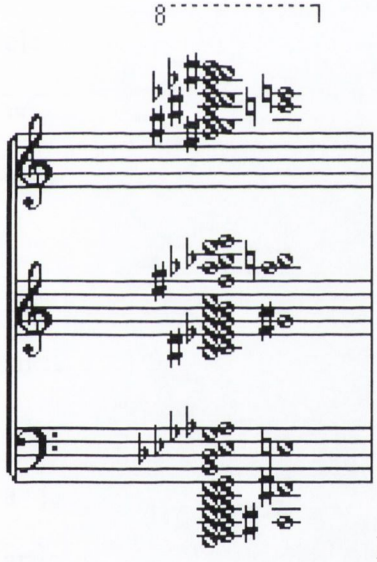


Fig. X. 7. Outer registral limits: bars 52-9 (S_{1a})

S_2 begins as almost the simplest possible texture, and is of course simpler than any preceding it. **Fig X. 8**. shows the pitches, all of which are fixed for some time. It is very significant that considerable new heights are reached in the pitch space here, because this allows pitch novelty of two kinds: a completely new upper register is experienced, and the 46-note cluster has more internal space than was previously possible. The density of this cluster gradually erodes internally (see bars 68, 71 (va 4), etc) until bar 104 where 14 fixed pitches remain. S_2 also involves a completely radical rhythmic language change, since polyrhythm is replaced for a while by a single even rhythmic division on the xylophone. As the section proceeds, complexity of rhythm returns with 3s against 4s against 5s as they were in S_{1a}, but with additional, new smaller divisions in the xylophone part and the upper strings, bearing 3s, 4s and 5s at

a new double speed scale (compared to S_1). As a textural type, S_2 is very simple at first, and therefore the only place where stochastic techniques could have been applied here is in deciding the internal intervallic structure of the initial large cluster (using a different distribution equation, see appendix). The selection of which pitches drop out and when they do so might also be decided on a stochastic basis, as it appears asymmetric and therefore randomised. An important *a priori* condition operates here though: the outer pitches are not erased. Conditions such as this are intuitive decisions which do not rely on the stochastic aspect of his technique, but are a more general part of his technique.



Bar 60

Fig. X. 8.

S_{2a} is defined by another radical change of texture; while the rhythm can be seen on the page to be based on the familiar combination of 3s, 4s and 5s, it is in fact experienced as something new, because the rate of change of direction in the *glissandi* is slower than ever before.[226] The adherence to the polyrhythmic combination simply

[226] This relates to the slope of a line on the geometric plane, which Xenakis calls the speed of the event. Controlling large numbers of these in a randomised way can be achieved using Maxwell and Boltzmann's kinetic theory of gases.

keeps up the general level of non-coordination and helps the performers to keep control. Another *a priori* decision appears to follow at bar 108, where the texture abruptly drops in density from 29 parts in *glissandi* together to an area varying from 1 to 3 in density. At this point the texture is sparse enough for a perception of phrases to return, for the first time since S_1.

S_3 quickly crushes that state with the densest, most complex edifice of sound in the whole piece. At this point it is advisable to reflect briefly on what exactly complexity is: in S_1 there was the complexity of the interaction of at least three audibly discernible and contrasting elements; the fact that they all had breaks not only allowed each one to come through the texture, but also enriched the information content itself, since the time length of a phrase and of the gap between phrases adds to the complexity by being varied (lengths of phrase plus lengths of gaps times three elements gives six new aspects to observe). In contrast, S_3 presents a wall of sound whose constituent elements number four (at bar 122—see **fig X. 6**.), but without the easy separability, and without the phrasing.

The techniques involved in building up S_3 probably consisted of a super-imposition of at least two random distribution equations (see appendix). One for the sliding elements and another for the definite pitches. As S_3 goes on, there are adjustments visible in the score which are not particularly audible, and may represent a fault in Xenakis' judgment. These are the moments where certain types of articulation (see score where *arco brefs* or *pizz **fff*** is indicated) are meant to emerge forcibly, but they don't do so successfully (alternatively, this could be the fault of the performers). The reappearance of the knocking element (at bar 139) certainly seems destined to be inaudible. Another radical change occurs at bar 180 when moving pitch in all the string parts ceases and is replaced by fixed pitch. This is a simple, traditional technical decision of re-combination of previously expounded elements: fixed pitch, an element from S_2; *pizzicato*, from S_1; and the rhythmic combination of 3/4/5 from the *arco* material of S_1. Once more the composer intervenes boldly and intuitively.

At bar 180 a completely radical change affects the string texture instantly, as noted before. The role of the trombones here is interesting: they are a striking foreground element that is unaffected by the radical change, as such they act as a (fairly crude but effective) ligature connecting these textures, which otherwise would sound like a complete break. As it is, this helps to associate all of S_{3a} and this latter part of S_3 with the main part of S_3, thus strengthening the logic of the piece as a whole.

Thanks to the trombones, S_{3a} comes across as a simple outgrowth of S_3. The sense of disintegration in this subsection is created by the simple device of thinning out (in time and in density), slowing down and quietening the texture as it was at the end of S_3 proper. This may appear to be non-stochastic device, but in fact it can be achieved by lowering the constant *a* in the Gaussian distribution, which defines the 'temperature' in its more usual application—the kinetic theory of gases.

S_{4a} re-introduces a level of contour simplicity not heard since the end of S_2. Its sparsity allies it with S_{3a}, but it has no material in common with it. It can be further broken down into two sub-units; the *pizz.* and the *col legno frappé* elements. In terms of technique this requires no stochastic working out, as nearly everything here is defined by absolute conditions. Thus bars 200-201 consist of three groups, each at a separate rhythmic speed. Together the three groups presents a single contour, each group doing so in a five-note semitone cluster in mostly parallel motion. The tessitura of each group is contiguous to the next. So again this is an intuitive intervention from the composer, not derived from a system *per se*. What is important, however, is that all such areas of more traditional compositional working share the basic language of the piece, including overtly stochastic parts. This can be seen to hold true in these bars, since the polyrhythms are exactly those for all of S_1, and S_3, and the cluster of up to 15 notes is harmonically similar to those sections also. The lines, though broadly parallel, are not always exactly parallel, nor is the cluster always of exactly fifteen

notes, so a certain looseness has been composed in, to further match the texture with Ss 1 and 3.[227]

S_4 begins as the most contrapuntal section, with a variety of musical materials that are heard to overlap in time. As it develops, one type of material (i.e. one articulation/timbre) replaces all of the others by gradual transfer until a complete texture change is effected. This happens three times: 1) bar 231 where held pitch returns (i.e., last heard in S_2) in 7 upper parts; by bar 237 all 46 parts are holding long notes. 2) the transfer from this state to the next from bars 239 to 243, by which stage all parts are playing *arco tremolo sul pont* + *gliss.* (an element previously sharing the texture at 212-230). 3) Approaching bar 250 this element dwindles to a single line very high up and is replaced by a held natural harmonic. The timbre of a high *tremolo sul pont* and of a high natural harmonic are very close. Even more so when the harmonic is played *tremolo* as in 251-2, so this change may appear on the page as a break in material, but in fact sounds like a smooth transition from a large group sliding to a single held pitch.

The start of S_4 presents four very audibly distinct types of *glissando*. Their entries are staggered, and they appear in order of their ability to penetrate texture, so that we are definitely aware of each new strand as it enters, despite the increasing complexity of the overall texture. One is also more aware here of direction. Compared to S_3 where each part changed direction frequently and independently of the others, here the parts work in directional groups—it might be said that this possibility was introduced to the piece in S_{4a}—of two to six players, so that at any one moment we hear a group momentarily dominate or lead the texture, so its direction dominates, with others supporting. This is why the start of S_4 sounds quite contrapuntal.

The technique that controls texture is therefore a mixture of mathematical manipulation of textures and more traditional composer's interventions. Xenakis is not

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[227] Yet in my aural analysis this subsection did stand apart a little too much—that's on a purely subjective basis—so one *might* say that the different compositional techniques (stochastic vs hand-made) are heard to jar a little.

a believer in the necessity for the decisions at the local and global levels to come from the same root. This gives the freedom for gradual or radical changes to occur, or any combination he may imagine. But it is also a vital aesthetic distinction, in relation to other composers' practice (see also p.16 of *Formalized Music*).

Rhythm

It is quite remarkable that for the great majority of this piece a single polyrhythmic template controls the rhythmic surface of the music. This polyrhythmic device of 3s against 4s against 5s has already been described above so only a few further comments and observations are necessary.

The rhythm in *Pithoprakta* falls into two major categories: asymmetrical and symmetrical. However, the picture is complicated by instances where the two categories interact, or one transforms gradually into the other. The easiest way of exploring this is by considering the various sections separately.

S_1 begins with the purest asymmetry that the 3s/4s/5s template can provide (see analysis). By bar 14 it is approaching saturation (as previously defined), so it is becoming gradually more ordered and less symmetrical. When the pitched *arco* material arrives, it is marked by a different treatment of the template: the three layers of rhythm are allowed, for the first time, to coincide at the start of the beat. This changes the sound in an essential way: from asymmetry to pulsed polyrhythm, giving an environment I have already described as 'rhythmic heterophony'. This is a sort of halfway condition between symmetry and asymmetry, since both perceptions are present in the ear simultaneously: it is a matter of scale; at the smallest level and between beats the polyrhythm adds up to asymmetry of time (albeit in repeating cycles), but from beat to beat the coinciding points occur regularly, showing symmetrical ordering of time. The effect can be described as sounding like three layers attempting to be parallel, but failing spectacularly, which is why I chose the

term 'heterophony' (with apologies to ethnomusicologists). Once the first parts of each beat are all allowed in every layer, the ear's ability to separate the sound into three rhythmic layers is greatly helped.

With S_{1a} the pitch quality, as already noted, changes in an essential way, from specific pitch to sliding pitch. This brings forward a new way of comprehending time, which is only latent in the fixed pitch environment: speed. For instance, take two notes, for argument's sake E and G, a minor third apart. If played as crotchets without *glissando*, their essential distance in time is felt to be the same as if they were a major seventh apart. If, on the other hand, they are played with an even *glissando* connecting them, the minor third requires a much slower speed of ascent than the major seventh, though the distance between the end points is still a crotchet. 'Speed' is a real, separate rhythmic dimension, though unfamiliar. The speed is a rhythmic quality which can be felt (and differentiated) regardless of the actual position in time: i.e. the speed of pitch change of an individual *glissando* can be felt at any point along that *glissando*, without reference to the end points of the event. In other words, speed is a time quality that is not really dependent upon definite points of time. This is directly parallel to the pitch situation in *glissandi*: the fabric of the material, in both pitch and time, is not granular but smooth, and points along the continuum are as present as the end points. This rhythm quality is analogous to the *slope* of a line in geometry, as distinct from its length, or its position on the plane. Despite all of this, the endpoints of the *glissandi* are privileged, and they operate rhythmically as they would without *gliss.*; the speed is merely another layer of rhythmic information on top of the existing polyrhythm. Deciding and composing it requires another layer of mathematical data, independent of that required to fix the pitches, if the mean distribution of speeds is to be organised in terms of its proximity to, or distance from, real randomness. The rhythm of the endpoints actually works in much the same way as the *arco* material in bars 18-51 of S_1, except here the pulse is halved.

S_2 brings a shocking change to the rhythmic surface of the piece. All previous models are abandoned and the simplest possible symmetrical rhythmic environment

takes over. From bar 60-62 time is marked in the purest way possible by even, unaccented pulse from a solo xylophone. Through S_2 this pure state does the only thing it can if progress is to be made: it breaks down. This is a gradual process. First the pulse is filtered by rests of varying lengths, then at bar 68 polyrhythm reappears (see vn. I/3); this uses the 3s/4s/5s template, but choosing only 3s against 5s as the first step, which maximises the aural separability (it is also worthy of note that these additions are all solos, for greatest clarity). At bar 75 the 4s appear, but the 3s drop out, thus gradually increasing the rhythmic dissonance. At bar 77 all three parts of the template are together, and by further insertion of rests and multiplication of the rhythmic strands the texture goes on to increase in rhythmic complexity. Two other pulses, one slower and one quicker (than are provided by the template) occur: these are regular minims (xyl. bar 77) and triplet semiquavers (xyl. bar 88). Rhythm remains confined to these basic conditions, with further complexity being effected mainly through the increase of the number of moving lines over the number of static lines. At bar 97 the *gliss.* brings the return of the rhythmic element of speed. The array of speeds is actually somewhat limited: with the *pizz./gliss.* articulation it is possible for parallel *glissandi* (identical speeds) to have opposing pulses. This can be seen quite clearly in the score (e.g. bar 100-1 cellos 1, 2 and 3). The parallel *glissandi* then gradually peel apart, adopting slightly differing speeds, but maintaining the similar directions.

By the end of S_2 a good deal of asymmetry has been restored to the texture, yet when S_{2a} arrives there is a feeling of a radical move towards further complexity. This is due to the stricture of parallel and near parallel speeds, lifted at S_{2a}, which sees a level of freedom of speed closer to S_{1a} than anything else.

So S_{2a} reasserts the primacy of asymmetry. It goes on to develop rhythm, by slowing and thinning. There was a relatively small range of speeds at the end of S_2, and they should be characterised as slow, but the issue was a little clouded by surface rhythm. Here, by dropping the regular pulse element of S_2, the music concentrates on the issue of speed. That is the aspect of rhythm being developed here. The speeds

behave more independently and vary more in bar 105-120 (S_{2a}) than before, (in fact this is a compensation for the loss of pulse, since at this point in the piece the movement is towards greater complexity). The concentration is achieved by reducing the number of parts immediately from 23 in bar 107 (the 46 strings operate in pairs) to four or less in bars 108-117. At this point, while retaining a great variety of speeds, the slower ones are bound to stand out; as they last longer. They also stand out because they are some of the slowest events in the piece as a whole. Thus the rhythmic aspect of technique is subtler and much more varied than might at first appear. I say that because throughout S_{2a} one can see the 3s/4s/5s template in the score, but one can't really hear it, because they are not actually articulated. The template at this point only provides asymmetry of entry and exit of each *gliss*. The range of speeds and the new importance of slower speeds, are the dominant forces here.

S_3 returns a rhythmic environment almost exactly like the one in the latter parts of S_1, the template appears to be operating as fully to provide maximal surface complexity (in fact, as the first notes of each beat are struck, this should sound less than fully asymmetrical). One must go outside the question of rhythm to discuss the differences between this and S_1, some of which was dealt with above. To that I add: the chief differences are 1), the suddenness of the arrival at the full use of the template (rhythmic saturation), and 2), the contrast in contours of the individual lines; i.e., in S_1 each part typically changed direction less often than in S_3. Up to six notes could be in the same direction in S_1, whereas in S_3 four appears to be the limit, with one direction change per note very common. Rhythmically this section is relatively uniform, and that is what mostly gives it its monolithic quality. Phrasing, as a macrorhythmic quality, also differentiates S_1 from S_3, as discussed above under texture. Indeed, it is the adherence to the saturated template rhythm which holds S_3 together at bars 179-80 (when the nature of the material completely changes), along with the overlap of trombones. And it is again rhythm that will determine the arrival of S_{4a} and S_4. Technically and audibly one can recognise areas such as bars 180-85 and 189-91 (of

S_3) as a combination of elements in S_1 and S_2, with the rhythm of S_1 and the fixed pitch texture of S_2. But this convoluted cross-relationship is outweighed by the very long stretches of dissimilar material. Bars 193-5, at the very end of S_{3a} make a feature of the half-speed triplet, which has occurred before, in S_{1a}, but never before has it been the sole rhythm in the texture, so we are returned to the rhythmic simplicity of S_2, and we hear the slowest isolated pulse so far. This is yet another example of the rhythm in the piece exhibiting new features as the piece goes along, but all from the template or simple variants thereon. This points to a surprisingly traditional aspect of technique: deriving material from a limited set of possibilities (if we disregard pitch).

S_{4a} uses only the template in simple saturated form; the use of pitch is new here, but not the use of rhythm.

S_4 exhibits more coordinated attacks than any other part of the piece, so once more rhythmic practice is renewing itself. Again this is from within the template, as the quintuple division of the beat is used in all parts here. This means that it appears to use time in a more symmetrical way than even most of S_2. However, the *glissando* texture returns us to the speed element, and this, plus moving pitch, goes against a perception of total simplicity. The speeds are much more independent than in the end of S_2, for example, but less independent than in S_{1a}, because of the rhythmic agreement and because of the tendency for groups to operate in parallel contours (or similar motion). Bar 211 allows rhythm to become a little less simple, with quaver and semiquaver *pizzicato* (all in 5s or 10s, therefore without polyrhythm) appearing together. The 10-semiquaver division is new, though obviously derived about as simply as possible from the quintuplet quaver. So for the first time, we have the effect of three layers of pulse all reinforcing one another, rather than disagreeing. It has to be said that the difficulty of performance of the piece mitigates against this new level of rhythmic agreement being properly appreciated by the listener, going by the *Orchestre National de L'O.R.T.F.* recording. But a change of rhythmic fabric is nonetheless felt. S_4 goes on to the fixed held pitch reference to S_2, and here a new aspect is found: regular pulse (the xylophone) is left out. When that texture is supplanted by *gliss.*

arco sul pont tremolo, rhythm generally returns to its former state, but with less sense of operating in parallel groups. The difference in coordinating contour is reminiscent of the contrast made above between S_3 and the latter parts of S_1. Speeds (of *gliss.*) in this area are in a faster range than before. The feature of layering of rhythmic divisions ceases to exist also, as all are *tremolo* (which looks on the page like all giving a 10-semiquaver division to each bar, but one can't really expect anything coordinated to occur). The rhythmic environment from bars 250-68 resembles the sparser parts of S_1 more than anything else, the time intervals between entries are bound to be so asymmetrical as to appear genuinely random, despite use of the template. That is, of course, the whole purpose behind the template, to furnish a range of effects from complete randomness to absolute symmetry, and an interesting selection of intermediate states which successfully contrast and differ, without running out of possibilities in the course of nine and a half minutes' music. The setting up of large quantities of independent speeds and random sounding time intervals was done with the aid of stochastic maths, but the composer has surely used very traditional means of teasing out the possibilities inherent in the 3s/4s/5s template.

Finally, little mention has been made of silence, which operates here as a macro-rhythmic element. Its purpose is simple: it is used to signal change. The silences separate the piece into its subsections, except for S_{1a}, which runs into S_2. **Fig. X. 1**. shows that (generally) the silences become progressively longer through the piece. Also, the use of four pockets of silence in quick succession at 6'45", 6'56", 7'05" and 7'26", seems to exhaust the use of this device, perhaps making S_4 the final possible section. There is a rhetorical difference between the first two silences and the later group of silences: the first two are followed immediately by a radical change in texture, but the first two of later group are followed by textures which relate back to the previous texture; it takes two more silences then to complete the task of signalling change.

Harmony

A) Linear pitch structures

The linear pitch ordering throughout the piece exhibits no functionality concerning interval type *per se*. That is not to say that interval size cannot be important, but even that functions only in the context of groups of intervals and their average size. The most important linear qualities are those concerning contour: distance and direction, both of which are most pronounced in the *glissando* context. One general comparison on this subject has already been made above: between S_1 and S_3.

The pitch environment is often generated as a random dispersal of points on the pitch-time plane, so that there are no independent latent structures to uncover, one merely wishes to understand the exact working method of the composer. Assuming the generation of points within a defined space, the parameters which must be decided and controlled are: 1) overall registral area, 2) selected areas of the pitch band subject to special conditions (if any), 3) selected areas of time subject to special conditions (if any), 4) division of the parts by timbre (where applicable) and 5) assignment of pitches to specific instruments.

Some examples of the above list are:

1) applies to all sections of the piece.

2) S_{1a} has a particularly good instance of this, where a hole in the pitch space opens up in the middle of the texture (see graph, volume two, **fig. X. 9**.).

3) the phrase structure in S_1.

4) the best example of this is S_3, (where conditions (2) and (3) scarcely apply) where different timbres are selected for dominance at different times.

The fifth category is the most difficult to pin down: how does the composer decide which part should have to play each note? Obviously the note must be within the instrument's register, but what else determines the selection? The simplest examples are those where the pitches are all fixed; S_2, the latter part of S_3, and the central and

final parts of S_4 show this condition. The next logical state is where linear movements of minimal range occur, and directional change is minimised (e.g. bars 200-205). A gradually wider range of linear intervals, and a greater rate of frequency of directional change can be introduced, until the texture becomes fully randomised. S_3 displays the fullest extent of this kind of surface change and here linear interval size reaches a maximum for the piece (of nearly three octaves: see Vn I/12 in bar 127). One can define what leads me to that conclusion by comparing linear contours from S_1 with those from S_3. It is necessary to create some new analytical tools, the main novelty being the "index of directional change", or i.d.c.: in a given line, two measurements count: 1) the average interval size (a.i.), and 2) the frequency of directional change. The second measurement can be expressed as a fraction, e.g. 1/3 or 0.333... for Vc 7 bar 18-19 (see **fig. X. 10a**.), because in a stream of 9 notes there are 3 changes of direction, hence 3/9 = 1/3. Vn II/8 in bar 25 (see **fig. X.10b**.) has 1/7, or 0.143 for its i.d.c., which is very low. The average interval size for these lines was: 2.38 (slightly greater than major second) and 3.333...(greater than minor third).

Vc 7, bs. 18-19

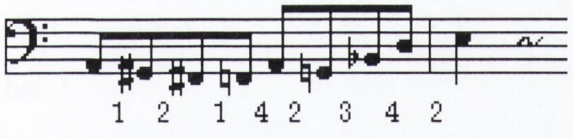


Fig. X. 10a.

Vn II/8, b. 25

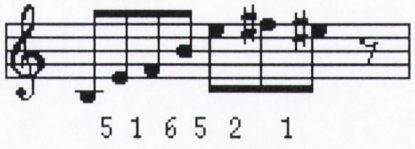
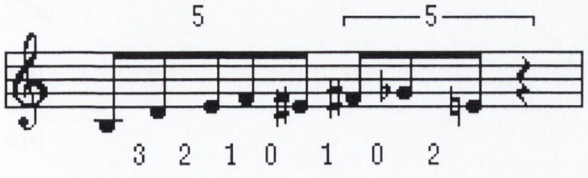


Fig. X. 10b.

Vn II/8, S4a



Vn II/12, S4a

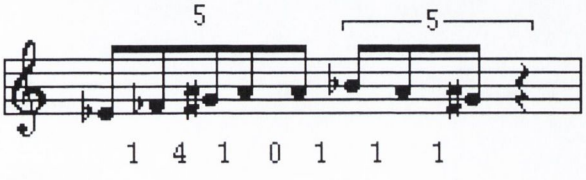


Fig. X. 11a.

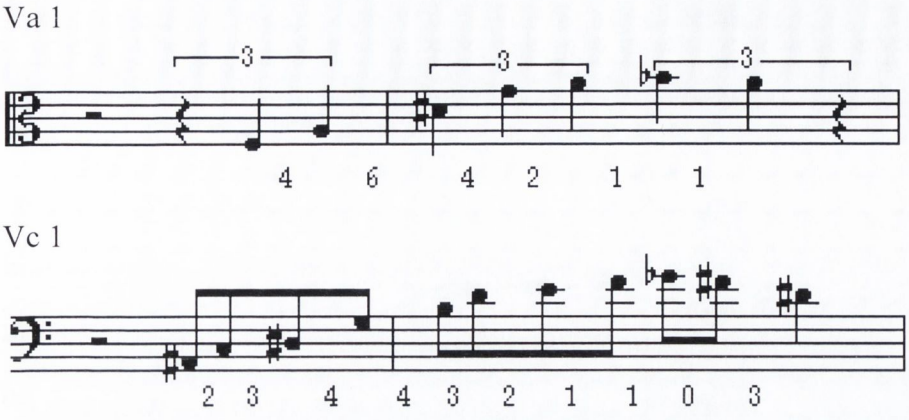


Fig. X. 11b.

A third important way of comparing lines in this general statistical way, is to take the sum of intervals into account; taking the first and last notes and placing them side by side, one can instantly see the overall sense of direction and distance. This seems very simple, but it produces a useful shorthand for the line as a whole. Presumably the greater the number for the first two observations, the greater the degree of randomness in the texture as a whole. If one takes an apparently strictly controlled texture such as S_{4a} (see **fig. X.11a/b**), one sees for both vnII/8 and vnII/12 the i.d.c. of 0.125, and the a.i. of 1.29. For a viola line (va/1) the figures are: i.d.c. 0.143 and a.i. 3. The first cello has the i.d.c. 0.091, and the a.i. 2.3. These low numbers confirm what we already know, that this is a controlled environment that avoids a random sound. S_3 will display a much greater degree of randomness than either this or S_1: the following are typical lines from bars 122-4, see **fig. X. 12**. in volume two.

The data is:

vnI/4: i.d.c. = 0.44 a.i. = 23 (a compound major seventh)

vnI/9: i.d.c. = 0.57 a.i. = 15.9 (nearly a major tenth)

va/2: i.d.c. = 0.5 a.i. = 17.07 (a perfect eleventh)

Some consideration needs to be given to the i.d.c. and what the figures mean in relation to randomness. Imagine a line that changes direction on every note: this effect soon becomes predictable, and not random, despite whatever choice of pitches. Such a

line will give an i.d.c. of x-2/x, which tends towards 1 for very long samples (e.g. 99-2/99 = .979). Therefore those i.d.c. figures near 0.9 or even 0.8 will tend not to sound truly random, as they oscillate. Equally, small figures such as 0.125 (as in S_{4a}) sound deliberately organised. So it is figures around 0.5 which sound the most random, and we find that the lines in S_3 tend towards this number. As for the average interval, the higher the value the more randomised the appearance, (the a.i. figure does not give us the mixture which makes it up, which itself must be heterogeneous); why this should be depends on the inherent quality of interval size to linear relatedness. Why it is perceived thus may be a matter of melodic tradition, or of something more fundamental in human perception, but that need not concern us here.

So random clouds of notes can be pinned to individual lines which themselves sound random in terms of interval size and direction (it is clear that the rhythm is another matter), or not so random, according to the above criteria. I would speculate that Xenakis uses these more random lines where the clouds themselves display random distribution, and does not attempt to put randomised lines into controlled textures or controlled lines into random textures. The comparison of S_{4a} and S_3 bears this out.

B) Vertical pitch structures

The polyrhythm template may ensure that the perception of harmonic relations in a line is clearer and more immediate than the perception of vertical harmony,[228] nonetheless vertical pitch structures are organised, along similar lines to the rhythm and the horizontal lines. Symmetry in vertical pitch structure has been more fully explored by Lutoslawski than here in this piece: the simplest type of vertical symmetry is the semitone cluster, and that is used extensively in this piece. The easiest example to deal with is in bars 200-201; each strand of independent pulse

[228] As was more obviously the case in Lutoslawski's string quartet.

presents near-parallel lines, where vertical disposition naturally becomes clear to the ear (see **fig. X. 13.**, vol. 2). Taking the second violins 8-12 (bar 201), the five instruments present the vertical chord structure (0,1,2,3,4) on seven out of the eight time-points; the exception is the second quaver, with (0,1,2) as the chord. The violas 1-5 (bars 200-1) present (0,1,2,3,4) on all seven of their time-points. The cellos present (0,1,2,3,4) for the first six of their time-points, then (0,1,3,4,5), (0,1,4,5,6), (0,1,4,5,6), (0,1,2,5,6) and then returns to (0,1,2,3,4). The basses have (0,1,2,3,4) on all six of their time-points. Thus a single symmetrical chord and some small deviations from it form the basis of the harmony here. Furthermore the independent rhythmic lines occupy the same pitch areas so that the violas and violins fill in the gaps in the cello chords.

Another simple example of vertical pitch structure is the long-held chord at the opening of S_2. At bar 60 there is a 46-note cluster spread over six-and-a-half octaves. The internal spacing of this chord (see also **fig. X. 8**.) is as follows (reading upwards): 3211212212422122321122112162111322213111 12 (there are some unisons there also). This can be characterised as a random ordering of intervals within the fixed range of 0,6 but with statistical weighting towards 0,1 and 0,2. Such a structure can easily be constructed and tested with the normal distribution equation in a way analogous to defining random points on a line, as used for the rhythm of S_1 (see first mathematical example above); the difference is simply that the line is vertical rather than horizontal. This example differs from the first in being entirely asymmetric.

Many other vertical structures in the piece are only the by-products of random distribution of points in a field (i.e. a defined portion of space on the plane defined by the pitch-time axes). They will not yield interesting or structurally significant 'chords' in the sense we may usually expect in music. What concerns Xenakis is not intervallic 'flavour', but rather contrasts of density, thickness or thinness and the gradual or abrupt transition from one to the other, generated by altering the mean of density for an event, or the mean of probable occurrence of a given sonic entity, while often keeping other elements constant. These alterations can themselves be abrupt or

gradual, and such a decision on the part of the composer is by definition part of the intuitive compositional technique, as distinct from the stochastic part of the technique.

Conclusions

The overall picture of Xenakis' technique which has emerged here shows an interesting and somewhat surprising mixture of radical new departures and traditional ideas. The derivation of all rhythmic material from a very limited set of values may have been decided in order to make the rehearsal and performance practicable, but it is used to such exclusion of all else that one must also see it as following a (surprisingly) traditional notion of material derivation. In contrast the treatment of pitch/harmony is rigorously radical, taking pitches as points on a graph and abandoning the last vestiges of ideas such as 'theme' or 'motif', which even total serialism cannot really claim to do. With the function of pitch thus properly redefined, it becomes fully integrated with texture, i.e. there isn't a possibility of harmony suggesting a direction of development independent to dynamics or timbre. In fact timbre becomes the parameter which controls structure at the broadest scale. One can say that their traditional roles are reversed, with pitch providing colour contrasts and timbre providing structural definition. Such a role reversal is hardly unknown in music of this century, but usually there is *some* equivocation, especially about the role of pitch; and seldom is timbre so clearly and cleverly exploited within one instrumental family. There are other areas which display traditional roots, e.g. the use of phrase structure to enrich the sense of meaningful complexity, and the use of contrapuntal superimposition of strands of material (defined by timbre) for the same reason. It is interesting that these devices are used sparingly and only in the outer sections.

There is no doubt that the mathematical shaping, and the degree of importance of mathematical thinking and execution create conditions and effects which could never

be fully realised otherwise, and which make this music distinct from any other, much as Boulez's application of serialism led to a guaranteed fracturing of the musical surface; indeed the root cause for this is the same search for maximal surface complexity, at least as an option. But in the case of Xenakis, important *a priori* decisions are found to shape the music throughout. Timbre, rhythm and on occasion register and even pitch are subject to these intuitive aspects of technique. Furthermore, again and again through *Formalized Music* Xenakis refers to the freedom of the composer to use the stochastic laws however he sees fit in the course of composition, e.g.:

> Here also, may we emphasize, a great liberty of choice is given the composer. The restrictions are more of a general canalizing kind, rather than peremptory. The theory and the calculation define the tendencies of the sonic entity, but they do not constitute a slavery. Mathematical formulae are thus tamed and subjugated by musical thought.[229]

The Relationship between the analysis and the technique

The analysis found that *Pithoprakta* fell into four major sections. These are largely unrelated in the traditional sense of sharing material. Therefore the piece was found to be fundamentally episodic in structure. This aural impression is brought about by the unfolding of contrasting timbre effects, and the use of opposing conditions in the rhythmic environment (for example, the saturated rhythmic complexity of S_1 against the stark simplicity of S_2), and the pitch environment (S_2 and S_3 display the greatest possible opposition in terms of sustained versus changing pitch). There is no subtle thematic or harmonic grammar creating links under the surface either. There is only

the underlying derivation of rhythm from the template of 3s, 4s and 5s, as discussed under the technique heading. As this is used to produce such radically different conditions through the piece, it does not serve to unify the piece in any traditionally perceptible way (that is, in the sense of overcoming the sectional differences; it does serve as a unifying factor within sections). Nevertheless, it was found that the large sections followed a kind of quasi-rhetorical ground-plan in which they appear to balance one another in terms of gestural shape and direction, so it appears that they are shaped with the presence of the others in consideration. In that sense it is a whole piece, and not a series of indifferent forms.

It is evident that the technique sets certain limitations, and that these stem from an *a priori* aesthetic/philosophical set of ideas. The main technical limitation is the lack of the possibility of functional pitch material, in the sense of harmonic or linear grammar, as already mentioned; this precludes the possibility of the existence of underlying links which might mitigate the material unrelatedness of sections. This is a prime example of technique limiting the kind of structural articulation that is possible.

On the other hand, the pitch selection technique, though deliberately crude, is not inflexible. It displays a remarkable freedom to range over extremes of simplicity (sustained-pitch textures, and low density textures) and complexity (areas of maximal pitch movement and high densities), and exploits a wide range both at and within the extremes. The same can be said for the rhythmic selection. The aesthetic behind the technique is not hung up on asymmetry *per se*, but allows the freedom to range from absolute symmetry to maximum asymmetry. Furthermore the rationalisation and codification of degrees of asymmetry and complexity is Xenakis's great achievement, in this piece and elsewhere.

The technique is reductive in that it forces the perception that what we are hearing is a mass event of randomised individual elements; there is rarely any sense

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[229] Ibid., 34.

that we should pick out any detail (e.g. of line) and expect to be rewarded for straining our ears. Instead we soon learn that the important thing to hear is everything at once, and that the basic index of activity or restfulness is the subject matter, together with macro shaping forces such as register and dynamic. But that, in the context of the music of the time, is something of a liberating feeling, that what you hear is what you are supposed to get. Furthermore it leads to the inevitable conclusion that the technique is unequivocally in charge of the received musical result. There is, for all the misgivings one might have, a one-to-one correspondence between technique (or composing grammar) and music (or listening grammar). And where the music is coherent, the technique is coherent. Equally, where the music eschews coherence, as with the traditional question of pitch function, so does the technique.

Therefore there is a directness about the technique; the admission and acceptance of randomisation which had crept into music over the years was the starting point for a thorough examination and categorisation of degrees of randomness. By the understanding and exploiting of randomness in many areas, e.g. line direction, duration/pulsation, linear tessitura, allied to more traditional working in the area of timbre and overall register, he extracts, from the very unpromising material of pure randomness itself an original language capable of successfully articulating extensive structures.

In dealing with Lutoslawski and Carter, the pitch technique was found to be attempting some kind of functionality, whereas with Xenakis and Boulez there is a level of complexity which obliterates such ideas as motif, theme, and with that, linear function. The vertical harmony in these cases also eschews functionality, though in the case of Boulez, the use of a series is meant to bestow some unifying qualities (this is clear from his writings). By discussing the technique each in its own terms, one can end up criticising, say, Carter, for attempting and only partially succeeding in this, but in the case of Xenakis no criticism of his pitch technique occurs on the grounds that it is obvious that pitch function is irrelevant. It seems unfair, in retrospect, to criticise one composer for not fully succeeding at something, but with the composer who hasn't

even attempted the same thing (which, let's face it has been a core value of all serious music for a few hundred years) one doesn't make any criticism. I point this out as something for the reader to consider at any rate. It is a question akin to the debate in morality; whether moral values are decided purely relatively, within a closed context, or whether a set of absolute values is regarded as given from above, in which case one is caught in endless debate about *which* fundamental values are the truth. The question in music becomes: is music without harmonic logic really music? One has to bear in mind that functional harmony in the case of Xenakis has at least been replaced by a system of positioning the pitch events (precisely) on a relative scale from order to chaos. One immediately thinks of electro-acoustic music, which generally tries to find its way without harmonic logic. Certainly in that case it seems that Xenakis is positing a valuable principle in the absence of a traditional solution. With instrumental music he is open to the criticism that he has thrown out something and replaced it with something inferior; but under the caveat that perhaps what he threw out was in a poor state when he got to it! It is for this reason that his music is very often spoken of as a kind of electronic music done by instruments.

Appendix to chapter four: further notes on the mathematical aspects

This is an exploration of the correlation of Sections in *Pithoprakta* to the mathematical procedures involved in their making:

S_1: points on a line in random distribution

this is governed by the exponential distribution equation:

$$Px = \delta e^{-\delta x}\, dx$$

P is the probability of the occurrence of any length x (of time), d is the mean number of points expected for a given larger length. This was used to check the degree of randomness of the rhythm of the percussive sounds.

S_{1a}: a total of 1148 speeds distributed in 58 distinct values according to Gauss's law, were calculated and traced for the passage of bars 52-60. Examining fig. X. 5. one sees the 46 stringed instruments, each represented by a jagged line. The individual speeds are calculated with the formula:

$$f(v) = \frac{2}{a\sqrt{\pi}} e^{-v^2a^2}$$

S_2: randomisation of a tone cluster: Xenakis quotes the following equation:

$$\theta(\gamma)\, d\gamma = \frac{2}{a}\left(1 - \frac{\gamma}{a}\right) d\gamma$$

to give the probability that an interval within a segment of length a, will have a length included within γ and $\gamma + d\gamma$ for γ between 0 and a.

S_{2a}: as it involves glissandi, the equation for S_{1a} applies. As the average speeds are slower, the value for a must be lower here. (The value in the case of S1a was $a = 35$, see *Formalized Music*, 15).

S_3: this must use a combination of all of the foregoing equations, although wherever the rhythmic template is used in saturation, the equation governing (time-)points on a line is extraneous. As the texture goes on, the average size of the linear interval gradually falls, until at bar 180 all parts are reduced to repeated pitches. This is analogous to the lowering of speed by adjusting a single variable as at S_{2a}.

S_{3a}: with all pitches fixed and rhythm using the simplest possibilities from the template, the only choice open to randomisation is the vertical pitch structure; therefore the equation for S_2 applies.

S_{4a}: I suspect that this required no stochastic control, as the degree of determinism seems to be the fullest possible. It should be recalled that Xenakis' view of maths would include fully determined textures as one extreme on the continuum leading to full randomness.

S_4: rhythm is unified, obviating the need for the first equation. The variables concern register, density, speed, but not timbre, which is most likely determined. Linear plotting is simplified by the fact that the directions strictly oscillate; i.e. are not randomised. The formula

$$f(v) = \frac{2}{a\sqrt{\pi}} e^{-v^2 a^2}$$

certainly applies, along with other criteria to determine the grouping of instruments which can be seen in the texture.

CONCLUSION

The substance of this thesis is a call for recognition of the goals of analysis to be clearly cast in terms of whether the listening grammar or the compositional grammar is being addressed. This applies particularly to music of the post-war period, right up to the present. The desired result is analogous to stereoscopic vision, that perhaps the two images will agree in essential outline forms, but the combined effect of even minor differences causes a major impression of depth to emerge. The concluding part of each chapter benefits, I believe, from this new perspective.

In the course of each chapter, certain original discoveries were made: for Boulez and Xenakis, it was the degree to which the composer retained intuitive freedom. For Carter, it was the exactitude of rhythmic definition in establishing musical strata. For Lutoslawski, it was the existence of two types of climax, gestural and textural. In the field of harmony, certain original methods were evolved which I believe may have relevance to further study of music in this period. Prominent examples of this are: 1) the establishment of objective criteria for examining the amount of randomness in a line (Xenakis), 2) the systematisation of quantifying harmonic rate of change (Lutoslawski), and 3) the general realisation that tabulating the interval content in strands of material can confirm what the ear already suggests: that they can be somewhat randomised (showing constant presence of all intervals) yet retain an harmonic 'flavour' due to 'statistical swing'.

What follows from this is a modification of the caution expressed by Berry and Lerdahl concerning the cognitive constraints surrounding randomisation.[230] Their concern grows out of the unease that such ingredients as the series remain cognitively 'opaque', yet analysts never fail to speak of such an ingredient (it may be another feature, such as a stochastic or aleatoric element). What needs to be more fully explored, and I have begun it here, is the collection of musical information which remains transparent in spite of this. There is a rich seam of musical detail that, even in these difficult works, remains clear to the listener, and this even includes our ability to listen statistically. The more opaque facts can then be considered separately, in the light of this knowledge.

In the case of Boulez and Carter, it is often found that a passage uses all of the intervals, but not in a random (i.e., fully equal) frequency distribution. This even applies to aspects (especially vertical harmony) of Lutoslawski, but ironically, not Xenakis' music in *Pithoprakta* (though it does apply to Xenakis' later music). Thus, for example, in a given strand of material one might find a strong weighting towards one or two ics, while the other four are notably weak, but nonetheless present. If it is acknowledged that this endows the music with a certain audible harmonic quality that can serve a useful purpose for musical contrast, we are enriching our traditional notion of harmonic function. Furthermore, this goes somewhat against the warnings sounded by Berry and Lerdahl. Their points still need to be respected and borne in mind, since full randomisation can only result in the abandonment of harmonic function, as I have observed in the case of *Pithoprakta*. Naturally, the closer the mixture of intervals is to equality (what statisticians, interestingly, call 'statistical noise'), the harder it is to perceive the promoted interval(s). This point, properly confronted, has ramifications for future analysis and composition, for if it is accepted that statistical weighting is a

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[230] Recall that 'cognitive constraint' is Lerdahl's own term; 'randomisation' is Berry's.

significant property of post-war harmony, it follows that statistical analyses are a significant tool for analysis, which is a point which is still resisted often. Likewise the composer can perhaps relax the traditional strictures concerning manipulation and derivation of material from a limited set of motifs and themes, and pay a little more attention to the resultant sound, without necessarily finding, as Xenakis did, that:

> Linear polyphony by its present complexity destroys itself. What one hears is in reality no more than a heap of notes in various registers. The enormous complexity prevents the hearer from following the criss-crossing lines and has as a macroscopic effect an irrational and fortuitous dispersal of notes across the whole range of the sound spectrum.[231]

The problems that exist for cognition of music cannot, in truth, be confined to discussions of pitch. Comprehension of structures, particularly those articulated in time, relies on our ability to parse the events, in order to build up sets of comparative relations. Therefore the role of rhythm, phrasing, and all the non-pitch parameters is vital to the task of understanding the pitch quality. For example, in Carter's Variations, the stratification set out by timbre and rhythmic differentiation allows us to notice the (sometimes very slight) statistical swing in the various strands, but without that separation in those non-pitch parameters, this would be virtually impossible. In *Bourreaux*, the phrasing sets up the possibility of comparing numbers of direct pitch links as a discourse of evolving relations. In the string quartet, the technique of 'partitioning' the parts, supported as it is by the independence of pulse, allows separate subsets of the chromatic set to stand out. But in *Pithoprakta*, for large passages (such as section 3), the music refuses simple textural/phrase parsing. This is as much due to a lack of perceptible variety in density (both horizontally and vertically), dynamics and register, as it is to direct pitch concerns. It has its roots in the same technical process, however: a stochastic determination of texture including all

these factors. The irony is that by surrendering to the call of statistics and placing them in the technique *a priori*, Xenakis robs the listener of the challenge of applying his/her own internal statistical ability.

> Our attention is unable to follow all the various events, so instead we form a general impression. That's simply how our brain reacts to mass phenomena—there's no question of scientific computations. Our brain does a kind of statistical analysis! Again, the solution is probability theory.[232]

In that sentence Xenakis simultaneously acknowledges the mind's ability and its limitations in coping with complexity.

I will now go on to explore further issues under separate categories: those of technique, analysis and historical context.

Technique

The technique of each composer here falls into two distinct areas:
1. the techniques peculiar to them and with which they are often identified,[233] and
2. techniques which are more generally shared between composers.

These two categories are related to 'compositional' and 'listening' grammars, because when working within the first area a composer is more likely to create a conflicting structure to the listening grammar than when working within the second.

This clear division is worthwhile, although a little simplified, since I have found some personal slants in this second area, making for a possible middle area—personal

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[231] Iannis Xenakis, "The Crisis in Serial Music," *Gravesaner Blätter* 1 (Gravesano, 1955).
[232] Varga, 78.
[233] In the case of Boulez, total serialism was, of course, not confined to him, but in the context of comparing him with the others in this study, it is 'peculiar to him' and he can perhaps in some sense stand also for Stockhausen and others in the following comments.

amplifications of common techniques. But for the sake of simplicity I will limit the types to two. Finding the proportion of technique 1 to technique 2 for each composer will be attempted here, as a first step in reaching an overview.

An 'excess' of individualistic technique and a dearth of common technique will generally make objective appraisal of a composer difficult, and, although it is perhaps of no particular concern to an individual composer, it will make cross-comparisons of a group of composers difficult. The more private and personal the composer's methods (and hence overall sound-world), the more resistant to outside comparisons.

To clarify the relative positions of the four composers in this regard I have constructed a graph (see volume two), **fig. Cn. 1**., which shows the type of technique each applies for various areas of technique.

For the sake of comparison here I regard Boulez's serialism as an instance of individual technical application. The basic notion of opening out the series to include duration, intensity, and where possible, timbre, was 'in the air' and cannot be ascribed to him alone, but his methods of elaborating the series and shaping the work are indeed highly original and personalised, therefore for figure **Cn. 1**. his technique belongs mostly in category 1.

Figure **Cn. 1**. shows eleven technical areas and which kind of technique each composer applies to each area. (It is possible that a composer will apply a personal technique to one parameter in one part of the piece and then a more common technique to the same parameter elsewhere. This is why the graph includes the category '1 and 2'.) Various aspects of this diagram require further comment: it may be felt that 'overall form' and 'macrorhythmic organisation' are synonymous; the reasoning used here is best explained by example. Carter is using a traditional overall form, theme and variations, and so here he falls into category two. In his planning of the variations and how they are interleaved and arranged he displays largely original thought-processes through his techniques of stratification and divergent simultaneous flow, so this is listed as category 1. By contrast, Boulez has interwoven the cycles of *Le Marteau* in a complex and innovative way (overall form), but in the organisation of

the three large sections in *Bourreaux*, there is a symmetry and order reminiscent of Berg or Webern (macrorhythmic organisation). It is dangerous, to be sure, to claim to be definitive in these matters, so let it be stated here that this diagram is open to adjustment in the readers mind, in terms of some of its details, but nonetheless it shows certain noteworthy overarching tendencies. The first of these is that all four composers apply individual solutions to the challenge of creating textures and controlling harmonic content. This is interesting in view of the diversity elsewhere, and perhaps it indicates that innovation in these areas is something of a *sine qua non* for composers in this period. These parameters are among the most forceful in defining style, and perhaps in time this will allow the historical perspective to group them more closely together.

That all four are in category two for use of register is not all that surprising, since all composers aim to be striking in their use of this resource, so most avenues are already well explored. For Boulez, in *Bourreaux*, he is quite nonchalant, after the first section, about exploiting register; this might almost qualify him for the middle category. As an aside, I would be inclined to propose Ligeti as a rare example of a composer applying a personal solution to the challenge of register; he seems to use register as part of the subject matter of his music, rather as if the frame were to become part of a painting's subject.

The data from **fig. Cn. 1**. can be given in another form: the proportion of use of category one to category two. Thus for Boulez we get 9:3, for Xenakis 8:4, Lutoslawski 7:4 and Carter 5:6. As the middle (double) category gives extra instances and hence different totals, for comparison it is better to produce numbers out of these figures by dividing the first by the second thus: Boulez: 3. Xenakis: 2. Lutoslawski: 1.75. Carter: 0.833. This then is the descending order of use of innovation, according to **fig. Cn. 1**. (In no way should this be taken for a value judgment, saying Boulez is the best, or even the opposite, let it sit as a value-neutral observation).

Another noteworthy point is that not even the most elaborate technique is given over entirely to personal concerns. In fact this can form the basis of a modification of

Lerdahl's opposition of listening grammar and compositional grammar, the crux of his view of this opposition is that compositional grammar in the case of serial or stochastic music can 'throw' the listener, because of the difficulty in cognising randomised events, but my analyses have shown that there always remain some elements of these techniques (or compositional grammars) which are shared with other music and therefore correspond to existing listener's expectations: i.e., there are areas (even in Boulez and Xenakis) where compositional grammar and listening grammar intersect. Certainly this not to reject Lerdahl's idea, but in fact to extend it: the degree of non-intersection becomes a measure of the degree of difficulty in cognition.

Fig. Cn. 1. does not directly address intuitive compositional decisions. These deserve mention because (as I see it) the more deterministic approaches attempt to minimise the role of the intuitive decision. This could be (quite rightly in my view) to avoid slipping back into accidental cliché. There are many assumptions and patterns of thought ingrained in all of us by our education which have no firm logical basis and which we don't notice ourselves using. Intuition can be the habitat of prejudice. Boulez addresses this most forthrightly when he says at the end of *Boulez on Music Today*:

> I consider that methodical investigation and the search for a coherent system are an indispensable basis for all creation, more so than the actual attainments which are the source or the consequence of this investigation. I hope that it will not be said that such a step leads to aridity, that it kills all fantasy, and since it is difficult to avoid the fateful word, inspiration. Far from seeing the pursuit of a method and the establishment of a system as proof of the withering of the faculties, I see it on the contrary, as containing the most powerful form of invention, wherein the imagination plays an essential, determining role. This is certainly not an original thought on my part, for the claim that intelligence must participate in elaboration was formulated long ago in the field of poetry. Baudelaire overcame this opposition between 'lucidity' and 'genius' a century ago, and in what terms! . . . 'Technique' is not, in fact, a dead weight to be dragged around as a guarantee of immortality. It is an exalting mirror which the imagination forges for itself, and in which its discoveries are reflected; the imagination cannot, without running the risk of weakness, rely on 'instinct' alone, as Baudelaire emphasises. Over-reliance on this instinct has led it, like the cuckoo, to lay its eggs in the nests of others. Imagination must stimulate intelligence and intelligence must anchor imagination: without this reciprocal action, any investigation is likely to be chimerical.[234]

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[234] *Boulez on Music Today*, 143.

It is worth noting his point about the cuckoo: he places comprehensive technique in the role of the progenitor of an original voice. Neither does he rule out the use of instinct, however, merely the use of "'instinct' alone".

There is nothing controversial in claiming that a comprehensively worked-out technique is a requirement for all composers aiming to succeed. The controversy arises when the technique is highly personalised, as then the question of whether it achieves all it sets out to do can no longer be assumed by historical or contextual precedent.

The conclusions in each individual chapter have already dealt with the degree to which complexity and randomisation affect the listener's grasp of the key processes as defined in the analyses, under the heading "The Relationship between the Analysis and the Technique", since this is a core concern of this study.

Analysis and Musical Logic

Analysis generally seeks to find unity. The definition of syntax, the search for logical connections, even when they are not easily heard, are driven by a desire for unity. The degree and definition of unity can vary: for example, in Schenkerian analysis the goal is to show the *Ursatz* and how it is articulated in the work. In atonal music, there is always the *possibility* that a piece will define a single syntax that operates across an entire work, with separately functioning opening gestures, prolongation, and closing gestures, all satisfactorily sharing common material. Twelve-note music grew out of the aesthetic view that the use of a single tone row was at least the starting point to writing a unified work. When integral serialism was elaborated out of this by the post-war generation, there was still the desire amongst many composers for an aesthetic justification stemming from unity of the whole. Especially in the cases of Stockhausen and Boulez, there was almost a boastfulness in their technical writings (as we have seen for Boulez) with the suggestion that they were in the possession of the one true

technique, and that the beauty of their technique was that it allowed maximum surface variety, complexity (where desired) and freedom of expression, but at the same time the whole work had been developed out of a single set of (unifying) quanta. Stockhausen said: "against doubt and hostility we will hold fast to the idea that the 'structure of a work and its material are one and the same thing.'"[235]

But not all composers are equally desirous of unity. Some have sought to modify the traditional definition of unity, some have played down its importance, and others have abandoned the search for unity, rejecting the assumption of its importance. So there is often a risk that the analyst is working to a different or even irrelevant agenda to the composer.

Unity in any case needs some discussion. Webern said:

> Unity is surely the indispensable thing if meaning is to exist. Unity, to be very general, is the establishment of the utmost relatedness between all component parts. So, in music, as in all other human utterance, the aim is to make as clear as possible the relationships between the parts of the unity: in short, to show how one thing leads to another.[236]

But as Dunsby and Whittal point out in the context of more recent music, "to show how one thing leads to another" need not be same as establishing "the utmost relatedness between all component parts."[237] So unity in the strict sense can be left behind without leaving behind coherence. They go on to propose a contrast between synthesis and symbiosis, where synthesis parallels the stricter condition of 'utmost relatedness' and symbiosis the freer one.

In the case of the four composers here, they all express in their writings a desire to retain coherence; they have not repudiated this traditional goal, though they would all seek more liberal conditions than Webern.[238] But the degree to which they succeed

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[235] Karlheinz Stockhausen, "Actualia," *Die Reihe* 1 (London, 1958): 51.

[236] Anton Webern, *The Path to the New Music*, translated by Leo Black (Bryn Mawr: T. Presser, 1963), 42.

[237] Jonathan Dunsby and Arnold Whittal, *Music Analysis in Theory and Practice* (London: Faber, 1988), 173.

[238] Lutoslawski said: '. . . any strictly composed musical form contains opposing forces. Every form is a product of the conflict between these forces. We could call them centrifugal and centripetal. Centrifugal forces result from the variety of the musical material; they must somehow be balanced by a centripetal force which will bind these fugitive elements into a whole.' Kaczynski, 57.

in their music as distinct from their stated (written) objectives is worth exploring. Based on what was found here it could be said that Lutoslawki and Xenakis were found to risk unity the most, with the further point that Xenakis was more deliberate in the risks taken than Lutoslawski. One could say that Lutoslawski desired to stay within traditional norms more than Xenakis, so in his own terms Lutoslawski was less successful in this regard. Boulez also inclines towards not fulfilling all of his own conditions, as there is a conflict between the ordering in the source series, and the subsequent highly transformed derivatives. Carter in his music and his writings remains close to the model of symbiosis; separate strands co-existing without a requirement of relatedness, yet with a quality of interdependency. A problematic result in his case is the risk taken with harmonic coherence.

As to my own assumptions in analysis, these have been covered in my Introduction, but I will enlarge on them here: when I first embarked on this thesis I had the idealistic aim of finding a single strand of logic for each work, no matter how diverse in surface characteristics. The idea was that some process within the piece would reveal itself (under analysis) to be the unifying factor, put there deliberately or unconsciously by the composer, and audible to the discerning listener. Hopefully there would also be evidence of an harmonic grammar/syntax replacing traditional pitch organisation. In short, I was looking for unity, under the doubly strict condition of audibility. The position adopted was a prejudicial one, really, or at least somewhat purist, and in hindsight, not very realistic; but for all that it worked as a viewing instrument to compare works from contrasting backgrounds, and the conditions seemed reasonable. My other initial analytical condition was personal: in order that I would not unconsciously *force* the material to produce evidence of unity I refrained from immersing myself in the technical knowledge until after I had completed the analysis of the listening grammar. By putting composer-specific technical knowledge aside in the initial stages of each chapter, I sought to assess them from a common standpoint. This follows another assumption: that composers expect their music to communicate through sound and time, not through a battery of additional data. The

writings of each composer quoted thus far demonstrate this to be a reasonable assumption (for the chosen composers).

With those conditions/biases in full view, what did I find?

Boulez

In the case of *Bourreaux*, because the compositional grammar gives us very clear local structures identifiable (to the eye) in the score, it was reasonable to assess the relationship of these to the audible local structures found in the analysis of the listening grammar. These were not aligned in a one-to-one correspondence, yet elements of structure in one aspect did line up with elements in the other. It was also found that much of the most graspable structuring—phrasing, local resultant rhythm, registral process, pauses and tempo changes—was in the realm of intuitive decision, outside the strict serial schema, and that moreover the *schema* was subject to flexible treatment. The fundamental question of pitch ordering also appeared to receive free treatment in that it was subservient to textural shape; so all in all, the schema was not governing many of the principal compositional decisions. Yet it functioned to furnish a guarantee of stylistic unity which included the avoidance of unwanted resonances of functional harmony and line (in the traditional sense), and replaced them with an alternative set of important pitch links. I cannot therefore fully agree with Lerdahl when he says:

> Experienced listeners do not find *Le Marteau* totally incomprehensible, but neither, would I argue, do they assign to it a detailed mental representation. . . . The serial organization that Koblyakov found is opaque to such structuring.[239]

However I do agree with Lerdahl that:

> . . .a musician of Boulez's calibre would not use a compositional system without drawing crucially upon his musical intuition and experience. Music-generating algorithms alone have always produced primitive outputs; not enough is known about musical composition and cognition for them to succeed. Boulez had the intellectually less ambitious goal of developing

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[239] Lerdahl, 98.

> a system that could just produce a quantity of musical material having a certain consistency. He then shaped his material more or less intuitively, using both his "ear" and various unacknowledged constraints. . . .
> The degree to which *Le Marteau* is comprehensible, then, depends not on its serial organization but on what the composer added to that organization.[240]

Carter

In the chapter on Carter's Variations there was an almost parallel finding, that ultimately the shaping forces which operate alongside of (and sometimes independently of) pitch selection are lending the piece a convincing coherence; but it is the realm of pitch that lends the piece any problematic opacity that it has. This is not because of any adherence to a system, but because of adherence to an unstated, partly sublimated, *principle* of comprehensive variety of chord and interval selection, which had not yet become codified into a system: a corollary of the situation in Boulez's case.

Lutoslawski

In the case of Lutoslawski what was found was an uneasy compromise between overall planning and autonomy of the sections. The source of my misgivings may be the initial aesthetic conditions just prior to the creation of the work, i.e. that the mobile sculptures of Calder sparked an idea for a redefinition of musical form which required an increase in rigidity (of linear material) to counterbalance the increase in flexibility (of timing), which in turn created an obstacle to the formation of common material bonds across sectional boundaries. Assuming that Lutoslawski recognised and accepted these conditions set down by his new treatment of material, he must have expected the macro-structural planning to succeed in binding the piece. My conclusion was that for large parts of the quartet the two opposing morphological qualities constituted a structural schism. This is another conflict of oppositional

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[240] Ibid., 98.

structural strands, this time both are within the compositional grammar. It is interesting to note in the context of what was just said about Boulez and Carter that with Lutoslawski that while there is a greater simplicity and elegance in his pitch technique (with the caveat that stasis can build up over time with the grid technique), problems of coherence of discourse arise from other technical concerns, not particularly from pitch selection procedures. This is almost the opposite of what was found for them.

Xenakis

Xenakis has the boldest approach to pitch selection; while Boulez has been criticised for his pitch selection having a 'statistical quality',[241] for Xenakis it is a bald fact that his pitch selection is statistical. In chapter four it was noted that in the case of *Pithoprakta* the application of a statistical world-view could span a gamut from purest simplicity of events to great complexity, so that the strength of this approach surely lies in the flexibility it brings to audible formal planning. By combing out different levels of complexity/simplicity, and setting sections within separate distinct ranges of complexity/simplicity, which then transform occasionally from one to the other in a controlled manner, a new dialectic of organisation appears, to replace the lost traditional motivic/harmonic function (almost all trace of which has been abandoned). Because of this it has been implied that his orchestral music shares challenges with those found in electro-acoustic music, indeed the present generation of electro-acoustic composers seem to regard Xenakis as a father-figure. One can scarcely escape the uncomfortable feeling, however, that a break in historical continuity actually takes place here, a revolution rather than evolution in the matter of pitch treatment. The other three composers adhere to a utilisation of pitch as musical material (theme or motif) manipulated "in ways familiar to all of you"[242] (according to

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[241] "The piece is hard to learn by ear in a specific sense; its details have a somewhat statistical quality." Ibid., 98.

[242] As Carter put it, see quote above, page 98.

traditional, if highly extended, procedures—see 'historical context' below). Xenakis, taking the aforementioned opacity which this *sometimes* leads to, runs with it and makes a study out of grades of opacity—which can be seen either as revolutionary and anti-tradition, or just admitting a problem and going around it.

However, I would avoid the notion that 'here be monsters', if only because a break in historical continuity has been claimed before, for instance about Schoenberg's technical innovations, and again about integral serialism's, and many times in the further past in what we now view as evolutionary development. Also, it is his coherent control not just of the simplicity/complexity gamut, but of all the other parameters, notably timbre as a contrasting device, and density/register (which here tend to form a single complex) as a linking device, which bring his music back into the fold of part of musical evolution and not revolution.[243]

The historical context

The above brings this discussion forward to a general consideration of the place in musical history of all four of the composers here: because they are contemporaries of one another, they all stand in the same time-relationship to forebears such as Schoenberg, Webern and Stravinsky. There is evidence to suggest that they sought to justify their work in terms of reaction to or development from dodecaphonic music, yet what they each saw as a logical progression from the second Viennese school was very different. Serial music of the 50s has been credited with taking the logical step forward from twelve-note music: making it more consistent by serialising the other parameters; there is a criticism of Schoenberg: that he stopped short of emancipating the whole of musical structure, by being conservative with rhythm and form. Of

[243] I can not resist comparing this with the initial shock of De Koonig and Pollock, who are now treated almost as 'classic' in painting.

course with Boulez the criticism is not implied, but forcefully stated, in "Schoenberg is Dead":

> There is no point in denying that the 'case' of Schoenberg is primarily annoying for its flagrant incompatibilities.[244]

and:

> It has to be admitted that this ultra-thematicization is the underlying principle of the series, which is no more than its logical outcome. Moreover, the confusion between theme and series in Schoenberg's serial works is sufficiently expressive of his inability to envisage the world of sound brought into being by serialism.[245]

However there are such dissenting voices as Carl Dahlhaus:

> The contention that there exists a contradiction in Schoenberg's twelve-note works between advanced pitch structure and traditional, outmoded rhythm, a contradiction which was resolved only by serial music, is inaccurate, because both the twelve-note structure and the non-serial rhythms serve the same purpose: namely, to recreate 'large-scale' autonomous instrumental forms within an atonal context. In Schoenberg's musical thinking it is not the analogy between the parameters but their functional complementation that represents the principle controlling the relationship between pitch structure and durational structure.[246]

It is a striking fact that Xenakis and the serialists (not Lutoslawski or Carter) seem to have either missed or been deeply unsympathetic to this point of view, and arrived at different techniques as a result.

Carter took a more benign view of his great forebears: he didn't see a contradiction in trying to progress from both Schoenberg and Stravinsky, as the serialists (if we can assume they would all agree here, for argument's sake), and even Lutoslawski did (see quote below). Carter states this quite explicitly in "The Time Dimension in Music."[247]

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[244] Pierre Boulez, "Schoenberg is Dead," essay in *Stocktakings from an Apprenticeship*, 209.
[245] Ibid., 212.
[246] Carl Dahlhaus, "A Rejection of Material Thinking?," essay in *Schoenberg and the New Music*, translated by Derrick Puffett and Alfred Clayton (Cambridge: Cambridge University Press 1987), 275-6
[247] The Writings of Elliott Carter, 243-7.

For Lutoslawski, the opposition between the serial forebears of the second Viennese school and the other figures (Bartók, Stravinsky, etc) as posited by Adorno and others, continued through his own career:

> I distinguish two movements in this period of music history. One of them is easy to define: the post-Schoenberg movement, that is to say, everything connected with twelve-tone technique—serialism, Webernism, post-Webernism, etc The other movement is more elusive: its source and starting point, if we stay in this century, is Debussy. Stravinsky's early works belong here, also Varèse and now Messiaen. I have far more in common with this movement than with the Schoenberg one. In fact I have composed only one work based wholly on the twelve-note series, and the purpose to which I put this technique was quite different from that of the twelve-note system.[248]

The greatest divergence in technique among the composers in this study concerns their various approaches to the historical furtherance of motivic/thematic referentiality, which is a key issue thrown into relief by Schoenberg's pioneering technique and identified in writing by Boulez and Xenakis (and we might assume Carter and Lutoslawski would not dissent). For Lutoslawski and Carter it was to be stretched and expanded, for Boulez it was to be stretched to the limit and questioned, and for Xenakis it was to be abandoned. There is a distinction also, between Carter and Lutoslawski's approaches in this regard: Carter is stretching the treatment of themes, whereas Lutoslawski is stretching the treatment of motifs. It is important here to draw the distinction between 'theme' and 'motif', where motif carries the implication of smallest musical unit, subject to many kinds of transformation, while theme denotes a larger element, possibly less flexible in its transformations.

Boulez mentions Schoenberg's ultra-thematicism, but this does not necessarily mean that he would deny all use of material referentiality. On the subject of motivic unity Boulez is fascinating and extraordinary. In *Boulez on Music Today* he virtually takes the view that no amount of transformation of material can lose the material's relatedness to itself. A motif (expressed purely in pitch) within a series may undergo augmentation, diminution, or may be 'multiplied' by a neighbouring motif to create a much bigger complex, and then have the durations dynamics and possibly timbres

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[248] Kaczynski, 140.

decided by similar means, all under the general condition of asymmetry. Yet he presents this as "organising a FINITE(sic) ensemble of creative possibilities connected by predominant affinities, in relation to a given character; this ensemble of possibilities is deduced from an initial series by a FUNCTIONAL(sic) generative process (not simply the consecutive expansion of a certain number of objects, permutated according to restrictive numerical data)."[249] He is simultaneously questioning and stretching traditional concepts of motif, but refusing to abandon all such connection. The 'problem' of randomisation posited by Berry does not appear to have occurred to him.

A key finding in this study is therefore that each of the composers is either controversial or problematic in one clearly identifiable area of his technique, while (and I must stress this) fundamentally sound in the majority of his technique. For Boulez, it is the above point concerning transformation of material; for Carter, it is the wide inclusiveness in harmony; for Xenakis, it is the loss of harmonic colour (whether that serves local or longer-term coherence) as a controlled musical element; and for Lutoslawski it is a structural discord between local and global shaping procedures (in *part* of the work considered here). Each of the composers shows from their subsequent works that they were aware of these issues, as development occurs in precisely these areas, so I believe that they are highly relevant to any study which traces their subsequent stylistic evolution.

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[249] *Boulez on Music Today*, 35.

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