AN INVESTIGATION OF TEXTURAL ACTIVITY AND ITS
HIERARCHICAL STRUCTURES IN SELECTED WORKS
BY KRZYSZTOF PENDERECKI

THESIS

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This study focuses on temporal aspects of the music of Krzysztof Penderecki and deals with these on the level of textural activity. The analyses are based on a referential idea called a "discrete sound event," defined as an occurrence of a sound or collection of sounds which, as a unit, is distinct from the surrounding texture. These sound events are then used to appraise textural activity from layer fluctuation and composite density.

The pieces selected for applying these techniques are the Threnody to the Victims of Hiroshima, from 1960, the Fluorescences, from 1961, and the 1965 Capriccio for oboe and strings.
TABLE OF CONTENTS

LIST OF TABLES ........................................ iii
LIST OF ILLUSTRATIONS ................................. iv

Chapter

I. INTRODUCTION ........................................ 1
II. THE ANALYTICAL APPROACH .......................... 18
III. THRENODY TO THE VICTIMS OF HIROSHIMA .......... 44
IV. FLUORESCENCES ..................................... 61
V. CAPRICCIO ............................................. 75
VI. CONCLUSION .......................................... 92
APPENDIX ................................................. 98
BIBLIOGRAPHY ............................................. 100
### LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>I.</td>
<td>Textural Activity Scale</td>
<td>32</td>
</tr>
<tr>
<td>II.</td>
<td>Textural Activity Scale--Threnody</td>
<td>56</td>
</tr>
<tr>
<td>III.</td>
<td>Textural Activity Scale--Fluorescences</td>
<td>69</td>
</tr>
</tbody>
</table>
### LIST OF ILLUSTRATIONS

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Sectional Interruption</td>
<td>23</td>
</tr>
<tr>
<td>2.</td>
<td>Sectional Cadence</td>
<td>24</td>
</tr>
<tr>
<td>3.</td>
<td>Discrete Sound Event</td>
<td>26</td>
</tr>
<tr>
<td>4.</td>
<td>Three Discrete Events</td>
<td>28</td>
</tr>
<tr>
<td>5.</td>
<td>Threnody, Pages 18-19</td>
<td>34</td>
</tr>
<tr>
<td>6.</td>
<td>Layer Fluctuation for Figure 5</td>
<td>37</td>
</tr>
<tr>
<td>7.</td>
<td>Composite Density Factor</td>
<td>39</td>
</tr>
<tr>
<td>8.</td>
<td>Two Layers</td>
<td>41</td>
</tr>
<tr>
<td>9.</td>
<td>Event Partitioning</td>
<td>46</td>
</tr>
<tr>
<td>10.</td>
<td>Threnody, Page 13</td>
<td>47</td>
</tr>
<tr>
<td>11.</td>
<td>Sectional Organization of the Threnody</td>
<td>51</td>
</tr>
<tr>
<td>12.</td>
<td>Threnody, Beginning</td>
<td>52</td>
</tr>
<tr>
<td>13.</td>
<td>Layer Fluctuation, Threnody</td>
<td>57</td>
</tr>
<tr>
<td>14.</td>
<td>Composite Density Factor, Threnody</td>
<td>58</td>
</tr>
<tr>
<td>15.</td>
<td>Textural Cadence</td>
<td>63</td>
</tr>
<tr>
<td>16.</td>
<td>Event Partitioning, Fluorescences</td>
<td>65</td>
</tr>
<tr>
<td>17.</td>
<td>Fluorescences, p. 26</td>
<td>68</td>
</tr>
<tr>
<td>18.</td>
<td>Layer Fluctuation, Fluorescences</td>
<td>71</td>
</tr>
<tr>
<td>19.</td>
<td>Composite Density Factor, Fluorescences</td>
<td>71</td>
</tr>
<tr>
<td>20.</td>
<td>Capriccio, p. 8</td>
<td>77</td>
</tr>
<tr>
<td>Section</td>
<td>Title</td>
<td>Page</td>
</tr>
<tr>
<td>---------</td>
<td>-----------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>21.</td>
<td>Twelve-tone Aggregate</td>
<td>82</td>
</tr>
<tr>
<td>22.</td>
<td>Sectional Hierarchy of the Capriccio</td>
<td>84</td>
</tr>
<tr>
<td>23.</td>
<td>Event Partitioning in the Oboe Solo</td>
<td>86</td>
</tr>
<tr>
<td>24.</td>
<td>Layer Fluctuation, Capriccio</td>
<td>88</td>
</tr>
<tr>
<td>25.</td>
<td>Composite Density Factor, Capriccio</td>
<td>89</td>
</tr>
</tbody>
</table>
CHAPTER I

INTRODUCTION

In 1959, a young, relatively unknown Polish composer came suddenly into prominence when he entered three works in a national competition, Poland's Second Young Composer's Competition, and thereupon was awarded first, second, and third prize. After this instant success of the Psalmy Dawida, Emanacje, and the Strofy, the career of Krzysztof Penderecki (born November 23, 1933) progressed steadily. He has, since his first success, firmly established a reputation for himself not only as "Poland's best-known composer after Lutoslawski" (6, p. 112) but as an international leader of the post-World War II avant-garde. His reputation has also managed to reach outside the avant-garde circles:

It is a remarkable aspect of Penderecki's career that he has been able, and almost from the first, to write music of a wide and direct appeal which makes use of advanced vocal and instrumental effects and places no long-term reliance on tonality. His success may be ascribed to his treatment of momentous subject matter, whether religious or secular: tearing conflicts, drama, mourning and victory are his strong points. And yet his music contains the most subtle shades of sound alongside shattering blocks, delicacy as well as vehemence.(9, p. 349)

Penderecki's initial compositional studies occurred under F. Skolyszewski, and he continued his studies at the
State High School of Music in Cracow under Stanislaw Wiechowicz and Artur Malewski (11). Penderecki also taught at that conservatory, being appointed rector in 1972 (9). Over the years since his initial success he has collected an impressive number of awards, including the Westphalia Prize (1966), the National Prize, first class (1968), the Prize of the Union of Polish Composers, an honorary doctorate from the University of Rochester, New York, and honorary membership in the Royal Academy of Music, London (1975). Bradley Albers has compiled a chronological listing of Penderecki's compositions (1), which is shown in Appendix A.

Many of these works have received high honors. The Threnody to the Victims of Hiroshima was recognized by UNESCO's Tribune Internationale des Compositeurs in Paris, Dimensions of Time and Silence was presented at the fourth Warsaw Autumn, and Anaklasis received a premiere at the music festival in Dauaushingin (1, p. 18). The premiere in March, 1966, of his St. Luke Passion at Münster Cathedral in West Germany has been singled out as the most important event in establishing Penderecki as one of the most important composers of the second half of the twentieth century (13, p. 1645).

Descriptions of Penderecki's style often point to the eclecticism in his music and accordingly the diverse number of stylistic representations: "post-Webern serialism, aleatory, Ivesian and Bartokian dissonance. Dada a la Cage."
Name it, and it is in Penderecki's music." (12)

The writers also concur in a feeling that Penderecki's primary compositional element is raw sound, or
direct engagement with the matière sonore, virtually stripped of everything but its immediate impact as sound. Works like Penderecki's Threnody to the Victims of Hiroshima (1960) and his St. Luke Passion (1966) create intense, dramatic effects with their use of tone clusters, free choral babbling, Gregorian motifs, striking contrasts, and even major triads (10, p. 179).

Despite the novelty of Penderecki's compositional technique, this technique should be seen as part of the organic, evolutionary process that is twentieth-century music, (which in turn is part of the organic whole of music history), and not as an isolated phenomenon with no connection to the past. In an interview for Nutida Musik, Penderecki points out that even his most distinct compositional element has its basis in past styles:

The emancipation of sound colour as an equal element of the composition has a long tradition behind it. Listen to any of Tchaikovsky's symphonies, forgetting their harmonic evolution and the specific pitch of the various sounds, and concentrating only on the development of the instrumental sound, its colour, dynamics, register, the duration of each sound, its density and width in terms of the whole score, the kinds of figuration in the strings, etc. You will find that the evolution is extremely interesting in itself, rich and absolutely controlled. In artistic value, it sometimes considerably surpasses the harmonic content of the work--just compare it with the piano score. With Tchaikovsky, these things are, of course, still strictly connected with one another, and listening to him in the way I have proposed is an artificial experiment. It brings home, however, that a habit of responding to the sound of music took root a long time ago--although at first strictly in an interval context.
It can also be clearly seen that the hegemony of this factor has been increasing and at times became absolutely predominant. Take, for instance, the magnificent ending of the *Pathétique* with its gradual muting of the strings, down to cellos and double-basses in pppp. The choice of intervals is insignificant here, the important thing is the very effect of the softness of the strings gradually dissolving into a murmur . . . To me as a composer, this element of the composition, enriched with new sounds by new means of articulation, is what matters most (6, pp. 125-126).

To understand the evolution of Penderecki's compositional technique, it is useful to consider musical evolution throughout history. Keeping in mind that music history is an organic whole and not a series of disjunct blocks of time, we can nonetheless recognize four overall periods in musical history which represent fundamental differences in the actual organizational processes behind musical compositions. This is not to say that the chronological distinction is clear and that specific dates can be named as signaling the change from one period to another, as there is in fact a great deal of overlap among all four periods. The characteristics of each period, however, are quite distinct, and each period offers the analyst its own unique organizational properties. These periods are: (1) Music of Antiquity, (2) Pre-Common Practice, (3) Common Practice, and (4) Post-Common Practice (2, pp. 385-389).

Of these periods, the one most often dealt with in musical analysis is the Common Practice period, which encompasses the Baroque, Classical, and Romantic periods and
which includes the majority of the best-known composers in the present day concert repertoire. The primary characteristic of this period is the use of tonality based on tertian harmony, or triadic structures, and reliance on the major-minor system.

While little is known about the music of antiquity, the pre-Common Practice period is characterized by monophony and modal counterpoint, as well as the use of the church modes, and the twentieth century is characterized by attempts to develop and explore new principles of musical organization.

By far the most challenging of these periods to the music analyst is the twentieth century. This is certainly due in part to the simple fact that the music of this period is too recent to have received a thorough analysis as compared to music from previous periods, but it is perhaps due more to the incredible diversity of compositional approaches which exists in this century. Not only have composers in this century sought to avoid the norms of the past, they have also been somewhat reluctant to establish and follow new norms, so that a new composition is often not just a new arrangement of ideas within an existing style but creates an entirely new genre, and represents a totally new statement about what music is or should be. As Salzman puts it:

nearly all the creative musical thinking of our century--even that which is described as "conservative"--has participated in the search for new
forms . . . all twentieth-century musical art has had to establish its own expressive and intellectual premises (10, p. 2).

This attitude about music, which actually forms the basis of twentieth-century musical thought, can be seen as unique to Western culture and to recent centuries, although not just the current century. As Salzman later points out, some of our fundamental ways of thinking about music and musical creation are . . . inheritances from the recent past. Indeed, our whole notion of "art" and artistic creation as a unique and separable human activity is a relatively modern Western idea, by no means universal in human experience, and one which strongly links the "Romantic" era with the twentieth century. The notion of the creation and experience of music for its own sake is one that entered Western music at a relatively recent date, and in spite of many attempts in the last decades to modify this rather special conception of the role of music in our society, we still tend to think of the highest forms of music-making as the purest--that is, the most isolated and detached from other forms of human activity . . . The very notion of "the avant-garde" as it is usually understood is a nineteenth-century, Romantic conception (10, p. 3).

One might almost say that the nineteenth and twentieth centuries represent one period, characterized by the continuing search for new expressive means, and that the years around the turn of the century simply mark a collective decision by composers to abandon the existing norms of musical organization which nineteenth-century composers had more or less accepted and worked within. The fact that these two centuries are generally viewed as two entirely separate periods in musical history is evidence as to just how monumental this decision was.
Penderecki evaluates his position in this evolution in this way:

Is it in practice possible to cut oneself off from the whole history of music or to create a system of new laws without tapping the achievements of earlier periods? Can there be a generation with that immense a creative potential, however much it may have been dreamed of by each of them from Romanticism on? The revolution always proves incomplete because we bear too heavily a load of habits which make themselves felt even in our boldest explorations. Contemporary audiences often fondly imagine they are witnessing something totally transformed and draw an artificial distinction between the heretofore, or traditional, and the new, supposedly wholly unlike it . . . It is only the vocabulary that changes in music—the sound material and its grammar—but the general principles of consistency of style, logic and economy of development, authenticity of experience, remain the same. Good music is a concept which still means exactly what it used to (6, pp. 126-127).

In addition to the abandonment of functional tonality, the twentieth century has seen a revolution in attitudes about what actually constitutes a musical sound. Although the most radical and well-known manifestations of this revolution appear after World War II, the beginnings of this movement can be found much earlier.

Charles Ives stands out as an important figure in this revolution, as he was "the first important Western composer to stand outside the mainstream of European culture, and he was the first to propose . . . the totality and unity of the human experience as a subject matter for art." (10, p. 128) Ives's experimentation with musical elements can be seen as having a direct impact on attitudes about musical sound. His use of percussion and percussive instrumental effects
an important textural element is one evidence of this. Such usage of percussion also appears in music by Stravinsky and perhaps even more notably in works such as Varèse's Ionisation. Varèse was perhaps the first composer "to conceive of sounds as objects with sculptural, spatial configurations held together by rhythm's energy." (10, p. 134) He is said to have preferred the term "organized sound" when referring to his music, and it is in this attitude that we begin to see a basis for Penderecki's style.

At the same time that this revolution in musical attitudes was taking place, another revolution was occurring in audio technology, and it was inevitable that composers' search for new sound colors would lead them to explore this new electronic medium. The two primary areas in this new compositional medium were electronically synthesized music and musique concrète.

In both of these areas, but perhaps especially in musique concrète, we begin to see similar concepts which we find in Penderecki's music. The basic concept behind musique concrète is to replace the traditional material of music (instrumental or vocal sounds) with recorded sounds obtained from many different sources, such as noises, voice, percussion, and others. As a rule this material is subjected to various modifications: a recorded sound may be played backwards, have its attack or resonance cut off, be reverberated in echo chambers, be varied in pitch by changing the speed of the record or playback, be modulated in various ways, etc. The montage of the
resulting sounds on a final single or multi-track tape has been compared to the collages of certain 20th-century painters (2, pp. 560-561).

Because these sounds were often modified electronically, the total variety of sound colors made possible by this technique opened up a whole new world to composers. Electronic music centers were developed in several countries, and many important composers became involved, including Karlheinz Stockhausen, Edgard Varèse, Yannis Xenakis, and many others. It is interesting to note that both Stockhausen and Xenakis are often mentioned as forerunners to Penderecki's compositional style (9).

From the list of Penderecki's compositions in Appendix A, it can be observed that only two, the Psalmus of 1961 for electronic tape, and the Canon of 1962 for orchestra and electronic tape, actually use electronic sound. All others are either instrumental or vocal (or both), but utilize a greatly expanded collection of sounds which can be seen as being directly influenced by electronic music.

It seems that the limitations of electronic manipulation of sound began to be realized, and other compositional techniques, mentioned above, began to take shape.

Anything can be reproduced or synthesized on tape except the act of performance itself. The result was that the experience of working in the studio led composers back to the performance situation with a new understanding of that medium (10, p. 159).

Lukas Foss is perhaps more descriptive of the
phenomenon when he states:

Electronic music showed up the limitations of live performance, the limitations of traditional tone production, the restrictiveness of a rhythm forever bound to meter and bar line, notation tied to a system of counting. Electronic music introduced untried possibilities, and in so doing presented a challenge, shocked live music out of its inertia, kindled in musicians the desire to prove that live music "can do it too." When I say: "I like my electronic music live," the somewhat flippant remark contains a tribute. Via electronic music came a new approach not only to the above-mentioned instruments and voices, but to their placement on stage, to phonetics, to notation. Percussion found a new climate in a "handmade" white noise. Today, it appears to some that electronic music has served its purpose in thus pointing the way. "Tape fails," says Morton Feldman. And I remember reading in Thomas Mann: "Everything, even nature, turns into mere scenery, background, the instant the human being steps forward." (8, p. 47)

For the music analyst, the changing attitudes about music necessitated a re-evaluation of the subject of analysis itself, to determine to what extent traditional concepts and methods are applicable to the new music and to develop the necessary new concepts and methods. This is perhaps most evident in music such as Penderecki's, where, because of the novelty of his compositional technique, investigations of his music often fail to reach beyond mere description, usually focusing on the sounds utilized in the music and the methods by which these sounds are created. James Drew writes:

Currently it appears that top priority is being directed towards the "means" by which a work is brought into existence, rather than what the work will ultimately yield. This attitude is certainly not new to us, but it has again been more recently intensified.
Seen historically one cannot ignore the fact that this kind of misdirected analytical interest was in many ways responsible for the tremendously distorted understanding of Arnold Schoenberg's music during the early part of our century—a state of affairs that over a period of years has had an alarming affect on the general comprehension of all subsequent twelve note doctrine. . . Every artistic manifestation which is associated with a particular period of time finally undergoes an evolutionary transformation. This results in a new species which in turn becomes unique to the following period. But this observation can only be pertinent to one aspect of art, and that is the aspect known as style; style is an ever changing element and it stands apart from the act of human communication. . . Whatever the nature of the "means" might be we nevertheless still have the obligation of presenting a musical idea as accurately as possible (5, p. 89).

Edward Cone points out that such descriptions—informative as they may be, and often necessary preliminaries to further investigation of the music—fall short of achieving the goals of true analysis. He goes on to explain these goals:

In order to explain how a given musical event should be heard, one must show why it occurs: what preceding events have made it necessary or appropriate, towards what later events its function is to lead. The composition must be revealed as an organic temporal unity, to be sure, but as a unity perceptible only gradually as one moment flows to the next, each contributing both to the forward motion and to the total effect. What is often referred to as musical logic comprises just these relationships of each event to its predecessors and to its successors, as well as to the whole. The job of analysis is to uncover them explicitly, but they are implicitly revealed in every good performance. Description, restricted to detailing what happens, fails to explain why (3, p. 174).

To analyze Penderecki's music in this way requires that we look beyond the novelty of the technique and attempt to perceive whatever "musical logic" is present. In doing so,
we must determine to what extent past analytical practices can be put to use in analyzing Penderecki's music. Cone addresses this problem in this way:

The analysis of music of the periods closely preceding our own—the 18th and 19th centuries—has almost always assumed the applicability of certain familiar norms: tonally conditioned melody and harmony, periodic rhythmic structure on a regular metrical basis. Naturally such standards cannot be applied uncritically to the music of our own century, but on the other hand they should not be dismissed without examination. I contend that, in a more generalized form, they are still useful. Regardless of vocabulary, linear and chordal progressions still show striking analogies to older tonal procedures, analogies that are in turn reinforced by rhythmic structure. Only in those rare cases where the music tries to deny the principle of progression . . . are such analogies completely lacking (3, p. 177).

With music as radically different from the "traditional norms" as Penderecki's, one may doubt that such analogies truly are applicable. What is to be the basis for applying these analogies? In other words, what exactly are we to look for?

Cone provides a clue in answering this question when he states that "the best analysis is the one that recognizes various levels functioning simultaneously, as when a tone resolves once in the immediate context but turns out to have a different goal in the long run." (3, p. 178)

There has in fact been considerable work done in developing a vocabulary and a set of analytical methods for observing this kind of hierarchy of structure in tonal music. The work of Heinrich Schenker is by far the best
known example, but Paul Hindemith has also proceeded along these lines for the expanded tonal usage in the twentieth century. However, similar techniques which are not based upon tonal considerations are necessary before such levels can be adequately recognized in music such as Penderecki's.

It is, I suppose, possible that these deeper levels of structure do not exist within this music. Salzman states that the weakness of this music "is that the entire effect lies on the surface," although he does point out that "it is a surface of great, intense effect." (10, p. 179) It is also possible, however, that the vocabulary and techniques necessary to investigate such levels have not been adequately specified.

This, then, is the purpose behind the present work: to develop a vocabulary and a set of analytical techniques which will serve to point out underlying structure within this type of music. The study will focus on temporal aspects of the music, as this seemed from the outset to be one of the most quantifiable aspects in Penderecki's music. Cooper and Meyer have pointed out "architectonic levels" (4) within music and deal with these from the standpoint of rhythm. Yeston deals with "stratification" of rhythm in musical structures (14). Each of these works, however, deals with more traditional rhythmic concepts, such as the existence of a regular pulse and a low level of rhythmic complexity, at least in relationship to the music under
investigation. By "low level of rhythmic complexity" I mean that the durational proportions between attacks are generally on the order of one to one, two to one, etc., and rarely reach a higher complexity than three to two.

Allen Forte has dealt with more complex proportional relationships as seen in the music of Webern (7), but he again bases his analysis on the existence of a regular pulse, and on deterministic (although more complex) rhythmic proportions.

Neither of these characteristics are consistently present in the music of Penderecki, however. In this music, the very low level of rhythmic determinacy and lack of a regular pulse make precise measurements such as Forte's difficult if not impossible to make. Thus it becomes necessary to expand the focus on temporal aspects to the level that I call textural activity, by which I mean the combination of (1) rhythmic proportions, on a broader level than discussed above, (2) pitch motion, defined as pitch change occurring through time, and (3) the number of layers within a texture.

The pieces selected for this analysis are the Threnody for the Victims of Hiroshima, from 1960, the Fluorescences, from 1961, and the 1965 Capriccio for oboe and strings. The Threnody is one of the best-known compositions employing the compositional techniques discussed above, and thus presents a useful starting point.
The Fluorescences, from approximately the same period, uses sound in much the same manner as the Threnody but provides contrast in its scoring for full orchestra. The Capriccio is from a slightly different style period (9), and was selected to see if the newly developed techniques would find the same structural characteristics in a composition with a different musical character.

Chapter II presents a discussion and definition of the analytical method. The following three chapters thereafter apply this method to each composition, and Chapter VI presents overall comparisons, conclusions, and suggestions for further research.


CHAPTER II

THE ANALYTICAL APPROACH

In order to achieve a thorough analysis of each individual composition and still maintain consistency in analyzing all three, the following series of steps was followed for each piece:

1. Identify sectional divisions,
2. Identify discrete sound events,
3. Calculate textural activity,
4. Evaluate overall structure.

First, the sectional divisions within the piece are determined by performing a general survey of the overall composition. This seems to be an obvious first step, because the sectional characteristic of Penderecki's music is one of its most obvious features and is often mentioned in general discussions of the work. One writer, for example, has described the Threnody to the Victims of Hiroshima as "a series of contrasting sections, each of a different coloration, flowing into each other in the unity of the work's total impact." (3, p. 108)

Observing and specifying this sectional organization
provides a framework for further analysis in two important ways. First, once these sections are determined, more detailed measurements can be performed on each section so that the sections can then be compared to determine overall patterns, or musical "gestures." A "gesture" in this sense can be described as a general melodic or contrapuntal shape or direction combined with its level of textural activity to form the creation of a total musical effect. The type of gesture is determined by the speed, density, and overall direction of the sound, i.e. a general ascending, descending, or static character. Second, by observing the relationship of such gestures in textural activity to the sectional organization already determined, a sense of the total structural organization of the composition is achieved. For example, finding that certain underlying gestures follow exactly the sectional organization of a work would certainly be significant, but it would be as significant (and perhaps more musical) to find that the underlying textural activity presents contrary or complementary gestures to the obvious sectional organization, thus yielding a totality which is deeper in its overall structure. As it turns out, in the three pieces analyzed, the latter is most often the case.

What, then, are the factors which determine this sectional organization? In the statement quoted earlier the author referred to a "different coloration" in each section,
suggesting that changes in instrumental color mark the divisions between sections. The compositions certainly bear out this idea to a degree, as Penderecki often utilizes similar types of sound color in a given part of a composition. This is not always the case, however, and even so it would seem that other factors would be involved in sectional organization.

Silence would appear to be an obvious method of delineating sections. Silence is the "canvas" upon which musical events take place, and its occurrence within a composition could easily suggest a space between parts. We must keep in mind, however, that this can be true on many different levels, and that the proportional degree of silence must be taken into consideration when using it as a sectional delimiter. Consider, for example, the situation of a traditional melody, perhaps in quarter note rhythm, which is performed with staccato articulation. There would be perceptible silence occurring between each note, but no one would suggest that each note represents an individual section of the piece. We must also keep in mind that, through such instances of sudden color shifts, sectional delineation can and does occur without any occurrence of silence.

Traditional music achieves sectional delineation through what is usually referred to as the cadence. The Harvard Dictionary of Music defines a cadence as "a melodic
or harmonic formula that occurs at the end of a composition, a section, or a phrase, conveying the impression of a momentary or permanent conclusion." (1, p. 118) One cannot help noticing the exclusion of rhythm as a cadential element in this definition, and its restriction to pitch-based musical organization causes it to be of less help than hoped in analyzing Penderecki's music. We can, however, retain the concept of some kind of "formula" which closes a particular musical idea, and use this concept in developing a sense of cadential usage in the music under consideration.

Cone refers to the problem of cadence in modern music as that of locating the "structural downbeat," which he explains as meaning a phenomenon "like the articulation by which the cadential chord of a phrase is identified, the weight by which the second phrase of a period is felt as resolving the first, the release of tension with which the tonic of a recapitulation enters." (2, p. 182) Here again, the concept of cadence is based on somewhat "tonal" notions, but the implication in all cases is the same: some sort of musical gesture reaching completion. This, then, will be our definition of cadence; cadence will imply musical information which, due to its context within a piece, implies some form of completion.

It is important to note that the cadence, as defined above, plays a less predominant role in creating sectional
division in Penderecki's music than it does in tonal music. Figure 1 is an instance of sectional delineation caused by change in color alone, and thus is simply a termination or interruption of a section rather than the completion of an idea. On the other hand, Figure 2 shows an instance where change in color, a significant occurrence of silence, and the fact that a large-scale musical gesture is reaching completion, all combine to create a rather prominent sectional division. It seems, in examining all three compositions, that the structural importance of a sectional division is linked to the degree to which these various elements are present, which demonstrates the composer's control over all structural levels within the compositions.

Once this sectional organization is established, the next step in the analysis is to determine the basic referential idea upon which to base the analysis of each section and ultimately the piece as a whole. This concept is certainly not new, and in traditional musical analysis the fundamental structural unit takes various forms, such as the chord in harmonic analyses, the motive in melodic analysis, the key area in formal analysis, etc. In the music of Penderecki, however, none of the above concepts apply, at least directly. For this reason, as well as the particular rhythmic problems discussed in Chapter I, it is necessary to settle on a new type of basic referential idea, one which would in some way allow for an appraisal of
textural activity.

The concept for the referential idea finally decided upon actually can be related to electronic music and *musique concrète*, which, as discussed above, were important forerunners to Penderecki's compositional style. A basic technique in the creation of such music was to record large "chunks" of sound, all of which varied in duration and contained a very wide variety of internal textures and levels of activity, but which, nonetheless, were treated as complete units. These "chunks" would then be arranged and combined in various ways to create overall compositions. This concept manifests itself in Penderecki's music through his use of large "chunks" of particular sound colors which vary in duration and internal activity but which are again treated as complete units. His usual method of creating these chunks, which in my analysis I have called "discrete sound events," is demonstrated in Figure 3. Here we see a particular figure begin in the cellos, who then continue to repeat it while the other instruments gradually join in with the same figure until the entire texture consists of one "chunk" of sound. Despite the fact that the event contains numerous individual attacks and even a certain amount of variety in individual sound color, it can easily be perceived as one unit because of its relative homogeneity and its distinctiveness in comparison to the surrounding texture because of its internal level of activity and its
Fig. 3—Discrete sound event, Threnody, p. 6, (c) 1961 by PWP, Warszawa.
sound color. Thus a definition for a discrete sound event begins to take shape. A discrete sound event is an occurrence of a sound or collection of sounds which, as a unit, is distinct from the surrounding texture.

Several factors combine to distinguish events from the surrounding texture, many of which are the same as those used in identifying sectional divisions. These include occurrences of silence (with the same considerations discussed above), distinct timbre, and distinct levels of internal activity. The primary conceptual difference between discrete sound events and sections, other than a simple matter of scale, is the fact that sound events can occur simultaneously, overlapped, consecutively, or in any combination of these to create layers within a texture. In other words, the concept allows for arrangement in "space" as well as time, "space" in this case referring to the spectrum of overall sound quality, including timbre, pacing, etc. The concept of sections, on the other hand, is a one-dimensional concept referring to chronological ordering only. One would not, for instance, speak of two sections of the same piece occurring simultaneously.

Figure 4 presents another example of event usage. This particular page of the score contains three discrete sound events; one in the military drum and bongos, one in the strings, and one created by the typewriter.

Identifying the partitioning of these discrete sound
events is probably the most crucial stage in performing this type of analysis, as all future evaluation will be based on these judgements. Unfortunately, not all cases are as clear-cut as the examples just presented, and many require subjective judgement in deciding how much of a given texture is heard as a complete, distinct unit. In any such decisions, for any kind of music, the ear must be the final judge. Cone states that "true analysis works through and for the ear." (2, p. 174) The analyst must rely on a sense of how these musical sounds are heard in deciding how to partition the sound events.

This high degree of subjectivity may lead one to suspect the validity of comparisons based on such decisions. Indeed, it will be pointed out that numeric data derived from event measurements should be dealt with cautiously, and that less attention should be focused on the actual quantities involved than on the overall comparative contours observed. "Accuracy" is a somewhat difficult concept when applied to musical analysis, as it suggests that there is one uniquely correct way of hearing. To make this assumption, however, would be to lock oneself out of ever discovering new and unique aspects of music, which is a large part of the purpose for musical analysis. The key element in these analytical decisions must instead be consistency. If one is careful to apply the same criteria in all decisions involving event partitioning, then
meaningful results may be obtained.

After the critical step of determining event partitioning, the next step is to find some method of relating the events to each other. After all, deciding where chords occur within a traditional piece would hardly be considered harmonic analysis, and simply pointing out the discrete sound events in Penderecki's music, although challenging and often enlightening, leaves us short of our goal of appraising textural activity. In order to make comparisons among sound events, a set of criteria for such comparisons had to be developed.

One possible criterion for comparing textural activity of events is the relative pacing within the events. Pacing refers to the rapidity of the rhythm, and one method of measuring pacing is to determine the attack density, or the number of attacks per given time unit. This measurement provides a number which generally gives a precise indication of the pacing within a given section of a composition, but performing this measurement on Penderecki's music is somewhat problematic. The indeterminacy of many aspects of this music has already been mentioned, and Figure 3 further illustrates the difficulty. In this section, each instrumentalist repeats the notated figure continuously, as rapidly as possible, with the entrances of the instruments staggered at an unspecified time interval. An attempt to calculate a specific attack density for this section would
be futile at best. This type of activity represents a large percentage of all three of the works under consideration and disallows the use of a specific attack density measurement in comparing sound events.

Another problem with criteria based on individual attacks is that they ignore the pitch motion element of textural activity mentioned in Chapter I. Pitch motion refers to pitch change through time. This element would require a different type of measure, and once again we encounter the problem of indeterminacy. One could, of course, try to measure the rate of motion by determining the distance moved per given time unit, but the lack of precision in the rhythmic notation in these compositions would again make such measurements difficult to obtain and of less value than might be hoped.

The solution found for this problem has the benefit of transcending these surface level indeterminacies and focusing on a deeper, more determinate level of structure. It is to establish a scale of overall textural activity based on general observations of such factors as attack density and degree of motion. By first relating each event to this scale, accomplished by assigning it to one of the scalar categories, we can then compare events to determine their relationship with each other. Table I shows the textural activity scale which is used in the analysis of all three works, and lists representative events for each
TABLE I
TEXTURAL ACTIVITY SCALE

<table>
<thead>
<tr>
<th>Event Type</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Single 'point' of sound</td>
<td>Cap.*, beg.</td>
</tr>
<tr>
<td>2</td>
<td>Sustained narrow sound</td>
<td>Thren.*, C. 15</td>
</tr>
<tr>
<td>3</td>
<td>Sustained w/internal activity</td>
<td>Thren., beg.</td>
</tr>
<tr>
<td>4</td>
<td>Sustained pitch shift</td>
<td>Thren., C. 10</td>
</tr>
<tr>
<td>5</td>
<td>Pitch shift w/internal activity</td>
<td>Cap., M. 36</td>
</tr>
<tr>
<td>6</td>
<td>Reiterated pitch, rhythmically simple</td>
<td>Cap., M. 19</td>
</tr>
<tr>
<td>7</td>
<td>Reiterated pitch, rhythmically complex</td>
<td>Fluor.*, C. 19</td>
</tr>
<tr>
<td>8</td>
<td>Articulated pitch change</td>
<td>Cap., M. 60</td>
</tr>
<tr>
<td>9</td>
<td>Homogeneous sound complex</td>
<td>Fluor., C. 48</td>
</tr>
<tr>
<td>10</td>
<td>Articulated sound complex</td>
<td>Fluor., C. 55</td>
</tr>
</tbody>
</table>

*Cap., Capriccio; Thren., Threnody; Fluor., Fluorescences.

One point which must always be kept in mind when reading this analysis or executing a similar type is that the textural activity scale is not nor does it attempt to be an absolute scale. By this I mean that a category six on the scale, for example, is not intended to represent an actual quantity of anything, such that six is exactly twice as much as three, etc. It is instead only meant to represent a general category of texture. As it turns out, the categories have indeed been arranged in what seems to be a consistent increase in textural activity from level one through level ten. This is simply for convenience in making event comparisons.
I should also like to point out that these ten categories are not intended to represent the totality of all activity in all modern music, or for that matter even all of Penderecki's creative output. It is simply intended to represent the various types of discrete sound events observed in the three compositions under consideration, so that these events can be more readily compared with one another.

Once the discrete sound events have been identified, many measurements are possible using these events to gather information about overall textural activity. In the analyses contained herein I focus on two of these, "layer fluctuation" and the "composite density factor," both of which will be defined shortly. Chapter VI, however, discusses several additional possible measurements using discrete sound events for use in further research in this area.

As mentioned earlier, the concept of discrete sound events allows for arrangement within space as well as time. "Layer fluctuation" is an attempt to measure the varying degree to which this space is filled through the course of a composition, and is obtained by calculating the number of events within the texture at a given point of time. By charting these layers throughout a composition, as in Figure 5, and calculating the amount of time for which a given number of layers exists within the texture, an overall
Fig. 5--Threnody, pp. 18-19, (c) 1961 by PWP, Warszawa
picture of the spatial usage within the piece is obtained. Figure 5 demonstrates this technique.

At circle sixty-two, there are three sound events occurring simultaneously, as shown by the circles. The event in the twelve violins at the top of the score and the one in the contrabasses have just entered the texture at this point, while the event occurring in the string groups labeled I, II, and III is carried over from before. This three-layered texture lasts for eight and one-half seconds (such a precise estimate of time is made possible in this instance by the rare appearance of regular barlines), after which the string-group event comes to an end, leaving two layers in the texture. The sound event occurring in the cellos and basses then follows suit at circle sixty-six, leaving a texture consisting of a single sound event. (The entrance of the eight basses at circle sixty-five are a part of the existing sound event which began in the violins at circle sixty-two). Figure 6 shows a layer fluctuation graph for this part of the piece, with the horizontal axis representing time in seconds.

You will notice that the layer fluctuation measurement ignores the textural activity categories earlier assigned to each event. This particular measurement is intended to provide information about the number of layers within a given texture only, and thus the surface activity within each event is not a factor. In order to determine the
behavior of this surface level of activity over larger periods of time, other techniques need to be explored.

One possible approach to measuring this surface activity would be simply to calculate the average activity category for each section. This would indeed give a general sense of the level of activity within each section, thereby allowing the sections to be compared, but it would also gloss over some rather important aspects of textural activity. It would, for example, completely ignore the amount of time for which a given level of activity occurs, which is, in fact, an important factor in overall pacing. Also, by ignoring whether the events within a section occur simultaneously or consecutively, this general average could conceivably provide deceptive data. For example, one section which contains three discrete sound events, of types three, six, and nine respectively, all of which sound simultaneously for the duration of the section, would yield
an average activity of type six. Another section containing one discrete sound event of type six would yield the same result. By looking only at the average activity type, we would conclude that the two sections contain identical levels of activity, and yet the first section, which contains level nine activity for its duration plus two additional textural layers, would be perceived as more active. Thus it is necessary to develop a way of measuring this activity by considering not only the categories present but also the relative durations of each type and the number of layers within the texture.

The solution to this problem used in these analyses is illustrated in Figure 7. Here the activity types of each event have been multiplied by the duration (in seconds) of the event, after which the products are added together and the sum divided by the total duration of the section (in seconds). This process is expressed by the following equation:

\[
\frac{(c_1 \times t_1) + (c_2 \times t_2) + \ldots + (c_n \times t_n)}{T}
\]

Where:
- each \(c\) = an event category,
- each \(t\) = the duration of each \(c\) (in seconds),
- and \(T\) = Total duration of the section (in seconds).

The result is a number which reflects textural activity within the section by taking into account relative durations and layers in the texture. It should again be pointed out that the numbers used in this equation do not refer to
Fig. 7—Composite density factor, Capriccio, p. 12, (c) 1968 by Moeck Verlag, Celle. Composite density factor = 5.2.
specific quantities but instead to a general ranking of textural activity. Therefore, the result of the equation also does not refer to a specific quantity but is simply to be used for general comparison between sections.

In the above example, there are actually no occurrences of a texture deeper than a single layer. Thus the composite density factor in this section represents an average which is weighted by the relative durations of each event type. Figure 8, on the other hand, shows a section containing two textural layers. From this example we see that multiple layers dramatically affect the composite density factor, multiplying the weighted average mentioned earlier by the number of layers. In other words, a section containing two simultaneous events of type two would have a composite density factor of four. This is indicative of the fact that multiple textural layers squeeze more textural activity into a smaller amount of time, thereby dramatically increasing the density of the overall texture.

Chapter I stated that one of the primary goals in applying these analytical techniques is to locate hierarchical levels of structure within Penderecki's music. The final step in these analyses, therefore, is to examine the collected data for evidence of such levels. Such evidence would manifest itself by the appearance of large-scale patterns or gestures on the underlying structural levels. Once these gestures are identified,
Fig. 8—Two layers, Capriccio, p. 23, (c) 1968 by Moeck Verlag, Celle. Composite density factor = 5.7.
general observations can be made about how the deep levels of structure interact with surface levels to give the piece its overall character. One observation which I find fascinating is the structure's relationship to the ancient concept of the "Golden Section," (4, pp. 17-26) often considered to be the perfect proportion. This point, roughly corresponding to the end of the first sixty-two percent of the piece, is therefore calculated for each piece and included on each graph for general observation. It is in these overall structural observations that the hierarchical structure of the piece begins to come into focus, and the role of each individual particle in the structure becomes clearer. The relative success of the analytical method in pointing out such roles also becomes apparent at this point.

This method assumes the role of "departure point" rather than "final word" on structural or textural analysis of this type of music, and it is not suggested as the only method of perceiving such organizational principles. The fact that meaningful relationships are obtained through the application of this method to these particular compositions, however, creates a certain amount of hope that the techniques presented here will prove useful in further research in the analysis of modern music.


CHAPTER III

THRENODY TO THE VICTIMS OF HIROSHIMA

The Threnody was composed in 1960 and first performed in 1961 at the nine-day Festival of Contemporary Music in Warsaw, a meeting ground for new music from both the East and the West. In 1961, the Threnody was distinguished by a UNESCO award, the Tribune Internationale des Compositeurs, and was given the Polish State Artistic Prize the following year. The work has since established itself as a milestone of the late twentieth-century avant-garde.

The word Threnody comes from the Greek "threnos," which is a song of lamentation (1, p. 794). As in many twentieth-century compositions, the title is an integral part of the overall dramatic quality of this work. It should not, however, be considered program music, despite the fact that many listeners have attempted to find references within the music to specific sounds from the tragedy itself, such as "the fading hum of the bomber as it leaves its completed mission" or "the wailing of the living left to mourn the dead." (2, p. 108) Instead, it is, as the title states, a song of lamentation for the victims of the Hiroshima holocaust.

The string orchestra for the Threnody consists of
twenty-four violins, ten violas, ten cellos, and eight contrabasses. The instruments are treated with total equality in Penderecki's orchestration as demonstrated in the opening sound of the piece. All instruments begin the piece in the same way, by sustaining the highest note possible on the instrument. Throughout the composition, the instruments participate equally in each type of sound event, and all instruments are used to create a wide variety of sounds. Page three shows the abbreviations and special symbols used in the score (3), and is evidence of Penderecki's utilization of a full range of possible sounds created by string instruments.

Despite the variety of actual sounds utilized in this piece, the types of sound events which occur can be divided into three categories, accepting slight variation. These are: (1) the long sustained sound block, as at the beginning of the piece; (2) the "pitch-shift" event, as at circle ten, Figure 9; and (3) the articulated sound complex, as at circle twenty-six. This general economy of means creates cohesiveness within the composition, and also contributes to the overall somber effect of the work.

One rather interesting compositional technique used in the Threnody is the use of strict imitation beginning at circle twenty-six, a section also notationally unique in the use of apparent "measures" (Figure 10). At this point Penderecki creates three groups of instruments, each
Fig. 9—Event partitioning, Threnody, p. 8, (c) 1961 by PWP, Warszawa.
Fig. 10—Threnody, p. 13, (c) 1961 by PWP, Warszawa
containing four violins, three violas, three cellos and two contrabasses. (The remaining instruments are tacet until circle sixty-two). The first group begins with a complex collection of sounds which lasts for a total of thirty seconds, "cadencing" (as discussed in Chapter I) in the final seconds with a shift to a more homogeneous texture. At circle thirty-eight, group I continues the complex texture while group II enters with a strict imitation of what group I played at circle twenty-six, in what can be called "textural inversion", where the higher pitched instruments reverse textural roles with the lowest pitched instruments. After thirty more seconds, group III enters with material from the fifth measure of the original material. The composer's mastery of contrapuntal technique is revealed in that all three instrumental groups, despite their contrapuntal entrances, converge using the same sustained event category at "measure" forty-eight. Of course, it could be argued that the complexity of activity in this section makes it extremely difficult to recognize the imitation which occurs, and for this reason one might be tempted to dismiss its significance. Such judgements should be made only after further analysis of the piece as a whole, so that the structural significance of this portion of the piece can be determined. This will be one of our goals in the analysis of textural activity.

As discussed in Chapter II, it can be very useful
analytically to look for obvious sectional divisions of any composition. This is perhaps especially true in the case of Penderecki's Threnody, as the distinct sectional organization of the work is one of its most obvious features. The cadential gestures of the Threnody which lead to these divisions take on various characteristics. Perhaps the most prominent means of achieving cadence in any composition is the use of silence, which is certainly the most obvious signal that a musical idea has ended or has in some way been interrupted. We must exercise caution, however, in assuming that any occurrence of silence signals the end of a section, because silence can and often does occur as an internal part of a sound event. At circle twenty-six, the "pointillistic" texture creates a situation in which silence occurs at least as frequently as sound. In this instance, the short durations of silence along with the homogeneity of the overall texture negate any feeling of cadence. We must, therefore, be careful in deciding at which structural level the silence occurs, whether between sound points, between sound events, or between sections.

Circle sixteen marks a short period of silence which does in fact occur between sound events. However, because of the close similarity of the events and the overall gesture created by the rise in activity type from circle fifteen to circle eighteen, we can consider this to be more of an interruption within a section rather than a sectional
cadence. A traditional version of this concept is the "period form," in which the antecedent phrase presents a temporary cadence which is then answered by the consequent phrase, thus creating a larger gesture. The section between circle fifteen and circle eighteen can almost be seen in these "antecedant/consequent" terms. Silence, then, although an important cadential characteristic, cannot be used as the only means of determining sectional organization.

Texture also plays an important role in delineating sections in the Threnody. At circle six, for example, there is no actual occurrence of silence (although the dynamic level has diminished to a level approaching silence), but the entrance of a completely new type of sound event signals the beginning of a new section. Circle sixty-two marks a very similar example, except that in this case the event types have been reversed--this time a sustained sound event begins after what had been a "pointillistic" texture. These two instances are the most dramatic changes of texture in the piece and signal a symmetrical relationship between the beginning and ending of the work.

With these factors of sectional organization in mind, we can begin to determine overall sectional divisions. Figure 11 graphs the sectional organization of the Threnody, showing the relative durations of each section.
In this graph the symmetry mentioned above is further demonstrated, although somewhat shifted to accommodate the concept of the "Golden Section." Points A and B mark the textural changes mentioned above.

\[\text{Fig. 11--Sectional organization of the Threnody.}\]

\*Golden Section.

With this sectional information providing a background, we can now use the analytical techniques from Chapter II to gain a sense of the relative activity within and among sections. By measuring event usage in these ways we can see how the rhythmic activity of the work interacts with the factors discussed above to create the underlying structure of the Threnody. The first, most critical step in performing this analysis is partitioning the discrete sound events and assigning to each an activity category. Some of the key decisions made in partitioning these sound events warrant further discussion.

The first such decision occurred at the beginning of the piece (Figure 12), where I have chosen to consider the entire first page (forty-nine seconds) as a single sound event. It can be argued that every instrumental entrance,
Osiarom Hiroshima
TREN

Fig. 12--Threnody, beginning, (c) 1961 by PWP, Warszawa
each of which is indeed audible as a new sound, constitutes a separate sound event, and perhaps that even the individual changes to *tremolo* or the *subito* dynamic changes constitute separate events. These are in fact "changes" in the texture on the surface level, but, as discussed in Chapter II, are not distinct at the structural level which I have defined as the discrete sound event. Although the entrance of each instrument is audible, its sound immediately becomes part of the existing sustained sound, so that the overall effect is that of a single sustained sound with internal activity (activity type 3). The "pointillistic" activity of the cellos beginning at circle six is distinguishable as an entirely different sound and thus marks the beginning of a new discrete sound event.

The section between circle ten and circle fifteen presented another problem in determining discrete sound events. The cello figure of the first fifteen seconds could be considered one event with internal activity or as four separate events, as in Figure 9. Because this kind of figure occurs often in this section (but only in this section), this decision would be of considerable consequence when the actual levels of activity are determined. In the end, the decision to consider the figure as four separate events was based on the fact that each of these smaller events can be heard as a distinct type of activity, while this cannot be said for the figure as a whole. While this
subjectivity in such a decision may seem to diminish the validity of the overall analysis, an important aspect of any system is its consistency with the other decisions made throughout the work.

Circle twenty-six marks the beginning of a section which is pivotal to the work in many ways. In addition to the implementation of strict imitation mentioned earlier, the longest period of silence occurring in the piece occurs immediately before the beginning of this section, lending even more significance to the section. This is the only part of the entire work which utilizes symbols similar to traditional rhythmic notation, even going so far as to include what could be considered barlines to mark sections of time. There are six of these "measures" every fifteen seconds, so that each measure is two and one half seconds long, and each one contains two quarter notes of value. The section could in fact be rescored as being in 2/4 meter at quarter note = 48. The fact that the composer chose not to include this level of determinacy, however, should be taken into account when making analytical and performance decisions about the work.

Event partitioning within this section could range between two extremes. At the most surface level, one could consider each individual attack as a separate event. Even with very careful listening, however, the sheer number of attacks within the texture makes it extremely difficult to
hear each as an individual event, and partitioning the events in this way would not be consistent with partitioning elsewhere in the piece. Also, the combination of these individual attacks creates an overall texture which does give a sense of one sound (although an admittedly very active sound) which can thus be considered a single sound event.

The other extreme in partitioning this section would be not to partition it at all and consider the entire section, from circle twenty-six to circle sixty-two, as a single event. Such a decision by a conductor of this piece would result in a lack of variety within the section. The occurrence of imitation within this section should not be ignored, and one could consider each "entrance" of the imitated material to be a new sound event. Also, if we examine the fifteen seconds immediately preceding circle thirty-eight, we observe a sudden change from the "pointillistic" texture to an almost static sonority. This change in the texture helps provide a sense of cadence which leads into the entrance of the second instrument group at circle thirty-eight. Each of these parts is a discrete sound event, and I have treated them each as such in my analysis.

After deciding on the event partitioning throughout the piece, the next step in the analysis is to assign activity levels to each event. Table II lists the event types and
representative events from the Threnody for each event type.

TABLE II
TEXTURAL ACTIVITY SCALE--THRENODY

<table>
<thead>
<tr>
<th>Event Type</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Sustained narrow sound</td>
<td>Circle 15</td>
</tr>
<tr>
<td>3</td>
<td>Sustained w/internal activity</td>
<td>Beginning</td>
</tr>
<tr>
<td>4</td>
<td>Sustained pitch shift</td>
<td>Circle 10</td>
</tr>
<tr>
<td>5</td>
<td>Pitch shift w/internal activity</td>
<td>Measure 17</td>
</tr>
<tr>
<td>10</td>
<td>Articulated sound complex</td>
<td>Circle 26</td>
</tr>
</tbody>
</table>

Figure 13 shows the layer fluctuation for the Threnody, with the amount of time for which each level occurs also represented. This chart demonstrates several interesting aspects of structure within the piece. As can be seen, most of the Threnody stays within a fairly narrow band of layer fluctuation, generally alternating between one and two layers of texture. There are, in fact, only two occasions where the texture strays outside this narrow band: immediately before section 0, where the only significant duration (five seconds) of silence (zero layers) occurs, and immediately following section 0, where three separate layers occur simultaneously for a duration of eight seconds. These two occurrences provide a "frame" for section 0, and further point out the structural significance of this particular part of the piece.

Another interesting aspect of structure made apparent by examining layer fluctuation is the cadential
characteristic of each section. Every section which actually contains an occurrence of more than one textural layer concludes with a decline to a single layer or, as in section N, a decline to zero layers. On a somewhat deeper level, we can see how the piece begins and ends with entire sections containing a single layer, and the widening of the fluctuation in section N through section P provides an area of climax.

Fig. 13--Layer fluctuation, Threnody

While layer fluctuation provides a measure of activity at a deep structural level, the composite density factor discussed in Chapter II is a means of combining this deep level measurement with surface level information to provide an overall sense of activity. Figure 14 shows the composite density factors for each section, and it is in this measurement that we begin to gain a real sense of the organization of textural activity in the Threnody. This factor seems to coincide with the observations made earlier in several ways. First, the near symmetry of the work can be observed in the fact that it both begins and ends with sections at the same composite density factor, three, which
is the lowest in the piece. The contour of the graph also points out this characteristic.

Fig. 14--Composite density factor, *Threnody*

We can also observe the cadential gesture noticed earlier at the sectional level, this time at a higher structural level. In Figure 14 we see two such occurrences, with the high level in section K gradually subsiding to a level very close to the beginning level, concluding with the five seconds of silence before circle twenty-six. This gesture is followed by the other high point of the piece, which in turn is followed by a similar decline to the level at which the piece began. This cohesiveness at different structural levels, made obvious through these analytical
techniques, is the aspect most often overlooked in discussions and performances of Penderecki's music, and demonstrates that even music with a "surface of great, intense effect" (4, p. 179) can achieve effects at deeper structural levels as well.
CHAPTER BIBLIOGRAPHY


CHAPTER IV

FLUORESCENCES

While the Threnody to the Victims of Hiroshima represents a compact form with compact instrumentation, the Fluorescences of 1961 represents an expansion in both aspects. It is scored for full orchestra, including piano and four "batteries" of percussion instruments, ranging from such traditional instruments as timpani to less conventional concert instruments such as "a piece of wood," "a piece of iron," saws, and a typewriter. Page three of Penderecki's score lists the orchestra used in Fluorescences (1).

Pages four and five of the score list the special techniques and symbols used in Fluorescences. Most of the string techniques are recognizable from the Threnody, with the addition of the techniques of striking the strings with the open hand or fingers and of tapping the desk (music stand) with the bow. In this piece, Penderecki revised the notation for tapping the soundboard in the strings. The addition of wind instruments to the ensemble adds still more sound production techniques, including playing the reed or mouthpiece alone and striking the keys alone to produce percussive sounds.

The clear sectional organization that we first observed
in the **Threnody** is also a characteristic of **Fluorescences**. The extremely wide range of sounds and dynamic levels made possible by the large ensemble is fully exploited to achieve this sectional division. The types of sound events within sections are relatively uniform, so that sharp changes in texture signal the beginning of a new section. Figure 15 illustrates this kind of textural cadence.

An interesting similarity between this composition and the **Threnody** is the inclusion in each of a strikingly unique section, in comparison to other sections, proportionally placed at approximately the same location within each piece. In the **Threnody** it was the section containing strict imitation and "pointillistic" texture, while in **Fluorescences** it is the section between circle 68 and circle 85, which contains 135 seconds of timbral metamorphosis on the single pitch C. This technique is not unique to this composition, having been utilized previously by Castiglioni in **Tropi** and by Elliott Carter in **Eight Etudes and a Fantasy**, one of which remains on a single pitch from beginning to end. Its utilization in this piece is particularly interesting, however, because of the work's overall emphasis on a wide diversity of sounds, most of which are barely distinguishable as definite pitches. The entire composition seems to point out the fact that pitch can be stripped of its importance as a structural element not only by utilization of sounds of indeterminate pitch but
Fig. 15—Textural Cadence, Fluorescences, p. 17, (c) 1962 by Moeck Verlag, Gellers.
also by removing all pitch change, so that attention is drawn to change in other musical parameters such as timbre.

The overall pitch usage in *Fluorescences* is quite similar to what we observed in the *Threnody*. With the exception of the single-pitch section discussed above, all other instances of specifically notated pitches occur in clusters, the notes of which are spaced by equal intervals. Penderecki uses these equidistant clusters to fill particular frequency bands with varying degrees of density. This can almost be related to the electronic music concept of narrow-band noise, sometimes called "pink" noise.

In beginning the analysis of textural activity in *Fluorescences*, there were many crucial decisions to be made. As was the case in the *Threnody*, event partitioning is generally quite apparent from a quick scan of the score. Figure 16 shows the beginning of the piece, including event partitioning. The only event of the entire first section with an activity type other than three is the sustained piano sound at circle three, which is type two. It could, of course, be argued that this is simply the ending of the event which began the piece, but the fact that the accompanying sounds which participate in this event end and another event begins at circle three causes this piano sound to be heard as a separate, albeit transitional, sound event.

One interesting lack of event partitioning occurs at circle twenty-seven. At this point, the oboes, clarinets,
Fig. 16—Event partitioning, Fluorescences, beginning, (c) 1962 by Moeck Verlag, Celle.
and violas enter a texture of flutes and violins, all playing very dissonant, extremely high-frequency clusters (the strings producing harmonics). This entrance is indeed a contrasting timbre and thus might be considered a separate sound event. However, the fact that this entrance only increases the band width of the cluster and that the dynamic level is not only notated as quadruple piano but also with an additional direction stating "as soft as possible" makes it fairly obvious that this entrance is a continuation of the existing sound event. Circle forty marks a very similar instance, where visual investigation of the score indicates that several separate events are taking place in the flutes, clarinets, and oboes. These entrances of the three instrumental groups actually constitute contrapuntal entrances within a single event.

Circle six, on the other hand, presents a somewhat contrasting example. Here the piccolos and violins, playing the highest pitch possible on each instrument with an extremely rapid tremolo, combine with whistles to produce a sound event which is clearly distinct from others around it. Seven seconds later, at circle seven, the strings continue the same sound, although now at a piano dynamic level, joined by an alarm clock, a sound fairly similar to the previous sounds. In glancing at the score one might be tempted to consider this to be simply a continuation of the previous sound event. The actual aural effect is quite
different, however, because of the sudden ending of the
whistles, piccolos, and brass sounds. This is an example of
a discrete sound event created more by the ending of
existing sounds than by the beginning of new sounds.

Perhaps the most difficult event partitioning is found
in the monotone, timbral metamorphosis section (beginning at
circle sixty-eight) discussed above. All activity within
this section is achieved by constantly adding new
instrumental colors to the texture while removing others.
Do we therefore consider each instrumental entrance to be a
separate sound event, or is the entire section actually one
continuous event? In fact, neither of these interpretations
would be consistent with other event decisions, the latter
because of the large amount of time involved (135 seconds),
and the former because, in other similar instances, the
instrumental entrances have been considered to be
contrapuntal entrances within a single event. Fortunately,
the composer has provided a compromise between these two
extremes by dividing this area of the piece into three
smaller sections, beginning at circles sixty-eight,
seventy-six, and eighty-one. This division is accomplished
by introducing single *sforzando* sound points to the texture
to create an initiating gesture (Figure 17). Each of these
sound points is a discrete sound event (activity type one),
and their addition to the texture at the points mentioned
above provides sectional division for this part of the
Table III lists the activity categories occurring in Fluorescences, including representative events for each type. One of the more interesting occurrences in this regard is at circle fifty-five. This is the most active event encountered thus far in either Fluorescences or the Threnody, primarily because of the large number of instruments in the texture, all of which are performing complex patterns.

### TABLE III

**TEXTURAL ACTIVITY SCALE--FLUORESCENCES**

<table>
<thead>
<tr>
<th>Event Type</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Single 'point' of sound</td>
<td>Circle 76</td>
</tr>
<tr>
<td>2</td>
<td>Sustained narrow sound</td>
<td>Circle 26</td>
</tr>
<tr>
<td>3</td>
<td>Sustained w/internal activity</td>
<td>Circle 68</td>
</tr>
<tr>
<td>4</td>
<td>Sustained pitch shift</td>
<td>Circle 102</td>
</tr>
<tr>
<td>7</td>
<td>Reiterated pitch, rhythmically complex</td>
<td>Circle 19</td>
</tr>
<tr>
<td>9</td>
<td>Homogeneous sound complex</td>
<td>Circle 48</td>
</tr>
<tr>
<td>10</td>
<td>Articulated sound complex</td>
<td>Circle 55</td>
</tr>
</tbody>
</table>

A chart of the layer fluctuation in Fluorescences presents a somewhat different but equally revealing picture of the activity as that of the Threnody. Figure 18 gives a graphical representation of the layer fluctuation within Fluorescences. It is interesting to note that the texture reaches as many as four layers, and that it does so four separate times throughout the piece: at circles twelve,
The first two such occurrences are quite similar, each occurring as the summit of a step-like gesture. The final two instances are also similar to each other but different from the first two in that they appear almost suddenly out of a relatively shallow texture and then taper off. These two contrasting types of gesture serve as a frame for the entire work and create a deep level gesture, shown by line Z in Figure 18, of rising and falling.

In comparing the layer fluctuation of Fluorescences to that of the Threnody we not only have more layers occurring in Fluorescences but also more variety in the large scale gestures. In the Threnody, every section ended with a decrease in textural depth, whereas in Fluorescences we find several sections ending with increases in the textural depth. Sections C, D, J, and L cadence in this manner, and section M contains two textural layers throughout. This added variety at a deep structural level echoes the added variety in sound color made possible by the large orchestra.

Also notable from Figure 18 is the fact that certain gestures take place across sectional boundaries, creating further stratification within the piece. The two step-like gestures occurring in the first four sections have already been mentioned, and the latter half of the piece contains cadential gestures consisting of decreasing activity which cross sectional boundaries.
Fig. 18--Layer fluctuation, Fluorescences

Fig. 19--Composite density factor, Fluorescences
Figure 19 graphs the composite density factor for each section, and again we see an increase in the complexity of the form in comparison to the *Threnody*. While it doesn't demonstrate the same clarity observed in the *Threnody*, it does further point out the concepts of overall gesture and deep structural levels of textural activity. One cannot help noticing upon examining Figure 19 the series of identical or near identical pairs of numbers between sections C and H. While these data do point out a certain similarity between the particular sections, we must not place too much significance on the fact that the numbers are identical, because they are based on a large number of decisions, many of which are quite subjective or contain a low level of determinacy. As discussed in Chapter II, we can use the composite density factor only for making general observations and comparisons.

Another interesting aspect of Figure 19 is the way that the important timbral metamorphosis section is pointed out. The unique section in the *Threnody*, characterized by the strict imitation between circle twenty-six and sixty-two, appeared on the composite density factor graph as one of the most active in the piece, whereas the unique section of *Fluorescences* appears as the least active—less active, in fact, than the beginning and ending of the piece. The element common to both sections, however, is the contrast with surrounding sections which points out their
significance to the structure of the respective compositions. Thus is revealed Penderecki's mastery at utilizing seemingly opposite techniques to achieve the same goal, and at achieving such a goal at several structural levels. It is in this way that the value of the analytical techniques used to uncover these levels is also revealed.
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CHAPTER V

CAPRICCIO

The Capriccio for oboe and eleven strings represents a departure from the style of the two works previously examined. This departure is representative of a general change in direction which "came to Penderecki's music around 1964, a change which may be described as a turn towards tradition." (4, p. 349-350) It shows up in the Capriccio in several ways, the most obvious being an increased reliance on definite pitch as an organizational element. The overall notation of time elements is also quite different from either of the two previous works, using measure lines every second (or thereabouts) instead of large blocks of time, and including such traditional temporal directives as *piu mosso*, *ancora piu mosso*, *meno mosso*, and *presto possibile*. Inclusion of the regular measure lines allows for far greater control and determinacy in rhythmic activity, although still not to the point of traditional metrical notation. This increased control is also achieved through the temporal directives, which control the duration of each measure. Another aspect of the rhythmic notation which is closer in appearance to traditional notation is the extensive use of stems, beams, and flags in notating
articulated rhythms. This notation did, of course, appear in the other works, most notably in the Threnody's strict imitative section, where the extremely precise rhythmic notation could almost be considered metric. It is the fact that the Capriccio contains such a high percentage of this type of notation which seems significant, however, and this significance should be taken into account in making an analysis of textural activity.

It is, in fact, important that we investigate the usage of all the seemingly traditional notational techniques used in the Capriccio in our analysis. How are the stems, flags, and beams used? Do the temporal directives suggest the presence of a regular beat, which is to be accelerated and decelerated accordingly? The presence of measure lines at regular intervals certainly seems to support such an idea. Figure 20 will serve in attempting to answer these questions.

This example shows the use of stems and beams typical of the composition. The beginning of this section contains two score markings, one a large Piu Mosso (more motion), the other in smaller type directing tempo rubato marcato. This suggests that the overall tempo (as determined by the rate of the measures) is to increase slightly, and that the articulation of the individual notes is to proceed in a rubato manner; that is, in "an elastic, flexible tempo involving slight accelerandos and ritardandos that alternate
according to the requirements of the musical expression." (1, p. 742) The suspicion that these eighth note values are not literal eighth notes is strengthened by the fact that this solid note-head, single-flag note is the only such traditionally notated rhythmic value used throughout the piece, but it does not always represent the same time value. For example, the oboe in measure seventy has four of these note values to fill the measure, while the cello has five of the same note values to fill the same amount of time. Many similar examples occur throughout the piece, ranging from three "eighth notes" per measure to six. These eighth note values must, therefore, represent a semi-regular articulation (as indicated by tempo rubato) of the notated pitches, with the beams designating larger groupings to be performed within the amount of time specified.

This, then, helps us to decide whether the measure lines in fact represent actual beats or simply provide reference points for performance realization. As it turns out, the overall irregularity of individual attacks within the texture negates any feeling of regular beat, so that the overall effect of a sustained, although very active, mass of sound is actually much closer to what occurs in the other works examined than is immediately apparent.

Without the existence of a regular beat, the temporal directives in the piece must represent changes in overall pacing of sound, or textural activity. Thus we can see that
what may appear to be a return to traditional rhythmic
concepts is actually an attempt to achieve finer control
over the same types of textural activity which were observed
in earlier compositions.

The instrumentation in the *Capriccio* is somewhat
thinner than in the two other compositions, consisting of
the solo oboe, six violins, two violas, two cellos, and a
contrabass. The same special instrumental performance
techniques are present in this piece, although their usage
represents a lower percentage of the overall composition.
When such devices do appear, as in measure 111, it is
usually as a sudden interrupting or cadencing gesture,
reinforcing the "capricious" character of the piece. The
oboe in particular seems to have avoided such special
effects, especially in comparison with the many unusual
sounds produced by the wind instruments in *Fluorescences*.
One somewhat notable technique in the oboe part is at the
beginning, where the oboe is instructed to perform a "double
trill (utmost rapid) [sic]." (3, p. 4) This is achieved
by using both hands to produce the trill, where "the second
hand is ninety degrees out of phase with the first hand,
thereby doubling the speed at which the trill is produced."
(2, p. 80) While the double trill is usually used to
achieve an extremely rapid trill to one additional pitch, in
this case the two trills are to two different pitches, one a
half step, the other a whole step above the notated pitch.
The effect is one of an extremely active, somewhat dissonant sound.

As mentioned earlier, the use of definite pitch as an organizational element is one characteristic of the Capriccio not encountered in the other two works. While we still want to concentrate on textural activity rather than pitch usage, a few words on the organization of pitch in this piece are certainly not inappropriate. Indeed, it may be interesting to compare our general observations about pitch organization to the more detailed information about textural activity which we will collect later to see how, at least in a general way, the two elements interact.

The most general observations we can make about pitch usage are the beginning and ending pitches, both of which are unison sounds (allowing octave displacement), with the piece beginning on D and ending on B. The first few sections of the piece seem to suggest a chromatic expansion away from the D, with the first additional pitches encountered being E flat, C sharp, E natural, and C natural, and this general idea is maintained throughout most of the piece. In the section between measure 60 and measure 100, for example, the chromatic scale from E flat down to B flat provides all pitch material. This suggests a sort of pitch frame for the piece, as the E flat is one half-step above the first pitch of the piece and the B flat is one half-step below the last pitch. This does not explain all pitches
used within the piece, of course, as all other pitches from
the chromatic scale occur in the piece, but even many of the
deviations can in some way be related to this idea. For
example, the section beginning in measure 305 contains
material strikingly similar to the beginning of the piece.
The suspected importance of this section is reinforced by
the *poco rallentando* just before this section and the *meno
mosso* marking in measure 305. The primary difference
between this section and the beginning is that it starts on
G rather than on D, but the G is expanded chromatically in
the same manner as the beginning D, and even the perfect
fourth from the D up to the G echoes the perfect fourth
between B flat and E flat in the section mentioned.

Another observation helps to explain this pitch usage
in a somewhat more specific manner. A twelve-tone pitch
aggregate occurs in the lower strings beginning in measure
112 (Figure 21). These fugal entrances of the aggregate are
the only such clear-cut usages of a twelve-tone aggregate
throughout the piece, but examining the row helps explain
other pitch usage. If we consider the possibility of
tetrachordal and trichordal rotation, then almost all pitch
material in the *Capriccio* can be related to this row.

To explain the sectional organization of the *Capriccio*
we apply the same criteria as in the previous analyses, such
as textural changes, occurrences of silence, etc. The
*Capriccio*, however, contains a deeper hierarchy of
Fig. 21—Twelve-tone aggregate, Capriccio, p. 11, (c) 1968 by Moeck Verlag, Celle
sectional organization than was observed in the other works. In other words, there are many small sections in the piece, which can almost be referred to as "phrases," and which are combined to create larger sections, etc. What makes this piece unique is the degree to which the organization has been refined, with each level of the hierarchy receiving a different type of cadential gesture. The composer even helps in pointing out the highest level of this hierarchy by including temporal directives. This again points to an increased desire for control by the composer over the elements of structure within the composition. Figure 22 shows this sectional organization for the Capriccio.

The fact that the Capriccio represents something of a departure from the style of the other works is another reason to apply this newly-developed analytical technique. The event-based system does not seem to apply as well to this particular piece, as it seems to have a much finer degree of control over rhythmic activity than these kinds of rough measurements of textural activity will detect. However, the music of the Capriccio is still largely event-oriented, and many of the same problems still exist, such as the still quite indeterminate graphical notation for time elements and the lack of a regular beat. It will also be interesting to examine the results of these "rough-scale" measurements to see if the same degree of hierarchical organization is revealed in the overall textural activity.
Fig. 22--Sectional hierarchy, *Capriccio*
*Golden Section.*
The extensive use of "melodic" gestures in the Capriccio makes event partitioning particularly difficult. For example, the situation in Figure 20 is extremely difficult to divide into discrete sound events because, as discussed above, the irregularity of rhythm in the various parts causes this section to sound like a single, highly active event. As a result, in an attempt to maintain consistency with previous analyses, I have chosen to consider everything from measure sixty to measure seventy-seven as a single sound event. At measure seventy-eight and following, event partitioning is achieved by sudden changes in instrumental texture and by occurrences of silence. By partitioning this type of activity in this way, and by including the activity categories in the analysis, we can gain a fairly accurate sense of the textural activity achieved in this type of "melodic" gesture.

Figure 23 presents a somewhat different kind of problem. This section of the piece contains a cadenza-like solo by the oboe. The event partitioning here is achieved by alternating between rather different types of activity. In other words, the passage contains some figures which are articulated pitch change, some which are sustained pitches, etc. Each occurrence of these different types of activity represents a discrete sound event.
Layer fluctuation in the Capriccio is shown in Figure 24. One interesting feature of this graph is the rapidity of the fluctuation, as evidenced by the numerous one and two measure changes in depth. This constant change in textural depth would certainly enhance the capricious character of the piece. Such changes of texture, activity, and density have been a part of such character pieces for centuries, and were a favorite device of Beethoven's in the Scherzo movements of his symphonies.

Probably the most significant aspect of this graph is the existence of the kind of large-scale gestures which we observed in the previous analyses. While they are not as well-defined as in the earlier pieces—perhaps another manifestation of this work's capricious nature—they do provide ample evidence that the concept of stratification of textural activity is still applicable.

The composite density factor (Figure 25), which combines the surface level activity with the number of textural layers, further supports the observations made above. The constant, dramatic shifts between very high and very low levels of activity again is evidence of the capricious character of the piece, while the presence of an overall gesture demonstrates the structural cohesiveness observed in the Threnody and in Fluorescences.

This analysis is not, nor does it pretend to be, a complete analysis of every aspect of this composition. As
mentioned earlier, the fact that pitch plays a more important role in this composition and the composition's finer degree of control over rhythmic activity seem to make the event-based analysis only partially helpful. However, the fact that these techniques yield significant results, even in this type of composition, suggests that they might indeed be generalizable to apply to many different styles in analyzing deep-level textural activity.
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CHAPTER VI

CONCLUSION

With the structural characteristics of textural activity in all three compositions having been tabulated and analyzed, it becomes possible to make some overall observations comparing the formal aspects of the works. Although all three compositions demonstrated the presence of some type of deep-level design, each of the works displayed individual characteristics.

Of the three works, the one which demonstrated the most clarity of form was the Threnody. This characteristic was observed in an intuitive way in initial observations of the work, and it was verified by the subsequent analysis of textural activity. Evidence of this clarity is found in the composite density graph of the work, Figure 14, which displays a well-defined contour showing a clear two-part design. While the Fluorescences also displays large-scale gestures, these contain a higher degree of hierarchical complexity; that is, there are several sub-gestures within each. This characteristic is shown most clearly by Figure 18.

Despite the fact that the Capriccio seemed to be less appropriate for this analytical method than the other works
(or perhaps because of that fact), its analysis turned out to be in many ways the most fascinating. This is because of the way in which the character of the piece suggested by the title was shown to exist not only at the surface of the piece but at deeper levels of structure as well. This is illustrated by the sharp, sudden contrasts in the composite density factor (Figure 25). Along with this rapid variation in textural activity, however, the analysis shows an even deeper structural gesture shown by the gradual increase in textural activity over the course of the piece, suggesting that, in spite of the Capriccio's seeming dissimilarity to the other works, the same principle of underlying order applies to all three compositions.

As stated in Chapter I, the goal in developing this analytical method was to enable the recognition of hierarchical organization within the textural activity of this music. That the analysis of each of the three compositions revealed the presence of musical gestures on several different levels of structure is a positive result in evaluating the analytical method. This is not to suggest that the method contains no weaknesses, however. Indeed, this is only intended as a first, experimental step in developing an overall system for illuminating textural activity, and certain considerations need to be addressed in refining this method for further research.

One such consideration is the high level of
subjectivity contained in the method. This subjectivity was mentioned in Chapter II, and it was noted that such a high level of subjectivity would not diminish the significance of the analytical results as long as the techniques are applied with a high degree of consistency. In attempting to generalize the method for comparisons among a wider variety of pieces than the three works presented here, however, it may become desirable to develop specific measurements and calculations for use in partitioning and classifying discrete sound events.

Another aspect to keep in mind when evaluating this method is that it intentionally ignores pitch usage, except where such usage affects textural activity, as in pitch motion. This focus on temporal aspects was not meant to suggest that specific pitches do not play an important role in the structural organization of Penderecki's music, but it seemed useful to limit the scope of this investigation by excluding such pitch considerations at this point. Applying such considerations to the music of Penderecki could take two forms: (1) examining manifestations of serialism, such as the twelve-tone aggregate observed in the Capriccio, and (2) examining pitch as a "spatial" dimension, such as in determining the way in which the frequency spectrum is used.

Further research in this area can take many forms. One possibility for such research is to develop and use the additional measurements made possible by the concept of
discrete sound events. Once these events are determined, many more analytical methods can be applied to the music of Penderecki which would make use of these events. As mentioned in Chapter I, the low degree of rhythmic determinacy makes specific calculations of surface level durational proportions somewhat problematic. This is also true in trying to determine the relative regularity or irregularity of attacks on the surface level. Regularity refers to the presence of perceptible patterns which recur at consistent time intervals. This phenomenon might also be termed "periodicity," and its importance in the rhythm of traditional music has formed the basis for most of the work done in rhythmic analysis. Despite the difficulty in measuring this phenomenon at the surface level in Penderecki's music, the concept of discrete sound events makes possible such determinations at a deeper structural level, as the delineation of sound events contains a much higher level of determinacy.

Another calculation which could be made using the textural activity categories of events is the fluctuation which occurs in the event types used. Whereas the composite density factor had something of an averaging effect on event types within a section, calculating type fluctuation would determine the contrast occurring within a section and the relative rapidity of changes in event type, and this in turn could demonstrate the same hierarchical structure as that
Several possibilities also exist for expanding the general use of discrete sound events in analyzing music of this type. One such possibility is to apply the concept of discrete sound events in examining the aspects of pitch usage discussed above. This might be accomplished by classifying events according to pitch usage, such as set usage, registral usage, etc. Events might also be classified according to such parameters as dynamics and timbre to examine their relationship to overall structure. By combining these techniques in various ways, one can observe many aspects of structure in music of this type.

Upon examining and comparing the results of the analyses of these three works, one might be tempted to proclaim the detection of a chronological stylistic trend. Most of the changes from work to work, such as the expansion of overall scope, increased complexity in hierarchical structure, etc., do in fact seem to suggest such a trend, as they all follow the chronological order in which the works were composed. However, three compositions taken from the context of the total output of Krzysztof Penderecki do not provide a sufficient basis for such conclusions, and statements about stylistic trends can only be made after many more of Penderecki's compositions, perhaps all of them, are analyzed and compared to see if such trends are indeed present over the composer's total output. It is hoped that
the analytical vocabulary and techniques presented here can be generalized to the point of allowing such analyses, not only, perhaps, for Penderecki but for other late-twentieth-century composers as well, and that this method can then be combined with other contemporary analytical techniques to develop a more effective system for the analysis of late-twentieth-century music.
APPENDIX A

Chronological List of Krzysztof Penderecki's Compositions

1957  **String Quartet**
1957  **Three Miniatures**, for clarinet and bassoon
1958  **Two Songs**, to words by Leopold Stoff
1958  **Epitaphium on the Death of A. Malawski**, for string orchestra and kettle drums
1959  **Strophes**, for soprano, reciting voice and ten instruments
1959  **Emanations**, for two string orchestras
1959  **Miniatury**, for piano and violin
1960  **Dimensions of Time and Silence**, for choir, strings and percussion
1960  **Anaklasis**, for forty-two strings and six percussionists
1960  **To the Victims of Hiroshima--Threnody**, for fifty-two string instruments
1960  **String Quartet**
1961  **Fonogrammi**, for flute and chamber orchestra
1961  **Psalmus**, for electronic tape
1961  **Polimorphia**, for forty-eight strings
1961  **Fluorescences**, for orchestra
1962  **Violin Concerto**
1962  **Canon**, for orchestra and tape recorder
1962  **Stabat Mater**, for choir a cappella
1964  **Cantata in honorem Almae Matris**, for choir and orchestra
1964  *Sonato*, for cello and orchestra
1964  *Mensura sortis*, for two pianos
1965  *Capriccio*, for oboe and strings
1966  *De natura sonoris I*, for orchestra
1966  *St. Luke Passion*, for soloists, boy's choir, three mixed choirs and orchestra
1967  *Dies Irae*, for soloists, chorus and orchestra
1967  *Pittsburgh Overture*, for brass band and kettle drums
1967  *Capriccio*, for violin and orchestra
1968  *Quartet No. 2*, for strings
1969  *The Devils of Loudun*, opera
1970  *Cosmogony*, for solo voices and orchestra
1971  *Utrenja*, for solo voices, choir and orchestra
1971  *De natura sonoris II*, for orchestra
1971  *Prelude*, for brass band, percussion and double-bass
1971  *Actions*, for chamber ensemble
1972  *Partitia*, for harpsichord, electric guitar, electric bass guitar, harp and orchestra
1972  *Concerto*, for cello and orchestra
1972  *Canticum canticorum*
1972  *Carmina curat*, for six male voices
1973  *Eclogue VIII*, for six male voices
1973  *Symphony no. 1*, for orchestra
1973  *Intermezzo*, for twenty-four strings
1974  *Als Jakob erwachte . . .*, for orchestra
1974  *Magnificat*, for bass solo, two mixed choirs, boy's choir and orchestra
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