20TH-CENTURY SERIAL THOUGHT

AND ITS DEVELOPMENT FROM PERFORMED TO ELECTRONIC MUSIC

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INTRODUCTION

The music of the 20th century shows a diversity of style and idiom without precedent in the history of Western music. This arises from the fact that composers have sought for new ways of expression after it became clear that the musical language of the preceding era was no longer sufficient to satisfy their need. The style which has led to the most fruitful developments and which may reasonably be considered as the most important in this century is that of serialism. This study will therefore trace its development from the end of the 19th century to the present.

The music written between (circa) 1650 and 1900 was based on a system of tonality which had as its basis the mathematical relationships of the harmonic series. The source of all pitch material was the diatonic scale, and the music achieved progression and forward movement from the beginning of a work to its end by exploiting the conflict between those sounds considered concordant and those considered discordant.

Discord engendered emotional tension, concord relaxation as discord resolved onto concord. Thus dissonance was understood as a necessary disturbance of a consonant and emotionally reposeful norm; it was usually found at cadential points and was carefully approached — the ear was prepared for the coming tension. The seven triads built up on each degree of the scale were considered as generating varying degrees of concord and discord, and thus each contributed to the construction of music which constantly moved towards climaxes of tension, and away again to the norm of relaxation. Each performed a function in relation to the six others, and each was ordered in a hierarchy of importance according to its function.

Bach and, later, Beethoven contributed greatly to the early simple tension-relaxation relationships of tonality. They created varying degrees of tension-relaxation by expanding the vocabulary of dissonant chords by increasing their number, and by investing them with varying degrees of expressivity. Thus, as music advanced as a language capable of expressing more and more different types of emotion, so multiplied the degree and type of dissonance. Yet these discords always had to resolve in the framework of the triadic hierarchy and in relation to a tonic.

It is with the age of expressivity, the 19th century, when composers considered music as a language to express mainly individualistic, personal emotion, that the world of dissonance became vastly expanded, including in the chords notes which bore to

the tonic relations of a more and more distant nature. This meant that in order to prepare and resolve the tension accruing to a particularly expressive chord, longer passages of preparation and gradual resolution had to be written, passages moving progressively further away from the home-key in order to prepare for the very foreign chord. These passages, and especially individual dissonances, gradually became less and less related to the hierarchical structure of tonality, and were appreciated for their expressive content only, with a corresponding lessening of regard for their formal commitments.

Finally such passages "broke their moorings", so to speak, and drifted, free, away from the tonic; the relationship became obscured to the point where it was no longer able to act as a cohesive factor. New methods of coherence had to be found.

This movement is known as "the emancipation of the dissonance". The music which eventually resulted is known as "atonal", i.e., music which bears no relation to a tonic, and does not involve the functional relationships of tonality.

The final years of the 19th century, and the opening ones of this, wrought vast changes in the individual's consciousness of social and religious security, a sociological phenomenon beyond the realm of this study. As the individual became more and more isolated from his fellow-men, spiritually speaking, his need for a highly individualised emotional voicing led him to use greater and more unfamiliar dissonance than ever before.

The mean of dissonance-consonance had been rising

steadily until by the beginning of this century it had reached a point where the consonance norm would have been considered extremely dissonant 250 years before. With the abandonment of the tonal hierarchy, a composer could only rely on his own emotional appraisal and grading of degrees of dissonance in order to obtain a sense of progression as understood in traditional tonal terms.

Obviously, the composer's grading of discord and the listener's might be vastly different, when there were no universally accepted criteria by which to judge. Thus this was not reliable as a guide to comprehension. What, then, did atonal music use to ensure coherence and hence comprehensibility?

The loss of tonality as an ordering system applying to pitch movement was not, however, the only problem which confronted composers at the turn of the century.

The system of tonality also assisted in the progression of easily recognizable ideas which were usually stated at the outset as themes with clearly defined melodic and rhythmic character. If a second theme was used, it would usually be of contrasting character and was frequently in a contrasting key with a different type of harmonic accompaniment. Transitional material was similarly differentiated. The thematic material was developed and varied throughout the work, and the listener's understanding of the music depended in part upon his recognition of the varied progression of the material by reference to the original thematic structures.

Set patterns of modulation in the use of referent-

ial thematic material helped to produce clear-cut formal divisions as in, for example, sonata, rondo, and minuet-and-trio forms.

Rhythm, besides being based on the relationships of the harmonic series, as was the pitch system, was presented as an integral part of the thematic material, and thus able to act referentially both in conjunction with this material and on its own, as in Beethoven's 5th symphony, or the second fugue from "The Art of Fugue", where the whole fugue is permeated by the dotted rhythm of the subject. The rhythm also helped to define, say, the first and second subjects in sonata-form — the contrasting rhythms of each contributed to the recognition of the melodic and harmonic contrast of such themes.

Metre was presented in a system of bars, containing equal numbers of the basic unit of measurement of the piece. These bars, with their accent on the first beat, helped in the movement of tension-relaxation by stressing or underplaying dissonance according to its distribution in the bar. An obvious example of this is the so-called feminine ending of the classical period, where the discord is displaced from its normal weak-beat position to the strong beat, thereby acquiring still greater tension.

Besides this, the actual number of bars in a theme served to separate it into antecedent and consequent, usually 2+2, 4+4, etc. Any variation in this arrangement could be achieved by varying the number of bars in either. Thus metre, too, participated in the tension-relaxation progression by asymmetry of bar numbers.

Themes and their development were further differentiated by means of their orchestration, which was thus also able to act referentially. In the 18th century, the various departments of the orchestra were used primarily to differentiate the main from the subsidiary material.

In the 19th century, with improvements in the construction of orchestral instruments as a contributing factor, the orchestra came to be considered far more in terms of its timbric value. The individual instruments began to play their role as vehicles for expressivity and were treated far more soloistically in orchestral music than ever before. The differentiation of the instruments and the recognition of their individual expressive value were greatly strengthened in the colourful and unusual instrumentation of composers like Mahler, Strauss and Sibelius, to mention only three; this instrumental development through the 19th century laid the basis for the instrumental sound of 20th-century music.

As these three elements — pitch, rhythm and instrumentation — were so intimately bound together in the enunciation of tonality, the atonalists had not only to grapple with the problems engendered by the decaying organization of pitch, but with those presented by functionless rhythm and instrumentation too — functionless, because these had formerly acted referentially in conjunction with harmonically-defined thematic structures in the tonal system. One of the most fundamental changes which occurred in music from this period onwards was the emergence of these three elements as equally important; in fact, instrumentation has gradually gained ascendancy over the other two, particularly where the

timbric colour of juxtaposed structures acts as a guide to comprehension in the music of today.

This study will deal with the period of atonality and the problems it engendered; Schönberg's solution; Webern's advancement of serial technique and this composer as a forerunner of the school of total serialism; total serialism and its attendant problems; the emergence of electronic music as one solution to these and, finally, the breakdown of serialism. Throughout I shall attempt to trace a clear path of development from its beginnings at the turn of the century to its final abandonment 60 years later.

CHAPTER I

THE ATONALISTS

Atonal music means, literally, music which is not based on the tonal system and which therefore is not involved in a system of hierarchical relationships to a tonic.

The progressive admission of more and more foreign chords to the basic key in order to achieve emotional tension and movement has already been discussed in the introductory chapter. These foreign chords frequently involved a great number of chromatic changes, so that chromatic harmony, based primarily on semitonal relationships, gradually weakened irreparably the cohesive power of diatonic harmony where the semitonal relationships only occur between certain degrees of the diatonic scale and are fundamental to the tension-relaxation principle and thus the whole hierarchical structure, as they are involved in the enunciation of cadences.

Once functional diatonic harmony was seen to be thus weakened, two extreme solutions were offered to replace this system based on pre-specified semitonal relationships — music based on the whole-tone scale, where no semitonal relationships existed, and the 12-note scale, where all relationships were semitonal. The music which adopted the latter, the chromatic scale, as the source of its material can be seen to have evolved more directly out of the decaying diatonic system, and it is this music which led to the most profound and influential developments in music today.

The most important composers in this atonal and chromatic idiom were Arnold Schönberg and Anton Webern.

A study of their atonal practices will help to illustrate how the serial technique evolved.

Arnold Schönberg looms as the most influential composer of the first twenty-five years of this century. His importance is twofold: firstly, he was the founder of the 12-note system and, secondly, he forms a bridge between the classical techniques of traditional music and the serial technique of Webern and his followers. Thus the colossus faces both ways — backwards towards the 19th century, and forwards into the 20th.

The basic compositional method underlying all of Schönberg's work appears both in his atonal and serial music; it is one which ensures coherence in these essentially dissonant idioms: all the material used in a piece is derived from a "Grundgestalt" — a "basic shape".

The word "Gestalt" is difficult to translate into English; our word "shape" is inadequate, as the Gestalt also involves the character of what is contained in the design.

The concept of the "Grundgestalt" is not new and underlies all traditional music which we feel to be extremely formally cohesive. The appreciation of music up to the time of Boulez, Stockhausen and their contemporaries (where appreciation has to be based on quite different factors) arose from the recognition of certain referential structures which constantly appeared in their original form or varied in some way. How this recognition was ensured has already been discussed. Such a basis for appreciation applies to all

traditional music and can be applied to fairly loose-knit forms within the idiom as well as the more obvious examples from the "classical" period.

However, in the works of certain composers our sense of coherence and thus formal unity in the highest sense is so strong that we find such music totally satisfying, both intellectually and emotionally. Such works we revere as being the finest examples of the musical art that man has achieved, and it is in these works that the concept of the Grundgestalt operates to its fullest extent. In this connection, one tends to think immediately of Bach, though he is one of many.

In any one of the fugues or inventions that one examines, Bach's method of deriving all his material from that of the opening bars can be seen. It is probably true to say that once these bars were written, Bach did not introduce any new material into the piece, unless for its surprise value and thus as a tension-producing device. He was able to derive all his movement, which we hear as the progression of the music from the beginning to the end of the piece, from the motifs and rhythms contained in his Grundgestalt. A remarkable example, because so clearly illustrative of this, is the 2-part Invention,no.1, in C major. Likewise, all the material in each of his fugues usually comes from the subject, counter-subject, and codetta between the two.

Josef Rufer, in his "Composition with 12 notes related only to one another",* made an extensive analysis of the first movement of Beethoven's Piano Sonata in C minor, op.10,no.1. Here again, all the material can be shown to be derived from the basic shape contained in the opening bars. Rufer even shows how the

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* pub. Barrie and Rockliff, London, 1965; translated by Humphrey Searle.

material of the other movements is related to this opening as well. This principle can be observed in much of Beethoven's music.

By his use of the "Grundgestalt" in atonal music, Schönberg solved the second problem confronting the 20th century — that of supplying referential structures to aid the listener in his comprehension of music where harmonic progression no longer operated as a cohesive factor. He had yet to solve the first — to create a system for the organization of the chromatic material.

Schönberg usually presents the Grundgestalt at the outset of a piece; it can appear as a chordal progression, or as a melody with chordal accompaniment; perhaps it is a counterpoint of melodies, or even a single line. It has both a musical structure and an emotional character. Certain intervals, chords and rhythms are extracted from this shape and permeate all subsequent material. Thus every pitch and rhythmic event of the piece can be related to the basic shape; this ensures unity of musical material and a certain consistency of emotional character. The Grundgestalt thus acts as an all-embracing referential structure, to which all subsequent events can be referred.

The actual Grundgestalt itself was often composed by means of certain operations on one or two intervallic cells which might be presented horizontally (melodically) or vertically (chordally), transposed, and transformed, i.e., appearing in their original guise, inverted, in retrograde, or in retrograde inversion. Thus several easily identifiable referential structures, such as themes, accompaniment figures, etc., would arise out of

a single cell. At the same time, Schönberg then applied these same operations to the larger structures of the Grundgestalt throughout the rest of the piece.

A fine example of this is to be found in a very late atonal work, the first of the "Fünf Klavierstücke", op.23, written between 1920 and 1923. The basic shape is presented in the first four bars of the piece. This is a very good example of how the Grundgestalt is derived from operations on a motivic cell, and at the same time the latter is extricable in any of its forms to operate throughout the rest of the piece; the paradox of "unity in multiplicity" ensures an abundance of "new" material which is all related to an original referential structure.

George Perle has made a detailed analysis of these first four bars in his book "Serial Composition and Atonality"*. He shows how they contain the simultaneous horizontal and vertical presentation of a 3-note motivic cell, which is expanded to form a second, very similar cell, with a slightly wider compass. These two (melodic) motifs are transposed, inverted, presented in retrograde and retrograde inversion, presented horizontally to form melodic lines and vertically to produce the accompanying chords. Thus the basic shape appears, with its own character, as a 3-part structure comprising melodic strands and accompanying chords; all the material contained in it is derived from the two 3-note motifs. This basic shape then acts as a referential structure, to which all subsequent material can be referred.

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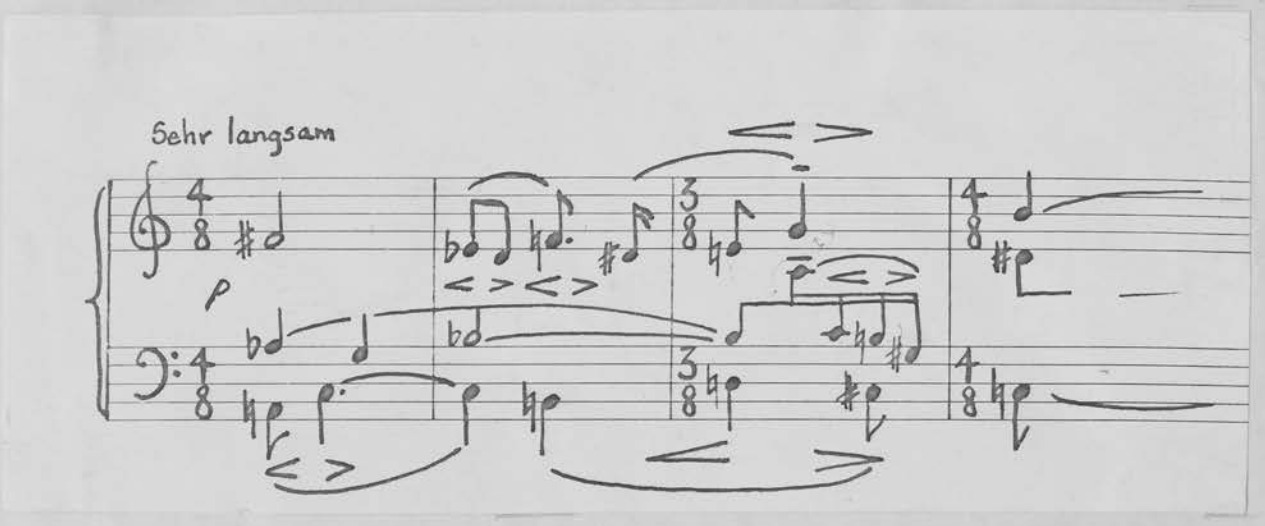
* pub. Faber and Faber, London, 1968.

Example 1: Op.23,no.1 : first 4 bars.



The initial motif appears in the middle voice as $A^{\flat}-G^{\natural}-B^{\flat}$ (semitone, minor 3rd) and is immediately followed by itself in retrograde inversion, now transposed, in Bar 3 $[A^{\natural}-C^{\natural}-B^{\natural}]$. It is accompanied in the lower voice by two overlapping statements of this motif, both in retrograde inversion $[A^{\natural}-C^{\natural}-B^{\natural}]$ and $[B^{\natural}-D^{\natural}-C^{\#}]$. Note that the first statement uses the same notes, one 8ve lower, as does the middle voice in Bar 3. In the upper voice, Bar 2, the original motif appears transposed $[E^{\flat}-D^{\natural}-F^{\natural}]$. This, in conjunction with the opening $F^{\#}$, forms a second motif $[F^{\#}-E^{\flat}-D^{\natural}]$, note also a minor 3rd and a semitone, though the fact that both intervals descend now widens the compass of the entire motif by one semitone. The second motif is transposed and in retrograde in Bars 2 and 3 $[D^{\#}-E^{\natural}-G^{\natural}]$, inverted in the middle voice in Bar 3 $[C^{\natural}-B^{\natural}-G^{\#}]$. Thus the 3-part contrapuntal texture can be seen to be made up of three melodic strands, each of

which is entirely derived from operations on two 3-note motivic cells.

The first chord consists of the notes of the first motif inverted [A♭-A♮-F♯], presented vertically; the last is a transposed vertical presentation of the second motif. Of course, a vertical presentation obliterates the special variants (inversion, etc.) of the original motif.

There are also "diagonal" relationships based on these two cells : the F♯ of the upper voice, the G♮ and B♭ of the middle voice (Bars 1 and 2) form the retrograde of the second motivic cell, as do the B♭ of the middle voice and the B♮ and D♮ of the lower voice in Bars 2 and 3.

This is a particularly illuminating example of Schönberg's atonal working, as the methods employed in evolving the Grundgestalt from the two 3-note motivic cells were later used to vary the presentation of the 12-note series, i.e., the series could be presented in the original, inverted, in retrograde or in retrograde inversion.. Any of these forms could be freely transposed; none of these operations changed the actual shape or character of the intervals of the series, as can be seen from similar operations on the cells in the four bars discussed above.

Another very important aspect of Schönberg's later serial technique can also be observed in this atonal passage — the equation of the horizontal with the vertical dimension : the successive notes of the 12-note series can be presented chordally as well as melodically and the early application of this principle can be seen in the chordal presentation of the 3-note cell above.

Just as Schönberg considers the 3-note cell as an entity of shape and character which then evolves into a Grundgestalt with a more traditional function, so later does he write a 12-note series of specific shape and character which then permeates the Grundgestalt. The latter, in turn, provides the thematic and subsidiary material of the whole work.

Schönberg's operations on motivic cells to create a coherent musical structure, the Grundgestalt, points the way to his later serial practices, while his use of the Grundgestalt as a referential structure from which all the material of the piece derives can be seen as a direct continuation of traditional practice.

Sometimes the Grundgestalt is presented as a thematic structure containing clearly defined thematic sections, as in op.11,no.1 (see Ex.2 below). These sections then act as main and secondary themes, while other elements in their presentation serve as subsidiary material for later use. The material, defined thus, is able to create formal divisions in the music, as in traditional practice.

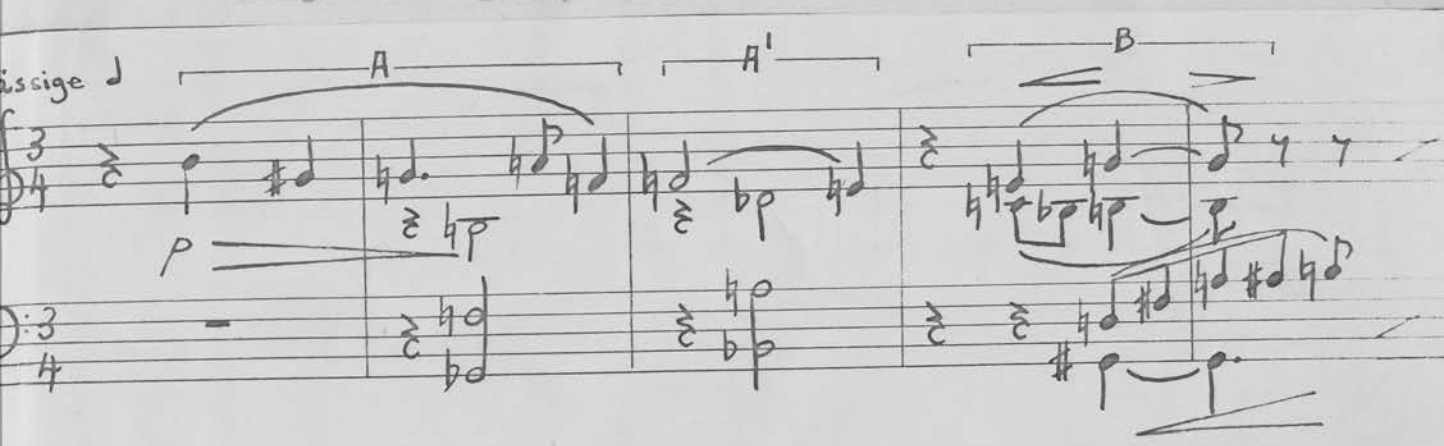
Subsequent reference to the Grundgestalt need not be only thematic or melodic. Thematic material is presented rhythmically, and on occasion the rhythm can serve as a separate referential structure without reference to the melodic structure it accompanies, again as in traditional music.

We have seen how these thematic structures of Schönberg are all derived from operations on motivic cells. These cells comprise one or more intervals and there is frequent subsequent use of these intervals acting referentially.

Such practices, clearly based on those of traditional music, are very clearly illustrated in Schönberg's earliest consistently atonal work, the Drei Klavierstücke, op.11, written in 1909.

In the first of the three pieces, the Grundgestalt is presented thematically, and is clearly divisible into two sections (marked here A and B).

Example 2 : Op.11,no.1. : Bars 1-4.



A ends with the semitonal melodic figure [A'] whose cadential positioning to A later becomes an important cadential feature of the piece.[1]

The elements which go to make up this Grundgestalt — the rhythm, contour, melodic intervals and actual pitch content (as opposed to transposable intervals) — are treated as separate components so that subsequently each can act as a separate referential structure.

This can be illustrated by a few examples from the piece.

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1. "Cadential" here must be understood as applying to a closing figure, divorced from any tonal, harmonically functional implications.

In Bars 9 to 11, reference is made to A by means of passages with similarity of contour and identical rhythmic structure, though different notes are used. The melodic descending semitone of A' is inverted in Bar 11, though the rhythmic structure and chordal accompaniment is the same as at its appearance in the Grundgestalt.

These three bars also constitute an example of the way in which Schönberg's thematic structures help to create formal divisions. After the Grundgestalt has been stated (Example 2), the B structure is repeated twice, with rhythmic displacements (Bars 5 to 8). The reappearance, with the variations discussed above, of A and A' in Bars 9 to 11 thus serve a recapitulatory function and bring the whole first section to a close.

The next section, which begins at Bar 12, is defined by a markedly different style of presentation, which is yet related to the first section in part by an interesting example of a rhythmic structure acting referentially. The descending semitone of A' is presented as

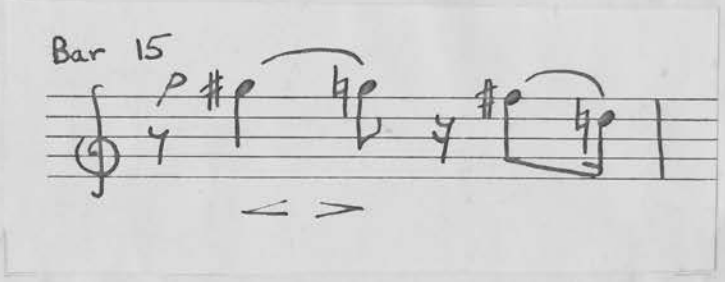
 in Bar 3.

In Bar 15, a descending semitone is presented as

 and immediately followed by  , though without the melodic component of the original structure, i.e., the notes here comprise a falling major 3rd — the descending semitone is discarded.

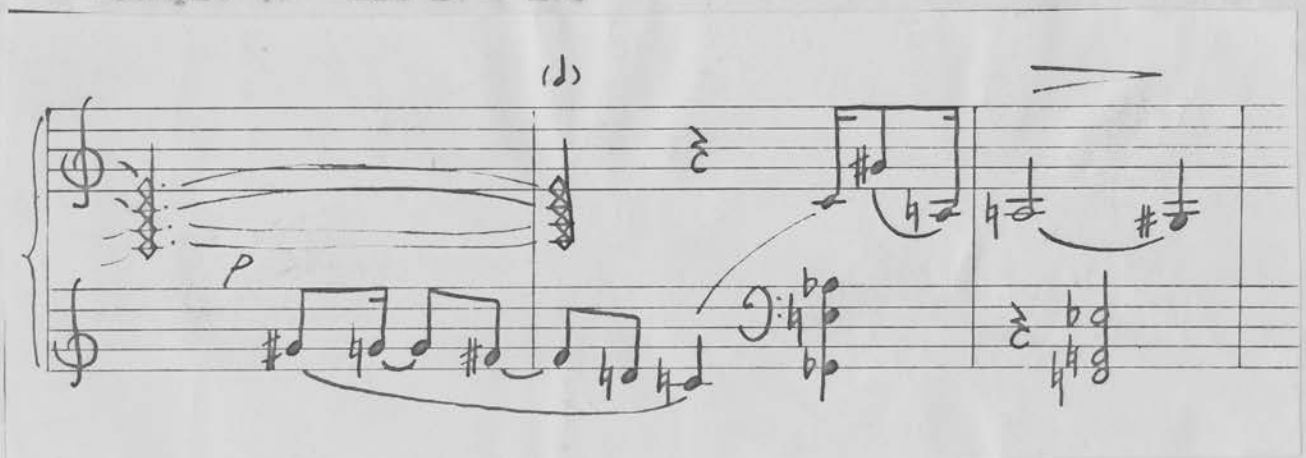
Example 3:

Example 3:



This figure [G♯-G♮-F♯-D♮] develops in Bar 16 to become the opening four notes of a figure which strongly recalls, in contour, the original figure A, an impression strengthened by the cadential descending semitone [A♮-G♯] in Bar 18.

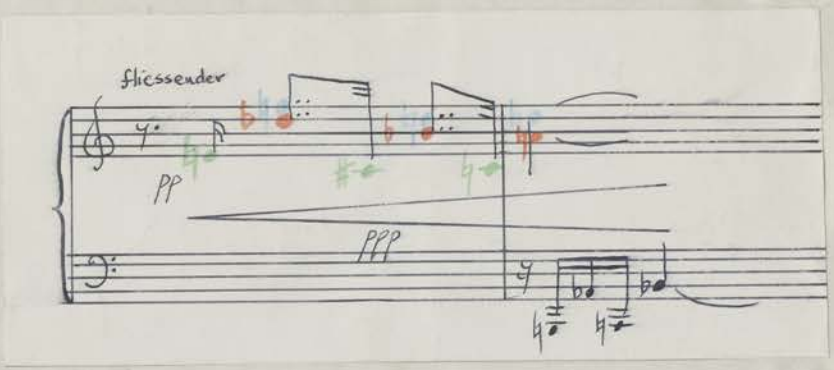
Example 4: Bars 16 - 18.



The figure A' again performs a cadential function in another interesting example of reference. In the final three bars of the piece, the melody notes of A, plus the 2 notes of the L.H. chord of A', reappear as a descending phrase, permutated and varied rhythmically and in register. These are followed by the 2-note figure, B♮ and B♭, now in octaves, in the final bar — A', now the final cadence.

version of A' [F♮-E♮].

Example 6 : Bars 34 - 35.



The whole section is developed from this germ; thus a section which contains apparently new music is actually derived from the intervals of the Grundgestalt.

The remarks above are not intended as a comprehensive analysis of op.11,no.1; rather have I picked a number of examples from the many there to illustrate Schönberg's use of the Grundgestalt, and to show such use as being a continuation of traditional practice.

The Grundgestalt of both works quoted above (op.23, no.1 and op.11,no.1) are essentially thematic; thematicism is in fact a general feature of Schönberg's work, as it is of tonal music.

Thus Schönberg can be seen as in the direct line of tradition in his application of earlier procedures to atonal material. ~~Even~~ after he had formulated and adopted the 12-note series he continued the compositional methods he had applied to his atonal music. His fusion of the discipline of the "Method of Composition with 12 notes related only to one another" and traditional practices was really his greatest achievement.

and at the same time explains his rejection by the more revolutionary disciples of Webern.

The theories and compositional methods of Schönberg can clearly be seen to have evolved from earlier procedures; not so those of Anton Webern, whose role in 20th century music is that of a revolutionary and whose music effected a fundamental change in the construction of sound progression from anything that had ever been heard before. The highly differentiated sound of music today and the theories underlying such sound originate in the music of Webern.

Already, in the first decade of the century, his atonal music constituted a radical break with tradition; the methods he used to order his atonal material, like Schönberg's, were so close to those of his later serial music that his transition from one method of composition to the other is barely noticeable.

Webern began studying under Schönberg in 1904 and in the period 1906-1912 he, Schönberg, and Schönberg's other famous pupil, Alban Berg, were in almost daily contact. Although their styles were so different, and thus Schönberg's influence does not appear to have been very direct, Webern obviously followed his sometime teacher's career closely, both in his adoption of the chromatic scale as the source of his atonal material, and in his first essay into the serial idiom very shortly after Schönberg's adoption of the 12-note row. These two men form the fountain-head of the mainstream of music today. Both exerted a profound influence, though it was Webern's more radical style and innovatory contri-

butions to serialism that exerted the greater influence on total serialists like Stockhausen and Boulez, and it is Webern's concepts which have survived the breakdown of serialism.

The importance of Webern and his subsequent influence can be related to two factors, the first being his revolutionary understanding of the nature of music, the second being the actual realization of this in his work — his highly individualistic sound. Both were clearly evident even in his atonal period.

Webern understood the interval between two notes as an object existing in space and time. An example will make this clear: in tonal harmony, the interval between the notes D♮ and the C♯ above (major 7th) was considered as dissonant and thus engendering emotional tension; at the same time, the actual pitches involved in the enunciation of this interval were considered in relation to a key-centre; the degree of importance of such an interval was evaluated according to its functional relationship to this centre.

Webern's evaluation of this is quite different. These two pitches are understood as the defining limits of a <u>distance</u> — and this distance embodies a specific character; out of the context of tonality it has no <u>relative</u> emotional force and no progressional commitments. The distance remains the same whether it occurs between D♮ and C♯, or D♮ and the E♭ below, when inverted; it remains the same whether D♮ is sounded first, or C♯: the retrograde presentation does not affect the identity of the <u>sound-object</u> in its essence. It is obvious from this that pitch, in the traditional sense, becomes unimportant, and, indeed, it performs a quite different

function in this music.

At the same time, the interval can be presented horizontally or vertically, or in diagonal relationships between two independent parts, without changing its essential nature; its varied effect in all these instances is achieved through its different positioning in space and in time.

In so far as the interval has specific character and is able to act as a structuring force, it bears certain resemblances to the Grundgestalt of Schönberg, now reduced to a single interval, but there the similarity ends. The Grundgestalt is basically a structure capable of development and variation; the progression of the music from the beginning of a work to its end is achieved by actualizing this. The interval-object, on the other hand, permeates the music totally, as itself, unchanging in its essence. Thus the form-building properties of the Grundgestalt, as used in traditional music and by Schönberg, are not operative here, and the construction of a work is achieved by entirely new means. Webern's great achievement is the dissolution of the various disciplines of harmony, counterpoint and form into a new concept, by reducing these to a single relationship between two notes.

Webern's choice of favourite interval is interesting; the source of his material is the chromatic scale, and thus the logical choice of interval is that basic to this scale: the semitone and its harmonic inversion, the major 7th, and expansion, the minor 9th. At the same time, Webern was concerned with the abolition of any tonal characteristic in his music, and we have already noted how the use of chromatic intervals tends to

obscure any implication of key.

It has been said that the interval is a structuring force in Webern's music. An interesting example of this is to be found in an analysis by Henri Pousseur of an atonal work, the first of the Six Bagatelles, op.9 (1913)*. He shows how each note is related to the next — either sounded melodically, or vertically, or in a diagonal relationship — by a chromatic step, either the minor 2nd or its derivatives. This he calls "direct chromaticism"; "indirect chromaticism" occurs where the note is related to the next but one by the same intervals. His analysis is illustrative of how the chosen interval completely permeates the music and at the same time organizes the pitch material effectively.

Thus far, the sole defining characteristic of this sound-object is distance. However, its character may vary considerably from the manner in which it appears; for example, a minor 9th in a high register on the flute has a considerably different character from a minor 9th in a low register on the cello. Likewise, its character varies according to its duration and accentuation and, though less, according to whether it ascends or descends. Thus the same interval can assume a varied character from its presentation, although its essential identity as that interval remains unchanged. All parameters[2] — duration, timbre, method of attack, register and dynamics, even pitch (the actual notes defining the distance) — operate to give character to the sound-object whose essence is distance. Webern now sees the interval as a sound-object which floats in a kaleidoscopic

* In an article, "Webern's organic chromaticism", pub.in "die Reihe", Vol.2.(1959), translated by Leo Black.

[2] The word is not used in its strictest mathematical sense; it is now commonly used by serialists to denote the variables in music, e.g., timbre, pitch, duration, etc.

environment; as in a mobile where the individual objects are comprehended in their various relationships to each other, according to their constantly changing arrangement in space, so is the interval variously comprehended in relationship to its constantly changing environment.

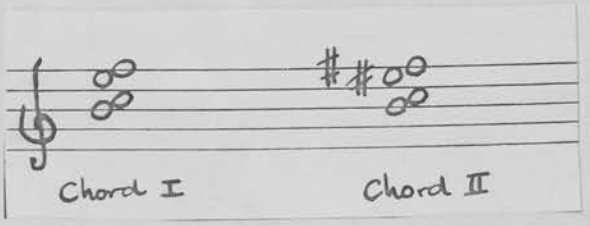
Music, permeated by a single interval with changing character might not be easily comprehensible, yet Webern's music gives an impression of extraordinary unity and clarity. The reason for this is that the various parameters operate not only to give the interval character but also to act in referential relationships with each other.

In traditional music, and in that of Schönberg, comprehension is achieved by constant reference to themes or parts of themes. With Webern's abolition of the theme — its nearest equivalent being a single interval, or perhaps two, arranged in a motivic cell — other sources of reference had to be sought and Webern found the answer in the parameters which now served to enunciate character. Now each was used as a significant referential element in a complex structure of cross-references. For example, a note sounded in an unusually high register may recall another sounded in the same register several bars before; recognition of this facilitates understanding of, say, the recapitulatory character of that section; here register acts referentially. A sudden pizzicato relating to one earlier may serve the same function. Pitch, too, as opposed to interval, is important as a referential element: an interval sounded between particular notes may derive special formal importance from its repetition at that pitch.

Thus even a single element may play its allotted part in the creation of an extremely tightly-knit web of interlocking referential structures. This method of composition is well illustrated in the 4th movement of Webern's Five Movements for String Quartet, op.5 (1909), analysed in detail by George Perle.*

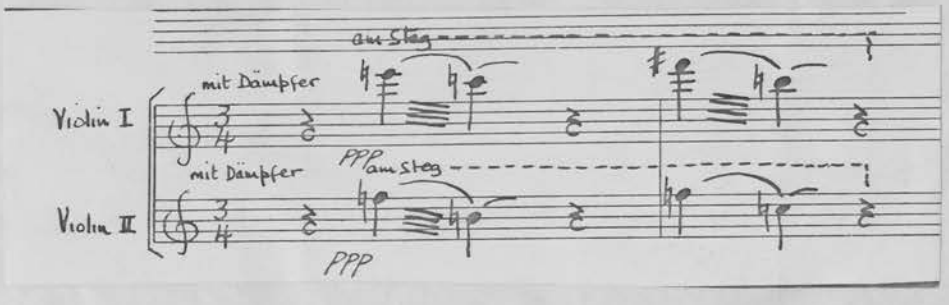
He points out that the two motivic cells dominating the work are generated by the interval of a semitone.

Example 7:



These two chords are derived from the transposition of the semitone, in Chord I, up a perfect 4th and, in Chord II, up a tritone. Their presentation in Bars 1 and 2 on the 1st and 2nd violins is interesting, as it illustrates another form-building method of Webern. In Bar 1, the vertical sounds produce a major 7th and a minor 9th; in Bar 2, a minor 9th, then a major 7th.

Example 8 : Bars 1 and 2.



This mirroring effect later became a very important constructional device in his serial music.

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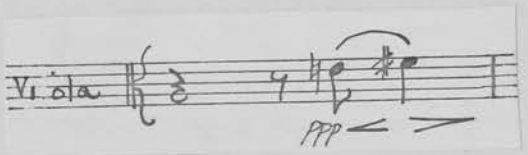
* op.cit.

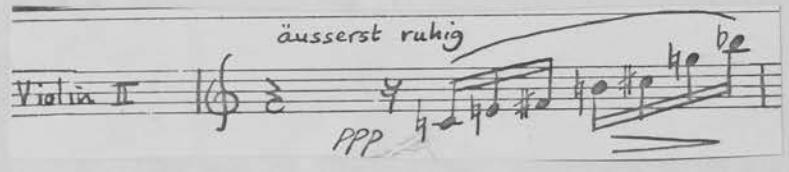
These two chords (Ex.7) generate a melodic element — E♮–F♯, which is comprised of the only two notes not common to both; this makes its first appearance in the viola in Bar 2 and appears in various guises throughout the movement.

Example 9: Bar 2.



(It has actually appeared as the top notes of the opening chords, but the first overt statement appears in Bar 2). Here pitch serves referentially — notice its inclusion in the semitonal figure of Bar 6.

Example 10: Bar 6.

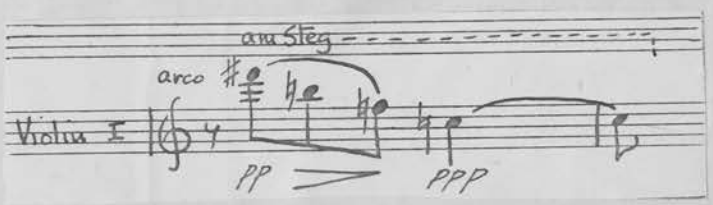


where it serves to relate apparently new material to an earlier structure.

Yet another example of how this interval actually structures the material is the relationship of the first note E♮ (1st violin) to the last, F♯ (2nd violin).

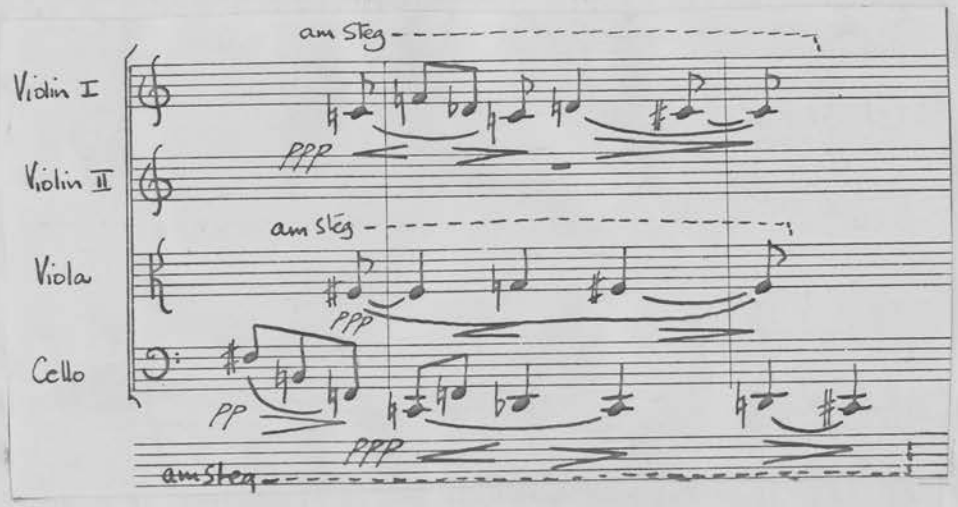
I have already discussed how the identity of an interval is retained in both its horizontal and its vertical presentation. Compare Bar 2 (Ex.8) with the 1st violin part in Bar 3.

Example 11 : Bar 3.

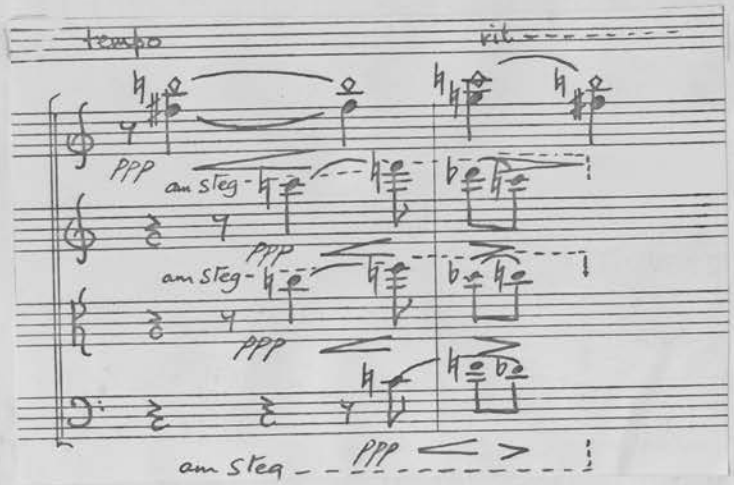


Exact repetition of an intervallic fragment will function as an obvious aid to understanding. Compare the fragment in Bars 4-5, on the 1st violin, with the cello in canon, with Bars 11-12 on the 2nd violin and viola; again the cello makes canonic entry. The "accompanying figure" ($F^{\sharp}$-$G^{\natural}$-$F^{\sharp}$) on the viola in Bars 4-5 (Ex.12) now occurs as harmonics on the 1st violin (Ex.13).

Example 12 : Bars 4-5.



Example 13 : Bars 11-12.



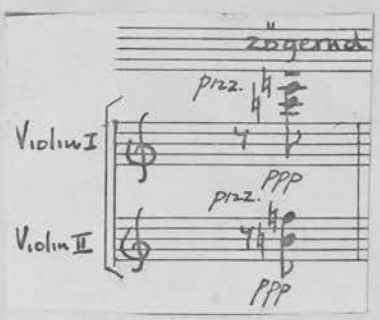
Here, also, the special colour of string harmonics is used to underscore the basic intervallic cell of the movement — the semitone ($F^{\#}$–$G^{\flat}$).

There are only two usages of harmonics in the entire piece: the harmonic $E^{\flat}$ on the cello, in Bars 7-10 is succeeded by the $F^{\#}$–$G^{\flat}$–$F^{\#}$ on the 1st violin, quoted above. The diagonal relationship between the cello and the violin thus highlighted by their mutual use of harmonics involves the important melodic element noted above: $E^{\flat}$–$F^{\#}$.

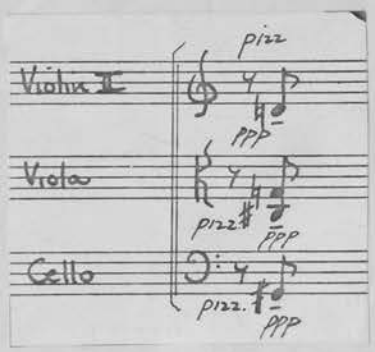
Notice, too, how the character of a repeated interval changes kaleidoscopically by variation of its parameters — the interval $E^{\flat}$–$F^{\#}$ assumes a substantially different guise when presented (1) as harmonics and (2) with its durational values radically altered (from the initial $E^{\flat}$ $F^{\#}$ in Bar 2, to $E^{\flat}$ $F^{\#}$ in the passage under discussion).

Notice, too, the only pizzicato appearances in the movement; in Bar 2, chord I is presented pizzicato and in Bar 12 (the second last bar) chord II, transposed.

Example 14: Bar 2.



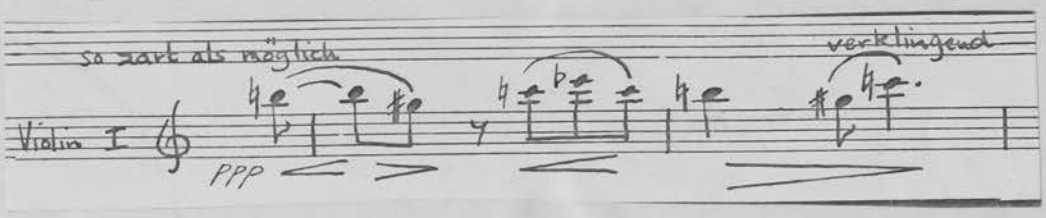
Example 15 : Bar 12.



This serves two purposes : firstly, it helps to define the recapitulatory nature of the last few bars; secondly, it emphasizes the importance of these two chords as underlying structures of the movement.

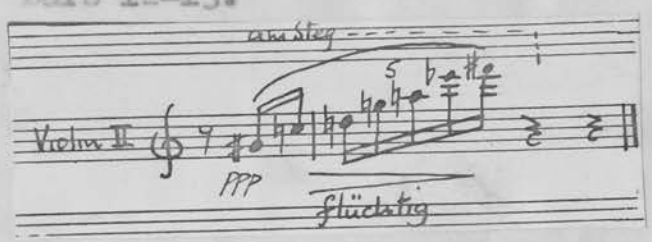
Finally, phrasing, too, serves a significant referential function here. There are only two semiquaver passages in the movement, in Bars 6 and 12-13. The manner in which this new figure is related to an earlier structure at its first appearance has already been discussed. Its final appearance is introduced by means of reference to an earlier phrasing. In Bars 7-8 the 1st violin phrases the two notes B♮ and G♯ together. Unexpectedly, the repetition of these notes with the same durational values in Bar 9 is not given the same phrasing. Instead, the G♯ is phrased to the following C♮.

Example 16: Bars 7-9.



The significance of this is only made clear in the final semiquaver figure, which starts with the notes G♯ and C♮.

Example 17 : Bars 12-13.



The entire movement is made up of such relationships; it is not necessary to go into further detail, as the few

points made above are sufficient to illustrate Webern's highly individual method of composition, where not one single event occurs without structural significance.

It is particularly interesting to compare this work with Schönberg's Drei Klavierstücke, op.11,no.1, as both were written in 1909 and both clearly display the composers' very different principles of composition, principles which separate them as to their historical function — Schönberg as the "bridge" between traditional and "modern" music, Webern as innovator with implications reaching far beyond his own works and time.

Webern's method results in what might be called a closed form. The basis of form in tonal music was the progression of ideas from one point in the music to another. Appreciation of this movement was largely achieved by a rational expectation of climax and repose, gained from familiarity with the material and from listening to the harmonic context. When listening to Webern's music, it is impossible to anticipate what will come: each musical event, however minute, is related to what has gone before and to what will come. Such relationships can only be appreciated after they have occurred. For example, the first pizzicato chord of Bar 2 gives no indication to a listener of its subsequent appearance. Only after the second chord has been sounded, right at the end, is the listener able to realize that he has heard this before and that its function here is recapitulatory. Thus the whole is comprehended as an involuted structure, a tightly-spun web of closely interlocking referential structures. This concept of form constitutes a radical break with tradition, and demands a quite different type of listening. It is a

basic concept in music after Webern — through purposeful determining by the composer, everything that is to come is made indeterminable to the listener.

At the same time, pitch as the main carrier of ideas has been dethroned. Each parameter is of vital importance, not only in the enunciation of the character of the interval-object, but in its ability to structure the music as well. Webern's achievement here was of the utmost significance in the later development of serialism. The extreme level of organization he extended to all the elements which go to make up music is found in his own serial composition, and ultimately led to the adoption of total serialization by composers like Boulez and Stockhausen.

The highly characteristic sound of Webern's music — a sound heard even in the electronic music of today, and especially in the pre-electronic works of the total serialists — derives chiefly from the sharp differentiation within the musical parameters themselves. For example, the dynamic element is differentiated into many degrees ranging from, say, *ppp* to *ff* , and each motivic cell, sometimes each note, carries minutely detailed instructions as to which degree it is to sound. In the same connection, note his use of "Klangfarbenmelodie" — literally, melody of timbres; each intervallic cell, — or sometimes a single note related to another to be heard later, both thus sounding the basic intervallic relationship — is sounded by a different instrument. A sort of text-book study of how he uses this melody of timbres can be heard in his orchestration of the Ricercar from Bach's Musical Offering.

This extreme differentiation arises out of the fact

that he no longer uses themes (with their consistency of timbre and dynamic) but motivic cells consisting of one or more intervals, and that no single event is without significance in the construction of the whole — every single change of parameter is of structural importance. It also explains why Webern's music is rather difficult to appreciate at first — a new type of listening altogether is demanded of an audience. This type of sound foreshadows the pointillistic technique of the total serialists.

Webern's emancipation of the interval from the psychological tension it derived from its relationship to a tonal centre is extremely important from three points of view: it removes the achievement of tension from pitch, it starts music on its path towards the juxtaposition of almost visual sound-objects, as opposed to an emotional flow where each event leads on to the next on waves of climax and repose, and, thirdly, it inaugurates the type of thinking which eventually led to the musical "objectivity" of present-day music.

CHAPTER 2.

THE ADVENT OF SERIALISM : COMPOSITION WITH TWELVE NOTES

That the chromatic scale would be the probable successor to the diatonic scale as the source of material for post-tonal music had been recognized by many composers since the end of the nineteenth century. That the atonal music so based, with no generally accepted criteria for its composition, had to be given a basic system of organization for its perpetuation was obvious.

The tonal system had given significance and meaning to each note in a musical structure, both in the horizontal and in the vertical dimensions. The counterpoint of Bach provides a good example of this : each individual note is understood both as functioning within an independent, characteristic melodic structure, and in relation to the chord of which it forms a part when the various melodic "voices" are sounded together. In this music, the organizing power of the key — of tonality — is ideally illustrated.

At the same time, tonality ordered the chords derived from the diatonic scale in a hierarchy, functioning in various relationships to one another. The chords so functioning interacted with each other in generally accepted progressions, which became almost formulas, for example, the cadential progression II^{6} | I$^{6}_{4}$ V | I ‖. These harmonic progressions helped to define the form of a piece : the harmonic patterns found at a cadence were not those of a transitional passage; progressions used to establish, say, a first subject in

sonata form were quite unlike the fluid and rapidly modulating passages of the development section. Once chords no longer functioned in such harmonic progressions, their aid in thus defining form was gone.

Schönberg, in his lecture delivered at the University of California in 1941 — and quoted in his book "Style and Idea"*, discusses this problem, and adds: "Hence, it seemed at first impossible to compose pieces of complicated organization or of great length" (p.106). One solution he found by setting a text or a poem, whose various parts then suggested the type of music used — the figurations, dynamics, instrumentation, etc.

Another fundamental principle, concomitant with that discussed above, had been abandoned with tonality, that of achieving an impression of movement by the use of a hierarchy of variously graded concords and discords, whose degree of tension was judged both in relation to each other and, ultimately, to a key-centre. These degrees were purely relative, and such a system of grading became invalid once the basic relationship to a key-centre had been denied.

Thus both the form of a work and its movement depended in large part upon the functional relationships of tonal harmony.

However, a sense of movement could be achieved by different means altogether. In music which was predominantly "discordant" — which used chords considered dissonant in the tonal system in long unresolved successions — the earlier classifications into consonant and dissonant became unnecessary. But music could still be understood as a series of events occuring successively

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* pub. Williams and Norgate Ltd, London, 1951.

and progressively within a certain time-limit by means of constant development and variation of the referential structures laid out in the Grundgestalt. At the same time, as we have already seen in the Three Piano Pieces, op.11, musical form could be achieved by this method too. The solution to the first problem — to find a method whereby the vertical and horizontal dimensions could be ordered by one and the same factor — was also to be found in Schönberg's concept of the Grundgestalt, and indeed, this concept was eventually to give rise to the most important musical system since the tonal era.

The need for an organizing principle was not recognized by Schönberg alone. I have already mentioned the fact that atonal music recognized chromaticism as its basis. Just as the diatonic major and minor scales had given rise to a whole system of aesthetics and organization, so the chromatic scale was to perform a similar role.

While Schönberg advanced steadily towards the theoretical formulation of his method, there were others who also attempted to build systems on a basis of twelve notes. The most important of these was Josef Matthias Hauer (1883 - 1959).

Hauer's system was bound to his own esoteric theory of aesthetics, which is one reason why it never became widely accepted. The musical basis of it, however, is indicative of the direction compositional thought was taking at the time. The twelve different notes were presented in what he termed a "trope" — basically a 12-note melodic series. The trope was divided into two sections containing six notes each.

The succession of the six notes within each section could be constantly varied by intervallic permutation, but the entire section had to be sounded before any note from the other section could appear. His first regular use of this system in a composition began in or about 1918, although he had been working on it since 1908. In 1919 the first paper on it was published in Vienna under the title "Uber die Klangfarbe". In his own composition, however, he did not exploit the atonal possibilities of it; both he and his pupil Golysheff wrote 12-note melodies but with fairly tonal-sounding harmonic accompaniments, although their chords did not function in the traditional tonal manner.

Schönberg himself, round about 1914, worked on a symphony which he never completed, the last part of which became the oratorio "Die Jakobsleiter" (1917 - 1922). In the sketch for the scherzo of this symphony he used all twelve notes divided into sections whose note-succession was not stipulated, as in Hauer's tropes. He soon realized, however, the limitation, the weakness, in Hauer's system. The trope did not stipulate the order in which the notes should be sounded, and thus was nothing more than a statement of the chromatic material available, analogous to a constant unorganized repetition of the notes of the diatonic major scale in tonal music.

I have said that Schönberg's 12-note serial theory had its origins in his concept of the Grundgestalt. There are three basic aspects to this concept; all are related to an entirely new vision of sound, at first operating unconsciously through his entirely musical need to use the Grundgestalt, but later formulated thus :

"The two-or-more-dimensional space in which musical ideas are presented is a unit. Though the elements of these ideas appear separate and independent to the eye and the ear, they reveal their true meaning only through their co-operation, even as no single word alone can express a thought without relation to other words. All that happens at any point of this musical space has more than a local effect. It functions not only in its own plane, but also in all other directions and planes, and is not without influence even at remote points ... A musical idea, accordingly, though consisting of melody, rhythm, and harmony, is neither the one nor the other alone, but all three together. The elements of a musical idea are partly incorporated in the horizontal plane as successive sounds, and partly in the vertical plane as simultaneous sounds. The mutual relation of tones [notes] regulates the succession of intervals as well as their association into harmonies; the rhythm regulates the succession of tones as well as the succession of harmonies and organizes phrasing. And this explains why .... a basic set [series] of twelve tones can be used in either dimension, as a whole or in parts .... The unity of musical space demands an absolute and unitary perception. In this space, as in Swedenborg's heaven (described in Balzac's 'Seraphita') there is no absolute down, no right or left, forward or backward. Every musical configuration, every movement of tones has to be comprehended primarily as a mutual relation of sounds, of oscillatory vibrations, appearing at different places and times ..... Just as our mind always recognizes, for instance, a knife, a bottle or a watch, regardless of its position, and can reproduce

it in the imagination in every possible position, even so a musical creator's mind can operate subconsciously with a row of tones, regardless of their direction, regardless of the way in which a mirror might show the mutual relations, which remain a given quantity."*

The first aspect to be considered will be discussed with reference to the Grundgestalt of op.23, no.1 (cf. p.13ff.) Examination of the first four bars shows how the entire Grundgestalt of the piece is derived through operations on two melodic cells made up of two intervals — the minor 3rd and the minor 2nd. These intervals are presented in their original form, are inverted, are sounded in retrograde and in retrograde inversion. They still remain the same intervals, but are perceived from different angles. Josef Rufer paraphrased the last sentence quoted from Schönberg's lecture thus : "An object, for example, a hat or a bottle, when viewed from different sides presents a different appearance each time, although it still remains the same hat or bottle."** This is a valid visual analogy : substitute "interval" for "hat" or "bottle". A succession of intervals presented upside-down as in inversion, or with its pitch components reversed as in retrograde, remains the same succession of intervals "viewed" from different angles. Such operations on the intervallic cell form the melodic motifs of the Grundgestalt.

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* From Schönberg's "Composition with Twelve Tones", delivered as a lecture at the University of California at Los Angeles, March 26th,1941, and quoted in his book of essays "Style and Idea", on pp.109, 113-114.

** Josef Rufer : op.cit., p.63.

local effect. It functions not only in its own plane, but also in all other directions and planes, and is not without influence even at remote points".....

As music tended to use more of the twelve notes with fewer repetitions before their complete announcement, it was only a matter of time before Schönberg conceived a Grundgestalt using all twelve different notes. Here theoretical problems of composition and his actual compositional practice converged onto a single point : the concept of a series of twelve different notes, laid out as a melodic structure, an ordered succession. And so through a natural historical process arose the most important single factor in the development of twentieth-century music — the 12-note series.

Once fully formulated, the series became the underlying ordering principle of much atonal music. In essence, it is the thematicized Grundgestalt — the twelve different notes are laid out in succession according to the intervals desired for use in the composition. These twelve notes are then arranged in chords, or as melody with accompaniment, or in a contrapuntal texture; in short, they operate to build up the basic patterns of the Grundgestalt — the melodic motifs, the harmonic structures, etc., to which constant reference can be made — much as did the intervallic cells of the atonal period.

It is obvious that in a 12-note series, no note can be repeated before all twelve have been sounded. Moreover, each series will be different for each work;

as the series is the melodic representation of the composer's musical ideas, and as each new work is the product of new ideas, so each series will be different.

As visualized by Schönberg, the notes of a series are related only to those immediately preceding and following them, by intervallic relationships. Thus the series effectively destroys the notes' predetermined relationship to a given tonic; as Rufer says, "It gives back each note its own musical weight, its inherent meaning and its individuality; these had been lost under the dictatorship of tonality."* Hence the method of composing with a 12-note series could aptly be termed, from the title of Rufer's book, "Composition with twelve notes related only to one another."

The series of 12 notes as originally conceived by the composer is known as the series in its original form (O). This original form can be inverted (I), or appear in retrograde (R), or as the retrograde of the inversion (RI), without losing its essential shape and intervallic structure. Such operations on the series can be seen as a mere extension of similar operations on cells containing only, say, two intervals, as in the Grundgestalt of op.23,no.1. As in the latter case, the series thus variously presented accords with Schönberg's concept of Musical Space, and is illustrated in his essay** by the following diagram and example:-

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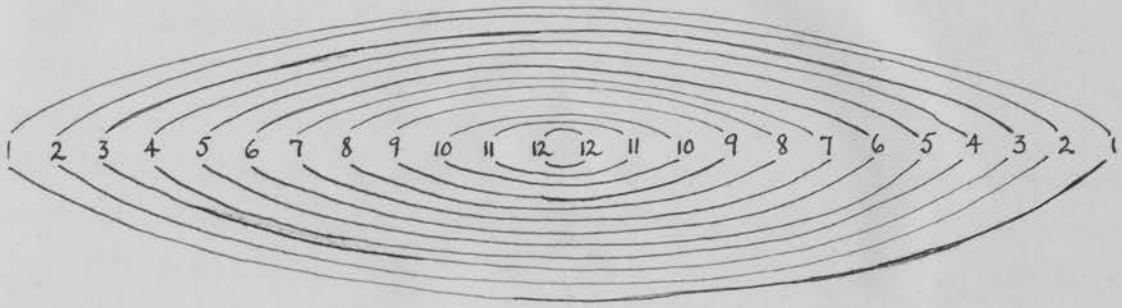
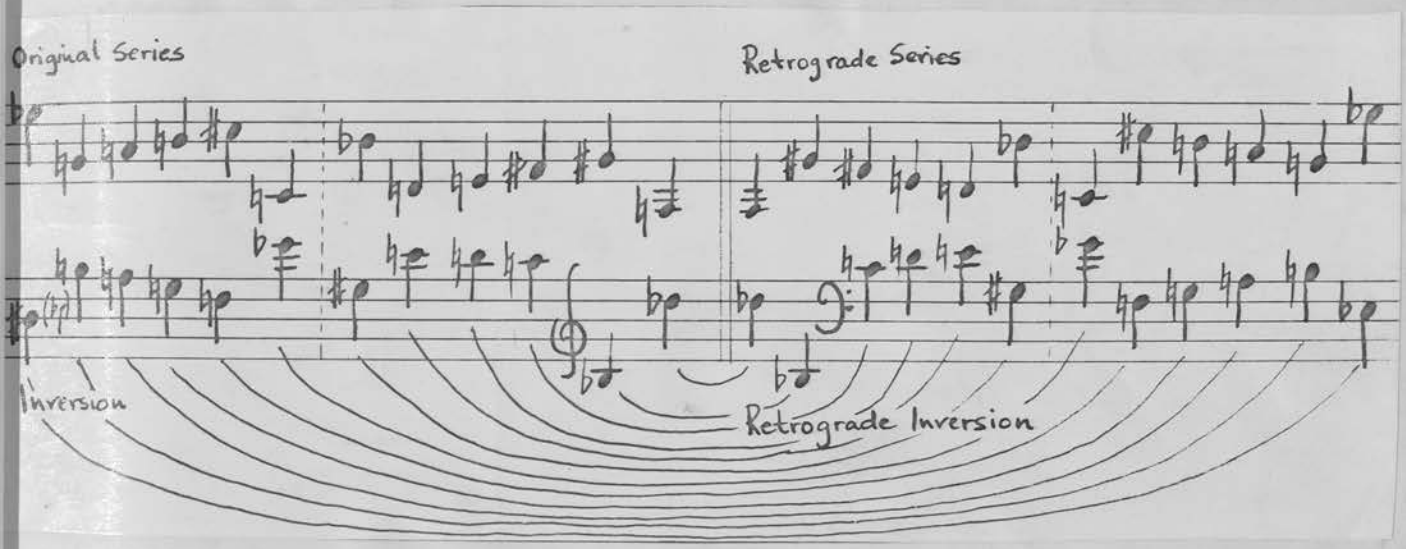
*Josef Rufer : op.cit., p.80
Schönberg : op.cit., p.115

Example 18:-



Example 19 (from Schönberg's Wind Quintet, op.26):-



Each form of the series can be transposed to any of the remaining eleven notes, making forty-eight possible forms altogether.

Composition with a 12-note series involves the continuous repetition of the series, in any of its forms and transpositions, throughout the work. As Schönberg derives characteristic themes, chords, figures and accompaniments out of his series, these operate as they did in his pre-serial work, serving to define the form

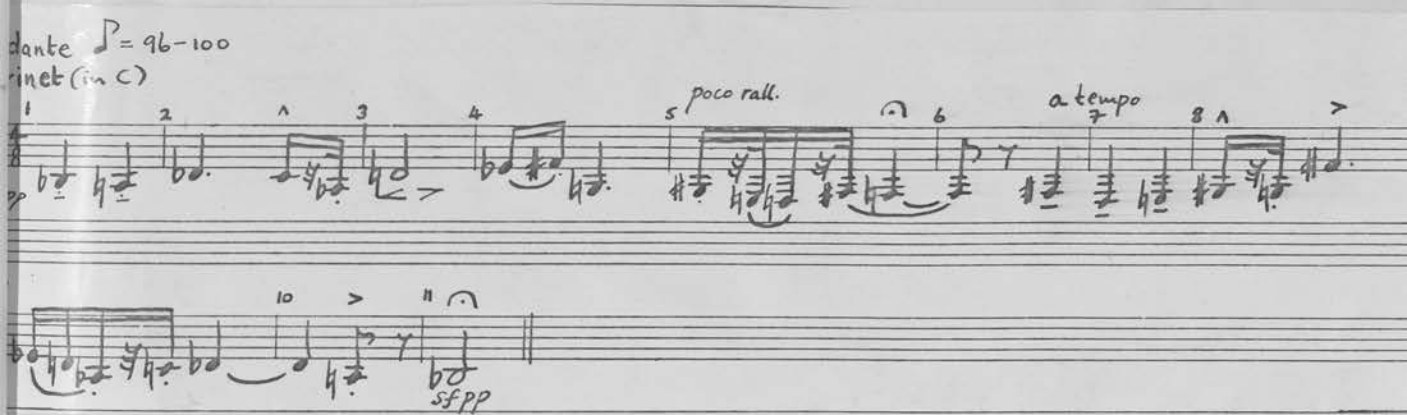
and acting referentially.

The first work to be written entirely on a 12-note series was in 1921 — the Suite for Piano, op.25. Between this and the last work to be written in its entirety in the free, non-tonal style — the Four Songs with Orchestra, op.22 (1913-1916) — come two transitional works which overlap with the writing of op.25: the Five Piano Pieces, op.23, and the Serenade, op.24, both composed between 1920 and 1923.

These two works, besides containing 12-note sections, are clearly illustrative of how certain characteristic features of serial composition were basic to Schönberg's compositional style and point the way to his serialism, which drew all these constructional features together into one systematized method.

The variation movement (the 3rd) of the Serenade does not yet use all twelve notes and is based on an 11-note theme, played by a solo clarinet. Three notes are repeated and the note B♮ is missing:-

Example 20:-



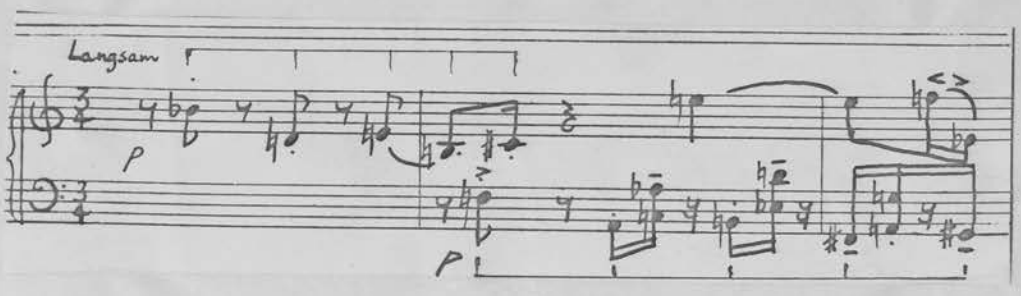
The theme is composed of two sections, the antecedent and the consequent (cf."question" and "answer" in classical themes). The antecedent ends at Bar 5, at

see Ex transition

the pause mark 𝄐; the consequent is the retrograde version of the antecedent, overlapping at the central note F♮, and with rhythmic alteration. This effectively ensures a close correspondence between the two as their intervallic structure is thus identical. Rufer uses this as a further example of how melody gradually took over certain functions formerly assigned to harmony alone by comparing the melodic mirroring here with the harmonic mirroring in classical themes, whose antecedent and consequent involved the basic harmonic progression I - V, V - I.

Interestingly enough, the relationship of the first note (B♭) and the axis note (F♮) is a traditional one and, in fact, one which Schönberg frequently used even in his serial music. Another example of this from these transitional works can be found in the first three bars of op.23,no.3, where the basic shape consists of a 5-note theme sounded initially in the right hand and imitated exactly one bar later in the left hand a perfect 4th-plus-8ve below:-

Example 21:-



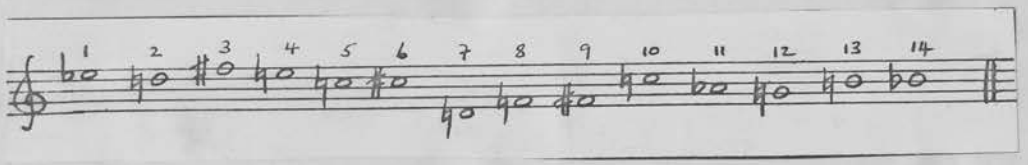
To return to the theme of the variation movement of the Serenade: the correspondence between Schönberg's construction of this theme and serial practice is obvious.

The five variations of the theme employ the trad-

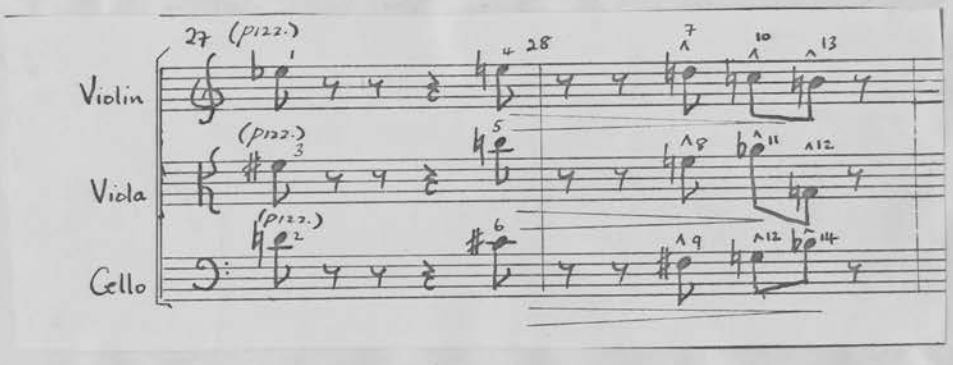
itional methods of variation of Beethoven and Brahms, and also variations of the theme by means of inverting it, using it in retrograde and transposing it.

Another precursor of serial practice to be observed in this non-serial movement is the ability of the 14-note theme to form chords. Compare the pizzicato chords of Bars 27 and 28 with the retrograde inversion of the antecedent of the clarinet theme.

Example 22:- RI of antecedent:-



Example 23 (Bars 27 and 28, violin, viola and cello parts only):-



This practice has already been noted in the Grundgestalt of op.23,no.1, and relates to the concept of musical space.

Another example of this is to be noted in the last six bars of op.23,no.3, where the actual pitch content of the 5-note theme and its imitation is presented in two chords.

The close correlation between the construction of the Grundgestalt of op.23,no.1 and later serial practice

has already been discussed.

Rufer further points out that in these two transitional works "all the harmonic and melodic formations in a piece or movement have arisen from one and the same sequence of notes". This sequence, both in its intervallic relationships and in the number of notes it contains, underlies the whole basic shape, which in turn presents, for later reference throughout the work, certain characteristic features. Rufer goes on: "This clarifies and justifies the role which the series, as the given melodic extract of the 'basic shape', plays as a factor which creates shape, form and coherence in the musical organization of the piece in question; this role corresponds to that of tonality, or of a key. Just as in a tonal piece each note always has a direct or indirect relationship to the key-note, so here in every position it is always part of a series. For everything is derived from the series — chords, main and subsidiary parts, accompanying figures, etc. This presupposes (or, one could say, it follows from this) that the series must be present in every moment of the course of the music; in other words, it must be continually repeated. Thus the requirement that the series must be repeated without cessation arises from a musical necessity."*

The series, then, is the Grundgestalt in melodic, non-rhythmic form, which is to be repeated constantly throughout the work, in its various transformations and transpositions. How is the series used to build up recognizable themes, figures, chordal structures, etc.? The answer again is to be found in Schönberg's earlier

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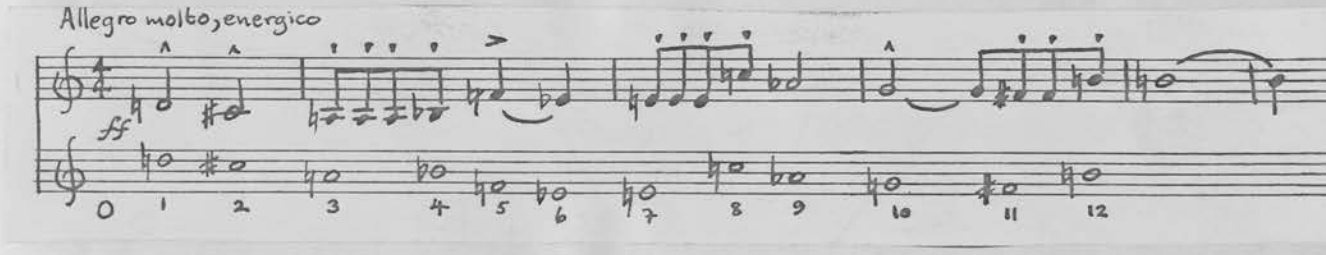
* Rufer: op.cit., p.76ff.

practice. Just as the characteristic features of the Grundgestalt were built up from various presentations of the melodic cells, so are they now built up from the series.

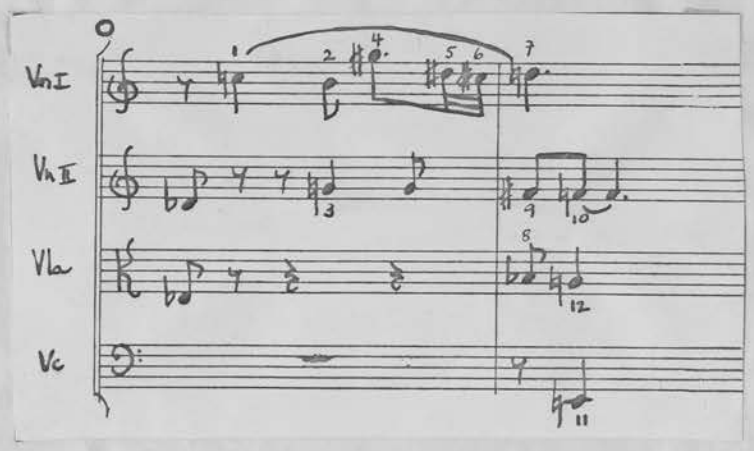
Themes may be composed either from the mere sounding of the notes of the series, or part of the series, in succession, as in the following example from the 1st movement of Schönberg's 4th String Quartet, op.37:-

Example 24:-



or by sounding certain notes of the series and utilizing those between as accompanimental figures or chords:-

Example 25 (Op.37, 3rd movement, Bars 633-634):-



Several forms of the series sounded simultaneously can create a contrapuntal structure consisting of several melodic strands sounded together, as frequently happens

in the canons of Webern; e.g., the 4-part canon which opens the Symphony, op.21, utilizes for each "voice" a different form and/or transposition of the series.

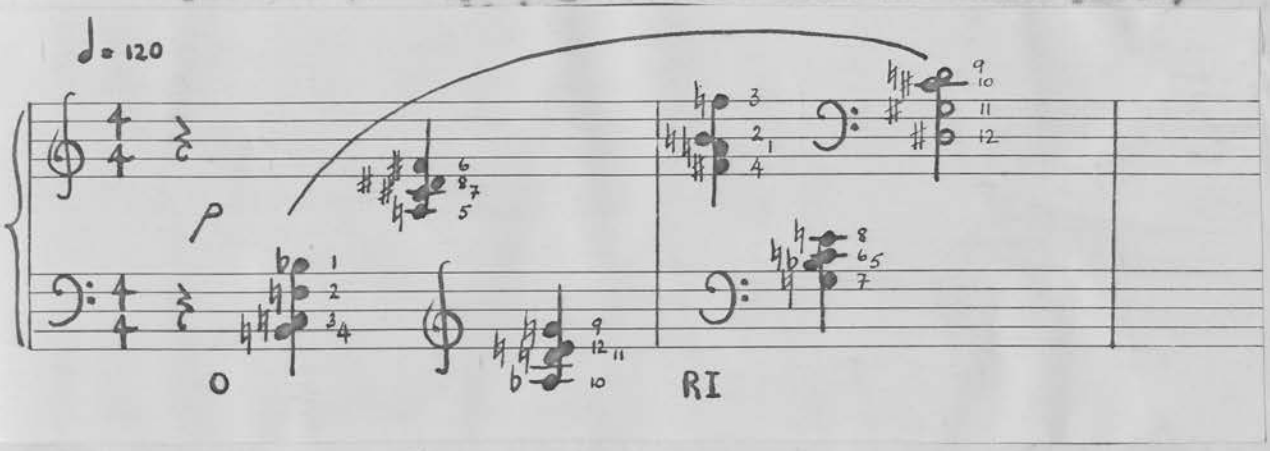
Chordal structures can be built up by:-

(i) presenting the consecutive notes of a single series vertically:-

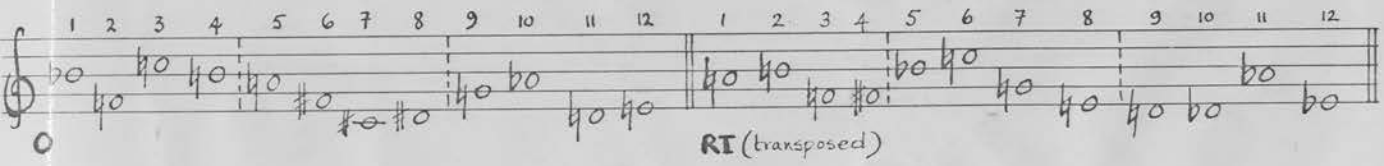
e.g. 1 5 9
2 6 10
3 7 11
4 8 12

, or with the notes of the chords permutated, which is the more usual:-

Example 26a (the opening two bars from the Piano piece,



x.26(b) (cf. Ex26a.):-



(ii) the simultaneous sounding of various forms of the series;

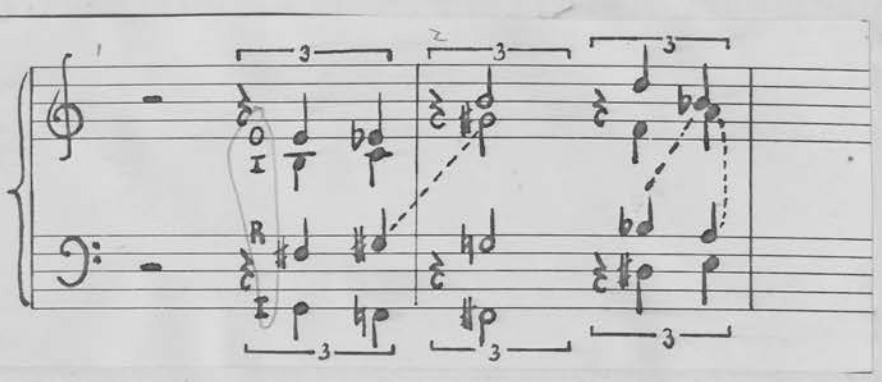
(iii) A combination of these two methods.

A problem arises when the second means is used, which is well illustrated by Reginald Smith Brindle*

*Reginald Smith Brindle: "Serial Composition", pub. Oxford University Press, London (1966).

in an example of his own construction (p.83):-

Example 27:-



It will be observed that between the second and third chords the G♯ is repeated, at the interval of an 8ve; this occurs also between the penultimate and last chord in the case of the B♭, while in the last chord there are two A♮s. The former case is known as "false relations" of the 8ve, the latter simply as 8ve doubling; both are considered highly undesirable by serialists.

Schönberg, as early as 1911 in his "Harmonielehre", advocated the avoidance of 8ve doubling: "To double is to emphasize, and an emphasized tone could be interpreted as a root, or even a tonic; the consequences of such an interpretation must be avoided."* It has already been mentioned that the method of composition with a 12-note series made each note of equal importance, abolishing the tonal hierarchy; the emphasis resulting from the doubling of a particular note would give to that note a special importance, thus contradicting the basis of the method.

However, the practice of accompanying one form of the series with another was valid in the context of serial theory. Schönberg himself admitted that on occasion

* Quoted in his essay, op.cit., p.108.

the initial inspiration — the series — had to be reworked to accord with certain compositional requirements. In a letter to Josef Rufer, written in 1950, he said: "It will not often happen that one obtains a perfect series which is fit for use as the first immediate conception. A little working-over afterwards is usually necessary. But the character of the piece is already present in the first form of the series. This working over depends chiefly on constructional considerations. For example I endeavour to avoid one of the forms ending with the same tone with which another begins, and vice versa, for fear of monotony." In the same letter, he put forward his solution to the problem of resultant 8ve relationships when one form of the series is accompanied by another: "Personally I endeavour to keep the series such that the inversion of the first six tones a fifth lower gives the remaining six tones. The consequent, the seventh to twelfth tones, is a different sequence of these second six tones. This has the advantage that one can accompany melodic phrases made from the first six tones with harmonies made from the second six tones, without getting doublings."*

The series of the Fourth String Quartet, op.37 (1936) furnishes an example of this:-

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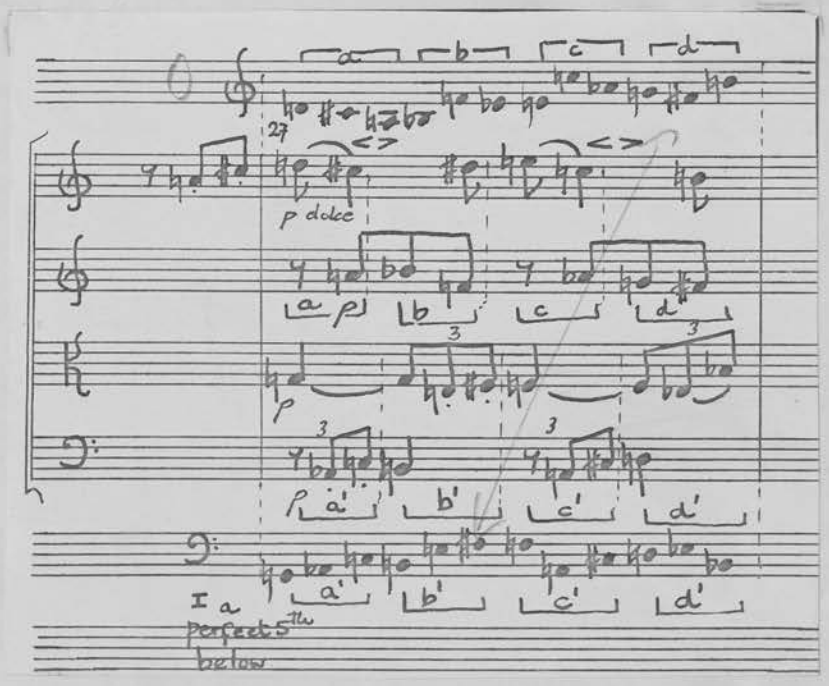
* Quoted in Josef Rufer's book, op.cit., p.94ff.

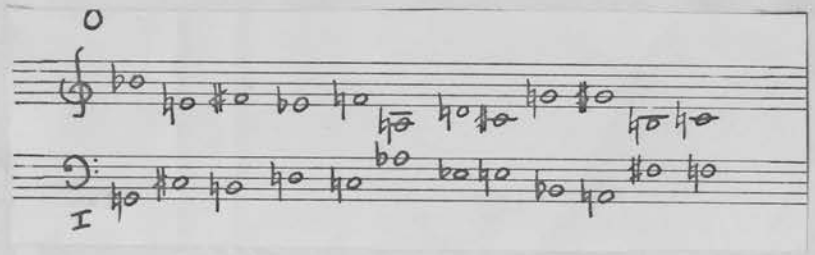
Example 28:-



In Bar 27, quoted above, the results of such a series is illustrated. O is divided between the first and second violins, while I, a perfect 5th below, is shared by viola and cello.

Another example of this type of constructed series is that of the Variations for Orchestra, op.31 (1926-1928). Here the inversion a minor 3rd below produces the same result.

Example 29:-



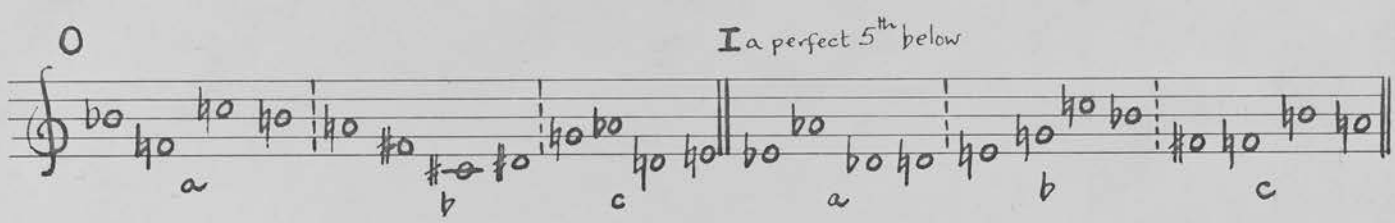
It is probably no mere accident that Schönberg pre-

ferred the perfect 5th relationship (cf. p.45), this being a natural acoustical one, occurring between the second and third notes of the harmonic series, and one which had dominated Western music since its earliest days; Schönberg considered his work to be in the line of tradition, and therefore his choice of this interval would not be contradictory to his method.

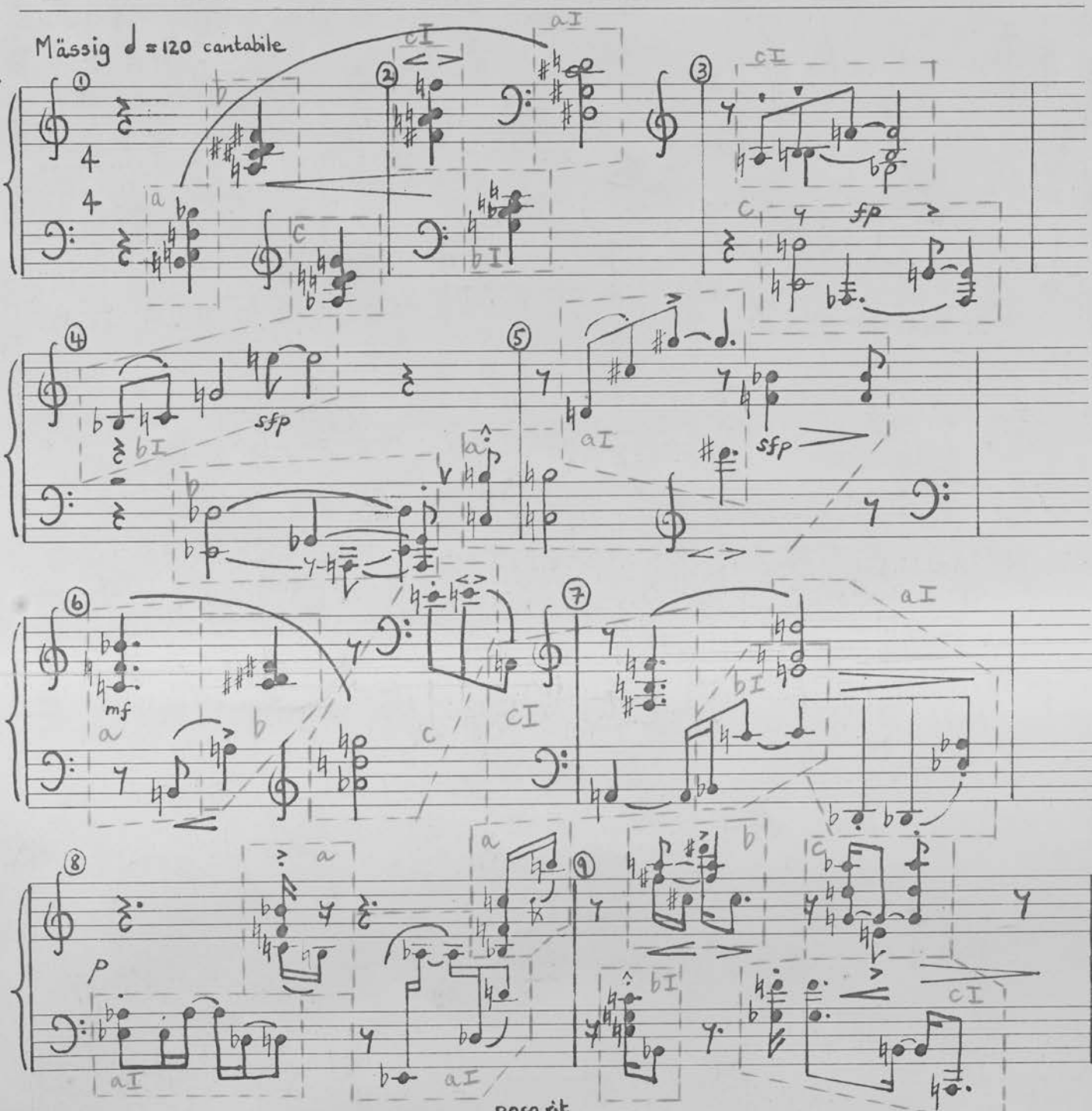
Another series considered desirable for constructional reasons was that which contained corresponding intervals between the various segments. For example, in the series of op.25, the Piano Suite, the interval of a diminished 5th occurs between notes 3 and 4 and between notes 7 and 8. This effectively divides the series into three 4-note groups which can be interchanged without altering the basic character of the series. They can also overlap each other and be coupled together vertically, very much as if they were individual 4-note series. This subdividing of the series might seem contradictory to the tenet of serial theory which holds that the series must unfold its twelve notes in a predetermined succession. There is some truth in this, particularly when it is carried to the lengths of some Schönberg followers, who,,through constant permutation of the interval successions, alter the original beyond recognition. At this point, the series tends to lose the reason for its very existence, namely, that of acting as a recognizable, unifying shape underlying all the musical structures of the piece through its constant repetition. Schönberg himself allowed, however, that once the series had been firmly established in the consciousness of the listener, a certain amount of permutation was quite legitimate.

Example 30a and 30b :-

a.



b.



The types of rows constructed by Webern, where each subsequent segment is an inversion or a retrograde of the first, is a logical extension of Schönberg's rows containing corresponding intervals. In such a case, the character of the row is already contained in the first segment, all other segments being transformations and/or transpositions of this basic shape.

Schönberg's Piano Piece, op.33a, written in 1928, furnishes an example of a highly sophisticated use of a sub-divided 12-note series (see Ex.30a and b). The series is clearly divided into three 4-note groups (a, b and c) which are closely related through their intervallic correspondence: each contains a perfect 4th, an augmented 4th, and a major 2nd or the harmonic inversions thereof, while the first and third groups each contain a minor 2nd, and the second and third groups have a minor 3rd in common.

The Grundgestalt is presented in the first two bars as six chords; this shape contains both the serial material of the piece, and the underlying compositional idea. Two forms of the series are used here: O, and I a perfect 5th below, presented in retrograde. The 4-note chords of the Grundgestalt each comprise a verticalized segment of the series and thus each chord is related to the others through correspondence of interval content. In the analysis of the interval content of the 4-note segments given in the preceding paragraph, it will have been observed that the corresponding intervals do not necessarily occur between successive notes; the segments' presentation as chords obviates any necessity for them to do so.

The whole work is constructed by using these seg-

ments almost like independent 4-note series which interact with each other and do not have to be presented consecutively, i.e., as they appear in the 12-note series. Thus by presenting, in the Grundgestalt, the two forms of the series to be used (basically O and I) as six verticalized segments, Schönberg clearly indicates the basic constructional idea he is to use.

Analysis of the first 9 bars, to the end of the "poco rit..." (see Ex.30b, below) illustrates the following compositional features:-

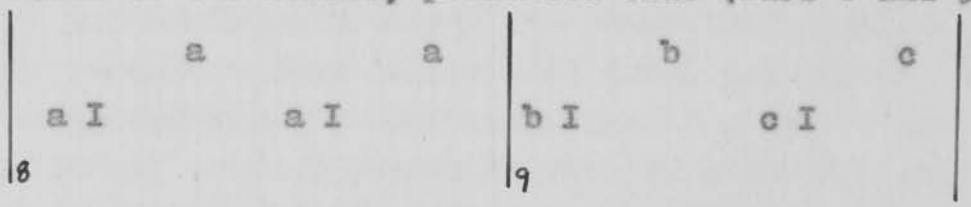
(a) The Grundgestalt (Bars 1 and 2), discussed above;

(b) Corresponding segments from both forms of the series accompanying each other (Bars 3, 4 and 5): in Bar 3, the R.H. plays c I, accompanied by the L.H. playing c; Bar 4 has the R.H. playing b I, while the L.H. plays b; in Bar 5 (and the last quaver of Bar 4) the single notes are the consecutive notes from a I, in retrograde, while the chords are a; (as the segments are presented c, b, a in each hand, both forms are actually sounded in retrograde; however, when successive notes are verticalized, the term "retrograde" has no real application.)

(c) (Bars 6 and 7) : Presentation of the two forms in "strict" form, i.e., the chords and single notes succeed each other as in the 12-note series; each series form, O, then I in retrograde, is split up between the hands, in contrast to the procedure in Bars 3, 4 and 5; (one point worth noting is that the mirrored presentation: a, b, c, cI, bI, aI is stressed at the axis by repeated single notes ($E^{\flat}$, $A^{\flat}$) and these notes sound the interval which is basic to the relationship between the two forms of the series: the perfect 5th.)

(d) New combinations of the corresponding segments from

both forms of the series, presented thus (Bars 8 and 9):-



Between the two hands there is a direct intervallic correspondence, one playing the inversion of the other.

Here, Schönberg's use of a sub-divided series is entirely constructional and musically valid; the unity of the series remains unimpaired because of the close correspondence between its subdivisions.

(Perhaps, too, Schönberg here foreshadows some of the most recent developments in music, where sound-clusters — i.e., notes sounded together and successively but all obviously comprising one structure separated from other, contrasted, structures — interact with each other in musical space.)

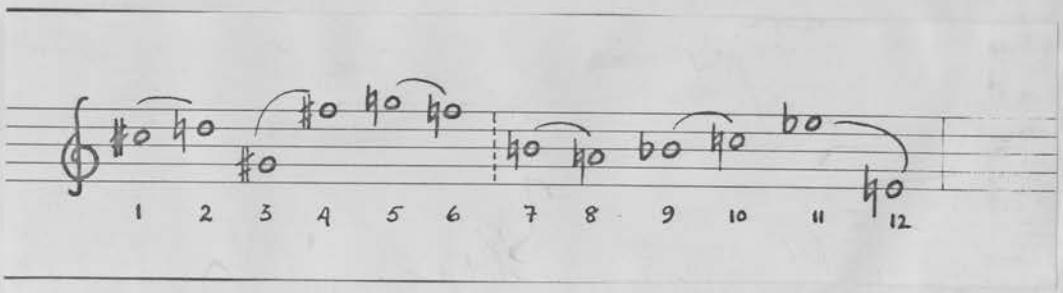
In the analysis of a serial work, the original series is frequently considered as lying within an 8ve compass; it should be realized, however, that this is only the melodic extract from widely diverse figures used throughout the work, and that the same interval can be presented variously as, say, a minor 3rd, a minor 3rd plus an 8ve, or a major 6th (its harmonic inversion). Precedents of this in tonal music are too numerous to mention; in both tonal music and serial music the basic interval is still recognized as such, thereby legitimising the practice. Webern, however, preferred to structure even such changes, holding that an 8ve change of a note's position subtly altered its character. (This will be fully discussed with reference

to op.21 in the following chapter.) Such an idea was foreign to Schönberg, however, who considered much of his work to derive from traditional tonal practice.

It was Schönberg's contention that the series had evolved out of musical necessity and was a natural conclusion to the period of unstable chromaticism. He frequently insisted that the series should never be allowed to dominate the composer's creative imagination; rather should it be a useful technique employed in the service of music. He himself was undoctrinaire and very flexible in his usage of the technique.

This is remarkably illustrated in his opera "Moses und Aron", written between 1930 and 1932 and considered by many to be his chief work. This is a full-length opera, lasting several hours and is most diverse in its musical presentation, ranging from the contemplative "sprechgesang" of Moses, through the lyrical tenor lines of Aron, to the wildly exotic and sensual Golden Calf scene. The entire work is written on a single series which can be divided into two 6-note segments of corresponding interval-content between their component dyads:-

Example 31:



The position of these dyads in relation to each other is constantly changed within each segment and the free-

dom ot the series arises from such permutation.

Schönberg himself said, "In the first works in which I employed this method, I was not yet convinced that the exclusive use of one set [series] would not result in monotony. Would it allow the creation of a sufficient number of characteristically differentiated themes, phrases, motives, sentences, and other forms? At this time, I used complicated devices to assure variety. But soon I discovered that my fear was unfounded; I could even base a whole opera, 'Moses and Aaron', solely on one set; and I found that, on the contrary, the more familiar I became with this set the more easily I could draw themes from it. Thus, the truth of my first prediction had received splendid proof. One has to follow the basic set; but, nevertheless, one composes as freely as before."*

The unity arising from such use of a single series is undeniable; here the series performs a similar function to the diatonic scale of tonal music: it gives rise to highly varied forms and structures which are fundamentally related through their common origin.

At all times the series was subordinated to his musical needs, and, indeed, actually arose out of them.

Where Schönberg wanted concords — as in the "Ode to Napoleon", op.41 (1942) — he did not hesitate to use them; this work ends with an unmistakable chord of E♭ major and the series first appears in a chord-group made up of tonal triads.

The "rules" which he laid down — e.g., no 8ve doubling — he felt to be in accordance with the new style of composition, rather as consecutive 5th and 8ve

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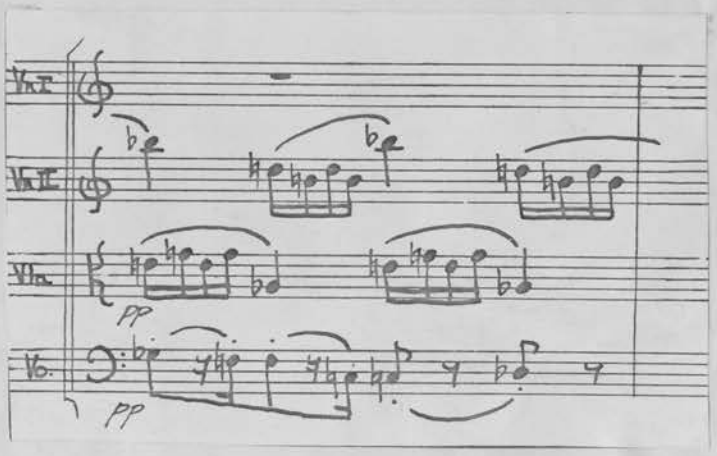
* Op.cit., p.114.

movement in tonal harmonic progressions is not wrong in an absolute sense but, rather, anachronistic to the style.

Hence he felt his subdivision and permutation of the series into segments to be quite valid, providing that its underlying character as a series remained intact, achieved by intervallic correspondence in the two instances briefly examined above.

(2) Likewise, the rule forbidding repetition of any note before all twelve had been sounded was in accordance with the chromatic basis of the 12-note technique; repetition of a note would tend to make that note conspicuous, which again was contradictory to the style. He himself, however, frequently "broke" this rule in certain musical instances. One such instance is where an ostinato is to be used; an ostinato might here be considered as a moving pedal-point, in essence a chord held for a certain length of time. Another instance is in trills and tremolos; yet another is in figures such as that at Bar 78 in the 4th movement of the 3rd String Quartet, op.30:-

Example 32:-

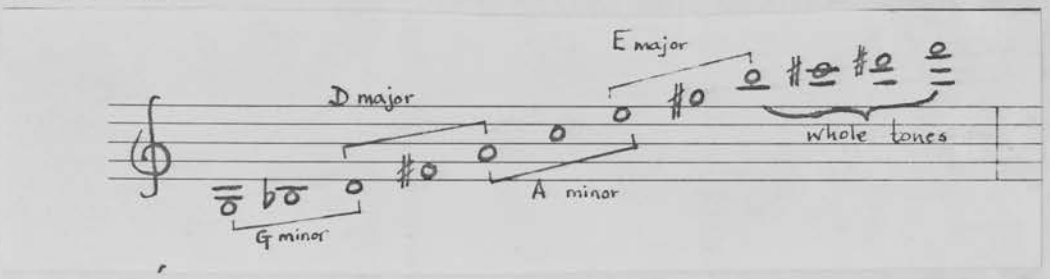


These all involve return to a note already sounded. Immediate repetition of a note is equally valid, as when it is a characteristic feature of a figure, for example, the opening theme of the 1st movement of the 4th String Quartet, op.37 (cf.Ex.24), or when the sound is likely to die away although its continued sounding is considered desirable as, for example, in pizzicato chords.

A series arises directly from a composer's creative needs; as it serves as the basis for all the themes and other musical characters he wishes to use, it must contain the possibilities of these within itself.

The type of sound required by Alban Berg, for example, is richly chromatic with a certain tonal bias. The row of his Violin Concerto (1935):-

Example 33:-

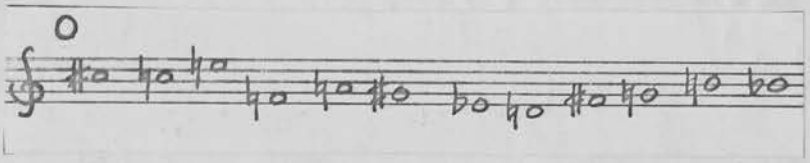


is therefore constructed in such a way as to enable him to realize such sound, but on a serial basis. In its original form it contains alternating and overlapping major and minor triads while the last four notes form part of a whole-tone scale.

Schönberg, when wishing to use certain tonal elements in his Ode, op.41, constructed the series for this so that concordant elements are present, and the row in its original form and especially when inverted and in retrograde, is rich in "leading-note" and "falling 7th"

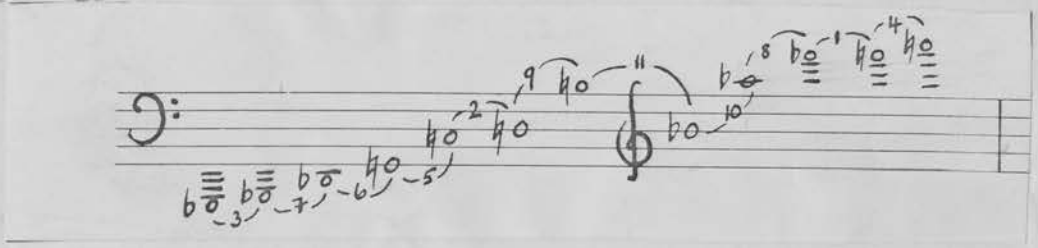
relationships:

Example 34:-



For the maximum possible variety of interval, and thus great variety in sound throughout the work, Křenek suggests, in his "Studies in Counterpoint"*, the use of an all-interval series. This contains all eleven intervals possible; basically there are only six, the other five being harmonic inversions of these.

Example 35:-



(The intervals are measured in number of semitones; this method of measurement is usually used in serial music.)

Smith Brindle points out** that such a series is good for a work in which harmonic variety is required, though it is unsuitable for melodic writing as such great variety is not inducive to what he calls "melodic coherence."

The series of Anton Webern are markedly different from all these. As they were to serve music of a radically different kind from anything which had gone before,

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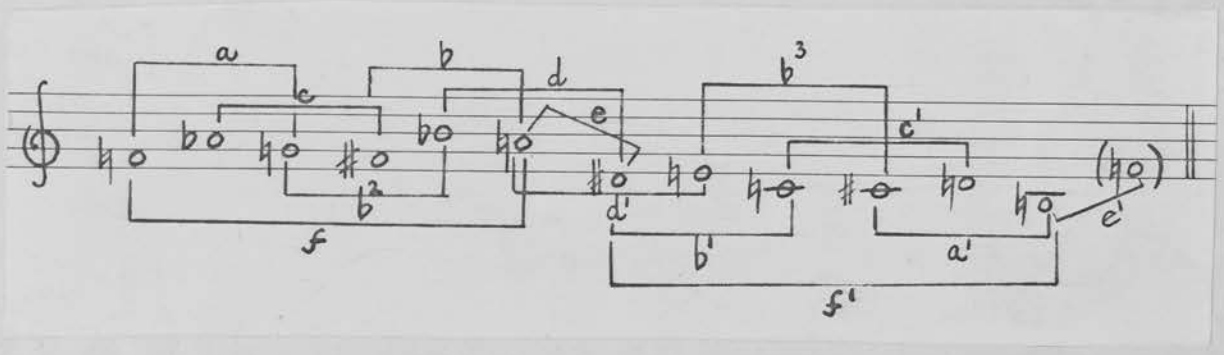
*published by G. Schirmer, Inc.(New York) 1940.

**Reginald Smith Brindle: op.cit.

music whose basis was the minute intervallic cell, they frequently contain within themselves mirrorings and transpositions of such a cell, as in the series of the symphony, op.21:-

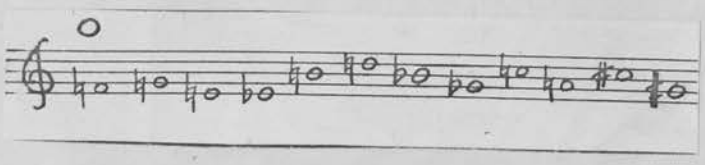
Example 36:-



a' is the retrograde of a; b' is the retrograde of b; b^2 is the retrograde inversion of b; b^3 is the inversion of b; c' is the inversion of c; d' contains the same intervals as d; e' is the inversion of e; f' is the retrograde of f;(each varied presentation involves transposition, of course.)

In his series, Webern also frequently concentrated on the elimination of any suggestion of concord, as this might bear a tonal implication. Here, such an implication is cancelled by a chromatic contradiction of the interval immediately after its sounding, as in the series of the Three Songs, op.23:-

Example 37:-



All his life, and in the face of immense opposition, Schönberg maintained that he was not a revolutionary. At first this may seem curious coming from the innovator of serial music, which has certainly led to some undeniably revolutionary sounds since its inception. Closer examination, however, and from the vantage-point of almost fifty years after he wrote his first serial work, shows him to have been correct in his assessment of his own place in history.

The mind which made the leap from chromatically-based atonal music to the serial method of composition was undoubtedly that of a very great and far-seeing musician, but it should be remembered that actual musical practice had been moving in this direction for at least fifteen years before the first work based on a 12-note series was written. Schönberg's achievement was his recognition of the potential in this unsystematized dodecaphonic music, and the intellectual feat of creating such a system. His formulation of the serial method was thus the logical conclusion to this period of flux.

Schönberg, however, was responsible for the most truly revolutionary concept of the century, namely, that of Musical Space. This has since become fundamental to musical composition today, and is the basis of a system of music which bears virtually no relation to earlier systems, and whose understanding involves an entirely new type of listening. Schönberg himself used it to rationalize the various mirror forms of the series, but it was Webern who first realized, in his own music, the revolutionary aspects of such an idea, although possible foreshadowings of the technique may be

seen in the construction of op.33a (cf. above).

Like all apparent innovators — Bach, for example, or Beethoven — Schönberg is both the culmination of the period before him and the start of a "new" era. In his music one discovers a synthesis of traditional tonal practice and the basis of a type of music which was carried far beyond him by his successors.

The classical precedents for the use of the Grundgestalt have already been discussed. This underlies all of Schönberg's music; in addition to his use thereof, even in a serial context, most of Schönberg's music is conceived thematically; in turn, his thematic writing serves a formal function by subdividing the work into main and subsidiary sections, as did thematic writing in the tonal era.

Rhythm, which was later to become an integral part of serial structures, was treated by Schönberg in accordance with his general compositional principles, that is, rhythm was associated with themes, accompanimental figures, etc., and acted with them referentially; as in tonal music, however, rhythm could act referentially on its own, and also helped to define the form. In music where referential connections were more difficult to make because of the comparative unfamiliarity of a dissonant idiom, however, durational values tended to become far more differentiated and characteristic than before.

In expression, too, Schönberg's music is in the Romantic tradition, rich in emotionally evocative harmony and melody. His music, based as it was on long-accepted principles of composition, ushered in the era of serialism in a perfect synthesis of the two styles. One reason for this achievement is undoubtedly that he

always allowed himself to be guided by his musical needs and never permitted theory to become dogma.

I might end this chapter with two quotations: in a letter to Hauer, written on the 1st of December, 1923, when he was working on the formulation of his method, he said: "I am completely in the position of being able to compose as unhesitatingly and imaginatively as one only does in one's youth and yet I remain under a precisely definable aesthetic control".*

And later, he said, in an article published in 1949: "Recently it has often happened that I have been asked whether certain of my compositions are 'pure' 12-tone or even 12-tone at all. In fact — I do not know. I am always more a composer than a theoretician. And when I compose, I try to forget all theories, I only begin when I have made my mind free from all such influences. It seems to me important to warn my friends against orthodoxy. Composition with 12 tones is really only to a small degree a method which 'forbids' or excludes. In the first instance it is a method which should ensure logical order and organization; and the result of it ought to be easier comprehensibility."**

No more need be said.

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* As quoted in Rufer: op.cit., p.78.

** ibid: p.107.

CHAPTER 3.

ANTON WEBERN.

The music of Anton Webern constitutes a landmark in the history of serial music. At a first hearing one is immediately struck by the sounds of a music without precedent; everything appears to take place in a world of incredible refinement and on a very small scale: the brevity of the music, its low level of dynamics, and its intense, fragmented instrumental utterances. This is the work of a man whose musical thought was radically new, and who realized in sound certain ideas which were to guide music along paths it had never travelled before.

Webern left only thirty-one works with opus numbers; those not numbered include certain very early compositions, arrangements of the works of other composers and his orchestration of the Ricercar from Bach's "Musical Offering". Of these thirty-one, the longest lasts a mere sixteen minutes.

Just as they are slight in length, so are they in size of ensemble — almost all of Webern's work can be described as chamber music; in most cases his orchestras are chamber orchestras (the exception is the Six Pieces, op.6) and most of his work is for chamber ensembles and/or voice.

In his book, Josef Rufer writes: "A composer's thought will create form logically and will obey the law of artistic economy; therefore he will instinctively try to present the content as exhaustively as possible. This means, from the other point of view, that he will not

bring in any musical ideas which are superfluous or would cause the content to 'overflow' the form. He will not bring in anything which one could either leave out or take out afterwards; rather it is what one has to leave out in order not to overburden the content and form, or spoil its clarity and perspective."* This might very well be applied to Webern's music, which demands a quite different type of listening: one of the greatest difficulties it presents stems from the fact that no event is unnecessary: each and every one contributes in some way to the overall form, and is involved in various relationships with other events — and should be recognized as such.

In this connection, too, George Perle suggests that the remarkable brevity of each work "is not an idiosyncratic feature but a necessary and logical consequence of the multiplicity of function of every single element."**

The compositions of Webern constitute a contribution of paramount importance to the development of serial music from three different aspects: the first is the radically new principles embodied in his work, principles which have survived the eventual breakdown of serialism; the second is his advancement of the actual serial technique; the third is his sound — quite new in the history of Western music, but which set a precedent for later music which has since gone far beyond his own methods and theories of composition. A discussion here of these three aspects will be rather in the nature of a summary, as the basic principles of his composition were already operative in his atonal work and have already been discussed in Chap-

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* op.cit., p.99.

** op.cit., p.21.

ter 1, and a detailed illustration of these as found in his serial music has been incorporated into the analysis of his Symphony, op.21, which is given below.

These principles involve a basically new conception of Schönberg's musical space. Schönberg, when describing this in "Style and Idea", says: "There is no absolute down, no right or left, forward or backward." This concept he applied to the four-fold presentation of his series, described in the previous chapter. Webern extends this concept beyond its application to pitch; for him it embodies a fundamental formal principle, and all musical events work towards a clearly recognizable enunciation of this principle.

This latter idea is by no means new : the purpose of defining thematic material through its pitch content, rhythm, instrumentation, general character, etc., in tonal music was to enable these to function referentially in the enunciation of tonal forms. What is new is the actual formal principle involved, for here the idea of progressive development is totally absent. Any mirrored structure — whether as the retrograde, or the inversion, of material — is essentially closed, involuted and self-reflecting. In practice, the enunciation of such forms involves the ordering of all parameters, including pitch, into large-scale patterns which are mirrored, either by inversion or by retrograde movement.

Closely related to this is a principle we have already seen operating in Webern's atonal music. "There is no absolute down, no right or left, forward or backward": as conceived by Webern, musical space is a three-dimensional framework in which sound-objects interact with each other in varying relationships. Here, too,

the vertical and horizontal dimensions become different aspects of the third dimension — time; these two represent simultaneous and successive moments in time, respectively, while the whole dimension of time is included in the concept of musical space.

Webern's extension of the principle underlying series presentation to be the basis of the formal structuring of a complete work — or movement — becomes an ideal means for structuring the relationships between the sound-objects in space. At the same time it provides a solution to the problem of form in serial music. Schönberg's use of the Grundgestalt to create form, as it had done in traditional music, is quite valid because his music is essentially thematic. Nevertheless, there is an inherent contradiction here; tonal forms are based largely on harmonic movement — cadential structures, modulation, contrasted keys : in short, they are ideal for the expression of tonal music; material and form are intricately bound together, the one arising from the other. Thus a combination of such forms with atonal pitch material can at best be only a temporary compromise, based as it is on only one aspect of tonal form — that of its organization of referential thematic structures.

In Webern's music, however, a close correspondence between material and form is once more achieved : his forms arise out of the fundamental principles organizing serial material.

Such a concept of musical space, which underlies all of Webern's serial work, is indicative of a totally new way of thinking; it really marks the true beginning of the age of serialism, and explains why Anton Webern is often referred to as "the father of the new music."

It is thus almost ironical that his ideas, which fathered the era of total serialization, should have survived it to become fundamental to the music of the post-serial period, where complex 'statistical' structures, which have their roots in the minute sound-objects of Webern, are juxtaposed to form ever new relationships with each other in space according to the chance whim of the performer.

The first works in which Webern used a 12-note series were the Five Canons for soprano, clarinet and bass-clarinet, op.16, and the Three Folk Texts for soprano, violin, clarinet and bass clarinet, op.17, both written in 1924. In the first of these, that is, the very first serial work he wrote, Webern uses what might be called "serial form" — i.e., the forms, described above, deriving from basic serial techniques. These in turn are contained within a form which comes from an era preceding that of tonality — the canon.

The first, second and fifth canons employ canon by inversion, the third and fourth are exactly imitative. Here already is an example of the application of the principle of series inversion to the musical form of the piece, in his inversion of the pitch structures of the leading voice. The first, third and fifth canons are written for all three instruments, the second and fourth are for voice and clarinet, and voice and bass clarinet respectively. This again shows another type of mirror formation, exact as to number of instruments used, slightly varied as to which. Minor variations in the mirroring are often introduced to avoid expectation on the part of the listener, once the presence of a mirror has been detected. This idea set a precedent

for later serialists, in particular Stockhausen, who aimed, through the predetermination of all parameters, to structure the listening behaviour of his audiences.

The two forms, serial and canonic, are those most used by Webern. Metzger* suggests that in his predilection for the canon he illustrated yet another aspect of serial theory, relating to the equation of the horizontal and vertical dimensions: "It is possible to make identical material enter into horizontal, vertical and 'diagonal' relationships with itself, by means of constantly-varying displacement in time; to create an overall connection that would resolve the different 'dimensions'..... As if to establish by an extreme example that simultaneity is a special form of succession, Webern composed 'canons' with interval of entry zero, as in the choral sections of the fifth movement of the Second Cantata."

Webern's series, too, indicate a new, serial way of thinking; in the first place, they frequently utilize the interval fundamental to the chromatic scale (as opposed to its specific functional usage in diatonic harmony): the semitone and its expansion and harmonic inversion; any suggestion of a concordant interval — and thus, possibly, a triadic connotation—, is immediately negated by a chromatic contradiction (as discussed in Chap.2,p.46); furthermore, the series are composed by various serial operations on one or more intervallic cells. If his series are compared with those of Schönberg and Berg, an obvious difference is immediately noticeable: Webern's series are actually conceived serially, and arise from his total commitment to the basic

* In an article"Webern and Schönberg", pub. in "die Reihe", Vol.2, (1955), translated by Leo Black (p.43)

concepts of serialism.

As far as Webern's advancement of the actual serial technique is concerned, the first point to be considered is his ordering of the parameters besides pitch. This ordering will be described in detail in the analysis below; it is quite different from the later serialization of all parameters, but it undoubtedly points the way there.

More important, perhaps, than the actual fact of his ordering is the principle on which this ordering was founded. Besides their involvement in the enunciation of form, the various parameters serve to define the interval-objects in musical space. It is the interval which is of prime importance, and all parameters, including pitch, are equated in their function of characterization thereof. Thus pitch, for so long the predominant musical element, is dethroned and the others, previously very subordinated in their musical service — e.g., dynamics and methods of attack — become of like importance. This is the culmination of a tendency already present in the music of the early years of the century, now reached in Webern's music and thereafter a general feature of the works of the post-Webernites. It is also another reason why listening to the music of Webern and his followers is difficult for those thoroughly accustomed to tonality — the ear constantly awaits some recognizable pitch pattern, and becomes confused by the vast quantity of highly differentiated information presented in such music.

The problem of rhythm and metre in serial music is analogous to that of form. In tonal music, both were bound to harmonic and melodic progression to a very con-

siderable degree. One has only to think of the placing of "important" melody notes within a bar, for example, or the added tension of a discord occurring on a strong beat, while the cadential structures of tonal music are inconceivable in a non-rhythmic, non-metrical system.

We have seen how in Schönberg's music the rhythm was composed in conjunction with thematic structures and was thereafter able to act referentially, either with these or on its own. We have also noted how rhythmic figures become, in his music and that of his fellow atonalists, far more characteristic and differentiated.

Rhythm and metre in Webern's music present the listener with considerable problems at first. Not only does the tendency towards a high degree of differentiation become more pronounced, but the rhythmic figures are frequently "irrational", usually involving triplets with complex dotted figures and rests. A further peculiarity is the frequent change of metric unit : a glance at the score of the first movement of the Second Cantata, op.31, shows a change of time-signature at almost every successive bar; besides this there are passages where the separate "parts" are playing in different metres. These two features are still more remarkable in the final movement, a double canon, where the metre of the leading voice is exactly imitated, resulting in constant vertical dissimilarity.

The precedent for this is almost certainly the metrical practices of the pre-tonal contrapuntal era, with which Webern was very familiar, having obtained his doctorate with a thesis on Heinrich Isaak (c.1450-1517) in 1906. This supposition is further strengthened by

the fact that such complexity is found more often in those works where his use of canon is most clearly audible (the canons of some instrumental works are obscured to a certain extent because of the constant crossing of canonic "voices" and the highly discrete presentation of small note-groupings; the rhythm of these is considerably simpler, as can be seen in, for example, op.21, 1st movement and op.27, 2nd movement).

His time-structures are still further complicated by constant fluctuations of tempo — frequent ritenutos, etc.

All this complexity creates a most curious effect : a sort of counterpoint between rhythm and metre emerges. Webern considered the metre to operate as a "temporal 'cantus firmus'" — to quote Metzger once again — over which the rhythm weaves its contrapuntal figures. There is no doubt that such an effect is achieved, more noticeably perhaps in a rhythmically simpler work like the last movement of the Piano Variations, op.27.

The time-signature here is $\frac{3}{2}$, and yet the rhythmic structures themselves seem to give no indication of this. This is particularly noticeable in the "syncopated" section which starts at Bar 45, "Wieder im tempo, doch bewegt". All events happen "a quaver late" — that is to say, the section opens and then continues at a quaver's distance from where the actual pulse of the bar lies. When playing this, one asks oneself why it is not easier to count each event as occurring "on the beat"; the answer is that such a procedure completely destroys the audible counterpoint existing between this silent metre and the actual sound. Here Webern has included silence in the rhythmic parameter and works with it as with any

other compositional element.

Peter Stadlen who, in about 1937, was asked by Webern to give the first performance of this work, began a period of intensive study of this under Webern himself, and gives an account of it in an article, "Serialism reconsidered".* He describes what happened at Bars 43-45 of the last movement: Bar 43 has an accelerando which continues across Bar 44, which is a bar of silence; at Bar 45 the music continues at a slower tempo (see above), and Webern always insisted on a caesura over the bar-line between Bars 44 and 45, although this is not in fact in the score.

Stadlen recounts: "Whenever we got to this spot, Webern would not only conduct my playing of the bar (Bar 43), but would continue to count out in a loud and excited voice the three accelerando beats of the next bar: 'One, two, three!' He would then pause before continuing to conduct my playing of the next, slower bar. It was clear that what mattered to him here was not the overall length of the silence between the two sounding notes: the pulsating of the time-continuum had itself become a primary compositional element."

No doubt he also has in mind the section which follows this pause (discussed above) when he continues: "We can, of course, in all music distinguish between rests that contain music and others that don't. But here the changes of tempo have become so numerous compared with the number of notes as to reverse the usual ratio of sounding and non-sounding events in music. This tends to upset the familiar relation between rhythm and metre where the one is understood as the significant exception from the insignificant rule of the other. Instead there

* Pub. in "The Score", No.22, February 1958.

is a tendency towards a strange relativity — generally characteristic of dodecaphonic mentality — where one significance has to be related to another."

Up until this time, rests frequently served to punctuate the music, as it were; they were where the music stopped — as Metzger puts it, they "were the means of expressing the caesura." This is undoubtedly an over-simplification of their role as there are numerous precedents for their more active participation in the overall rhythmic structure of certain passages in earlier music. Nevertheless their main function was that of punctuation, whereas in Webern's music this is subordinated to his consideration of them as silent notes of exact duration with a dynamic value of zero. As such, they are included in the structuring of all the compositional elements of a work. They enter, for instance, into the mirroring of the rhythmic structures in the middle section of op.21, 1st movement. In addition, silence here performs a most interesting formal function, at the axis of the whole movement — this will be discussed in full detail below.

Perhaps one of the best comments on the subject comes from one of Webern's most devoted admirers and followers, Pierre Boulez*: "One of the truths hardest to demonstrate is that music is not just 'the art of sound' — that it must be defined rather as a counterpoint of sound and silence. Webern's one, unique, rhythmic innovation is this conception whereby sound and silence are linked in a precise organization directed toward the exhaustive exploitation of our powers of hearing."

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*In an article, "The Threshold", pub. in die Reihe, Vol.2, translated by Leo Black (p.40).

During the course of his study of op.27 with Webern, Stadlen asked him to explain the serial construction of the work; this Webern declined to do "because, he said, it was important that I should know how the work should be played, not how it was made. He acted as if he himself were not aware of the serial aspect of his work, or at least never thought of it when playing or discussing it. He seemed to imply by his behaviour that both he and we need only be concerned with the prima facie appearance of the correspondences and structures as we see them in the score and as they are made to sound according to his instructions — and that knowledge of their serial implications was not required for a full appreciation of the music."

Of course, those very "correspondences and structures .... as they are made to sound" are, in fact, the musical realization of serial principles and arise from the serial ordering; thus an explanation of the serial construction would have been superfluous. And yet in spite of what might seem a purely intellectual concern with formal principles, Webern's music is invested with tremendous emotional depth, and is appreciated by his followers and admirers for this quite as much as for its theoretical importance.

The most immediately striking feature of Webern's music is its high degree of differentiation between successive sounds, arising from the fact that the characterization of each sound-object requires its various parameters to define it sharply from its neighbours. This results in a discontinuous texture and effectively ensures recognition of each sound-object. Such a discontinuous texture became known as pointillistic, and can

be heard in the music of Boulez, Pousseur and Stockhausen, although these composers in fact structured their parameters rather differently from Webern, along the lines of total serialization.

Even in the scores of Webern, the detailed changes of most parameters from one note, or group of notes, to the next, make great demands on the performers. In the still more complex, pointillistic scores of the post-Webernites the difficulties of realizing these constant and detailed changes led to a situation where Stockhausen and Pousseur had eventually to structure even the "zones of inaccuracy" of their performers.

Pointillism is incompatible with the use of large symphony orchestras, and thus so much of this type of music is for chamber groups. Webern's work is characterized by the use of unusual timbres — though it is still played on conventional instruments. This tendency is far more pronounced in the music of Boulez, where many non-Western — and otherwise unfamiliar — instruments are used in the search for new timbres to express the new sounds. With the advent of electronic music, the world of unusual timbre was expanded to include every conceivable sound desired.

One further point concerning Webern's sound should perhaps be considered. Already, in Schönberg's music, there had been a tendency towards a new treatment of the voice, a treatment which at first seems unvocal. Over half of Webern's music is for the voice, and in spite of his avoidance of a melodic phrase of any length, he is yet able to set his chosen texts in an expressive and otherwise appropriate manner.

As the vocal line is also involved in the musical realization of the principles discussed above, and thus

enters into serial relationships of correspondence with the other instruments, the singer is expected to sing relatively difficult intervals and complex rhythms, formerly considered beyond the realm of vocal ability. Critics have pointed to the fact that, for example, in the Five Canons, op.16, the soprano sings the same line as the two other instruments involved, and has therefore an instrumental (and thus by definition unvocal) part. However, singers of Webern's music (and here I am referring specifically to those who sang for the Robert Craft recordings of Webern's complete works) do not complain of any particular difficulty — and some of these did not have "perfect" pitch.

Subsequent vocal music in the serial idiom has been very obviously influenced by Webern, in its wide leaps and its intense fragmented utterance; nowhere is this better evidenced than in the music of Boulez — one has only to think of the vocal part of "Le Marteau sans maître", for example.

Thus the radically new sound of Webern's music, even when considered separately from his serial practice, has had a profound influence on the music after him. It has become the most characteristic sound of 20th-century serial music and its influence is felt even beyond the serial era, as we shall see in subsequent chapters.

In order to illustrate — and by means of concrete examples to clarify — all of what has been said above, I have chosen to analyse the first movement of the Symphony, op.21. Although it is a fairly early serial work, it is nonetheless a good example of how Webern's principles and theories were realized in his music.

Webern's Symphony, op.21, was written in 1928 and is his fifth serial work. It is written for

Clarinet
Bass clarinet
2 Horns
Harp
Violins I
Violins II
Violas
Cellos

and is in two movements : the first, "Ruhig schreitend" (♩ = ca50), is a double canon by inversion written within the framework of a sonata-form movement; the second, "Sehr ruhig" (♩ = ca54), is a theme and variations. The entire work lasts only ten minutes and is written on a single 12-note series.

A detailed analysis of the first movement now follows, in which I hope to show how Webern realized in sound his radically new vision of the nature of music, and how his methods of composition in a work written just seven years after the first completely serial work — Schönberg's Piano Suite, op.25 — point the way to the

later, more radical, developments in serial music.

The first movement employs three forms — one contrapuntal, one classical and the third, serial. A double canon by inversion is laid out in an exposition lasting twenty-four bars which is, as in classical tradition, repeated. The next section sees the canon developed by the introduction of varied rhythms, greater register variation and new instrumentation; here, too, other transpositions of the series are used. The whole of this development section is written as a mirror — that is, there are two halves, the second being the retrograde of the first; this, too, can be seen as a variation of the mirror principle employed in the actual canon: one form of mirroring is by inversion, the other is by retrograde movement. At Bars 42-44, a clear recapitulation begins; the exposition is repeated at pitch, apart from changes of registration. Rhythm, instrumentation, dynamics and modes of attack, too, are varied. Thus the canon is contained within a clear classical form, although the music itself has nothing whatsoever in common with the music usually associated with this form.

Both these traditional forms are accomodated within an overall serial conception. As we have seen, the four forms of the series are equivalent in musical space, the basis of their equivalence being a mirroring principle whereby the series as a whole is presented in inversion, in retrograde and in retrograde inversion without changing its essential character. The traditional forms as used by Webern are themselves illustrative of this : the canon is in inversion; the recapitulation of an exposition with an intervening development section ensures

the symmetrical structure of A B A, and thus mirroring of another type; the fact that Webern's development section itself forms two halves — the second the retrograde of the first — results in a formal extension of the basic serial principle of equivalence in musical space : A, B : B_R, A.

Webern considered serialism to be a fundamental principle of his music, deriving from Schönberg's concept of musical space, as opposed to its being merely a method for the organization of pitch; we have already seen how he applied this idea to the two traditional forms he chose for this movement.

For the serial principle to be completely realized in music, it had to permeate all aspects of the work; this means that all parameters had to be involved in the sounding of those overall formal structures which Webern had derived from this principle. Thus it is not only pitch — as ordered in the series — that enunciates the two forms of this movement, but also rhythm, instrumentation, dynamics, registration, even methods of attack.

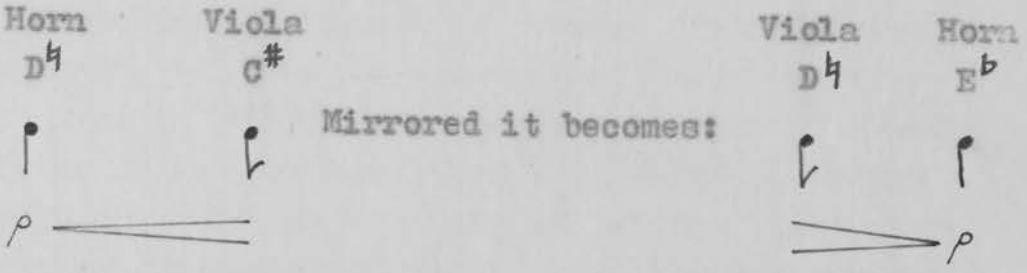
In a sense, then, the serial principle operates here analogously to tonality in its ability to order all the various aspects of the music — from its pitch structures to its overall forms.

There is another aspect to consider in connection with Webern's ordering of all parameters. In Chapter 1, it was noted how Webern saw the interval as the basic structural element of his music (cf. p. 22 ff). He reduces the 12-note series to a few intervallic cells, comprising one or two intervals only, which are then presented in inversion, retrograde and retrograde inversion within the series itself. The series of op.21 is

an illustration of this.

The interval, besides its character as such, derives further characteristics through its enunciation at a certain pitch in a certain register, through the rhythm and instrumentation — including methods of attack — of its pitch components, and through its sounding at a certain dynamic level. The interval thus appears as a highly differentiated sound-object in musical space.

This sound-object, when inverted, still involves essentially the same interval but, just as its pitch components are mirrored, so too may be its rhythm, dynamic level and instrumentation; for example, the interval of a major 7th might appear thus:-



Thus the serial principle of mirroring operates to structure even within the sound-objects themselves, while the two aspects of Webern's concept of musical space become fused in a single practice : serial forms, arising out of basic serial techniques, become the structuring force for the relationships between highly differentiated sound-objects in space.

An analogy with sculpture may help here. Consider a structure consisting of many separated objects which are related to each other in various ways. These objects are in turn arranged in larger groupings which interact with each other in relationships of a similar kind to those which exist between the individual compo-

nents. Each minute relationship can be appreciated in itself; step back and view the structure in its entirety and further forms, macrocosms of the microcosmic relationships, become apparent. Such a visual analogy might well be applied to the composition of the first movement of op.21.

It is obvious that music conceived and realized in accordance with such completely new concepts requires a new type of listening altogether. Such music, too, ushers in the era dominated by a musical theory and practice which has rendered the enjoyment of "serious" music almost inaccessible to all but the initiated few.

The canonic structures of the first movement of op.21 may be seen in Figure 1.* There are really only two "voices", but each is composed of two clearly definable strands (which have therefore been separated in Fig.1), so as to make four strands altogether. The leading "voice" is marked in shades of red, the imitative "voice" in shades of blue; thus the two strands of Voice I, (a) and (b), are written in orange and red respectively, while the two strands of Voice II, (a) and (b), are written in mauve and blue respectively.

Voice II is the inversion of Voice I, and enters exactly two bars after it. As the second strand, (b), of each voice enters one bar after the first, (a), the actual effect is that of an entry at one bar's distance.

The two strands of each voice are strongly differentiated from each other, the first containing much simpler pitch and rhythmic figures and entailing fewer

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* This Figure and all following are to be found in the Appendix.

struction.

The division of each voice into two characteristic strands means in effect that Voice I (a) — in orange — will be in canon by inversion with Voice II (a) — in mauve —, and Voice I (b) — in red — will be in canon by inversion with Voice II (b) — in blue. Each strand takes its own forms and transpositions of the series, the instrumentation is structured within each strand — because it is bound to the pitch —, registration and dynamics, too, are structured for each strand, and thus for the purposes of this analysis I shall discuss each strand separately.

The 12-note series used for this work is composed out of a number of intervallic cells which are transposed, inverted and in retrograde. Again, note how Webern's concern is with such cells, as opposed to a Grundgestalt composed of twelve different notes, as in the series of Schönberg. The series is seen at Figure 2 (already quoted on p. 61):-

a^1 is the retrograde of a , transposed;

b^1 is the retrograde of b , transposed;

b^2 is the retrograde inversion of b , transposed;

b^3 is the inversion of b , transposed;

c^1 is the inversion of c , transposed;

d^1 contains the same intervals as d; in d , both intervals fall, in d^1 , one falls, one rises;

e^1 between notes 12 and 1 of the series is the inversion of e , transposed;

f^1 is the retrograde of f , transposed a tritone below, i.e., six semitones.

There are usually 48 possible forms of the series,

12 transpositions of the 4 presentations : O, R, I, RI. The fact that notes 7 to 12 (f') are the retrograde of notes 1 to 6 (f) at a tritone's distance means that there are only 24 possible forms, as the O form transposed up six semitones gives the first form of R and vice versa; likewise the I form transposed up six semitones gives the first form of RI and vice versa. Thus O 1-6 = R 7-12; O 7-12 = R 1-6; I 1-6 = RI 7-12; I 7-12 = RI 1-6. This is quite clearly illustrated in Figure 3.

The first form of each presentation of the series has been designated O_{1}, R_{1}, etc. Thus the O form transposed up one semitone becomes O_{2}, two semitones, O_{3}, etc. The enclosed column of numbers at the left of each set indicates the number given to each transposition, according to this plan. Next to each set is an unenclosed column of numbers; these indicate the equivalent presentation at the transposition of a tritone; for example, I_{5} is the same as RI_{11}, O_{1} is the same as R_{7}, etc.

This type of series construction is characteristic of Webern's idiom as a whole. By equating the first twenty-four possible transpositions with the second, he ensures still greater concentration of possible pitch material.

The row of numbers above each set of twelve transpositions represents the numbers of the notes as they appear consecutively in the series.

When laid out within the compass of an 8ve, the series will be seen to contain one tritone, six semitones, two minor 3rds and two major 3rds. The preponderance of semitones is characteristic of Webern for several reasons: the new pitch material, deriving as it does from the 12-

note chromatic scale, has the semitone as its basis; it was his avowed aim to avoid any suggestion of tonality in his series, and the semitone, when presented as a major 7th or minor 9th, is the melodic interval least used in tonal music, generally speaking; besides this, the constant association of the concordant intervals with semitones within the cells from which the series is constructed tends to neutralize any triadic implications that might arise from such concords; finally, and as Pousseur noted, Webern frequently uses this interval to structure his pitch movement.

Because of the high degree of differentiation between the two strands which make up each of the two voices of the canon, and because of the fact that different structures of symmetry order the various parameters in each, each strand will be dealt with separately. In addition, the (a) strands are in canon with each other, as are the (b), and so Voice I (a) will be discussed in conjunction with Voice II (a), Voice I (b) with Voice II (b).

Let us look at the exposition first, i.e., the first twenty-four bars, up to the repeat sign. It has already been mentioned that the (a) strands are much simpler than the (b). A glance at Figure 1 will show that :-

(i) There are far fewer notes in (a), as a lesser number of series forms is used. There are two forms in the (a) strands of each voice, four in the (b).

(ii) The durational values are longer, on the average, in (a); the longest durational value is the d in (b), but the o in (a).

(iii) The instrumentation is far less varied, and changes much less frequently in (a). There are five changes of instrument in (a), but fifteen (sixteen at the repeat) in (b).

(iv) The range of dynamic values is wider in (b) than in (a), moving only from *pp* to *mp* in (a), but from *pp* to *f* in (b).

(v) (b) contains acciaccaturas and 2-note chords and has an overall fragmented, pointillistic texture, whereas (a) has no acciaccaturas or chords, and is characterized by a number of legato phrases joining two notes together. In addition, (a) contains the only repeated notes of the section : $F^{\#}$ and $C^{\natural}$.

All the factors described above combine to separate the two strands into one of complexity, the other of relative simplicity, one of discontinuous, pointillistic effect, and the other containing phrases of some length. This is the result of formal considerations, as the canonic strands are made more easily recognizable by such differentiation.

Only two forms of the series are used in (a), and these are chosen in such a way as to allow notes 11 and 12 of the first form to overlap notes 1 and 2 of the second. In Voice I (a), I_5 then $R_2(O_8)$ are used; in Voice II (a), O_5 then $RI_8(I_2)$ are used (cf. Figure 3). His choice of these particular forms also ensures that the pitches within each strand are mirrored within a pattern of mirrored 2-note cells. The axis is at the point of overlap (see Figure 4).

Examination of Figure 4 will show that there is no mechanical symmetry here. The variations in the mirroring are structured, and here, as at many points in the construction of this work, Webern foreshadows later serialists by his structuring of small variations in relation to a structured whole.

As the following remarks apply also to Voice II (a)

(as the pitch, although inverted, is in canon), examples from Voice I (a) only will be considered.

The two cells immediately preceding and following the axis ($D^{\natural}C^{\#}$) are mirrored as to position in relation to the axis, as are the two outer cells ($A^{\natural}F^{\#}$, and $G^{\natural}A^{\flat}[G^{\#}]$). The positioning of the notes within the cells remains the same in relation to each other, i.e., for example, $D^{\natural}$ comes before $C^{\#}$ in both cells.

The third and fourth cells, ($E^{\natural}$,$F^{\natural}$, and $B^{\natural}$,$B^{\flat}$) exchange positions in relation to the axis cell when mirrored; this inversion constitutes a variation in the symmetry of cell positioning. This is compensated for by a mirroring of note positioning within the cell: $E^{\natural}$,$F^{\natural}$ is mirrored $F^{\natural}E^{\natural}$; $B^{\natural}$,$B^{\flat}$ is mirrored $B^{\flat}$,$B^{\natural}$.

Thus in the first, second and fifth cells, cell positioning is mirrored, note positioning is not; in the third and fourth cells, cell positioning is not mirrored, note positioning is. The cell positioning in the 1st, 2nd and 5th cells thus bears an identical relationship to the note positioning of the 3rd and 4th cells, and vice versa.

Perhaps it should be added that this division of the series into 2-note cells for the purpose of the pitch ordering does not bear any relation to the musical phrasing of the notes; the latter operates independently of this altogether. It should also be noted that all pitches are mirrored within the strands at the same register. The remarks in this last paragraph apply to all four strands.

The instrumentation of the (a) strands, too, is ordered in mirror-structures, as can be seen at Figure 5.

Besides its ordering as a separate parameter, i.e., as a parameter which is ordered within itself, independently of the other parameters, the instrumentation is also bound up with the enunciation of the pitch symmetry described above. The 2-note cells are combined in groups each containing two or three cells whose instrumentation is symmetrical.

In Voice I (a), the cello plays the axis cell and those immediately preceding and following it, the clarinet plays the next two, while the horn takes the two outer cells.

In Voice II (a), the viola plays the axis cell and those immediately preceding and following it, the bass clarinet plays the next two, while the horn takes the two outer cells.

Thus the instrumentation within each strand is mirrored. The number of notes taken by the various instruments is canonically imitated between the strands; although there is canonic correspondence as regards the horn, interesting alterations are noticeable : Voice II substitutes bass clarinet for clarinet, and viola for cello. More will be said of this later.

The grouping of the 2-note cells into groups containing two or more cells ensures a certain continuity of sound, and an impression of relatively long phrases, which is in marked contrast to the (b) strands of the voices.

Before examining the rhythm, dynamics and methods of attack — which are composed with reference to the canonic structure only, as opposed to the two-fold ordering governing pitch and instrumentation, i.e., the canonic ordering and the ordering within the single

strands which make up the canon — let us look at the (b) strands as regards their internal ordering of pitch and instrumentation. Here the organization governing the (a) strands is extended and rather more complex, although obviously based on the same principles.

As mentioned above, the (b) strands are in marked contrast to the (a) strands, containing a far larger number of notes, shorter durational values, a discontinuous texture, and a new feature: chords and acciaccaturas.

Four forms of the series are used. As in the (a) strands, these are chosen so that the last two notes of one form are the same as the first two of the next, and so that they form the same type of mirror-structures seen at (a).

Voice I (b) uses O_{1}, then I_{10}, and then again, and using different durational values, O_{1}, I_{10}. Voice II (b) uses I_{9} then O_{12}, and again, as above, I_{9}, O_{12}.

The mirror-structuring of the 2-note cells can be seen at Figure 6. There are three overlapping mirrors here (indicated by the lines <u>below</u> the row of pitches), the axis of each being at the point where the various forms of the series overlap. The 2-note cell mirroring, noted in the (a) strands, is present in each mirror, as is the variation in the cell mirroring with its corresponding mirroring of the actual notes within the cells (cf. the note on this for the (a) strands). Besides these three overlapping mirrors, there is one overall mirror (indicated by the lines <u>above</u> the row of pitches). This, too, of course, shows the variation in the cell mirroring discussed above. One other interesting point involving pitch is that the axis cells in both (b) strands stand a tritone apart from each other

(cf. the tritone relationship governing the various transpositions of the series).

The instrumentation of the (b) strands is far more complex and less audibly symmetrical. In the (a) strands, the instrumentation is designed to emphasize the pitch mirroring; in the (b) strands it is designed to obscure it.

Figure 7(a) shows the instrumentation. Let us look at Voice I (b) first. In the first mirror, marked in red, with its axis at D♮ B♮ on the harp, the four opening notes, taken by harp (one note) and cello (three notes) are "mirrored" by the harp (two), viola (two); the next four notes — B♭ A♮, E♭ E♮, on the violin (one) and harp (three), are mirrored on the violin alone; the two horn cells correspond.

In the second mirror, marked in black, with its axis at F♮ A♭ on the viola, the opening cell, D♮ B♮, on the harp is mirrored by harp (one) and viola (one); the next six notes — horn (two), violin (four), are mirrored by the viola alone; as in the first mirror, the two cells immediately preceding and following the axis — now played by the harp — correspond (cf. the horn cells of the first mirror).

In the third mirror, marked in light blue, with its axis at D♮ B♮ on harp (one) and viola (one) — note the correspondence with the axis instrumentation of the first and second axes (first: harp, second: viola) — the first two notes on the viola are mirrored by harp and cello (these notes are absorbed into the first two notes of the repeat); the next two — G♮ F♯ — on the harp are mirrored on the harp; the six notes immediately preceding and following the axis are on the viola : thus, in this third mirror, there is direct correspond-

ence, except for the first cell, and an interestingly organized instrumentation of the axis.

The overall mirror (and now referring to the repeat), marked with lines above the row of pitches, has its axis at the notes F♮A♭, on the viola; the two harp cells on either side correspond; moving outwards from the axis, horn and violin are mirrored by viola alone; the two notes D♮B♮, on the harp, are mirrored by harp and viola; the six notes taken by violin (one), harp (three) and horn (two) are mirrored on the viola alone; the 3-note group taken by the cello is mirrored on the bass-clarinet, while the first harp note, F♮, is mirrored by the last note, A♭, also on the harp.

Voice II (b) shows the same type of asymmetrical mirroring, but with certain instrumental changes; that is, the number of notes taken by each instrument is canonically imitated, as in the (a) strands, but, also as at (a), there are certain substitutions in the actual instrumentation : the first change is the substitution of the viola in Voice II for the cello (cf. the (a) strands, where the same substitution occurs); later, the cello is substituted for the violin; at the central axis (F♮A♭, in Voice I, C♯B♭, in Voice II) the violin substitutes in Voice II for the viola; the next two changes involve the substitution of the cello for the viola (cf. above). Finally, the 3-note group on the bass clarinet in Voice I — at the repeat — is on the viola in Voice II. All this is illustrated at Figure 7(b).

A point worth noting, and most easily seen at Figure 7(b), is that the instrumentation of the cells immediately preceding and following the first two axes is

clearly symmetrical; the instrumentation at the third axis, however, forms a lopsided mirror. This is owing to the curious correspondence in axis instrumentation already noted:

in Voice I, 1st axis - harp; 2nd axis - viola; 3rd axis - harp, viola;
in Voice II, 1st axis - harp; 2nd axis - violin; 3rd axis - harp, cello;

notice the substitution of cello for violin in the 3rd axis of Voice II, already noted in the canonic substitutions between the strands. This results in a lopsided effect, as the second note of the axis is absorbed by the instrument playing the succeeding six notes. This sort of lopsided mirroring is one of the features used to vary the mirror-structures, and one we shall note again in the development section.

The canon between the (b) strands is considerably obscured by so much variation in the canonic imitation of the instrumentation. This was not the case with the (a) strands, which are further differentiated from the (b) as regards instrumentation by their exclusive use of the clarinet, while the (b) strands make use of the violin and harp, which do not appear in (a) at all.

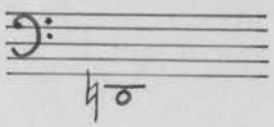
The instrumentation proves, in this music, to be an invaluable contributor to the form of the piece. Its contribution to the exposition alone is summarised below:-

(i) It serves to differentiate the two strands of each voice by the use of some mutually exclusive instruments, and also by its great variety in the (b) strands as compared with (a).

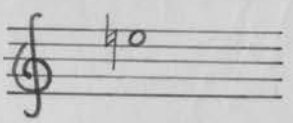
(ii) It assists in the listener's appreciation of the canons by constantly imitating the number of notes taken by the instruments; such an advantage is somewhat lessen-

ed, however, by the fair amount of variation in the canonic imitation of the actual instruments involved.
(iii) It emphasizes the pitch symmetry of the individual strands, more especially in the simpler (a). In the (b) strands, the three overlapping mirrors are emphasized by the use of the harp at all axes, and in first and final groups of notes. At the 1st and 3rd axes the harp is involved in the actual notes of the axis cell; at the 2nd axis, i.e., the central axis of the overall mirror, it enunciates the 2-note cells on either side of the axis cell. In the first and final four-note groups of both (b) strands, it is used in conjunction with the cello in Voice I, the viola in Voice II (at its first sounding; the repeat substitutes bass clarinet for cello); thus it is no accident that it is these two, the viola and cello, which enunciate the central groups of the (a) strands, where there is no harp. This subtle instrumental relationship is typical of the high degree of organization found even in this relatively early work.
(iv) These three instruments — harp, viola and cello — also serve another function, that of drawing attention to a distinctive feature of the (b) strands: the tritone chord $A^{\natural} - E^{\flat}$. This occurs twice in each voice, the first being played in both voices by the harp, the second appearing on viola and cello in Voices I and II respectively. Thus the relationship involving these three instruments operates variously in the clearer enunciation of the form of this work.

The range of intervals and registers used are worth noting, as variations of these in the recapitulation are structured. The lowest note in the exposition is:



, the highest



(At Figure 1, the sign 𝄞₈ at the beginning of each stave indicates that the notes are written one octave higher than they occur in the orchestral score.) The sound is thus generally placed in a middle register.

The methods of attack, i.e., the manner in which each note is played — staccato, legato, etc., tend towards canonic imitation, with only two variations in the (a) strands; there is a considerably larger number of divergences in the (b) strands, however, in accordance with the latters' more complex structuring.

The rhythm of each voice is precisely imitated between the strands, although there appears to be no consistent ordering <u>within</u> the strands themselves.

The choice of dynamics appears to be quite free, with no predetermined ordering. They are neither canonically imitated nor internally ordered.

Thus in the exposition we find the pitches and instrumentation combining to enunciate clear mirror formations; both are canonically treated between the two strands which go to make up each voice. The rhythm is subject to canonic treatment only, so are the methods of attack with several divergences; dynamics do not appear to be ordered at all.

The "development" section is both a development of certain constructional elements in the exposition and a simplification thereof.

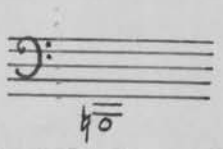
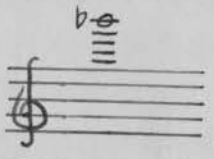
A constructional feature noted in the individual strands in the exposition — the mirroring of certain parameters — now becomes the basic structuring principle: the whole of this section is written as a mirror formation

in which all the parameters of all four strands participate to varying extents. At the same time, besides the exact canonic imitation between the two corresponding strands of each voice, there is, with certain variations at the mirror axis, an overall 4-part canon.

The canonic structures and mirror formations are shown at Figure 8.

Before discussing this section more fully, some features of overall difference between this and the preceding section should be noted:

The high degree of differentiation between the two strands which make up each voice is noticeably lacking here, the obvious reason being that all four strands are now involved in the presentation of a single 4-part canon. An effect of far greater unity is also achieved in this section because of the mirrored repetition of the material, a repetition in which all parameters participate to some degree.

The register compass is considerably widened, the lowest note being  , the highest  .

The dynamic level is reduced, and now includes *ppp*. Much of the exposition was *p* or *mp*, whereas the overall effect of the development section is *pp*. This is interesting, as the dynamic level rises sharply in the final, recapitulatory section.

A new rhythm is introduced:  and the 2-note chords which were a feature of the (b) strands in the exposition do not occur here.

Finally, the instrumentation is simplified, each instrument taking several notes successively, thus reducing the highly pointillistic effect of the exposition.

In the exposition Voice I was imitated by Voice II; here Voice II leads. At the axis of the mirror, which occurs at the barline between Bars 34 and 35, this order is reversed and Voice I leads once again.

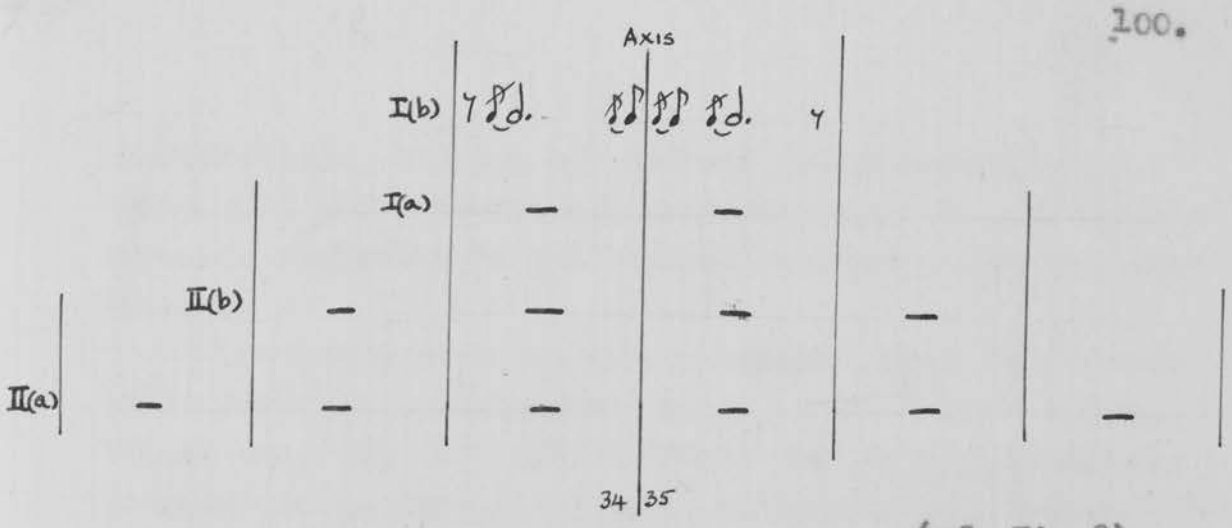
As in the exposition, the canon is in inversion, the corresponding strands of the imitative voice being the inversion of those of the leading voice.

Each strand is made up of two forms of the series; as in the exposition the relationship between the series used in the (a) strands is closer than those of the (b), as they both start on $E^{\flat}$. Voice I (a) uses I_{12} and RI_{12} (cf. Fig.3) while Voice II (a) uses O_{12} and R_{12} ; Voice I (b) uses I_4 and RI_4 while Voice II (b) uses O_8 and R_8 . (The augmented triad formed by the opening notes of these four strands — $C^{\flat}, E^{\flat}, G^{\#}$ — recalls the same relationship in the exposition a perfect 5th lower — $F^{\flat}, A^{\flat}, C^{\#}$; cf. the key relationships of classical sonata form!)

The choice of such series effects an exact mirroring of <u>each successive pitch</u>, as contrasted with the more complex mirroring of 2-note cells noted in the exposition.

In accordance with Webern's customary avoidance of entirely mechanical mirroring, however, there is a curious variation of this pitch mirroring in the (a) strands, which results in what might be termed a "lopsided" mirror.

The axis of the mirror is clearly recognizable as such and is distinguished by an arithmetically increasing and decreasing number of silent bars:-



(cf. Fig.8)

However, unlike in the (b) strands, the two series forms used by each (a) strand overlap their final and first notes; this "pivot"-note occurs on the right-hand side of the mirror as an acciaccatura, ringed in red at Fig.8. Thus as far as the <u>pitch</u> is concerned, the axis of the (a) strands is at this point, although the axis of the overall mirror is clearly dictated by the proportioned bars of silence, as described above. (This lopsided mirroring recalls the lopsided instrumental mirroring in the third mirror of the (b) strands in the exposition.)

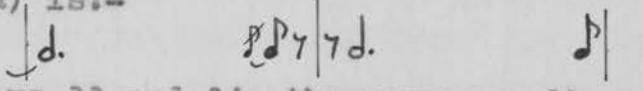
The rhythm, besides forming a 4-part canon, is mirrored exactly, except for the figure  which remains  (as opposed to becoming  , which would be its "correct" mirror form). These two parameters, pitch and rhythm, should not be considered separately, as they are bound together in their enunciation of the mirror, each pitch being associated with a particular durational value within each individual strand. Their association is varied only in the mirroring of the figure (, , etc.), thus:-

e.g.  becomes  .

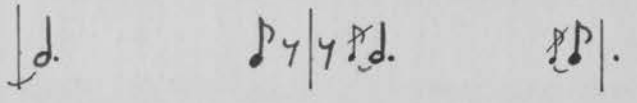
The "pivot"-note of the (a) strands occurs as an

acciaccatura, and is, of course, not mirrored, this pitch and its attendant durational value thus forming a curious variation in the formal enunciation of the symmetry.

The leading voices are interchanged at the mirror and there are certain variations in the 4-part canon. These occur at the axis, between the voices, while the corresponding strands of each voice remain in exact canon. These variations involve the placing of acciaccaturas only and are most easily noted by comparing Voice II (a) with Voice I (b) in Fig.8: the disposition of the acciaccaturas at Bar 30 and 31 in Voice II (a) is:-



; contrast this with Bars 33 and 34, the corresponding rhythmic points in Voice I (b):-



These are, of course, mirrored, and so a corresponding change will be observed on the right-hand side of the mirror, excluding the "pivotal" grace-note. The change is canonically imitated in the corresponding strands. It is interesting to note that these variations involve the rhythmic "odd-man-out" in the mirroring: the red-ringed .

The instrumentation, like the rhythm, is closely associated with the pitch. Thus it is also involved in the enunciation of the mirror and is in 4-part canon, again with certain variations at the axis. As can be seen quite clearly at Fig.8, the instrumentation of the (a) strands is in exact canon and forms an exact mirror; the instrumentation of each (b) strand also

forms an exact mirror, but there is an interesting canonic variation between the strands at the axis. The notes played by the clarinet alone in Voice II (b) are played by bass clarinet, cello, harp, and again harp, cello, bass clarinet in Voice I (b). This change involves the strand whose notes actually straddle the axis while the other strands are silent.

Besides this marked deviation from an exact canonic imitation, another variation occurs, which recalls an instrumental practice of the exposition: in these (b) strands, the number of notes taken by each instrument is imitated although the actual instrument used is not; in addition to this, the instrument variation is similar to that of the exposition: the viola is substituted for the cello and the bass clarinet is one of the instruments substituting for clarinet at the axis variation discussed above.

Thus the 4-part instrumental structure (with the substitution of three different instruments for the clarinet at the axis) is canonic in so far as the number of notes taken by each instrument is concerned.

There are two instances of canonic imitation of actual instrument between the (b) strands and both illustrate the subtlety of Webern's organization. The first involves the horn (d.. | d.), the second the harp (♭♭). The harp takes the figure ♭♭ | ♭♭ at the axis — the correspondence is obvious. The harp, too, is one of the only two instruments invariably imitated in the exposition; the other is the horn. It is also worth noting that the greater instrumental complexity and the greater number of instruments used in the (b) strands in the exposition occur in the (b) strands of the development section as well.

The dynamics, although not in exact 4-part canon by any manner of means, show far closer canonic correspondences and in far greater number than in the exposition. There is a strong mirroring tendency, more pronounced in the (a) strands than in the (b), in accordance with their greater simplicity of construction in general. The eight notes sounded alone at the axis are at the "lowest" dynamic level of the whole movement, *ppp*, approached by dim..... and quitted by *pp* on the notes immediately preceding and following them. These eight are in fact "accompanied" by the lowest dynamic level possible, that of zero, accorded to the rests.

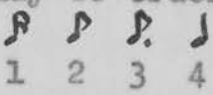
The modes of attack, again with a fair number of deviations, tend toward 4-part canonic imitation and overall mirroring. As in the exposition, these two last parameters are not subjected to as definitive an ordering as are the others.

Thus the development section as a whole extends both the canonic and mirror forms found in the exposition to all parameters of all strands (with varying degrees of deviation). This has the effect of clarifying and simplifying both.

At the same time, the whole section is a very good and concise illustration of Webern's methods of composition; one might say it constitutes a concentrated example of some of the main principles governing his compositional practice.

We have already noted Webern's conception of the interval-object in space and its derivation of further character from its various methods of presentation. In this development section, each pitch — or group of

pitches — within each strand is accorded a set of characteristics; it is given a specific rhythm, instrumentation, method of attack and dynamic level which makes it clearly identifiable and as such it enunciates those forms which can be seen as deriving from basic serial techniques.

Such ordering of the other parameters as well as pitch, which marks a new stage in the development of serial thinking, is conceived quite differently from the later ordering of the various parameters as practised by the post-Webernites; in the latter case, the serialization of the 12 pitches is extended to the other parameters, i.e., the actual method of laying out the twelve pitches in a certain unchanging order is applied to each parameter, which is divided into an arbitrary number of graduated degrees. For example, the rhythmic parameter may be ordered in relation to the semiquaver unit : 

, etc. This will be discussed in detail in the next chapter.

Webern's ordering of the various parameters bears no relation to this relatively simple extension of a compositional procedure, though the mere fact of his ordering them at all led later serialists to do likewise, after their own fashion.

There are two aspects to consider in relation to Webern's use of the canon: firstly, his concept of musical space equated all the previously clearly defined dimensions, and thus in the canon he was able to make identical material enter into varying spatial relationships through constantly varying displacements of the material in time (cf. Metzger's comment, quoted on p.71);

secondly, the canon is a form dating from a pre-tonal era with which Webern was very familiar. His predilection for this form is no doubt also related to a general tendency in this music divorced from tonality: once there were no criteria for the regulation of harmonic progressions, composers turned more to contrapuntal thinking — and, what is more, the earlier type of counterpoint, which was characterized by a relative lack of consideration for the vertical result.

What I call Webern's "closed forms" were a feature already to be noted in his atonal period; his use of mirror-structures thus not only corresponded to his new serial way of thought, but was a continuation of his earlier formal practices.

Variations in the mirror-structures effectively make anticipation on the part of the listener impossible; what this led to has already been mentioned on p.71.

The development section of op.21 is a good illustration of much of this, but it should be remembered that this was a comparatively early serial work and so certain aspects are not as yet fully developed. For example, the ordering of the dynamics and modes of attack is fairly rudimentary as compared with the ordering of the pitch and instrumentation. In a later serial work, the Piano Variations, op.27, the structuring is very close-knit and involves all parameters, again in the enunciation of mirror-forms and canons.

In music which is atonal and athematic, the recapitulation of an earlier section has to be clearly recognizable through its repetition of some other highly characteristic features of that section. In the recapitulation section of op.21, — 1st movement — marked in

Fig.1 by a dotted line (p.(v)) — Webern achieves this recognition by an exact repetition of the pitches of the exposition. This means, of course, that the mirror features of the pitch organization noted in the exposition are present here as well. The voices enter in the same order as at the opening of the work and after the same lapse of time, although all entries are now syncopated and start on the final quaver of the bar. The exact recapitulation of the pitch also means that the opening notes of the four strands are now those of the original augmented triad: F♭-A♭-C♯, thus a perfect 5th lower than that which opens (and closes) the development section (C♭-E♭-G♯).

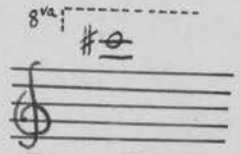
All other parameters of this closing section are, however, markedly different from those of the exposition and will be discussed in some detail below.

Two features are immediately noticeable:- the recapitulation attains what might be called a climax of loudness and a climax of register.

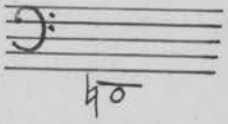
It has already been noted that the average intensity of the development section is *pp*, as contrasted with the *p* of the exposition; in the recapitulation the average intensity is *f* and the section contains eight markings of *sf*; this is unusual for Webern, as his work is usually characterized by its very soft dynamics. In addition, the section contains the widest range of dynamic markings in the movement, from *ppp* to *sf*.

The same type of contrast between the three sections is noticeable in their range of register. The exposition is placed generally in a middle register; the development section widens the range and though

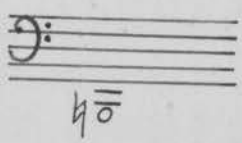
also generally in a middle register moves more frequently into the lower register. In the recapitulation, there is a noticeable upwards shift: it is generally placed in a higher register and contains the highest note of the movement:



. The lowest note is the F♮ below middle C. Contrast this with the lowest note of the exposition:



and of the development section



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We have noted that the pitch of the exposition is recapitulated exactly. There is one remarkable difference, however, and that is that the register of these pitches is markedly changed and, what is more, these changes are clearly ordered. At Figure 9, this ordering can be seen : above each pitch the number of octaves each is transposed are noted. Thus $^{3}G\natural$ means that this note is transposed three octaves higher in the recapitulation than the corresponding G♮ in the exposition.

In all cases the pitch, when not remaining at the same register as in the exposition, goes up. These changes are not canonic, i.e., a change does not take place at corresponding pitches in the strands; rather is each related to <u>a specific pitch</u> (cf. the ordering of the rhythm in the development section). It has been said earlier that the object in space is defined

by its various characteristics and is then able to interact with other objects with similar characteristics. Here the object is defined both by its pitch and by its register; it then interacts "vertically" with similar objects in the other strands, and horizontally in mirrored structures within the strands.

All G♯s go up one octave;
all B♭s go up two octaves;
all G♮s, C♮s, C♯s and D♮s go up three octaves;
all B♮s, E♮s, F♮s and F♯s do not move but remain in the same registers as in the exposition.

Two pitches do not conform to this consistent movement of register: A♮ and E♭. These form an interval which is fundamental to the pitch organization of the whole work, and in the exposition are combined to form the only chords (i.e., within the canonic strands themselves; the word "chord" here never refers to any vertical simultaneity which arises from the sounding together of the strands).

In Voice I (b) the A♮ on the left-hand side nearest the axis does not move, whereas the nearest A♮ on the right-hand side moves up three octaves; in Voice II (b) this is reversed (marked in Fig.9 with red asterisks). This alternating pattern, applying to the horizontal dimension, then operates "vertically" as well throughout all four strands, as can be seen quite clearly from the green asterisks.

This last pattern is also applied to the E♭s between the (a) strands, at the axis (see mauve asterisks). Notice now how the pattern 3 = 0 is altered in the organization of the register of the E♭s in the (b) strands (these changes are marked with blue asterisks).

The chords of the exposition do not appear here at all, and remain a unique feature of the first section. The repeated notes of the (a) strands in the exposition are still confined to the (a) strands in the recapitulation but are here expanded in number (and clearly relate to the instrumental ordering). They are bracketed at Fig.9; the first repeated notes, F♯ and C♮ (those of the exposition), stand at the distance of a tritone; the second and third repeated notes within the strands also bear this relationship to each other : G♮, C♯ in Voice I (a), and B♮, F♮ in Voice II (a). Their register contributes towards the enunciation of this relationship as well : the F♯ does not move, the C♮ is transposed three octaves up, and, as is by now to be expected (!), the tritone of Voice I (a) is transposed three octaves up, the tritone of Voice II (a) remains at the same register as in the exposition.

The (b) strands of this final section are characterized by a large number of acciaccaturas — there are none in (a). The 2-note chords of the exposition are now replaced by acciaccaturas : the first chord in both strands (A♮-E♭) becomes A♮ E♭ ; the second chord is varied in the following way : the A♮ forms the second quaver of a 2-quaver group, the E♭ becomes an acciaccatura; note the inversion.

This is a pattern followed almost throughout: the adjacent note to the acciaccatura in the exposition now becomes the acciaccatura, while the original acciaccatura is given a normal durational value. Note again the inversion, now of formal significance between sections.

A further change recalls another basic organization-

al procedure : the two 2-note cells containing the 3rd and 4th, 5th and 6th notes of the final statement of the series (in Voice I (b) C♮C♯, A♮B♭ ; in Voice II (b) F♯F♮, A♮G♯) are interchanged with respect to the appearance of the acciaccatura in the recapitulation : in the exposition, the second cell contains the acciaccatura — in both cases the A♮ ; in the recapitulation the acciaccatura occurs in the first cell.

Finally there is an acciaccatura added, where there was none in the exposition — between the 10th and 11th notes of the final statement of the series.

The main intention of such a detailed analysis of the structuring of the acciaccaturas in the recapitulation is to show how a formal principle applying to the overall structuring of the work is applied to its details as well. We have noted the inversion of a procedure; besides this, the type of variation found in the pitch mirroring is applied to the structuring of the acciaccaturas, too. Thus an overall organizational procedure may be extended to even the smallest detail.

The rhythm of the recapitulation shows marked differences from that of either of the two preceding sections. Most noticeable is the syncopation — groups of notes frequently start on the last quaver or crotchet of a bar, and long notes are frequently tied across barlines.

The shortest durational-value in both voices — excluding the acciaccaturas — is the quaver (compare this with the exposition, where there are no quavers at all, the shortest value being the crotchet). The longest value in the (a) strands is that lasting seven quavers, in the (b) strands, that lasting eight, though this is never written as a semibreve in this syncopated context.

The notes are, on the whole, arranged in groups of two, while the notes contained in larger groups are frequently phrased in pairs, as in the groups of quavers in the last few bars of the (b) strands. This musical grouping into pairs is interesting : fundamental to the pitch organization of this movement is the grouping of the notes into 2-note cells, although, as already noted, this grouping was purely a structuring device, divorced from the musical patterns of the work. Now, in this final section, Webern seems to have openly indicated the basis of his pitch structuring; although the musical grouping and the structural grouping do not always correspond, the fact of such a basis is made explicit.

There is no direct correspondence between the rhythms of the two preceding sections and those of the recapitulation. There are no mirrored formations, as in the development section, nor is there a 4-part canon. The corresponding strands of the separate voices are in canon, however, as they were in the exposition.

The overall rhythmic effect is pointillistic, as was that of the (b) strands in the exposition. As in the exposition, too, there are frequent correspondences between certain rhythmic figures, but there appears to be no ordering according to the formal principles which govern the behaviour of the other parameters.

In his book,* George Perle makes a brief mention of this work, and says "a primary integrative function is assigned to rhythm in this work". Here he is referring to the rhythmic patterns which are neither canonically imitated nor mirrored; they emerge from the sounding of

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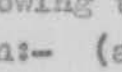
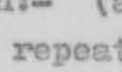
* op.cit., p.127.

the four strands together and are repeated fairly frequently. If every new attack is recorded as it occurs successively, the following two predominant patterns emerge in the exposition:- (a)  , which starts at Bar 2 and is repeated to Bar 10 inclusive, and appears again in Bars 12 and 14; (b)  is first given at Bar 13 and is then repeated without cessation from Bars 15 to 22. Perle's assessment of rhythmic function may well be correct, as the rhythm certainly does not contribute to the enunciation of the serial forms examined. However, this might also be regarded as forming a counterpoint to the rhythms occurring within the note-groups of the individual strands: a sort of "temporal 'cantus firmus'".

As if to compensate for the pointillistic effect of the rhythm, the instrumentation of the recapitulation is far simpler than that of the exposition, and involves far fewer instruments : this means that each instrument plays a larger number of notes successively. Thus the instrumentation, too, shows little correspondence with that of the exposition.

As the pitches (notwithstanding register changes) are the same as in the exposition, instrumental changes can be seen quite clearly from a diagram giving simply the number of notes taken by each instrument, as at Figure 10.

As in the exposition, certain instruments are exclusive to one or other pair of corresponding strands : the harp, horn and bass clarinet appear only in the (b) strands; in the exposition the last two were exclusive to the (a) strands (apart from the final notes in (b) at the repeat); the harp, however, is confined to the (b)

strands in both sections.

The (a) strands, being the less complex throughout the movement, show in this recapitulatory section a canonic correspondence between the number of notes played successively on a single instrument; the grouping together of the clarinet and cello in Voice II as a canonic imitation of the violin in Voice I does not fundamentally alter this pattern. At the same time, the presence of the repeated notes in the opening group ensures a mirroring of the number of notes, although the mirroring of specific instruments occurs in only one instance, that of the viola in Voice II (a). There is almost no correspondence between the exposition and recapitulation either as regards specific instrumentation or the number of notes taken successively by each.

The instrumentation of the (b) strands shows even less strictness of organization; even the number of notes is not canonically imitated between the two strands, and there is certainly no mirroring of either specific instrument or number of notes within the individual strands. One rather interesting point: it has been noted that the use of the harp is confined to the (b) strands; almost as if to emphasize this peculiarity, the harp, in both strands and in both sections, plays the first note and is invariably the penultimate instrument of the strand.

It would seem here as if Webern counterbalanced the stricter organization of the pitch, registers, and methods of attack in the recapitulation with a less rigorous ordering of the instrumentation.

Between each pair of corresponding strands, the modes of attack are canonic, with a few exceptions: there are four different changes in each pair of strands;

two in each pair appear to be ordered.

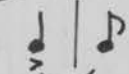
In the (a) strands, the first two changes involve the following inversion:-

(i) In Voice I(a), Bar 45,  is imitated by Voice II(a), Bar 47,  ;

(ii) In Voice I(a), Bar 47,  is imitated by Voice II(a), Bar 49,  .

A similar procedure can be noted in the first two changes of the (b) strands:-

(i) In Voice I(b), Bars 44-45,  is imitated by Voice II(b), Bars 46-47, 

(ii) In Voice I(b), Bars 46-47,  is imitated by Voice II(b), Bars 48-49,  .

Here, the canonic correspondence is far greater; there are fewer variations than in the exposition, and half of these show a certain ordering as has just been demonstrated, whereas in the exposition the variations show no such clear and obvious correspondences.

The dynamics, forming as they do a "climax of loudness", naturally show no correspondence to those of the exposition. They are neither mirrored within the strands, nor are they in canon, though there are certain definite canonic correspondences.

At the beginning of this analysis, I suggested that the structuring of this movement might be compared with that of a piece of sculpture comprising objects which stood in relationships to each other as the microcosms of the macrocosmic relationships of the whole. Throughout the analysis, I have tried to show how those principles which govern the overall forms of the work govern the relationships between the individual sound-objects

too and even, for example, the variations within an ordered structure, as in the case of the acciaccaturas.

Finally, there is one curious feature of this whole movement which is not involved in the canonic construction nor the mirror formations; rather is it superimposed upon these.

Owing to Webern's choice of series forms, certain intervallic cells of identical pitch are repeated across the various strands. This is most noticeable in the recapitulation where a preponderance of 2-note groups and a generally discontinuous texture assists in their recognition. A few examples of this should suffice to illustrate this point. Compare the figures ringed by dotted lines in the recapitulation (in Fig.1), (i), (ii), (iii), (iv) and (v).

Note the exact repetition of the register, and frequent correspondence of rhythm; note too the frequent mirroring of the pitch content of the cells. An interval-object takes its character from its environment : each of these has identical pitch, identical registration, often identical rhythm — and yet each functions in a quite different formal context, is preceded and followed by different notes, is played by different instruments, frequently involves different modes of attack and dynamics. This is a fine illustration of the interval-objects interacting from various points in musical space. The effect is that of an object kaleidoscopically altered from moment to moment, but still remaining in essence the same.

It has already been noted that some parameters have been far more rigorously ordered than others; here it should be remembered that this was only the fifth of

Webern's serial works. Webern was the first to appreciate the revolutionary implications of Schönberg's method and his later serial works illustrate in full many of the concepts already partially realized in the Symphony.

The instrumentation of op.21, already highly differentiated, is made still more so by the fairly frequent use of special colouristic effects, such as muted horns and, in the string section, "pizzicato", "on the bridge", "with mutes", sudden solo passages, and the use of harmonics. Such effects tend to fragment the canonic strands still further, in accordance with Webern's characteristic use of the pointillistic "Klangfarbenmelodie". They show a certain tendency towards canonic imitation, though this is by no means consistent and is frequently not possible owing to the fact that the instrumentation itself is not always canonic (e.g., a pizzicato passage finds no echo in the corresponding passage on the clarinet). There are closer correspondences in the development section, where the ordering generally is the least complicated: all effects are mirrored within the strands though there is no canonic correspondence; a further feature of the section is that all strings are muted throughout.

The purpose of this analysis has been to show the new methods of composition and formal construction found in the music of Webern. His discarding of tonality is achieved in part through the two different forms he uses : his use of the canon involves a new interpretation of the three dimensions — now encompassed by a single, all-embracing concept, musical space —, while his mirror-formations, including his inverted

canonic structures, clearly derive from the fundamentals of serial pitch theory.

Just as Schönberg's importance lies in his creation of a "new" order which guided music out of the turmoil succeeding the breakdown of tonality, an order which applied specifically to pitch, so Webern's importance lies in his establishment of a new, serial way of musical thought.

"Father of the new music", he was called, and in the next chapters we shall see how his work bore fruit.

CHAPTER 4.

AND AFTER WEBERN

The ordering of the various parameters besides pitch had served two functions in the music of Webern: that of enunciating forms which had arisen out of the fundamental serial principles, and of defining the sound-object in space. Now such ordering accorded exactly with Webern's requirements and with his vision. But if music was to develop along these guide-lines, it was clear that it could not simply copy, as the result would merely be little pointillistic pieces in the style of Webern.

And yet the fact of his music was undeniable; in it, and for the first time, certain problems had been made explicit. One of the chief of these was the contradiction between the pitch material — based on the chromatic scale and freed from any inherent polarity — and rhythm, which was bound up so intimately with the enunciation of tonal progressions. Webern solved this problem temporarily and in a way that was inimitably his own. Here the operative word is "inimitably".

In order to give some impression of the trends in music in the ten years after Webern's death, the work of the most prominent composers of the avant-garde school of serialism will be discussed in some detail.

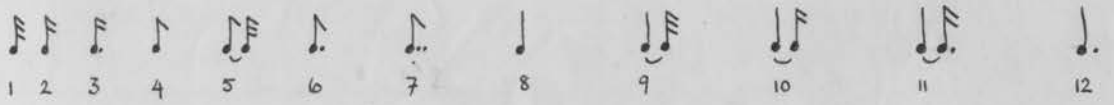
This period is very difficult to describe as there is no straight line of development here. The work of Schönberg can be seen as arising out of the turmoil im-

mediately succeeding the final breakdown of tonality at the beginning of the century; his 12-note theory answered the particular needs of atonality and laid the foundations of the main musical movement of the next thirty-odd years. Again, Webern's work can be seen as an advancement of the basic principles of serialism as laid down by Schönberg, while his outlook was of fundamental importance for future composition. But the period we have to deal with now is characterized by a great deal of experimentation, where each work written by a serialist is in the nature of an attempt to continue the line of serial development suggested in the work of Webern, while at the same time each poses new problems. Nevertheless, one can certainly trace the general trends. And in each significant work of the period, the seeds of the breakdown of serialism are sown.

Between the years 1948 and 1950 a composer who is not essentially a serialist at all wrote several works for the piano in which a series was applied to durations and to dynamics; the composer was Olivier Messiaen, teacher of the two foremost serialists of the day: Pierre Boulez and Karlheinz Stockhausen.

In 1948, Messiaen wrote his "Cantéyodjaya" and in 1949-50 four piano pieces collectively known as "Neumes Rythmiques". In these he used an additive series of durations derived in the following way: taking a basic unit of, say, the demisemiquaver, he derived his series thus:

Ex.38:



He then permutated this series in various ways, thus making it analogous to a pitch series. In these works, he also used a series of graded dynamics.

These innovations were bound up with Messiaen's search for greater rhythmic complexity and with his desire for an all-embracing chromaticism, but they were adopted and used within a strictly serial context by the younger school of composers. This difference of usage is worth noting: as employed by Messiaen, such series accord with his general compositional methods; as used by the serialists, they constitute merely a paper solution to the contradiction in the material of music discussed above. The problem was later re-thought by Stockhausen with far-reaching results.

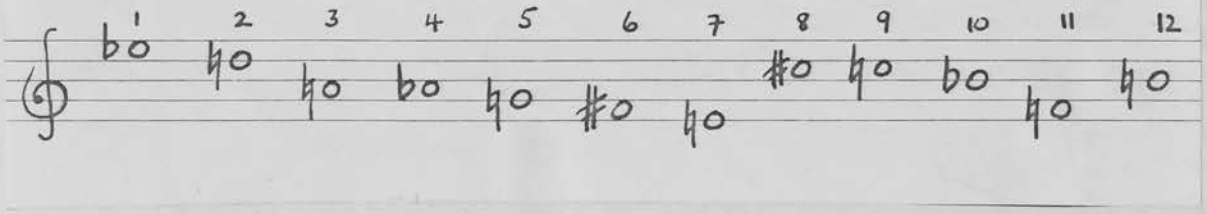
One of the most representative works of this period is the "Structura 1a" for two pianos by Boulez, analysed in detail by György Ligeti* and described by him as a "textbook example ... [of] the way constructional principles were used in the early stages of serial music", a work of "basic experimentation". The work was finally completed in 1952. Although it can be criticized from certain standpoints, it represents an attempt to continue along the guidelines set out in Webern's work and is thus another step on the road to the full realization of the new musical thought suggested there.

The work is based on a series of 12 notes which is that of Division 1 of the note-succession from Messiaen's "Mode de valeurs et d'intensités" (one of the four pieces from "Neumes Rythmiques"); it was deliberately chosen as homage to his teacher. Besides this direct reference, Boulez also imitates Messiaen's device for

* In an article, "Pierre Boulez", translated by Leo Black, published in "die Reihe", Vol.4.

deriving his duration-series; the basic duration-series of "Structure 1a" is that given on p.119.

The pitch series



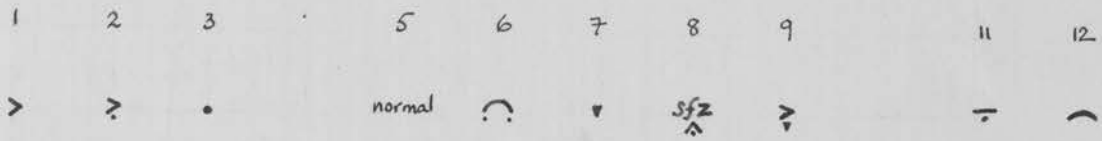
recalls those of Webern; firstly, there is the symmetrical identity of the second and penultimate intervals. In addition, the series in its original form contains only those intervals larger than a tritone if each is measured upwards; in the inversion, all intervals are smaller than a tritone, the only interval in common being the tritone itself, which forms the final interval. This intervallic differentiation means that the series can function to enunciate form, thus following the lead set by Webern. (Compare this with the series of Schönberg, which functioned thematically.) Note also the preponderance of the semitone.

The dynamics and modes of attack are also arranged in series of 12 values; the dynamics are graded from *pppp* to *ffff*, while the modes of attack are arranged in an arbitrary order for obvious reasons.

Ex.40: Series of dynamics:

1	2	3	4	5	6	7	8	9	10	11	12
pppp.	ppp	pp	p	quasi p	mp	mf	quasi f	f	ff	fff	ffff

Ex.41: Series of modes of attack:



Having thus decided on his primary material, Boulez had next to utilize it in the structuring of the piece of music. His method of permutation within the various series was one which ensured the automatic succession of the values after the initial choice, and one which enabled the critics to use the term "paper music" with considerably more justification than they had ever had before, in the earlier years of serialism. He chose to derive the succession of values within the various parameter series from the succession of numbers in a magic square. ("Magic square" is the name given to an arrangement of numbers in which the numbers in each column add to the same number as those of each row.)

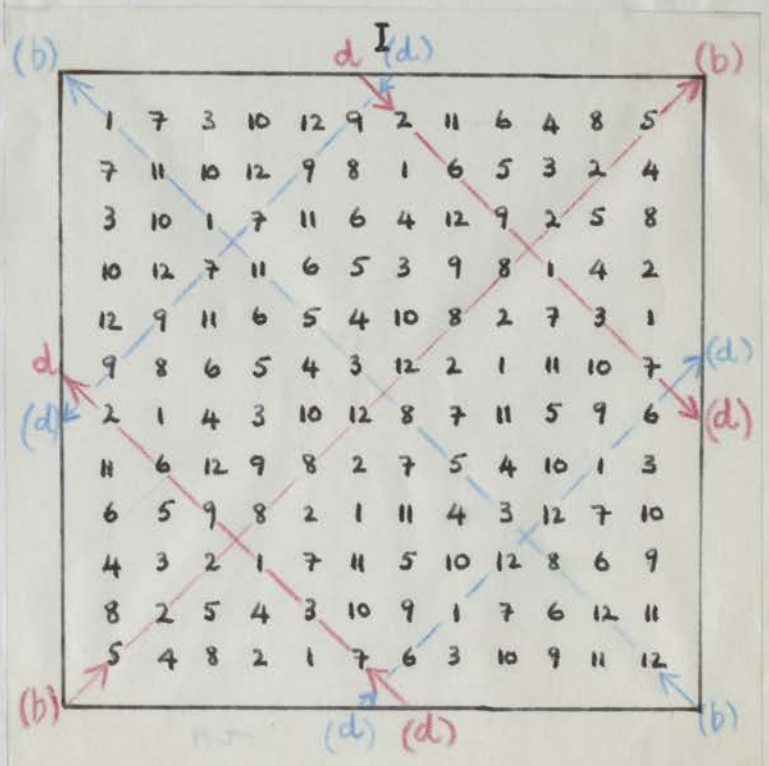
The magic squares given below are those applying to the O and I pitch series:-

Ex. 42:

O

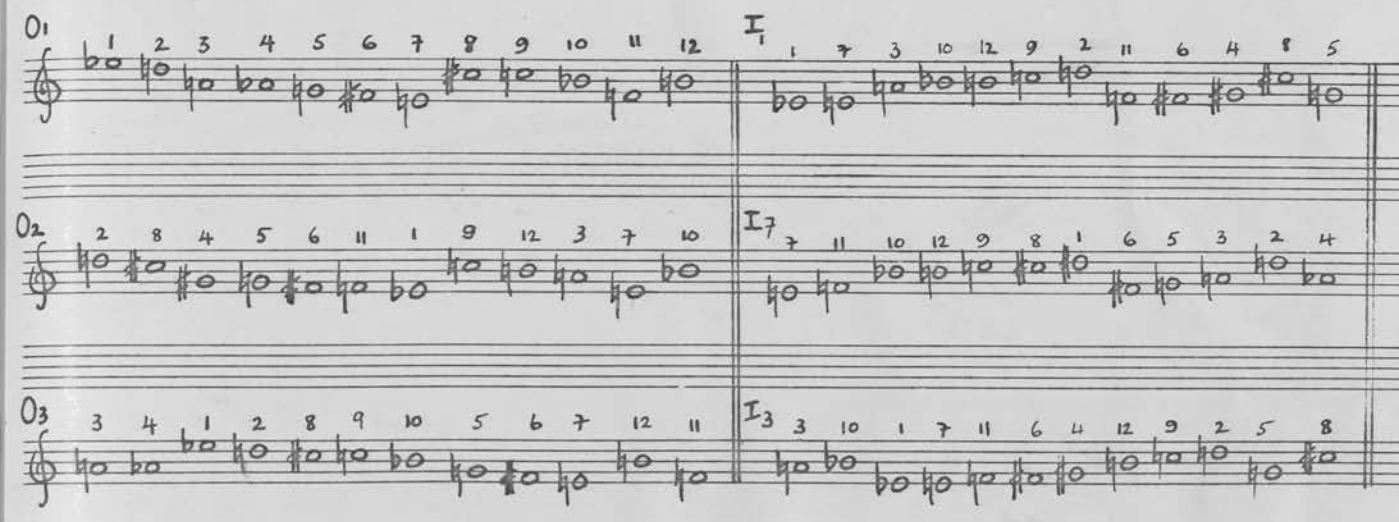

(a) (c) (c) (a)
1 2 3 4 5 6 7 8 9 10 11 12
2 8 4 5 6 11 1 9 12 3 7 10
3 4 1 2 8 9 10 5 6 7 12 11
4 5 2 8 9 12 3 6 11 1 10 7
5 6 8 9 12 10 4 11 7 2 3 1
6 11 9 12 10 3 5 7 1 8 4 2
7 1 10 3 4 5 11 2 8 12 6 9
8 9 5 6 11 7 2 12 10 4 1 3
9 12 6 11 7 1 8 10 3 5 2 4
10 3 7 1 2 8 12 4 5 11 9 6
11 7 12 10 3 4 6 1 2 9 5 8
12 10 11 7 1 2 9 3 4 6 8 5
(c) (c) (c) (c) (c) (c)
(a) (c) (c) (a)

I


(b) (d) (d) (b)
1 7 3 10 12 9 2 11 6 4 8 5
7 11 10 12 9 8 1 6 5 3 2 4
3 10 1 7 11 6 4 12 9 2 5 8
10 12 7 11 6 5 3 9 8 1 4 2
12 9 11 6 5 4 10 8 2 7 3 1
9 8 6 5 4 3 12 2 1 11 10 7
2 1 4 3 10 12 8 7 11 5 9 6
11 6 12 9 8 2 7 5 4 10 1 3
6 5 9 8 2 1 11 4 3 12 7 10
4 3 2 1 7 11 5 10 12 8 6 9
8 2 5 4 3 10 9 1 7 6 12 11
5 4 8 2 1 7 6 3 10 9 11 12
(d) (d) (d) (d) (d) (d)
(b) (d) (d) (b)

The magic squares applying to the R and RI series can be derived simply by reading those given here backwards. The numbers refer to the twelve successive notes of the O series in its O transposition; for example, the first note of O_1 is $E^{\flat}$ (see Ex.39); the number 1 therefore always refers to the note $E^{\flat}$. The first number of each row thus indicates which transposition is to be used. An example here will suffice:

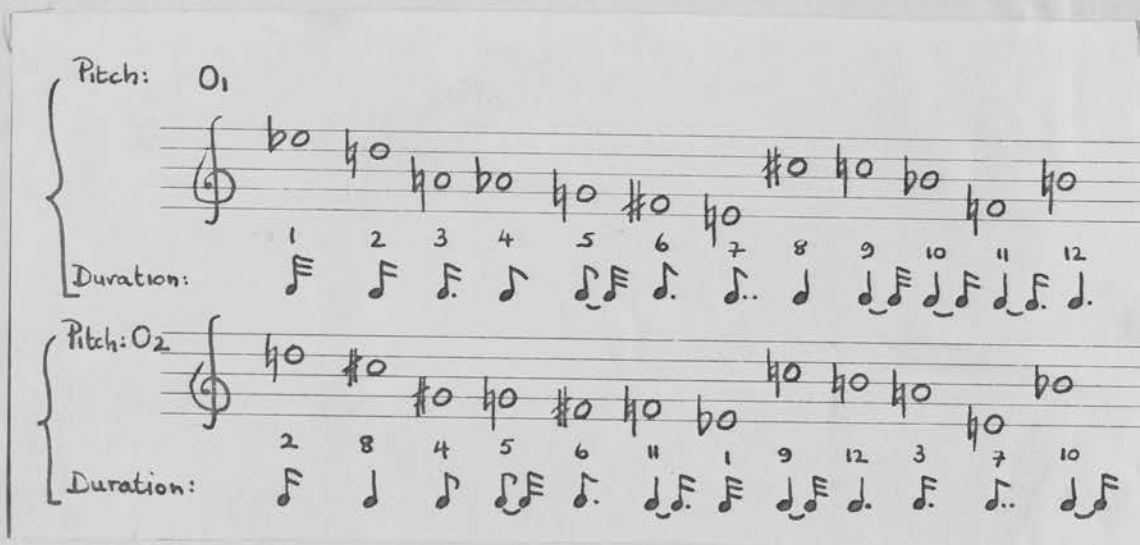
Ex.43:



There are four magic squares used, applying to the four transformations: O, I, R and RI.

The duration series are associated with those of pitch and thus the permutations thereof are derived similarly; for example:-

Ex.44:



The succession of values within the series of dynamics are arranged according to the diagonal succession of numbers marked in red at Ex.42. There are four in all : (a), (b), (c), (d). Immediately noticeable is the mirror-symmetry, which ensures some discernible formal structuring of this parameter at least, rather in the manner of Webern. At the same time, this arrangement results in a fairly wide differentiation between successive dynamic values; for example: 7, 12 gives *mf*, *ffff* ; 6, 1 gives *mp*, *pppp* (see Ex.40). The numbers 4 and 10 do not appear at all in the diagonals of either magic square used. This means that the dynamic values of *p* and *ff* never occur, as *p* is the 4th value and *ff* the 10th in the 12-value dynamic series. It should be noticed that the constituents of (c) and (d) are the same, although their succession varies.

The successions of modes of attack are also derived from these squares, and in a similar manner, now using the diagonals marked in blue at Ex.42. Again there is symmetry, but here only at (c) and (d), and then only within the two halves which make up each succession. Again, two values are missing, 4 and 10. (In fact, as can be seen at Ex.41, there are no values given for numbers 4 and 10; the reason is obvious: modes of attack can not be graded, as can dynamics.)

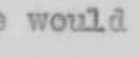
Before the overall structuring of the work is discussed, it might be useful to stop here and examine the significance of these procedures.

Although Boulez' duration-series must be considered as an attempt to bring rhythm into line with serial practices previously applying only to pitch, it must be considered a failure as such.

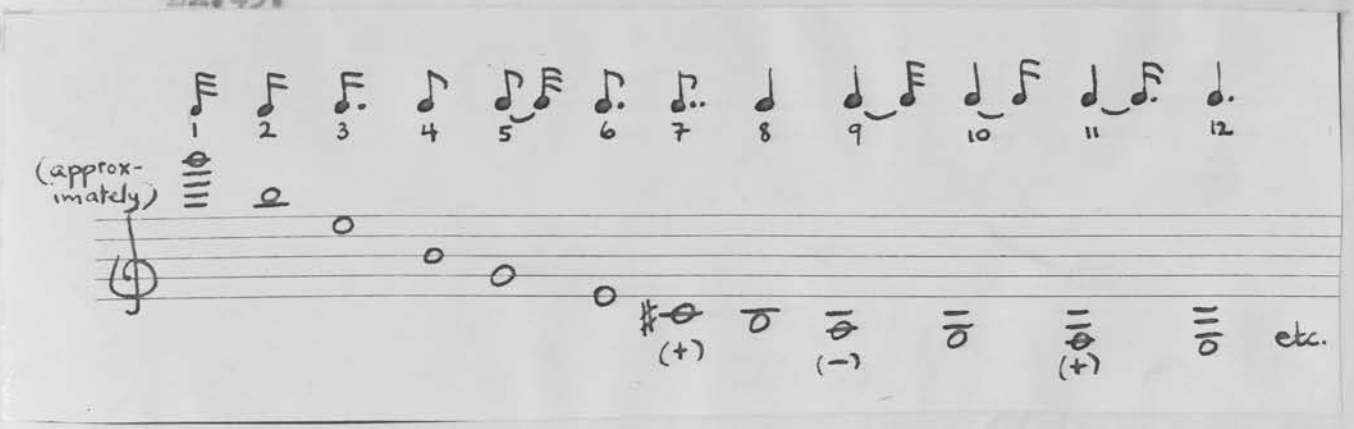
Firstly, the numbers 1 to 12 as applied to a pitch-series tell us nothing about the pitch itself; any given number merely gives us an indication of how many notes have passed and how many are to come; for example, a note described as the 5th note of the series tells us that four have passed and seven are to come. In contrast to this, and once given the basic unit, the numbers 1 to 12 tell us what type of duration is involved; for example, the 5th value of a duration-series tells us that the value equals  , when the basic unit is  . Thus, in the case of durations, the series of numbers bears a very real relationship to the values it expresses; in the case of pitch, on the other hand, the relationship is merely one of convenient notation and a means of enforcing discipline on

the composer who must (at least in theory) retain the succession of pitches as originally relating to the series of numbers.

In an article, " .... How Time Passes".... ,* Stockhausen discusses this experimental stage and advances several criticisms. Those relevant to Boulez' work will be summarized here.

Music is based, of necessity, on the manner in which we hear. Stockhausen notes that when two events are sounded successively we discern less their absolute values than the proportion they express. Let us take an example from Boulez' duration series: our ears are quite able to tell us that  is twice as long as  (2:1), whereas we would perceive  (11:12) as virtually the same — if we were able to detect any difference at all.

If the proportions of the duration series used by Boulez are compared with similar proportions in the field of pitch, it will be seen that they correspond approximately to those of the harmonic series, inverted, Ex.45:**



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* Published in "die Reihe", Vol.3, translated by Cornelius Cardew.

** given on p.13 of Stockhausen's article, op.cit.

what Stockhausen calls a "subharmonic scale". Such a comparison enables us to see more easily that the proportions at the end of the series — 8:9, 9:10, etc., are very much smaller and accordingly more difficult to appreciate than those at the beginning.

The chromatic scale of pitches is contained within the octave proportion 2:1. In the well-tempered system, the proportions between those pitches a semitone apart are logarithmically determined so that we perceive them as being of equal size; this means that the distance between C♮ and C♯ is to our ears the same as that between, say, B♭ and B♮. Thus, as Stockhausen points out, a series of durations of the type used by Boulez will not be perceived analogously to one of pitch.

Stockhausen's major criticism is thus an acoustical one. He also points out another objection: "It was not surprising that in a time-structure formed with such a series of durations, the long values devoured the short ones; and that, even where the smallest unit was extremely short, the result was a slow average speed."*

What Stockhausen calls "a truly drastic way to escape" from this latter disadvantage was attempted, by combining various duration-series; this is, in effect, what is done by Boulez when the various permutations of his series are sounded together. The result is anything but serial, and is merely a succession of durations whose proportions are unordered and which are repeated at unordered intervals of time. However, this experiment did lead to a vitally important development, which will be discussed fully later.

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* op.cit., p.13.

In his analysis of the work, Ligeti advances yet another criticism. He discusses what happens when the values of the duration-series are permutated in the same way as those of pitch (cf. Ex.44). He says : "Since in a series the decisive thing is the relationship between each element and the next, the contrast between the two procedures is obvious; whereas with the (organic) transposition of the note-quality [pitch] series, the individual note-qualities are permutated but the interval-relationships always remain the same, the permutations of durations (which are in fact not transpositions at all) occur mechanically, according to tables, and have constantly different internal proportions."*

However, this procedure can be viewed quite differently if regarded as relating to the practices of Webern. The consistent association of the duration-series with those of pitch results in each pitch always being associated with a specific duration. A glance at Ex.44 will illustrate this : in both "transpositions" the G♯ occurs as ♪(4), B♮ occurs as 𝅗𝅥. (12). Thus each number specifies (a) a pitch value and (b) a duration value. Each sound-event is thus clearly characterized by two consistent parameters (i.e., every G♯, for example, will occur as ♪ throughout the work), although once characterized it does not serve to define clear-cut formal structures, as do the sound-objects of Webern.

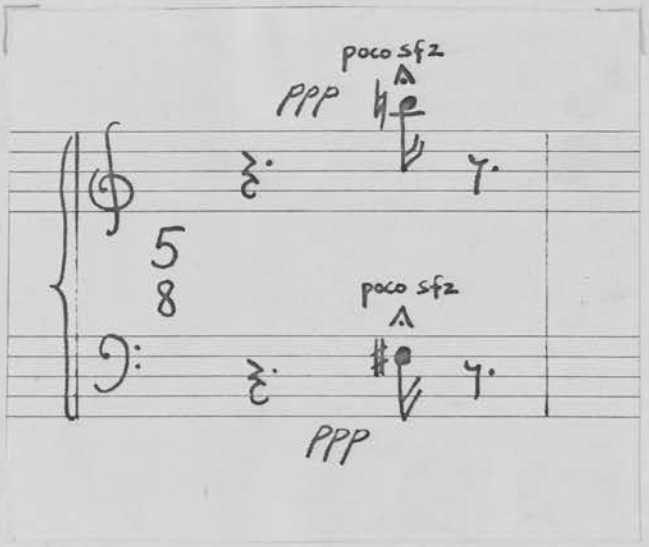
The method for deriving the successions of dynamics and methods of attack is far more dubious from a musical point of view, although the actual result —

* op.cit., p.39.

in the field of dynamics — strongly recalls the forms of Webern (cf. p.125).

Unfortunately, this type of automatic serialization occasionally creates problems of contradiction during the course of the music between, firstly, methods of attack and dynamics, and secondly, methods of attack and durations. Below is Bar 46, Piano 2:-

Ex.46:



For an example of the second type of contradiction, one has only to think of the difference in duration between a note played staccato and one played legato.

These two examples should suffice to show the problems confronting the performer, who in such a case will be unsure as to the correctness of his rendering. This is, of course, a problem fundamental to musical interpretation, as there can be no <u>absolute</u> value accorded, say, a *ppp*, or *poco sfz*, which have always been interpreted with reference to their context. Such "inaccuracy" on the part of the performer becomes a

real problem in highly serialized music, however, because recognition of the series of minutely differentiated values is — theoretically — fundamental to the appreciation of this music. But it is extremely difficult to differentiate between, say, *mf* (7), **quasi** *f* (8), and *f* (9), still more to reproduce exactly the same dynamic level at its second appearance. Thus such a series can only really be interpreted as a relative movement from — in this case — dynamic to dynamic. The interpretation of a series involves this problem in the case of all parameters but that of pitch, whose values are automatically determined and need not be guaged by the performer. Recognition of the problem led composers, again with Stockhausen in the vanguard, to yet another, and radically new, development, where the inaccuracy potential of each musical situation was taken into consideration.

One further point of criticism should perhaps be mentioned as, again, it underlines the difficulties facing the total serialists. (It need hardly be said that these comments are certainly not intended as a criticism of the music as such, but of its serial structuring.) The succession and appearance of the dynamics are predetermined; sometimes, however, a predetermined occurrence might not be musically practical. Such a situation does in fact arise at the "Lent" section (Bars 32-39); the second piano is to enunciate *ffff* at Bar 35, but this would obscure the low F♯ played **quasi** *p* by Piano 1. Boulez therefore reduces the marking of Piano 2 to *fff* (!). In order to retain the desired relative decrease in intensity between this and the following section, beginning at Bar 40, Boulez

has now to use *ff* instead of *fff* at the subsequent section. Now *ff* does not, in fact, ever occur according to the diagonals used, as it is the 10th value of the series (cf.p.125). This, incidentally, is only one of various changes made, including some involving durations. Although such changes are perfectly valid from a musical point of view, they do tend to cast some doubt on the absolute efficacy of these methods of composition for always producing what is desirable musically.

A detailed analysis of "Structure 1a" is unnecessary here (and can be read in Vol.4 of "die Reihe"), but one or two further points about the general construction of the work should be noted.

The work is constructed out of serial threads, each thread comprising one transposition of the pitch series in conjunction with one permutation of the duration series. The two are used in their O, I, R and RI forms, combining to make a total of 48 threads altogether. Each thread is assigned a dynamic and a method of attack for its total duration. The individual threads are combined into "bundles" containing one, two or three threads. Each piano has a bundle, and thus the vertical density ranges from 1 (when one piano is silent, and the other plays only one thread) to 6 (when both pianos each play a three-thread bundle). Each bundle is clearly demarcated from the others.

As Ligeti says, " .... The composition is quite rigidly articulated into sections — the place for artistry is in the balance or contrast of the sections, since within them practically everything happens automatically." * There are fourteen sections, and these are separated by pauses of varying lengths. Each is

* op.cit., p.45

accorded one of three tempi, though some consecutive sections share the same tempo, in which case there is no separation by pauses; the work is thus divided into eleven effective sections.

The three tempi are "Très Modéré"(M), "Modéré, presque vif"(V) and "Lent"(L). They are distributed as follows:-

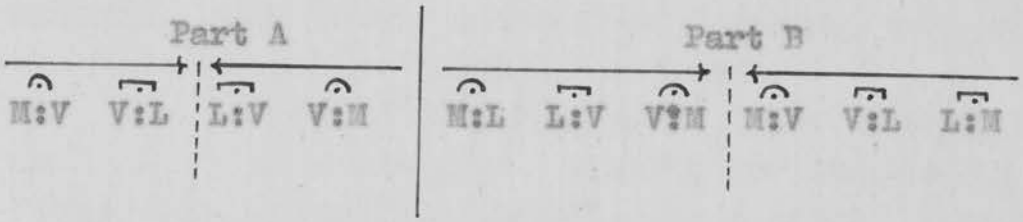
Ex.47:

Part A :	Section:	I	(M)
		IIa, IIb, IIc	(V)
		III	(L)
		IVa, IVb	(V)
		V	(M)
Part B :	Section:	VI	(L)
		VII	(V)
		VIII	(M)
		IX	(V)
		X	(L)
		XI	(M)

(The division into Part A and Part B will be explained below.)

The pauses have been distributed between the sections in such a way as to result in the following proportioned symmetry:

Ex.48:*



Notice the varied symmetry which strongly recalls the formal practices of Webern.

His use of pauses is particularly interesting. Besides expressing the symmetry noted above, they have been structured according to a newly-recognized criterion. This criterion is related to the theory of experiential time, which is clearly expounded by Stockhausen in an article called "Structure and Experiential Time".**

One of the tenets of this theory is that one perceives the passage of time as fast or slow according to the varying degree of surprise afforded by events. A succession of similar events gives the impression of slowness, even if such events are sounded at a rapid tempo. Similarly, and contrary to expectation, a succession of consistently contrasted events will <u>also</u> produce an impression of slowness; this is because the mind grows accustomed to a norm of contrast, as it does to a norm of similarity. It must, however, be understood that this effect is quite divorced from the actual tempo of the music. In order to structure the listener's perception of time, therefore, it is necessary to ex-

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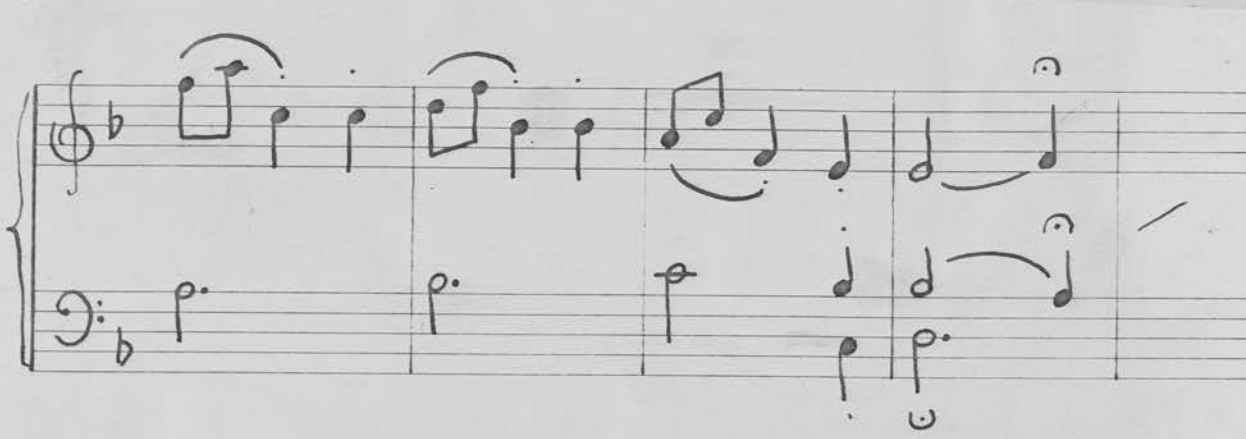
* given on p.51 of Ligeti's article, op.cit.

** Pub. in "die Reihe", Vol.2.

tablish a norm before the introduction of a new event; this will then create a moment of surprise, thus giving the impression that "time has moved on".

(Consideration of the surprise value of an event in music is by no means new. Mozart, for example, in his Minuet in F major, K.2, establishes a certain expectation by ending repeated thematic phrases with a perfect cadence; in the penultimate repetition of this phrase, and for the first time in the piece, he closes with an interrupted cadence,

Ex.49:



thus creating a moment of great surprise for the listener. What is new, however, is the modern composer's constant and conscious consideration of this factor within the framework of a theory of time. Formerly, such consideration related to the principle of tension-relaxation which is fundamental to tonal music.

This trend has already been noted in Webern's work, in connection with his varied symmetrical structures.)

In "Structure 1a", Boulez structures his pauses with this in mind. The pauses function to separate the sections of the work, and their type and distribution are so ordered as to maximize the degree of surprise afforded by the entry of a new section. Here Ligeti says: "Between the sections or major sections the fermatas are so distributed that out of the 10 caesuras 5 are longer (𝄐) and 5 shorter (𝄐). With the maximum difference in tempo (V:L, L:V), the caesura is short (𝄐); between the quicker tempi (V:M, M:V) it is long (𝄐); between medium and slow tempi, however, it varies according to the order, so that long fermatas are used when the faster tempo comes first (M:L) and short fermatas when the reverse holds good (L:M). This is a wholly functional use of fermatas, since when the difference in tempo is greater the separation of the sections is in any case ensured, and the new tempo's degree of surprise is higher, so long as it enters without great delay; on the other hand, smaller tempo alterations do not mark the borders of the sections so clearly, so that longer caesuras have to emphasize the separation (though this is only true in this special case, where the whole architecture of the piece is designed so that the individual sections are to be as easily distinguishable as possible)."*

The thread-density (cf. above) is distributed between the sections again with the factor of audience surprise in mind.

The division of the work into two parts, A and B, has been noted. Such a division arises because the

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* op.cit., p.51

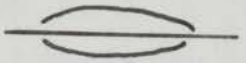
work is divided by both a vertical axis — producing two successive parts, A and B, — and an horizontal one, between the two pianos. Thus for purposes of allocation of material, the work is divided into four sections. Without going into the detailed ordering involved, it might be noted that the basis of this allocation illustrates what is known as Boulez' "X-polyphony":

Ex.50:

	Part A	Part B
Piano I	Op, RId Dyn: a, Attacks b	RIp, Id Dyn: c, Attacks d
Piano II	Ip, Rd Dyn: b, Attacks a	Rp, Od Dyn: d, Attacks c

Series: p = pitch
d = duration
Dyn. = dynamics

Piano I, Part A, uses the magic square applying to the transpositions of the O pitch series, and that applying to the permutations of the RI duration series; Piano II, Part B, uses the magic square applying to the transpositions of the R pitch series, and that applying to the permutations of the O duration series, etc.

Note how the two pianos mirror their pitch contrapuntally, thus:  . The exclusive pitch material of each, noted on pp.121-122 — i.e., O contains all intervals above the tritone, I all those below — is exploited here to define these sections.

But there is another aspect to this sound. With several serial threads sounding simultaneously and the successions of dynamics and modes of attack being organized according to arbitrary tables, the listener cannot hear these points as organized into individual series, i.e., he cannot hear the primary organization of the material. What he does hear, however, is what Ligeti calls "a structured conglomeration of points": he hears a shape comprised of many points, a shape whose character is determined by the "higher-order" structuring — the actual employment and distribution of the various serialized parameters; he hears a shape of specific tempo, density, and a certain constancy as regards interval content. In this work, these shapes correspond to the eleven sections. Much of the interest of "Structure Ia" arises from the juxtaposition of these contrasting "statistical" shapes.

The difference between the "pointillistic" and the "statistical" is summarized very aptly by Ligeti, when he says: "So when we hear this composition a complex network unfolds — of coarser or finer weave, variable aural perspicuity; consisting of a significantly ordered flock of sounding 'points': these are organized to form threads of varied thickness, which now stand out plastically, now become less distinct. The threads, for their part, are woven together with greater or lesser density. For the listener, knots, relationships, connections of many kinds emerge; the result is an organism as ramified as it is elastic ..... Seen at close quarters, it is the factor of determinism, regularity, that stands out; but seen from a distance, the structure, being the result of many separate regularities, is

seen to be something highly variable and chancy, comparable to the way the network of neon lights flashes on and off in a main street; the individual lamps are indeed exactly controlled by a mechanism, but as the separate lights flash on and off, they combine to form a statistical complex"*

"Statistical" appreciation, then, involves the listener gaining a general impression of what might be called the average of all the structured characteristics with which each serialized "point" is endowed when these points are sounded, inextricably, together.

At the end of his analysis, Ligeti remarks: "The 'beauty' of a piece like this lies in quite new qualities. Webern's interval-objects still contained a trace of the (discreetly) 'expressive', and although the satisfaction derived from his music is the result of quite different qualities, the traces of 'expression' present at times do provide crutches for the struggling listener. All this has vanished in our example from Boulez' 'Structures'; they expose to view something that in Webern already formed the nucleus: beauty in the erection of pure structures."**

Although one might quarrel with his summary dismissal of Webern's emotional expressivity, Ligeti is certainly correct when he notes that much of the beauty of Webern's music derives from his concern with structure "for its own sake". After Webern, this concern comes to predominate, and any emotional expressivity arises more or less accidentally. (Thus a composer like Messiaen,

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* op.cit., p.61

** op.cit., p.62

although employing certain elements of serialism in his music, does not really enter into the scope of this study, as his aim is undoubtedly, indeed avowedly, the maximum of emotionally expressive content.)

Finally, in "Structure 1a", we note one other feature fundamental to the serial music after Webern, which might be summed up in the phrase: the renunciation of the composer's right to complete freedom of choice. There are two aspects to this: the first relates to the predetermination of certain events, the second to the inaccuracies which occur in performance.

Once the composer has chosen that a succession of events shall be determined by some plan (in this case, the magic squares), he effectively relinquishes his control over the course of these events. When the serial threads of "Structure 1a" are combined, their vertical result is wholly uncontrollable as the duration and pitch of each event within the threads has already been determined. What Boulez does control, rather, is the overall characterization of the sound-network, and, as we have noted, freedom of choice in this work consists in the juxtaposing of structures whose individual content is determined by the magic squares.

A defence occasionally offered when critics attack this loss of freedom is that of comparing the modern-day composer with the composer whose freedom of choice was limited by the dictates of tonality. As far as this work, or those similarly predetermined, is concerned, such a comparison is invalid, as the restrictions on the tonalist were of a purely musical kind and were in fact, fundamental to the system: tonality without the "rules" would not be tonality. This is obviously not the case

here; having extended the realm of possibilities in sound far beyond those of the tonal system, but needing to impose some restriction on the wealth of material now at their disposal, modern composers have tended to impose arbitrary restrictions; these usually involve various proportional relationships. In one sense, the difference lies in the quality of restriction, for proportional relationships and numerical puzzles do not derive solely from musical considerations. Furthermore, the "restrictions" of tonality, being essential to the system, are meant to be fully discernible and are; the listener to "Structure 1a", on the other hand, is quite incapable of appreciating that here the "restriction" involves the use of magic squares, unless he has actually analysed the work, i.e., the "restriction" goes quite unappreciated as such.

Besides this voluntary restriction laid upon him in the field of actual composition, the composer also has far less control over the interpretation of his work than ever before; this is because the values of the various parameters are so precisely, so minutely, differentiated, while such differentiation is essential to the recognition of the series.

We have noted the fact that for reasons of musical effectiveness, Boulez has made some changes in his serial successions (cf. p.131). These "flaws" in the serial structure are inaudible to the listener as such and thus raise the question: is serialism really necessary here in order to achieve the final effect of more-or-less dense structures whose character is statistically appreciated? Could not the same effect have been achieved without the use of an arbitrary and superimposed plan for the composition

of the countless varied points which contribute to this character?

"Structure 1a" is indeed a "textbook example"; it has been discussed in a fair amount of detail because it illustrates many aspects of this early period of total serialization and affords an example not only of the attempts to realize in practice the new concepts of music, but also of the problems such attempts engendered. Serial composers of the avant-garde school learnt much from this work; many of the subsequent advancements made arose out of attempts to resolve some of the problems and contradictions outlined above.

Before discussing the work of the chief theoretician of the school — Karlheinz Stockhausen — it might be useful to examine the contribution made by another serialist, Henri Pousseur, whose work was based largely on his interpretation of Webern's technique.

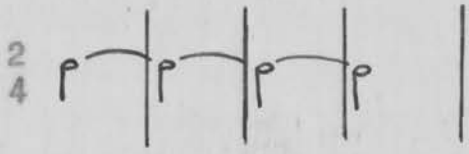
To the volume of "die Reihe" devoted to the life and work of Anton Webern (Vol.2), Henri Pousseur contributed an article,* in which he analysed the first of Webern's Six Bagatelles for String Quartet, op.9,no.1 (cf. p.24 of this study). Here he showed how each note of the piece is related to its neighbour — sounded successively, simultaneously, or diagonally, i.e., sounded successively in another part — by a chromatic step. This might occur as the interval of a minor 2nd, its harmonic inversion (the major 7th), or its expansion (the 2nd sounded one or more octaves apart). Having thus satisfied himself of the chromatic basis of Webern's pitch-organization — and, indeed, he makes out a con-

* "Webern's organic chromaticism"

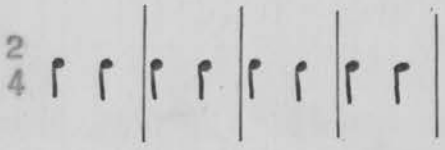
vincing case for it in his analysis of this work — he attempts to build his own system for pitch organization on an extension of this basis.

In his Quintet for clarinet, bass clarinet, piano, violin and cello, written in memory of Anton Webern in 1955, he derives all the pitch structures from the intervals of Webern's series for op.22, the Quartet for violin, clarinet, tenor saxophone and piano.

The work is divided into four main sections of approximately 96 bars each, each with its own overall tempo marking; the bars are notated in $\frac{2}{4}$ throughout. Each section is subdivided into 24 4-bar "metres", each metre being again subdivided into between 1 and 8 equal durations; e.g., the first duration of this series would be a single value held for 4 bars:



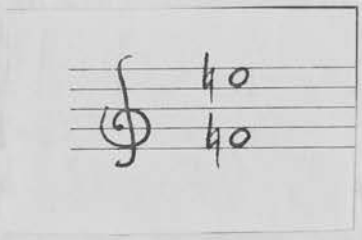
, while the last of the series would be eight equal durations divided up over the same number of bars:



. Thus the metre is filled out by the durational subdivision allotted it; a fifth of a metre is repeated five times, a third, three times, an eighth, eight times, etc.

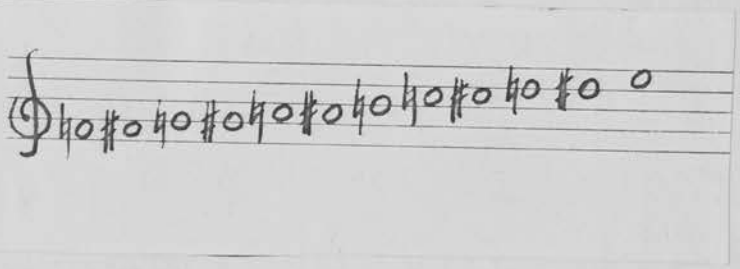
Each metre is assigned one of the intervals of Webern's series, which is then filled out chromatically. An example will make this clear: suppose the interval assigned to a given metre to be the major 7th:-

Ex.51:



The notes then available to that metre would be:-

Ex.52:



One of the end notes will be the last note of the preceding metre, or the first of the succeeding one, thus making available eleven different notes in all; the notes are completely free as to register. Each note-group is then fitted into one of the available durations, given above, e.g., the 11-note group might be fitted into the smallest durational length available — the crotchet.

The composition of the notes within the limiting interval is free, besides the restriction that all connections between the notes are made chromatically by means of major 7ths and minor 9ths, a method of connection obviously deriving directly from Webern's practice in op.9,no.1. Any intervals other than these arise from the crossing of these chromatic chains, and are used structurally: for instance, Pousseur frequently allows a non-chromatic interval to characterize a section. This latter practice tends to offset the rather monoto-

nous effect which inevitably arises from the consistent use of fragments of the chromatic scale.

Rests are quite freely introduced into the subdivisions of the metre; they can occur at the beginning, in the middle or at the end of the metre, and can vary as to the number in succession.

The homogeneity of harmonic effect is in fact an advantage, as inherently interesting pitch structures would tend to distract from the quite new function assigned here to pitch — that of characterizing each metre by its density. In a discussion of this work,* Pousseur himself says: "The lowest density, or greatest slowness, is ... established if a minor 2nd coincides with the subdivision 1, i.e. when for four $\frac{2}{4}$ bars a single note is available; while the greatest density, the maximum speed, results in the places where the density index 11 — the major 7th — coincides with the subdivision 8, i.e. where eleven ... notes have to be made to fit into a single crotchet. The densest groups are also the shortest, but this is compensated by the fact that they occur correspondingly oftener, so that there is felt to be a definite average density over an entire metre"** (the underlining is mine).

Here one can see a certain similarity between this work and "Structure 1a": the individual sound-events are ordered according to some system of serialization, but the work as a whole is to be appreciated as a series of juxtaposed "statistical" structures. In "Structure 1a", the density of each structure depends mainly on the number of serial threads assigned to each; in

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* In an article, "Outline of a Method", translated by Leo Black, in "die Reihe", Vol.3.

** op.cit., p.51ff.

Pousseur's Quintet it arises from the interplay of the duration and pitch parameters.

A few further details concerning this work's composition should suffice to illustrate the main trends in Pousseur's musical thinking.

The various metres are joined together in groups of 24 to form the four main sections of the work. Although there is much individual movement and variation within these main sections, there is an overall average density discernible for each, which may be expressed by the following numerical values:

2 - 1 - 3 - 2.

This scheme is realized in the following way: in the two outer sections the various subdivisions assigned to each metre are ordered most irregularly, while those of the two middle sections follow a much more regular arrangement. Pousseur makes some further comments on how the density contributes to the overall form: "Although one can not speak of strict progressions (for there are delays, pauses, retrogressions and sudden jumps) it is indeed true that the slowest metres [cf. above] in these two [middle] sections are found at the beginning of the second and at the end of the third, while their meeting-point (the centre of the piece) shows the greatest piling-up of the subdivisions and the greatest densities, thus quite clearly marking out this section as the climax. The two middle sections are thus welded together in a single broad movement to and fro, in a rise and fall of the statistical density, while the outer sections build a firmer, stationary frame around this process of development."*

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* op.cit., p.52

Note the mirror structure here; the influence of Webern is undeniable. But although there are certain points of similarity in their work — like this mirror-symmetry, the instrumental combination chosen, the use of the op.22 series, the sounding of occasional fragments from this series, and the intervallic connections between all notes (major 7ths, minor 9ths) — the final effect of this Quintet is quite different from the sound of Webern's music.

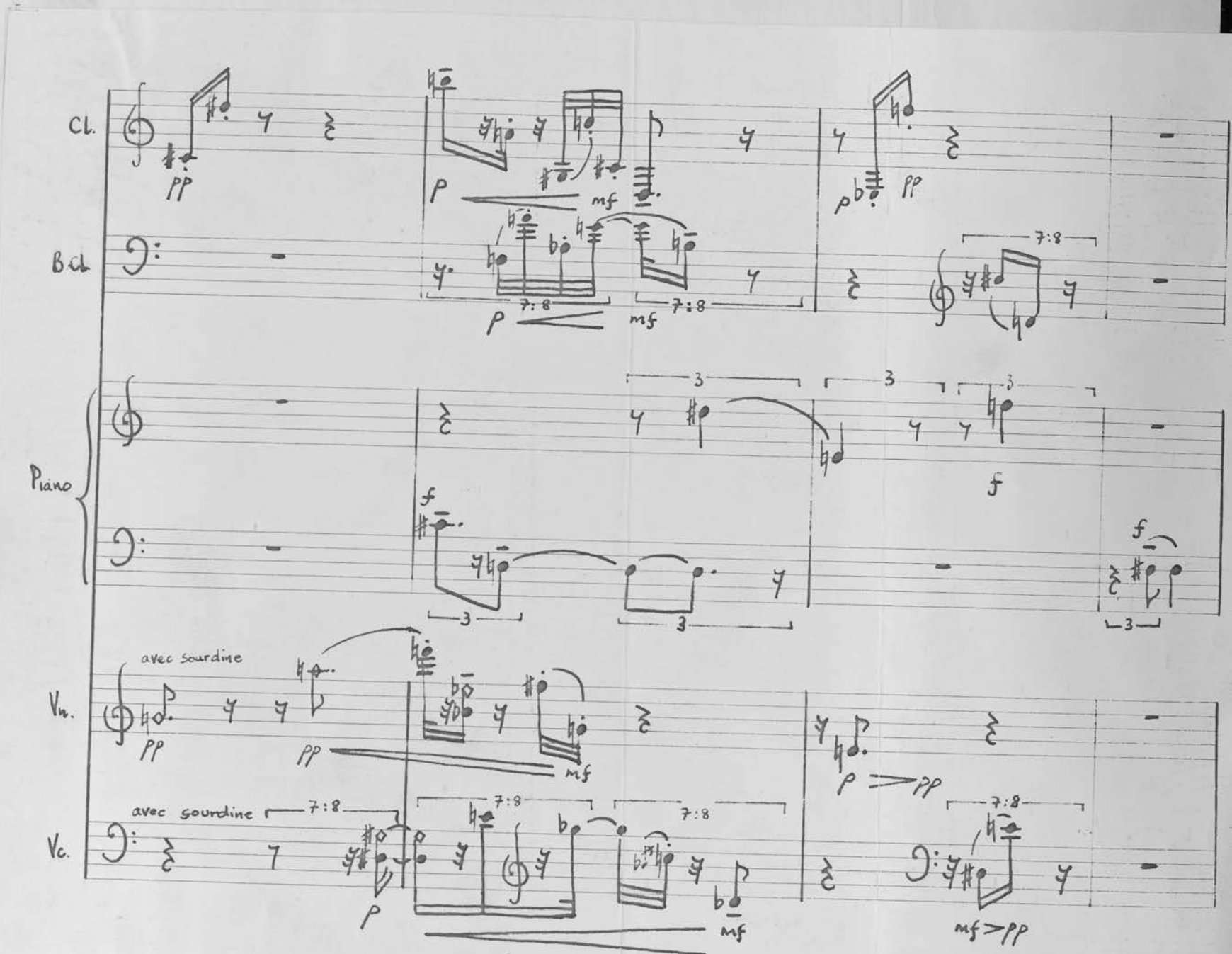
The five instruments of the Quintet are so grouped as to make three "voices", three polyphonic strata. The piano is always on its own, while in the first and third sections the grouping is according to register — violin and clarinet, cello and bass clarinet —, and in the second and fourth it is according to timbre — both woods, both strings.

A polyphonic texture results from the fact that each of these three instrumental groups sounds a separate subdivision of the metre, e.g., the two clarinets might subdivide the metre into eighths, the two strings into fifths, while the piano subdivides into quarters. Thus density variations occur horizontally, in the three contrasting strata, and in the successive, statistically-appreciated metres.

The density of the four successive main sections is so ordered as to sound an arch-like structure, as described above; and to the enunciation of this structure the density-ordering of the three polyphonic strata contributes as well. We have noted that in the two outer sections "the various metric subdivisions are arranged very irregularly"; this irregularity occurs not only from metre to metre but also within the metre

through the superimposition of three highly contrasted subdivisions as enunciated by the three instrumental groups. (The beginnings and ends of metres will always coincide, of course, as the overall duration of the 4-bar metre is always the same, whatever its subdivisions.) Below is the first metre of the Quintet:-

Ex.53:



Because he felt his alternating scheme for instrumental combination (cf. p.148) to be rudimentary and "incapable of producing real structural vitality"*, Pousseur introduced some variation into the first two-thirds of the second section and the last two-fifths of the third section by occasionally dropping one instrument from a 2-instrument group. This means that the group of notes assigned to each subdivision of the metre, and which is normally divided up between the two instruments, has in such instances to be played by only one, thus increasing the horizontal density of that particular stratum for that metre. The reason that such variation occurs at these particular places in the score is to obscure the divisions between the principal sections. This point is worth mentioning because it illustrates a peculiarity fundamental to this composition.

Throughout, Pousseur has stipulated a very regular and simple scheme — four sections containing an equal number of bars, regular bar-lengths and regular metre lengths, regularly alternating instrumental combinations, etc. — and then deliberately proceeded to obscure this wherever possible.

Finally, it is worth noting that the serialization of pitch in this work has nothing whatsoever in common with traditional composition with a 12-note series. The intervals of Webern's series for op.22 are used here as an index of density, i.e., the density depends upon the number of notes contained within each interval. Thus the minor 3rd, for example, has relatively low density as it contains only three notes within its span, the major 7th has the maximum density, with eleven notes.

* Pousseur : op.cit., p.53

The movement of the notes within each chromatic fragment does not follow the dictàtes of traditional serial practice either; the only "rule" here derives from Poussseur's concept of "organic chromaticism". Again the question might be asked: apart from its realization of the dedication, was the use of a pitch series really necessary? when even its function of ordering the density of a structure is dependent upon those subdivisions of the metre with which the intervals are combined.

With these two works as illustrations, it might perhaps be fruitful to stop here and summarize the general trends of serial music at this time.

Fundamental to the new music is the serialist's concern with structure. "Absolute" music has for centuries been regarded by the composer largely as a means of conveying his own mood or emotion through the language of sound; this tradition is still strongly present in Schönberg's music even though the idiom of the language has changed.

It is in the music of Webern, that the seeds of the new trend are sown. We have already examined Webern's new concept of musical space and his characterization and definition of the "sound-objects" in space; these sound-objects in turn are so arranged in space and time as to enunciate overall formal patterns. And yet his music is still concerned with emotional expression: one has only to consider the large number of works which are set to texts, consider the texts themselves — to realize that Webern still conceived of music as an expressive language with which to convey his own thoughts and feelings. This dual expressiveness of

music — its emotional voicing, and that other expressiveness arising from the beauty of ordered formal structuring — is by no means new. (It is perhaps one of the fundamental reasons for the powerful appeal of Bach's music, for example.)

Post-Webernite serialists, however, extracted from Webern what they felt to be relevant to their own aesthetic requirements; "objectivity" is a word often met with in their writings. Taking Webern as their guide, their primary concern is with the sounding of structures in space and time. Any emotional expression seems to be unintentional and arises by accident, so to speak.

Furthermore, the structuring of traditional music had, in virtually all cases, aimed to effect a sense of forward movement and progressive development. In Webern's music we noted a quite new formal type: a self-reflecting and self-contained structure which did not seek development but which rather aimed for contrast in the juxtaposition of varying musical events. The importance of such a revolutionary concept of form can hardly be overestimated; it forms the basis for most works of the avant-garde school of serialism, where it has been extended to include the composition of large-scale structures juxtaposed in contrast to each other. The two works examined above illustrate to some degree the methods of composing such forms.

The contrasting characters of such structures are determined "statistically": within each structure all the "points" — the individual musical events — are chosen for their contribution to the overall character of that structure; once chosen, they are no longer im-

portant in themselves, but derive significance from their arrangement. The listener then gains a general impression of the structure from the character and arrangement of its component "points".

The early attempts to serialize durations contributed substantially to this type of perception. The superimposition of various duration-series — noted, for example, in "Structure 1a" — may have been "incorrect" from a serial point of view, but had far-reaching and unlooked-for results. In this work, the varying number of series superimposed results in a varying density, i.e., the density of a section is perceived as higher according to the greater number of series superimposed because a greater number of notes has to be fitted into the overall length of a section. Here the ear cannot disentangle the series as separate, and "they become merely inextricable threads in a network, and this network must be audible only as such, and not as a superposition of parts."* Thus the listener no longer hears "pointillistically", as, for example, in Webern, but "statistically", in that he gains a general impression of the average density of a section. Duration-relationships here become a component of another parameter : density.

The difficulties experienced in the performance of this new, minutely defined music will be discussed again when the work of Stockhausen is examined. With the heightening degree of differentiation from one musical event to the next, the exactness of realization in performance becomes proportionately less. We have also

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* Stockhausen: "... How Time Passes ...", op.cit., p.15.

seen a vast increase in the use of the irrational durations (and this is even more marked in Stockhausen's music); these are difficult for instrumentalists to realize, their experience having been mostly with the regular — the rational — divisions of a beat. Here again, it was Webern who set the precedent in his equation of the triplet with the rational durations as a counting unit. In connection with this, Henri Pousseur's work is extremely interesting as it illustrates yet another aspect of post-Webernite music.

Pousseur's concern is with the qualitative, as opposed to the quantitative and he discusses this in connection with his Quintet.* He is not interested in the exactness of differentiation between two given durations; rather does he wish the listener to recognize the fact of difference only. He gives the following example : "One may write two successive notes, crotchet and dotted quaver, within a group of seven semiquavers, not so as to suggest to the hearer the exact comprehension of a numerical relationship 3:4 (which would of course mean the perception of a common factor, a regular pulsation), but so as to make him aware of two durations, approximately equal and yet palpably different, and to prevent the establishment of any apparent periodicity. Thus the relationship between the two note-values loses its quantitative character and becomes a connection exclusively between different time-qualities, a time-tension of essentially dynamic character ....."** This idea accords with Stockhausen's theory of perception, i.e., that the listener does not perceive the exact lengths of successive durations, but rather the proportions

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* op.cit.

** op.cit., p.54

they express. At the same time, it relieves the performer of an almost impossible task although, as Pousseur points out, his understanding of what the music is trying to express has to be far greater: "It would free the performer from a whole series of difficulties that are merely those of communication, unconnected with the meaning of the work. Certainly it would impose on him other problems, new difficulties of understanding and imagination; in particular, he would be faced by the task of finding and respecting not the letter but the spirit of a musical text."*

In practice, Pousseur's conception of relationships in terms of their quality involves blurring the outlines of the components of such relationships. He extends this conception to his interpretation of pitch as well, and notes that "the larger chromatic intervals — major 7ths, minor 9ths, etc... are 'impure', out-of-tune octaves."** In his work, then, Pousseur seeks to relate indistinct values; as Koenig says***: "Indistinctnesses are brought into relationship to each other."

All this recalls composition with overall statistical structures : both involve the expression of relationships between various events whose difference is qualitatively defined.

Yet another trend in this music is a certain weakening of the composer's control over both the composition and the performance of his music. We have noted how certain aspects of a work pass beyond the direct control of the composer once a general plan for the over-

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* op.cit., p.54
** op.cit., p.54
*** In an article, "Henri Pousseur", translated by Leo Black, pub. in "die Reihe", Vol.4, p.24

all course of events has been chosen, and have examined the predetermination of the successive "points" in Boulez' "Structure 1a" in this connection. As far as this weakened control over performance is concerned, one might point out that a certain measure of freedom in interpretation — now more, now less — has always been a feature of music. But two aspects mark the latitude in this new music as being unusual: firstly, it occurs — in works such as "Structure 1a" — in spite of precise and definitive instructions as to the sounding of each event; here the composer forfeits control through his excessive desire for that very exactitude which is in fact beyond a performer to give him. On the other hand, in Pousseur's work, the performer is deliberately offered greater latitude and, concomitantly, greater responsibility.

It is in this period, just after the death of Webern,[3] that electronic instruments became recognized as an exciting new medium for the new music. It offered possibilities in sound only wishfully visualized by these composers; it was able to solve certain problems of serial theory; it was in many ways the ideal medium for realizing the complex trends and requirements of this new musical era.

With the adoption of this medium, we can note a strong divergence in the matter of freedom in performance. On the one hand, electronic instruments were capable of realizing exact values in all parameters; on the other, we see instrumental music becoming more and more free as to its interpretation.

And now it is time to examine the work of Karlheinz

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3 in 1945

Stockhausen, who is generally considered to be the leader of the school of avant-garde serialism.

Born in 1928 near Cologne, he received his initial training at the Musikhochschule in Cologne from 1947 to 1951. He then went to Paris where he studied under Messiaen and Milhaud. While there he also studied the techniques and principles of "musique concrète" at the Club d'essay and the French radio studios. From 1954 to 1956 he applied himself to a study of phonetics and communication theory under Dr Werner Meyer-Eppler at the University of Bonn. Meanwhile, in 1953 he had joined Herbert Eimert at the newly-founded electronic music studio of the Cologne radio station (the first ever to be established) and in 1963 he was appointed artistic director there on the retirement of Eimert. The two men, however, continued to work together in their joint editorship (since 1955) of the periodical devoted to developments in serial music, "die Reihe". Since 1957 he has also given classes in composition and analysis at the International Summer School for New Music in Darmstadt.

This man, with his specialized knowledge in the field of acoustics and the electronic medium, has been in the forefront of serial composition and has evolved much of the underlying theory thereof. He, more than any other single person, has been responsible for so much of what is happening in the musical world of today.

Moreover, it has been primarily he who has been responsible for the present interest in the science, or mechanics, of sound and sound production; when discussing their own works and methods of composition, compo-

sers of this school make frequent reference to his theories, and, indeed, the writings of this period read very like semi-scientific treatises.

Much of Stockhausen's theoretical work is to be read in an article he wrote for the third volume of "die Reihe", called "... How Time passes ...." Here he suggests that the three parameters [4] of duration, pitch and timbre all fundamentally arise from the same source: the alternations of sound and silence. The speed and combination of these alternations, which may be periodic or aperiodic, account for our perception of them as these three distinct parameters. All are aspects of the same thing: time.

All events sounded more than approximately one-sixteenth of a second apart we hear as separate, as durations. Once the interval between the sounds is less than 1/16th of a second the ear cannot distinguish them as separate and registers them as frequency vibrations, i.e., as pitch. This immediately becomes clear if we think of one of the lowest "notes" audible to us, that whose frequency is 32 cycles per second, i.e., the events are sounded 1/32nd of a second apart. This pitch we can admittedly hardly even hear as such, but the pulses — the successive events — are sounded too rapidly for us to register them as separate durations. The more rapidly these pulses vibrate, the "higher" do we place the pitch. We are able to "hear" up to between 16,000 and 20,000 cycles per second; the ear is

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4 The term "parameter" has been frequently used throughout this study and originates in the writings of this "scientific" period of musical theory. Although the word itself relates to mathematics, it is now an accepted term of present-day musical jargon.

not able to register as sound pulses vibrating still more quickly. We perceive combinations of these periodic vibrations as timbre.

The basic set of durations used in tonal music derived from regular divisions of a unit, the semibreve:-

1 $\frac{1}{2}$ $\frac{1}{4}$ $\frac{1}{8}$ $\frac{1}{16}$ $\frac{1}{32}$ $\frac{1}{64}$, etc., or from regular multiplications of a given unit, here the hemidemisemiquaver:-

These were arranged in bars which contained a constant number of regular basic pulses; these pulses could again be subdivided into various durations — themselves regular in their division (cf. above) and thus easily related to the underlying pulse, which was not necessarily sounded at all.

These divisions (or multiplications, as above) have regular proportions which stand in the constant ratio of 2:1 to each other; in the field of pitch this proportion corresponds to that of the octave.

The triads of tonal music derive from the first five harmonics of the harmonic series. These five express relatively large proportional relationships to each other and were thus considered concordant; the smaller proportions found in the "upper" section of the harmonic series — that furthest from the fundamental — were considered as generating dissonance.

We have noted how the so-called "rational" divisions (or multiplications) of a unit correspond to the octave in the field of pitch. Those "irrational" durations most frequently used in tonal music were the triplet, quintuplet and septuplet; these correspond in the field of pitch to, respectively, the perfect 5th, the major 3rd and the minor 7th above the fundamental, i.e., the triad, and the dominant 7th.

Now, as timbre results from which overtones of the harmonic series are sounded in combination, we can clearly see the close correspondence between the compositional material and its medium of realization in the tonal system.

In our examination of the early attempts to serialize durations, we noted how a regular multiplication of a basic unit resulted in the proportions corresponding to those of the harmonic series inverted (a "subharmonic scale"). Division of a unit would thus correspond to the harmonic series as is. Stockhausen gives a diagram showing these proportions arising from the division of a fundamental unit, the semibreve (corresponding to the fundamental tone in the field of pitch), and then offers an analogy with pitch.* These are quoted below:-

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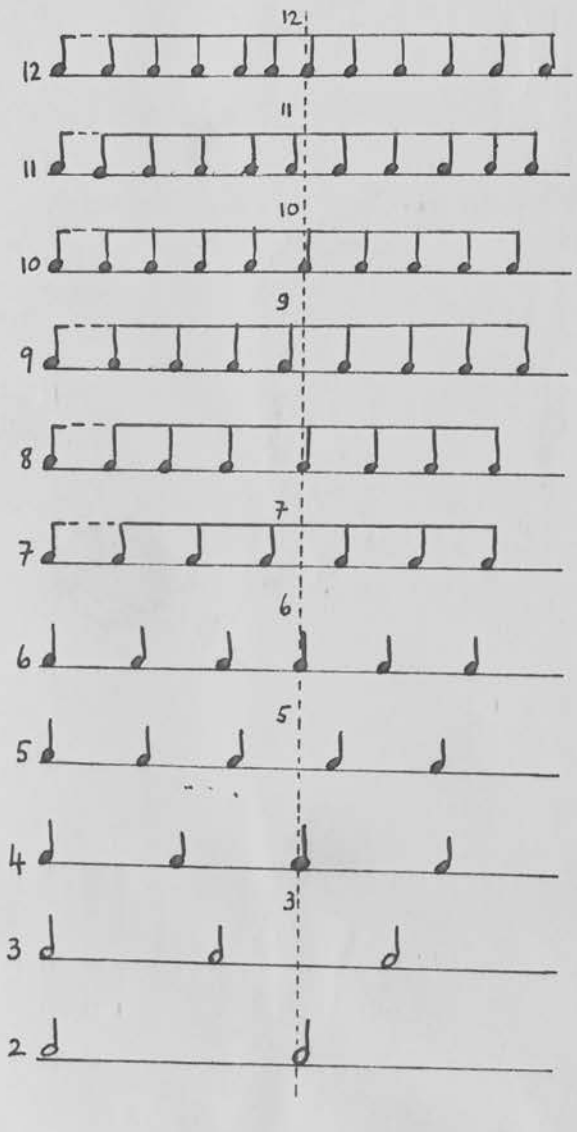
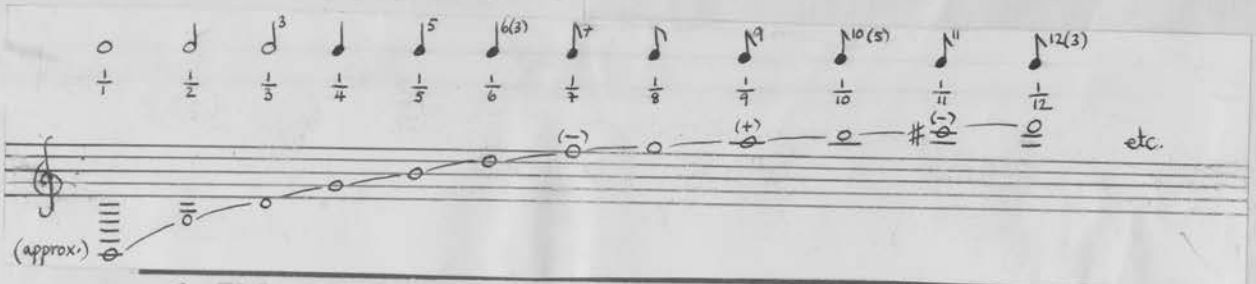
* In "... How Time passes ...", op.cit., pp.16 and 17

Ex.54a[5]:



The abandonment of tonality meant in the first place the abandonment of a system of organizing pitch which was based on the harmonic series. In its place a system arose which was based on a series of the 12 different notes possible in our tempered system. It has already been noted that the successive frequencies of the chromatic scale are logarithmically determined to give us the impression that they are of equal distance apart.
Ex.54b:



5 This analogy with pitch possibly bears further

Thus there is a fundamental contradiction in 20th-century (serial) music between its pitch and (i) its durational values and (ii) the instruments which sound it, both of which are derived from the subdivisions of the harmonic series. As Stockhausen puts it: "Here the earlier identity of material and composition fell completely apart."* The attempts described above obviously provide no real solution to the problem, so what to do?

Stockhausen tackles first the question of durations. He suggests a "tempered chromatic scale of durations", which would thus approximate to the tempered chromatic scale of pitches, and offers the following method for achieving this: "We take a pocket metronome, which can be quickly altered while still in motion. We fix eleven duration-intervals per [octave], in such a way that they are felt to be equal. As long as we use the traditional signs for duration, the only possibility is to take the same sign (e.g., o) for all twelve chromatic time-values, and to differentiate its duration metronomically. If

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elucidation. We know that the frequencies of the harmonics derived from any fundamental are multiples of the frequency of that fundamental, e.g., if the fundamental vibrates at 60 cycles per second, the 2nd harmonic vibrates at 120, the 3rd at 180, the 4th at 240, the 5th at 300 c.p.s., etc. But the frequency of a pitch can be viewed from two angles: (i) the number of pulses which occur per second — the pitches of the ascending harmonic series are thus multiples of the number of pulses per second of the fundamental —, and (ii) the length of the duration between each pulse; in this latter case, the interval between the pulses becomes progressively shorter, and are thus divisions of the duration between the sounding of the pulses of the fundamental. Stockhausen bases his analogy on this latter definition of frequency. Thus, conversely, multiplications of a fundamental duration give the "subharmonic series".

* op.cit., p.20

we choose a logarithmic scale of 12 within an [octave] from, for instance 𝅝 = 1" to 𝅝 = ½" (2:1) we get:

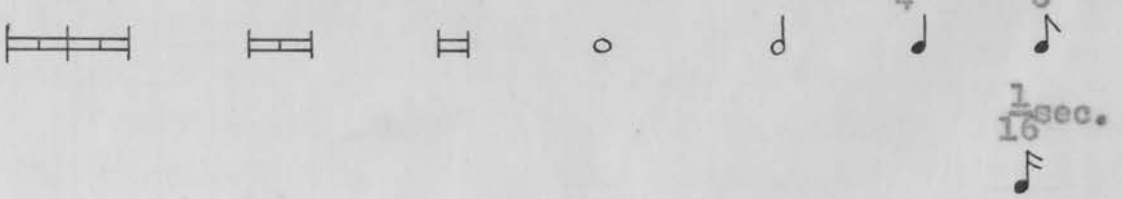
M.M. 𝅝 = 60, 63.6, 67.4, 71.4, 75.6, 80.1, 84.9, 89.9,

95.2, 100.9, 106.9, 113.3, 120.

For the last value 𝅝 =120 we can also write 𝅗𝅥 with 𝅝 =60, and the same chromatic scale sets out, with this value, into the next [octave]. Thus we obtain the [octave]-transpositions of the scale by altering the sign for the fundamental duration: 𝅝 =60-113, 𝅗𝅥 = 120-226, ♩ = 240 -452, etc.

The sphere of <u>duration-composition</u> has not hitherto exceeded seven duration-octaves; fundamental phases [the durations between the successive events] longer than 8" or shorter than $\frac{1}{16}$" are seldom required ('playability' sets a bourn here, and we have seen above that the perception of duration passes over into the perception of pitch at this point; equally, our powers of recollection impose limits on the length of time-phases, ruling out fundamental phases that are much more than 8"). Thus, the composition of durations has at its disposal a <u>chromatic scale of durations over approximately seven octaves</u>, between 8" and $\frac{1}{16}$" :

8 seconds 4 secs. 2 secs. 1 sec. ½ sec. $\frac{1}{4}$sec. $\frac{1}{8}$sec. $\frac{1}{16}$sec.

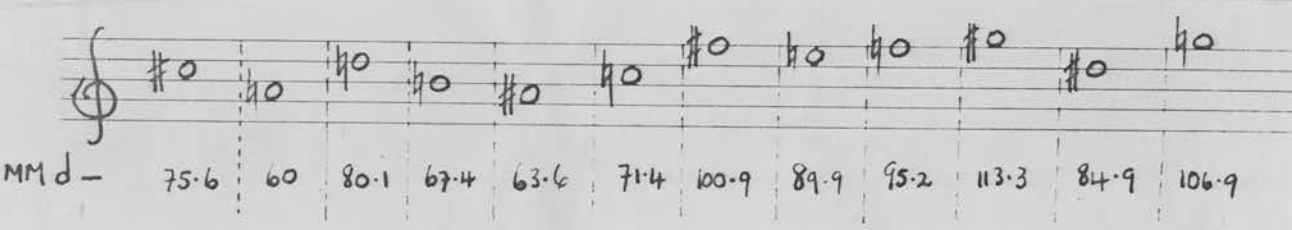


and in every 2:1 relationship, the chromatic scale of twelve durations, fixed by metronome markings, repeats itself."*

The composer is then free to choose from this range of durations those which will give him the particular time-relationships required for that particular work, just as he chooses his pitches from the range of seven or eight pitch-octaves at his disposal.

Stockhausen next outlines his method of composition with these durations. As in the case of the 12 pitches of a pitch-series, the 12 durations from any one "duration-octave" may be sounded in any order chosen by the composer, and all must be sounded before the repetition of any one. This results in a series of durations, every single one of which has a different metronomic speed (cf. above). In the example below a comparison with pitch is offered as an aid to understanding.

Ex.55:



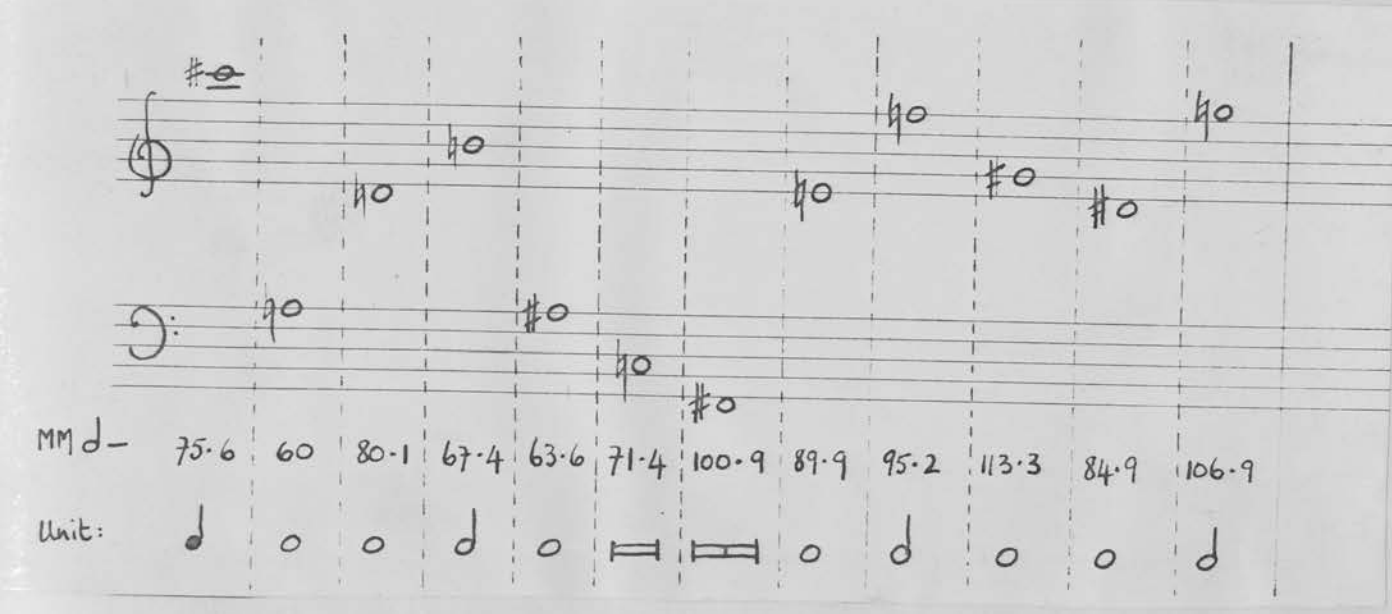
Stockhausen considers these to be fundamental durations, just as he considers the pitches of a series to be fundamental pitches; this will be discussed below.

Pointing out that the original pitch-series is initially conceived as lying within a single octave, but is

* op.cit., p.21

frequently presented across several octaves in the actual piece of music, Stockhausen proceeds to do the same with his durations. His duration-series originally lay within the "duration-octave" of ♩ = 60 to ♩ = 120. He now varies the octave "registers" of some of these durations (here again a comparison with pitch is offered.) :

Ex.56:



This "placing" of the durations in various "registers" results in a succession of varying units, between ♩ and 𝅗𝅥, whose metronomic marking continues to be related to ♩.*

Stockhausen points out that the interest in the sounding of a pitch-series no longer arises from which

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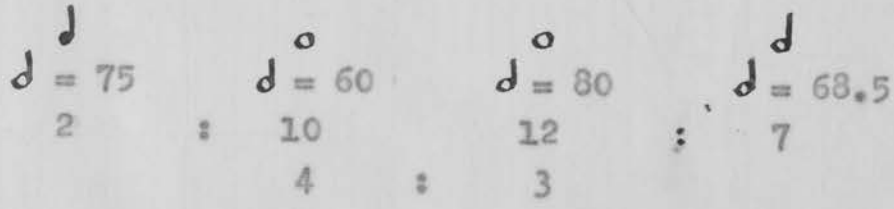
* These two examples, 55 and 56, are given on p.22 of Stockhausen's article, op.cit.

specific pitches are sounded (cf. the dethronement of pitch), but from which proportions they express; he therefore proceeds to proportion his duration series, the components of which are now these metronomically-determined and varying units. Once the various proportional relationships between the successive durations have been determined — i.e., his primary material — he now has to use them in the composition of a work.

The following are the first three proportions of the series (the metronome markings have been slightly altered from Ex.55, above, to accord more exactly with the proportions required):-

Ex.57:



This is more easily comprehended if the durational lengths are translated into seconds:-

$\frac{2}{5}$" 2" 1½" $\frac{7}{8}$" .

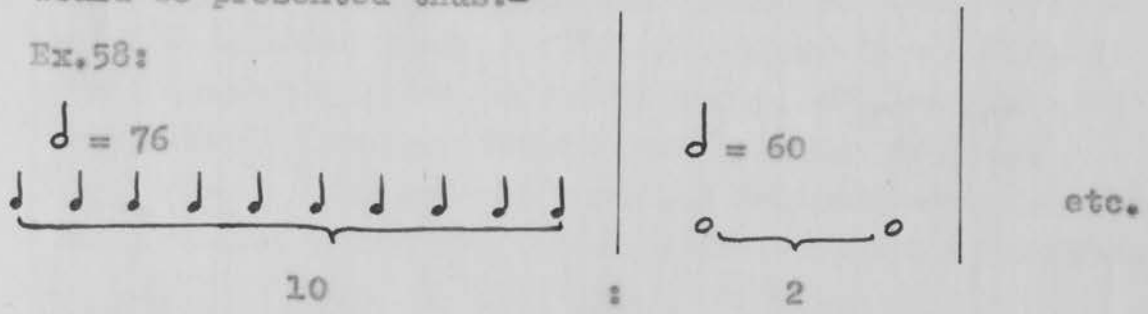
The first metronome marking means that each minim lasts $^4/_5$ths of a second ($\frac{60}{75}$); as the given unit is ♩, it will last $^2/_5$" only; for the second unit, each ♩ lasts 1 second, and thus 𝅗𝅥 = 2"; the first unit therefore lasts exactly $^1/_5$th of the length of the second (2:10), etc.

So far Stockhausen has been dealing only with single durations and their proportions. For practical

purposes, he considers it desirable to apply these proportions not to single durations, but to groups of durations.

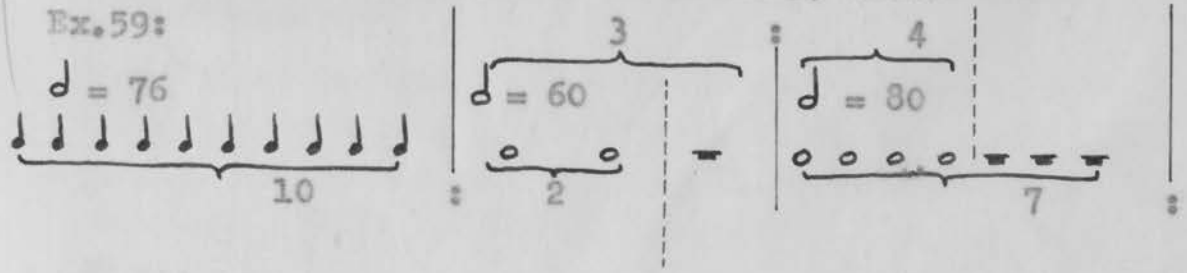
Now the proportion 2:10 implies two things : in the first instance, it means that the first unit is five times as short as the second; secondly, it implies that 10 of the first units will take the same length of time to sound as 2 of the second (2x10 = 20: 20 = 10x2). And so Stockhausen reverses the proportions (10:2, 3:4, etc.) because he is no longer dealing with the relationships existing between successive single duration-units, but to those between the numbers of durations in each successive group. Such groups would be presented thus:-

Ex.58:



But the second group here is also the first of the next expressed proportion 3:4. This ambiguity — this facing in two directions at once, which occurs in both constituents of all proportions saving the first and last — results in either a rest or an overlap, thus:-

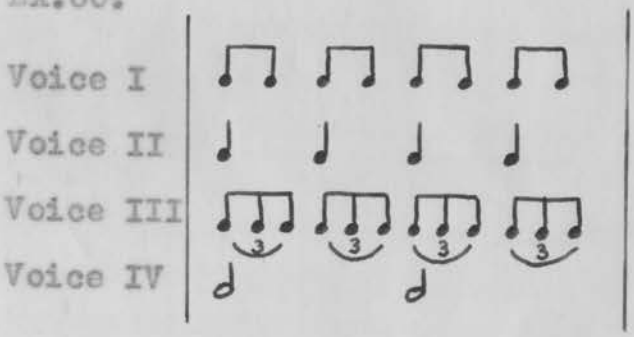
Ex.59:



The advantage of this arrangement in groups is that the tempi extend over a far greater number of durations, which meets performing requirements far better. Each of these groups is then accorded what Stockhausen calls a "formant-spectrum".

The formant-spectrum is illustrated in Ex.54a. A basic duration is divided into two equal parts, three equal parts, four equal parts, etc. These divisions are known as "formants". Several formants superimposed will all start and end at the same time, because they are all variously subdivided parts of a common whole. The duration of this common whole (the fundamental) is thus defined at the points at which the superimposed subdivisions begin and end, and therefore need not itself be sounded at all. This is clear if one thinks for a moment in terms of tonal music, and imagines the fundamental duration to be a bar, lasting, say, one semibreve. The various parts — "voices" — might each express this bar-length quite differently, for example:-

Ex.60:



but the sum of each "voice" adds up to the duration of a single bar (i.e., one semibreve) which is perceived as such. The greater the number of subdivisions, or formants, so presented, the clearer will one's perception of the fundamental be.

It has already been noted that Stockhausen considers his series of metronomically-determined durations (cf. Ex.55) to be a series of such fundamentals.

Now if this were still a matter of single fundamental durations, each would be defined by its own formant-spectrum; but here Stockhausen, to facilitate performance and to obtain structures of overall greater length, has arranged these single durations in groups of durations, as described above. The formant-spectrum is therefore composed for "the supra-ordered duration of the whole group."*

The formant-spectrum is composed ..... : the composer is free to combine those formants which meet his compositional requirements and "the most diverse methods of serial composition can be used" in deciding the number, their combination, etc. In deciding such matters, the composer obviously chooses those which accord with some overall structure or shape which he wishes to express. In fact, Stockhausen always starts the composition of a work with some specific structure or overall movement in mind, and arranges his formants accordingly.

The concept of an overall structure which is realized through a combination of its many details relates to the new method of statistical composition. All the numerous "points" within that structure contribute to the expression thereof. The whole structure is then "statistically" appreciated by the listener, who is unable to disentangle the individual "points" from their web of combination.

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* op.cit., p.26

In Stockhausen's composition, both pitch and duration are conceived as arising from a unitary perception of time. Both are based on a "chromatic" series, i.e., one whose values are based on logarithmic relationships. He conceives of the 12 pitches of the chromatic scale as fundamental tones whose formant-spectra are determined by the instrument, or instruments, which plays them. (Here it should be remembered that timbre is the result of certain overtones (formants) of the harmonic series in combination; thus the formant-spectra of the pitches vary according to which instruments sound those pitches.) In the field of durations, Stockhausen composes a logarithmic series of fundamental durations which corresponds approximately to the logarithmic series of fundamental tones (i.e., the proportions between the values are logarithmically determined). He then arranges these in groups, and proceeds to compose the particular formant-spectrum considered desirable for each group.

For the performance of these groups, he suggests several orchestras under separate conductors, or several small groups of instruments as in "Kontrapunkte" (which was composed according to the method outlined above). The various instrumental groups "would at times play independently of each other, at differing tempi, orientating themselves to the others only at the points where they entered. Before each entry, each group — or each conductor — could prepare for the next tempo without difficulty (with a metronome). Spatial separation would result naturally from the need to make various time-strata appreciable."* This last sentence once

*op.cit., p.25

again underlines the modern composer's concern with the sounding of structures in space. The idea of dividing the music between several groups was intended, too, to make the task of interpreting the various time-strata slightly easier for the performers concerned.

When composing this type of music for electronic instruments, the question of inaccuracy in performance does not arise. But the composer who wishes to write for orchestral instruments has now to take this into account in the actual composition of the piece. Again, it was Stockhausen who was in the vanguard of experiments in this direction.

Two main problems arose in the performance of this type of composition by Stockhausen. The first relates to the fact that Stockhausen makes frequent use of the more complex formants — the so-called "irrational" durations; here he continues a trend already noted in this period. The second problem arises when several separated groups of performers are to perform the various time-strata.

The present notation of durations is still derived from that which was used in tonal music; as we have seen, tonality employed mainly the rational and the simpler irrational durations; for these, this notation was perfectly adequate. But it is quite inadequate to express the complex irrational durations of the post-Webern music. It was noted quite early on in this period that the more complex the notation and the more highly differentiated — as composers sought to express their complex rhythmic ideas in symbols which were fundamentally not equipped to do so — the less precise

was the performer's realization thereof.

Furthermore, the longer several groups play in differing tempi, the more likely is it for them to get out of phase, so to speak. This becomes still more probable when the individual formants deriving from a single group of durations (i.e., within a single tempo) are composed flexibly — when their speeds are subject to such alterations as, say, accelerando and ritardando. Stockhausen quotes an instance where a first group of formants is to be played at a constant tempo, i.e., as written, a second is "as fast as possible", a third speeds up and a fourth slows down; all derive from a common fundamental which is exactly measured as a single value (although quite possibly not actually sounded), so that the four variables are all to occur within a clearly defined length of time. Here there is a two-fold opportunity for inaccuracy: firstly, in the realization of each group of formants by the individual performers and secondly, in their superimposition.

All this endangers the expression of the composed proportions, and the balance of the overall statistical structures is impaired through an imprecise realization of their individual "points". Stockhausen therefore suggests determining the degree of inaccuracy in these cases and then composing a series of proportions applying to zones of inaccuracy. For example, in the case of inaccuracies arising from complexities in notation, he proposes testing good instrumentalists in a number of situations to try to define the zone of inaccuracy in each instance, and then serializing these zones.

The problem of fallibility in performance, coupled with the trend towards statistical composition, results,

then, in an important new development.

Much has been said of statistical structures and their perception as such. Up until now, generally speaking, this type of perception has arisen through the density of a structure being such that the serial relationships between the individual "points" have not been distinguishable as such. As Stockhausen puts it: "The necessary condition was that a certain number or mass of details were crowded into a short time. However, as soon as one can hear through such processes, or follow them slowly enough, they are, and remain, nothing but 'periodic, harmonic, sub-harmonic, tempered-chromatic and other' relationships of regular, individually-defined facts. Here, then, mass-structure is a special case of a unitary structure that is, at bottom, individually determined. 'Complex' time-processes are thus the result of heaping up exactly defined time-'points' more or less densely in time. Mass-structure means, then, merely the momentary opacity of a group."*

Composition with "indistinctnesses" as in the work of Pousseur, or with zones of inaccuracy which are actually composed into the work, as suggested by Stockhausen, involves the extension of the statistical idea from mass-structures to even the details thereof. The immediate problem here was how to notate these.

Now there were, in fact, precedents for durations which could not be precisely measured, e.g., the acciaccatura, although these were formerly not related to any general theory.

In tonal music, the duration of the acciaccatura was unmeasured, but dependent upon the general tempo of the section — or piece — in which it occurred, and on

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* op.cit., p.32

its distance from the note it preceded. Stockhausen was able to take his cue from here. Indicating that each acciaccatura was to be played "as fast as possible", he composed a group of these to be played on the piano; the lengths of each were dependent upon two principal factors: (a) the magnitude of the distance between them, thus making their lengths dependent upon the amount of movement necessary for the pianist to "get over them" (the dependence here would be direct, as everything is to be played "as fast as possible"); (b) by instructing that each note "should be distinctly recognizable in pitch", the "lower" acciaccaturas would of necessity have to be held for a greater length of time than the "higher" ones. It is therefore possible to create a series of varying lengths for a single symbol () by exploiting the limitations of both performer and instrument. A certain amount of variation (or "inaccuracy") would arise from the difference in each different performer's speed of movement, and such factors as the varying resonance of different rooms, etc., but this would not disturb the fundamental <u>proportions</u> at all, because <u>all</u> lengths would vary similarly in the instances mentioned; for example, in a highly resonant room, <u>all</u> acciaccaturas would have to be held for a slightly longer time, thus retaining the actual proportions involved.

Continuing along these lines, the composer can determine many such desired variables by the actions of the performer. Here rests should be considered as well. The length of a rest is determined partly by its actual notated length, and partly by the fact that notes struck, say, on the piano in various registers or in different

ways take varying lengths of time to die away to silence, thus adding to the notated length of the succeeding rest. Rests between notes can also be determined "statistically", i.e., they, too, can be made dependent upon action. This can be especially noted in the scores of John Cage, the American composer, where preparations for the sounding of his events — they are not always notes! — are frequently most elaborate (although, as Stockhausen points out, such preparations are not composed with a series of proportions in mind).

Besides its notated duration, the length of a sound can also be made dependent upon its method of attack and its dynamic. By way of example, Stockhausen quotes the following instruction: "Engage the right-hand pedal, attack the note staccato and immediately allow the pedal to spring just so far back that the note goes on sounding softly as an echo."* Here the loudness of the note and its register will also influence its duration.

Thus the composer can arrive at a series of graded action-sizes, i.e., he can grade the varying lengths of time involved in certain actions and proportion them as he pleases. Instead of the performer being considered a fallible encumbrance in the performance of the new music, he can become a vital and absolutely necessary factor in its realization.

Such a contribution to musical history is of paramount importance. It was in this period that composers were confronted with the dilemma: if they wanted exact realization, they could not use performers and would have to write for electronic instruments only; if, on the other hand, they wanted to write instrumental music,

*op.cit., p.35

they would have to sacrifice absolute precision. With the new impetus thus given instrumental music by — primarily — Stockhausen, music took two different directions, and serial composers were free to follow either, or both.

In statistical composition applying both to "mass-structures" and to their details, the instrumentalist is able to play an exciting new role, and one in which he becomes more involved in performance than ever before. Formerly, the various movements in music — tension-relaxation, mirrored structures, etc. — were expressed through a succession of static points in time; now time is enunciated as a flexible, flowing thing. No longer does the instrumentalist have to struggle with precise realization; now he is to plunge himself fully into the work in hand, and only by so doing can he realize, as Pousseur says, "the spirit of the text" as opposed to the letter. Heinz-Klaus Metzger notes:* "The specifically new thing about present-day instrumental music is that its traditional task — to realize the printed text exactly — has been taken over by electronic music. Instrumental music must pull itself together and for the first time allow the interpreter what is his by rights; composers need the interpreter for their new types of time-conception, since these can only be realized through interpretative freedom (as defined for the work concerned)."

Composers have recognized this need; many today work in close collaboration with specific performers or

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* In an article, "Just who is growing old?" pub. in Vol.4 of "die Reihe", p.77

ensembles: Henri Pousseur and a group of seven, Pierre Boulez and the Südwestfunk, Luciano Berio and Cathy Berberian, John Cage and David Tudor, Lukas Foss and his Improvisation Chamber Ensemble.

The experiments described above dealt with single durations, but this type of composition could equally well be applied to groups of durations as well, again taking the "limitations" of the performer and his instrument into account. Stockhausen discusses this in some detail in his article "... How Time passes...". He notes that because a woodwind player (compared with, say, a pianist) cannot play continuously without breathing, the length of time taken to play any group of notes depends in the first instance on the length of the player's breath. Stockhausen continues, "If we ignore physiological factors, the duration of a breath depends on the register, density and loudness of the notes to be played. The lower and louder the notes, and the fewer sustained notes there are to play, the shorter the duration of the breath is. When the tempo indication 'as slow as possible' is given, this means that a group of single durations must be distributed over as long a total duration as possible, depending on the duration of the breath."* Thus the length of the breath would determine the length of the whole section, while the varying proportions of length accorded each successive whole section would depend upon such factors as register, dynamic, and number of notes in each. Here the composer has statistically determined the overall lengths of sections, whose individual durations may or may not be precisely determined.

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* op.cit., p.35

In the case where the individual durations of such sections are to be statistically determined, it is obvious that action cannot play any significant part in their determination (as is the case when a pianist is involved). And so here Stockhausen suggests subdividing the section into sub-sections. In the simplest case, these sub-sections could be of equal length but contain varying numbers of durations whose only instruction for performance would be, for example, that "no periodicity may occur". The fewer the number of durations in each sub-section, the greater latitude has the performer in the matter of their individual lengths; the more notes he has to "squash" into the sub-section, the less room has he in which to manoeuvre, so to speak. Thus here the durations are not notated at all; only the number accorded each sub-section is given. If the composer wishes to restrict the performer he will have many short sub-sections with large numbers of notes in each; on the other hand, if he wishes greater latitude, the sub-sections will be few and contain few notes. The number of durations in each sub-section, too, can be statistically determined, the composer suggesting, say, 3-5 in the first sub-section, 15-20 in the second, etc., and, vice versa, the number of durations in each may be constant, but the number of sub-sections variable; even both can be! Meanwhile, all the sub-sections are contained within a section whose overall length depends upon the breath control of the player.

It must by now be obvious that serial proportioning from point to point has no place in this music. Its necessity even in a pointillistic work like Boulez' "Structure 1a" has already been questioned; in that work,

the serial relationships from note to note go largely unappreciated owing to the crossing of serial strands; furthermore, the chief concern of the composer was with the overall effect gained from the juxtapositioning of more-or-less dense structures. Again, in the work of Pousseur examined in this chapter, we saw how serial relationships no longer governed the movement from point to successive point in the realm of pitch. Finally, in the new type of music suggested by Stockhausen, the question of a series governing the point movement does not even arise.

But the serial concept has by no means been abandoned in this music. Stockhausen frequently refers to the fact that a series of proportions governs the overall movement in his work. We have already noted how a "chromatic" series of durations is applied to the tempi of the fundamental durations. Furthermore, the zones of inaccuracy applying to the imprecisely measured durations, etc., are governed by a series of proportions. Dieter Schnebel says,* "But since proportions are composed, the elements' significance comes not from their predetermined size but from their power of forming relationships. The individual events are important as foci of the relationships. In each piece there arises a dense network of relationships, which is further intensified according to the degree of polyphony."

The formal basis of this music, developing out of Webern's concept of musical space, involves the idea of relationship between several defined "mass-structures".

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* In an article, "Karlheinz Stockhausen", translated by Leo Black, pub. in Vol.4 of "die Reihe", p.131

Within each structure a certain directed movement is discernible; this movement characterizes the structure which in its turn represents some stage in the general movement expressed by all the structures when sounded together. This general movement might express symmetry, or perhaps a steady "crescendo" of movement to a final climax.

In the discussion of Webern's work (in Chapter 3), it was noted that Webern's op.21 suggested certain analogies with a piece of sculpture, where the proportions of the whole governed the proportions of the detail, and the whole was a macrocosm of the detailed microcosmic relationships.*

This analogy could also be applied to much of Stockhausen's music. Schnebel points out that the original aim of serialism was to "annul the principle of dominance". This aim is completely realized here. "No longer are the elements, in this case the vibrational tempi[6], to be subordinate to one dominant element; they are to co-exist as individualities. They are to form a 'series'. So in composition one first has to create space for this. One fixes a proportional field, i.e., one settles what are to be the relationships into which the juxtaposed tempi[6] enter. The relationships now remain fairly constant, but it becomes possible for the tempi themselves to vary in many ways. Once chosen, these relationships regulate the piece in general and in

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* On p.84.

6 By "vibrational tempi", Schnebel is referring to both pitch and duration, cf. Stockhausen's conception of these parameters as both being variously-perceived aspects of the same dimension : time.

detail — they stamp themselves on the overall form, the parts of this form and the elements of which the parts consist"* (the underlining is mine).

The new latitude accorded the performer can also be extended to the overall structure of a work. A fine example of this is the last of Stockhausen's set of piano pieces, "Klavierstück XI." Here he composes a number of separate structures — groups of notes — who have at first no overall duration-marking, dynamic curve or method of attack; these are to be variable and will result from the properties of the preceding group. All groups are composed simultaneously and any one can follow after any other. Within a group, several series of statistical proportions (i.e., variable proportions within certain limits) fix the relative time-proportions and thus the number and succession of the notes. Once thus composed, the relative positions of the individual pitches and durations are not interchangeable; there is therefore a certain directed movement within each group. These groups are then scattered irregularly over a piece of paper and the performer may start with any he chooses. It has been noted that the general properties of each group are to result from those of the preceding one; this comes about in the following way:- at the end of each group there are instructions for the performance of the group to be played next, e.g., "from ♩ =ca 40 get faster and then slow down again"; "make a diminuendo from *mf* "; "r.h. legato, l.h. staccato", and so on. Thus the general properties of each group stand in some ordered relationship to those of the preceding group, although

* op.cit., p.133

the actual details within each cannot contribute significantly to the expression of this relationship because the choice of which group succeeds which is left to the performer. Noting that "the structure of the piece is not presented as a sequence of development in time", Stockhausen quotes the general instructions for performance: "play any group, selected at random, quite freely as the first, then, equally at random, look the paper over and play the group next seen, but observing the directions given at the end of the group played first, etc. When any group is seen for the third time, the piece is over." Stockhausen continues, "As it is probable that several groups will be played twice, the pitch-structure of some groups is, in parts, notated twice; when a group is played for the second time, some single notes drop out, others are interchanged (the ones in brackets), whole groups are shifted one or more octaves (by ignoring octave signs), etc."*

In such a work there is no directed flow of successive events, but rather a directionless interaction of proportional time-structures, although a certain movement from structure to structure is obviously perceptible because of the composer's instructions at the end of each completed group. The analogy often offered here is that of the mobile, where each structure has its own internal proportions, while constantly new ones arise between the structures as they are arranged in ever-new relationships to each other.

Up until now, instrumental music has (on the whole) had to use discrete, distinct pitches because of the nature of the instruments. The extension of the stat-

* op.cit., p.36

istical method of composition to pitch would involve the building of some new instrument which could present pitch continuously. Of course, electronic instruments can do this, but fundamental to this method is the live performer. (Indeed, the theory and practice of these compositional concepts derived partly from the desire to continue writing instrumental music. The method really involves a realistic understanding of the limitations of the instrumentalist and his instrument, and is an attempt to compose music which is able to realize the new trends in compositional thought, while at the same time incorporating those very limitations.)

Some years after Stockhausen wrote his article propounding the main tenets of his theory, " ... How Time passes ...", Gyorgy Ligeti composed his "Volumina" for organ; originally written in December 1961 — January 1962, it was revised in 1966. As one turns the pages of this score, one is confronted by black and white juxtaposed blocks of varying lengths and widths, wiggly black bands that look like snakes in motion, two pages of what can only be described as "squiggles" (which look for all the world like unravelled knitting!), various other curious sketches, and finally a long, continuous, thick black band which extends through several pages to end the work. At various intervals over these "diagrams" there are duration markings in seconds (which have to be timed with a stop-watch) and registration instructions. Certainly, an unorthodox method of notation! Yet here is an attempt to create a work (and notate it) incorporating bands of pitches whose lower and upper limits are frequently very ill-defined. The performer's methods of presenting these ill-defined bands vary;

for example, at one point the organist places his fist, knuckles down, over a group of notes, and then rotates his fist from side to side in a generally upward movement. The effect is of an alternating ascending and descending smudge of sound (a "cluster") whose band-width is determined in part by the size of the organist's hand and in part by the size of his rotation; the general direction of the whole is upwards. Fists, arms and elbows are freely employed throughout the work: in one instance, for example, the organist is to lay his hands and arms, up to his elbows, flat on the manual between two defined pitches.

The pitch of this work can only be appreciated statistically, i.e., the individual components of the pitch-clusters can not be heard, nor are they meant to be. The listener is made aware only of a general direction in the work, a general movement in which the statistical pitch-structures, the intensity, the timbre (registration), and the durations all participate (the duration-markings define the time-limits in which various events are to take place). The realization of the "Volumina" will obviously vary (within limits) with every performance.

It is unnecessary to note that all traces of serialism as one knew it twenty years ago have completely vanished here; not only would it be unnecessary to serialize the relationships between the successive individual pitches and durations, but positively pointless, as, by the sheer nature of the work, the individual values of these parameters can neither be realized or appreciated.

The seeds of this abandonment of the old serial

ordering have already been noted in Stockhausen's work; the article in which he propounded his theories, his "new morphology of musical time" and his new compositional methods was written as early as 1956, and in fact applied specifically to the compositions "Zeitmasse", "Gruppen für drei Orchester" and "Klavierstück XI". Since then, serialism has been completely discarded by the avant-garde school, but this will be discussed in the final chapter of this study. The Ligeti work has been mentioned here because, although written about a decade later than the works discussed in this chapter, it affords an example of how Stockhausen's statistical method could be extended to pitch, using conventional instruments.

Schnebel, in his article on Stockhausen*, notes that each new work by Stockhausen constitutes his opus 1, as it were, because each demonstrates something special and new. Each realizes a specific conception, or idea, whose characteristics pervade the details and the overall flow of the piece. As Schnebel puts its : "The method of composition used in these works is what distinguishes them so powerfully from all others that one is forced to concentrate on them. Each group of works and each work has a quite special method, because for each work there is a specific, suitable selection of elements and a specific, suitable course for them to follow. The method of composition is determined, then, by construction, i.e., by the way the moment takes shape, for Stockhausen always starts by imagining a particular and unique whole whose structure affects the details as much as the all-embracing unity."** Further-

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* op.cit.

** op.cit., p.121ff.

more, each work, from "Kontrapunkte" for ten instruments (1952-3) onwards, incorporates attempts to realize the theories outlined in this chapter; these include the eleven piano pieces, the wind quintet "Zeitmasse", and "Gruppen".

It is perhaps significant, in connection with the dual pathway taken by music after Webern, that the year of the completion of "Kontrapunkte" (1953) saw also the first serial electronic work: Stockhausen's "Studie 1". From then on, Stockhausen composed for both media, and the last piano piece (XI), in which so much of his new method was incorporated, was written in the same year as a classic of electronic music, his "Gesang der Jünglinge"(1956).

The wind quintet, "Zeitmasse" (1955-56), employs all of the techniques discussed above.

We have already noted the difficulty arising out of various tempi being sounded together within the defined limits of a given duration (cf. p.172); in "Zeitmasse", the five performers are confronted by a situation where one has to play in an exact tempo set by a metronome, another is to play his notes as fast as possible, yet another as slowly as possible, while another is to accelerate or decelerate.

In many passages of the work it is essential that the performer thinks only in terms of the "irrational" durations set before him, and does not relate these to a steady, rational pulse. Here the precedent was set by Webern, who used the triplet as he did beats measured in twos and fours, i.e., not as an irregularity perceived against a background of regular proportions, but

as an individual entity of equal importance to the rational beats. In Stockhausen's music, as in that of Boulez and Pousseur, this conception of the irrationals has become a common feature, and has been extended to include far more complex irrationals than the triplet.

The method of determining the statistical length of a structure according to the length of a player's breath is used in this work, too.

An important innovation in "Zeitmasse" concerns the performers' relationship to each other. Here again the performer's involvement with the work in hand is stressed, for now each must relate his part to that of another: he must either play with, or after, but at any rate according to, another's "line".

Finally, a few points concerning the notation of "Zeitmasse" are worth mentioning: only what is actually played is given — there are no empty bars in the score for rests; this is logical when one considers that the player's entry is not defined by the precise length of preceding rests, but by what is occurring in the other parts; accelerandos and ritenutos are notated by writing the notes either closer and closer together or further and further apart, depending upon which movement is required.

In this chapter we have noted only the general trends in serial composition after Webern. A great deal of attention has therefore been devoted to the work of Stockhausen, who incorporated into a general theory and system of composition many of the trends already present in the work of the other two primary figures of the period, Pousseur and Boulez. This focus on

Stockhausen has tended to exclude any detailed discussion of some of the other major works of the period. One such work, which has become a classic of the idiom, is Boulez' "Le marteau sans maître".

"Le marteau" was written in 1955, and is a setting of texts by René Char; the work is for alto and flute, vibraphone, guitar, viola, xylorimba and a large percussion group comprising a number of most unusual instruments: bongos, maracas, tambourines, claves, bells, tam-tam, triangle, gong, cymbals, and small cymbals. Although the music bears the unmistakable stamp of Boulez, certain influences are apparent, chiefly that of Webern, and Schönberg's "Pierrot Lunaire".

It is interesting to note that Robert Craft compares the 6th movement of this work to the 1st movement of Webern's op.21. He remarks that both pieces are "melodic in substance and both stress some of the same melodic intervals, especially 6ths and 3rds". He sees similarities in the overall form and "the spatial dispositions are similar (but more complex in Boulez), and so are the instrumental styles with their doublings and overlappings".

"Le marteau" is made up of nine short pieces; the third piece for voice and flute "is so near to Pierrot _"Pierrot Lunaire"_ — and even in the 'expressionism' — that the flutter-tongues seem almost like a cross-reference." Craft also sees certain rhythmic echoes of Stravinsky.

In an article, "Notes on the music", pub. in "The Score", no.24, Nov.1958; originally included in his recording of this work and "Zeitmasse" for Columbia, 1957.

One of the most noticeable characteristics of "Le marteau" is its speed; the fact that the instruments chosen are those of higher register undoubtedly reflects the fact that the general movement is very fast. Boulez' characteristic fast speed is 208 beats per minute; compare this with Webern's, which is about 168.

Much of the form of the work is recapitulatory and not only within the pieces themselves; later pieces recall earlier ones, e.g., the music of the 9th movement is exactly the same as that of the 3rd, in retrograde. Some intervals, too, serve a recapitulatory function. Such cross-relationships are part of the serial organization, and illustrate Boulez' concept of serialism as a method for creating unity in his music. In this, his work is far more closely related to that of Webern than to that of Stockhausen.

As in "Structure 1a", the series is extended to the other parameters besides pitch. In this work, too, Boulez is concerned with density-relationships.

Boulez reflects a general trend, already noted, when he equates durational units of 5, 6, 7, 8 and 9 with the more familiar 2, 3 and 4; this is further complicated by his indication that a group is to be played in the time of another, e.g., "6 notes in the time of 5".

"Le marteau" also allows the performer a certain latitude in the field of durations. In the 5th movement, especially, the constant and rapid changes of tempo are allowed a certain flexibility in their realization. Boulez uses the sign ↗↙ to mean a flexible tempo up or down to the metronomic limits and mediums he sets. And yet Craft feels that the basic beat is never far from present in this music.

To a certain extent, this latitude is extended to pitch; Boulez makes frequent use of "Sprechgesang", which, by its very nature, involves an element of indeterminacy in its use of pitch-bands whose outer limits are relatively ill-defined.

These two works, "Zeitmasse" and "Le marteau", both written at more or less the same time, illustrate ideally the vastly different styles which can be derived from a similar method of composition. Both are concerned with statistical structures of density, both use fluctuating tempos, both extend serial control to all parameters. And yet their final effect is quite different.

In the first place, in a work where a text is used, the composer can hardly avoid the expression of a certain amount of emotion which does not arise purely from the sounding of structure. Furthermore, "Le marteau" seeks after exotic effects (here it might be recalled that Boulez studied under Messiaen), and contains many of what can only be considered as melodic fragments.

The appeal of Stockhausen's "Zeitmasse", on the other hand, stems purely from its formal structuring, and is intended to do so; every aspect of the music is involved in the sounding of statistically-appreciated structures which are juxtaposed in such a way as to express certain overall formal movements. All traces of melody seem to have disappeared — indeed, in this music, far more than in that of Boulez, "the principle of dominance" is truly annulled, and all parameters are made equal.

This chapter has been primarily concerned with the final stages in the development of serial thought. It

has dealt with the three most significant composers in the field: Karlheinz Stockhausen, Pierre Boulez and Henri Pousseur. There are many others concerned with work of this type, but these three have been mainly responsible for the pioneering of the new music. This music has branched off into two directions — electronic and instrumental — each of which solves certain problems of serialism, but which frequently cross-fertilize.

So far we have examined attempts to bring instrumental music into line with the new compositional concepts; in the next chapter we shall have a look at electronic music in some detail. It should always be remembered, however, that the two types of music are not separate and distinct from each other, but are both expressions of the same fundamental concepts.

CHAPTER 5.

ELECTRONIC MUSIC

The composition of music for the electronic medium would seem to be quite new in the history of music. Certainly "electronic music" as we know it today was made possible only with the invention of the tape recorder and work on this type of music started in the early 1950s.

But this was, in fact, the end of a development which had originated with the invention of the dynamo by Faraday and others in the middle of the 19th century. This invention introduced the possibility of using electricity to produce sound, although, apart from the electric church organ, these electro-magnetic instruments found little favour with musicians. With the turn of the century came the invention of the diode valve which opened up the world of electronically-generated sound. The many exciting possibilities here were soon recognized by musicians. Furthermore, it is certainly no coincidence that much of this interest arose at a time when the traditional system for the composition of music was breaking down; the material of music was extending far beyond the realms of tonality, and there was a corresponding interest in a new means whereby to express this material.

Busoni saw Cahill's Telharmonium — which appeared in the first decade of the century — as a means to "unconditional freedom", and electronic concert instruments such as the Thereminvox (1920) and the Ondes Martenot (1928)

were used in the works of some of the young composers of the time. In 1926 Jörg Mager exhibited his Sphärophon, and later his Elektrophon, Kaleidophon and Partiturophon; although these instruments in themselves gained little general acceptance, Mager conceived of them as the instruments of the future, visualized them as eventually making possible whole new worlds of musical thought and composition. He stated that it ought to be possible to "make available to artists of the future all frequencies, melodically as well as harmonically, as well as the partial tones† which determine the timbre."*

In his book "Toward a new music"(1937), Carlos Chávez prophesied the elimination of the performer as "middleman" between composer and listener, and in 1942 John Cage advocated "experimental radio music" to further efforts so far limited to experiments with percussion. These ideas became reality when in 1948 Pierre Schaeffer inaugurated "musique concrète" at the radio studios in Paris; we have already noted that Stockhausen did a certain amount of study on the principles and techniques of this type of sound, and Boulez has also worked with it.

Here we must note some basic differences between the work of inventors like Mager, Theremin and Martenot,

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† overtones derived from multiplications of the frequency of a fundamental, as in the harmonic series.

* Quoted by Herbert Eimert in his article, "What is electronic music?", pub. in "die Reihe", Vol.1 (on pp. 2-3).

and that of men like Cage and Schaeffer.

In both cases sound is produced by electronic means, but in the former the instruments were concert instruments, to be played by performers, whereas work with tape recorders and radios dispenses with the performer altogether.

There is a further point of difference. Certain electronic concert instruments, like the Hammond organ, were designed primarily to imitate the sound of orchestral instruments; others widened the range of tone-colour with sounds which were still recognizably instrumental, e.g., both the Thereminvox and the Ondes Martenot produce a hybrid sound somewhere between the sound of the violin and that of the flute. The important point here is that such concert instruments were conceived within the framework of familiar orchestral sound.

Work with magnetic tape, on the other hand, is concerned with the production of a completely new sound altogether. The composition of "musique concrète" involves recording noises from both the natural and the industrial environment and then arranging these in any order the composer desires, while it is Eimert's avowed aim to use sounds which recall no other in his electronic music.

It is with this latter medium that the serialists are concerned: electronic instruments which are capable of producing a completely new world of sound, and which dispense with the performer.

In 1951 Herbert Eimert and Dr Werner Meyer-Eppler founded the electronic music studio at the radio station of Cologne; in the same year, Cage composed his "Imagi-

nary Landscape" for 24 radios. The following year saw Luening's "Low Speed", composed by manipulations of magnetic tape, Ussachevsky's "Sonic Contours" for tape and instruments, Messiaen wrote his "Timbres-durées" for tape, and Pierre Schaeffer gave a full account of his work and its aims. In 1953 Luciano Berio founded an electronic studio at Milan ..... and Karlheinz Stockhausen composed his "Studie I" in which serialism was first united with composition for the electronic medium — here the two streams of development meet.

Serialists who contributed articles to the first volume of "die Reihe"* like to claim that the adoption of the electronic medium arose out of the needs of serialism. This is only partly true: the use of electronic instruments did answer certain needs, but the short history above should show that it was also part of a general development which existed alongside, and in part independently of, serial music. This parallel development is neatly underlined by two events of 1949: the composition of "Mode de valeurs et d'intensités" by Messiaen, which, as we have seen, was highly significant in the development of serialism, and the composition of the "musique concrète" classic, the "Symphony for One Man" by Pierre Henry and Pierre Schaeffer.

The initial work on serial electronic music was undertaken at the Cologne studios. Its introduction to the public is summarized by Eimert**: "The first studies were broadcast in an evening programme of Cologne Radio in 1951 and were performed at the International 'Ferienkurse für Musik' in Darmstadt. In 1953

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* On electronic music, pub. 1955.

** op.cit., p.5

there was a public demonstration in connection with the music festival in the Concert Hall of the Cologne Radio. The first real electronic compositions were performed in a concert in the Cologne Radio on the 19th October, 1954; there were seven pieces, in all twenty-eight minutes of music, the second half of the concert being devoted to them. The composers were H. Eimert, K. Goeyvaerts, P. Gredinger, H. Pousseur and Kh. Stockhausen. Of importance for the further development of the medium was a concert in the Cologne Radio at the end of May, 1956, in which the 'Fünf Stücke' by H. Eimert, 'Klangfiguren II' by G.M. Koenig, the 'Oratorio for Pentecost' by E. Křenek and the 'Gesang der Jünglinge' by Kh. Stockhausen were given their first performances". Other composers in this field include Pierre Boulez, Luigi Nono and Giselher Klebe.

The worlds of electronic music and instrumental music are very different, and the former should never be considered as replacing the latter. On the contrary, as we have noted in Chapter 4, the composer is now able to exploit the special advantages of both, and thus his field of action is considerably widened. A brief summary of the chief contrasting characteristics of each should be helpful here.

The composer of instrumental music (— and here vocal music is included —) is dependent upon the performer for the realization of his work; in the new music examined in the preceding chapter, this dependence is greater than almost ever before, as the interpreter's understanding of the work is now absolutely essential for its realization. The greater the degree of latitude he is given, the greater must be his involve-

ment with the work in hand: his realization is not to be of "the letter but the spirit of a musical text." In electronic music, the composer is the performer; the two roles are fused into one. This arises from the very nature of electronic music itself.

In instrumental music the composer works with material already existing and basically unchangeable, i.e., the instruments themselves, each of which has a specific range, characteristic timbre, etc. But the composer who works with electronic instruments is confronted with the task of creating the very material with which he is to compose, and recording the composed material in its final shape onto magnetic tape. Here there is obviously no place for the performer.

(This "elimination" of the performer brought its own problems. Electronic music broadcast over the radio is quite a different matter from electronic music presented to an audience in a concert hall. Boulez says*: "Psychological reactions of an audience to which the music is fed by loudspeakers can hardly be avoided where that audience is deprived of the possibility of associating a sound with a gesture." The solution to the problem thus posed is one which accords closely with the concept of musical space. Several loudspeakers are placed in various positions — above, behind, in front of the audience, and their arrangement is part of the work itself; this is not stereophonic effect for its own sake, but is actually incorporated into the composition of the music — as Boulez puts it, "the arrangement in space becomes a structural

* In an article, " 'At the ends of fruitful land ....' ", pub. in "die Reihe", Vol.1., (p.21)

necessity." There were other, more fundamental, reasons for incorporating the spatial distribution of the sources of sound into the compositional structuring of the work; these arose from the basic principles underlying this new music and will be discussed below.)

A further point of difference between the instrumental and the electronic sound-worlds is that the material of the former is limited, that of the latter unlimited. This statement needs some clarification and modifying.

We have already noted that each instrument has its own range and timbre; in addition, and generally speaking, it is able to sound only those notes which are a semitone apart ..... generally speaking : the string family is an obvious exception, and so is the voice, though here the composer has to contend with the (Western) performer to whom intervals smaller than a semitone are relatively difficult to sound accurately.[8]
Furthermore, we have already noted that many problems of accuracy in performance arise from the difficulty of realizing the "irrational" durations.

In electronic music, no such limitations exist: the composer is able to obtain any timbre and range he desires, any interval smaller than the semitone he might choose to use and his durations and dynamics can be realized with extreme precision.

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[8] This has not prevented composers from writing these, however, and performers have risen to the challenge, as witnessed by Donald Lybbert's "Lines for the fallen" (for soprano and two pianos), Penderecki's "Passion according to St. Luke", and that composer's "Threnody for the victims of Hiroshima" for string orchestra, to name only three works; there is also Hába's work with quarter- and sixth-tones.

Dieter Schnebel, discussing Stockhausen's work with both media,* says: "Stockhausen's electronic music engages in an effort to make material that is limitless yield the limited, terse unity of a work. His instrumental music seeks to explode pre-determined limits." However, this "limitless" world is something of a fallacy, as we shall presently see.

The question of imprecision in the performance of the new instrumental music and what this led to has already been examined in detail. With instruments which do not require a performer, and which can realize with extreme precision any sound the composer desires, the problem does not arise.

Finally, composition with electronic instruments gives rise to a situation which has never before been encountered in the history of music. Musical composition has always involved a two-fold process — the composer records his work on paper, but the work cannot exist as music without the performer. But the composer who creates his own sound material, structures it, and then records it onto tape works similarly to the painter, the sculptor, the author, for once an electronic work has been thus composed it is finished; nothing further is needed for its presentation, and it is recorded for all time as initially conceived.

Now what is this new material of electronic music? What are these electronic instruments?

The composer's basic equipment consists of an electronic sound generator, a loudspeaker, a tape-recorder

* In his article "Karlheinz Stockhausen", pub. in "die Reihe", Vol.4, p.124

and a filter; in actual practice, he usually uses more than one loudspeaker and at least two tape-recorders; however, these four items provide him with the basic equipment with which to work.

Because the composer has to create the very material with which he will compose, he has now to ask himself, "What is a note?"(Compare this with his question when writing tonal, instrumental music: "How does the note function in relation to its context?")

A note is the vector sum of its four basic parameters — pitch, timbre, duration and intensity (dynamic level). Method of attack may be considered as an elaboration of this basic structure and is able to effect a certain degree of variation in the latter three parameters — timbre, duration and intensity; e.g., there is some variation of all three between one pitch played legato and one played staccato, even though the two are identically notated.

The pitch of a note is determined by its frequency, i.e., by the number of vibrations sounded per second. A single frequency sounded on its own constitutes a "pure tone", or "sinus tone", familiar to us in the sounding of a tuning-fork. Sinus tones can be generated at any frequency desired.

A note sounded on an instrument is not a pure tone, but a complex sum of several frequencies sounding simultaneously; our perception translates this complex sum into the characteristic timbre of the instrument concerned. The various timbres are comprised of a varying number and combination of frequencies, some of which are sounded more loudly than others; all frequencies so combined derive from the frequency of a common

fundamental, by whole-number multiplication of that fundamental, i.e., 2, 3, 4, 5, etc. times the frequency of the fundamental. As we have seen, frequencies so derived correspond to those of the harmonic series. Thus instrumental timbre results from the combination of various so-called "partials" of the harmonic series, sounded at varying intensities. Our perception of the pitch so sounded is determined by the frequency of the fundamental, even if this is not itself actually sounded.

The combination of those frequencies which derive from multiplications of the frequency of the common fundamental by other than whole numbers — the so-called non-harmonic partials — results in what we hear as "noise".

Timbre can be electronically obtained in two ways: the composer can build up a montage of sinus tones which stand in harmonic relationships to each other — in which case a sound resembling an instrumental timbre will be obtained, or which stand in non-harmonic relationships to each other, to effect noise; secondly, he can filter "white noise" to give various combinations of sinus tones. "White noise" is the term given to the effect produced when all the band-widths of frequency are sounded together to give the effect that each is of equal intensity. Besides the instrumental timbre to which we are accustomed, the composer has two new elements with which to work: the pure tone, and noise — "white" or filtered.

The duration of a sound is fixed in terms of its recorded length on the tape when the latter is moving at a certain speed; the various tape-lengths are cut according to the duration required and are then spliced

to form a master tape.

Intensity is controlled by means of the strength of the electric signal to the recording head, and is measured in decibels.

Thus the quality of a sound is determined by its quantities as measured by the means outlined above.

Nothing is already existent: the material and its composition are one, and must be renewed with each work. The composer has not only to create the overall structure of the work (— which is to compose —), but has also to create each individual sound as well. When such a method of composition is used, it is obvious that a sound occurring in one work is meaningless in another because it has been constructed in its microcosm to relate to the macrocosmic structure of the whole. As Stockhausen says,* "the structure of a work and its material are one and the same thing" (the underlining is mine). It is not surprising, then, that it can easily take up to four weeks to create one minute of what Eimert calls "real music", by which he means to exclude the "atmospheric effects" frequently used for films and the like.

Having examined the basic material of electronic music, we must now ask how it is employed in the composition of a work. Boulez points out that a first meeting with the electronic medium tends to dazzle the composer; he is at first quite awestruck "by the wonders of the machine". In his article on electronic music,** Boulez says : "With electro-acoustical proce-

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*In an article, "Actualia", pub. in "die Reihe", Vol.1, p.51

**op.cit.

dures we can create with little trouble what has never been heard before. Unusual conditions, simple procedures such as acceleration, slow motion, montage juxtapositions, already put us into a 'modernistic' atmosphere ..... Nothing is simpler than the composition of canons at the unison; just take one track with several heads. Different speeds suffice to make a fugue and there is nothing easier than making a tape-loop and so obtaining an ostinato. Unfortunately, this mechanical efficiency is of little use to us. For after all, who really wants to make canons which only function at the unison? Who, today, cares to compose fugues in which the tempo is automatically regulated by the transposition of the subject? Who requires ineradicable ostinatos? Only a primitive mind will be impressed by the wonders of the machine, only one which is ignorant of music evolution (p.20) ..... In the first flush of electro-acoustic experiment there were many grandiose, if naïve, conceptions: freedom, precision, the unlimited possibilities which a truly modern civilization gave the composer; this was to be music's own 20th century. The very freedom which he sought becomes chaotic and if it is not limited all work loses its point"(p.29) ..... and how is this freedom to be limited? and what is composition with electro-acoustical procedures to be? This brings us back to serialism.

In the preceding chapters we have seen how far serialism has developed from its origins; the importance of Webern in this development has been repeatedly stressed. What has actually been developed is not <u>the series</u> as such, but rather the <u>serial principle</u>

based on Schönberg's concept of musical space, the full implications of which were first appreciated by Webern. In Webern's music, the series governs the relationships within the individual parameters as well as those of the overall structure. Here the series operates as a structuring principle. We saw how this principle was extended to include every detail of all parameters in the work of Stockhausen, Pousseur and Boulez, and how it also governs the relationships between juxtaposed structures which stand in various proportions to each other. Thus serialism has gradually evolved to become a system of variously-proportioned relationships which operate within the details of the material and between the larger structures which go to make up its overall form. It is as such that it operates in the composition of electronic music. Once again consider the analogy with a piece of sculpture in which the microcosmic relationships are reflected in those of the macrocosm — and vice versa.

Křenek notes that "every dimension and detail of the composition [arises] from a pre-established row of proportions"*, and Paul Gredinger says**: "For us the Series means a principle, a generating law of proportion, of duration, the essential principle of our music. A specific approach to all musical problems is conceived. Our series .... is the fundamental principle of relationship which generates the structure of a work.

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* In an article, "A glance over the shoulders of the young", pub. in "die Reihe", Vol.1, p.14

** In an article, "Serial Technique", in the same publication.

The serial principle creates forms in which the whole as well as the parts depend on a single characteristic of the Series"(p.42) .... and elsewhere he notes, "Our aim is an art, in which proportion is everything; a Serial Art"(p.40).

Webern's work may be considered as particularly meaningful in this connection; his importance to the new generation of serialists is summed up by Gredinger:* "In Webern's work we realize for the first time the necessity of a system of proportion .... Webern's music is not serial, but it is on the way to being so in its limitation of itself to a single system of proportion in a composition. Webern is a twelve-note composer, but that is only of secondary importance. For him the important thing was the relationship of intervals." Eimert notes that in "traditional 12-note music" — by which he means primarily Schönberg's — the omnipresence of the series was recognizable only through constant reference to its initial presentation as a basic thematic shape of emotional character; Webern reduces this shape to the single interval — or cell — which then generates the overall structure. This is far more akin to electronic serial composition, where the proportions within the material generate the overall structural proportions.

What is often called "musical objectivity" has been referred to several times throughout this study. Pousseur maintains** that in the music of Debussy — contrary to the general trend of 19th century music —

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* op.cit., p.40

** In an article, "Formal elements in a new compositional material", pub. in "die Reihe", Vol.1.

the listener's attention is drawn to the sound-material itself, as distinct from its emotional connotations; certainly the Impressionist period did see a movement away from the rich Romantic-emotional expression of the late 19th century, although this is no doubt partly related to the fact that Impressionist music attempts to give a relatively objective musical description of some extra-musical idea.

The increasing differentiation of the musical material noted in the work of the atonalists (cf.Chap.2) and the sheer unfamiliarity of much of the new sound forced the listener to focus his attention on that sound still more closely than ever before. Pousseur points out that although Schönberg moulded his serial work in a classical, thematic, form, he contributed to this trend by expecting the listener "to adapt his ear constantly to the reception of new phenomena and the simultaneous sounding of the most variegated formal elements and tensions".* This trend became even more pronounced in the work of Webern, for here the highly differentiated sound-events entered into completely new formal relationships; for a full appreciation of these, an awareness of each minute detail of the material was essential.

Composers after Webern concerned themselves more and more with the material of their music and with its formal structuring. Much of this concern has been with contradictions within the material, and has involved attempts to unite the composition of the material and its structuring by a single aesthetic concept

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* op.cit., p.31

which would be able to control both; such a concept is serialism. Composers of electronic music create their very material before they can actually structure it into overall forms, and in serial electronic music, serial proportioning governs the composition of both. In much of this music — as in the instrumental music of this serial period — the tendency towards elimination of personal emotional voicing reaches its climax: any emotional satisfaction derived by the listener must arise from the appreciation of the structure and its material for their own sakes.

Thus in electronic music we see the full realization of certain concepts and the culmination of many tendencies discussed throughout this study: the concept of musical space is fully realized in the juxtaposition and superimposition of both the detailed sound-events within the material and of the larger structures which make up the overall form — and in the stereophonic distribution of the sources of sound, the loudspeakers; the precise realisation of highly differentiated elements and exactly measured proportions is made possible by the use of electronic instruments; the new aesthetic is the generation of "emotion" out of the material itself — here the idea that music is a language through which the composer voices his personal emotion is abandoned; finally, and perhaps most important of all, composition with electronic instruments realizes the fundamental idea which underlay the creation of the series by Schönberg: the creation of an order which could control both the material and its composition. We have seen how the composition of tonal music arose from the very material itself, i.e., we have noted the identity of the material with its composition; at last, in electronic

music, serialism is able to supply a similar basis for identity.

The two main problems of the early period of electronic composition were those posed by the limits of audibility, and by timbre.

Dieter Schnebel talks about "limitless" material, and Eimert refers to "the limitless range of possibilities of the electronically emancipated material."* This conception is somewhat fallacious, for, although electronic instruments are certainly capable of producing any possible sound, in actual practice limitations are imposed by the factor of audibility. (One delightful illustration of the exploitation of this "limitless range of possibilities" occurs in the work of those who have composed with supersonics; the audience listens to silence, although informed that music is being played all around them; quite true, but, unfortunately for the audience, the music has been composed beyond the limits of audibility!)

A sound-event which lasts for less than about $\frac{1}{16}$th of a second is not registered by the ear (as we have seen, several events sounded successively still faster are registered by the ear as pitch — one such event is not registered at all); an event which lasts longer than about 8 seconds is difficult to relate to another in any type of comprehensible relationship because of the memory factor. These are the extreme limits (approximate) of the range of durations available.

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* op.cit., p.5

Giselher Klebe writes of his early experiences with composition in the electronic medium:* "Of particular interest to me were experiments with rhythm. I had assumed that, by electronic means, one would be able to realize complex rhythms, which in their rapidity transcended the technical possibilities of traditional instruments. To my great surprise, I discovered that the limits beyond which the ear could not differentiate in any detail, roughly corresponded to the limits of the traditional instruments."** Where the idea of "limitless possibilities" is realistic, however, is with reference to the absolutely precise realization of complex rhythmic structures now possible; here, undoubtedly, the composer has freed himself from the limitations of the instrumentalist.

Pitch, likewise, is subject to the limits of audibility. The extreme limits of the audible range are between 20 and 30 cycles per second (the "lowest") and between 16,000 and 20,000 c.p.s. (the "highest"). Besides being limited thus by range, the ear cannot differentiate with any exactitude intervals much smaller than $\frac{1}{6}$th of a tone, so to compose with still smaller intervals is in fact a perfectly pointless exercise.

Examination of the duration-series used in Boulez' "Structure 1a" showed us that the listener is easily able to discern that the two events  and  are different and that the first is twice as long as the second; the unit of difference here is the  . When the

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* In an article, "First practical work", pub. in "die Reihe", Vol.1, p.17

** In his article, op.cit.

same unit of difference is used between two long durations (e.g., ♩‿𝅗𝅥. : ♩.) the ear has extreme difficulty (a) in registering any difference at all and (b) in determining that the unit of difference is the same as in the first case. This phenomenon can be noted in the field of pitch as well.

In his discussion of aural perception,* Boulez goes into these problems in some detail, and says: "Let us take a relatively wide interval, such as a twelfth (octave plus fifth); it is certainly true that at first hearing the ear will have considerable difficulty in establishing a precise difference between this exact interval and the same interval altered by the addition of a sixth of a tone. But if we modify a single whole tone interval by a sixth of a tone, the difference is immediately perceptible."**

Thus the ear's ability to discern is a variable factor, operating at its best within a small range, and at a medium level (i.e., its ability again diminishes in the extreme "registers" of both duration and pitch). The process becomes still more complicated if the events occur simultaneously : at least memory is of some help when they occur in succession.

When composing electronically, the ear's limitations must be taken into account; in the field of pitch, Boulez suggests dividing the material into two main contrasted areas of operation, one where a wide compass is used, with the semitone as its unit, the other with a small compass and microtones. For composition with

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* In his article, op.cit.

** op.cit., p.22

durations — and here we should remember Stockhausen's examination of time discussed in the previous chapter —, Boulez again suggests using two main contrasted areas: where the durational units are short, an arithmetical scale of differentiation could apply; where they are long, a logarithmic scale — which maintains a constant proportion of difference (2, 4, 8, 16, etc.) — would be more applicable. These two areas correspond to those in the field of pitch. Obviously, a great deal of further work is needed here; in his article, Boulez goes into little specific detail, but is content to map out the general directions such work will have to take.

In tonal music, the parameter of dynamics was probably the least consciously considered. Throughout the development of serial music, however, we have observed a steadily awakening consciousness of its structuring ability and attempts to integrate it into the serial composition of a work. In electronic music, this parameter really comes into its own, so to speak.

In the first place, electronic instruments enable the composer to maintain the required dynamic levels throughout the course of a work, because each can be measured exactly, in decibels; continuity of movement in this parameter has always been possible — as in the crescendo and diminuendo. Of the greatest significance, however, is the important contribution intensity can now make to the spatial dimensions of a work. This is discussed by Paul Gredinger*: "The impression of space

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* op.cit., p.43ff.

in Electronic music .... is caused by the differentiation of intensities. About fifty values of the logarithmic scale of intensities can be discerned by the ear. From this scale we derived a measure of distance from the source of the sound to the ear receiving it, and so can characterize movement of notes or tone mixtures as 'towards' or 'away from' the point of aural perception." Such an effect will, of course, be enhanced by the stereophonic distribution of the loudspeakers.

The basis of this discussion was the limitations discovered in electronic composition by composers who had at first naïvely haled the new era of freedom; this basis has been widened to include a general discussion of three of the parameters which comprise our perception of sound. The fourth parameter, timbre, has caused the greatest difficulty in its composition. As this is to many listeners the most noticeable difference between electronic and instrumental music, it is worth considering in some detail.

As in the case of dynamics, timbre has come to assume a far greater significance in the structuring of a work than in the 19th century. We have traced its development through the characterization of the interval-object in space, the use of "Klangfarbenmelodie", and the serialization of timbre; parallel to this developing serial concern, there has been an ever-increasing search for new sounds — the piano tone-clusters of Henry Cowell, Alois Hába's work with quarter- and sixth-tones, electronic concert instruments, the exotic ensembles of Messiaen and Boulez, musique concrète, etc.

At the same time we have noted theoretical concern

with the fundamental contradiction between the sound-material of serial music and its composition — a contradiction which could not be resolved as far as timbre was concerned as long as traditional instruments continued to be used, because their timbre derived from combinations of the various partials of the harmonic series.

There is a further contradiction, less fundamental, but still disturbing to the total serialists: a series cannot be applied to dissimilar things; in series of pitches, durations, dynamics, there is a common denominator underlying each series, there is a relationship of similarity between the values of each; no such relationship is discernible between different instrumental timbre (— what common denominator can be discerned between, say, the timbre of the flute and that of the cello? —); thus a series cannot really be applied to instrumental timbre.

The method for obtaining "timbre" with electronic equipment has already been described : the composer can either superimpose sinus tones of various frequencies, making some louder than others, or he can filter "white" noise to give him the same superimposed structure. In theory, this presents no problems; in practice, however, electronic composers soon ran into difficulties. In the first place, instrumental timbre was impossible to reproduce synthetically because of its complex and variable structure; composers who have tried this — like Henk Badings — create sounds which bear a certain resemblance to the instrumental sound required, but which are unmistakably synthetic. Boulez feels that such composers do not actually appreciate the essence of electronic music — its artificiality, and hence never fully realize the potential of the new

synthetic sound in their work with this medium.

Those composers who proportioned the constituent tones of their sounds in relationships other than those of the harmonic series also found unexpected difficulties. Pousseur says*: "We argued that as a harmonic timbre was the resultant of harmonic partials, it followed that a non-harmonic quality would result from the setting together of non-harmonic sinus notes [tones]. We anticipated that these would be well suited to our ideas of form." Unfortunately, it was not quite as simple, as Pousseur realized when composing his "Seismograms", in which he composed his timbre by superimposing sinus tones. He soon found that "the small number of partials, the fact that generally they began and finished sounding simultaneously in time, and the constancy of the relationship which existed between their relative dynamics" did not produce timbre at all, but something quite unexpected: "Where the loudest of the constituent partials did not simply swallow up the rest and in cases where, despite its brevity, the process remained aurally perceptible, one tended to hear 'chords' in which the components were related in a fairly complex manner but still remained as isolated, fixed pitches. At the same [time] they had a soft transparent timbre which characterizes sinus [tone] production." Predictably, it was Stockhausen who achieved some sort of breakthrough in this direction, in his "Studie II"(1954).

In this work, Stockhausen superimposes sinus tones in such a way that they cannot be perceived individually.

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* op.cit., p.33

This had only been achieved once before, in Paul Gredinger's "Formanten", where the sinus tones were arranged according to harmonic proportions. In "Studie II" Stockhausen does not utilize such proportions; "the note [tone] mixtures are arranged by the equal distribution and equal loudness level of their components in such a way that they resemble a 'coloured noise', like that derived from the filtering of [white] noise from the tape";* from this it would seem that the component tones of these "timbres" — these tone mixtures — are separated by a constant interval.

The listener can gain only a "statistical" impression of the pitch of such mixtures; there is a clearly discernible effect of pitch direction, but this is achieved through movement from one pitch area to another.

In this work, too, the listener is given the impression that the sound is moving towards and away from him; this is achieved partly by rapid dynamic variation, including crescendos and diminuendos (cf. above), and partly by the varying density of these tone mixtures. Here the time-space dimensions become a sounded reality, i.e., the listener is made sharply aware of these dimensions through the medium of sound.

As Stockhausen is the most prolific of the electronic composers, and has, moreover, done a great deal of pioneering work in this field, some of his electronic compositions will be examined briefly.

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* Pousseur : op.cit., p.34

One of the classics of serial electronic music is his "Gesang der Jünglinge", composed in 1955-1956. This work is remarkable for the fact that Stockhausen incorporates a boy's voice into the otherwise synthetic sound-world generated by electronic instruments.

The text is based on the Biblical tale of the three youths in the fiery furnace; the vowels, consonants, syllables, etc.(the "phones") of the text are serially structured as is all the other sound material. The phones are included in the series of electronic timbres, so that where the text does not supply degrees of relationship which are necessary for the composition, they are supplied by electronically-generated sound. The phones are also subjected to permutation, in which case at least one of the series used includes the phones in their original order, i.e., as they appear in the text. Stockhausen gives the following examples* of phone permutation: "telbju, lebtuj, jubelt, blujet, etc"; only the third one makes any linguistic sense, though all are equally valid musically. In some cases the words are completely intelligible, at others the component phones emerge as musical sounds only, divorced from any linguistic intelligibility. Between these two extremes there are varying degrees of comprehensibility. This is an important factor in the composition of the work. As Stockhausen puts it: "It is possible to have a continuous transition from listening to comprehension. It can be said that the more the sound-aspect dominates (sound connections with a fixed meaning) the more typical of speech it is; and speech can approach music, music can approach speech up to the point of dissolution

* In an article discussing this work, "Actualia", pub. in "die Reihe", Vol.1.

of the boundaries between sound and meaning. If a listener does not understand the German words, he can still appreciate."*

The phones and their permutations are recorded directly onto tape by the boy soloist. "Where possible the pitch level, duration and dynamic intensity desired for the singing of the phones or sequences of them are executed by the boy at the recording. Otherwise, the sung sounds are transposed to their final pitch levels, durations and dynamics during the montage. The timbre is, as far as possible, determined during the recording."**

The problem of serializing timbre, of arranging timbre in a series of successive values which are related to each other by some discernible similarity of nature, has already been discussed (on p.212 of this study); in the "Gesang", Stockhausen goes some way towards a solution of this difficulty: "The basic elements of the electronic sounds must be differentiated in a way similar to the elements of the various speech phones — and vice versa. Only if this is so can we consider real permutation and only then can a continuum of timbre be perceived."*** Once such a continuum is perceived, of course, timbre can be serialized as can pitch, duration and intensity.

The "Gesang der Jünglinge" was the first serial work in which the spatial distribution of the sources

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* Quoted in the programme notes to a concert of his music performed in London on November 25th,1968; the notes were compiled by Brian Dennis.

** "Actualia", op.cit., p.46

*** op.cit., p.46

of sound was considered as a structural factor in the composition of a work. Here we see the final stage in the development of the concept of musical space. From its origins in the four forms of the 12-note series, it developed to structure the sound-material of Webern's music into overall "serial forms". In the music of the total serialists it is not only the basis for the structuring of the details within the material, but also underlies the overall formal conception where the larger structures of a work are juxtaposed in complementary and contrasting relationships to one another. Finally, it is extended to include the very sources of sound in the presentation of a work.

Stockhausen outlines the basis for his work in this direction, with reference to the "Gesang":* "The polyphonic idea in our present work demands a corresponding spatial projection. Sextuple stereophonic sound is used. There are six loudspeakers or groups of loudspeakers (according to the dimensions of the auditorium). They are placed around and above the listeners; in this way the listeners are, as it were, enclosed within the sound polyphony of the composition .... By regulating the positions of the sources of sound it will be possible for the first time to appreciate aesthetically the universal realization of our integral serial technique."

"Mikrophonie I" was composed in 1964 and was the second of his works to combine the electronic and instrumental media in a mutually dependent relationship of structured unity. It is written for tamtam, 2 microphones, 2 filters and potentiometers. One of

* op.cit., p.51

the features noted in the "Gesang" was its concern with the transition between the comprehensible and the incomprehensible; this same concern dominates the "Mikrophonie I". Stockhausen has this to say about it: "The known sound-world of the tamtam (sounds that we can identify) and unknown sounds that are the product of the transformation, the metamorphosis achieved by using electronic media, this opposition between the known and the unknown and the transitions from known to unknown sounds and back again, is the main idea of the composition."* This idea of transition from "known to unknown sounds" is interesting, as it relates to Stockhausen's concern with a continuum of timbre noted above.

His "Kontakte" for electronic sounds, piano and percussion, written in 1959-1960, was the first in his series of works combining both media, electronic and instrumental. Pousseur notes that here the percussion appearances act as points of anchorage out of which the synthetic sounds seem to grow and grow to become the larger structures of the work.

In "Mixtur" for orchestra, sine-wave generators and ring modulators (1964) the general trends noted in the works discussed above are combined in a single work. The method of its presentation to live audiences is discussed by Stockhausen:** "In 'Mixtur' the sounds of a woodwind ensemble, a brass ensemble, and two string ensembles — one-pizzicato — (seated in four groups around the audience) are picked up by microphones and put into four ring modulators; the four groups of microphones lead to four mixers, where sound engineers con-

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*In the programme notes, op.cit.

**In the programme notes, op.cit.

trol the balance of the various microphones, and the input levels for the ring modulators. Four players, each using a sine wave oscillator, with continuous frequency control, produce sine waves with which the instrumental sounds are modulated by the ring modulators. The results, reproduced over four separate loudspeakers, are blended with the orchestral sound. From each instrumental sound there arises a mixture-sound. The fifth instrumental group of 'Mixtur' consisting of three percussionists each playing a cymbal and gong, is provided with contact microphones connected to 3 separate loudspeakers. So a composition of differentiated timbres — which I had heretofore been able to achieve only with electronically produced sounds — becomes possible with the use of instruments.

In addition to the various transformations of timbres, it is possible to compose with as subtle differences in pitch as may be desired, beyond the common division of the 8ve into 12 equal steps. A rhythmic transformation of the instrumental sounds occurs whenever these sounds are modulated with sine wave frequencies lower than 16 Hz[9] " — this refers to the threshold between the perception of duration and that of pitch ;* Stockhausen combines the sounds of the orchestra with frequencies which are not actually discernible as pitch, thus creating sounds of new rhythmic impetus.

His "Solo" for any melodic instrument — at the London concert of November,1968 a trombone was used —, 2 tape recorders, filters and potentiometers (1966) adds a feature noted so far only in connection with

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9 Hz - Herz: measure of frequency equalling one cycle per second.

* See Chap.4 of this study, p.158

instrumental music: the soloist is given latitude to combine the sounds in various ways according to his own whim. He records the sounds, then transmits them over the loudspeakers "in the same order, in a different order, in superimposition up to 18 layers, with gaps, with different dynamics and space positions, etc."* The composer gives certain guiding instructions and the player realizes these as he pleases. Here there is a certain similarity of procedure with the "Klavierstück XI".

Finally, it should be noted that not all electronic music is serial. Besides most music for films and the like, there is a fair amount of work for the medium which bears little relation to the type of sound or methods of composition examined in this chapter; two of the foremost composers here are Henk Badings and Edgard Varèse.

Much of Bading's work has a fundamentally tonal bias, with its tonal rhythms and long melodic lines; he also frequently uses electronic instruments to produce timbres which bear some resemblance to instrumental sound, although these are still recognizably "synthetic". Two of his most easily accessible works are the "Capriccio" for solo violin and electronic sound generators, and the ballet music "Evolutions".

Edgard Varèse (who died in 1965) has always been interested in experimenting with new sounds and did a considerable amount of work in the field of timbre long before the era of these ("non-concert") electronic instruments. In his electronic work, he was especially

* In the programme notes, op.cit.

interested in varying the timbre by imperceptible degrees over a wide range and, as William Austin notes,* "he subordinated both harmonic and melodic intervals to rhythm and sonority." It is interesting to note that he preferred to refer to his own music as "organized sound", and was hailed by many as a leader of the avant-garde in the 1950s. One of his most well-known works for the electronic medium is his "Poème electronique".

We have seen how serialism has become a system for proportioning relationships in the new music, how in fact the serial principle has been developed (as opposed to the simple series of elements); we have seen, too, how a certain measure of chance has entered into both the instrumental and the electronic work of the serialists, in the freedom of choice now accorded the performer. The composition of music no longer involves directing a recognizable flow throughout a set of successive events, but is now concerned with the juxtaposition and superimposition of structures which are sounded stereophonically in space. No longer is music a language by which the composer communicates with an audience; the language is the message, so to speak.

And throughout this development, a question has been asked, one which has recently occurred insistently even to the serialists themselves: "Is serialism really necessary?"

In the final chapter of this study we shall discuss why the answer to this question was in the negative, why a system which had led to the most radical sound in the

* In his book, "Music in the 20th century", Chap.20, pub. by W.W.Norton and Co.(N.Y.), 1966.

history of music should finally have been discarded as unnecessary in the composition of that sound.

CHAPTER 6

THE BREAKDOWN OF SERIALISM

Before examining the possible reasons for its breakdown, it might be in order to give a brief summary of serialism and its importance to 20th-century music. Its impact and influence are undeniable; serialism has generated not only a new type of music, but new aesthetic concepts also. And yet, finally, it has been rejected — and not because a "better" system has replaced it. Perhaps this style, like others before it, contained within itself the seeds of its own destruction or perhaps, finally, more fundamental doubts prevailed. At any rate, a summary of its meaning and importance can only be useful here.

The series of twelve notes was originally conceived as a means of organizing pitch in the composition of a work; in so far as the series was composed of the twelve notes of the chromatic scale, it derived fairly directly out of the breakdown of tonality, where a system of functional harmonic and melodic relationships had been increasingly eroded by the introduction of chromatic elements.

Composition with a 12-note series involved consideration of three main aspects which were new and, on the whole, exclusive to the method. In the first place, the series consisted of an ordered succession of 12 equally important pitches which were "related only to one another" and not to a functionally-defined principal pitch; this abandonment of the tonal hierarchy effect-

ively invalidated former "rules" for pitch progression, which had now to derive solely from the law of serial succession. Related to this was a second consideration: in music whose pitch progressions were unfamiliar, the other parameters assumed a far greater importance than before in ensuring comprehension and recognition of the musical figures of a work. Thirdly, and most important of all, the 4-fold presentation of the series and its validity in both the horizontal and the vertical dimensions derived from a fundamentally new concept, that of musical space ..... "In this space, ... there is no absolute down, no right or left, forward or backward"; this proved to be the basic tenet of the new order.

Tonality, however, was not a system for the organization of pitch alone; rhythm and metre were intimately bound to the enunciation of tonal pitch structures, and the system had also given rise to characteristic forms most of which were definable through their thematic structuring and modulation formats. Thus composition with a 12-note series offered only a partial solution to the need for a system of ordering in music. For Schönberg, the problem never became acute as his music was essentially thematic and his compositional methods largely traditional. But the problem was there, nevertheless.

It was in the music of Webern that a first attempt to establish serialism as a mode of compositional thought was made. Webern recognized the full import of Schönberg's concept of musical space, which in Schönberg's music had been associated with the presentation of pitch material only. From this concept, Webern derived serial forms and structured the various parameters of his music to enunciate these; the spatial dimension was expressed

through the relationships between the individual sound-events.

For the first time since the abandonment of the tonal system, there emerged a concept of music on which the structuring of all the elements of music could be based. As we have seen, this concept had arisen in conjunction with the method of pitch presentation; now the two, concept and method, were united in a single musical system, somewhat like the integration of the tension-relaxation principle with tonal structuring to which it was fundamental.

Serial composers after Webern extended the idea of the serialization of pitch to the other parameters. This period was one of great experimentation arising largely from a concern with the theoretical problems of such serialization. By the end of the 1950s, serialism had become a system for the proportioning of relationships within the material itself and between the larger structures which made up the overall form of a work.

At the same time, two tendencies which had been apparent since the turn of the century reached their culmination. Much atonal — and, later, serial music — has been associated with a loss of the melodic element, in part due to its characteristically fragmentary, discontinuous texture and the high degree of differentiation between its events. In Schönberg's music, the melodic theme still dominated, but Webern's concern with the highly-defined interval-object tended to preclude the use of melody — at any rate, in the traditional sense. It is Webern's influence that is strongest in the music of the later serialists, and their work is generally

characterized by the absence of this element.

The other tendency has involved a new concept of expressivity. Throughout its history, tonal music had struck a balance between the emotion engendered, on the one hand, by the musical content of a work, and, on the other, by the actual structure of the music, i.e., by what the composer had to express, and by how he expressed it. But gradually serial music has concerned itself more and more with its formal structuring, and less and less with its emotional content.

Billy Jim Layton expresses this most succinctly (though with a certain amount of bias): " ..... Composers turned their attention exclusively toward the language, toward the creation of beautiful forms in and for themselves. Taking as a point of departure the later works of Webern, who had begun this process, an audacious and far-reaching constructivism emerged, an ideal of pure design which gave composers in their attitudes and working habits more the aspect of architects and engineers than that of the romantic poets of an earlier day. This aspect was even more striking when composers began to concern themselves with the scientific thought and technological products of the twentieth century, with an enthusiastic and overhasty scramble [sic] to use, for instance, statistical methods and electronic media. Charged with 'anti-humanism', composers rejoined that they were creating a music for the age of science."*

And what are the "beautiful forms" of serial music

*In an article, "The new liberalism", pub. in "Perspectives of New Music", Vol. 3, no. 2, 1965, p.138.

today? The concept of musical space, fundamental to serialism, has given rise to a completely new ideal of form, where contrasted and complementary structures are juxtaposed and superimposed in time and space. As Edward Cone puts it,* the new criteria for form are "symmetries, parallelisms, similarities and contrasts."

This type of music accords with a fundamentally new vision of the art and demands a quite different sort of listening and appreciation; here all familiar notions about music have to be re-examined. Tonal music had as its basis the idea of a forward, progressive movement in time, achieved in part through the use of sound progressions which were considered as engendering varying degrees of tension and relaxation, and in part through the development of musical ideas which were usually stated at the outset of a work. In serial music, based on the axiom: "There is no absolute down, no right or left, forward or backward", the idea of progressive development finds no place.

There is no doubt that serialism answered certain needs of the first half of this century: firstly, it gave to music a direction and discipline in the early years after the breakdown of tonality; it subsequently developed into a complete musical system in its integration of aesthetic concept and method — from this point of view, it can be considered as an adequate replacement for tonality; finally, it has engendered a great deal of exciting new thought about the very nature of music and in its preoccupation with structure for its own sake it accords closely with 20th century attitudes prevalent in

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* In an article, "Beyond Analysis", pub. in "Perspectives of New Music", Vol. 6, no. 1, 1967.

the other arts. And yet in the final analysis, serialism has proved wanting. Why?

It would seem that for a collection of sounds to be appreciated as music, the first prerequisite is that those sounds must be ordered in patterns which are clearly discernible by the ear. Perhaps one could go further, and say that for any art-work to be appreciated as such, it must be presented in some type of intelligible form. What the actual structuring is, is not of essential importance — this will change with each society and each age.

For serialism to operate as a structuring principle, then, it should be discernible as such. Schönberg's use of serialism was confined to his pitch material, which he then structured along traditional lines with his use of main and subsidiary themes, accompanimental figures, etc.; his forms, rhythmic figures and even instrumentation also derived from traditional practice. Thus his music is appreciated primarily with reference to traditional structural methods.

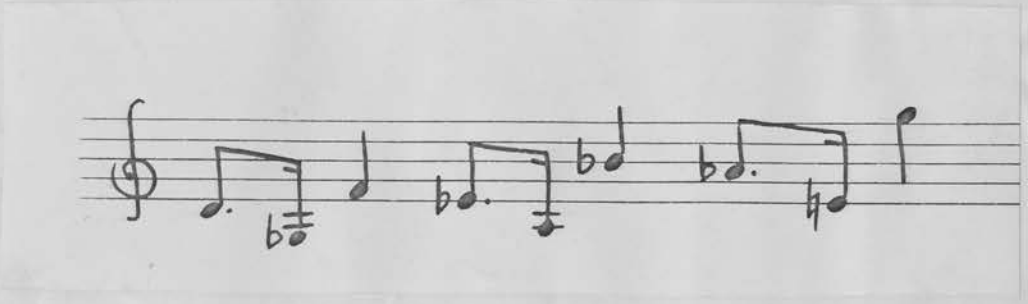
In this connection, it should be remembered that Schönberg considered that the great advantage of his serial method lay in the fact that it could be used in conjunction with any style or compositional method desired ..... "Composition with twelve tones is really only to a small degree a method which 'forbids' or excludes."*

But even at this stage in its history, the ordering power of the series was being undermined. Schönberg's method had many followers whose work has not been noted

* In an article "Rückblick", pub. in "Stimmen", no.16 (H.Knauer, Berlin, 1949), quoted by Rufer, op.cit., p.107.

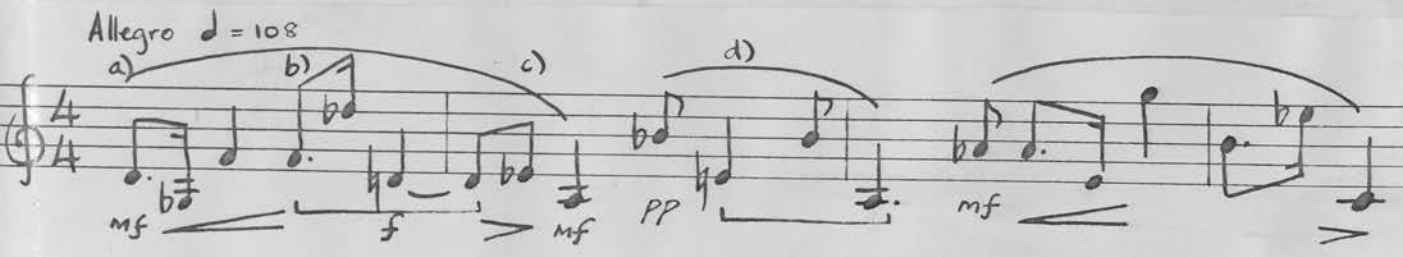
in this study as it offered no major contribution to the development of serialism. Amongst these was Ernst Křenek, who advocated constructing themes out of a combined number of series forms and/or their transpositions. An example will suffice here; in his "Studies in Counterpoint"*, he suggests that the following thematic outline, deriving from the O form of the series,:

Ex.61:



can be extended by interpolating notes of the I form of the series, thus:-

Ex.62:



He says: "The groups indicated by ⌊⌋ are taken from the I-form of the series, transposed to begin on F. The

*pub. G. Schirmer Inc. (N.Y., 1940)

tones G^{b}, G, and A^{b}, missing between D and E of this form, would again appear somewhere in the accompaniment. Notice the regularity emerging from the fact that the groups a) and b) are linked together by the common tone F, while the groups c) and d) have the same outer tones (A and B^{b}), differing only in their first tones (E^{b} and E). Combination of Ex.[61] with other forms and transpositions of the series may yield other interesting and useful thematic elements."*

A cursory glance at this extended theme will immediately show that it is not serial — atonal, certainly, but not serial —, for a fundamental violation of the law of serial succession is involved here.

Related to this practice is the device of permutation. In Chapter 2 we noted Schönberg's subdivision of the series into 4-note groups (in op.33a). This idea was extended by some — Eimert, Křenek and Fortner amongst others — to include the practice of changing the relative positions of these groups within the series. If a series — i.e., an ordered succession — of 12 notes is to be appreciated as such, it must be repeated continuously throughout the work; any variation in its note-succession implies the introduction of a new series. Now, although this is perfectly valid musically, the obvious question arising here is, "Why bother to use a series at all?"

It is only really in the music of Webern that serialism comes into its own, so to speak. Webern's music is structured solely according to serial principles and, with no other terms of reference, is to be appreciated as such. We have noted how all the parameters are in-

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* op.cit., p.32ff.

volved in the characterization of the pitch content of his series, and how the interval-objects, thus defined, are structured so as to enunciate forms which themselves arise from basic serial principles. Thus the series is ever present, both in the detail and in the overall structuring of the work: an order is discernible, unfamiliar at first but undeniably there — a serial order.

The extension of serialization to all parameters by composers after Webern did not always effect the increased awareness of the serial structuring desired. One of the classic instances of failure in this respect is Boulez' "Structure 1a". Here the values within the series are permutated according to the succession of elements in his magic squares. Once again, for the use of a series to be meaningful, an ordered succession, which can be recognized as such through its constant repetition, must operate throughout a work; once again one asks, "Why bother to use a series here at all?" when a completely free choice of successive values would achieve the same result as far as the listener is concerned.

The structuring of the pitch material of Pousseur's Quintet can be criticized from the same point of view (cf. p. 144ff). As a method of ordering it is perfectly valid but, again, the use of a series here seems to have no practical significance. It is not necessary to cite further examples from the work of the total serialists in this connection; a great deal of their work suffers from a discrepancy between method and final effect.

It would seem, then, that the essence of serial structuring is twofold: in the first instance, it is bound up with the concept of musical space, which in turn gives rise to what may be termed serial forms;

secondly, for the series — as an ordered succession of musical values — to fulfil its function of imparting a discernible unity to a work, it must be recognizable as such through its continuous repetition. Here again, note Schönberg's comment: "In the first instance [composition with twelve tones] is a method which should ensure logical order and organization; and the result of it ought to be easier comprehensibility."*

In the appreciation of the later serial music, a recognition of the first aspect only — that relating to musical space and serial forms — is important. The various structures are juxtaposed in complementary and contrasting relations to each other in space, often in such a way as to express some type of serial form, as in the arch-like overall form of the Pousseur Quintet.

The details of such structures are usually ordered in some succession of proportional relationships to each other, and are chosen and arranged in such a way as to contribute to the character of the whole — an extension of Webern's characterization of the interval-object in space. The listener is told that these details are serialized but, as a series is only meaningful as a structuring force when it is recognized as such, a single succession of proportioned relationships need hardly be considered a series for all practical purposes. Furthermore, these structures are to be appreciated statistically, i.e., the individual details are not intended to be heard as such, and so the question of whether they are serialized or not is purely academic.

Finally, in those works — such as Stockhausen's

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* In "Rückblick", op.cit., p.107.

11th Piano Piece — where the performer is free to choose the succession of the component structures, only the concept of musical space is operative. Each structure is clearly defined from another, but the overall form resulting from their juxtaposition need not be serial; in fact, the order of their succession is obviously quite random.

The element of chance when applied to the detailed ordering of a work (— as when, for example, the length of time which elapses between the sounding of several widely-spaced note-groups on the piano is dependent upon the individual performer's ability, or as in the case of a work like Ligeti's "Volumina" —) makes the possibility of clearly discerning the serial succession of those details even more unlikely. This is recognized by some contemporary American composers, amongst them Charles Wuorinen, who considers that electronic music is really the ideal medium for highly serialized music, as the serial structuring can be accurately realized. Of course, accurate realization does not necessarily ensure appreciation of the serial structuring at all — for that, the factors discussed above have to be taken into consideration, too.

In the above pages, an attempt has been made to show how the breakdown of serialism may have originated from within the system itself. But certain criticisms have been made since the inception of serialism; these relate more to the nature of music and give rise to the general question: "Does serialism conflict with the basic tenets of our musical culture?" Here a number of postulates about music are offered; although by their very nature these cannot be proved, they are worth con-

sideration, as they may have a certain validity.

One of the most common concerns is with the loss of melody. Perhaps because of its origins in song, music has always seemed inextricably bound up with melody and many harbour a lurking suspicion that music without melody is not music. Although a great deal of serial music is melodic, those composers who have been in the vanguard of serial development — those examined in this study — have tended to consider melody as more and more alien to their idiom; this is noticeable in both the pointillist style and in those works involving juxtaposed structures which are to be appreciated statistically.

One may consider this final abandonment of melody to be the culmination of a tendency which is peculiar to Western European music. In the last 300-odd years, harmony has gradually come to displace melody as the main vehicle for expressivity; here one has only to think of the expressive power of such chords as the "Neapolitan 6th" and the famous "Tristan" chord, or the powerful emotional appeal of the final pages of the Fantasia from Bach's Chromatic Fantasia and Fugue, for example, or the rich enharmonic modulations of Chopin or Schubert; none of these examples employ the melodic element to any significant extent, if at all.

Instrumentation, too, particularly from the 19th century onwards, has come to rival melody in its function of emotional expression. This is by no means to deny the expressive power of melody in Western European music, although one must consider the fact that it is in this musical culture alone that the burden of expressive communication is borne equally by harmony, instru-

mentation and melody; in all other cultures, melody predominates in this aspect.

Thus the serial music of the last twenty years could be seen as the final stage in this development: harmony and instrumentation have finally vanquished the melodic element altogether.

And yet some form of melody still seems essential to the musical art. It is a curious fact that those composers of this school who have retained some element of melody in their music, however fragmentary, tend to appeal to a wider audience; it is probably true to say that Boulez' music is generally preferred to that of Stockhausen (it certainly seems to be more widely performed), and this may be partly because a certain melodic element is still discernible in the work of the former.

The question of serial rhythm should also be considered; here one is possibly impeded by the lack of historical perspective.

In the music of the serial avant-garde, rhythmic groups are organized <u>in relation to each other only</u>; compare this with the organization of rhythm in tonal music, where the rhythmic groups are related to a constant, fundamental metre. Perhaps because this is the music with which we are most familiar, an impression frequently gained when listening to this serial music is that here there is no rhythm. In this connection it should be remembered that a great deal of pre-tonal music lacks this relationship of rhythm to metre as well; here our evaluation of serial rhythm may in fact be hindered by the factor of unfamiliarity.

Furthermore, serial music makes predominant use of the "irrational" durations. This poses many problems

for both the listener and the performer who are mainly familiar with the simpler durations of tonal music, which are based on logarithmic divisions of a unit (𝅝, 𝅗𝅥, ♩, ♪, 𝅘𝅥𝅯, etc.). Serial use of the "irrationals" tends to increase our impression that there is no rhythm, though here again the factor of unfamiliarity may be operative.

And yet there may be a more fundamental reason — other than just unfamiliarity — which leads us to this impression. There is no doubt that rhythm, like melody, seems basic to music; these two come naturally to man, as witnessed by the fact that they are the basic elements in all folk music. Moreover, a constant metre and simple regular divisions of a unit may seem more natural to us as they reflect both man's physiology (heartbeat, breathing, etc.) and his natural environment (the seasons, day and night, lunar movement, and so on); in addition, the ear itself has a logarithmic response.

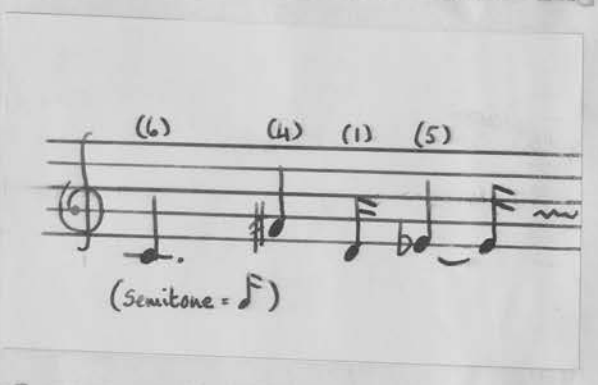
It is curious that one primary criticism of serial rhythm is made with reference to the tonal organization of rhythm, as one innovation in serial music has involved an attempt to unite the composition of pitch with that of rhythm in a single method; in its conception, this attempt might be considered as an improvement on tonal composition, where these two were organized separately.

The serialization of the durations in Boulez' "Structure Ia" might be considered a failure as regards its avowed intention of integrating the organization of pitch with that of rhythm on a single, serial basis; however, it certainly succeeded from another point of view. On p.129 of this study, we noted that Boulez' organization of his durations resulted in the consistent associa-

tion of one specific pitch with one specific duration, and we noted that this related to Webern's practice of associating the pitch content of a sound-object with a durational figure (cf. the development section of op.21, 1st movement).

Further experiments have involved associating an interval with a durational unit (here, again, the influence of Webern is obvious): here the length in time of a unit may be associated with the distance in space of an interval; for example, where the semitone is associated with the semiquaver, the following would result:-

Ex.63*:-



The speed of movement will depend both upon the durational unit used (e.g., if the basic unit is , the overall movement will be slower, if , it will be faster, than the above) and the size of the intervals in the series. Chords can have the duration of all the component intervals added together.

These examples involve an attempt to integrate both pitch and rhythm on a single-dimensional basis — that of space-time. Now, although rhythm — or, more specifically, accent and metre — in tonal music assists in the enunciation of tonal pitch structures, the two are not identified in their composition, as is the case in the

*Given on p.171 of Reginald Smith Brindle's "Serial Composition", op.cit.

experiments discussed above; whether the listener is able to perceive these two as a unitary structure in this music is another matter.

Still more difficult to tackle is the problem of expressivity: it is often considered that serial music is foredoomed because it no longer expresses anything but its own structure.

This criticism is based on a notion of expressivity deriving chiefly from the aesthetic criteria governing 19th-century music, where music was considered as a language and as such had to express something outside itself. In the case of "absolute" music, this "something" was usually emotional in nature, while "programme music" sought to represent an object, a scene, a story, etc. But we have already noted that other expressivity which derives from structure alone. Tonal music struck a balance between these two sources of expressivity until, in the 19th century, the idea of the "romantic poet" expressing his emotion through the medium of sound came to predominate.

Edward Cone suggests that our appreciation of "structure for its own sake" may not be an independent phenomenon after all, but may derive from some associative mechanism whereby a structural gesture is associated with something outside itself and therefore will often elicit an emotional response.

He says*: "Tempo is inevitably measured by unconscious comparisons with rates of human action; register relates itself to our concepts of height, weight, and mass; tone-colour brings with it obvious connotations of all kinds .... Many other areas in which associative

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* In his article, op.cit., p.49.

values are unavoidably implied will come to mind : absolute dynamics, melodic direction, rhythmic and metric patterns .... Whether the associations are in some sense 'natural' or whether based on generations of conditioning, they cannot be escaped by anyone musically trained in the Western tradition."

Here he implies that structure in music must always be associated with something outside itself for its appreciation. While this may sometimes be true, such association is not in fact necessary for the appreciation. A sequence of numbers, e.g., 2, 4, 6, 8, 10, etc., is appreciated simply as such, and thus sounds which expressed a similar regularity of sequence could equally well be appreciated simply for that regularity. One can now extend this to, say, the mirror-structures in Webern's op.21, where the listener's satisfaction derives purely from his recognition of those mirror-structures. We have seen that order is essential to music; surely perception of that order is sufficient to generate a sense of emotional satisfaction.

Such a notion of expressivity is the very antithesis of that governing 19th-century music, and so it is pointless to judge serial music by a criterion which is no longer applicable.

The theory that serialism cannot survive because it is not based on a 'natural' order, i.e., on the harmonic series, is one of the most telling and controversial. There is no doubt that the tonal system achieved a remarkable synthesis of its material and its compositional method, both of which had their basis in the proportional relationships of the harmonic series. It is therefore difficult to imagine any successful system without this

close relationship between a natural order and the musical creations of man. However, here it should be remembered that this is a feature of Western tonal music only and that other musical cultures afford an equal sense of "rightness" to the societies in which they arise.

We have noted that the concept of musical space is fundamental to serial music. Here it should be remembered that such a concept — although not consciously considered as such — has always been operative in the presentation of musical material; numerous examples spring to mind — an entire fugue by Bach may be composed by inverting the figures presented in the subject and counter-subject, and by employing the devices of double and triple counterpoint; in his piano sonatas, Beethoven frequently interchanges the relative positions of theme and accompaniment between the hands; the spatial separation of the "ripieno" and "concertino" instrumental groups emphasizes the contrasted musical presentation of such works, while the polyphonic practices of early church music have much in common with the stereophonic presentation of electronic music.

Furthermore, musical space has always operated as an analytical concept, where a sound is defined by its pitch, duration, timbre and intensity.

Both serial and earlier music utilize this concept, then; but there is a radical difference in their employment thereof. Essentially this difference involves the question of significance.

The essence of tonal music, its structuring and its meaning, did not fundamentally derive from the concept of musical space at all; rather was a recognition of this concept used purely as a compositional structuring device

in a far wider context which was not in any way dependent upon this concept for its existence.

Every aspect of serial music, on the other hand, — its forms, its compositional methods, its meaning —— derives purely from this concept and no other, and thus, to all intents and purposes, the concept can be considered as "new", certainly as regards its usage.

We have noted that tonal music achieved a progressive movement from one point to another by two means; one was by the use of sound progressions which engendered varying degrees of tension and relaxation, the other was by the development of ideas. Both these serve to express a progressive movement in time.

Such an idea would seem to accord with an idea fundamental to Western culture, as well as to man's physical and mental make-up. It can be noted in the two major religions of the culture — Christianity and Judaism — with their emphasis on man's striving to attain a superior spiritual state, while so much of our thinking involves anticipation and development of the present into the future. Closely associated with this idea is the concept of tension and relaxation, of struggle and attainment; this, too, of course, is fundamental to man's physical existence. The two ways in which this idea of progression is expressed in tonal music are noticeably lacking in the new serial music.

The loss of melody, already noted, is closely associated with the loss of the thematic structure. A theme has a clearly recognizable rhythmical structure, instrumentation and/or phrasing, as well as contour — which is usually melodic but not necessarily so (as in, for example, Schönberg's op. 33a). In traditional music, constant reference to the theme(s) throughout the work ensured both

unity and the recognition of progression through the development of that theme. The abandonment of the theme — or Grundgestalt — in serial music consequently means the abandonment of both this means of ensuring unity and the possibility of development along these lines.

A quite different idea underlies the forms of the new serial music: the listener is to appreciate the special qualities which characterize each structure, and the proportional relationships between them, i.e., the characteristic movement arising from their juxtaposition, e.g., sharp contrast, intensification, etc; finally, he is to appreciate their overall arrangement in space and time. In aleatoric music where the succession of the structures is constantly varied, the listener's impression of each individual structure only will remain unaltered with each performance, for his impression of the whole and the relationships between each structure must constantly vary. The analogy frequently offered here is the mobile.

Now, obviously, the idea of a structured development from one point in time to another is completely lacking here. And yet the values and general trends of thinking of any society and any era are reflected in the arts. In a period where traditional values and an accepted order of things are being questioned, where the only reality for many an individual is the present, in a period which has produced the philosophy of Existentialism, it might be argued that this type of music reflects most aptly the general trends of today's thinking. Furthermore, in an age of science and technology, the use of electronic instruments represents a closer association of science and art than has been generally known before.

The last twenty years have seen an increasing interest

in aleatoric music which may be considered as introducing an element of improvisation into this music. We have noted how the element of chance has been introduced and incorporated into serial composition, and how at the same time it has assisted in the breakdown of serial ordering.

Aleatoric methods, however, are not confined to serial music, where they are actually incorporated into the general methods and theories of serial composition. Outside of serial music there is a large body of work conceived using aleatorics; one of the leaders here is the American, John Cage.

In his book, "A year from Monday", Cage remarks: ".... I don't have absolute pitch. I can't keep a tune. In fact, I have no talent for music. The last time I saw her, Aunt Phoebe said, 'You're in the wrong profession'."* The tongue-in-cheek nonchalance of these statements has a great deal in common with Cage's attitude to his "composition". He has abdicated his right to creative composition almost completely: the "musical" events of his work are frequently determined through chance operations, such as tossing coins.

In his "Imaginary Landscape No.4" for 12 radios, first performed in 1951, he brought together 12 radios and "counterpointed" the various stations, allowing a certain amount of guided "interference" from the two players controlling each radio; what was being broadcast from each of the 12 stations was quite immaterial as far as the final effect was concerned, and depended upon the time of day and time of year when the performance took place. Lukas Foss notes that "in a number of Cage's

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* Quoted in a review of his book by Roger Maren, pub. in "Perspectives of New Music", Vol. 6, no. 2, 1968 (p.183).

compositions one may play as much or as little of the music as is convenient, use all instruments or only a few, depending on available performance time and personnel."* One of his most "well-known" works is that which consists of total silence!

Although Cage has only a handful of extremist followers, his works have undoubtedly helped to create an aesthetic climate where some of the latest musical works presented are little more than "happenings".

At the I.S.C.M. festival of 1960, reviewed by Peter Stadlen, one of the more entertaining works presented was by the South-Korean Paik. The composer, "who presented a tape on which he had recorded the most spine-chilling human yells and moans would emphasize the climax of his work by actually knocking over a fully-matured upright-piano placed in the middle of the crowded room, while for minor crises he reserved the smashing of eggs on a wall or the crunching of electric-light bulbs strewn over the parquet floor."**

In a recent Stockhausen work, three people are brought together — a man, a woman and a child —, each representing a particular way of life which bears no apparent relation to those of the other two; each is free to act as he pleases within a certain framework, and the result is offered as a "work". Now this may express man's sense of isolation from his fellow in today's world, though it cannot really be considered as music.

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* In an article, "The changing composer-performer relationship : A Monologue and a Dialogue", pub. in "Perspectives of New Music", Vol.1,no.2, 1963, p.53.

** Peter Stadlen: "The I.S.C.M. Festival at Cologne", pub. in "The Musical Times", No.1410 - Vol.101, August 1960, (p.486.)

Another such musical offering consists of counterpointing the sound of several people walking, running, skipping, etc., on different materials and wearing different types of shoe.

Again, the emphasis here is on the chance element with little interference from the composer; again, this reflects a more general feeling amongst some today that man has lost his ability to control his environment effectively. Such "works" are inspired by a curiously negative attitude which recalls the Dadaistic movement of fifty years ago, when society went through a similar period of social change and readjustment.

This study has been exclusively concerned with the origins and development of serialism. But, although serialism may be considered the most important and influential movement in the "serious" music of the first half-century, it is by no means the only one; indeed, the period has been characterized by a large number of widely diverse idioms and schools. Music today ranges from the "happenings" of John Cage to the neo-classical idiom of the Soviet composers, from the rich, romantic chromaticism of Messiaen to the spare serial style of Stravinsky's more recent works, from the uniquely British modernism of Benjamin Britten to the terrifying austerity of Penderecki's microtonal works.

"Traditional" serialism has still a large following. Charles Wuorinen, discussing music in America, notes*: "Twelve-tone technique is of course the primary influence on young composers ..... pitch serialization is no longer an issue. It is a technique natural to young compo-

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* In an article "The outlook for young composers", pub. in "Perspectives of New Music", Vol.1,no.2, Spring 1963, (p.57)

sers, in which they create with the same freedom and flexibility once enjoyed by the old tonal composers. Dodecaphonic organization reveals wider and wider applicability as its use increases, but young composers regard it for the most part as so familiar that there is today hardly a conscious decision on their part in employing it. Indeed it is the use of techniques that depart from dodecaphonic organization that requires conscious decision from the young composer". Wuorinen also points out, however, that the extension of serialization to all the parameters is far less widely accepted by the young Americans. And as Stravinsky, for instance, has demonstrated in his "Threni", the serialization of pitch can easily be incorporated into the individual and characteristic style of the composer, i.e., it does not dictate any specific style; in its adaptability it functions perfectly as initially conceived by its creator.

Today it is difficult to predict what course music will take in the future. The present wide diversity of idiom may continue, or one style may come to dominate. Undoubtedly, certain aspects of serialism are here to stay, whether as merely applying to pitch organization, or whether as surviving in the concept of musical space and the exciting new forms this has engendered. Another prospect is becoming a serious possibility — jazz.

From its early folk origins in the southern states of America, jazz has developed to the point where it has incorporated a number of aspects from the music of the serial avant-garde, amongst them the concept of musical structures interacting in space and time. One of the early examples of the fusion of jazz with serial music

is Ornett Coleman's improvisation against a background of stringed instruments whose parts were composed using a 12-note series. Besides this particular school, there are jazz composers like Lalo Shifrin who successfully combines the jazz idiom with that of neo-classicism.

Billy Jim Layton considers jazz to be the most likely candidate for the mainstream.* He thinks that the age of serialism is over — compare this with Wuorinen's remarks —, and that there will be little demand for such esoteric music understood by "a tiny handful of highly trained experts." Holding that the general feeling of the Western world is turned again towards humanistic ideals, he maintains that jazz reflects this movement most faithfully and that "a language with a base of jazz ... has a very good chance of being comprehensible to a much larger segment of the world's society". However this may be, it would certainly seem that the importance and influence of jazz can hardly be ignored in the music of today.

The title of this final chapter will now be seen to have been something of an oversimplification. Certainly a great deal of the most extreme developments of serialism have been discarded; nevertheless, these have tended to provoke much thought about the very nature of music and have helped to establish securely the basic principles of this most important movement.

The last half-century has seen a period of tremendous experimentation and development of new and interesting ideas, while the world of electronic music affords

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* op.cit., p.142.

a great potential for future development. Throughout this period, it has been serialism which has exerted the most profound and widespread influence; and there is no doubt that the principles and aesthetic tenets of serialism will have to be seriously considered in connection with any music of the future.

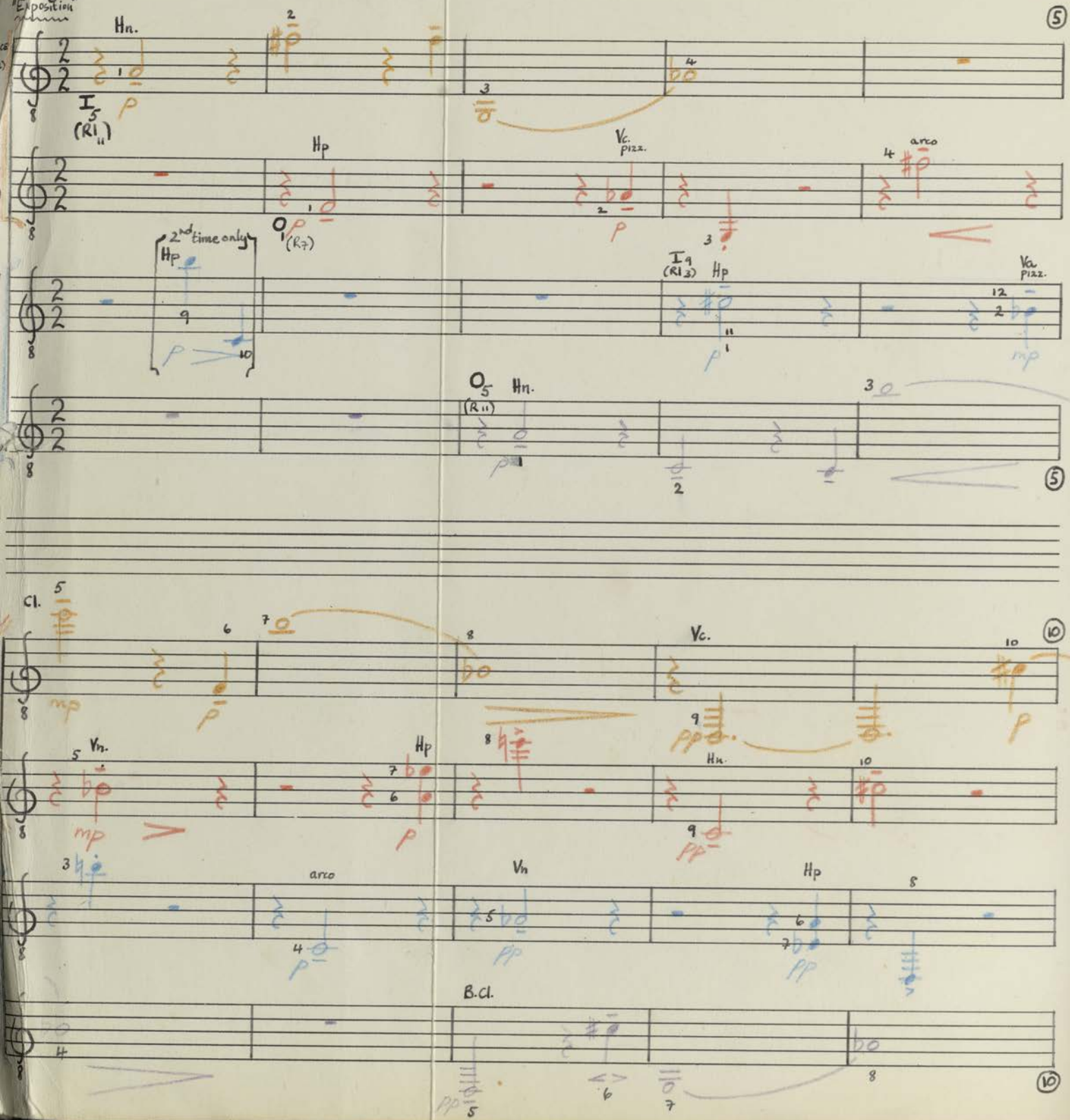
APPENDIX

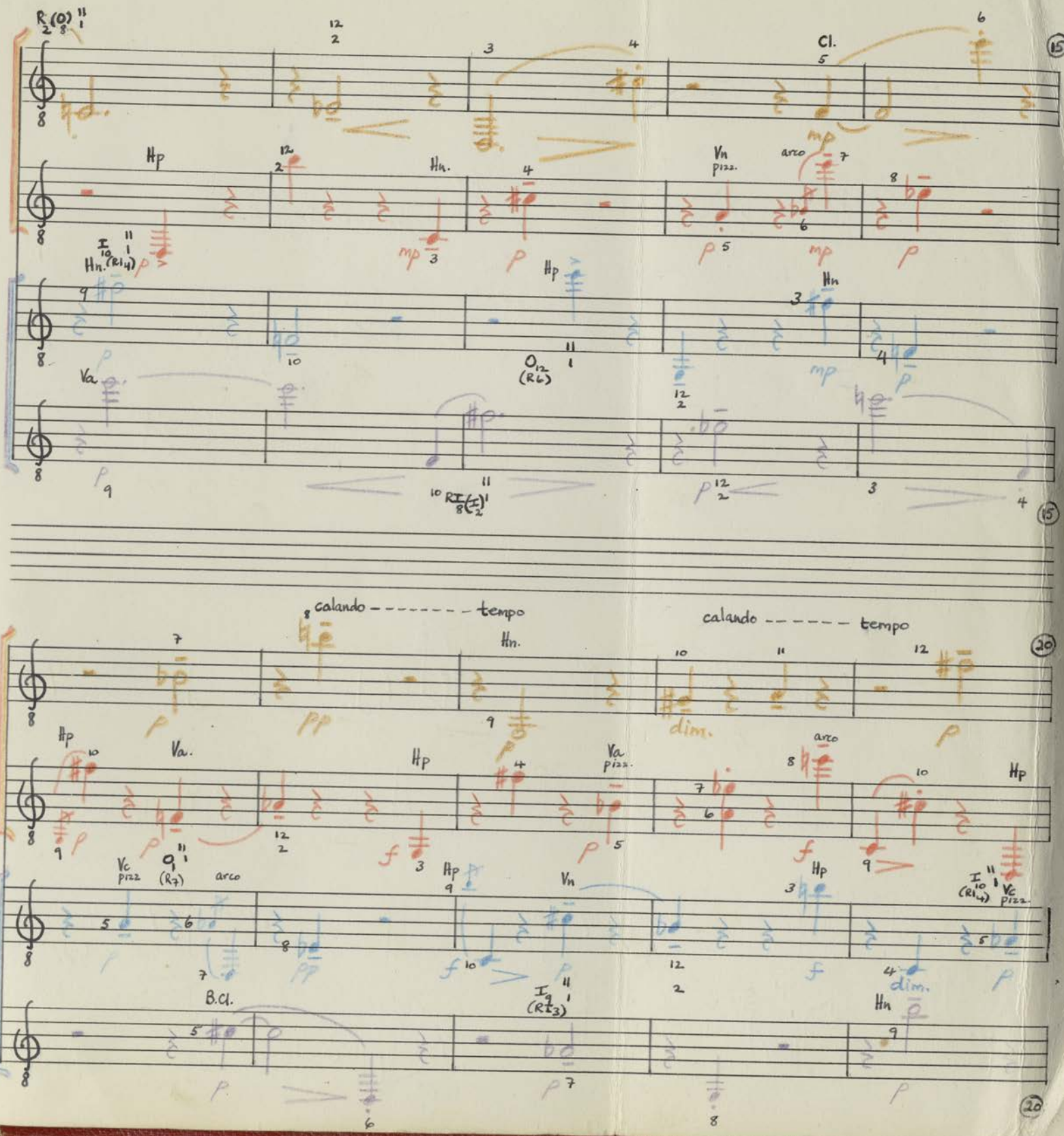
Figure 1:

The canonic structures of Anton Webern's Symphony, op. 21, 1st movement

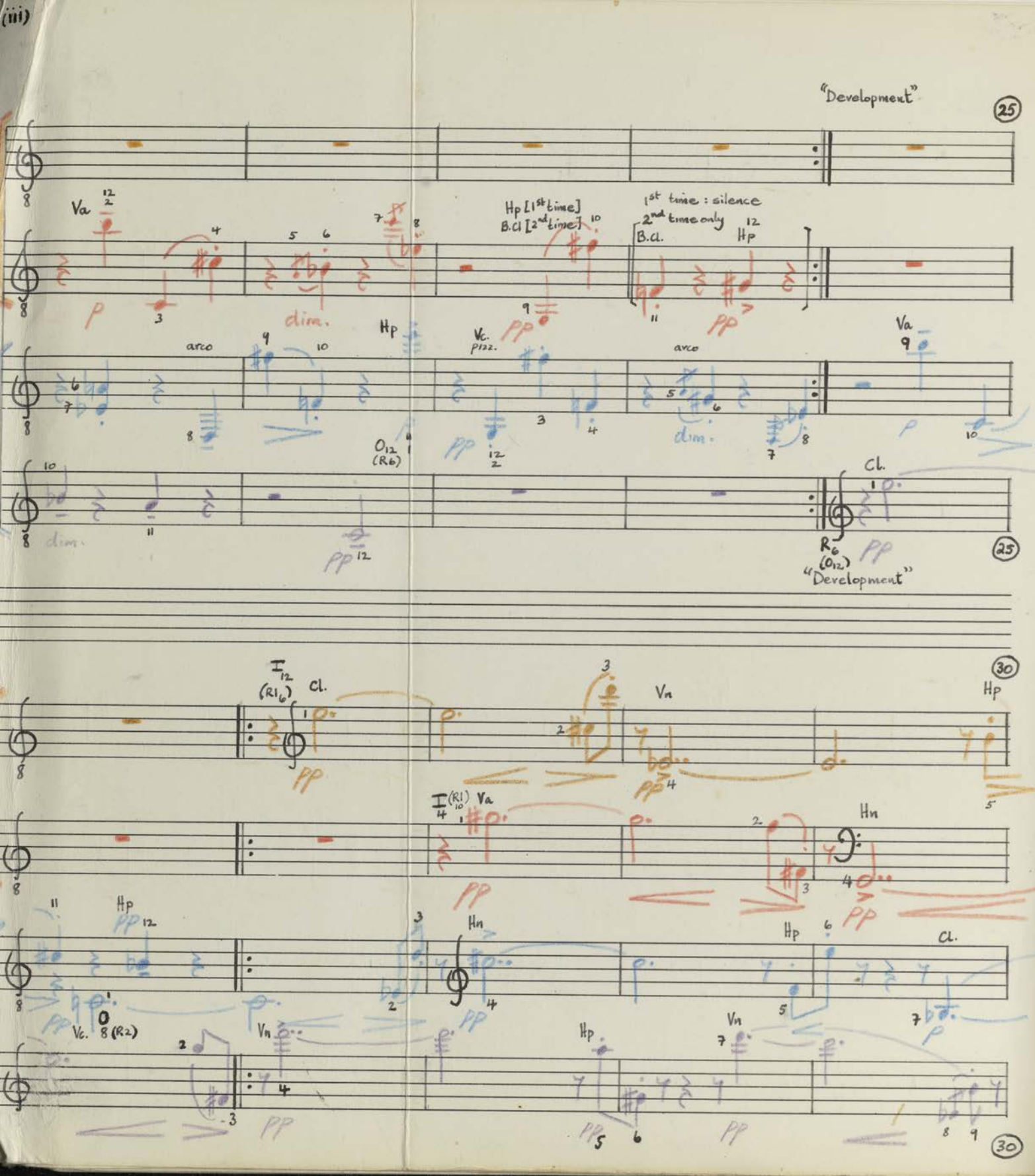
Ruhig schreitend (♩ = ca 50)

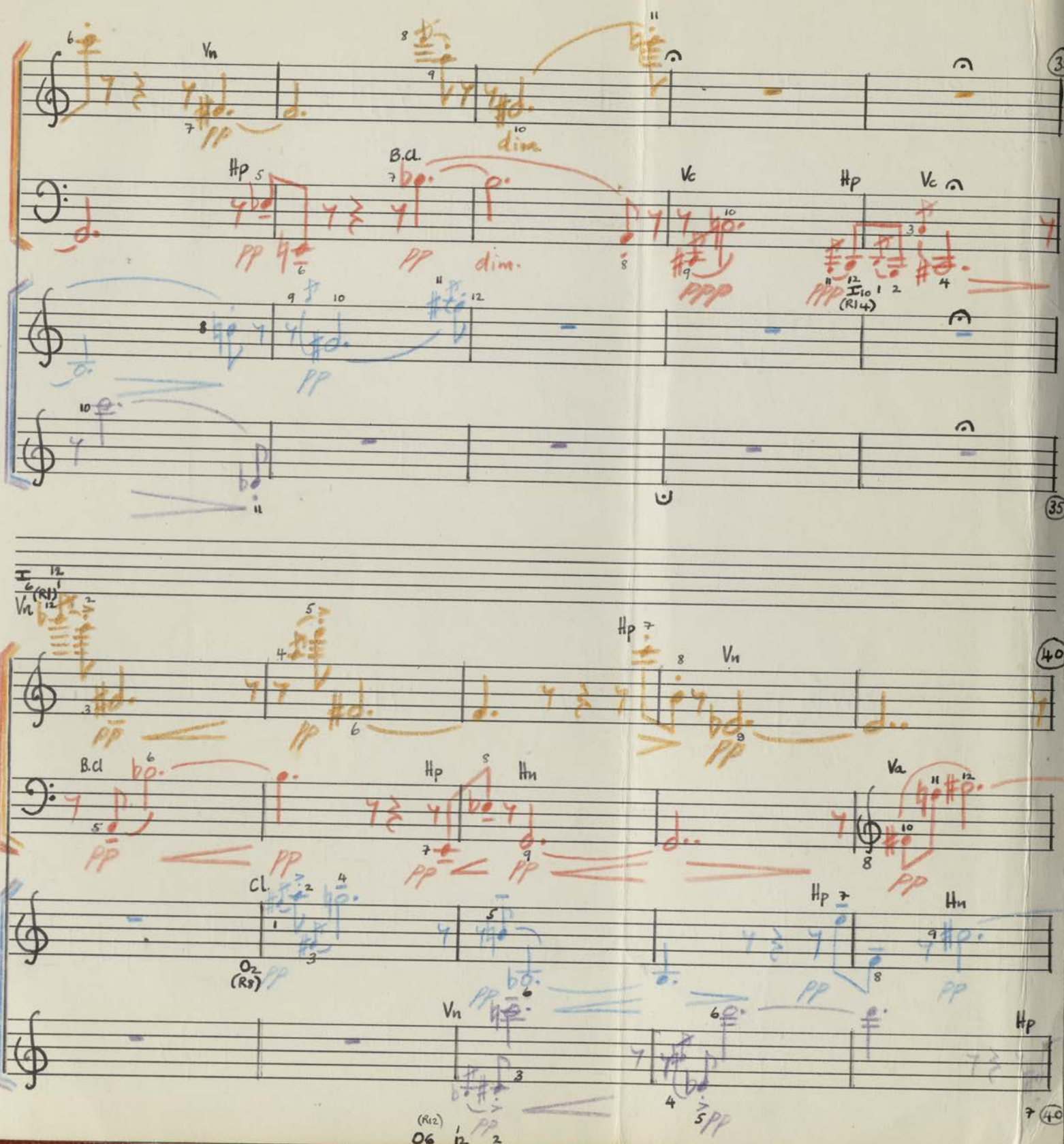
"Exposition"

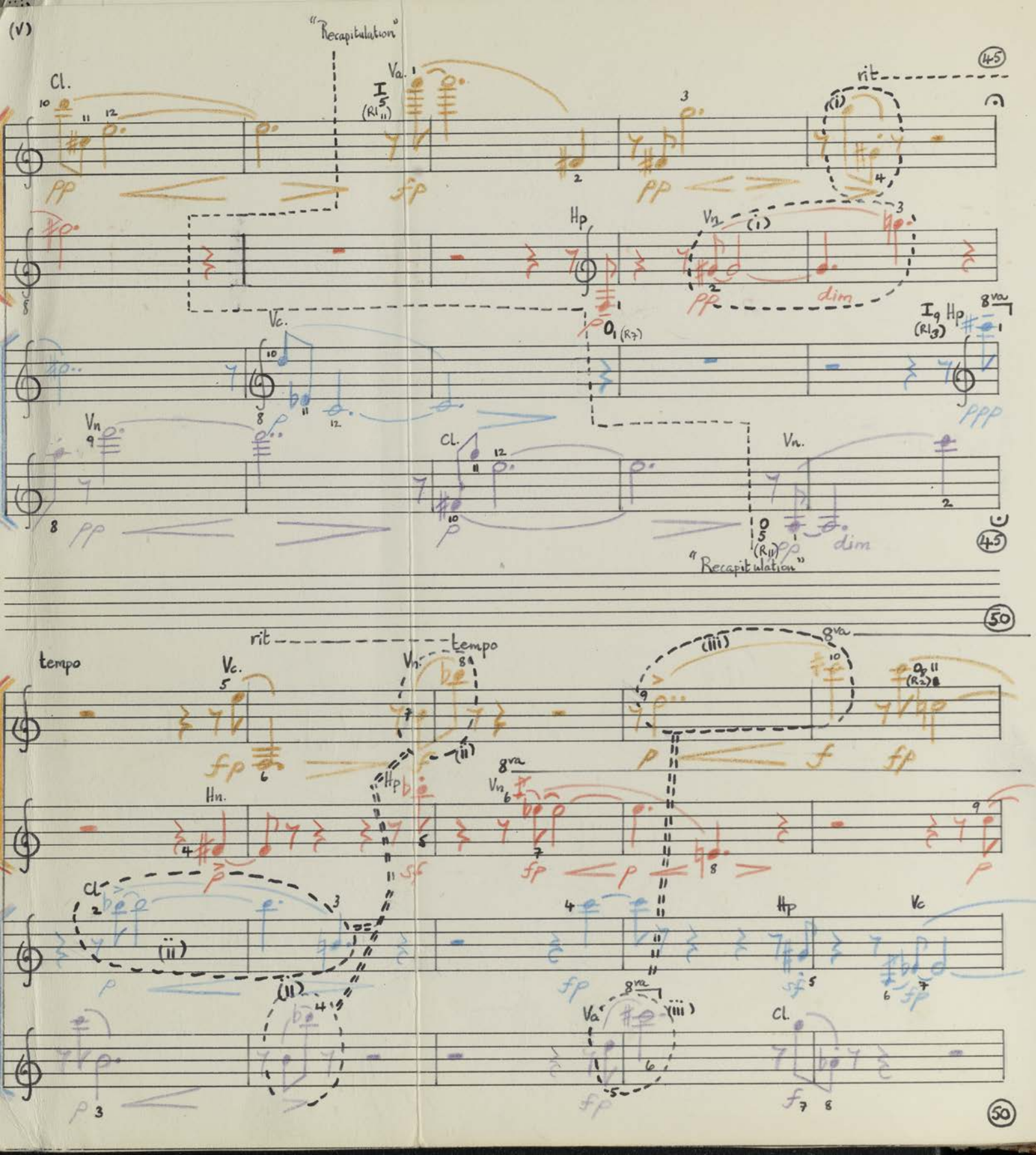


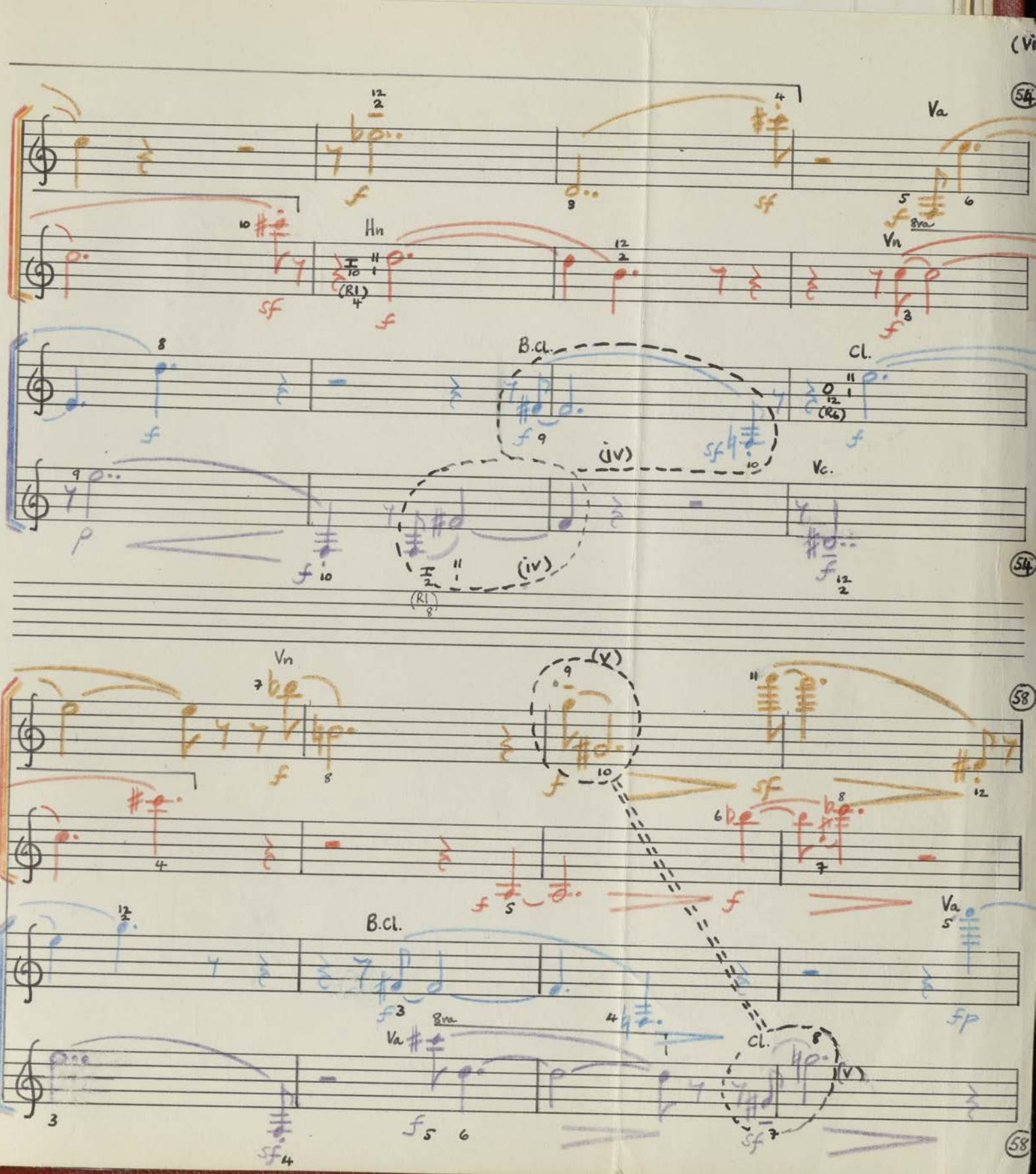

Cl.
Hp
Hn.
Vn
pizz.
arco
Va
calando - - - - - - - tempo
calando - - - - - - tempo
Hp
Va.
Va
pizz.
Vc
pizz.
arco
Vn
B.Cl.
Hn
dim.

(ii)


"Development"
25
Va
Hp [1st time]
B.C [2nd time]
1st time : silence
2nd time only
B.C.
Hp
arco
dim.
Vc.
pizz.
Va
Cl.
R6 (O12)
"Development"
30
Vn
Hp
Hn
Vc.
O 8 (R2)


Vn
B.Cl.
Hp
Vc
dim.
ppp
35
40
Cl.
Va
Hn
(R12)
O6


(V)
"Recapitulation"
45
Cl.
Va.
I 5 (RI 11)
rit
(i)
Hp
Vn.
(i)
dim
Vc.
O 1 (R7)
I 9 (RI 3)
Hp
8va
Vn
Cl.
Vn.
O 5 (RII)
dim
"Recapitulation"
45
50
tempo
rit
tempo
Vc.
Vn.
(iii)
8va
O 11 (R2)
Hn.
Hp
8va
Vn
(ii)
Cl.
(ii)
Hp
Vc
8va
Va
(iii)
Cl.
50


Va
Hn
Vn
B.cl.
Cl.
(IV)
(iv)
Vc.
54
Vn
(V)
B.cl.
Va
Cl.
58

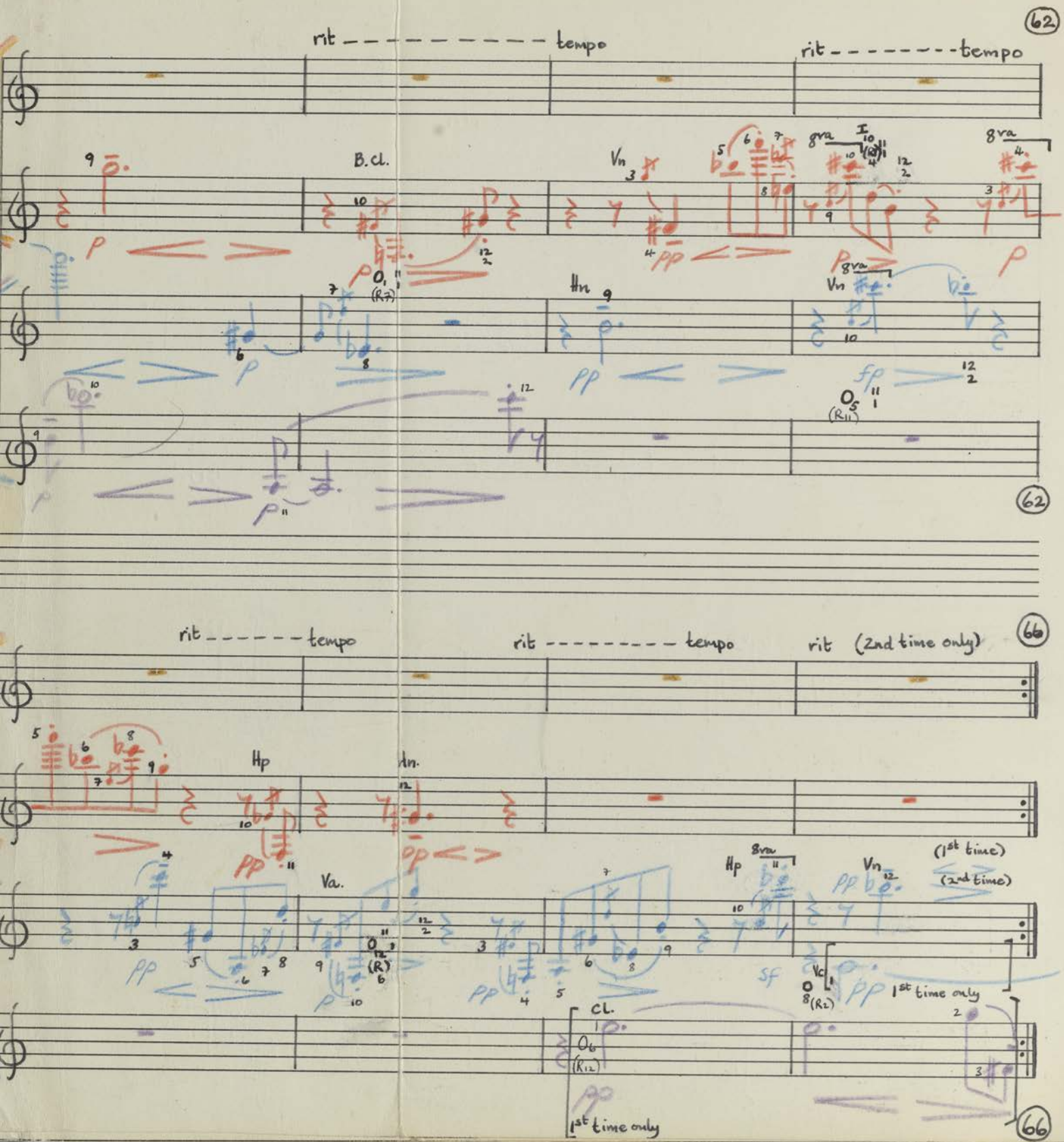

62
rit ---------- tempo
rit --------tempo
B.cl.
Vn
8va
Hn
O1 (R7)
O5 (R11)
62
66
rit ------ tempo
rit --------- tempo
rit (2nd time only)
Hp
Va.
Cl.
O6 (R12)
1st time only
(1st time)
(2nd time)
Vc
O8 (R2)
66

Figure 2:-

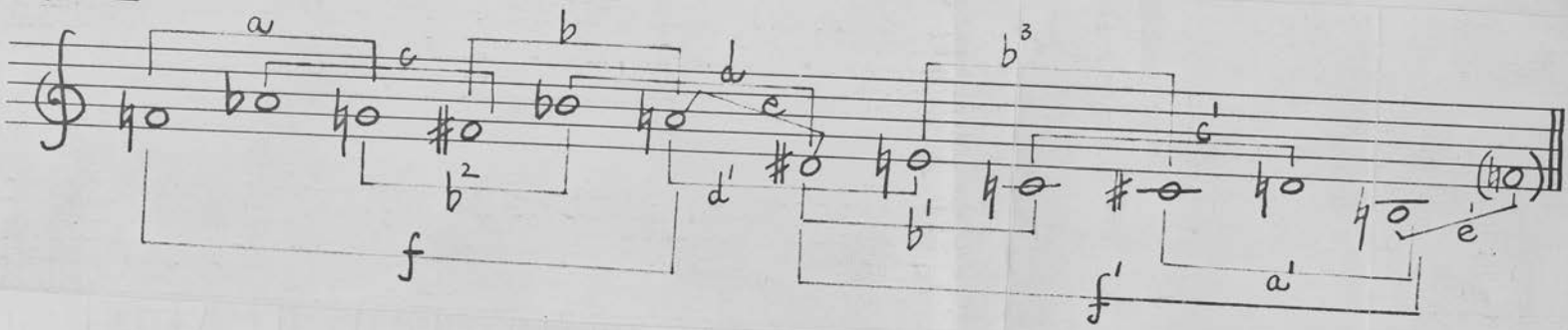


Figure 3(a):-

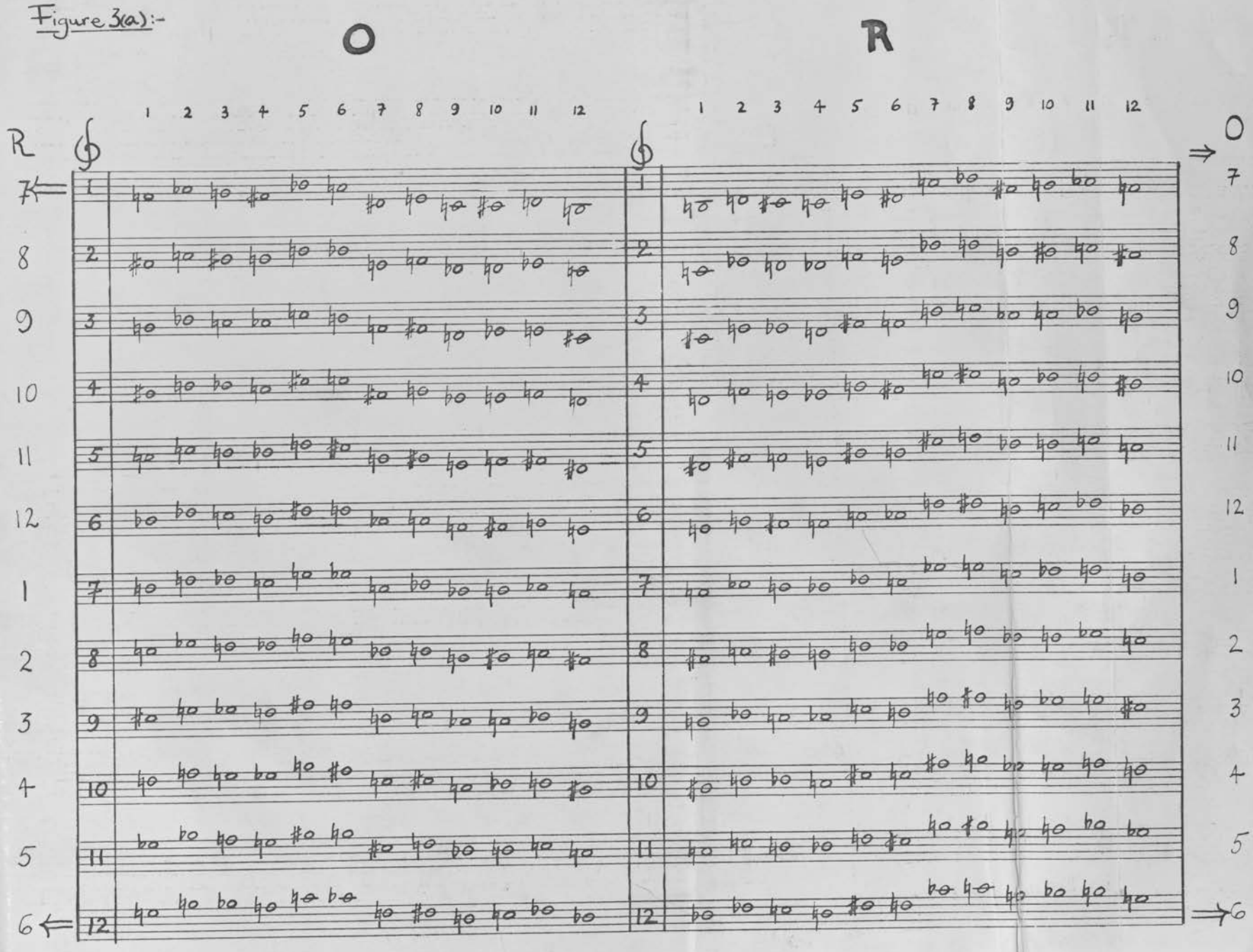


Figure 3(b):-

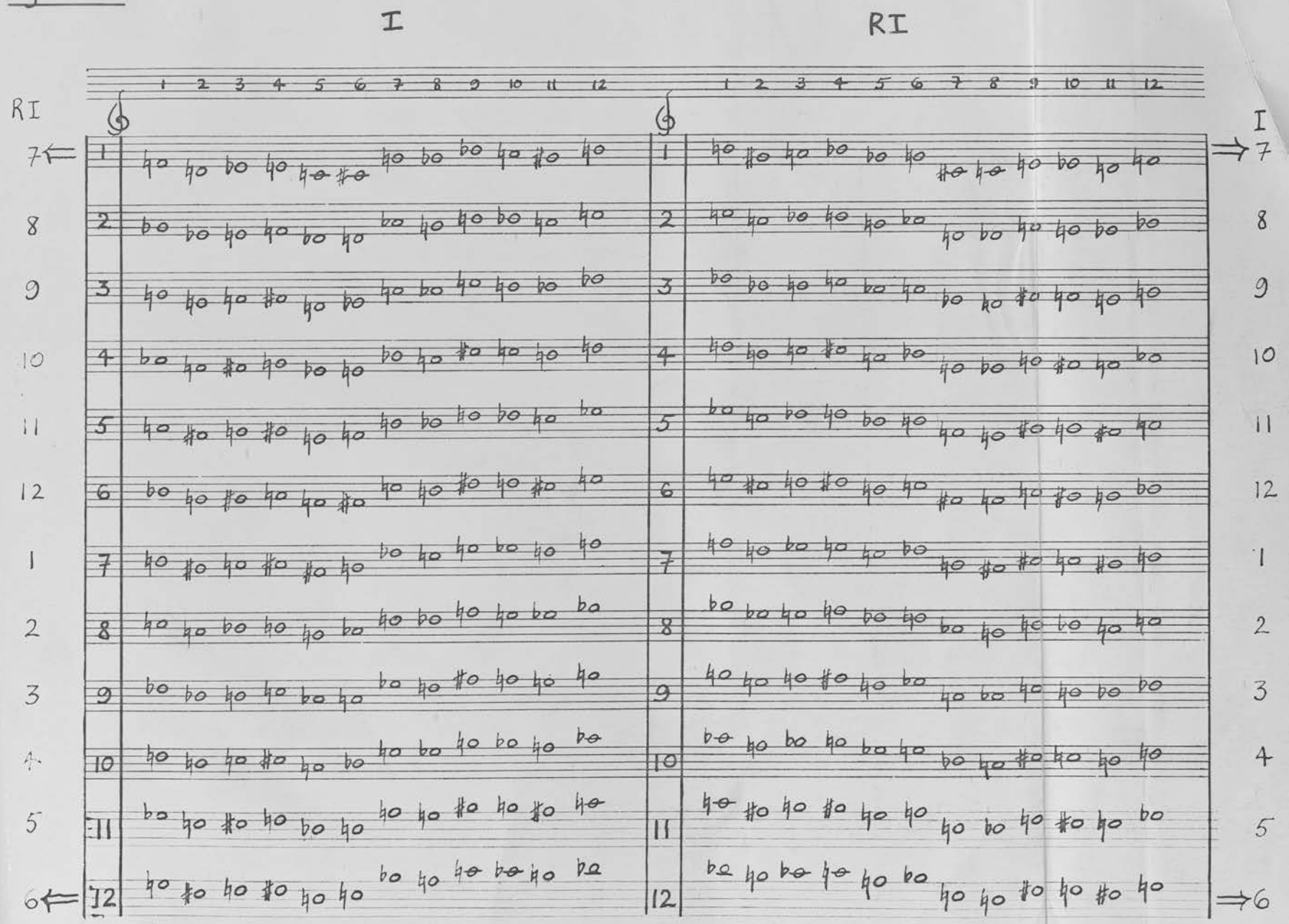


Figure 5:-

Figure 4:-

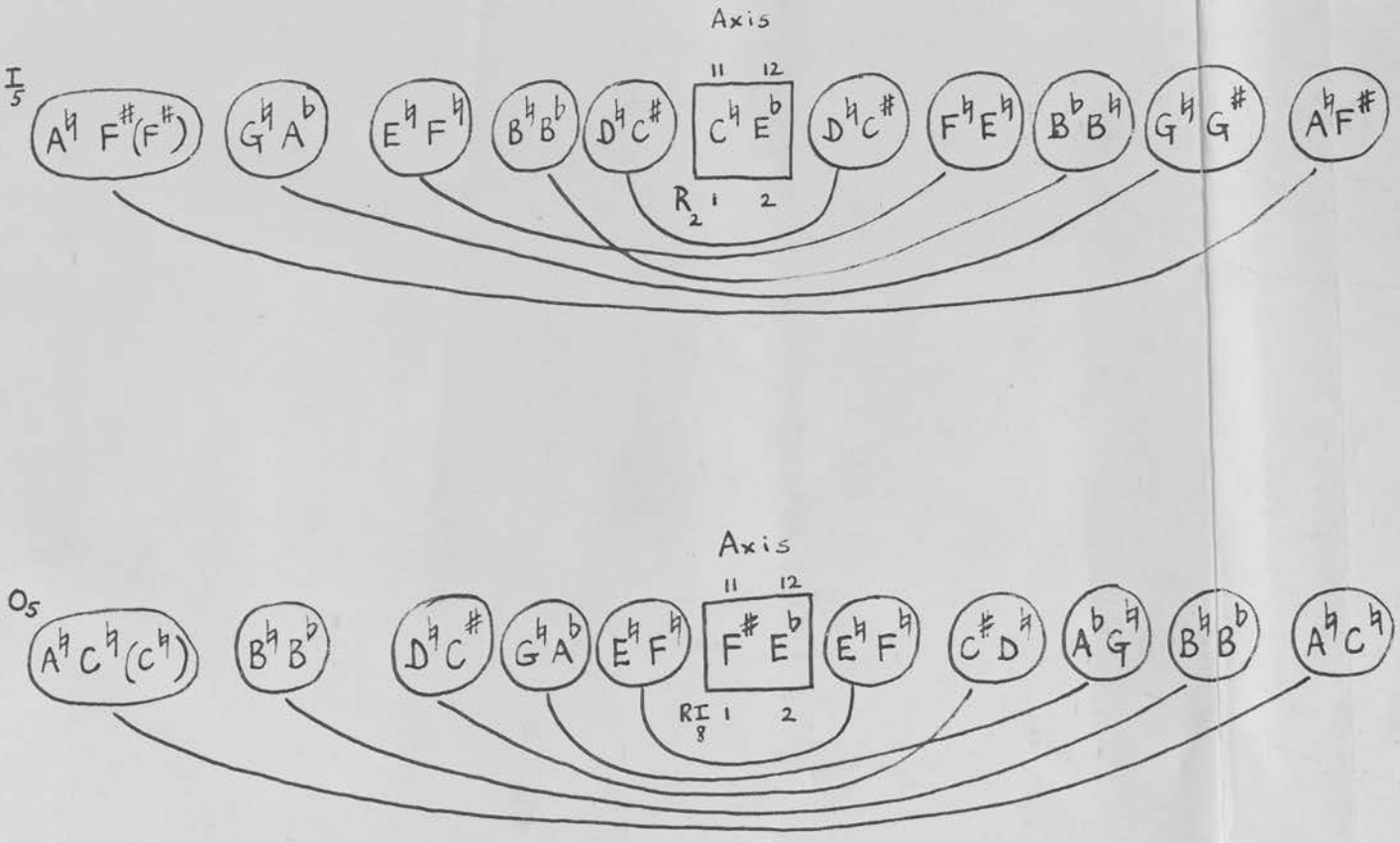
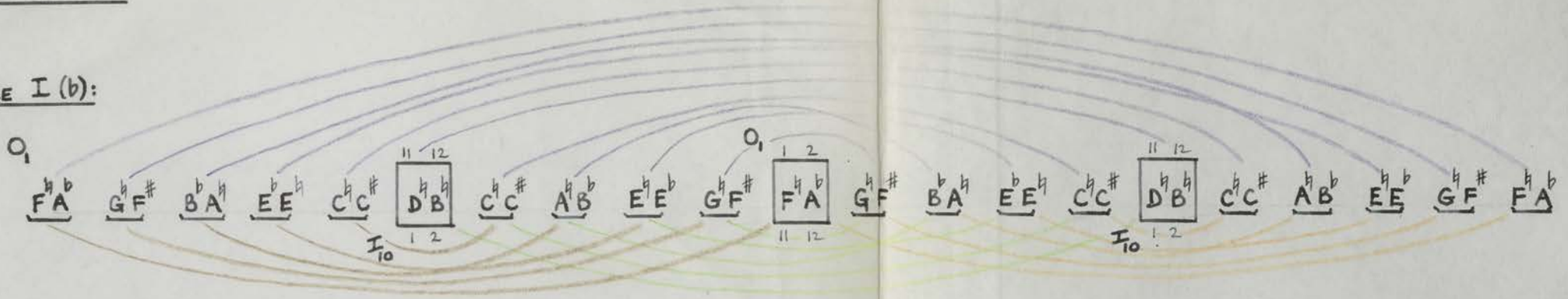


FIGURE 7 (a) :-

FIGURE 6:-

VOICE I (b):



VOICE II (b):

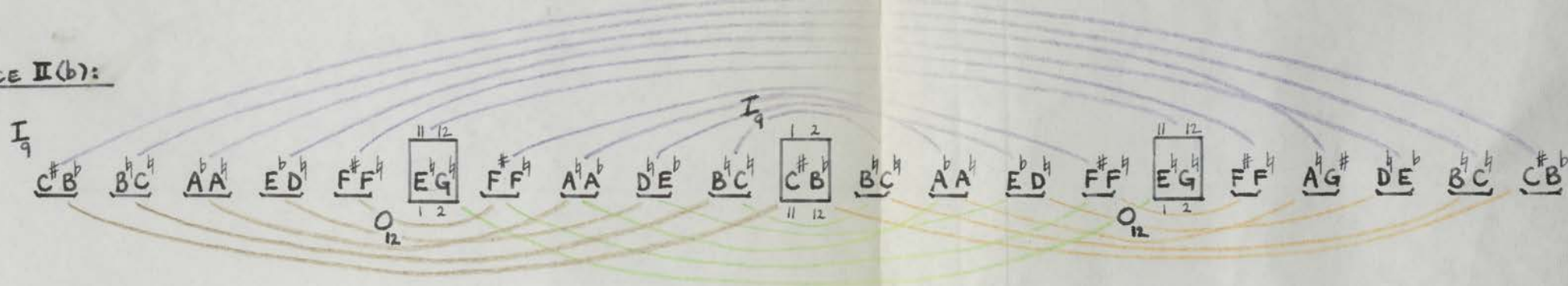
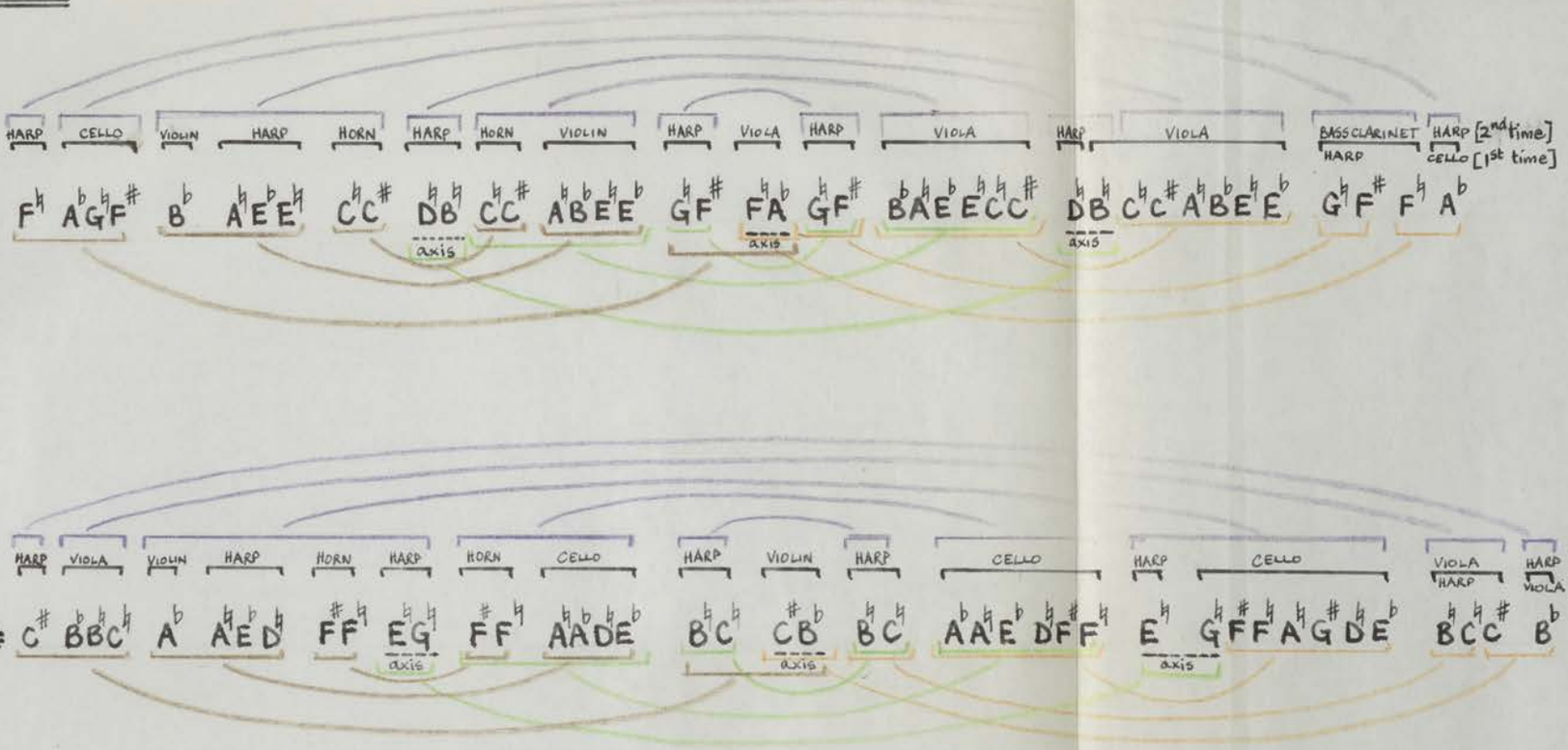


FIGURE 7(a):-



THE INSTRUMENTS GIVEN IN THE SCORE AT FIG. 1 TAKE THE FOLLOWING ABBREVIATIONS: HARP : HP ; VIOLIN : VN

FIGURE 7(b):-

The numbers in Fig. 7(b) refer to the number of notes taken by each instrument

Voice I:

HP	VC	VN	HP	Axis D♭ B♮ HN	HP	HN	VN	HP	Axis F♮ A♭ VLA	HP	VLA	Axis D♭ B♮ HP	VLA	VLA
1	3	1	3	2	2	2	4	2	2	2	6	1	7	

HP	VC
3	1
{B.CL. 3	HP. 1} at repeat

Voice II:

HP	VLA	VN	HP	Axis E♮ G♮ HN	HP	HN	VC	HP	Axis C♯ B♭ VN	HP	VC	Axis E♮ G♮ HP	VC
1	3	1	3	2	2	2	4	2	2	2	6	1	7	

HP	VLA
3	1
{VLA 3	HP 1} at repeat

FIGURE 8:

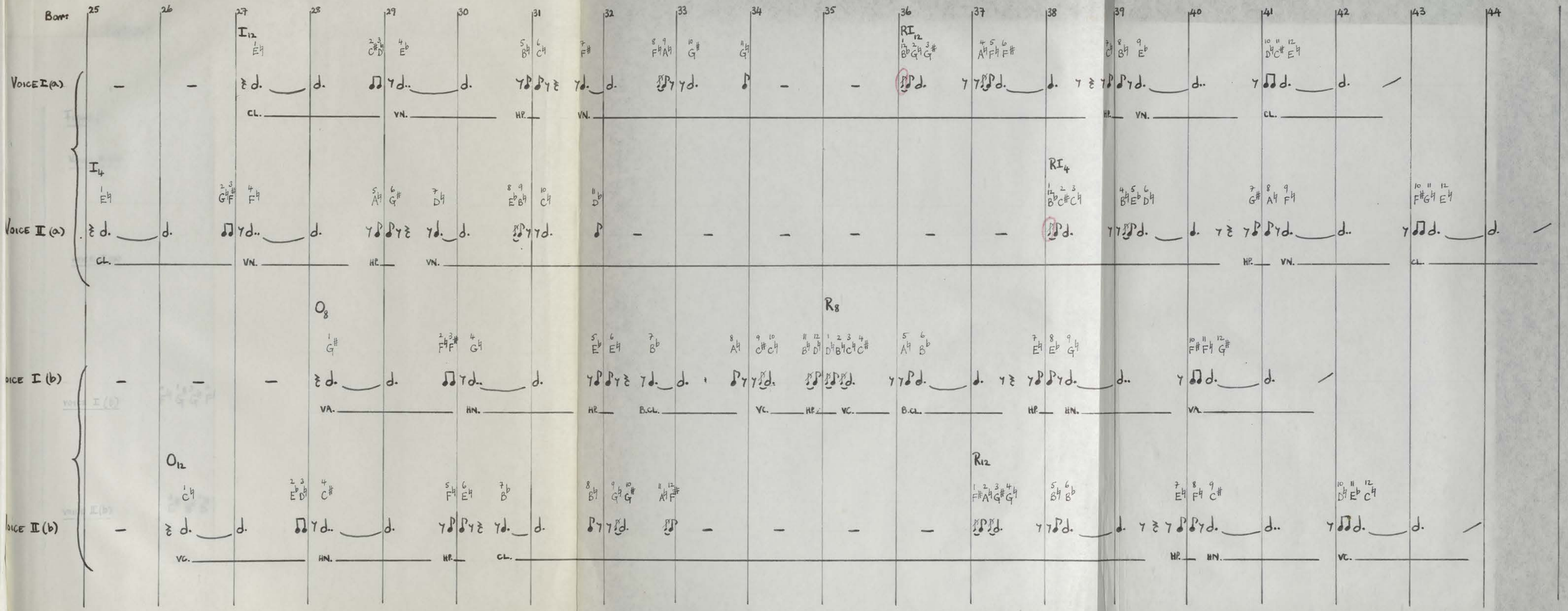
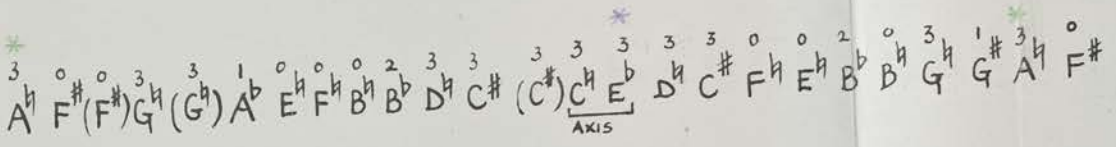
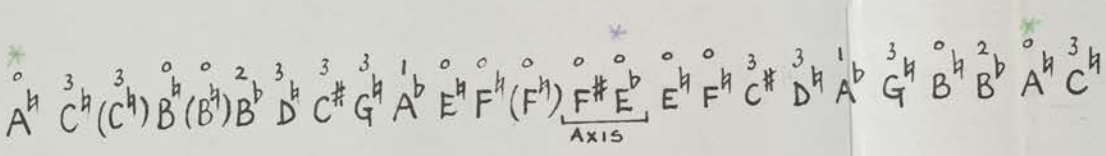

Bars: 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44
Voice I (a)
Voice II (a)
Voice I (b)
Voice II (b)
I12
RI12
I4
RI4
O8
R8
O12
R12
CL.
VN.
HP.
VA.
HN.
B.CL.
VC.

Figure 9:-

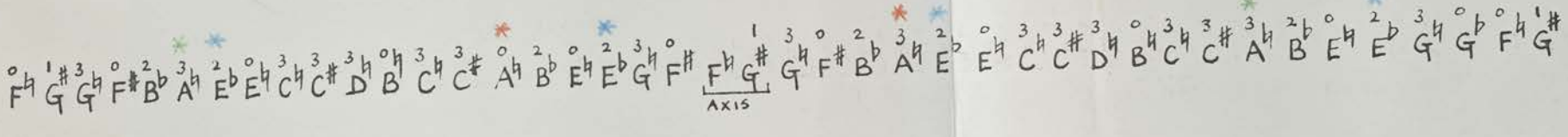
VOICE I (a)



VOICE II (a)



VOICE I (b)



VOICE II (b)

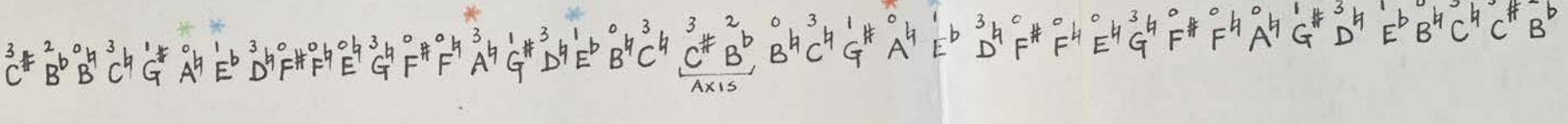


Figure 10 :-

VOICE I (a) :

EXPOSITION :	HN. 4 (+ 1)*	CL. 4	VC. 6	CL. 4	HN. 4
RECAPITULATION :	VA. 4 (+ 2)	VC. 2	VN. 8 (+1)	VA. 2	VN. 6

VOICE II (a) :

EXPOSITION :	HN. 4 (+1)	B.CL. 4	VLA. 6	B.CL. 4	HN. 4
RECAPITULATION :	VN. 4 (+2)	VA. 2	CL. 5(+1)	VC. 3	VA. 2	CL. 6

VOICE I (b):

EXPOSITION :	HP. 1	VC. 3	VN. 1	HP. 3	HN. 2	HP. 2	HN. 2	VN. 4	HP. 2	VLA. 2	HP. 2	VLA. 6	HP. 1	VLA. 7	HP. 3	VC. 1

RECAPITULATION :	HP. 1	VN. 2	HN. 1	HP. 1	VN. 5	HN. 2	VN. 7	B.CL. 3	VN. 17	HP. 2	HN. 1

VOICE II (b) :

EXPOSITION :	HP. 1	VLA. 3	VN. 1	HP. 3	HN. 2	HP. 2	HN. 2	VC. 4	HP. 2	VN. 2	HP. 2	VC. 6	HP. 1	VC. 7	HP. 3	VLA. 1

RECAPITULATION :	HP 1	CL. 3	HP. 1	VC. 3	B.CL. 2	CL. 2	B.CL. 2	VLA. 4	HN. 1	VN. 9	VLA. 11	HP. 2	VN. 1

* The number in brackets, eg. (+1) signifies the number of repeated notes added to the group; thus HN 4 (+1) means that the horn takes 4 different notes, one of which is repeated.

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