Cook, Nicholas. *A Guide to Musical Analysis*. New York: George Braziller, 1987.

CHAPTER NINE

ANALYZING SERIAL MUSIC

I

How far is analyzing serial music the same as analyzing any other music?

According to Allen Forte, the kind of reduction technique that Schenkerian analysis exemplifies 'is not suitable for the analysis of 12-tone music, nor is it required there in order to explain structure. The 12-tone system has its own history, its own terminology and analytic technique.'[1] Now the kind of analytic technique which Forte has in mind involves identifying the series present in a composition together with the various transformations in which it appears, which is sometimes called doing a *note count*; and it involves deducing the formal properties that hold between the various transformations of the series, so that they can be correlated with those aspects of the musical design that are not directly determined by the serial structure – things like rhythms, textures, thematic design and so forth. And procedures like this are basically different from the kind of analytical techniques I was setting out in the first part of this book. They are different on two counts. First, they are explicit; they require the application of precisely stated rules, so that they could well be carried out by a computer. Admittedly this is also true, to some degree at least, of the kind of formal techniques (such as Forte's own set-theoretical technique) which I discussed in Chapter 4, as well as the comparative techniques I described in Chapter 5; but even these are unlike the techniques of serial analysis, because (and this is the second point of difference) serial

[1] In Maury Yeston (ed.), *Readings in Schenker Analysis and other approaches*, Yale University Press, 1977, p. 33.

techniques relate directly to compositional procedures. That is to say, more or less any piece can be analyzed by Schenkerian, formal or comparative methods, if with varying degrees of success; it is in no way a precondition that the composer himself should have been consciously aware of Schenkerian or formal principles. Indeed, you can analyze a piece in terms of sonata form without being sure that the composer was consciously thinking of his music in terms of sonata form, because (as I explained in the last chapter) the basic principles underlying sonata form became a habit of mind for composers – something that they took for granted in writing music. But serial structures do not occur except through a conscious decision on the composer's part to construct them; and where they do not occur, serial analysis is simply a non-starter. Serial analysis, then, is more tightly bound to a specific repertoire than other analytical techniques.[1]

But even when a piece is composed by serial methods, are specifically serial techniques of analysis all that is required to 'explain structure', as Forte put it? The answer to this is certainly no, because the techniques of serialism – at least of classical serialism, meaning Schoenberg, Berg and Webern – leave so many crucial aspects of the music undetermined: rhythm, texture, patterns of consonance and dissonance, form and so on. All these free aspects of the music play a crucial role in determining what effect, if any, the series makes on the listener. In fact, it is only when there is an unusually direct association between these free aspects and the serial structure that it becomes possible for a listener to perceive the serial structure as such.

An example of this is Webern's Symphony. Everything here is designed to make the series audible. The series is presented melodically rather than harmonically. The texture is sparse and the tempo very moderate. Each statement of the series is divided from the next by a caesura and a change of texture. Under these circumstances it is, if not easy, then at least possible for a listener to pick out the occurrences of the series – in a way it is not when, as is more often the case in serial music, the series is used harmonically, split up texturally, staggered against the phrase structure, or used at faster tempi. But there is a further point. The fact that listeners *can*, if they try, pick out the series does not mean that they *do* so in the normal way; I have carried out tests

[1] I mentioned in Chapter 3 that motivic analysis arose partly through attempts by some of Schoenberg's pupils to discover more-or-less serial patterns in non-serial music, particularly that of the classical era. I do not find these demonstrations convincing or musically interesting, but for another opinion see Hans Keller's 'Strict Serial Technique in Classical Music', *Tempo*, No. 37, Autumn 1955, p. 12.

in which musically qualified listeners made detailed observations of the first movement of Webern's Symphony without becoming aware of its being serially structured at all – simply because they had not been asked to listen out for a serial structure! And the observations these listeners did make were the sort of observations that could have been made about many non-serial pieces – of tensional shapes, developmental processes, effects of finality and so forth. It is clear that basic categories of musical experience such as these are as applicable to serial as to non-serial music. And this means that if what you are interested in is how a given piece of serial music is experienced, then its serial structure can only be the starting point for your analysis. As with sonata form, the important thing is not the structure as such, but the use the particular piece you are analyzing makes of that structure.

This chapter includes brief expositions of the techniques of serialism, interspersed between the analyses. But its main topic is the relationship between these techniques and the wider concerns of musical analysis as a whole.

II

A piece of music is serial if in some respect it is determined by a strict pattern of recurrence. In classical serialism it is pitch classes that are ordered this way, and the series states every note of the chromatic scale once and once only. It is possible to use series that contain only a selection of the twelve chromatic notes, but when this is done the effect of the music tends to depend more on the harmonic properties of the set of notes as a whole, and less on the order in which they come. In twelve-tone serialism (also called 'dodecaphony' – a term which in practice implies serial organization, as opposed to 'atonality' which implies the lack of it) it is only the order in which the pitches come that distinguishes one series from any other. As the analytical techniques specific to serialism are based on ordering as their structural principle, it is twelve-tone serialism that I shall talk about in this chapter.

About the simplest possible example of twelve-tone serialism is the twenty-bar piece from Webern's sketchbook of 1925, the first half of which is shown in Fig. 143; it would be sensible to play it through before reading further.

Fig. 143 Webern, Piano piece, bars 1–19

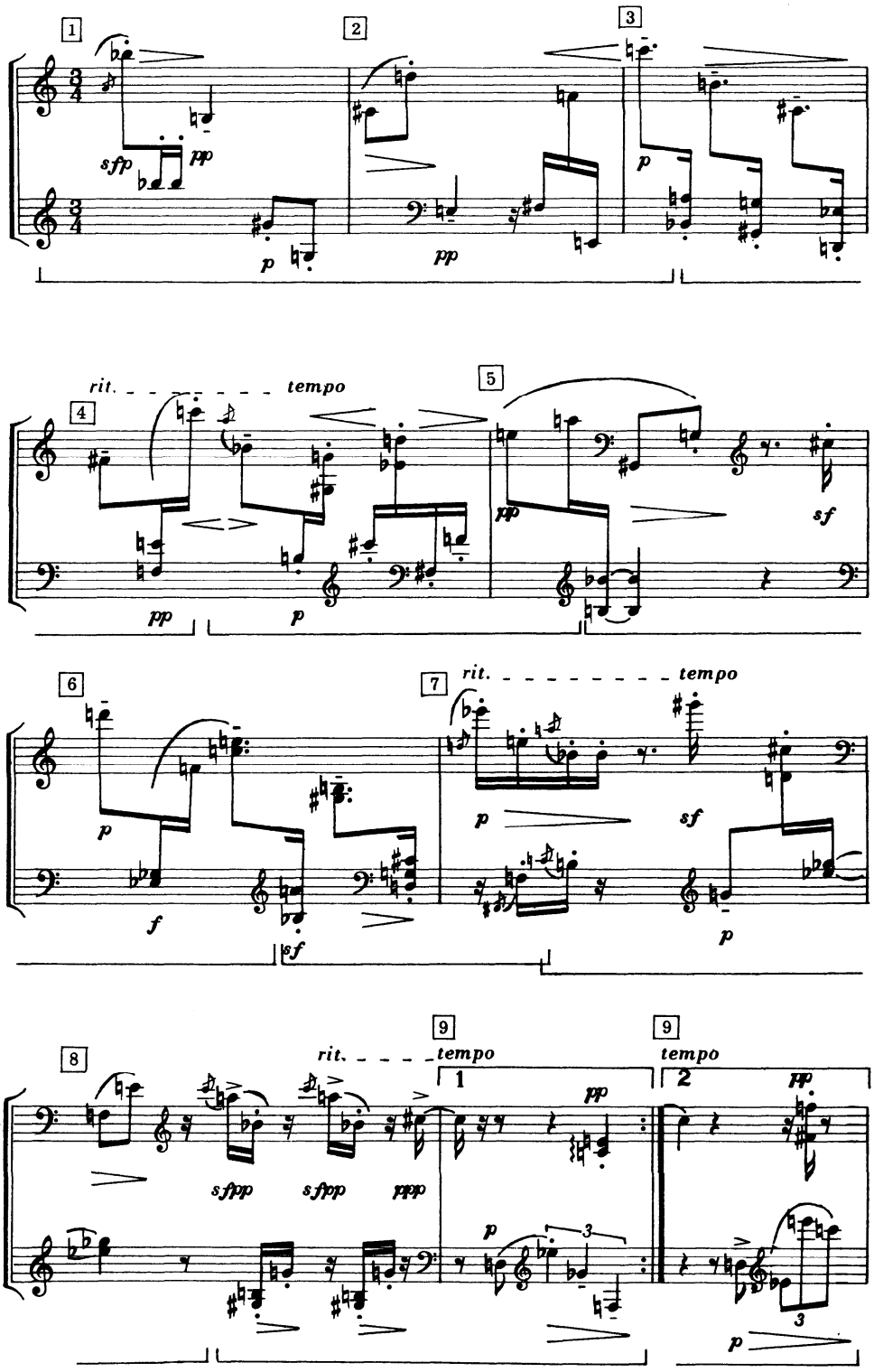


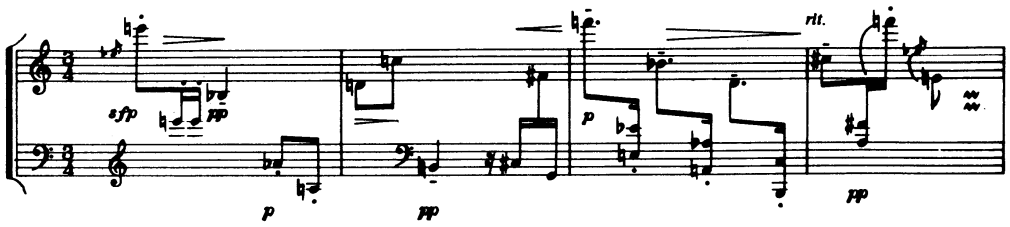
Fig. 144

Apart from a couple of minor reorderings, the music simply consists of the same pattern of pitch classes repeated over and over again, only at different registers and in different rhythms (Fig. 144).[1] The registral, dynamic and rhythmic variations, however, are inventive enough that the rather banal means of pitch organization is effectively disguised; the piece is best seen as an exercise in variation technique. This puts the analytical emphasis on the free rather than strictly organized aspects of the music, and a practical demonstration will confirm that the serial structure as such has a comparatively small part to play in the music's effect. Fig. 145 shows some of a recomposed version of the music which uses an entirely different series (it is in fact that of Stravinsky's *Movements* for piano and orchestra) while preserving the rhythms, repetitions and, as far as possible, the registers of the original. I think the effect is really quite similar, apart from a few obvious defects in the recomposed version – defects which are of a purely surface nature, such as the excessively disjunct left hand of my bar 3 in comparison to Webern's, or the excessive leaps from low B to high C♯ at the beginning of bar 4. (Why are these excessive? Obviously the answer cannot be a strictly serial one.) What this indicates is that it is the negative qualities common to most twelve-tone series, such as the lack of tonal weighting, rather than the positive qualities of this series in particular, that matter for the musical effect; and it follows from this that the registral, dynamic and rhythmic structure is what matters most from the analytical point of view.

Register, dynamics and rhythm work together in this piece to create a quite traditional pattern of musical motion in triple time – Webern marks it as a minuet, but the rubato indications reveal its affinity with the waltz. In other words, the bar lines indicate genuine downbeats, and in the absence of harmonic rhythm these are established primarily by means of surface rhythm – by the recurrent use of the opening ♩♫ figure to mark downbeats (bars 1, 4, 5, 6) and by the semiquaver upbeats to bars 3, 4, 6 and 7. Associated with this downbeat

[1] How do you decide what register to write down the notes of the series in, as in Fig. 144? There is no general rule: simply choose registers that make clusters of adjacent notes or motivic patterns easy to see.

Fig. 145



pattern is the division of the piece into distinct phrases which could be characterized as rhythmic statement (bars 1–2), counterstatement (bars 3–5) and development (bars 6–9). The last of these constitutes the climax of the first half. It does so rhythmically, through a kind of hemiola at bars 7–8, texturally (the thickening of the texture automatically means a quicker statement of the series), and registrally: the G♯ in the right hand at bar 7 is not only the highest note so far, but is the terminus of an upper registral line that starts at the beginning of the piece and moves upwards through B♭, C, D, E♭ and G♯ – a formation that has no function in relation to the series.

All this, then, constitutes a rhythmic and formal structure independent of the piece's serial construction. How do the two relate? The answer is given in the otherwise odd lack of alignment between the phrase structure and the rubato indications in the first half. In each case the ritardando is associated with B♭, the first note of the series, and the fact that the B♭ occurs at the same register each time helps confirm that it is not just an accident. These rubato indications, then, advertise an underlying pattern of temporal recurrence – the recurrence of the series – which is coordinated with the rhythm of the musical surface only at the beginning (the two rhythmic cycles start off together) and with the cadence at the end of bar 9, where they terminate together. In other words the coincidence of the surface rhythm and the serial pattern at the double bar seems to have a cadential function. At the same time it looks as if Webern had no great faith in the audibility of the series as a means of creating a cadential effect, because he reinforces it by a number of non-serial devices: the hemiola already mentioned, the spread chord in the right hand at bar 9, the triplet (a new formation to be developed in the second half) and, most of all, the unprecedented repetition of a motif in bar 8.

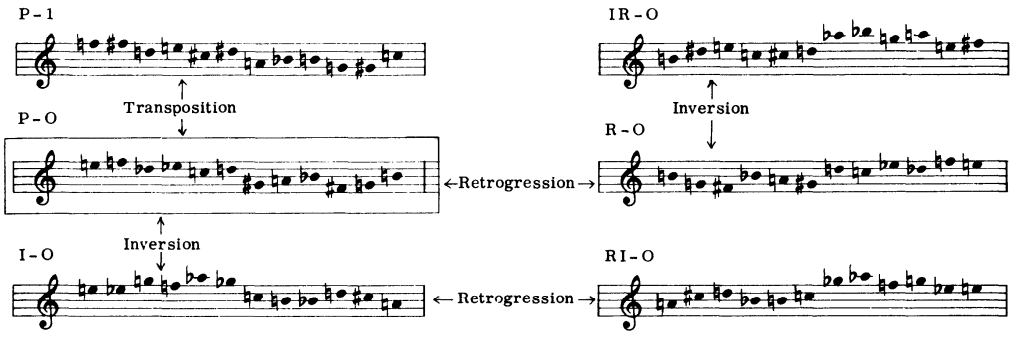
III

The piece discussed in the last section is an unusually primitive example of serialism. More representative is Webern's Piano Variations of 1935–6. Technically, the main difference has to do with the series being treated as a unit. In the 1925 exercise, the series functions simply as an indefinite stream of recurrences, without any particular beginning or end. In the Piano Variations, however, and in all classical serialism, the series is treated as a structural unit which can be modified, as a unit, in a number of ways. The basic ways in which a *prime set* (P) can be modified, or *transformed*, are *transposition* (T), *retrogression* (R) and *inversion* (I); these operations can be combined, as in inverse retrogression, and they are explained in Fig. 146.[1] In the case of most series these operations generate a possible repertoire of 48 different transforms: 12 (one transposition at each semitone within the octave) x 2 (prime or inverse) x 2 (stated forwards or in retrogression). In the case of certain series however – those that are symmetrical or made up of repeated intervallic cells – some of these 48 transforms are identical to others so that the repertoire of distinct transforms is smaller: like most of the formal properties of a series, this is something a composer can choose to exploit or to ignore.

In fact it is worth realizing that, though when set out like this the serial system seems so self-evident, a definite compositional decision is involved in looking at these operations this way. In classical serialism

[1] In Fig. 146 and elsewhere I use the American terminology for serial transforms, in which 'P' refers to prime, and set members and transpositions are both numbered from 0 to 11 (or terms 10 and 11 can be written as T and E to avoid confusion). Schoenberg and his followers, however, used 'O' (for original) instead of 'P' and numbered set members and transpositions from 1 to 12; this may seem more intuitive but it can cause problems in computation. A third, and less common, convention defines P–0 not as the first transpositional level at which the series happened to be stated in the piece, but as the statement of it that begins with a C; so that the transform marked P–0 in Fig. 146 would become P–4. It does not matter which convention you use as long as you are consistent; deciding what to call P–0 is just a matter of defining your terms, not a musical decision like deciding what key a piece is in. There is a further complication, which is that when the operations of inversion, retrogression and transposition are combined, the order in which they are carried out makes a difference. IR–0 in Fig. 146 means the inverse of R–0; really it should be written I(R–0), because the series is first put backwards and only then inverted. If the series is first inverted and then put backwards, it comes out at a different transposition; in this case you can see that IR–0 is the same as RI–2, but the transposition depends on the relationship between the series' first and last notes. Many people do not bother to distinguish RI and IR like this, however.

Fig. 146 Transposition, inversion, retrogression



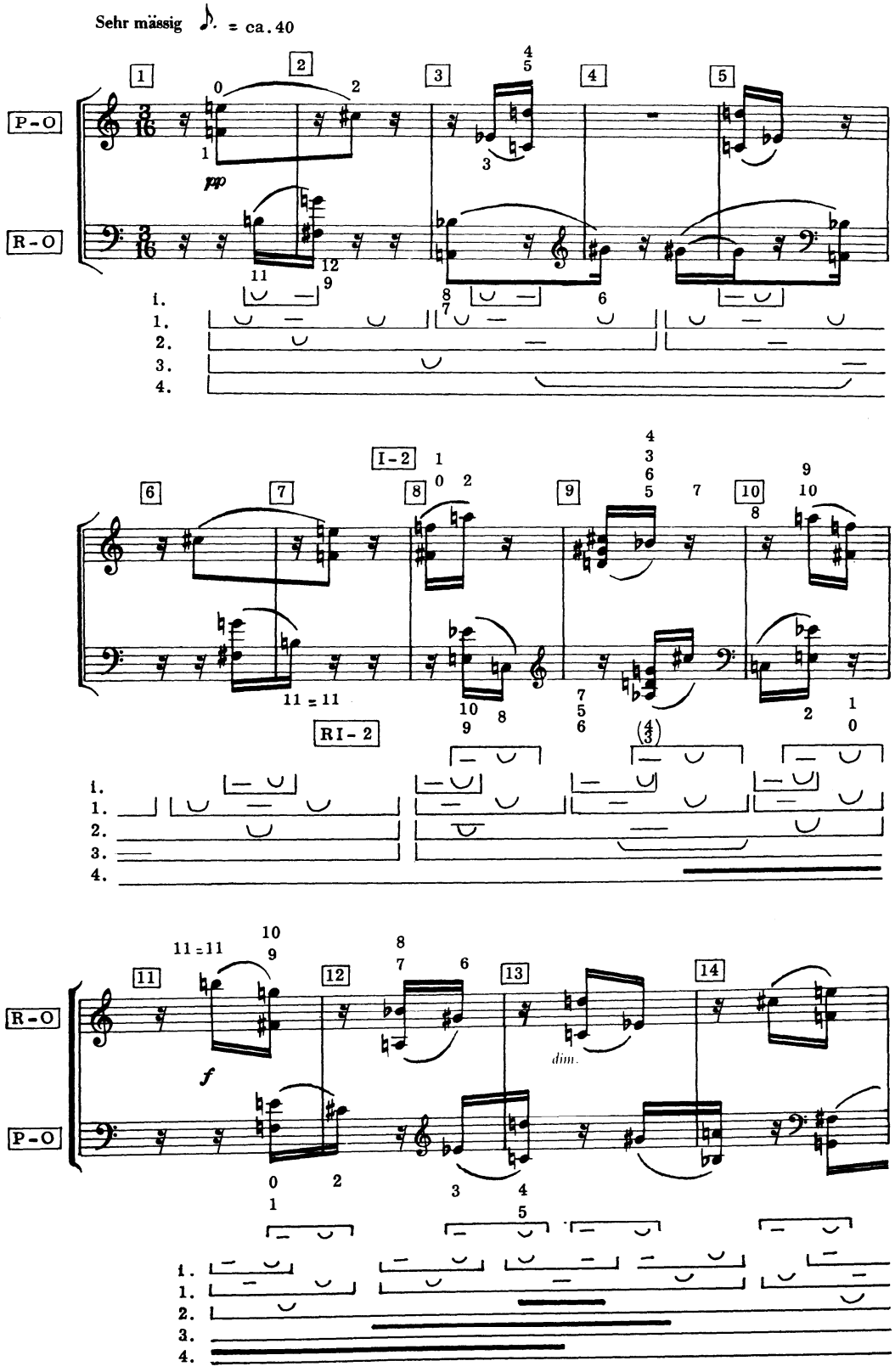
pitch classes were ordered systematically, in order to maintain a constant equality of weighting between the notes of the chromatic scale; the intervals between them were not systematized, so that certain intervals could be freely given prominence and others suppressed in any given series. But it would have been equally possible to serialize the intervals and leave the pitch classes free. Again, operations on pitch such as transposition and inversion result in permutations of the original ordering of the pitch classes. For example, if the members of P–0 in Fig. 146 are numbered as 0, 1, 2 . . . 11 then P–1 can be written as 1, 9, 5, 0, 2, 3, 7, 8, 11, 10, 4. This does not make much sense regarded as a permutation. Schoenberg and Webern chose to control relationships between different transforms in terms of pitch without making any very serious attempt to produce intelligible relationships of permutation between them; but logically speaking they could equally well have done the opposite. So the serial techniques I have been talking about are not a direct reflection of the formal possibilities inherent in the system as such. They take into account only a small fraction of those possibilities, the ones the composers actually exploited. Classical serialism, in other words, is not a system but a style.

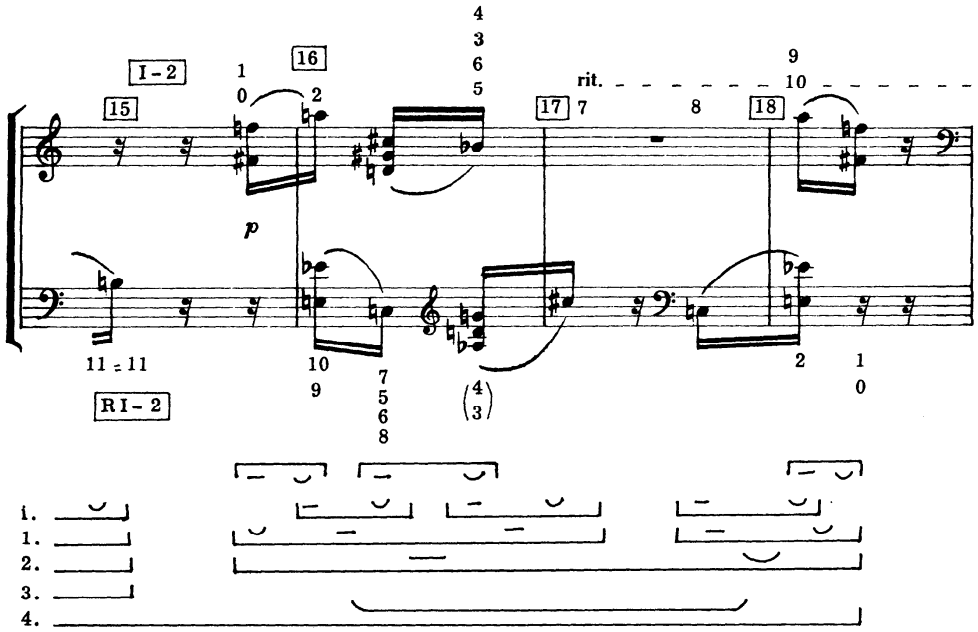
All the serial structure of Webern's Piano Variations can be explained in terms of the T, I and R relations, but to do this it is necessary first to identify the series and its transformations. Now, note-counting is fairly straightforward in Webern's music because there are few deviations and because the musical surface is so designed as to project the serial transformations clearly, so that it is essentially a mechanical trial-and-error search such as a computer could carry out, rather than one that requires musical understanding – though a musically-trained eye can pick out emphasized intervals or segments in the music, and

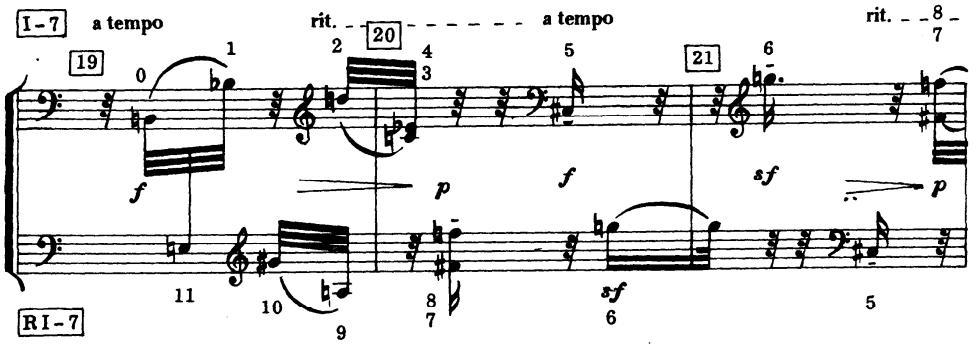
these are sometimes a short cut to deciphering the serial structure; familiarity with a given composer's style can also speed up the process. For example, you might find it difficult to work out what is happening in the left hand at bars 7–8 of the first movement of the Variations, if you were not familiar with Webern's habit of using a single statement of a note as a pivot for two statements of the series: you can see this in Fig. 147, which shows the whole of the first movement. Another complication arises from the use of chords. Obviously bars 1–4 could be derived from a series F E B G F♯ C♯ B♭ A E♭ D C G♯; it is only later, when the juxtapositions are altered, that it becomes clear that this is the wrong way of looking at things, and that they are a composite result of P–0 and R–0 statements being made simultaneously (and it is worth noting that the distinction between the two is not textural or registral but is made purely in terms of the distribution between the hands – that is to say, it is not an audible distinction). But even given this distribution, the set of the right hand could be F E C♯ E♭ D C . . . or E F C♯ E♭ D C . . . or E F C♯ E♭ C D . . . and so on; again deciding which of these is the correct interpretation involves looking ahead, and in fact since terms (0, 1), (4, 5), (7, 8) and (9, 10) are coupled throughout the first and last sections of the movement (bars 1–18, 37–54) it is only the middle section that shows which is the intended order. And since the middle section uses other couplings – for, instance, terms 3 and 4 always occur together – the whole series is never in use as a fully ordered set at any single point of the movement; there are works, such as late Schoenberg, where this is taken further, so that there is no single definitive statement of the series (this is sometimes referred to as serial 'troping').

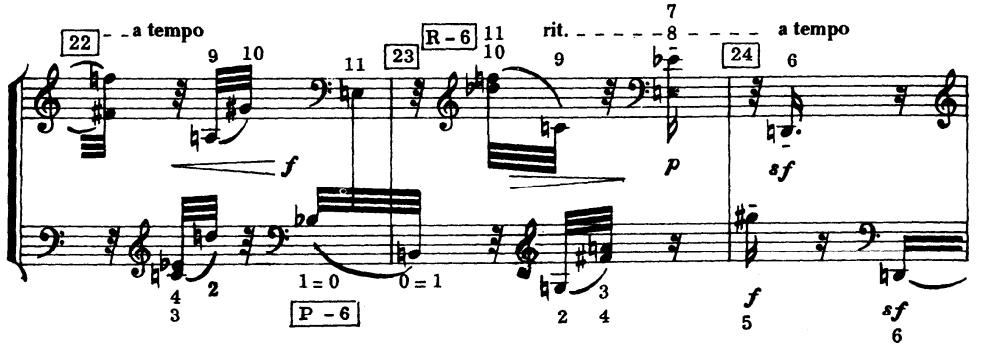
Now once the series has been established the analysis can go in either of two directions. One is to look at the formal properties of the series – such as the recurrence of intervals or sets of intervals between different segments of the series – which not only give the series an individual character but govern ways in which different transformations of the series can be associated with one another. These properties vary from one series to another, in a way the different keys of tonal music do not; so that you have to determine them for each individual piece. Perle calls this 'precompositional structure', as opposed to 'compositional structure', which (as I said in Chapter 4) refers to the ways in which formal properties are actually applied or exploited in the music; and this is a useful analytical distinction, though it does not really correspond to distinct stages of the compositional process. The second analytical direction I mentioned is the opposite: that is to say, concentrating on what the composer actually does and only after that going on to consider the

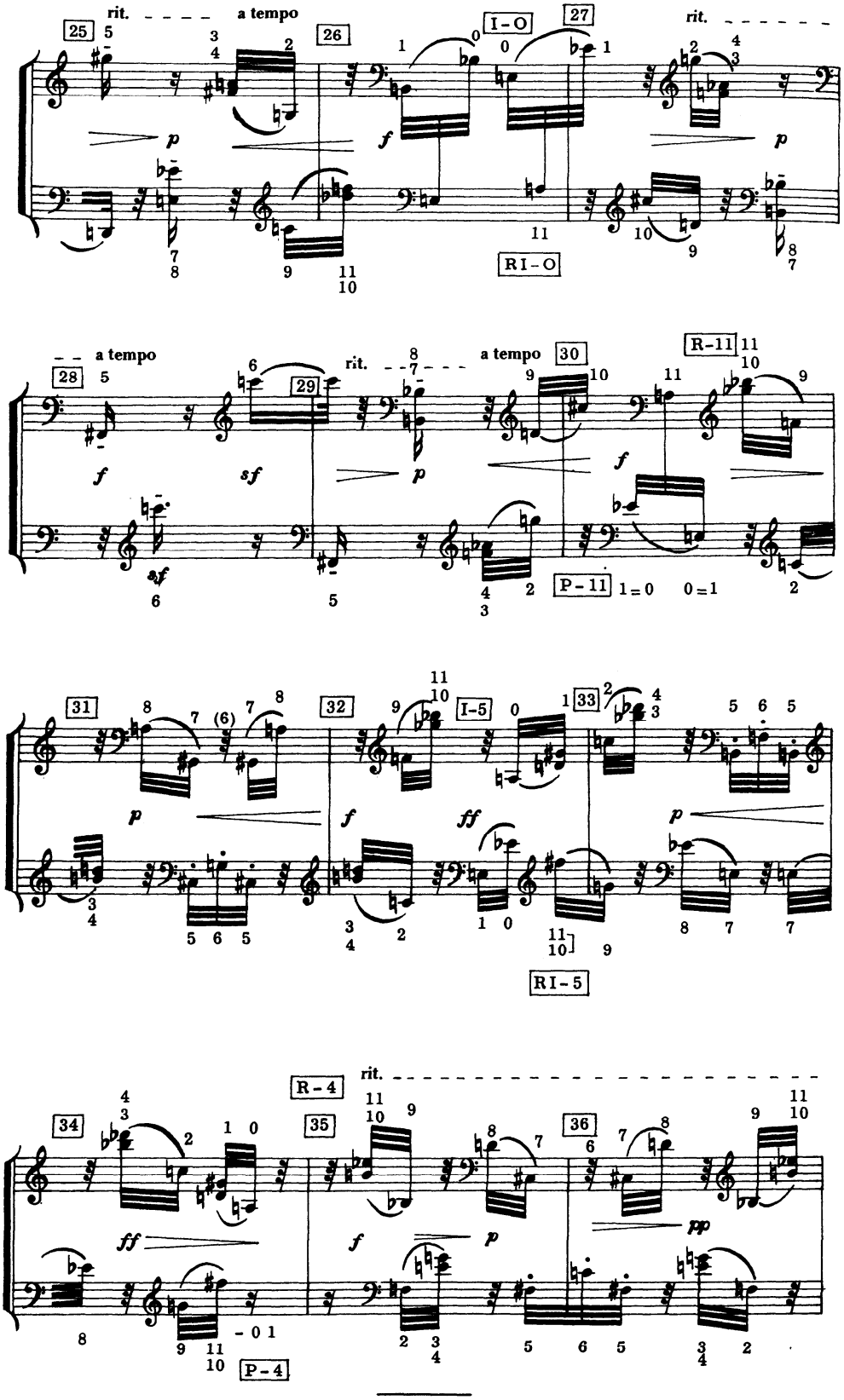
Fig. 147 Webern, *Piano Variations*, I

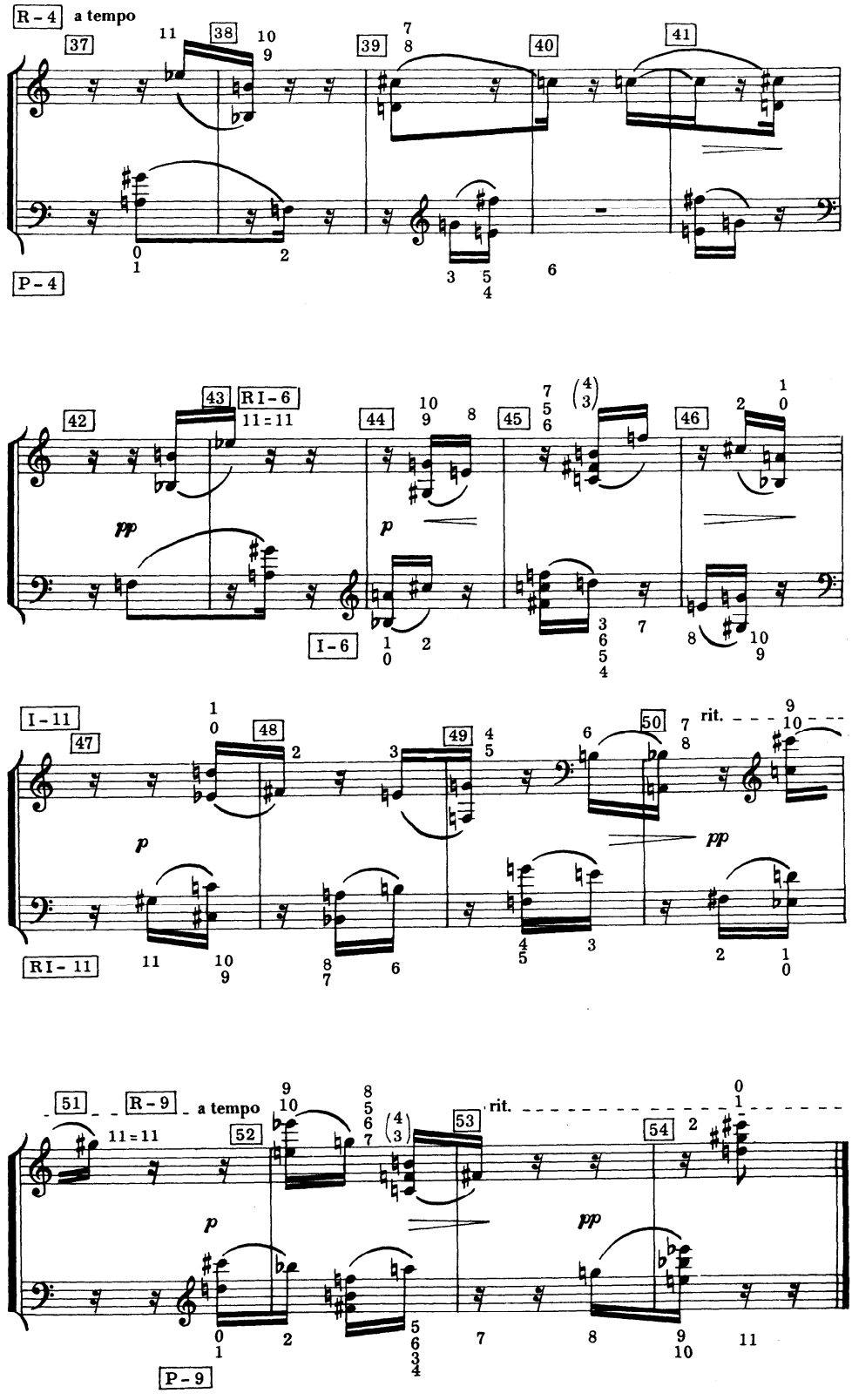



I-2
15
16
17
18
rit.
p
RI-2
1.
1.
2.
3.
4.


I-7
a tempo
19
20
rit.
a tempo
21
rit.
f
p
f
sf
p
sf
RI-7


22
a tempo
23
R-6
rit.
a tempo
24
f
p
sf
f
sf
P-6

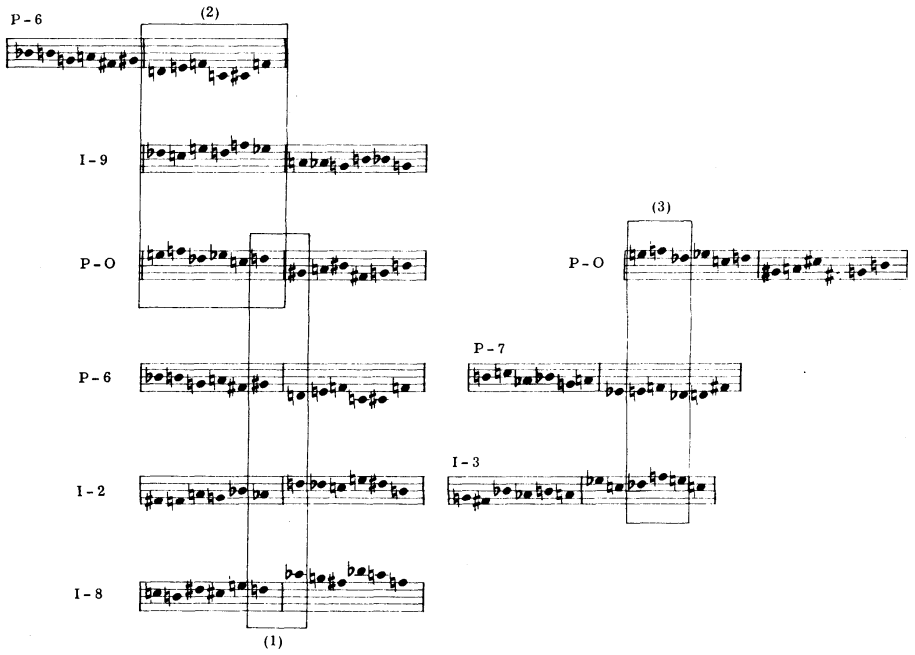

rit.
a tempo
25
26
27
I-O
RI-O
rit.
a tempo
28
29
30
R-11
P-11
1=0
0=1
31
32
I-5
33
RI-5
34
35
36
R-4
P-4
rit.


R-4
a tempo
37
38
39
40
41
P-4
42
43
RI-6
11=11
44
45
46
I-6
I-11
47
48
49
50
rit.
RI-11
51
R-9
a tempo
11=11
52
53
54
rit.
P-9

formal implications. In classical serial music this is usually a more sensible approach, simply because Schoenberg, Berg and Webern on the whole took advantage of only a small proportion of the structural possibilities inherent in the series. Fig. 148 illustrates this in the case of Webern's Piano Variations. It shows, first, that the series falls into two halves separated by a tritone, which does not appear anywhere else; and that the same tritone is a common feature between P–0, P–6, I–2 and I–8. Secondly, it shows that each half of the series (or *hexachord*) consists of a chromatic wedge, which is a common trait in Webern, and this means that the first hexachord of P–0 has the same content as the first half of the series I–9 or the second hexachord of P–6. Thirdly, it shows that one particular three-note cell or *trichord* (if we number it in semitones we can call it [0, 3, 4]) crops up several times in different transformations – for example, as D♭ – E – F it occurs as terms 0–2 of P–0, terms 7–9 of P–7 and terms 8–10 of I–3. Webern could have exploited all of these as neat ways to join different versions of the series by means of common segments between them, but in fact he does not take advantage of any of them. However, if instead of analyzing the precompositional structure you simply make a table of the transformations Webern actually *does* use, as in Fig. 149, then you can see that surface formations are employed as a way of linking serial transformations, but that these links are of a rather simpler nature. They are marked by the boxes and they consist of, first, shared final notes (but never first notes) and, second, shared but reordered pairs of first notes (but never final notes). And you can also see that the first relationship is used exclusively in the outer sections (bars 1–18, 37–54) and the second in the central section (bars 19–36). The rather casual nature of these serial relationships suggests that Webern saw them as more or less surface links between sections rather than as the basic structural principles governing the musical form. In other words, his approach to serial transformations seems to have been empirical rather than formalistic. For this reason the main analytical interest of his music, and that of his contemporaries, does not lie in the serial structure *per se* so much as the manner in which the serial structure is associated with the non-serial and often traditional aspects of the music.

The serial plan of the first movement of the Piano Variations corresponds quite closely to the main sections of the movement's form. This is an ABA structure in which the beginnings and ends of the sections coincide with statements of the series. Furthermore, although the serial structure as a whole is open or chain-like, there are recurrent relationships between pairs of series within each section and these are

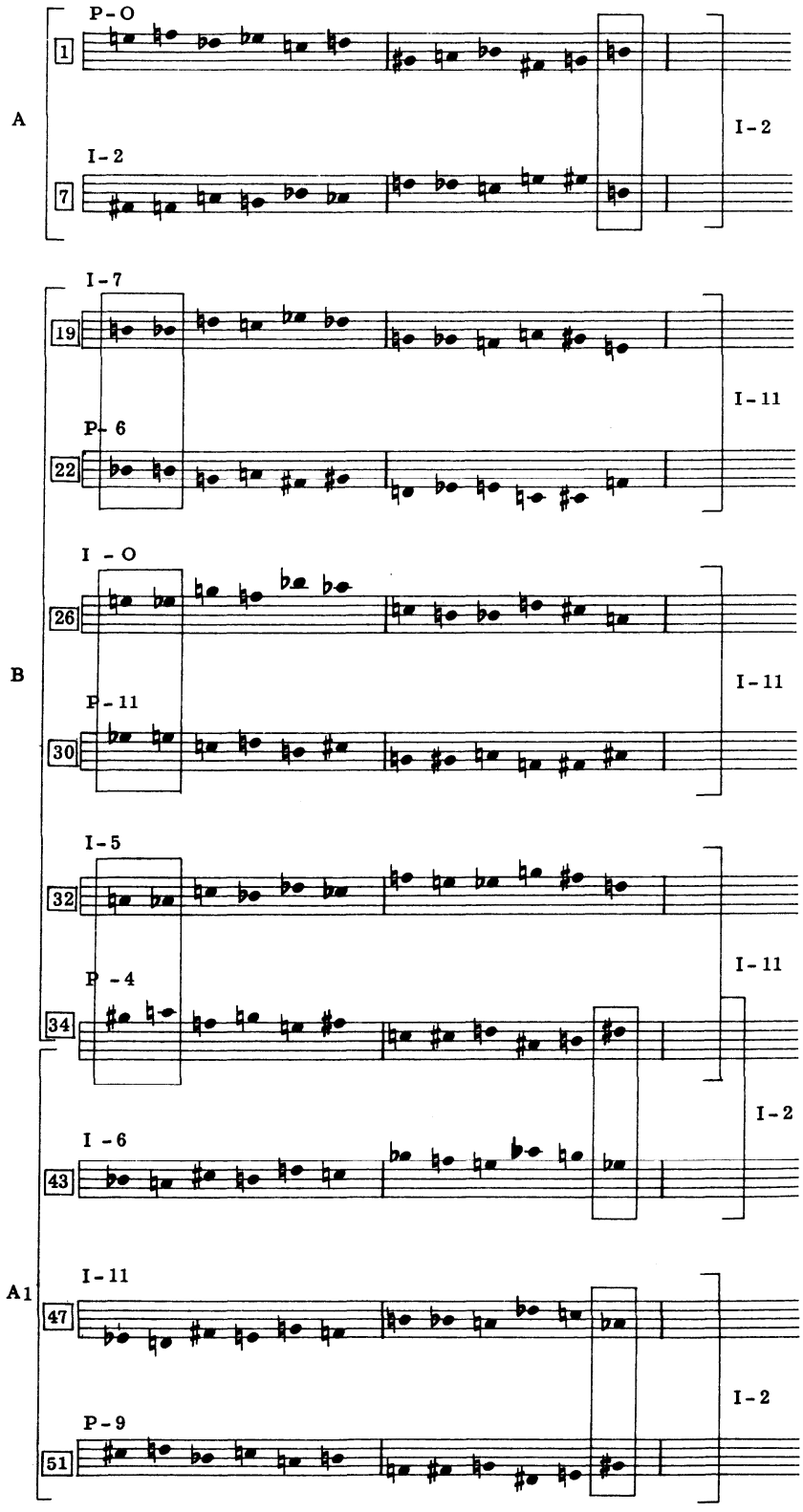
Fig. 148 Transformational invariants in the set of Webern's *Piano Variations*



marked at the right of Fig. 149. However this ABA form is primarily distinguished not by the serial structure but by the rhythms and the chords used in the various sections: the middle section is in more or less constant semi-demi-quavers as against the semi-quavers of the outer sections, and major and minor thirds predominate in the middle section as against the major sevenths and minor ninths of the outer sections. So much for the relationship of serial and non-serial structure at the level of form. There is also a close association between the serial and the non-serial structure at phrase level, particularly in the frequent palindromes that occur throughout, sometimes with their central axes prominent, as at bars 4 or 21, and sometimes with them lightly concealed, as at bar 9.[1] These palindromes create a kind of rhythmic rippling through the local recurrence of notes within the overall chromatic sonority. It is possibly because of this close association of the series and the phrase structure that it is relatively easy to hear the series in this piece, at least in the

[1] The palindromes are basically literal (apart from the structural though inaudible swapping of the hands) but there are some deviations, normally in register: the transfer of G – $F^{\sharp}$ to the lower register at 14:3 (as against 11:3) is an obvious example, the inversion at 14:1 of the minor ninth A – $B^{\flat}$ at 12:2 is less so. Similarly there are minor rhythmic deviations.

Fig. 149 Serial transforms in Webern's *Piano Variations*, I



negative sense that a 'wrong' note is more immediately recognizable as such than is often the case in serial music.

At the same time, there are important aspects of phrasing which cut across the palindromes and the serial structure in general. Some of these are visible in Webern's score: for example the tempo and dynamic markings which Webern supplies liberally. The dynamic markings sometimes have a palindromic structure paralleling that of the rhythm and pitch, as in all except the last two bars of the middle section; and the tempo markings of the middle section sometimes correspond to the serial statements, though they are not palindromic (the ritardandi are not mirrored by accelerandi). But at other points neither dynamics nor tempi follow the serial structure: the dynamic markings in the first section show the arch-like form typical of late tonal or freely atonal music (there is a climax about two-thirds of the way through, coinciding with the highest note of the section), while the only notated ritardando, at bar 17, has a cadential function. Neither of these has much to do with the serial structure.

However, if we want to understand the phrase-structure of Webern's music, we should not simply look at what Webern has marked in the score: we should consider the way people actually play the music, which is just as valid a source of information as the score. You could listen carefully to a professional recording of the music for this purpose. Or you might simply play it yourself. The sort of information we are after does not depend on masterly pianistic interpretation: it is simply a matter of how people naturally phrase the music as they play it. Even if you are not a particularly good pianist, you will find that, without thinking about it, you phrase the music through fine control of dynamics and tempo: try playing through it and see what you do. I find that, though no dynamic changes are marked in the first phrase (bars 1–7), I make a small climax towards the end of it, slowing down to the last bar and slightly lengthening the rest after it; and this means that the phrase mirrors the arch-like structure of the section as a whole, with its late climax. The second phrase (bars 8–10) is more compressed and urgent, with its climax coming perhaps as late as bar 10:2; there should be no rallentando or lengthening of the rest, otherwise the main climax at bar 11 will seem abrupt and unprepared. This climax continues until the second C—D at bar 13:2, where the diminuendo marked by Webern comes out as quite a rapid collapse coupled with a slight rallentando and a lengthy rest at bar 15. All through this section my playing seems to be shaped by a rhythmic structure which is no more than hinted at by Webern's notation and

which is based on rhythmic groups or cells. I have shown these in Fig. 147, using Cooper and Meyer's notation,[1] although there are so many ways of hearing relations of accent and non-accent in this music that it is hard to be absolutely definite about this. You can see that at the beginning there are rhythmic groups of three (unequal) beats whereas during the remainder of the section groups of two predominate; however, these are staggered against each other in such a manner that the latent metre of the time signature is constantly on the brink of establishing itself. (It actually does so in bars 8–10, and although it then becomes submerged again it remains as a latent force – hence the cadential rest in bar 17, which compensates for the elision at bar 16.) What is it that creates these relations of accent and non-accent? Partly, of course, the dynamic stresses resulting from both hands' patterns of one note succeeded by a chord, or the other way around; partly, no doubt, from intervallic patterns; but also from registration, since the rhythmic effect seems to be much weaker in the final section, which is the same apart from registral layout. In fact the final section strikes me as altogether less successful than the first; and yet its serial structure is just the same.[2] And this goes to show that what matters is not the serial structure *per se* but the way it interacts with the rhythmic structure; particularly striking is the way in which the palindromes highlight the juxtaposition of rhythmic groups by creating what Cooper and Meyer call 'rhythmic reversals' (two accented beats directly following each other, as in bar 4).

At all events it seems clear that there are musically important aspects of Webern's Piano Variations that have nothing to do with the formal properties of its serial structure. (Webern apparently thought so too, for Peter Stadlen, who gave the first performance under the composer's supervision, has recounted how insistent Webern was on just the small factors of dynamic shaping and rubato that I have been discussing.[3]) In spite of the close association between serial structure and phrase structure, the form of the movement is not essentially a serial one at all; so it would be instructive to compare it with a movement whose

[1] See p. 76 ff. above.

[2] Even less successful is the inverted version of the opening 7 bars Cone presented in his article 'Beyond Analysis' in Boretz and Cone (eds.), *Perspectives on Contemporary Music Theory*, Norton, 1972, p. 72. The interesting analytical question this raises is: why does this music work better in the one version than the other? and the answer – whether to do with registration, harmonic formations, or strictly acoustical factors – obviously lies outside serial theory as such.

[3] 'Serialism Reconsidered', *The Score*, No. 22, 1958, pp. 12–14.

form is essentially conditioned by the serial structure, and in particular by the use of pairs of notes that are shared by different transformations of the series.

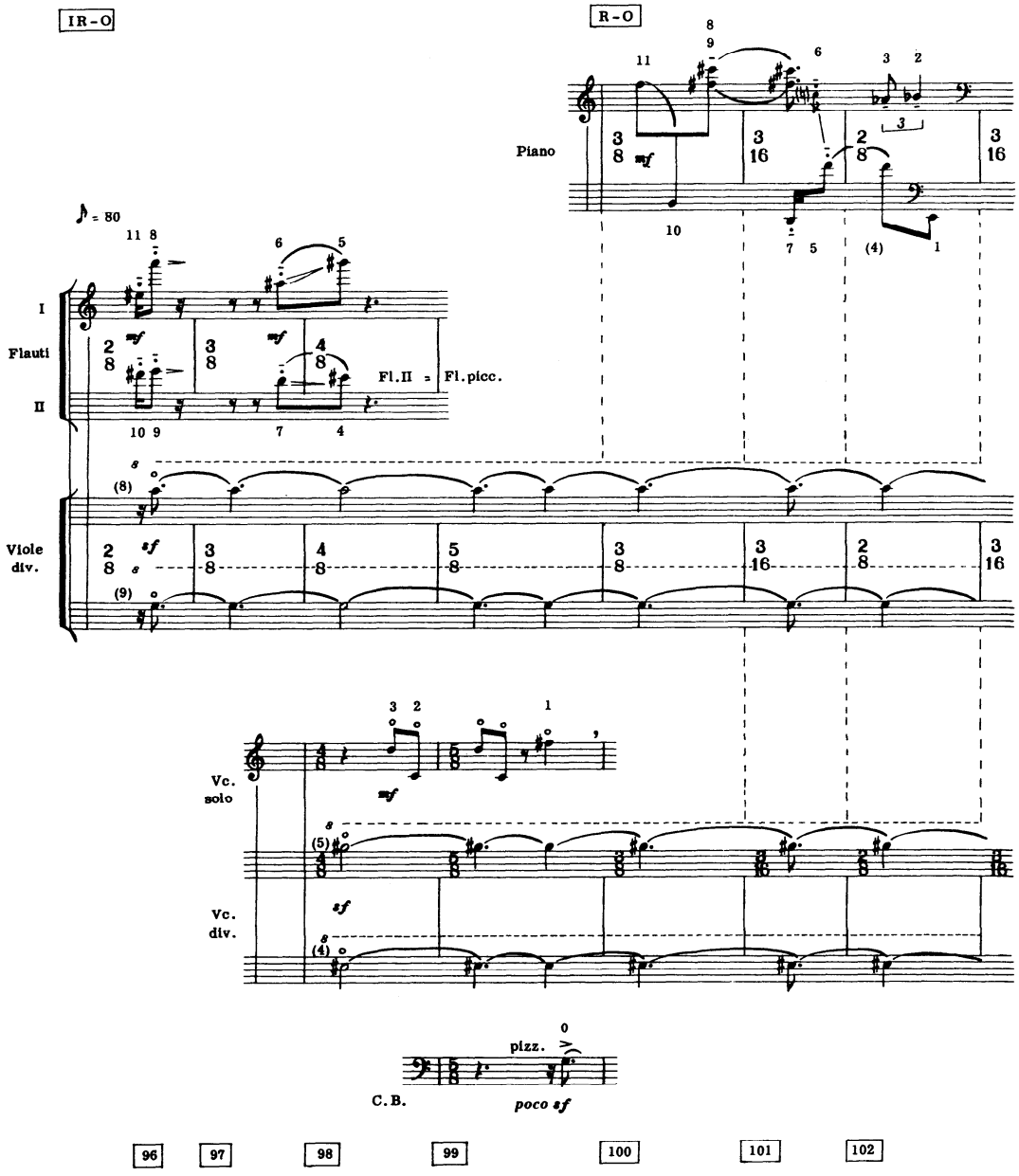
IV

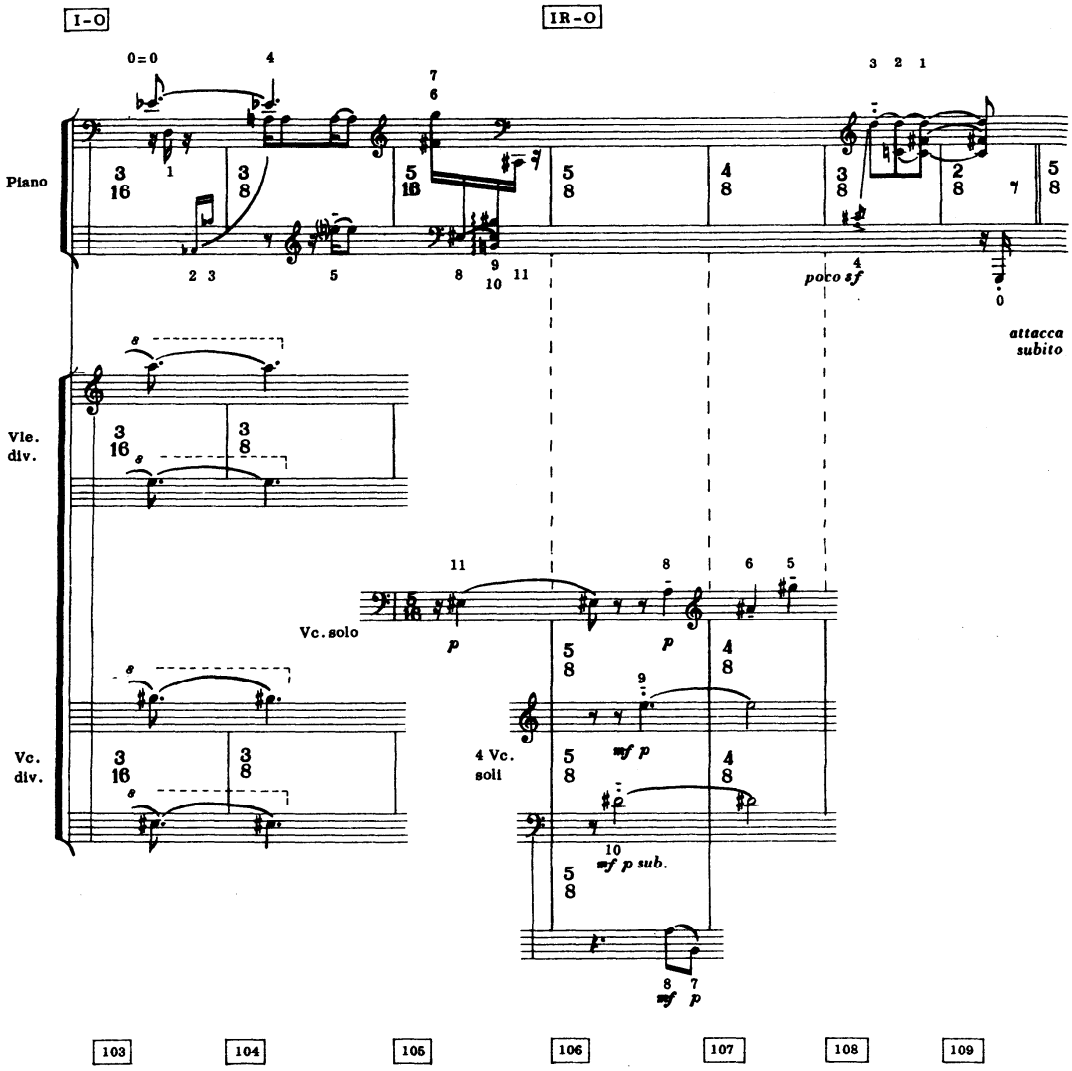
The fourth of Stravinsky's *Movements* for piano and orchestra, then, uses a similar means of relating transformations as Webern does in his Piano Variations, but does so in a form-building manner. A glance at the score (Fig. 150) shows that it consists of three closely similar sections. Each of these sections has more or less the same dynamic markings and follows the same plan: an introductory phrase for two flutes (or flute and piccolo) of which four notes are prolonged in string harmonics; an interjection from another group of instruments which is variable; an extended phrase on the piano; another interjection from four cello or double bass soli; and a short, final piano phrase. However, in terms of pitch structure the most striking link between the three sections is the string harmonics chord which is in each case made up of two superimposed fifths. Fig. 151 summarizes the relations of these chords: each includes A and C♯ at the same register, but whereas the third of these chords is simply a re-registration of the first, the second is a pitch class transposition at the fifth. These chords are so designed as to project the relationship between the informal aspects of musical design I have been talking about and the serial structure of the movement. Fig. 150 shows that the series is laid out in quite a straightforward manner; the movement is built on two transforms, P–0 and IR–0, together with their retrogrades, plus a single occurrence of I–0.[1] This means that transpositions are not used at all, so instead of talking about P–0, IR–0 and I–0 we might as well simply say P, IR and I. These transforms are shown in Fig. 152.

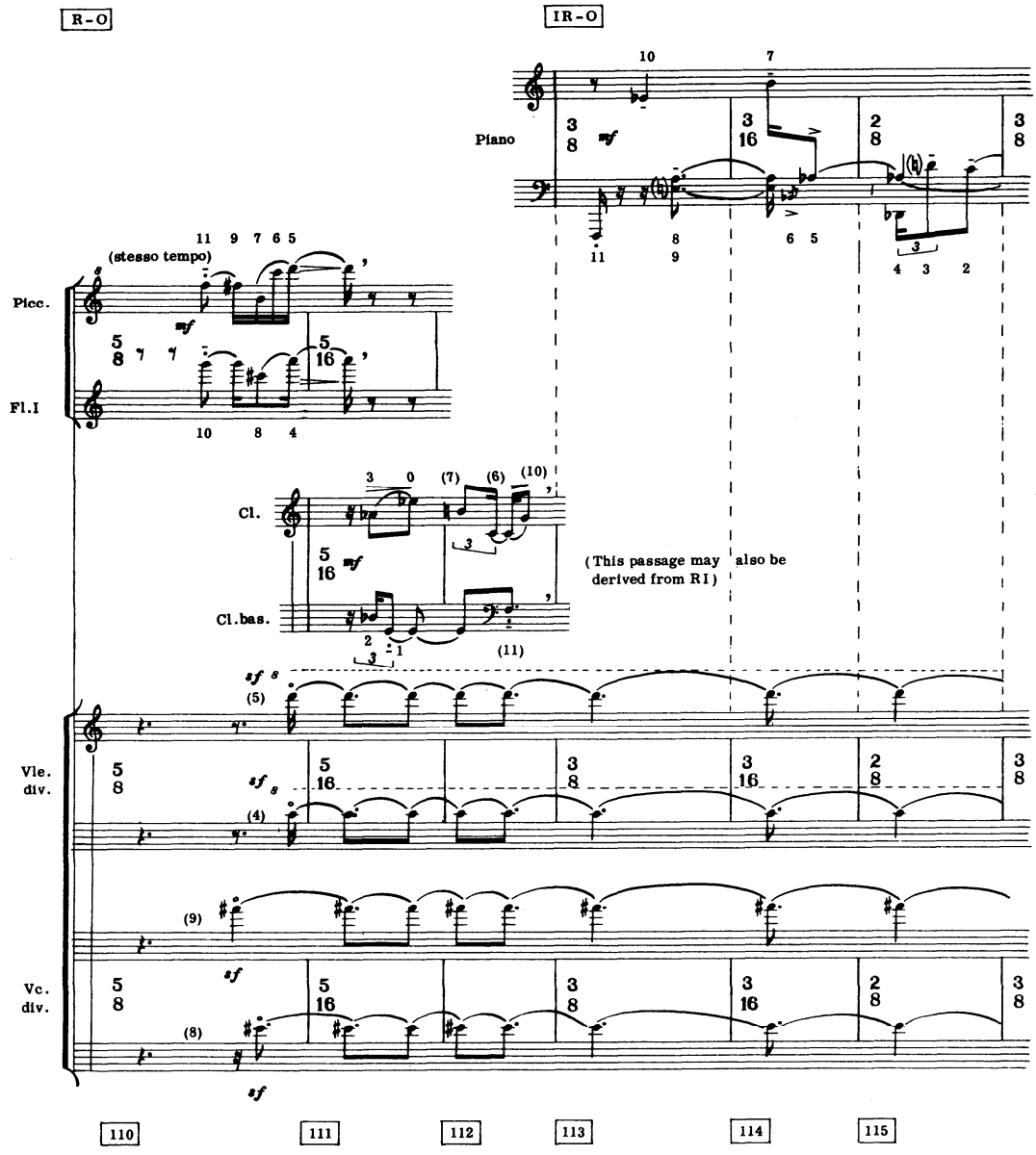
Now if you compare P and IR, you will see that the chord at bar 111 serves the same function within P as the chords at bars 98 and 125 serve within IR; that is to say, each has the same serial derivation (from terms

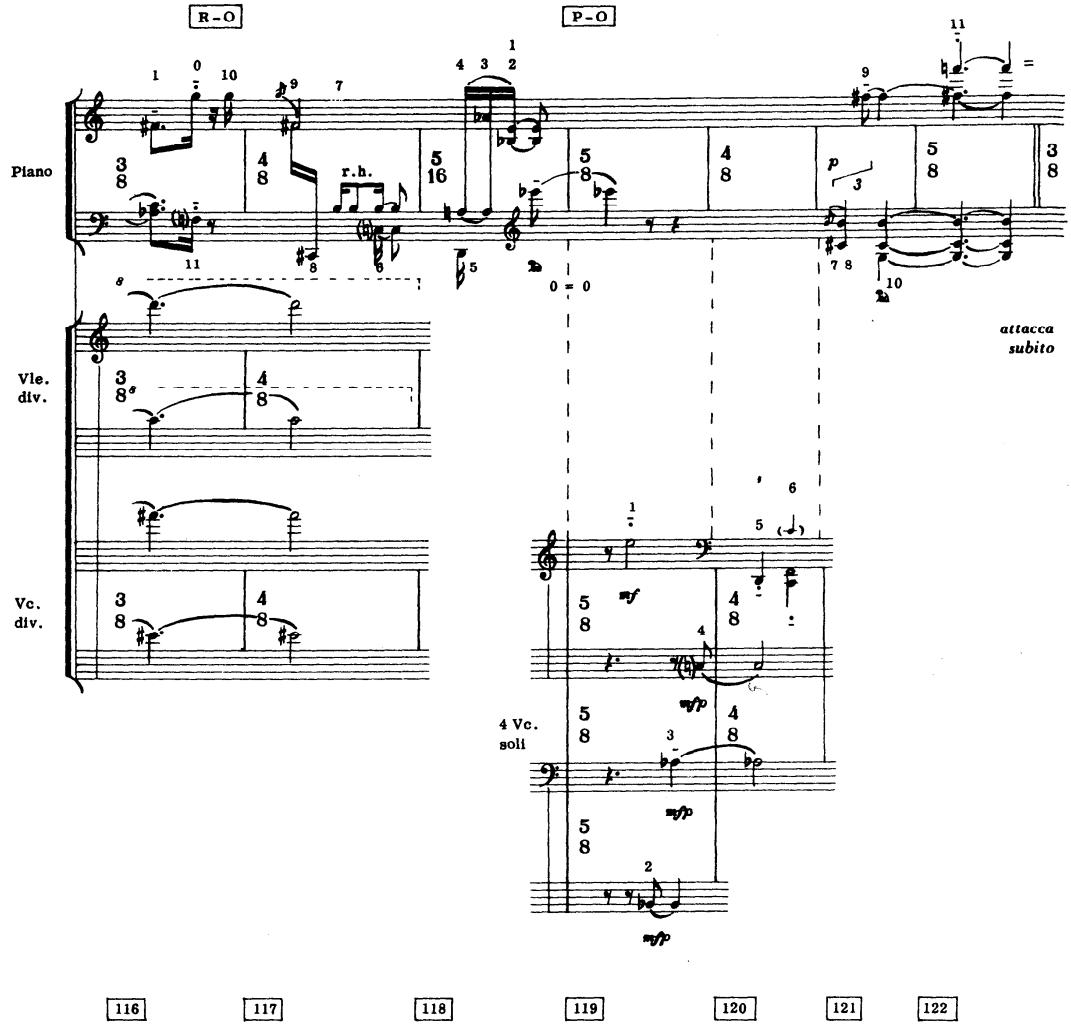
[1] Many people would refer to IR–0 as RI–2, or even IR–2 (see p. 300 above). But this is not appropriate here, as Fig. 152 shows, because the design is not based on transposition but on inversion round the first and last notes of the series. The first statement is labelled IR–0 and not P–0 because it is defined as such by the first statement of the series in *Movements* as a whole.

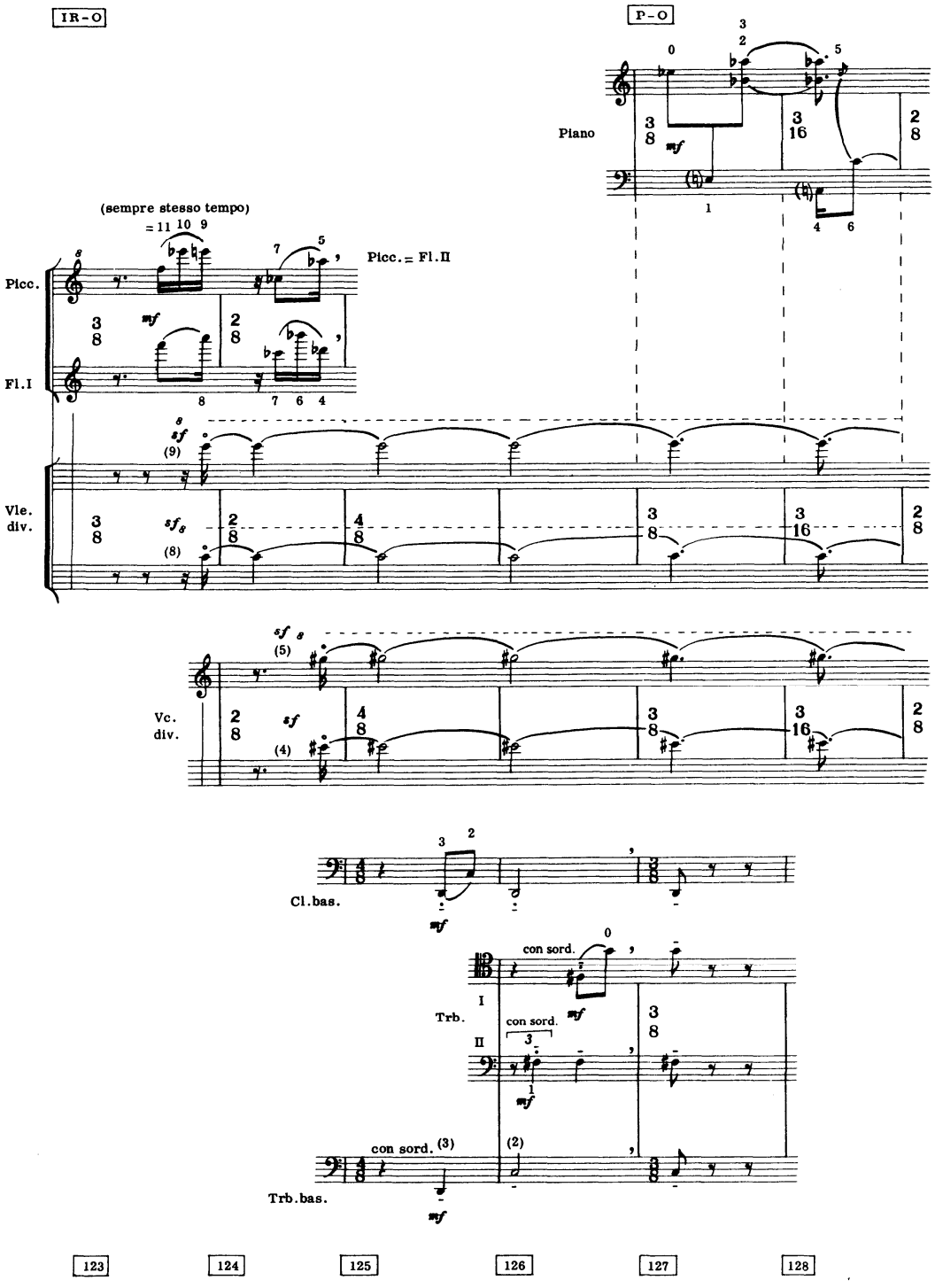
Fig. 150 Stravinsky, *Movements*, IV, with note count




I-O
IR-O
Piano
Vle. div.
Vc. solo
Vc. div.
4 Vc. soli
poco sf
attacca subito
mf p sub.
103
104
105
106
107
108
109


R-O
IR-O
Piano
Picc.
Fl.I
(stesso tempo)
Cl.
Cl.bas.
(This passage may also be derived from RI)
Vle. div.
Vc. div.
110
111
112
113
114
115


R-O
P-O
Piano
r.h.
Vle.
div.
Vc.
div.
4 Vc.
soli
attacca
subito
116
117
118
119
120
121
122


IR-O
P-O
Piano
(sempre stesso tempo)
Picc.
Fl.I
Picc. = Fl.II
Vle.
div.
Vc.
div.
Cl.bas.
Trb.
I
II
con sord.
Trb.bas.
con sord. (3)
123
124
125
126
127
128

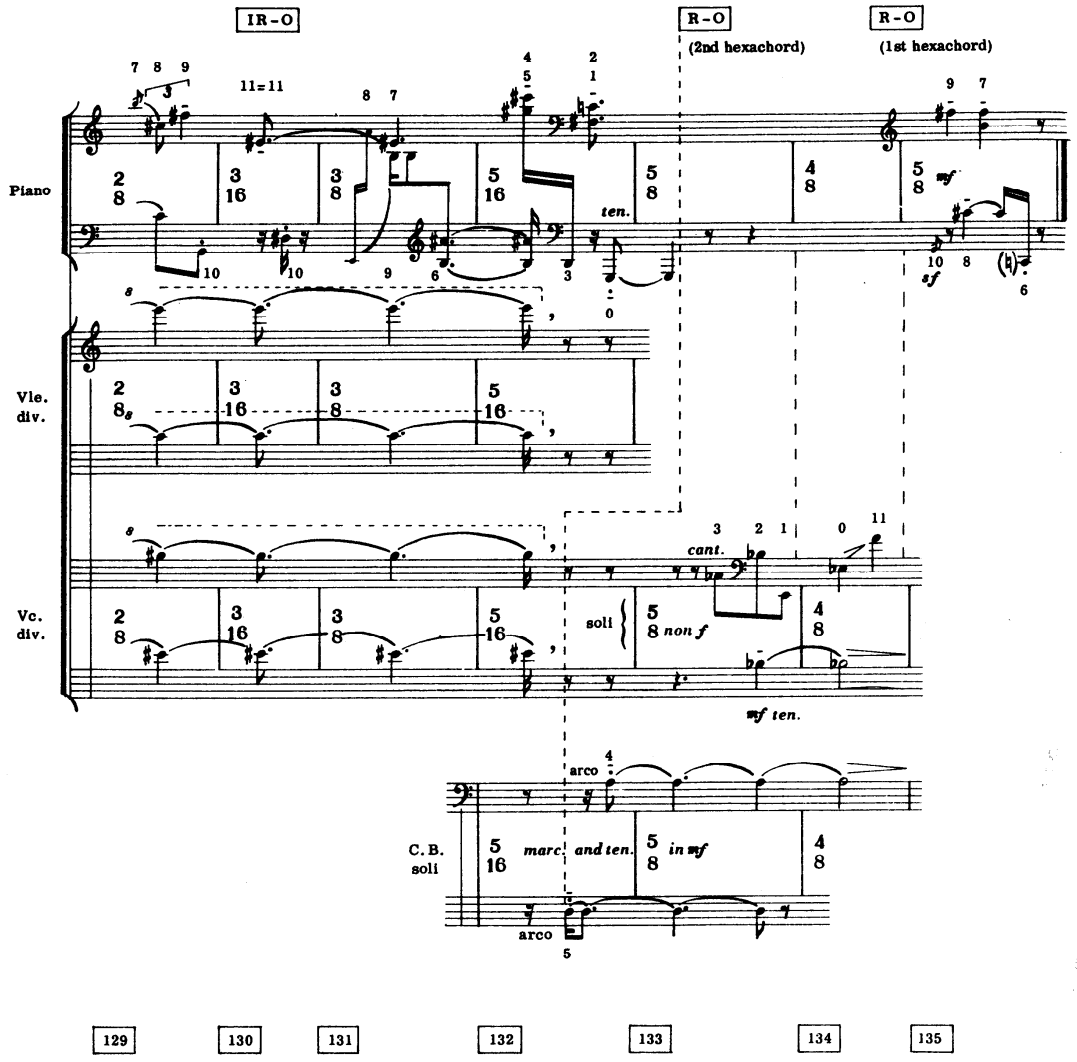

IR-O
R-O
(2nd hexachord)
R-O
(1st hexachord)
Piano
Vle.
div.
Vc.
div.
C.B.
soli
ten.
cant.
soli
non f
mf ten.
arco
marc. and ten.
in mf
arco
129
130
131
132
133
134
135

Fig. 151

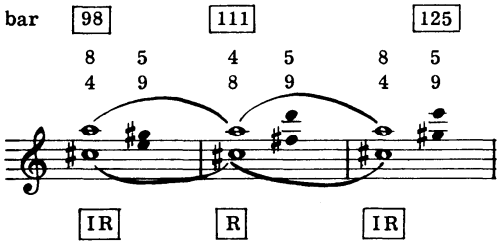
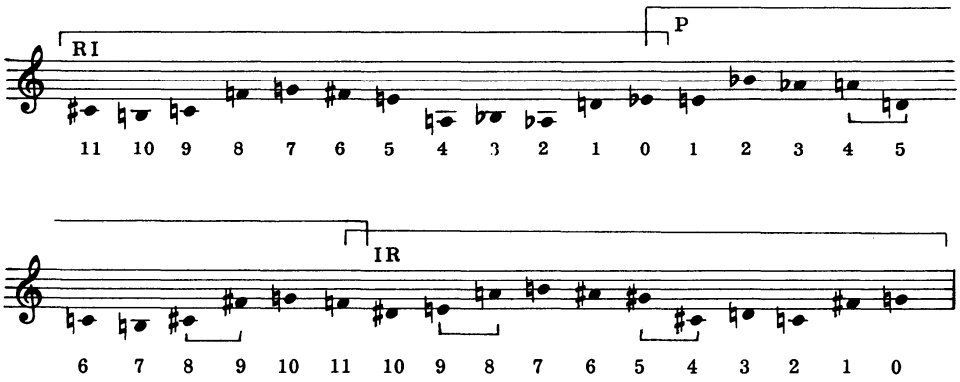


Fig. 152 Serial transforms in *Movements*, IV



4–5 and 8–9). The A and C♯ are common to both P and IR, providing an audible link between them;[1] but the other two notes are different (D and F♯, or E and G♯) and so these serve to identify the particular transform in use. Furthermore, if you examine the series closely, you will find that there are four other pairs of notes which are also common (or *invariant*) as between P and IR, namely D – C, E – E♭, A♯ – G♯, and G – F♯; the last two also appear in RI. As you might expect, then, all these pairs of notes play a disproportionately prominent role in the music – sometimes, as in the cello solo at bar 107 and in the bass clarinet and trombone at bars 125–6, being marked with accents or doubled. On the other hand there are other prominent two-note motifs, such as the minor seventh B–A in the fourth cello at 106, which do not recur as between the various serial

[1] Mathematically this is a perfectly trivial consequence of the fact that A and C♯ are equidistant from F, the axis of inversion betwen P and IR. But the important question is not why these formal relations hold: it is what use the composer makes of them.

transforms and which therefore serve to distinguish them from each other. In this way Stravinsky can choose to emphasize either the similarities or the dissimilarities between the various serial transforms, according to the motives he selects from them.

What is happening in this piece, then, is that Stravinsky is using informal, surface aspects of the music – motivic and chordal textures, register and dynamics – to project underlying serial relationships. To use Perle's terminology, the compositional structure is designed so as to present certain precompositional structures clearly. The principal technique Stravinsky uses to do this – the invariance of certain adjacent notes as between different transformations – is similar to that used by Webern in his Piano Variations. But Stravinsky uses the technique in a considerably tighter manner, employing a much smaller number of transforms than Webern. In a real sense the form of Stravinsky's movement, unlike that of Webern's, is most concisely expressed in the chart of its serial transformations. This is shown in Fig. 153. You can see that in nearly every case the series appears in a transformation inversely related to the corresponding point in the previous section. (Retrogression is irrelevant in this.) And since two inversions cancel each other out, the third section ends up more or less the same as the first; this means that the serial structure outlines an ABA plan roughly analogous to a tonal composition in ternary form, in which the same material appears successively in tonic, dominant and tonic.[1] This sectional pattern of identities and non-identities, repeats and transformations, is therefore a genuinely serial form, though a simple one; Fig. 154 shows the close association in each of the three sections between particular members of the series and the phrase structure outlined by orchestration, which is really the principal means of compositional articulation in this movement and in *Movements* as a whole.

Fig. 153

Bar				
96	IR	R	I	IR
110	R	IR	R	P
123	IR	P	IR	R

[1] Only the final appearance of the series – at bars 132–5 – deviates from this plan; it is altogether an eccentric statement, since the hexachords come in reversed order. I do not know whether Stravinsky is making some structural point here.

Fig. 154

2 flutes	4 –11				
Vle/vcl div.	4 –5, 8–9				
Variable group	0 –3				
Piano		0 –11	0 –11	}	0 –11
Vcl/cb soli					

However, this basically tight association between serial structure and musical surface is realized much more flexibly than was the case in Webern's Piano Variations. The rhythm of the piano part in bars 127–135 precisely repeats that of bars 100–109 (this, like the string harmonics chord previously discussed, advertises the ABA plan) but apart from this the links between the various statements of the series are quite loose and informal. Examples of these are the rhythmic link between the piano at bars 104–5 and 117–18, and the quasi-tonal C – D – F♯ – G formation that appears prominently three times – at bars 108–9 and 132 in the piano, and at bars 126–7 in the bass clarinet and trombones where the repeated chord not only draws attention to the formation but links up with a motif that runs throughout *Movements*.[1] In fact calling these surface formations 'statements' of the series, while of course correct, can be misleading in that it suggests that the only function of the surface is to project the series. It is undeniable that a rather pedagogical conception of music – as a projection of formal structures – is built into the serial method; but it is perhaps better to think of the musical surface of *Movements* (more so, paradoxically, than that of Webern's so-called Variations) as a series of fairly free variations on the series, because doing so puts the emphasis on the individual characteristics of each section of the music rather than on the underlying plan that is common to all of them; and, besides, the basically linear way in which each section varies the series is akin to the variation technique found in Stravinsky's non-serial music. After all, the surface of the music could not possibly be deduced from the serial plan, tight though the relationship between that plan and the musical form may be; everything I have said about *Movements* would apply equally if the entire piece were played upside down or backwards. The formal relationships

[1] Eric Walter White called 108–9 'a moment of ghostly allegiance to the tonality of G major', deriving it in a complicated and mistaken way from a reordered segment (6, 7, 8, 10, 9) of I–7 (*Stravinsky: the Composer and his Works*, 2nd edn., p. 506).

would still hold, even though the sound would be quite different. And if so little of the music we hear can be deduced purely from the serial plan, then equally little of the music's effect can be explained purely in terms of that plan.

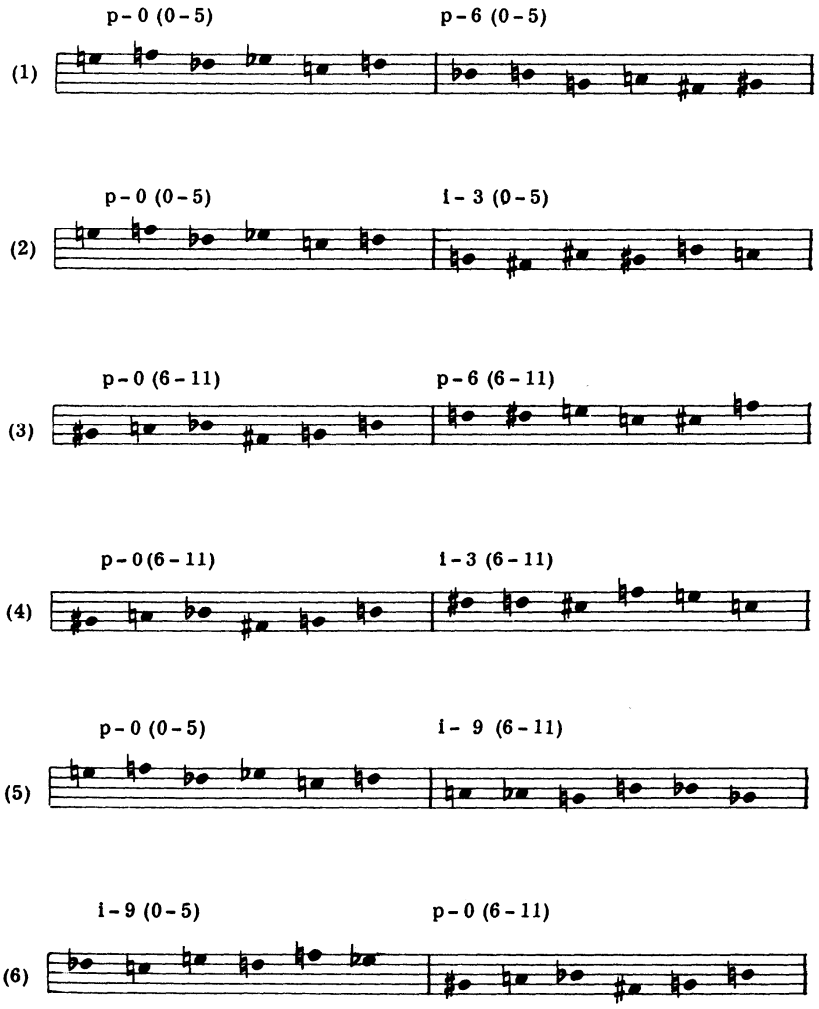
V

The final piece of serial music that I am going to discuss is Schoenberg's Op. 33a, which also closely integrates the serial with the musical form, but which does so by means of a much more explicit analogy between serial and tonal structure than the one I made with regard to *Movements*: Op. 33a is quite simply a serial sonata movement. However, before this can be properly illustrated there is one further technique for associating serial transforms to be explained. The kind of invariant formations I have been talking about do not really involve the structure of the series as a unit – they merely consist of isolated pairs of notes which recur under transformation, or groups of notes which share the same intervals and thus exchange positions under certain transformations. The technique Schoenberg uses extends this in two ways. First, it is based on the overall content, rather than the specific ordering, of consistent segments of the series such as hexachords or tetrachords (sets of four notes); this means that these segments are functioning as structural units. Second, it does not depend on relations of identity but of complementation between these segments (though obviously these properties are linked).

To clarify, suppose we look at the series of Webern's Piano Variations again. If we take its first hexachord and couple it with its transposition at the augmented fourth, as in the first line of Fig. 155, we end up with a new twelve-note set, since no notes recur as between the two hexachords; and this means that the two transforms of the first hexachord p–0 and p–6 are complementary. The same applies when p–0 is coupled with i–3 instead of p–6, as in line (2); and the same relations naturally hold for the second hexachord of the series as for the first, as shown in lines 3 and 4. Furthermore, a twelve-note set can also be formed between the first and second hexachords of the series when one is inverted in relation to the other: lines (5 and 6) show this. Here, then, we have six varied twelve-note sets each of which is derived from the original series (and the number of distinct sets can of course be multiplied by retrogression), and which could be used as semi-inde-

pendent subsidiary series. Alternatively you could use two different transformations of the series at the same time while maintaining a consistent chromatic sonority. It would have been easy for Webern to have done this in his Piano Variations; instead of merely coupling statements of one hexachord of the series with the other hexachord (which by definition gives you all twelve chromatic notes), he could have coupled one hexachord with a transformation of itself or a transformation of the other

Fig. 155 Combinatorial relations in the set of Webern's Piano Variations



Lower case letters identify transformations of a segment, rather than of the series as a whole.

hexachord, choosing the particular combinations that give a twelve-tone aggregate – that is, all twelve chromatic notes – in the case of this series. However, he didn't: and in fact Schoenberg was the only one of the Second Viennese School to exploit *combinatorial* relations, which is what this way of combining different segments of a series is called.

According to Milton Babbitt's terminology, which is widely used where a precise formulation is required,[1] a series is described as 'hexachordally combinatorial' when one hexachord forms a twelve-tone aggregate either with a transformation of itself or with a transformation of the other hexachord. And where there are multiple relationships of this sort, as in the set of Webern's Piano Variations, the set is referred to as 'all-combinatorial'. Hexachordal combinatoriality, though in practice much the most important, is not the only form of combinatoriality. You can get a twelve-tone aggregate equally well from combining three cells of four notes each, or four cells of three notes. Series that allow such combinations are called tetrachordally and trichordally combinatorial; the series of Stravinsky's *Movements* is trichordally combinatorial because either half of the second hexachord (but not the first, unless it is rotated) can generate a chromatic aggregate. The subsidiary twelve-note sets that result from such combinatorial relationships are termed 'derived sets' when they are formed from one segment under various transformations, and 'secondary sets' when they are derived from a number of different segments. It is probably worth using this terminology because it is explicit and consistent, but it is more complex than is actually necessary for an understanding of Schoenberg's relatively restricted use of combinatorial relationships; only when trying to account for the procedures of post-war American serialism does it become really indispensable.

Now it may have struck you that the combinatorial properties of the series I have discussed are really rather trivial, because in each case the segment I have discussed has simply consisted of a wedge of chromatic notes – so that it is quite obvious that a twelve-tone aggregate can be formed by piling these wedges on top of each other, and that inverted forms have the same properties as uninverted forms. However, combinatorial relationships are not generally so obvious, necessitating more deliberate planning on the composer's part – and more systematic unravelling on the analyst's. The series of Schoenberg's Piano Piece Op. 33a exemplifies this, and it is shown in Fig. 156. It could of course be

[1] 'Set Structure as a Compositional Determinant', *Journal of Music Theory*, V (1961), p. 72 ff. See also Perle's *Serial Composition and Atonality*, 5th edn (1981), pp. 96–104, for a concise explanation of combinatoriality.

calculated numerically, but possibly the easiest way of grasping the combinatorial relations of this set is by visualizing the first hexachord in the manner shown in Fig. 157. Seen like this, it is evident that it is made up of two chromatic wedges and that there are gaps between these wedges into which the wedges will fit when transposed (that is to say, shifted to the right in the diagram); but it is also clear that each wedge has to be transposed a different amount, so that the combinatorially equivalent transformation is not a straight transposition. It is, in fact, P–0 and I–5 that are combinatorially related (as Fig. 158 shows), and it is this particular combination of sets that Schoenberg uses in most of his mature serial works.[1] Apart from bars 1–2, 6–7, and 37–8 (in which these transformations, or their retrogrades, are used one after another) the whole of Op. 33a is made up of pairs of combinatorially-related sets used concurrently; while in the development section (bars 25–32:1) pairs of combinatorially-related hexachords are used. Consequently there is no particular reason to regard the single twelve-note series P–0 as the basic structural unit; really it would make just as much sense to regard the 24-note combined set P–0/I–5 as the basic unit, or to derive everything from a single hexachord.

Fig. 156 Series of Schoenberg's Op. 33a

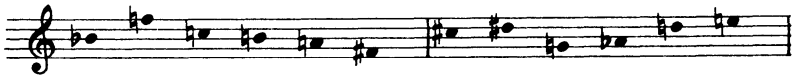
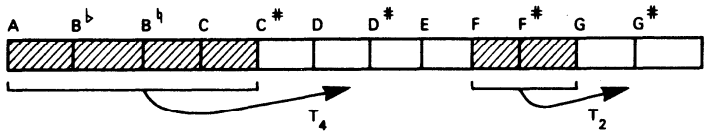
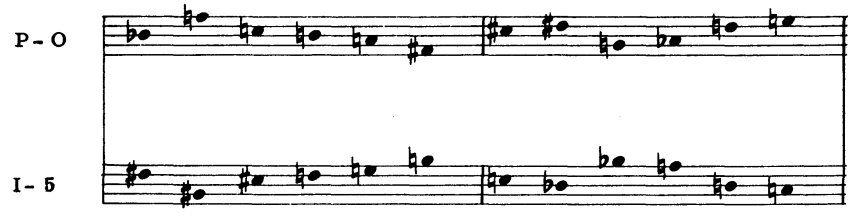


Fig. 157



[1] In fact the specific hexachordal content we find here – chromatic wedges of four and two notes separated by a minor third – also recurs several times in Schoenberg's mature serial works: see the Variations for Orchestra and the String Trio. But of course the ordering is different.

Fig. 158



There are other significant features designed into the series of Op. 33a apart from combinatoriality. As Fig. 159 shows, all interval classes appear between adjacent notes; the series presents a much more balanced spread of interval classes than the other series we have discussed. Therefore what gives the series of Op. 33a its distinctive character is the way its component intervals are organized according to the different ways in which the series, as a unit, can be split into segments or *partitioned.*[1] What we are concerned with here is the totality of the intervals between the notes of a given segment regarded as a harmonic unit – in other words, with what Allen Forte calls their 'interval vectors' (p. 134 above). When you split the series into hexachords, each hexachord has the same interval vector; that is obvious, since the hexachords are transformationally equivalent. And each hexachord contains all interval classes in a balanced distribution; this is shown in Fig. 160 where the interval vectors of the different segments are compared. In the second subject (bars 14–18, 21–23:1, 35–6) Schoenberg stresses the hexachords, treating them in effect as antecedent and consequent; but because the hexachords contain every interval class within them, this theme does not have any very striking harmonic identity as a whole, and the clear association of these passages with each other depends more on texture and register. By contrast, segmenting the series into tetrachords produces much more distinctive harmonic formations; you can see this from Fig. 160. And Schoenberg uses these distinctive harmonic formations to mark the first subject, which consists of a succession of four-note chords. Finally, segmentation by threes characterizes the development and again this produces distinctive harmonic formations, such as the superimposed fourths of the first trichord and the [0, 2, 6] formation

[1] By 'as a unit' I mean that, for instance, the significant tetrachords are 0 – 3, 4 – 7, 8 – 11 and not 1 – 4, 2 – 5 and so on. Strictly speaking 'partitioning' means something different from 'segmentation': partitioning is a formal property belonging to the series, segmentation means the way the composer chooses to divide it up at any particular point.

found in both the third and fourth trichords: a formation which can either lend a momentary tonal coloration (as an incomplete dominant seventh) or be used to build up whole-tone harmonies. An important aspect of combinatorial serialism is that it allows you to magnify the particular intervallic characteristics of a segment while keeping all twelve pitch classes in circulation, by using the same segment simultaneously in two combinatorially-related statements of the series. This is what is happening at bars 5–6 and 27, where the fourths and whole-tone harmonies reach their respective peaks. This is what is meant by the statement you will sometimes come across to the effect that combinatorial serialism stresses the harmonic rather than the linear aspects of the series – a statement which is otherwise puzzling, since by definition combinatorial relations depend on all twelve notes being present as an aggregate, so that it is only the sequential patternings of the notes that distinguishes one transformation from another.

In his book *Serial Composition and Atonality* (p. 113) George Perle

Fig. 159

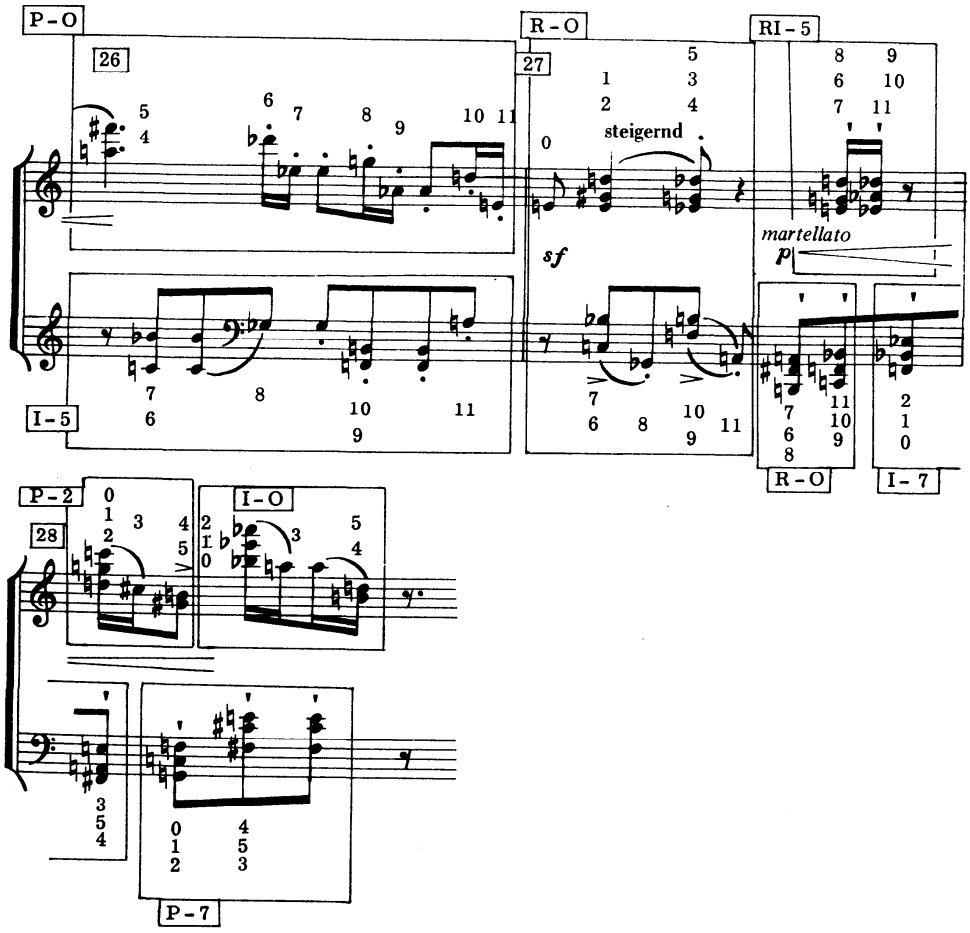
Interval class	1	2	3	4	5	6
Webern, Piano Piece	7	0	2	1	0	1
Webern, Piano Variations	4	2	1	3	0	1
Stravinsky, Movements	4	4	0	0	2	1
Schoenberg, Op. 33a	2	3	1	1	3	1

Fig. 160

Interval class	1	2	3	4	5	6
Hexachords (1,2)	4	2	2	2	3	2
Tetrachord (1)	2	1	0	0	2	1
(2)	0	1	2	1	1	1
(3)	1	1	1	1	1	1
Trichord (1)	0	1	0	0	2	0
(2)	0	1	1	0	1	0
(3)	0	1	0	1	0	1
(4)	0	1	0	1	0	1

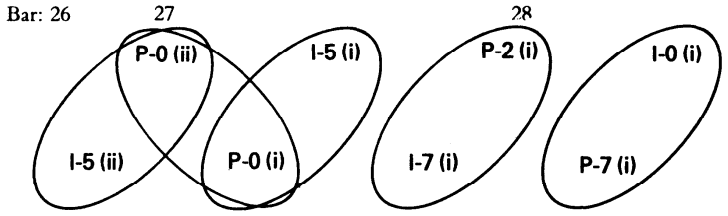
gives a chart summarizing the precise associations between different segmentations of the series and the traditional sonata pattern of Op. 33a. The transpositions within which the P-0/I-5 combined set appears are also associated with the sonata form, although they are not quite equivalent to the traditional tonal plan since the first transposition occurs near the beginning of the development (bar 27) and not with the second subject; this might be better regarded as an attempt to recreate the tensional arch-shape typical of a sonata rather than as a direct substitute for tonal relations. Nevertheless, the return from the 'foreign' transposition of P-7/RI-0 to the 'home' combination of P-0/RI-5 at the point of recapitulation is clearly modelled on tonal practice; there is even a cadential pause preceding, so to speak, the final tonic. And the first 'modulation', at bar 27–8, is also similar to tonal practice – at least its

Fig. 161 Schoenberg, Op. 33a, bars 26–8



technique is comparable, even though the aural effect clearly is not. Fig. 161 shows the passage, and Fig. 162 represents the serial relations schematically; the circles represent twelve-tone aggregates between hexachords. Only the first hexachord of the series is used in the actual 'modulation' (the second does not appear until the very end of bar 28), and Schoenberg takes advantage of the way in which the fourths of this hexachord overlap as between the different serial transforms he is using. Fig. 163 explains this and it shows how each trichord appears once and once only. This means that the fourths have different functions each time they appear, and what these functions are is only made clear by the other notes of the hexachord. These vary between transformations and thus serve to identify the transformation in use (this is a bit like the role chromatic inflection has within a cycle of fifths). The most interesting example of this technique, however, occurs in the right hand of bar 27 – that is, just before the 'modulation' proper. This is the only time Schoenberg exploits a peculiar relationship that exists between certain trichords of P-0 and I-5 and which you can see if you turn back to Fig. 158: the first two trichords of I-5 are the same as the final two trichords of P-0 (which are themselves transpositionally related) except that the G and the G♯ swap positions. Schoenberg is making this relationship as plain as he can in bar 27 by keeping each note in the same register throughout the passage.

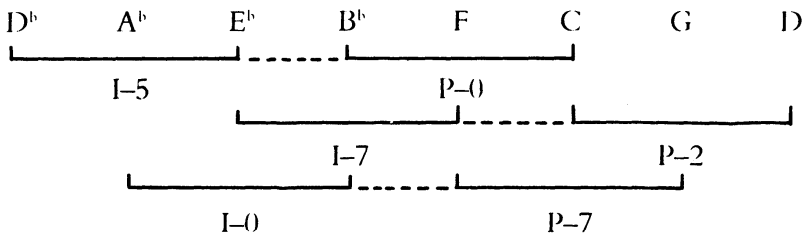
Fig. 162 Serial plan of Op. 33a, bars 26–8



(i) and (ii) mean first and second hexachords. Primes are not distinguished from retrogrades.

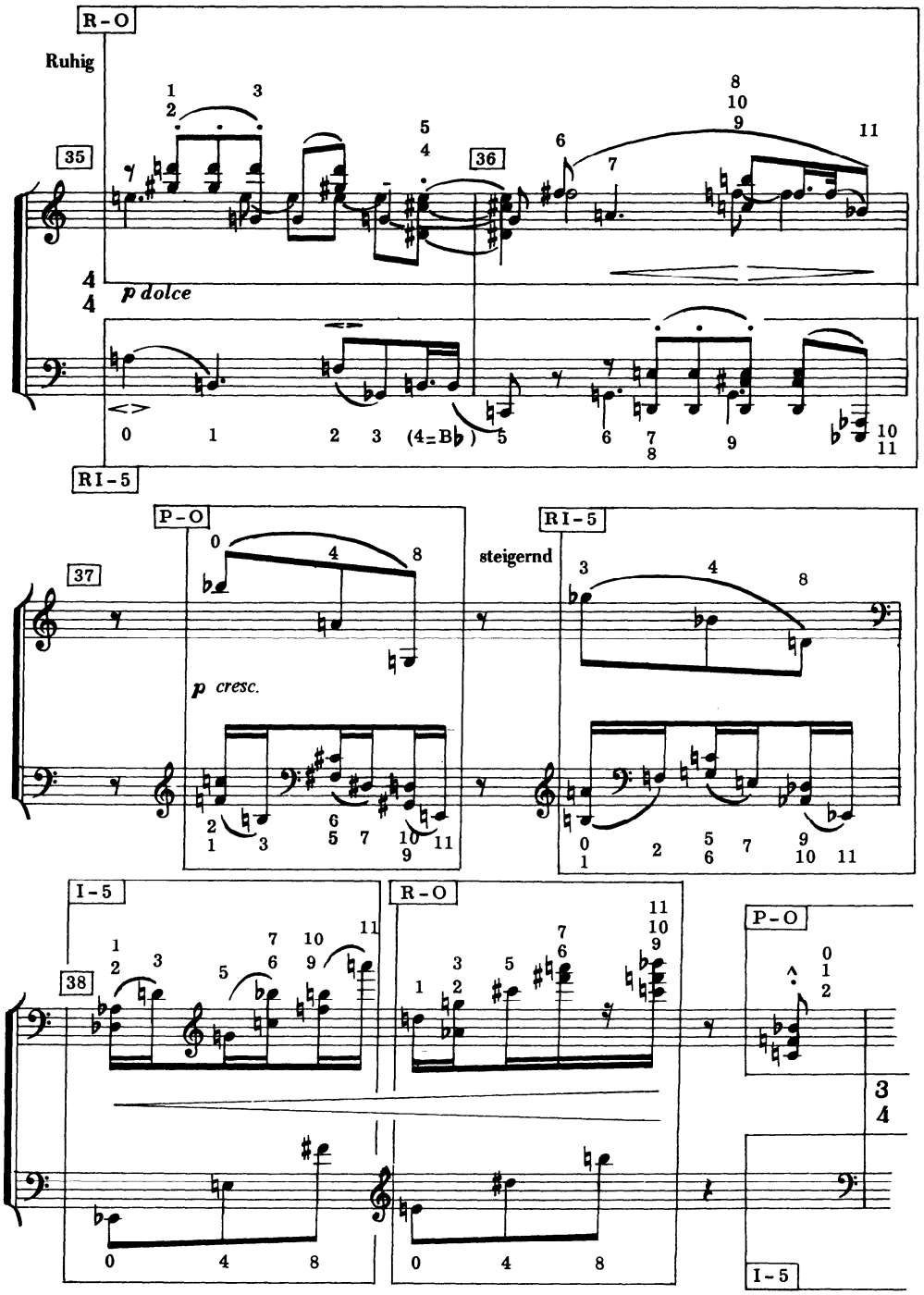
But all this rather abstract discussion tells us more about Schoenberg's technical aims than it does about the effect of the music. As usual, this depends to a very large extent upon factors that have little or nothing to do with the abstract structure of the series, and this is true both at the local level and in terms of the large-scale form. It can best be illustrated by examining first the phrase structure of the music and then its texture.

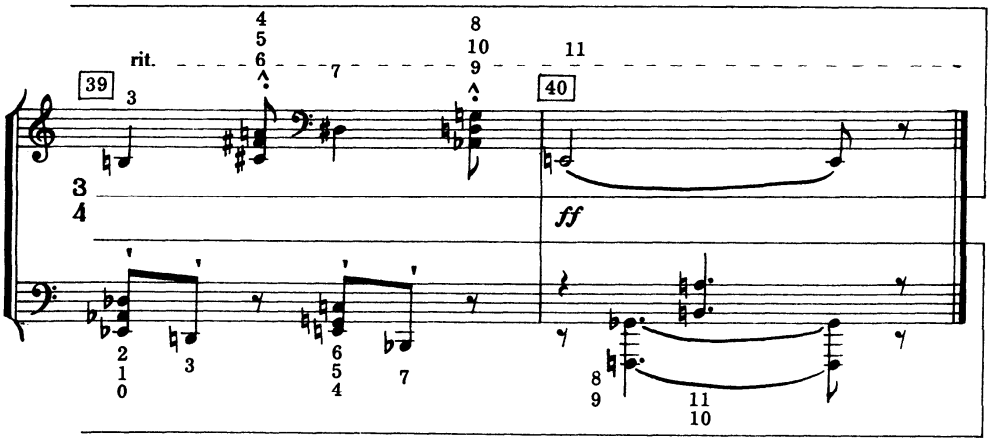
Fig. 163 Invariant fourths in Op. 33a, bars 26–8



The series of Op. 33a is buried deeper beneath its surface than is the case either in Webern's Piano Variations or Stravinsky's *Movements*. This becomes particularly plain if you compare the final bars of Op. 33a, in which the serial structure is palindromic (Fig. 164), with similar passages in the Webern piece. Only in the development, round bar 28, are brief surface phrases found which are transformed more or less in accordance with the serial plan, and these are clearly modelled on the sequential working of tonal developments. Nevertheless, the beginnings and endings of serial statements do generally coincide with the beginning and ending of phrases; and though there is not any very definite association of particular formal elements with particular transformations, structurally important points in the form generally coincide with a new transformation. However it is non-serial elements that have the crucial role in defining phrases: the same arch-like contours can be seen in register, dynamics and tempo. There are even cadential patterns (bar 13 rhyming with bar 8, for instance) whose syncopated rhythms come straight from Richard Strauss. And, as the application of the term 'syncopation' implies, there are definite upbeats and downbeats; the rhythm of, say, bar 27 clearly demands that the right hand chords on the second and seventh quavers of the bar be heard as dissonances, resolving to the chords that follow them. And how is this to be achieved in the absence of tonal relationships? Partly through the superficial kind of dissonance that can be created by registration and intervallic content, but mainly by the performer: the result is the somewhat cloying style of performance that is practically impossible to avoid when playing this piece, in which downbeats and other aspects of phrasing are projected by exaggerated dynamic accents and rubato. The same applies on the formal level: the conventional characteristics of the various formal areas all have to be exaggerated if the sonata plan is to be made perceptible – the assertive quality of the 'masculine' first subject, the downright slushy quality of the 'feminine' second subject, the tempestuous and

Fig. 164 Palindromic pattern in Op. 33a, bars 35–40





Bar	35	37		38		39
	R–0 RI–5	P–0	RI–5	I–5	R–0	P–0 I–5

gestural quality of the development (which, if it is played at anything like Schoenberg's metronome marking, goes so fast that the listener takes in little more than a build-up to the high chord at bar 28:2 with which the two virtuosic gestures at bars 29:3 and 30:4 begin). All this illustrates the importance of non-serial elements in clarifying not so much the serial structure as such, but the formal structure of the piece.

Like the phrase structure, the texture of Op. 33a has some association with the serial plan but is largely independent of it. As I said, the series is so designed that different textures – four-note as against three-note groups and so on – result in different harmonic formations, and some of the music's prominent minor-seventh dyads (or two-note groups) are directly derived from the series.[1] In particular A – B and D – E are invariant as between P–0 and I–5; but this does not apply to the equally prominent E♭ – D♭, while the important appearance of the major seventh B – C at the beginning of bar 12 requires a reordering of

[1] Why the prominent use of minor sevenths? Because they can be part of a fourths chord, a whole-tone chord, and tonal dominant or secondary seventh chords. These are all important harmonic formations in Op. 33a and the use of minor sevenths not just as dyads but as the outer notes of three-note chords helps harmonic integration.

P–0 for its achievement. In any case there are important aspects of the handling of chords that are purely traditional. It is very noticeable that Schoenberg tends to use each of the more prominent chords in a consistent formation throughout, that is to say with the different notes registered in the same way relative to each other (though the absolute registration may vary, except in the case of immediate repetitions – of which Schoenberg makes a great deal of use here). This helps to delimit and structure the otherwise rather diffuse harmonic vocabulary of the music; the chords singled out in this way are in fact largely similar to those found in Schoenberg's pre-serial music. Indeed, there are moments in Op. 33a which are clearly tonal, not simply in that tonal formations appear, but in that there is a harmonic effect which would disappear if the music were turned upside down – an operation which is by definition neutral as far as purely serial structure is concerned. The clearest of these moments is the VI^9 of $A^\flat$ in bars 17, 18 and 34. The first subject, too, has enough tonal coloration for the statement at bars 10–11, where the chord series is used forwards and backwards simultaneously, to sound distinctly bitonal. These tonal colorations function like the fourths and wholetones: as a play of light and shade, and as a recognizable sonority for highlighting important points, but without any deeper connection with the musical structure. In fact one could say that Schoenberg reverses tonal practice in that harmonic structures play a purely surface role in his sonata, while phrase structure and texture are the main means of formal articulation. This again emphasizes the importance of the compositional, rather than the purely precompositional, aspects of serial music – compositional aspects that vary widely between the three composers considered in this chapter, even though the serial technique they use is essentially the same.

VI

I began by saying that when they analyze serial music people tend to concentrate on the systematic, precompositional aspects: there seems to be a vague assumption that this must somehow explain the musical effect even when it is obvious that it does not relate to anything the listener is consciously aware of. It seems to me much more realistic to assume that twelve-tone series have very little perceptual identity and their transformations less, except under very constrained conditions

such as those of Webern's compositions that have extremely clear textures and use series made up of a few simple trichords. (Even then, it is probably the motivic identity of the trichords rather than their systematic association into twelve-tone series that most listeners perceive.) By contrast, textural techniques such as registration, repetition, grouping notes into motifs or chords, and associating non-adjacent notes by retiring unwanted pitches into the background, have far more effect upon the listener's experience; indeed they can be used to 'derive' more or less any desired formation from more or less any series. (This is made obvious by extreme cases such as Berg's serial 'composition' of Bach's chorale *Es ist genug* in his Violin Concerto). Books of instruction in serial composition, like Rufer's and Perle's, mainly consist of illustrations of such techniques, even though these are not serial techniques at all but simply compositional techniques – more specifically, they are variation techniques. In fact, the relatively simple techniques based on invariance and combinatoriality that I have described in this chapter constitute practically all the specifically serial techniques that can be found in works of the Second Viennese School (apart from Berg at any rate).

There are of course much more complicated serial techniques in post-war works: but techniques such as rotation and other permutational devices, Boulez' 'proliferating series' and the extension of serialism to parameters other than pitch always seem to mean a decline in serial perceptibility so drastic that trying to work out serial structure in such cases becomes as musically pointless as it is difficult and tedious. If it is the music rather than the compositional process that you are interested in, then the first step required in analyzing pieces like Boulez' *Le Marteau sans Maître* is to repress the natural urge to discover ciphers and secret keys and instead to attend to what you hear. But even when discovering the serial structure is straightforward, you should not think of this as a substitute for other analytical techniques. It would be better to think of it as on a par with the analysis of compositional sketches: that is, as a means of reconstructing the process of composition, which now and then illuminates problematic aspects of the musical experience.