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This article presents a brief outline of a theory of segmentation and an analytic method which I believe can be fruitfully applied to many twentieth-century compositions. In order to give as concrete an explanation as possible I will develop the theory through a close analysis of the opening measures of three works.[1] These works are the first of Schoenberg's Five Piano Pieces, op. 23 (1920); the second movement of Webern's Concerto, op. 24 (1934); and Stefan Wolpe's String Quartet (1969). Although these analyses are very detailed they are not complete and are intended primarily to illustrate theoretical points. For reasons which will become clearer below, it will be impossible in this limited space to present analyses of larger sections of a piece owing to the necessity of examining passages in great detail before proceeding to larger, more inclusive levels of analysis. Also we will proceed chronologically from the beginnings of pieces in imitation of the audition of the work, assuming that the meaning of a passage is conditioned to some extent by all that has preceded it. I have chosen to begin with the Wolpe because it is very clear in structure and will illustrate most of the essential aspects of segmentation in just a few measures. The Webern and Schoenberg works will illustrate some techniques not found in the Wolpe and will offer a broader view of the possibilities of structural formation.

Segmentation is generally understood as the division of a musical work into structural components. In the context of post-tonal music it also refers more specifically to the selection of structurally relevant pitch components or pitch-class sets. While segmentation will in the course of this paper be developed in the first, more general sense, I shall approach this topic through the more specific question of pitch relations.

The segmentation of a post-tonal work into constituent pitch-class sets presents the analyst with a number of important and related problems: the selection of relatively few pitch-class sets from the great number of possibilities; the treatment of pitch relations excluded from a set-class analysis; the relation of other parameters to those of pitch and interval; the significance of the selected relationships for musical hearing; and, finally, the problems of musical development and form. Each of these problems warrants more attention than can be given in the space of a single article.

Yet these topics are interrelated to such a degree that it is impossible to reach an adequate understanding of one without dealing to some extent with all the others. For this reason I will briefly address all these problems and suggest some possible

A version of this paper was read in Denver at the Third Annual Meeting of the Society for Music Theory in November of 1980.

[1]In this study I am indebted to the work of many researchers, particularly to that of Allen Forte whose nomenclature for pitch-class sets will be employed in the following analyses.

solutions beginning with the first—the question of selecting structurally significant intervallic relations. Due to the scope of the subject the treatment of segmentation presented here will necessarily be synoptic and in many ways incomplete. The solutions which I shall propose are not intended to be definitive but are offered in the hope of providing a useful point of departure for the continued investigation of important musical developments of our century which are still far from being understood.

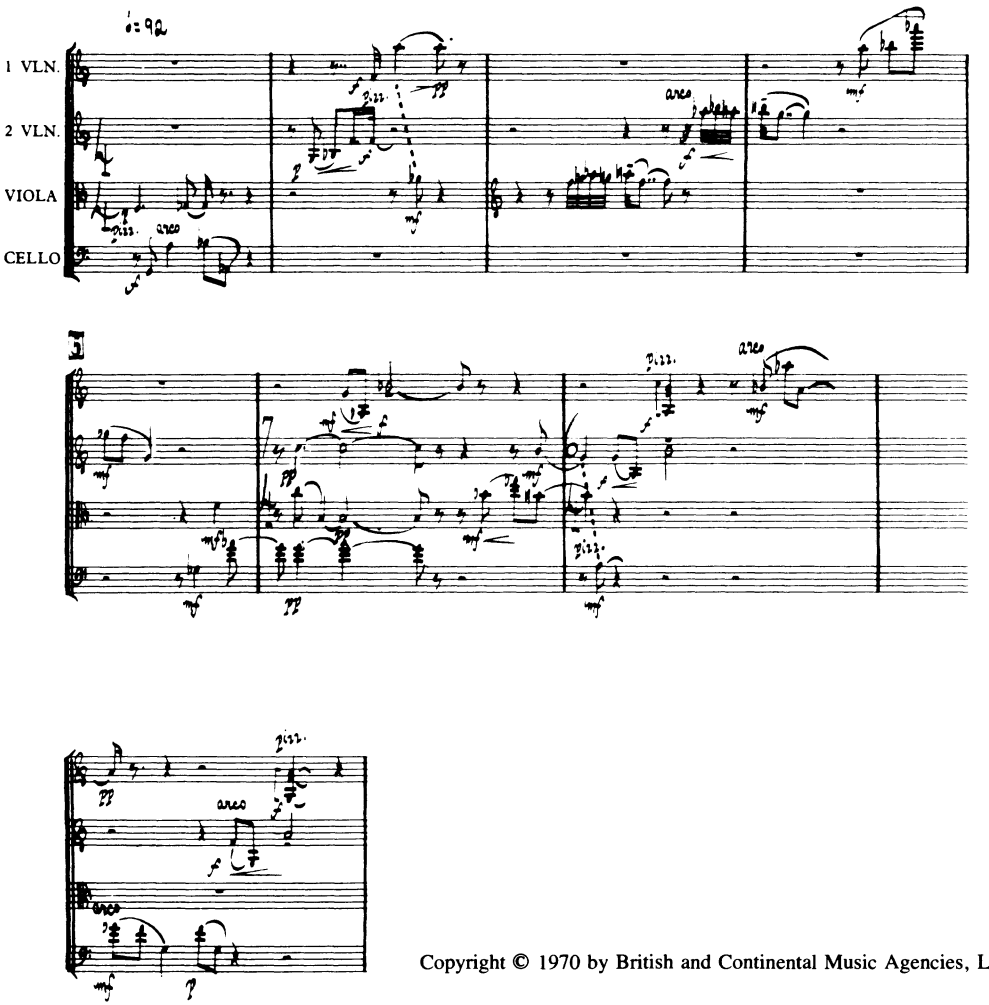
Before proceeding to an examination of pitch relations some attention should be given to the analytic method employed in this paper since the procedure followed here may not always be apparent in the analyses themselves. This method comprises two distinct steps. The first step is introspective in nature and entails listening to the music very carefully and noting various structural perceptions. In the second step rules are devised to form a theory which might account for these perceptions. These rules must not also account for interpretations which contradict perception, but they may uncover perceptions which were initially missed. Thus the rules may be tested for their adequacy by being used to predict the results of perception. In the analyses presented in this paper these two activities will not be treated equally—emphasis will be given to the theoretical component which predicates implicit musical perceptions. Here the reader's cooperation is solicited. If after careful consideration the reader finds that an analytic statement contradicts his hearing then a refinement or renovation of the theory may be called for.[2] The theory I shall outline below will be useful to the extent that it is general and flexible enough to accommodate sensitive hearings.

To return to the initial question of set-class segmentation let us begin with the assumption that the particular quality of a pitch, its meaning as a tone, is in large measure determined by the intervals it forms with the other pitches with which it is associated. The intervals which a single pitch forms with other pitches in a given context I will call simply the *intervallic associations* of that pitch. The question that immediately arises is that of segmentation, that is, with which other pitches is a given pitch in fact associated and to what degree? In tonal music, the music of the major/minor tonal system, the answer to this question is largely given through an understanding of the categories of consonance and dissonance. In the music we are considering here this understanding is radically altered. With the "emancipation of dissonance" any interval is capable of being heard as self-sufficient; thus, in principle, any pitch may be associated with any other pitch and any number of pitches may conceivably be heard sounding together *(con-sonans)* as a comprehensible harmonic unit. This being the case, we are presented with a bewildering number of possibilities in trying to ascertain the intervallic relations of pitches in this music.

This problem can be confronted more concretely through an examination of the first measure of Stefan Wolpe's String Quartet, the opening of which is shown in Example 1. The first measure is separated from the music that follows by silence and by a change of instruments and register. (This is, of course, already a segmentation and we shall return to it.) We are presented with six pitches forming the chromatic hexachord, set class 6-1. Each pitch in this collection has a unique set of intervallic associations with the remaining members of the collection. For example, the first pitch, F, forms the intervals (assuming octave equivalence) 1, 2, 3, 4, and 5 with the other pitches (that is, F forms the interval of 1 semitone with G♭, 2 semitones with G♮, 3 with A♭, 4 with A♮ and 5 semitones with B♭). The next pitch, G, has the intervallic associations 1, 2, 3, 10, and 11 and so forth. To understand more of the meaning of these six pitches we will want to know more about their specific properties and relations within the abstract pitch-class set 6-1.

[2]The reader should be reminded that it is not the highly abstracted analytic objects per se (set classes, intervallic associations, etc.) which should or even can be heard in an experience of the music. Rather, it is the perception of musical articulatons which might result from the analyses that offer a test of the validity of analytic statements.

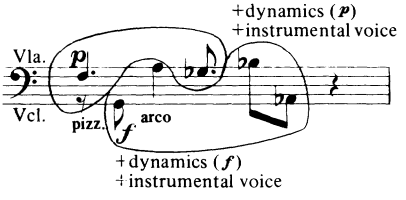
Example 1. Wolpe, String Quartet, mm. 1-8



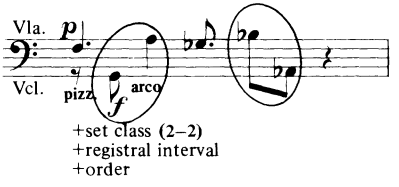
To ask what the dominant intervallic relations are is to ask which pitches interact with one another and to what degree.

Let us approach this problem by examining a few of the different ways of interpreting the first measure. I have listed six interpretations as Examples 2a, 2b, 2c, 2d, 2e, and 2f. In this measure one might hear the intervals formed among the five notes performed arco more strongly than the relationships of these five tones to the timbrally anomalous G pizzicato of the cello as is shown in Example 2c. Or, as in Example 2d, one might hear with particular clarity intervals formed among the last three pitches of the cello, the only pitches performed arco at the dynamic level of forte. In Example 2e is shown the possibility that one might hear the repetition of the whole-tone trichord, set class 3-6. These two occurrences of set class 3-6 have the same registral spacing and the second is expressed as a contour inversion of the first. All these possibilities are examples of segmentation. We have divided up this little bit of music into subcomponents, but how exactly has this been done? First of all we have invoked many musical properties, including timbre, dynamics, intervallic associations, register, and contour. These and many other properties I will refer to as musical *domains*.

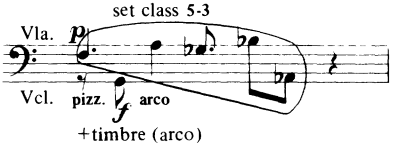
Example 2a. Segmentation 1



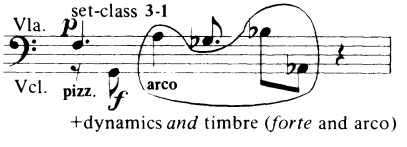
Example 2b. Segmentation 2



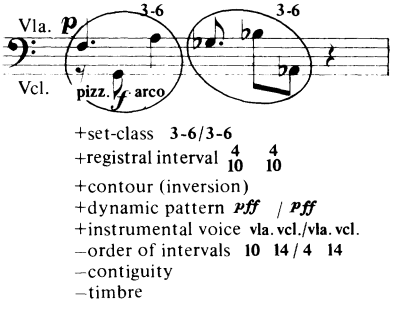
Example 2c. Segmentation 3



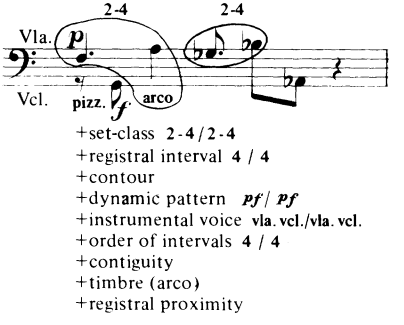
Example 2d. Segmentation 4



Example 2e. Segmentation 5



Example 2f. Segmentation 6



Each domain is characterized by the range of different values which we hear in a particular quality of musical sound. The definition of each domain is largely a stylistic matter. Also the relative importance of certain domains is not universally fixed. For these reasons the works of a single composer or an individual piece or even a section within a piece may create a particular definition of various domains. Some generalized domains may be broken down into more specific categories or subdomains. For example, the domain of intervallic association consists of three subdomains: that of registral interval or the actual distance between pitches measured in semitones; that of interval modulo-12 based on octave equivalence; and that of interval class in which an interval and its inversion are considered equivalent. Some domains consist of qualities which are not clearly related to one another. For instance in the domain of register at least three different properties may be noted: that of registral proximity, registral invariance and registral "function" (registral extremes or registral mid-point dividing or filling in a registral expanse). Space does not permit a closer examination of the structural properties of the domains, but reference to various domains in the following analyses should be clear.

The domains, while not functionally independent, are transparent of one another. For example, if presented with a single tone we are aware of the definite qualities of, let us say, duration and pitch but not of two objects—a duration *and* a pitch. For this reason we will say that in a particular musical object the various domains are in principle mutually undifferentiated, as in the example just given, where a change of duration will not alter the quality of pitch as pitch. For this reason we can treat the *structure* of different domains separately.

The problem of structure can, I believe, be approached through an examination of continuity and discontinuity in the values of the various domains. Very briefly stated, a change of value in a particular domain creates a discontinuity—a difference which isolates distinct objects for our attention. These distinct objects I will call elements. For example, in the first measure of the Wolpe work, six tones occur one after the other, each differentiated from the others as elements by their different values of pitch and temporal appearance. Such elements thus differentiated may, however, come to be heard as a unity if in some domain they possess identical values, that is, they may in turn become undifferentiated in this domain. Thus these six tones may be heard as a unity in that they all have the property of being initiated at regular intervals of the eighth note. This continuity of tones is, however, differentiated from the tones of measure 2 by silence; that is, the last tone of measure 1 and the first tone of measure 2 do not share that property by which the tones of measure 1 cohere. If there were rests in measure 1 the distinction between these two phrases could be destroyed. It is this property of being simultaneously differentiated and undifferentiated which creates structure. That is, the first six pitches being differentiated as elements become united as a structure through rhythmic non-differentiation. This structure itself becomes an element through its differentiation from the following music. Though this may appear to be making too much of the rather obvious reasons we hear the measure as a unity, I believe that the factors involved here can form a framework for understanding more complex phenomena.

To repeat: a structure has two aspects. First, it must have a unitary value in some domain, that is, there must be no change of value in this domain which would cause it to be broken up into subcomponents. Secondly, it must be distinguished as an object of our attention by possessing a difference of value in the same domain compared with another object. Thus, to take a very simple illustration, in Example 2c the five circled tones cohere as a structure because among themselves they are undifferentiated in being bowed but at the same time are differentiated as an object of our attention by the pizzicato G. It is this difference which allows this aspect of the domain of timbre to emerge as a distinctive feature.

On the basis of this concept of structure, a refinement may be

introduced in the definition of segmentation. Segmentation is the process of structural formation, the action of structures producing formal articulations. In drawing the concepts of structure and segmentation into such intimate connection, segmentation can be understood not as something imposed upon the work, but rather as something inherent—something to be discovered. Still, the terms are not synonymous. Stated in another way, segmentation may be regarded as the formation of boundaries of continuity and discontinuity which result from the structures of various domains. It is important to make this distinction between the terms structure and segmentation because, as can be seen from Examples 2e and 2f, many structures may share a single segmentation. In these and other examples a "plus" next to the name of a domain indicates a unity of value in that domain and a "minus" indicates a difference of value. Each of these six examples, 2a–f, represents a distinct segmentation of this measure.

Having indicated how segmentations arise, we must address two important and related questions: first, how can we choose among these six possibilities? And, secondly, how does this relate to our initial question of the meaning of pitch? Rather than to look for a single correct segmentation, let us consider the possibility of ranking these segmentations. We can consider stronger those segmentations which are supported by the greater number of domains. Thus segmentation five of Example 2e is stronger than segmentation three of Example 2c, the strongest being segmentation six shown in Example 2f. This solution is nevertheless somewhat arbitrary since all domains or combinations of domains are not equal in their aural immediacy and since we are primarily concerned with qualitative rather than quantitative distinctions. Nevertheless, as a general rule, stronger segmentations are usually more apparent to the ear and are usually borne out in the progress of the composition. Some different segmentations are not mutually contradictory, for instance, Examples 2b and 2f (the strongest of the six) are more specialized versions of 2e. On the other hand, some segmentations are quite incompatible, as between Examples 2d and 2e where different pitches are associated. However, I do not believe that contradictory segmentations entirely efface one another. Rather, ambiguity, if it occurs, is an extremely important aspect of this music. Although, as we shall presently see, some segmentations may have deep consequences for the work while others are quite ephemeral, the surface of the work supports all these structures and the surface absolutely determines the expressive quality of the music.

To return to our second question, an examination of pitch relations may help us to understand how these different segmentations exist simultaneously. For illustration let us turn our attention to just one of these pitches, the third note, A, although any of the pitches would serve equally well as an example. First of all, A is heard in the context of the six-note set, set class 6-1; its pitch quality is determined by all the intervals it forms with the remaining pitches of the collection. But this observation alone does not fully capture the specific quality of A in this context. Thus A could be given a very different quality by a rearrangement of these six pitches. The uniqueness of this pitch is to be found in the fabric of the pitch structures revealed in the various segmentations. Thus in Example 2c the interval A forms with G is suppressed—A becomes the A of set class 5-3. In Example 2d the intervallic association with B♭ and A♭ is heightened. In Example 2e on the other hand, A is strongly associated with the pitches F and G as a constituent of the whole-tone trichord 3-6. Of course, it is impossible to quantify precisely these intervallic associations, to say, for example, that A is five times more strongly associated with F than B♭ because five times as many domains support this hearing. However, it is possible to say that the predominance given to specific intervallic associations of a pitch arises from the strength of the segmentation. Thus I believe it can be maintained that the most distinct quality of the pitch, A, is its sounding of the interval 4 (or a major third) above F as is shown in Example 2f, the strongest segmentation. This can be maintained without in the least denying that the very

subtle quality of this pitch resides in the combination (in their various strengths) of all the intervallic associations that have been examined.

Having considered rather exhaustively the interaction of structures in this first measure, I would like to examine in much less detail the continuation of this passage in order to expand the concepts of structure and segmentation. In particular, I wish to show how multiple segmentations of the same material may be developed and how larger-scale structures arise.

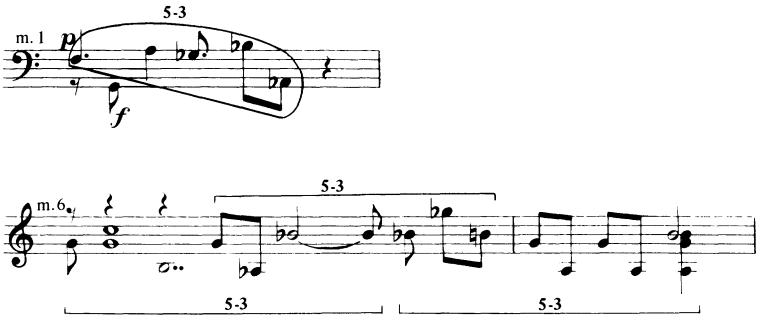
In Examples 3a, b, c, and d, four segmentations of measure 1 are listed, and below each is shown the reactivization of that segmentation in strong segmentations of the following music. Thus, for example, in 3c, segmentation five of measure 1 divides that measure into two statements of set class 3-6. Below this is shown the strongest segmentation of measures 7 and 8 which likewise results in the exposure of two statements of set class 3-6. Similarly, the other three segmentations of measure 1 in Examples 3a, b, and d form other structural connections within these measures. Segmentations one and two are latent possibilities in the material which remain unrealized in the first eight measures.

The presence of ambiguity in segmentation, of the sort we have seen in the first measure, allows for many interrelated lines of development to take place and thus makes it possible for the music to achieve a great structural richness and depth. As an illustration, one of the most important courses of development can be traced from the strongest segmentation, segmentation six (Example 2f). In Example 4a the first four measures of the piece are shown divided into three phrases. Each phrase is separated by silence and each is composed of six attacks. (The third phrase is divided into two parts—the first contains six attacks, but in the second part the first attack though sensed is omitted in the interest of rhythmic fluency.) Opposed to this division is another segmentation shown in Example 4b. Here these measures are divided into two parts. In the first part, the alternation of the intervals 4 and 3 which arises from segmentation six of measure 1 and is continued by the first two pitches of measure 2 which also continue the eighth-note pulse. The second part begins with the third pitch of measure 2 and initiates a new register and new values of duration. Interestingly, the interval class that separates these two phrases, interval-class 5, is otherwise quite suppressed in the first five measures and is for this and the above reasons non-structural (a *dis-sonans*), i.e., I believe we hear in measure 2 the interval G to B♭ and the interval F to A or F to A♭ much more clearly than the interval B♭ to F.

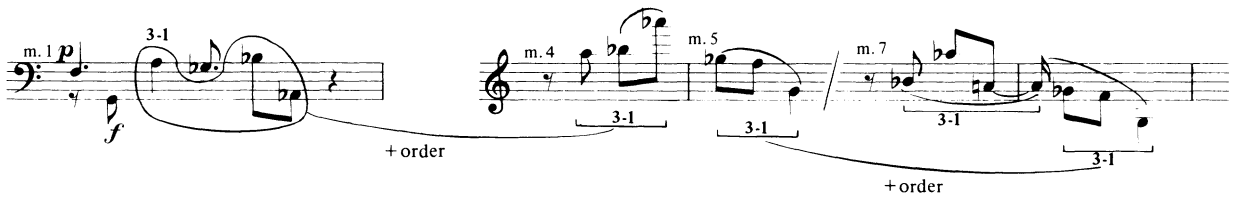
The ambiguity of segmentation shown by the opposition of tripartite and bipartite phrase divisions in Examples 4a and 4b illustrates one of the primary functions of multiple segmentation in much post-tonal music—the balancing of musical articulation and continuity. Thus the stuctures noted in Example 4b prevent the music from coming to a halt with the silences of Example 4a and in fact endow these silences with great energy.

Thus far we have considered only the most immediate, moment by moment continuities and discontinuities of domains. The renewal in measures 3 and 4 of segmentation six of measure 1 is shown in Example 4c. The continuities of set class, order, and contour create structures of a larger temporal range than those noted in Example 2 and for this reason point more urgently to the problem of musical form and its relation to structural formation. To pursue this problem it will be useful to employ the concepts of *opening,* which will refer to a movement away from a specific value or quality, and *closing,* a return to that quality. (These terms are also used in tonal harmonic theory where they characterize harmonic progression. In the context of the present discussion "opening" and "closing" will be employed in a much more general sense and without any reference to cadence or progression.) The term "closing" is problematic and must be examined more closely. In the definition above, the seemingly innocent word "return," with all its spatial connotations, already indicates a contradiction for there seems always to be a movement irrevocably *away* in time. But this is a contradiction only if time is considered as a series of irretrievable moments. It

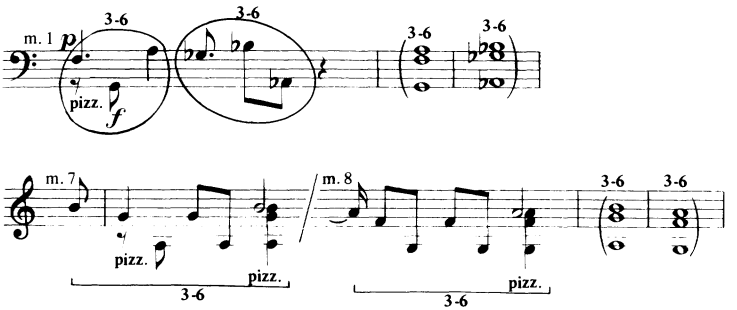
Example 3a. Segmentation 3



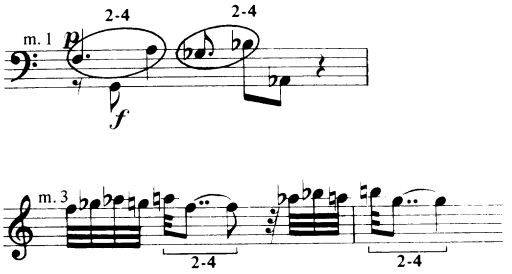
Example 3b. Segmentation 4 (Pitch classes G and A-flat are differentiated registrally in all three statements.)



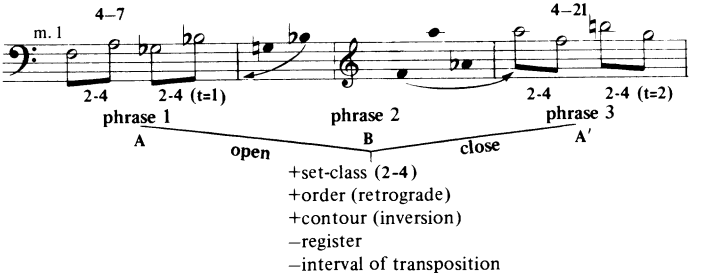
Example 3c. Segmentation 5



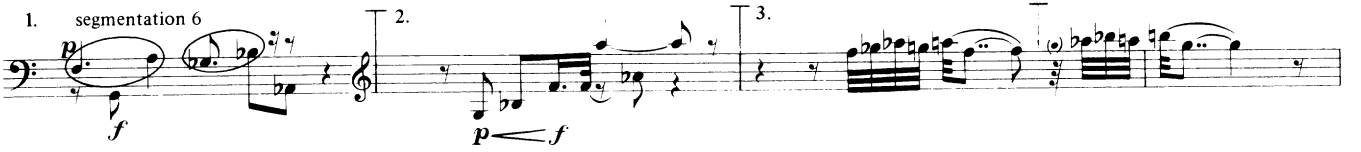
Example 3d. Segmentation 6



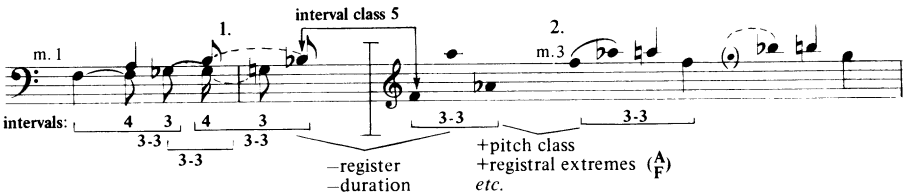
Example 4c



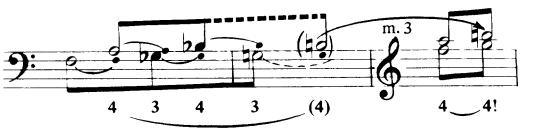
Example 4a



Example 4b



Example 4d



is one of the great powers of music that it can present us with another experience of time, one in which the past can exist simultaneously with the present moment as connections with what has occurred before are stored in the resounding present.

In the case of the first four measures of the String Quartet, when the repetition of certain qualities of phrase 1 is heard in phrase 3 (or at the beginning of phrase 1 in the end of phrase 2 as in Example 4b) the two phrases are not actually compared as separate entities, for phrase 1 is gone—only phrase 3 is heard. This point is easily lost in analysis because we have the score in front of us, and we can simply move our eyes back and forth between these two events represented on the page. I believe, rather, that in our hearing phrase 1 has to some extent become phrase 3. The similarities between the two phrases (the structures we have noted) complete or close the form. The differences between the two phrases open the form to future developments. While we have defined "opening" and "closing" in terms of the recurrence of particular qualities of the domains, it would be a mistake to identify closure with simple repetition. Closure involves also the development or fulfillment of various processes (as is implied by the phrases "movement away from" and "return to"). The forms of closure (the processes which may *lead* to a return) are in their number and complexity far beyond the scope of this paper. But two quite different examples should suffice to indicate their general nature. One such form is shown in Example 4d (cf. Examples 4b and 4c). Here the third phrase may be understood as the completion of a process begun in the first phrase but broken off in measure 2. The second example involves structures of a larger scale. The segmentation shown in Example 4c is weak in many respects—the two constituents are dissimilar in register, dynamics and duration; the tetrachords formed by each (set classes 4-7 and 4-21) have very different intervallic properties; also the B♮ of the third phrase is the first occurrence of a pitch class other than one of the initial members of the set class 6-1 of measure 1; thus B♮ redefines the intervallic associations of all the other pitches. There is, however, a larger-scale segmentation which reconciles many of these differences.

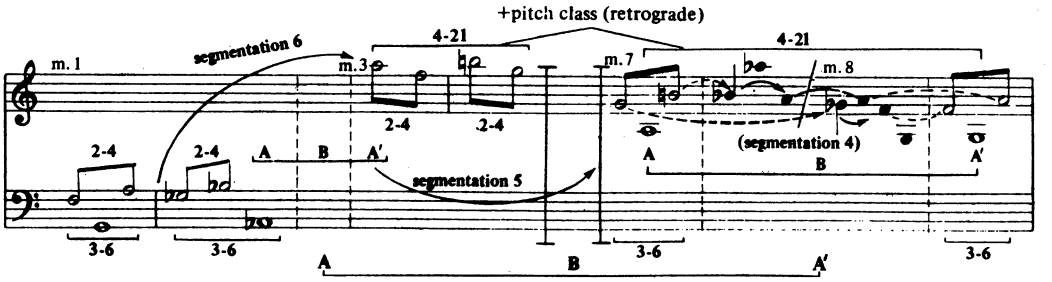
As is shown in Example 5, the strongest segmentation of measures 7 and 8 also effects a closure. In measures 7 and 8 the dyadic structure of phrase 3 (set class 2-4) as well as the anomalous tetrachordal structure (set class 4-21) and the novel pitch class (B♮) are expressed through the trichordal structure of segmentation five of phrase 1 (set class 3-6). One of the most striking differences between phrases 1 and 3, the dramatic change of register, is mediated by measures 7 and 8, which are precisely equidistant from these registral extremes. Although a complete account of this closure would involve a detailed analysis of the intervening material these remarks concerning Examples 4 and 5 indicate some of the ways in which small-scale structures can become constituents of larger-scale structures.[3]

The next two works to be considered, Webern's op. 24/2 and Schoenberg's op. 23/1, again present the problem of tracing a path through a great many possibilities. Since each of these works develops in a very individual way, an examination of their opening measures will help to broaden our investigation of the process of structural formation.

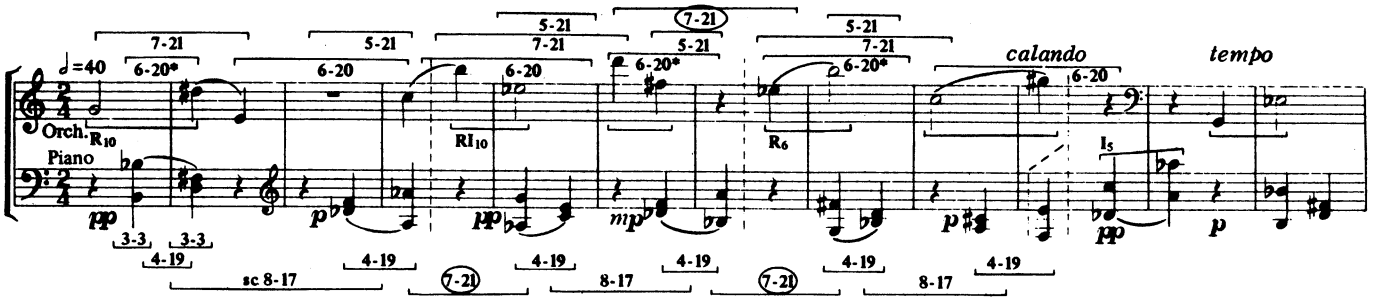
The opening of the second movement of Webern's Concerto is shown reduced to two staves in Example 6a. This work limits quite severely the values of many domains. Typically, Webern's minimalism, by suppressing many qualitative dis-

[3]The six-note segment occurring at the end of measure 7 and the beginning of measure 8 and labeled "B" in Example 5 is derived structurally from segmentation four of the first measure. (See Example 3b.) This figure functions to articulate the two statements of set class 3-6 at the beginning of measure 7 and the end of measure 8. It also connects the two statements in a reference to the first four measures. The dyad G-B (set class 2-4) of measure 7 descends through the intervening G♭ and B♭ to the dyad F-A of measure 8. This is a retrograde of the interrupted and registrally displaced motion shown in Example 4d. (For a more thorough analysis of measures 1-16 of the String Quartet I refer the reader to my doctoral dissertation, "A Theory of Segmentation Developed from Late Works of Stefan Wolpe" (Yale University, 1978), pp. 140-172. This study also contains an extensive investigation of domains.)

Example 5



Example 6a. Webern op. 24/2 (1934)



tinctions, allows other very subtle qualities to emerge all the more powerfully. In this movement there is a fairly constant rate in the circulation of the twelve pitch classes, there are only two durational values (quarter and half note), and there is great uniformity in texture and gesture. More remarkable, however, is the homogeneity of set-class structure. As will be seen from Examples 6a and 6b, there are many set-class correspondences, some of which result from combinations of different row forms (these set names are circled in the examples).

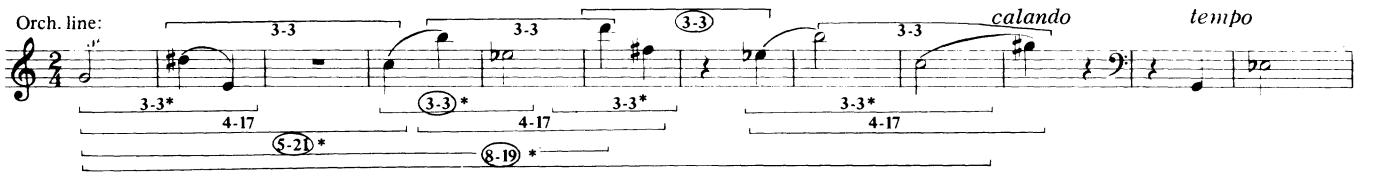
The details of all these structures need not concern us here; suffice it to say that there is a surfeit of set-class structures. Movement would seem to be minimized throughout most of this piece by the homogeneity of harmonic or set-class qualities—at almost any moment there is some sort of structural close in this domain. Nevertheless, because of this homogeneity, that is, since there are so few set classes involved, one can become highly aware of registral and other subtle qualitative differences within sets of the same class. All these structural distinctions are important and can help us to understand why these measures do not sound as static as the homogeniety of the material might imply. The process of segmentation, by creating a hierarchy of weak and strong relationships, allows us to follow a particular path through this music. Strong segmentations lead us to an experience of the piece in which weaker structural connections are suppressed.

In Example 7a the first section of this movement (measures 1 through 11) is shown divided into three parts, measures 1-2, measures 3-7, and measures 7-11. This segmentation is supported by the silences in the upper orchestral line and by the registral discontinuities in the piano. Notice that in the second part (measures 3-7) the successive tetrachords of the piano are connected by semitone, the minimal registral distinction. Example 7b indicates a further division of measures 3-7 into two smaller parts on the basis of retrogrades between the two voices of the piano. This division is supported in Example 7c by the rhythmic retrograde of the piano and orchestra combined. The segmentation of Example 7a is, however, weakened by timbre and dynamics.

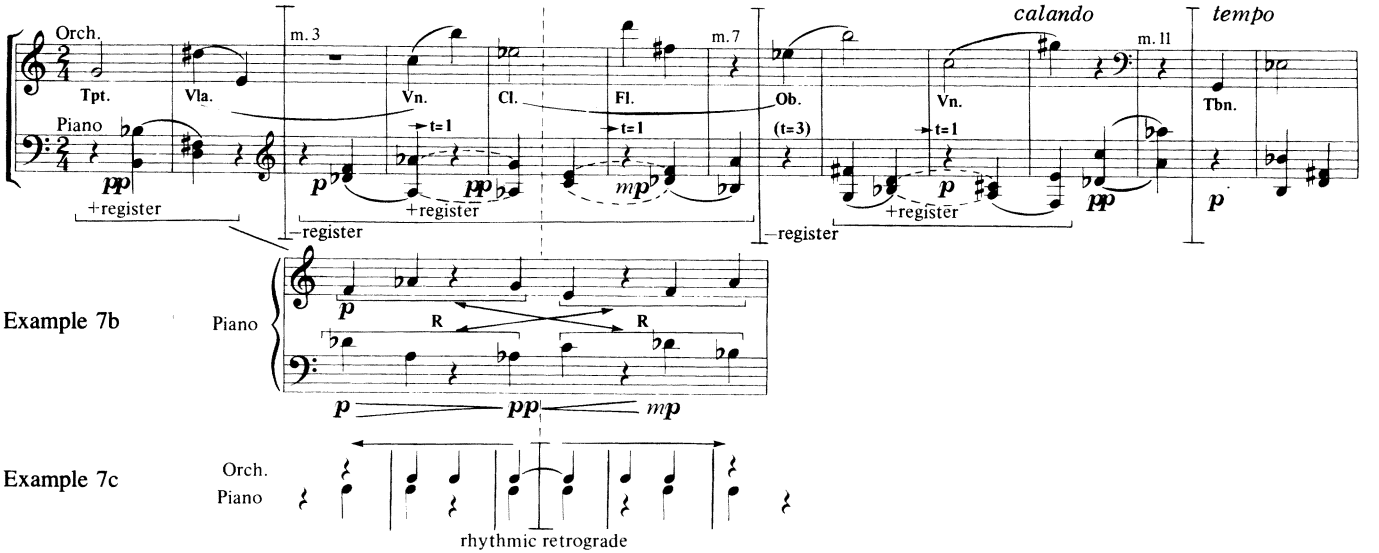
In the analysis of the orchestral line shown in Example 8, it will be seen that in measures 4 and 5 the first three notes of measures 1 and 2 are presented transposed in retrograde order. This reordering is, I believe, of special significance. The general form of closure was given as ABA. This arrangement reveals a retrograde—the opening, A to B, reversed in the closing, B to A. I believe that by generalizing this fact we can understand that more extended retrogrades also effect a type of closure. In many of his works, Webern relies heavily on retrograde as a formal device. Of course, he is not alone in this; for example, in almost all the closures in the Wolpe there are retrogrades on the surface of the music which intensify these closures. In the present example the intervallic retrograde is supported by the retrograde of durations and timbre, that is, trumpet then viola answered by violin then clarinet.

The next set-class correspondence occurs in measures 4 through 6. In measures 5 and 6 the set 3-3 of measures 4 and 5 is transposed. The two forms are elided through the sustained E♭ of measure 5. This elision and the closure we just noted of measures 1 and 2 by measures 4 and 5 both weaken this segmentation—the pitches D and F♯ of measure 6 could be heard

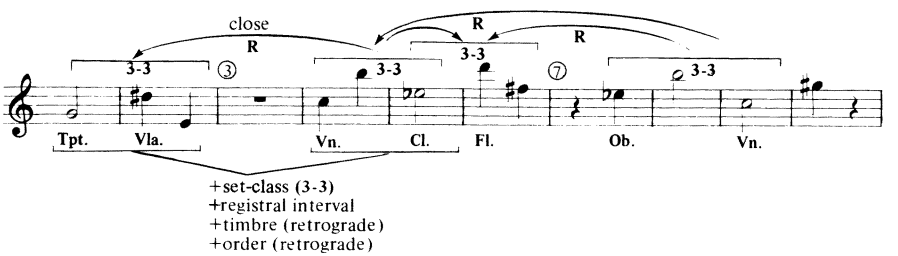
Example 6b



Example 7a



Example 8



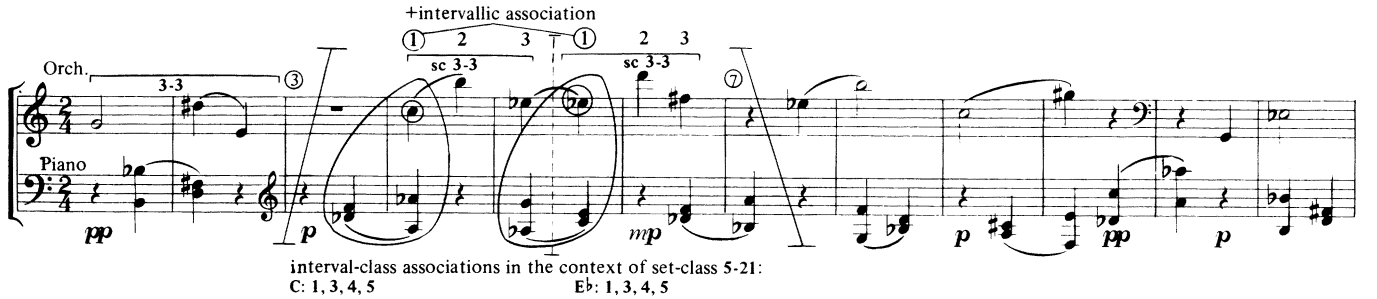
to begin something new. Also D and F♯ introduce a change in dynamic level. It is important to remember that merely locating a correspondence in some domain does not in itself tell us anything about the structural importance of the correspondence. Of course, here the length of the note E♭ and the timbral connection of clarinet and flute help us to hear the second trichord. Also supporting and supported by this segmentation is the division of measures 3-7 into two parts created by the retrogrades that we observed in Examples 7b and 7c. There is yet another factor that strengthens this hearing. Example 9 points out the similarities in intervallic association among the pitches of these two trichords. As can be seen in Example 9a, the first pitch in measure 4 of the first trichord, C, forms the set 5-21 with the piano. In the context of this set, C forms the interval classes 1, 3, 4 and 5 with the remaining members of the set. Likewise the first pitch of the second trichord, the sustained E♭, forms *on the second beat* of measure 5 the same set class, 5-21, with the piano and likewise forms the interval classes 1, 3, 4 and 5 with the remaining pitches of this collection. Thus the first pitches of both trichords in the orchestral line are given a similar sound through the harmonic agency of the piano. Further harmonic support for this segmentation is shown in Example 9b. The first pitches of each trichord of the orchestral line form set class 3-3 with the piano and the third pitch of each trichord forms set class 3-4 with the piano. In Webern's highly refined harmonic world, all these factors, subtle as they are, serve to strengthen the segmentation of measures 4 through 6 noted in Example 8. Returning to that example, a fourth trichord 3-3 in measures 7 through 9 closes the trichord of measures 5 and 6 by intervallic retrograde and closes measures 4 and 5 by an exact pitch retrograde. This is in a sense the end of the first phrase. The next pitch, G♯, in measure 10 does not enter into these structures. Also G♯ disturbs the intervallic homogeneity of the orchestral line thus far. In Example 10 all the pitches of the melody in measures 1 through 9 are displayed together in order from lowest to highest. These pitches are symmetrical around E♭. This means, among other things, that the pitches connected by lines in the example have identical interval-class associations and that E♭ forms the same interval classes with the lower three pitches that it forms with the upper three pitches. The pitch G♯ of measure 10 disturbs this equilibrium.

There is another segmentation related to the structures we have been following which should be mentioned here since it accounts for a number of important details. The first six pitches of the piece form set class 6-20 (Example 6a). This set class is one of three hexachords in which all six constituent pitches have identical interval-class associations and therefore are in this domain mutually undifferentiated. The homogeneity of this set (mirroring the larger-scale homogeneity of set-class structure noted above) is disrupted by the appearance of E which forms 7-21, a comparatively heterogeneous set that introduces two interval classes not present in 6-20 (i.e. 2 and 6).[4] Note also that E does not form the set class 3-3 with the piano as do the other two pitches, G and D♯. As a result of this, E is excluded from important structures of the first phrase and, I believe, sounds disruptive and somehow out of place. (In this way E serves a function very similar to the function of the final G♯ which disrupts the intervallic equilibrium of the trichordal segmentation as was shown in Example 10.) Of course, this E is connected in other domains—in timbre the viola plays D♯ and E under a slur and the E continues the quarter-note pulse preceding the silence. Its discontinuity with the first phrase nevertheless

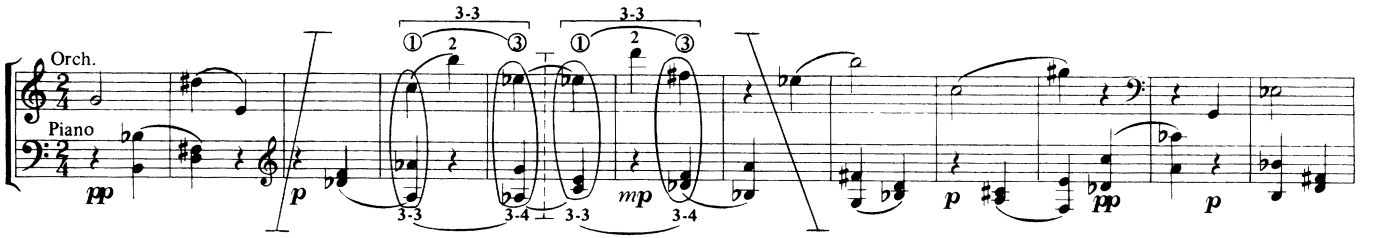
[4]The interval-class associations of each of the pitches of the set 6-20 are as follows, the intervals which E forms with these pitches in the context of 7-21 being shown in parentheses:

B♭	—	1	3	4	4	5	(6)
B	—	1	3	4	4	5	(5)
D	—	1	3	4	4	5	(2)
E♭	—	1	3	4	4	5	(1)
F♯	—	1	3	4	4	5	(2)
G	—	1	3	4	4	5	(3)
(E	—	1	*2*	*2*	3	5	*6*)

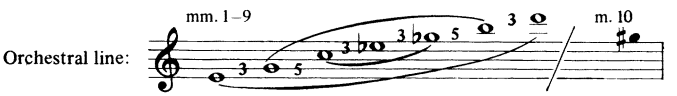
Example 9a



Example 9b



Example 10



creates an opening. The pitch E does however form an instance of the homogeneous set class 6-20 with the next five pitches and is connected by register to the pitch, F (measure 3), in the piano. (This device of carrying the music across the division by a rest is, of course, the same we noticed in the beginning of the Wolpe, but here the silence seems filled with more energy because of the unconnected quality of the E.) This segmentation of the orchestral line into dyads of set class 2-4 (bracketed below the line in Example 6a) gains ascendancy during the course of the section, beginning with the sudden change of dynamics in measure 6 and culminating in the connection of C and G# in measures 9 and 10 contradicting the trichordal segmentation noted in Example 10. This dyad is repeated by the piano in a cadential figure used throughout the movement and prepares for new segmentations of the material in the next section.

In Example 6a the sets 6-20 which are marked by asterisks are displayed in identical registral ordering with the result that corresponding pitches have identical registral intervallic asso-

ciations (the strongest, most audible intervallic relationship). Thus the pitches G and D♯ of measures 1 and 2 have the same quality in this domain as have the pitches of measure 6, F♯ and D respectively. This relationship may explain the appearance of the two forms of set 3-3 in measures 4-6 (Example 8)—since G and D♯ have the same quality as F♯ and D, the retrograde, E♭-*D*-*F*♯, creates a stronger closure of the initial trichord, *G*-*D*♯-E, than does the retrograde, C-B-E♭.

Though there is more to be said about the structure of these measures, both internally and in terms of the continuation of the piece, I hope to have shown how the great number of possible hearings are limited by the interaction of structures in various domains. Thus, in Example 6b it can be seen that not all the set-class correspondences are of equal significance. Those marked by asterisks are the ones we have been following, and the strength of their connections virtually negates most of the other correspondences.

One last point should be noted: in Example 6a, the dotted lines indicate the division of these measures by the appearance of different statements of the row. The segmentation we have found does not correspond to row division. It is important to remember that the structures we have followed are by no means automatic consequences of the series.

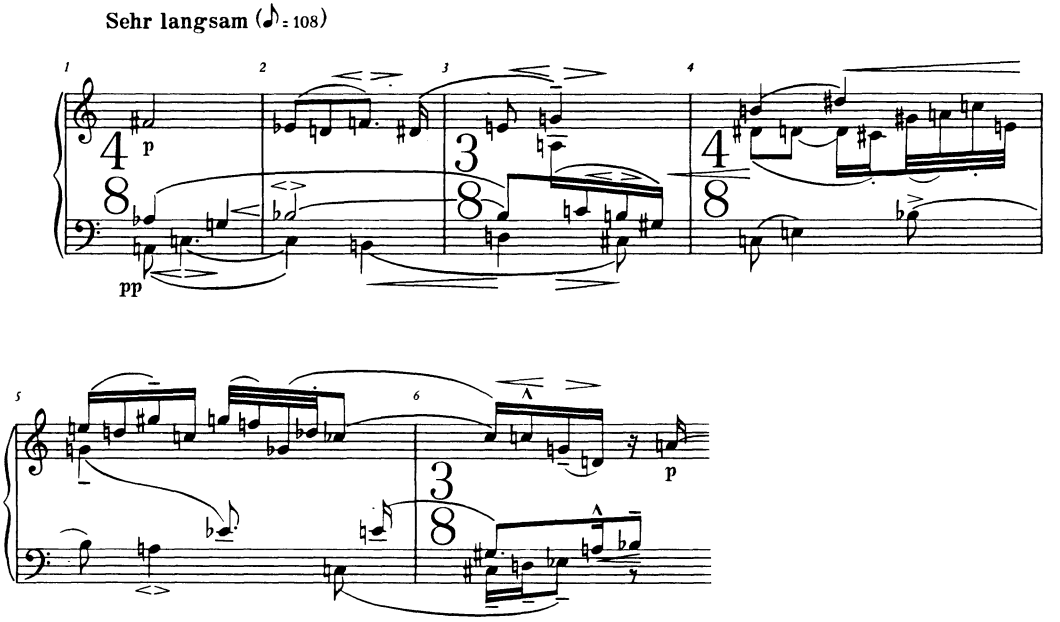
Webern's op. 24/2 offered a great abundance of possible set-class correspondences, ordered and unordered. Similarly, the last work we shall examine, the opening measures of the first of Schoenberg's Five Piano Pieces, op. 23 (Example 11a), presents us with the problem of selecting significant structures from a great wealth of "motivic" correspondences. Some of these correspondences are shown in Example 11b. There are others which could not be fitted into this example; for instance, the first five pitches of the tenor voice are a retrograde inversion of the bass. Again, merely to list all these repetitions would not bring us to an understanding of these first three measures. A cataloging of motivic correspondences is a static representation of structure both in terms of temporal development and of structural depth.

For reasons which will become apparent below, the first three measures form a phrase which can be divided into three parts, each comprising a measure. (The D♯ of measure 2 belongs to the third measure as an anacrusis.) Of the trichords formed by the three voices only one set class emerges as particularly significant. This trichord, 3-5, is shown in Example 12a. Although the second statement of 3-5 is inverted with respect to the first and third, the bass and soprano continue to move in parallel tritones. When the opening material first reappears beginning in measure 16 (Example 12b) it is these pitches of the same collection in the right hand (F♯, F and G) which are emphasized.

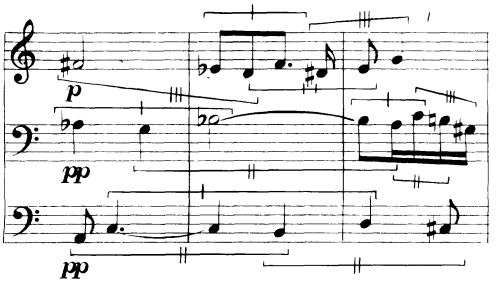
In the first measure only the lower voices move—the bass up three semitones and the tenor down one semitone (Example 13a). The eighth-note pulse is here halted by the quarter note G in the tenor. In measure 2 the soprano now moves in a retrograde ordering of these intervals—down one semitone and up three in the same rhythm as these motions appear in measure 1. Although there is no set-class correspondence here, the transpositions by the soprano of the tenor and bass motions are through the same interval class, 5, as is shown in Example 13b. The retrograde relationship creates a weak closure as the two accompanying voices coalesce into the leading soprano voice. Meanwhile, the tenor has broken across the phrase boundary, completing its motion under the slur of descent by semitone and ascent by three semitones. To this the soprano is an exact transposition at twice the speed. The bass in these two measures forms a retrograde inversion of the upper lines, but this connection is weakened by the phrasing.

In following the relationships indicated above no mention has been made of the initial F♯ of the soprano. It is not connected to any of this and seems to have faded from our awareness if we are attending to the structures just noted. F♯ does form the important set 3-5 at the end of the measure, but at this point in our experience of the piece we do not know the significance of this sonority. It is only in the third measure that this F♯ is absorbed into the structure of the piece, and this effects a closure of the

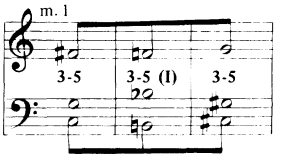
Example 11a. Schoenberg op. 23/1 (1920)



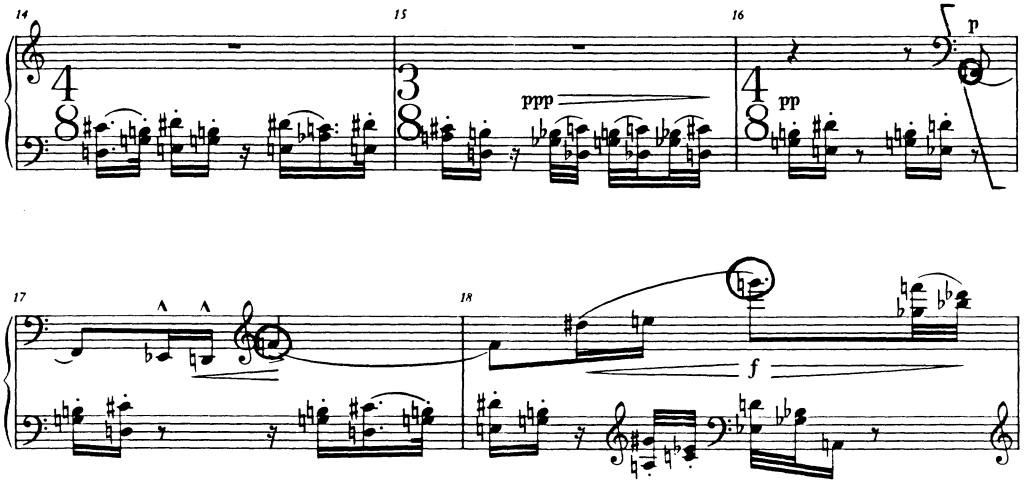
Example 11b



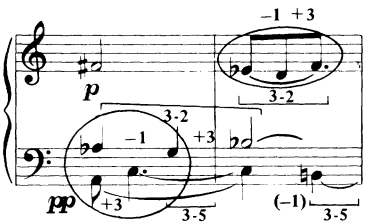
Example 12a



Example 12b

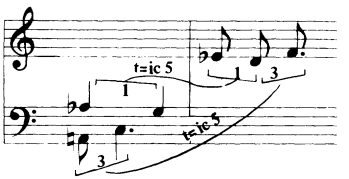


Example 13a



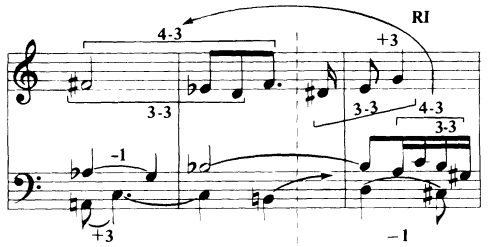
+interval succession (1,3)
+order (retrograde)
+duration pattern (♫♩)

Example 13b



first part of the phrase as is shown in Example 14. The first three pitches of the soprano are closed through retrograde by the last three pitches of the soprano, but it is the suddenly active tenor which closes the whole and strongly connects the initial F♯ of the opening soprano line. As the tenor in a kind of voice transfer now renews the initial soprano, the soprano and bass in measure 3 reenact the initial motions of bass and tenor—again in the eighth-note pulse the bass descends by semitone and the soprano ascends by three semitones. As a result of these developments, a bipartite division of the first phrase emerges as the stronger segmentation, the point of division being artfully concealed by the B in the bass.[5] The next phrase, which begins very abruptly in measure 4, is very complex and not at all as lucid in structure as the first phrase. Although it involves considerable over-

Example 14



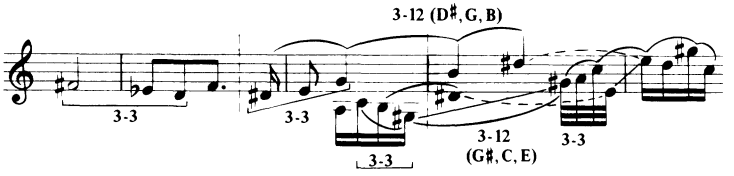
[5]The pitch, B♮, in the bass forms the important interval of the tritone with the soprano, F of the first part (cf. Example 12a above); but with the following D and C♯ in the bass it also prepares the entrance of the tenor in the second part, the first three sixteenths of which are a transposition of the bass moving four times as fast.

simplification, Example 15 indicates some of the connections between the two phrases. In the first phrase interval-class 4 is strongly suppressed—it does not occur as a melodic adjacency or as an interval of transposition between sets and appears only four times among the thirty harmonic intervals of the first three measures. This interval does occur however as the registral limits of the important instances of set 3-3. Phrase 2 rather unexpectedly expands upon this feature of phrase 1 sequentially multiplying the two occurrences of interval class 4 in the second half of phrase 1 to produce set class 3-12, a very homogeneous set suitable for this sort of fluid, transitional passage.[6] This method of overlapping phrases was seen earlier in the first three measures and is a characteristic of the first part of this piece.

The level of detail encountered in the above analyses indicates the difficulty of applying this sort of analysis to a large section or to the whole of a work. Until we know enough about the nature of structural formation in this music to be able to take more for granted, there seems to be no way of avoiding this difficulty. It is important to remember that higher levels of structure in a sense subsume the detail of lower levels, but cannot exist independently from that detail. In confronting the problem of segmentation using as examples just a few measures from the beginnings of these three pieces, problems of large-scale structure presented by the analysis of an entire piece have been avoided. From my experience in analyzing larger portions of music I cannot pretend that this analytic technique in all cases produces a clear, unequivocal background structure. There are often highly ambiguous passages with many segmentations of equal strength and passages which make no gesture of closure. In these cases it may be that the opposition of clarity and ambiguity, or the opposition of the dynamic and the static, constitutes a domain and so can have a structural function.

[6]In set class 3-12, the "augmented triad," the three constituents have identical intervallic associations modulo-12 and hence are highly undifferentiated.

Example 15



The means by which musical meaning and form can be created in post-tonal music represent a vast topic owing to the immense number of structural possibilities which have been discovered in the musical material during the past seven decades. In this preliminary study it has been impossible to devote sufficient attention to the domains—their number, their various structural properties, or the ways in which specific domains interact with one another. Clearly this information is crucial to the analytic method presented here. Since the domains are defined through their interactions in the creation of segmentations, I believe that careful attention to the articulations of representative works can lead to a better understanding of many of the redefinitions which have taken place in the music of our century.