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SOME ASPECTS OF TWELVE-TONE COMPOSITION

Milton Babbitt

Babbitt adota postura defensiva em relação aos ataques ao dodecafonismo nos EUA, anos 1950.

To disdain an alliance with those journalist critics, official composers, and custodians of musical patronage who regard the mere presence of 'twelve tones' as sufficient evidence of a fall from musical grace, or, on the other hand, with that smaller group—created, perhaps, by understandable reaction—which regards the same phenomenon as a necessary and sufficient condition for the presence of profound musical virtues, is to deny oneself the possibility of making any convenient summary of American twelve-tone music. For American twelve-tone composers, in word and musical deed, display a diversity of 'idioms', 'styles', compositional attitudes and accomplishments that almost seems calculated to resist that segregation by identification which many of their enemies, and some of their friends, would impose upon them. If this extreme diversity is, to some degree, a reflection of that multiformity which characterizes all aspects of American cultural life, it is also symptomatic of the relative isolation in which each composer pursues his own work and determines his own direction. The interaction of ideas and influences that probably would be produced by a wide knowledge and intimate understanding of each other's work can scarcely exist when this body of music goes largely unpublished, unrecorded, and unperformed by the larger orchestras or by the widely known and travelled chamber music groups. In this respect, it must be added, twelve-tone music suffers only slightly more than other 'difficult', 'advanced' music—to the extent that the label itself supplies a basis for automatic rejection; for the American 'music lover's' conservatism, a conservatism of ignorance rather than of considered choice, is nurtured and fostered by performers, concert managers, and Boards of Directors, for their own comfort, convenience, and profit.

Finding oneself a member of a minority within a minority may provide solace for but few composers; observing 'unintelligible' music from abroad being treated with respect and awe while comparable American music produces only anger and resentment may result in nothing more substantial than righteous indignation, while the realization that, if one's own music is performed infrequently if at all, the last three works of Webern are yet to be heard in New York, provides chilly comfort. Nevertheless, the number of twelve-tone composers here, as elsewhere, continues to increase.

Schoenberg nos EUA, 1933

The strategic date in the pre-war development of twelve-tone composition in the United States was that on which Schoenberg arrived here in 1933. Prior to that time, only the compositions of Adolph Weiss—Schoenberg's first official American student in Germany—and the *Dichotomy* of Wallingford Riegger had directed any attention to the American manifestations of twelve-tone composition, and Weiss soon became less associated with composition and more with performance, while *Dichotomy* remained a relatively singular work in Riegger's output until about 1943, when he became more closely identified with twelve-tone music.

Schoenberg's residence in the United States affected the musical climate not only because of his mere physical presence, or his activity as a teacher, but also, and primarily, because of the increased interest in, and performance of his music that resulted. The arrival of Ernst Krenek, five years later, added another figure who, through his writing and teaching as well as his music, directed attention to twelve-tone composition. Before the outbreak of the war, a number of young American composers—including George Perle, Ben Weber, and the present writer—were identified with the 'twelve-tone school'.

Since the war, the music of such composers as Erich Itor Kahn, Kurt List, Jacques Monod, Julius Schloss, and Edward Steuermann—whose careers had begun in Europe—have been relatively widely heard, while among the 'natives', Robert Erickson, Richard Maxfield, Dika Newlin, George Rochberg, and Keith Robinson are but a few of those whose music is evidence of the creative interest in twelve-tone composition among the younger composers.

In addition, there are those composers—including the most widely known—who have indicated their awareness of and interest in twelve-tone composition, either in an isolated work, or by frequently employing certain techniques that are associated generally with twelve-tone music.

The above list of composers is neither complete nor presumed to be representative or selective. As has been indicated, no one can be in a position to possess adequate enough and accurate enough information to compile a comprehensive list. Very likely there are composers often performed and exerting real musical influence whose music is unknown beyond a specific locality.

For this, and other obvious reasons, the present article, rather than including the customary descriptive catalogue—consisting of the names of composers whose music is of necessity scarcely known to the readers of the article, attached to adjectival paragraphs and four-bar musical quotations that possess meaning only to the extent that they are misleading—will concern itself with a brief presentation of the sources and nature of one significant phase of twelve-tone activity in the United States that should be of particular interest to non-American readers for its obvious relation—intent, if not in inception and method—to a widespread and more highly publicized development on the Continent.

The first explicit steps in the direction of a 'totally organized' twelve-tone music were taken here some fifteen years ago, motivated positively by the desire for a completely autonomous conception of the twelve-tone system, and for works in which all components, in all dimensions, would be determined by the relations and operations of the system. Negatively, there was the motivation by reaction against the transference to twelve-tone composition of criteria belonging to triadic music.¹ The specific bases, discussed below, for achieving a total twelve-tone work, were arrived at by the end of the war, and when, a short time later, there were reports of a group of young French, Italian and German composers who apparently shared like aims, their work was eagerly awaited. However, their music and technical writings eventually revealed so very different an attitude toward the means, and even so very different means, that the apparent agreement with regard to ends lost its entire significance. The most striking points of divergence can be summarized in terms of the following apparent attributes of the music and the theory associated with it. Mathematics—or, more correctly, arithmetic—is used, not as a means of characterizing or discovering general systematic, pre-compositional relationships, but as a compositional device, resulting in the most literal sort of 'programme music', whose course is determined by a numerical, rather than by a narrative or descriptive, 'programme'. The alleged 'total organization' is achieved by applying dissimilar, essentially unrelated criteria of organization to each of the components, criteria often derived from outside the system, so that—for example—the rhythm is independent of and thus separable from the pitch structure; this is described and justified as a 'polyphony' of components, though polyphony is customarily understood to involve, among many other things, a principle of organized simultaneity, while here the mere fact of simultaneity is termed 'polyphony'. The most crucial problems of twelve-tone music are resolved by being defined out of existence; harmonic structure in all dimensions is proclaimed to be irrelevant, unnecessary, and perhaps, undesirable in any event; so, a principle, or non-principle, of harmony by fortuity reigns. Finally, the music of the past—and virtually all of that of the present, as well—is repudiated for what it is not, rather than examined—if not celebrated—for what it is; admittedly, this is a convenient method for evading confrontation by a multitude of challenging possibilities, including—perhaps—even a few necessities. This latter represents a particularly significant point of divergence from the development to be considered here, which has its specific origins in the investigation of the implications of techniques of the 'classics' of twelve-tone music. Indeed, it is a principle that underlies the bulk

¹ e.g., that of consonance and dissonance, carried over from a domain where the structure of the triad is the criterion of intervallic stability to a domain where the triad has no such prior function, and where—thus—criteria of consonance and dissonance, if the terms have any meaning whatsoever, must be determined by principles relevant to twelve-tone phenomena. The same applies to the transference of the external 'forms' of triadic music to twelve-tone contexts, resulting in a divorce of these 'forms' from their essential tonal motivations; this, at best, leads to a merely thematic formalism, and if one is seeking mere formalisms, there are certainly more ingenious ones than 'sonata-form', 'rondo-form', etc., for all that they might not possess this purely verbal identification with the hallowed past.

of Schoenberg's work (namely, combinatoriality),² and another, superficially unrelated, principle occupying a similar position in the music of Webern (derivation), that have each been generalized and extended far beyond their immediate functions, finally to the point where, in their most generalized form, they are found to be profoundly interrelated, and in these interrelationships new properties and potentialities of the individual principles are revealed.³

QC4 de Schoenberg:
técnicas de
continuidade e
associação locais.

1. exploração de adjacências ordenadas;
2. adjacências de 3 notas;
3. progressão motivica
4. distribuição de elementos por inversão.
5. construção de conjuntos com continuidade linear (hexacordes)

Quite naturally, it was the 'early American' works of Schoenberg that were the most influential. As an example of a typically suggestive, but by no means unusual, passage, consider the opening measures of the third movement of the *Fourth Quartet*. Even a cursory examination reveals a number of significant techniques of local continuity and association: the exploitation of ordered adjacencies (the repeated adjacencies C-B of bar 619 and Gb-F of bar 617 cross-associate with the opening two notes of the movement and the Gb-F of the first violin in bar 621 to effect the closure of a structural unit; the three-note adjacency C-B-G of 619 also registrationally duplicates the first three notes of the movement), delinearization (the dyads of the first violin line of 620-1 are distributed among the three instruments that immediately follow), intervallic preparation and association (the simultaneously stated fourths of 619, 620 and 621 prepare the predefined fourth of the cello and viola in 623; the repeated C-B states with regard to the G in 619 the intervallic succession continued by the relation of the D#-E to the B in the same measure), motivic progression (the joining of forms of the set in 618 gives rise to the motive stated in the prime set itself by the last three notes, and the third, fourth, and fifth notes; the distribution of the elements of the inverted set between second violin and viola in 623 results in a three-note motive in the second violin which is the retrograde inversion of notes five, six, and seven of the simultaneously stated prime, at precisely the same total pitch level, and at the same time, the resultant viola line reveals two semi-quaver groups of four notes each which symmetrically permute the minor second and major third), functional 'orchestration' (the six-note unit of the first violin in 620-1 combines with the six-note unit of 622-3 to form a set), etc. But of far greater systematic significance, and far more susceptible to extension, is the familiar Schoenbergian principle of constructing a set in which linear continuity can be effected between sets related by the operation of retrograde inversion, by equating the total, unordered⁴ content of corresponding hexachords at a specific transpositional level. Such a set created by this ordering of hexachords supplies the basis of progression in bars 616 to 619, and, in general, such 'secondary set' construction supplies a basis of progression beyond mere set succession. A necessary corollary of this structural characteristic is that inversionally related forms of the set, at the specific transpositional

² See footnote 6.

³ Much of the remainder of this article is a highly condensed version of certain sections from the author's *The Function of Set Structure in the Twelve-Tone System* (1946), and *The Structure of the Twelve-Tone System* (in preparation).

⁴ i.e., the total pitch content, without considering the order.

interval, possess no notes in common, and therefore span the total chromatic, thus creating an 'aggregate'.⁵ In bar 623, successive aggregates are formed by the simultaneous statements of the prime form in the cello and the inverted form in the viola and second violin.

In almost all of his twelve-tone works (indeed, in all of his twelve-tone works of this period) Schoenberg employed a 'semi-combinatorial set'⁶ of the type just described; in his later works, his increased preoccupation with the hexachord as an independent unit led to his using it often without regard to fixed ordering, but merely with regard to total content. Strangely, he never used the other two types of semi-combinatorial sets: that which gives rise to secondary set relationships between inversionally related forms of the set, and thus, aggregates between retrograde inversionally related forms, or that which gives rise to secondary set relationships between retrograde related forms, and thus aggregates between prime related forms. (Obviously, any set creates aggregates between retrograde related forms, and secondary sets between prime related forms.)

The structural significance of such sets suggests a generalization to the construction of sets in which secondary set and, thus, aggregate structures obtain between any two forms of the set. There are six such 'all-combinatorial' source sets, here indicated arbitrarily as beginning on the note C, for purposes of easy comparison:

- | | | |
|---------------|-----|--------------------------------|
| 6-1 <543210> | (1) | C-C#-D-D#-E-F / F#-G-G#-A-A#-B |
| 6-8 <343230> | (2) | C-D-D#-E-F-G / F#-G#-A-A#-B-C# |
| 6-32 <143250> | (3) | C-D-E-F-G-A / F#-G#-A#-B-C#-D# |
| 6-7 <420243> | (4) | C-C#-D-F#-G-G# / D#-E-F-A-A#-B |
| 6-20 <303630> | (5) | C-C#-E-F-G#-A / D-D#-F#-G-A#-B |
| 6-35 <060603> | (6) | C-D-E-F#-G#-A# / C#-D#-F-G-A-B |



Oliveira (1998, pp. 208-232; 277)

It must be emphasized that these are 'source sets',⁷ and that any ordering, to effect a specific compositional set, may be imposed on either hexachord without

⁵ 'Secondary set' and 'aggregate' are necessary terms to define elements that arise compositionally, but are not pre-defined systematically. A secondary set (for example, that defined by the second hexachord of the prime set and the first hexachord of the inversion at the required transposition) is, indeed, in the strictest sense, a set, since it states a total ordering of the twelve tones; however, it is not necessarily equivalent to a derived set, nor is it ever one of the fundamental forms of the set. Of course, it can be thought of as a linear juxtaposition of parts of primary forms of the set. An aggregate can be thought of as a simultaneous statement of such parts, but in essence it is very different, since it is not a set, inasmuch as it is not totally ordered, because only the elements within the component parts are ordered, but not the relationship between or among the parts themselves.

⁶ 'Semi-combinatoriality' indicates the property of creating such secondary sets, or aggregates, between a specific pair of forms (in the case of hexachordal semi-combinatoriality); 'all-combinatoriality' denotes the possibility of constructing such secondary sets or aggregates among any pairs of forms of the sets, at one or more transpositional levels. 'Combinatoriality' is the generic term including both the others.

⁷ 'Source set' denotes a set considered only in terms of the content of its hexachords, and whose combinatorial characteristics are independent of the ordering imposed on this content.

"Semi-combinatorialidade" indica a propriedade de criar conjuntos secundários, ou agregados, entre um par específico de formas (no caso de semi-combinatorialidade de hexacordes); combinatorialidade total denota a possibilidade de construir esses conjuntos secundários ou agregados entre quaisquer pares de formas dos conjuntos, em um ou mais níveis de transposição. "Combinatorialidade" é o termo genérico que inclui os demais.

affecting the combinatorial properties. Among these six source sets, beyond many other secondary bases of similarity and dissimilarity, the first three sets possess the common property of creating combinatorial relationships at one and only one transpositional interval; they are thus termed 'first order' sets. Set (4) possesses two such interval levels, and is termed 'second order'; set (5), of 'third order', possesses three such levels; set (6), of 'fourth order', possesses six such levels. There is an inverse relationship between the multiplicity of these functional transpositions and the intervallic content within the hexachord. Thus, first order sets exclude one interval, second order sets exclude two, third order sets exclude three, and fourth order sets exclude six. As a result, all-interval sets, for example, can be constructed only from first order sets; even so, there is basically only one independent all-interval set that can be constructed from each first order source set. (This excludes such sets as that of the first movement of Berg's *Lyric Suite*, which uses the elements of set (3), though not combinatorially. This set is a derived set, as defined below, since the two hexachords are related by retrogression.)

It is of interest to note that Schoenberg employed set (5) in his *Suite*, op. 29, but only as if it were merely semi-combinatorial; however, in his last, unfinished work, *The First Psalm*, he used the same source set, but the 'set table' indicates his awareness of the total combinatorial resources of the set.

In addition to the value of such sets in effecting an interrelation of the 'vertical' and 'horizontal' far beyond mere identity, in generating fixed units of harmonic progression within which the components can in turn generate associative and variable relationships, and in determining transpositional levels, there is a far more fundamental aspect, in that a hierarchy of relationships exists among these sets as determinants of regions, an hierarchical domain closely analogous to the 'circle of fifths', and defined similarly by considering the minimum number and the nature of the pitch alterations necessary to reproduce source sets at various transpositional levels. For example, in set (1), the transposition of note C by a tritone—the excluded interval—or the similar transposition of the symmetrically related note F, reproduces the set structure a half step lower in the latter case, or a half step higher in the former case, with maximum association of content to the original set. Thus, any degree of motion away from the pitch norm is measurable. Also, the motion from the region whose structure is defined by one such source set to that defined by another source set is achieved and measured in precisely the same manner. For example, the transposition of the note C# in set (1) by a tritone results in set (2); likewise, the symmetrically related E, when so transposed, results in set (2). These properties suggest that whether the source sets are used as specific compositional sets or not, they possess properties of so general a nature as to warrant their presence as implicit structural entities.

An investigation of the six all-combinatorial source tetrachords reveals a hierarchical universe analogous to that of the hexachord. There are four such tetrachords of first order, one of second, and one of third order. An understanding of

their implications, and of those of the analogous trichordal units, together with the interrelationships among all types of combinatoriality, though fruitful enough in itself, leads one inevitably to a consideration of the technique of derivation.

Although this technique has often been used independently, it is only when considered in relation to combinatoriality that its extraordinary properties are fully revealed. Consider the set, so characteristic of Webern, that is used in his *Concerto for Nine Instruments*. It is presented in four three-note units: B-B \flat -D, E \flat -G-F \sharp , G \sharp -E-F, C-C \sharp -A; the first 'prime' three-note unit is followed by its retrograde inversion, its retrograde, and its inversion. Though Webern uses this set as his total set, it is obviously possible to apply this technique to a three-note unit of any set, and thus—by the operations applied to the total set—generate a derived set.⁸ Any three-note unit—with the exception of the 'diminished triad'—can generate such a set,⁹ and, in terms of the total content of hexachords, three independent sets can be generated. Of these, at least one is all-combinatorial. Of the twelve permutationally independent three-note units that exist, two generate one all-combinatorial set each, seven generate two, and two generate three (indeed, one of these latter two can generate four, though obviously not within the trichordal permutation of a single derived set). For example, the set of the Webern Concerto, though not so utilized,¹⁰ is a representation of source set (5); by interchanging the second and fourth units, we have a representation of source set (1). The eleven three-note units are individually unique with regard to the combinatoriality of the source sets represented by their derived sets, so that a given three-note unit of a set is a unique means of effecting change of both functional and structural areas. Consider a set constructed from source set (1), with the following initial hexachord: C-E \flat -D-E-C \sharp -F. The first three notes can generate derived sets of combinatoriality defined by source sets (1) and (2). Considering the first possibility, if we choose as the transpositional level for the three-note unit that defined by its pitch level in the original set, we derive the following initial hexachord: C-E \flat -D-D \flat -B \flat -B, which is a transposition of the original combinatorial structure; on the other hand, the original three-note unit, if transposed to D-F-E, could have generated a hexachord at the same pitch level as that of the original set; this, in turn, establishes a new transpositional level for the original tetrachord, beginning on D. The original three-note unit also can generate the hexachord: C-E \flat -D-G-E-F, and thereby establish the combinatorial region defined by source set (2).

In this manner, the functional and structural implications of a compositional set can be determined by the derivational interrelationships of such units, in relation

⁸ A derived set is *not* a new set in the composition. It can be thought of, also, as resulting from the juxtaposition of segments from the fundamental forms.

⁹ For example, the triad C E G, A F D, C \sharp A \sharp F \sharp , G \sharp B D \sharp . (Observe that this is also an all-combinatorial set.)

¹⁰ Webern does not exploit the combinatorial properties of this set; he does not create progression through secondary sets or aggregates, nor does he determine his transpositions in terms of such properties.

to the original set, and to each other, as defined hierarchically by the total domain of source sets.

As there are combinatorial trichords, tetrachords, and hexachords, so are there three-note generators, four-note generators, and six-note generators;¹¹ the extraordinary interrelationships that exist within and among the domains so defined emphasize the essential significance of the inherent structure of the set, and the unique compositional stage represented by the fact of the set, as the element with regard to which the generalized operations of the system achieve meaning, and from which the progressive levels of the composition, from detail to totality, can derive.

The twelve-tone structuralization of non-pitch components can be understood only in terms of a rigorously correct definition of the nature of the operations associated with the system. In characterizing the prime set, it is necessary to associate with each note the ordered number couple—order number, pitch number, measured from the first note as origin—required to define it completely with regard to the set. Then, as transposition is revealed to be mere addition of a constant to the pitch number, inversion—in the twelve-tone sense—is revealed to be complementation mod. 12 of the pitch number. (In other words, pitch number 4 becomes pitch number 8, etc.; naturally, interval numbers are also complemented.) Likewise, retrogression is complementation of the order number, and retrograde inversion is complementation of both order and pitch numbers. Any set of durations—whether the durations be defined in terms of attack, pitch, timbre, dynamics, or register—can be, like the pitch set, uniquely permuted by the operations of addition and complementation, with the modulus most logically determined by a factor or a multiple of the metric unit.¹² Thus, the rhythmic component, for example, can be structured in precisely the same way, by the identical operations, as the pitch component; rhythmic inversion, retrogression, and retrograde inversion are uniquely defined, and combinatoriality, derivation, and related properties are analogously applicable to the durational set. The result can be a structuring of all the durational and other non-pitch components,¹³

¹¹ i.e., 3, 4 or 6-note units which serve to generate derived sets.

¹² 'Set of durations' means specifically a 'set' in the sense of twelve-tone set. By durations defined in terms of attack, is meant the time that elapses between actual attacks, measured in terms of a fixed unit of durational reference. Likewise, timbral duration is defined by the duration of a certain timbre or, conceivably, of related timbres. The same with registrational durations.

¹³ The question of structuralizing non-pitch elements is certainly a very complicated one. If, for example, a rhythmic set is constructed with combinatorial characteristics, then secondary set structure, aggregate structure, derived set structure can all be arrived at in precisely the same manner as with pitches. The specific use of these means would depend upon the pitch structure of the composition.

The 'form' would arise out of the specific implications of the set itself, in terms of its total content, the content of the derived sets which its generators give rise to, the transpositional levels to which the derived sets lead, etc.

Naturally, this does not mean to say that a given set uniquely implies a given composition, but rather that a given set defines, in these terms, certain general possibilities which are uniquely associated with this set.

determined by the operations of the system and uniquely analogous to the specific structuring of the pitch components of the individual work, and thus, utterly nonseparable.

Even this extremely incomplete presentation should indicate the possibility of twelve-tone music, organized linearly, harmonically in the small and in the large, rhythmically—indeed, in all dimensions—in terms of the essential assumptions of the system.

Certainly, the resources indicated here do not constitute a guarantee of musical coherence, but they should guarantee the possibility of coherence. Above all, it is hoped that they serve to give at least some indication of the extraordinary breadth and depth of the twelve-tone system.

NOTE: Nearly all the footnotes to this article are answers made by the author to queries that were addressed to him. They are included in the hope that they will assist readers to grasp more clearly some of the more difficult conceptions in this (I believe) important study of twelve-tone composition. (Ed.).