THE SERIALISM OF MILTON BABBITT

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"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."[1]

The music of Milton Babbitt represents perhaps the ultimate in twelve-tone structure and intricacy. Spanning over 70 Years, Babbitt's output represents a sustained and unparalleled development of twelve-tone serial procedures, extending outward from the dimension of pitch to include all aspects of musical creation.

In the following discussion, despite Babbitt's own profession of "lack of success," I will describe a number of Babbitt's serial practices with the ultimate aim of imparting a sense of a prevailing aesthetic that informs the deepest levels of the composer's intricate musical structures. As even the most casual listener may know, Babbitt's music is characterized by a singular complexity. With this in mind, my secondary goal will be to present the material in a clear, pedagogical manner aided by a host of carefully-tailored examples, in order to facilitate the possibility of some future instruction on this topic. The paper is divided into two parts. Part one deals with the influence of Schoenberg and Webern, with emphasis on combinatoriality.[2] Part two deals with specific aspects of Babbitt's particular brand of serialism, and is further divided into four subsections: "Babbitt's Combinatoriality," "the Trichordal Array," "the All-Partition array," and "Babbitt's Rhythm and the Time Point System."

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[1] Babbitt 2003, p. 260.

[2] While Babbitt was aware of Berg's music, its influence was far less profound on the composer than that of Schoenberg and Webern, who will consequently receive sole focus in part one.

- PART ONE -
THE 'VIENNESE' INFLUENCE

> "This is where I come from – a notion of the music of Schoenberg. […] The combination of Webern and Schoenberg is absolutely crucial to me. It turned out that what they were doing quite separately converged for me at a certain point where they become eminently related without being intimately related. Each staked out his own little domain."[3]

SCHOENBERG'S COMBINATORIALTY:

Babbitt became interested in Schoenberg's music at an early age. Upon hearing the Opus 11 piano pieces played by an acquaintance of his at the Curtis Institute, he was immediately taken with the music, not via some kind of theoretical recognition, but because of the mystery it represented for him:

> "I didn't know what to make of the music, but even as a kid I became interested in it. […] [It was] so different, such an absolutely different world, that I became very interested."[4]

By the time Schoenberg arrived in New York in 1933, Babbitt had known his music for some time and was interested enough to seek him out[5]. Babbitt came to New York to study at NYU's Washington Square College. Schoenberg was living just "up Broadway at the Ansonia Hotel,"[6] and so Babbitt was able to meet and talk with him on several occasions, though he says he "actually knew him only very slightly".[7] At that time, Schoenberg was a giant figure in the music world, but his compositions were not that well known, especially in America. His presence in New York facilitated a general improvement in his American

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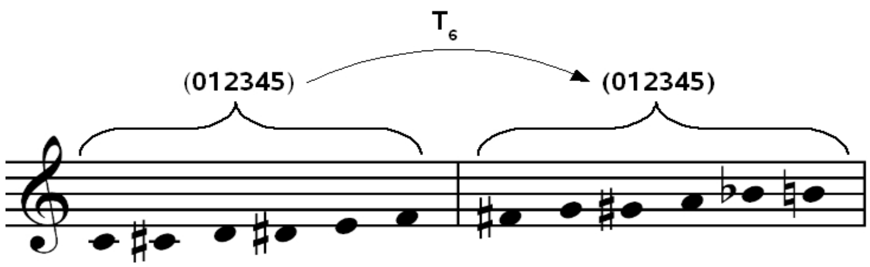
[3] Babbitt 1987, p. 24
[4] Ibid., p. 31
[5] Babbitt also attributes his move to the publication of Bauer 1933, which, in addition to emphasizing the importance of Schoenberg, featured score excerpts and discussions of the works of several other composers whose music was difficult to find in America at the time. He was drawn to Bauer and what her presence represented for his study of contemporary music. See Babbitt, 1991.
[6] Babbitt 1987, p.7
[7] Ibid.

profile. His works were performed more often, scores of his music became more accessible, and he drew young composition students to New York who were interested in learning about and discussing his twelve-tone method.[8] Babbitt did not formally study with him, for Schoenberg soon moved west to California to avoid the harsh east-coast winter. He did, however, through conversation with Schoenberg and his own peers, and through hours spent at the Fifty-eighth Street Library carefully studying scores, develop an intimate knowledge of Schoenberg's techniques.[9]

What became for Babbitt the most salient aspect of Schoenberg's system was the notion of inversional hexachordal combinatoriality[10]. "Combinatoriality" describes the property under which collections (sets) of pitch classes (PCs) can combine to form the complete twelve-note chromatic scale (aggregate).[11]



Example 1

For example, the set (C,C#,D,D#,E,F) and the set (F#,G,G#,A,Bb,B) can be added together to complete the aggregate (see example 1). Of course, these sets are actually the same, (012345), related by transposition at the interval of six semitones (T6). In this way, the single six-note set (hexachord) can be combined with a transposed version of itself to

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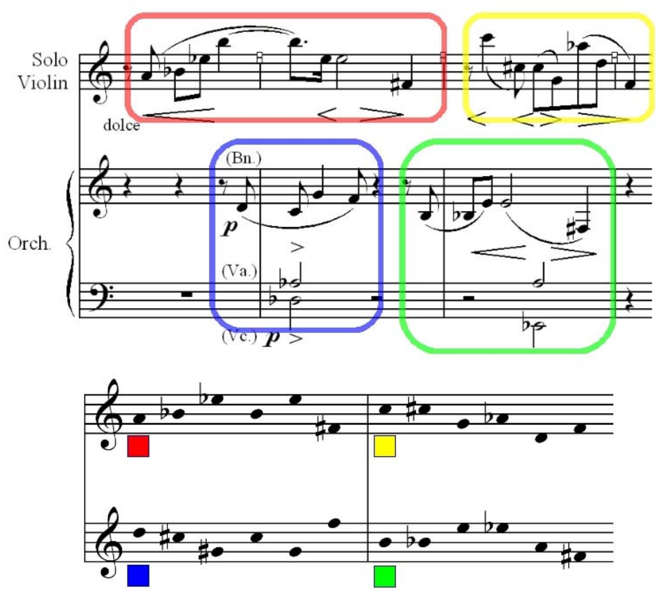
[8] I describe a general positive trend that occurred in the years following Schoenberg's arrival in America. For a more detailed account of Schoenberg's early years in America, see Sessions 1944.
[9] Babbitt 1987, pp. 3-32.
[10] An understanding of basic serial concepts including operations such as Transposition (T), Inversion (I), Retrograde (R), and Retrograde Inversion (RI) is assumed. All additional terminology will be introduced in the text.
[11] The order of PCs is not significant in the formation of an aggregate.

form the aggregate, and can thus be classified as combinatorial. In this case, the aggregate is formed by a hexachord exhibiting *transpositional* combinatoriality, since a transposition of the initial hexachord produces the remaining notes of the aggregate (its complement).[12] The type of combinatoriality that appealed to Schoenberg, especially in his later works, was *inversional* combinatoriality, whereby hexachords may be combined with inversions of themselves to complete the aggregate.

> "[T]he inversion a fifth below of the first six tones, the antecedent, should not produce a repetition of one of these six tones, but should bring forth the hitherto unused six tones of the chromatic scale."[13]

An example of this inversional combinatoriality at work in Schoenberg's music can be found in his Violin Concerto, opus 36, excerpted in example 2 below. The solo violin presents twelve distinct PCs in two groups of six, separated by a rest. The first six of notes are



Example 2 – Opening of Schoenberg's Violin Concerto, Op. 36 – underlying structure

[12] The (012345) hexachord also demonstrates other forms of combinatoriality, and will be discussed in more detail in the next section.
[13] Schoenberg 1984, p. 225.

related by inversion to the second six. The combination of these two hexachords completes the aggregate, specifically, Schoenberg's complete row. Now, consider the unfolding of PCs in the orchestral accompaniment, for this reveals an additional layer of the piece's structure and of Schoenberg's combinatorial system in general. Once again, Schoenberg articulates two distinct hexachords using rests. As shown in example 2, these two hexachords also demonstrate inversional combinatoriality. More importantly, we can see that two additional aggregates are formed in this passage by the unfolding vertical pairs of hexachords. That is, as the first six PCs in the orchestra unfold, the relatively simultaneous six PCs in the violin combine with them to complete the aggregate, a process which is then repeated to yield yet another aggregate. We now see four completed aggregates (one in the complete violin line, one in the complete orchestral accompaniment, and two successive aggregates between the orchestra and violin). Because all four hexachords are of the same type, and because their intervallic contents are preserved, any aggregate will necessarily be formed of hexachords that exhibit intervallic properties of the underlying row. Schoenberg had discovered a process wherein a high degree of unity could be achieved through the projection of a basic series of PCs and its resulting intervals across multiple dimensions of the musical fabric.[14]

Schoenberg's practice of dividing the row into combinatorial hexachords was perhaps the greatest single influence on Babbitt's own serial system. Indeed, Andrew Mead says that, while Babbitt significantly extended and developed the procedure, "at the heart of virtually all of his compositions is Schoenberg's combinatoriality."[15]

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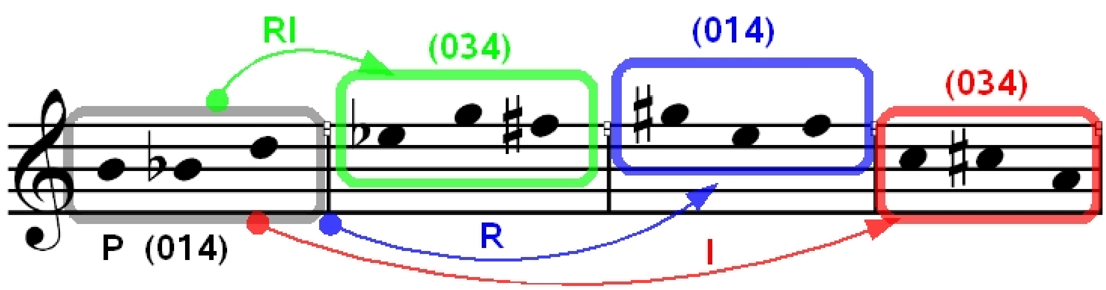
[14] For more on Schoenberg's Violin Concerto, including an interesting exchange between Babbitt and George Perle, see Babbitt 1963, Babbitt 1972 (reprint from 1963), Mead 1984, Mead 1985, Mead 1993, Perle 1963, and Pfau 1989-90.

[15] Mead 1994, p. 22

WEBERN AND DERIVATION:

Though, for Babbitt, Schoenberg was perhaps the most influential of the Viennese serialists, the music of Webern was also fundamentally suggestive. The opening row of Webern's *Concerto for Nine Instruments* is shown in example 3 below. As illustrated by the arrows, the entire row is generated from operations on the initial trichord. Webern is utilizing the traditional interval-preserving serial transformations to *produce* a row's order, rather than to *transform* a row's order. The row can be said to have been "derived"[16] from the trichord. Babbitt describes the compositional appeal of derivation:

> " [It] 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…"[17]



Example 3

The preservation of an underlying order or structure through derivation becomes a key element in Babbitt's serial universe. Another important feature of the music in example 3 is that Webern has utilized all possible permutations of the trichord (P,RI,R,I) to project a single intervallic relationship outward onto a larger structure. The notion of exhausting all

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[16] Babbitt first identified "derived" sets in Babbitt 1955.
[17] Babbitt 1950, p. 60.

possible combinations of some set of parameters, and that of projecting a single shape (or musical idea) onto multiple musical dimensions will reveal itself in Babbitt's music as well.[18]

While it is true that "Webern's inviolable precompositional ordering and Schoenberg's inviolable segmental content are both retained as initial premises of Babbitt's combinatorial procedures,"[19] Perle's use of the word "initial" is not to be missed. Babbitt has generalized and expanded upon nearly all aspects of the serial music of the Schoenberg and Webern, rendering a wholly different compositional world.

- PART TWO -
GENERALIZATION AND THE PURSUIT OF MAXIMAL DIVERSITY

In this section, I will describe a number of aspects of Babbitt's serial technique. I can not claim to add to the voluminous existing literature on this subject. However, as mentioned earlier, I will strive to present these complex topics in a clear, rudimentary manner, and thus offer a uniquely pedagogical approach to the material. The major concepts in this section include all-combinatorial hexachords, trichordal arrays, all-partition arrays, and the time-point system. By way of these larger topics, a few additional concepts will be defined. This list is by no means exhaustive, but it represents a highly-inclusive collection of Babbitt's most common serial techniques.

[18] Fore some additional information on set structure in Webern's *Concerto, Op. 24*, see Perle 1971, and Pousseur 1966 (106-108).
[19] Perle, p.128

BABBITT'S COMBINATORIALITY

Common to nearly all aspects of Babbitt's composition, is the notion of what Andrew Mead describes as "maximal diversity."[20] This principle refers to the use of all possible combinations of some parameter, or combination of parameters. For example, given an apple, an orange, and a banana, there are six possible orders in which one could eat all three.[21] If one were concerned with achieving maximal dietary diversity, that person would first eat all three, and to go further, also eat them in all six orders, totaling eighteen pieces of fruit (Those six would not quite represent the total number of combinations of course, as the person would also have the option of eating fewer than three pieces of fruit). For Babbitt, this principle is a natural property of the twelve-tone system, wherein a row is formed of all possible (the maximum number of) PCs. The group, in this case the row, is comprised of the greatest possible diversity of elements, the twelve PCs. At another level in the same system, a "row *class*" can be described as the maximum number of transformations of a single row.[22] Presenting all possible forms of a row within a row class is loosely analogous to eating the group of fruit in all possible combinations. As we will see, there is a multiplicity of levels within Babbitt's system that allow him to exercise his maximal aesthetic. Mead tells us that:

> "Babbitt has extended this idea [maximal diversity] to virtually every conceivable dimension in myriad ways throughout his compositional career. All sorts of aspects of Babbitt's music involve the disposition of all possible ways of doing something within certain constraints. […] Developing an awareness of this principle in all its manifestations is central to the study of Babbitt's music."[23]

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[20]Mead 1994, p. 19
[21] (A,O,B), (A,B,O), (B,A,O), (B,O,A), (O,A,B), (O,B,A)
[22] 12 prime forms, 12 inverted forms, 12 retrograde forms, and 12 retrograde inversions.
[23] Mead 1994, p.20.

The idea of maximal diversity intersects in many ways with another of Babbitt's compositional traits, which is to develop the highest degree of self-reference, or contextuality within a composition. The extent to which a work is self-contained, having set up and developed its own rules and internal laws, describes its degree of contextuality. Maximizing an underlying structure in pursuit of maximal diversity results in a greater degree of self-referencing because more musical material is derived from the piece's own unique foundation. Babbitt has often sought maximal diversity of elements by generalizing on existing twelve-tone procedures. For an example of this, let us turn our discussion to all-combinatorial hexachords.

Schoenberg used the principle of inversional combinatoriality to form his rows and used its inherent properties to inform his compositional procedures in other ways. Enacting this principle specifically involves selecting an inversionally combinatorial hexachord and pairing it with an inverted (and often retrograded) version of itself. To generalize this or any procedure, one needs to remove some degree of specificity. In Babbitt's case, he generalized Schoenberg's procedure by finding a way to allow the pairing of a hexachord with *any* transformation of itself, not just the inversion, thus removing the specificity of transformation type. He discovered a finite number of hexachords that could be transformed by all four traditional twelve-tone operations (at certain levels) and recombined with their originals to complete the aggregate. Babbitt calls these the "all-combinatorial" hexachords.[24] Example 4 lists the six all-combinatorial hexachords, labeled from 1 to 6.[25]

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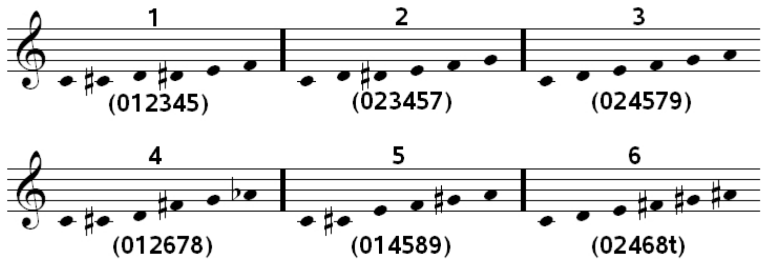
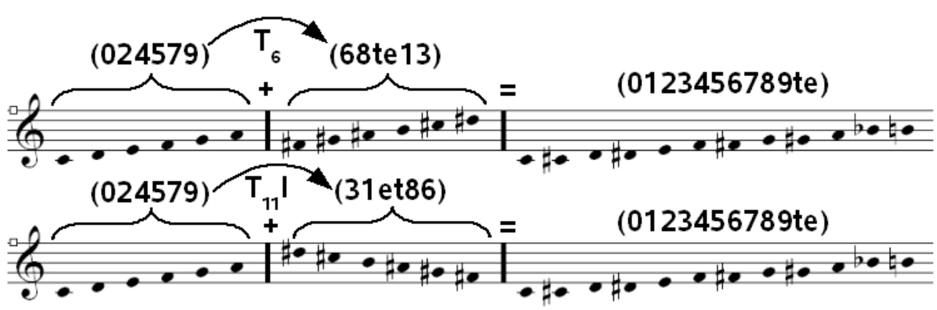
[24] "All-combinatorial" was first defined in Babbitt 1955.

[25] The labeling of all-combinatorial hexachords is not standard. Mead labels them using letters A-F. I choose instead to follow Babbitt's numerical labels appearing in Babbitt 1955, and thereafter.



Example 4

Hexachords 1, 2, and 3 can produce their own complements via any of the four transformations, as shown using hexachord 3 in example 4a.[26] These first three hexachords can produce their complement at only one transposition level, T6. Hexachord 4 complements at T3 and T9. Hexachord 5 can produce its complement at T2, T6, and T10 making it the most versatile of Babbitt's all-combinatorial hexachords, since he typically does not use the whole-tone hexachord 6, preferring instead to leave that one "for the Frenchman".[27]

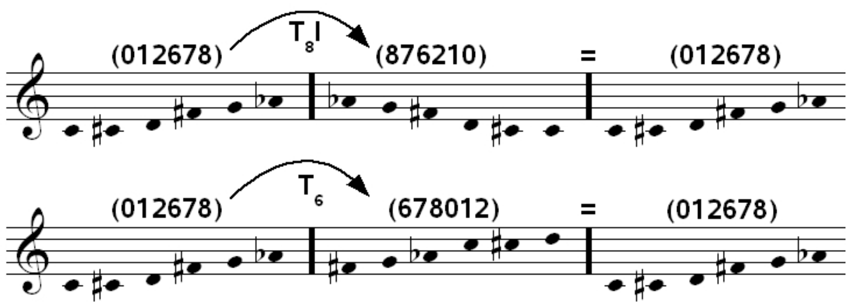


Example 4a – Hexachord 3 with its transposition and inversion

One may note that these hexachords can all be transposed onto their complements at any interval which they do not contain. This feature comes to bear on Babbitt's formal structure, as he often uses the missing interval to signal changes in collection. It is also

[26] Because order is not important within each hexachord of the completed aggregate, and because the retrograde of both the prime form and the inversion will produce the equivalent group of unordered notes, the R and RI transformations are not depicted in the example.
[27] Babbitt 1987, p. 53.

important to mention that these hexachords may also be inverted, and, in the case of 4, 5, and 6, transposed onto *themselves* as well as onto their complements (see example 4b). This allows for a maximal number of transformations within the same set, and a preservation of the same intervallic properties.



Example 4b – Hexachord 4 maps onto itself under transposition and inversion

Babbitt generalized upon Schoenberg's combinatoriality by working with hexachords that would allow more than just one transformation to combine into the aggregate. By removing the specificity of inversion in Schoenberg's combinatoriality, he generalized the procedure to include all possible transformations and therefore increased the possible variety of row versions within the same row class (maximal diversity). Babbitt's use of the all-combinatorial hexachords expands upon what he calls the "semi-combinatorial"[28] hexachords of Schoenberg, and exemplifies his aesthetic of maximal diversity. Before we can appreciate Babbitt's specific uses of the all-combinatorial hexachords in his music, we must first discuss the trichordal array.

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[28] Babbitt defines semi-combinatoriality in Babbitt 1955.

THE TRICHORDAL ARRAY

An "array" can be defined for our purposes as a background, pre-compositional aggregate structure.[29] For some clarification on the meaning of "pre-compositional," Babbitt offers a description:

> "I don't mean that this is something a composer does before he composes his piece. It's not a chronological statement. Precompositional means that it is in a form where it is not yet compositionally performable. You still have to do things to it. […] Therefore it is *pre*compositional because obviously it's not a formed composition. You have to make further decisions with regard to every element…"[30]

Actually, we have already seen an example of an array in example 2. The bottom of that example can be described as an array. It does not represent the actual surface of Schoenberg's music, but rather the underlying precompositional structure of sets and aggregates.

The trichordal array in Babbitt's music comes from another generalization of Schoenberg's combinatoriality, fused with Webern's trichordal conception of the row. We saw how Schoenberg used combinatorial rows to allow for the simultaneous unfolding of aggregates across two dimensions of the music. By employing Webern's atomization of the row, Babbitt reduces the combining segment from a hexachord to a trichord, allowing for *three* dimensions of aggregate formation. Example 5 reveals the trichordal array beneath the opening clarinet solo of Babbitt's *Composition for Four instruments*.

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[29] The term "array" as applied to twelve-tone composition is first used in Windham 1970. Though Windham devotes a large portion to his own work, the reader may find a detailed formal discussion of arrays in the first half of the essay. For a more detailed account of the origins of the term's usage in describing twelve-tone structures, see footnote 21 in Dubiel 1990.
[30] Babbitt 1987, p.90.

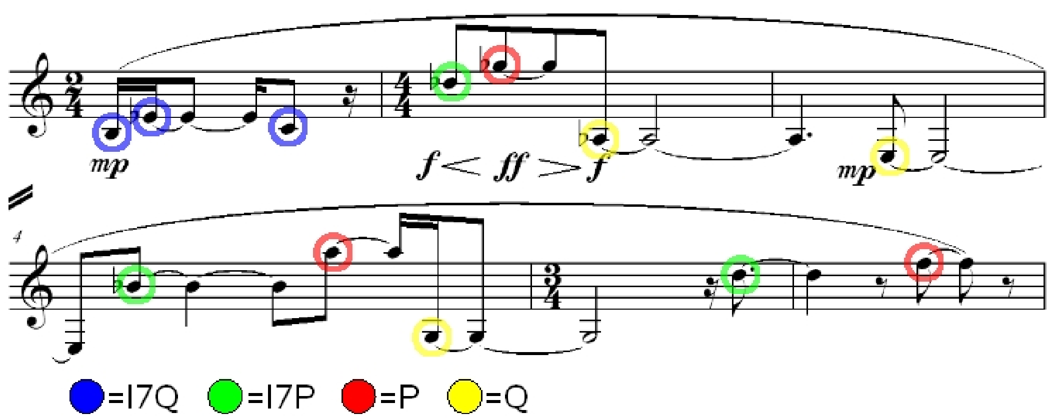
Example 5[31]

In the example, the precompositional horizontals of the array are called "lynes."[32] Aggregates are constructed every four measures in each lyne,[33] every two measures in each hexachordal lyne pair, and every measure in each four-lyne column of trichords. As one might imagine, this is no simple feat. Webern's generative process facilitates this increased combinatoriality in part. Every trichord of the array is a (014), because the row was derived from a (014). Just as in example 3, all four transformations of the trichord combine at the right levels to produce a twelve-note row. Of course, Babbitt has designed the trichord transformations so that they produce two all-combinatorial hexachords (012345). Each hexachord will contain two versions of the generative trichord, and will have its complement in any combination of the remaining two trichords. Via the trichordal array, Babbitt has carefully constructed an underlying counterpoint of related interval structures, which are

[31] Reproduced and amended from Mead 1994, example 2.5, p. 60.
[32] "Lynes" first defined by Michael Kassler in Kassler 1967.
[33] 'Measures' here refer only the measures of the array example, not to those in the actual music.

variously combined at multiple levels of the music, and are all fundamentally related to the prime row.[34]

As noted by Joseph Dubiel and also by Mead,[35] the essential row of the piece is not revealed on the surface of the music until the final movement. Looking at the array in example 5 however, P0 appears to be quite observable. This obscuring of the underlying structure is typical of Babbitt's array realization. As he stated, from the point of the array, "you still have things to do to it." Let us turn now to the clarinet solo in example 6, for a look at how Babbitt articulates the array.



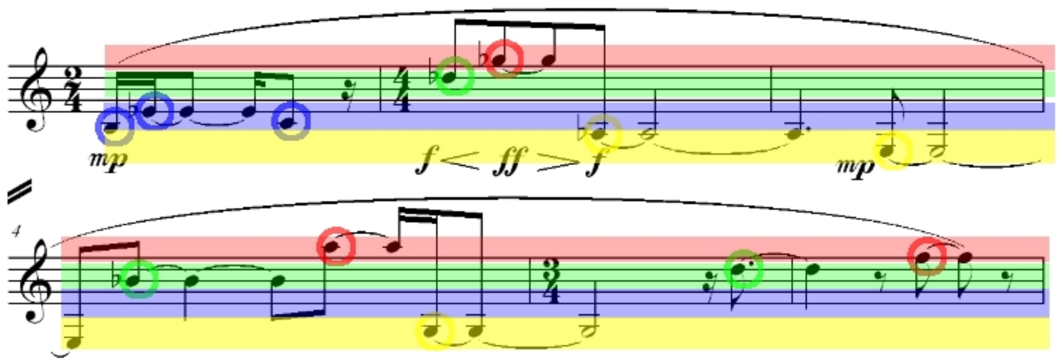
Example 6 – Opening 6 measures of "Composition for Four Instruments"

The first six measures of the music contain twelve distinct PCs. Referring back to the array of example 5, it may be difficult at first glance to decipher Babbitt's method for 'setting' his array structure. As the example clearly indicates, specific three-note groupings reflect a corresponding lyne (and row version) from the array. For example, the blue notes are the first three PCs of lyne 4 (I7Q). With respect to the rest of the groupings shown here

[34] For reasons of formal design, namely Babbitt's desire to withhold an interval for use in signaling hexachordal boundaries (mentioned above), he must use a secondary row in addition to the primary row. This row is derived from the original via its implementation of the same trichords. For more detail see Mead 1994, pp. 26-27.

[35] Dubiel 1990 and Mead 1987.

however, there may seem to be no obvious connection as they overlap one another. How are we to know which PCs are are members of the same lyne? Example 6a illustrates the connection.



Example 6a – Babbitt's parsing of register reveals array lynes

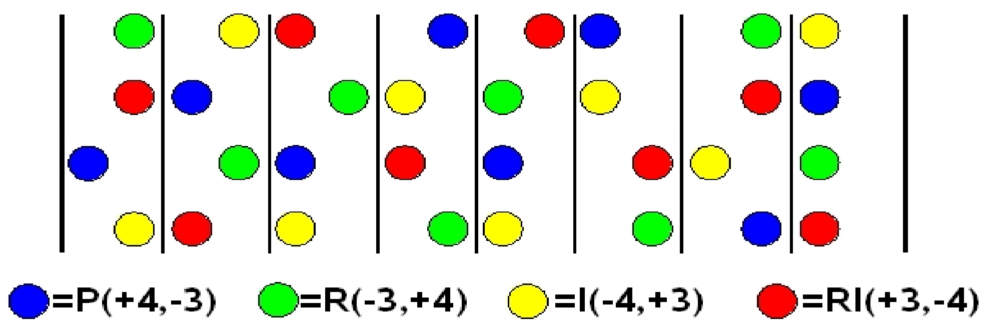
One of Babbitt's favored methods for delineating a lyne on the surface of a composition is to assign it its own distinct register. In a sense, he is carving up the frequency space of the clarinet and assigning each of the four lynes a mutually exclusive registral area. This allows him to realize the rigid structure of his underlying array while maintaining a more variegated surface. In other words, the aforementioned obscuring of the array is an intrinsically musical practice.

Although Babbitt makes the most explicit use of the trichordal array in what is commonly referred to as his first period (1947-1963), some manifestation underlies nearly all of his music.[36] The influence of Schoenberg and Webern is evident, but Babbitt's array expands upon the practices of both composers as it extends the influence of the row over a greater span of time and to a greater structural depth. In all of Babbitt's music, the trichordal array contains subtle internal relationships, which he often projects onto musical

[36] Dubiel 1990.

elements outside the initial array, and outside of the dimension of pitch. Let us reexamine *Composition for Four Instruments* for an example.

Looking again at example 6, it may be observed that Babbitt presents the four groups of trichords of the initial aggregate in a specific combination: 1 + 3. The first trichord is presented alone and then the remaining three are overlapped and so, in a sense, presented simultaneously. Rather than, "1 + 3," a more descriptive way to label this particular presentation of trichords would be "(P) + (R, RI, I)," where P represents the original presentation of the trichord (+4,-3), and R, I, and RI reflect the resulting interval pairs of their individual operations on P.[37] There are eight possible ways to fit these four trichords into two of fewer slots, excluding the null set. As shown by example 7, Babbitt carries out all eight possible permutations of trichord ordering, all within the initial clarinet solo. As the example depicts, there are eight complete aggregates in the opening clarinet solo and four registrally-divided rows (8X4). As it turns out, there are also eight sections in the entire piece and four

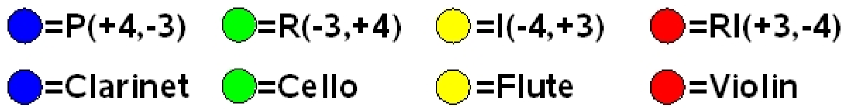


Example 7 – Distribution of trichords in opening clarinet solo - time flows left to right[38]

[37] Described in Mead 1994, p. 61.

[38] This chart corrects a small mistake in Mead's (ibid.) very similar example 2.6. He incorrectly inverts the registral positions of P and I in the first aggregate. As is clear from the opening, the (+4,-3) prime trichord is presented in the second-to-lowest register, not the lowest.

instruments in the ensemble (8X4). Further, each two-part section is characterized by a different alternation between instrument groups, producing four solo subsections; one for each instrument in the ensemble. Example 7a amends example 7 to show that Babbitt is mapping the very same distribution pattern onto the alternating instrumental sections. As Mead puts it, "The pattern of unfolding instruments of the entire composition is replicated in the unfolding of trichords in the initial solo!"[39] The level of unification and self-reference that Babbitt achieves in this way is extraordinary.[40] [41]



Example 7a – Distribution pattern projected onto multiple levels

Babbitt's pursuit of maximal diversity is evident in the formation of the trichordal array and in his exhaustive permutations of the elements. A trichord, via the *maximum* number of transformation types, generates a row, and its constituent all-combinatorial hexachords (capable of *maximum* combinations). The row forms are arranged to produce *maximum* aggregate completion over the *maximum* number of adjacent dimensions. Further, the generative trichord is dispersed across the four lynes of the clarinet solo in the *maximum* number of aggregate-filling configurations and the very same pattern is reflected onto elements outside of the pitch domain, namely the piece's orchestration. These kinds of relationships are common to nearly all of Babbitt's music, and though his maximal aesthetic

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[39] Ibid.
[40] For more detailed and varied analysis of *Composition for Four Instruments,* see Dubiel 1990; Lewin 1995; Mead 1994 (pp. 55-76); and Rothstein 1980.
[41] For more on trichordal arrays, see Babbitt 1976, Babbitt 1974, and Mead 1994 (pp. 25-30).

remains fixed, the ways in which he realizes it remain rich and varied. Such a variation may be illustrated through an investigation of what Babbitt's calls "all-partition arrays".[42]

THE ALL-PARTITION ARRAY

Babbitt worked with the trichordal array through the 30s and into the late 50s and early 60s before he began to pull on a thread that would lead him to develop an important variation on the trichordal array. And while the array described above will remain in some fashion throughout Babbitt's compositional practice, this new twist is seen by some as an entirely new structure, or at least a "new kind of array."[43] The major innovation has to do with the notion of array partitions. In the typical trichordal array, each aggregate is partitioned into four sections of three, three PCs for each of four lynes. In the 50's, Babbitt began to experiment with slight changes to this pattern, like pulling one PC from one partition and placing it into another, starting to unravel the even divisions of his earlier arrays. The reader may predict what must have been naturally appealing to Babbitt, given his aforementioned preference for dividing some number of elements into some number of parts or fewer (as in the ordering of trichords within each aggregate and the projection of that same pattern onto instrument groups within the entire composition – examples 7 and 7a). Rather than maintain the rigidity of four divisions of three, as was typical in his standard trichordal array, Babbitt began to construct a type of array that would divide the aggregate into all possible partitions distributed into some number of parts, or fewer: the all-partition array.[44]

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[42] First defined in Babbitt 1974.
[43] Mead 1994, p. 31.
[44] The all-partition array appears in conjunction with the onset of Babbitt's second period (1964-1980).

Preserved from the original trichordal array are Babbitt's expanded usage of Schoenberg's combinatoriality and the arrangement of all-combinatorial hexachords to produce the greatest number of aggregates across multiple dimensions. Therefore, the same combinations of lynes and lyne pairs are observable in the all-partition arrays. The opening portion of the all-partition array from Babbitt's 1966 solo piano piece *Post Partitions* is shown in example 8.[45]

Example 8 – Opening of Babbitt's Post Partitions – underlying array

At first glance, the lynes may be difficult to equate to those of the trichordal array, given the new temporal displacement and the following number of other differences. First, this array appears to triple the number of lynes from four to twelve, with six lyne pairs. Second, and not typical of all-partition arrays, the array's horizontal block length is six PCs rather than twelve. Third, and most fundamentally different, aggregates are now formed with varying

[45] This is Mead 1994, example 3.35, p. 173.

combinations of lynes in each column, reflecting the purpose of the new array. Let me address each of these three differences in turn.

In the all-partition array, Babbitt often works with a greater number of lynes. The aesthetic principle at work should be familiar: by using more lynes, he effectively expands the influence of the row across a greater time span, since a greater number of lynes equals a greater number of partitions to enact. The general procedure is the distribution of some number of elements (in this case the twelve PCs) into some number of parts or fewer (in this case the number of lynes). With four lynes, there will be thirty-four aggregates in the array. With six lynes, there will be fifty-eight, and with twelve lynes there will be seventy-seven.[46] Babbitt's natural tendency was to compose a piece entirely of one complete array, one essential structural gesture. By associating overall length with array length, Babbitt established a secondary relationship between the number of array lynes and total length wherein increasing the lynes meant – in a general sense – increasing the compositions total length. This explains the trend toward increased lynes, and a greater variety of lynes in the all-partition array as compared to the trichordal array. It should be added that, in the case of *Post Partitions*, the number of lynes is indeed greater that in most trichordal arrays, but, what appear to be twelve lynes are actually six lynes, where each lyne is a combination of two horizontals in the array, represented in the music by a pair of two notes in the same register, one short and the other long.[47] This is a special variation on the more frequent all-partition array, whose block length would normally span twelve PCs horizontally, and it demonstrates one way in which Babbitt is able to achieve variety within his seemingly rigid

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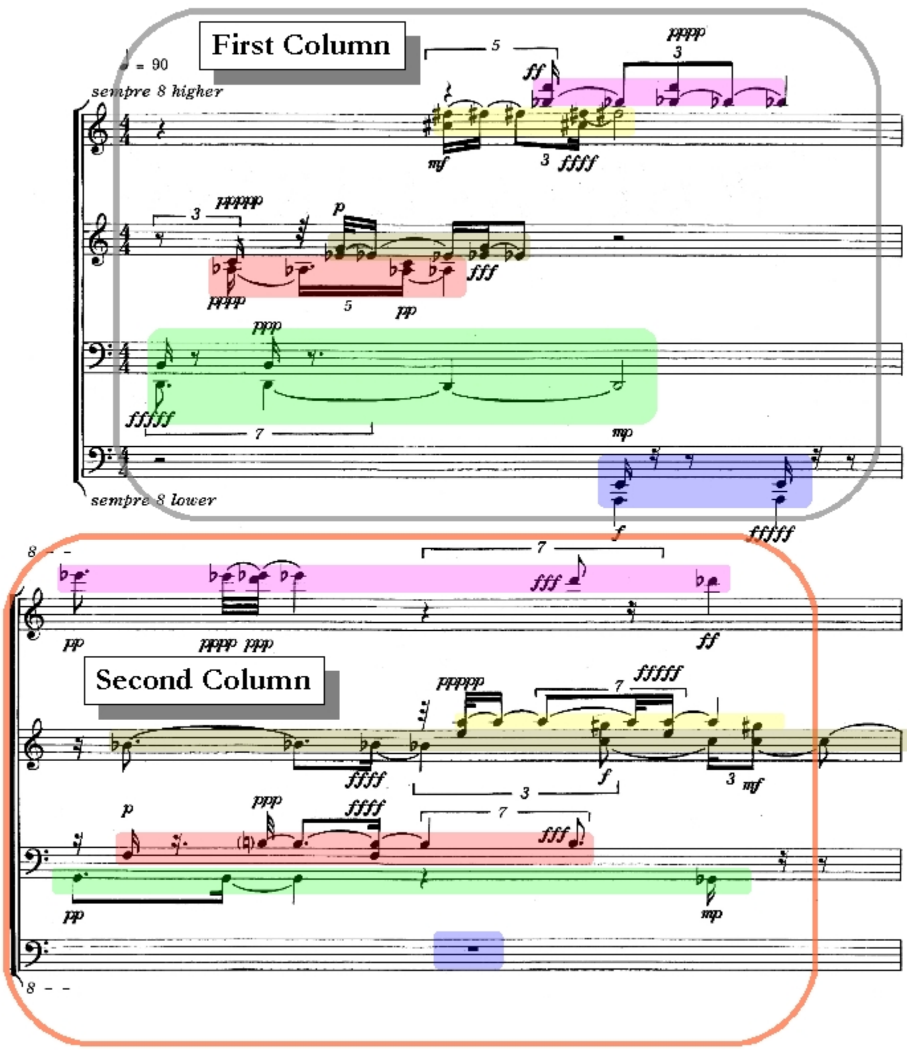
[46] Mead 1994, p. 32, also see Mead 1984.
[47] Mead calls these "composite lynes." 1994, p. 172.

precompositional structure, and also offers some explanation for the second major difference mentioned above.[48]

The third and most fundamental difference is the variation in the internal distribution of columnar aggregates. This is the essence of the all-partition array. Babbitt divvies up the aggregate differently in each instance of the array in this dimension. In the



Colors indicate composite lynes

Example 8a – Opening measures of Post Partitions related to the array

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[48] The array of *Sextet* (very closely related to that of *Post Partitions*) and its formation, with emphasis on the notion of hexachord rows and composite lynes, is discussed also in Dubiel 1990 beginning on page 235.

first column, each lyne (recall that each lyne is actually an entire staff consisting of two 'voices') has two PCs (indicated by the "2^6" below - *2* PCs in *6* lynes). In the second column, two lynes each contain three PCs, three lynes each contain three PCs, and one lyne will necessarily contain no PCs ($3^2 2^3$).[49] This permutation of partitions continues through the piece. Again, this permutation process may be understood as the determining factor in the pieces total length, since the piece terminates immediately following the fifty-eighth and final possible partitioning of the aggregate into six or fewer parts. This is not the only musical function derived from the all-partition array of course.

Example 8a reproduces the opening of *Post Partitions* and illuminates the connection with the underlying array. The opening gesture presents the full aggregate dispersed equally amongst lynes, which are distinguished, as mentioned above, by their register and by their pairing of two notes of polarized durations. In the array, a column's boundaries are established by the contained aggregate. So, when an aggregate is completed on the musical surface, the following music corresponds to the following column in the array. The final PC pair of the first column is A-E, appearing in the lowest register and represented by the lowest two horizontals of example 8. Moving forward in the array, one can predict the next arrangement of PCs in the score by noting the absence of material in the lowest register, and the increased density in the highest and third-highest register, each of which have picked up one of the missing PCs of the low lyne. A glance at example 8 will show this prediction to be accurate. From here one can imagine a possible orchestration for the remaining material shown in the array of example 8. One may also see the great compositional appeal that such a precompositional structure held for Babbitt.

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[49] Please note Mead's typo below the second column. It should read "$3^2 2^3$"

As was the case with his trichordal array, Babbitt guarantees himself a high degree of structural integrity, and now, with the underlying row even further in the background (operating over a longer distance via the all-partition array) he has extended and generalized the twelve-tone system to such a point where, but for the combinatorial core, it might appear to many as unrecognizable from its Viennese origins. Indeed, we have seen the system generalized to the utmost in terms of pitch, and we have also seen it operate on the levels of orchestration and form. One of Babbitt's most famous serial developments however, is one that incorporates the remaining dimensions of dynamics and rhythm.

BABBITT'S RHYTHM AND THE TIME POINT SYSTEM

This final section will present a brief study of Babbitt's "time-point system."[50] Brief, not for lack of detail, but because, as we will see, much of the system's complexity is derived from structures that we have already discussed, namely the array, combinatoriality, and the notion of maximal diversity.[51] We begin with a comparison between rhythmic procedures of Babbitt's first period, namely the duration row, and that of his second and later periods, the time-point system.

The time-point system relies on the presence of a "modulus" to articulate a mod 12 grid over which the rhythmic row may unfold, where note attacks correspond directly with the appropriate number on the grid. This modulus is defined as the division of some fixed time-span, which may vary from piece to piece and even within a piece, into twelve equal

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50 Introduced in Babbitt, 1962.

51 The focus and limited scope of the present discussion necessitates a general avoidance of the discourse concerning the issue of perception and the tenuous relationship between the natural application of the number twelve to the serialization of pitch, and the application of the same number to the dimension of rhythm and duration. The interested reader is encouraged to examine the following: Babbitt, 1962; Babbitt, 1964; Lester, 1986; Mead 1987; and Mead 1994.

parts.[52] This is analogous to the pitch domain's octave and chromatic scale, which can be described as resulting from the division of some fixed *frequency*-span into twelve equal parts.[53] Babbitt had experimented during his first period with the serialization of rhythm in different ways without using the modulus, often equating duration values, rather than attack points, with each PC of a row, resulting in what are called "duration rows."[54] In that system, the PCs (11, 2, 6) would become a three-note rhythm with eleven units of length for the first note, two for the second, and six for the third. As Babbitt was no doubt aware when using this method, there are almost no apparent relationships between the effects of standard twelve-tone operations on a rhythmic collection and the same operations performed on the same PC collection. For example, the PC set (11,2,6) is a minor triad, consisting of two internal intervals, the minor and major third. If one applies a T3 operation to this set, the result (2,5,9) is still a minor triad: it's internal relationships are preserved. Now, with the same rhythmic collection realized as a duration row (we'll assign the 16th note as the durational unit), the same T3 operation does not preserve an internal relationship. Babbitt's use of the modulus in the time-point system *does* preserve such operations and therefore represents a closer connection between pitch and rhythm. The difference between the two systems is illustrated in example 9.

From this short three-note example, one might recognize the implications for realizing combinatoriality in this dimension using the time-point system. Unlike the duration row, the time-point row exhibits clear properties of combinatoriality that can be especially

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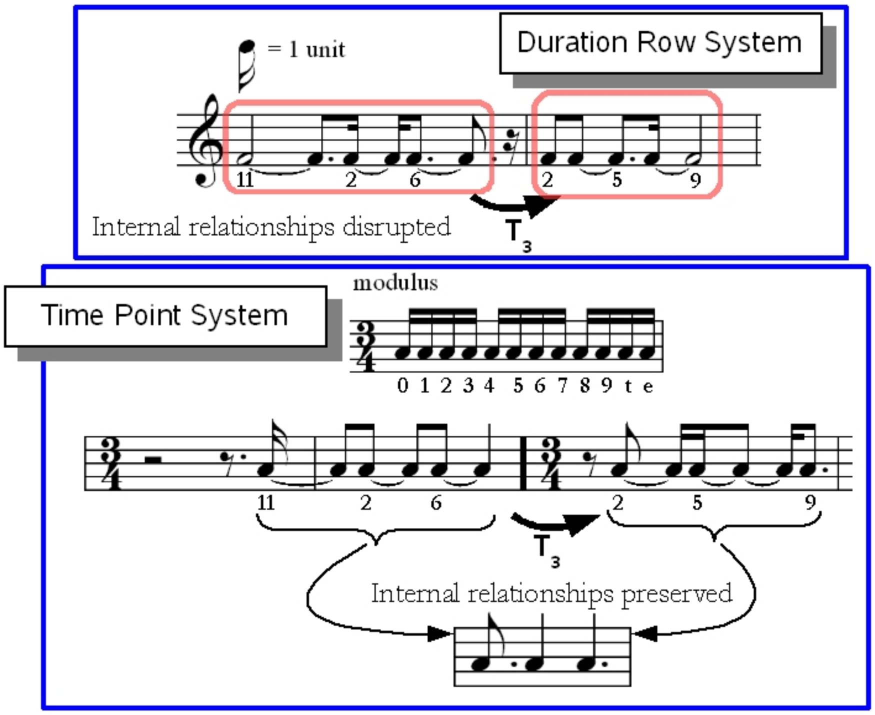
[52] Andrew Mead introduced the term modulus in Mead 1987.
[53] Of course, the truly equal division of the octave does not yield the tuning temperament of common usage, but the parallel is nonetheless appropriate.
[54] For the origin of the term "duration row," see Borders 1979 and Westergaard 1965.

apparent in a polyphonic situation. Because Babbitt uses fixed attack points for the twelve locations within a fixed, recycling time-span, combinatorial six-note rhythms can combine to



Example 9

fill out all possible attack points of the modulus over some equal or longer span of time.[55] Columnar aggregates are similarly effective. Therefore, an exhausting of all modulus points over any dimension of an array is easily possible and forms a strong parallel with the same procedures discussed earlier with respect to PC aggregates. It was natural then that Babbitt should use the same array to organize rhythmic material that he used to organize PC material.

Babbitt does often project the same all-partition array from the realm of pitch onto that of rhythm. However, a one-to-one unfolding is rare. More often the arrays unfold at

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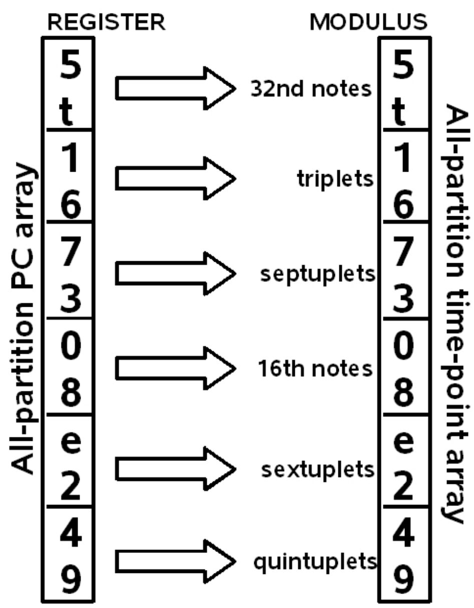
[55] Babbitt often repeats a given time-point attack at the equivalent location in the next cycle of the modulus before moving on to the next attack point in the row, resulting in a more unpredictable (more musical) rhythmic surface. This repetition is analogous of standard twelve-tone PC presentation, where notes are often repeated.

different rates, usually with more PC array blocks than time-point array blocks. The relationships between the two domains are often quite complex, reflecting various other interactions within Babbitt's underlying pitch structures.[56] If Babbitt's methods for associating time-point arrays with pitch arrays trends toward complex and varied, his methods for articulating time point array lynes follow an inverse trend, with some variety, but a preference toward a single procedure. The seemingly favored method for time-point array lyne articulation is to assign each lyne with a distinct dynamic level from soft to loud, much like PC lynes are assigned a specific register from low to high. Therefore, in a straightforward dynamically articulated array lyne, a note on the downbeat of the measure, marked "fffff" would represent the number "0" the highest lyne in the array and the same note marked "ppppp" would indicate a "0" in the lowest array lyne. Another common method, possible only in vocal music, is the assignation of certain vowel or consonant sounds to each array lyne as in *Phonemena* for soprano and tape.[57]

For a more detailed glimpse of Babbitt's time point practice, let's return our focus to *Post Partitions*, which is suitable for this purpose since we are already familiar with its array. In addition, this piece serves a good example because it exemplifies a number of ways in which Babbitt is constantly adjusting his procedures. There are three significant aspects of the *Post Partitions* time-point array which require special explanation. First, the modulus changes from lyne to lyne, so that each lyne's modulus corresponds with a different division of the quarter note, from three to eight (from eight-note triplets to thirty-second notes). This multiplicity of underlying rhythm accounts for the somewhat frantic surface. Second, rather than serving to distinguish the lynes, dynamics are themselves assigned values so that

[56] See Mead, 1987.
[57] For more detail on the piece in general also see ibid.

they will correspond with modulus points. This means that for each completed time-point aggregate, a dynamic aggregate will unfold as well. This ensures an addition level of tumult on the piece's surface. Third, and interrelated with the first two, lynes in the array are delineated on the surface by their unique modulus. Dynamics are otherwise employed, leaving the distinguishing feature of each lyne its distinct underlying rhythmic subdivision. Example 10 reproduces the first aggregate portion of the familiar all-partition array and illustrates its relationship to the time-point array. Note that common PC numbers are substituted for drawn notes and staves are represented by boxes.



Example 10 – Post Partitions, first aggregate – PC array maps onto the time-point array

Babbitt maintains a one-to-one relationship between pitch and rhythm so that the two arrays unfold simultaneously. The maximal diversity of partitions of the PC aggregate is now generalized and transferred to the rhythmic domain. Also, because of the one-to-one relationship, in addition to corresponding with time-point aggregates, the complete dynamic spectrum, or dynamic aggregate, will also be represented alongside the unfolding PC aggregates described in the previous section. Moreover, the transference of maximal permutation will transfer to the level of dynamics in this piece as well, so that, not only is every conceivable element serialized, but all possible distributions within an element's aggregate are exhausted via the all-partition array. Not only is this an example of 'total' serialism, but it is an example of supreme unification of elements.

CONCLUSION

Articles, essays, and entire books have been devoted to the intricacies of Babbitt's serial technique, many of them written by the composer himself. To say that I have barely scratched the surface in these pages would be something of an understatement. Andrew Mead, after nearly 300 pages devoted entirely to Babbitt's music says that he has "given us a glimpse of Milton Babbitt's development as a composer," and that "it is hardly a complete picture."[58] Similar statements appear in the majority of these writings. Babbitt has created music so rich and complex that it seems almost impossible to present a comprehensive view of a single piece, let alone that of his total output.

I have instead outlined a number of what I feel to be the most salient procedures of Babbitt's compositional process, salient not for distilling the architecture of any single piece (though I have attempted some such illumination), but for developing a sense of Babbitt's compositional aesthetic. I began by explaining the process by which Babbitt generalized upon the notions of Schoenbergian combinatoriality and upon Webern's particular use of the trichord to construct his own combinatorial universe, the first manifestation of which was the trichordal array. I then described how he generalized further upon aspects of the

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[58] Mead 1994, p. 264.

trichordal array, leading to the development of the all-partition array. Finally, I detailed one further generalization through a discussion of Babbitt's time-point system and it's manifestation as a projection of the all-partition array. What I hope has emerged is a broad understanding of Babbitt's unyielding pursuit of maximal diversity and a specific knowledge of what lies beneath some of the most impressively constructed music of this or any century.

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