Composing *Each Time*

Robert Morris

Introduction

Each time I finish a piece, there is little time to rest or reflect; something else demands my attention, and I attend to it. Of course, finishing a piece is not really abrupt; after the first draft, there is revision, computer engraving, and editing. During these tasks, new ideas and conceptions begin to enter consciousness so the experience of writing a particular piece fades even before all the work is done. Later, when I return to a work—to coach a performance or lecture on it—I try to reconstruct the process of composition and return to the way it felt to write it, but much of the passion and clarity that brought the work into being is lost. With some thought of addressing this problem I decided immediately after completing my piano piece *Each Time* to write about it while the experience of its composition was still fresh in my memory. In this way, I hope to express as vividly as possible what I try to put into a piece and how and why—something which might be useful to future performers or listeners.

In some respects, *Each Time* is not very different from my other piano pieces; however, I wanted to express in music some new insights I had into the phenomenology of time derived from Buddhist philosophy. Rather than spelling this out now, I'll just say that I composed the piece so it might suggest to an attentive listener that impermanence is at the root of experience and that time is both flowing and discontinuous at once. I'll return to this conception at the end of this text, after I have described the piece in some detail.

During composition, much is clear but not said. Musical ideas come and go, and, on a good day, one knows just what to do with and about them. From studying the scores of past composers, it is evident that they possessed great compositional knowledge and skill. Whether they could have spoken about these facets of their music is doubtful, for there was little or no technical language available—not to mention a conceptual base—to help frame their compositional ideas in words or other non-musical symbols. It has even been advanced that past composers knew *how* to compose, but not *what* they were doing. Nevertheless, the wealth of incredibly skillful and elaborate musical associations and transformations in earlier music contradicts that assumption.

By contrast, today's composers have access to sophisticated technical language, concepts, and techniques. In fact, many 20th-century composers such as Henry Cowell, Paul Hindemith, Arnold Schoenberg, Oliver Messiaen, Milton Babbitt, Pierre Boulez, Karlheinz Stockhausen, Iannis Xenakis, and John Cage are responsible for inventing or advancing various forms of musical discourse to develop their own creativity, with various degrees of rigor and clarity. Over the last forty years, American music theory has transformed and added to these compositional ideas, refined and generalized them, and put them to use in musical analysis. Thanks to these developments, the composer of the 21st-century can *choose* whether or not she wants to be articulate about her compositional practice and/or those of others. But even with such knowledge, there is reticence about talking shop in public. Some of this undoubtedly derives from the unfortunate split in our intellectual discourse between science and the humanities, called the "two cultures" by C. P. Snow. Be that as it may, words about music tend to be distrusted by the general public, who like their composers to be "intuitive" and non-verbal. Sometimes one hears it said that composers who can talk about their music are not as talented as those who cannot (or will not).

Being able to speak about one's work doesn't make you a better composer, but, contrary to superstition, it doesn't hurt. Cognitive style is an important factor, for negotiating the gap between the qualitative and the quantitative isn't altogether natural for many people. Even so, the act of writing using musical notation involves and encourages such translations in both directions. We write down a musical symbol that stands for a musical object like a note or a process like a crescendo. Both the object and process are meant to be experienced as, or contribute to, a musical event, which, despite its notation, is transient—often immediately transient—retained only in memory. From the other side, when we hear a musical event, we possess a way to grasp and retain it, exactly because we can notate it (even if we do not on a particular occasion). So in the following discussion, I will freely make use of musical notation to make points about the features of *Each Time* and its musical structure. At the same time, I'll try to keep away from technical terminology unless it is absolutely necessary. I will also assume the reader has only scant knowledge of serial composition; I hope those who do have such knowledge will appreciate my attempts to advance serial music in innovative and unprecedented ways.

When presenting my work to, say, a group of composers in a workshop or forum, depending on the time available, I commonly follow a more or less standard procedure. After a few introductory comments, I play a recording of the work, describe its basic compositional features, form, and structure; illustrate some of these with musical or written examples; play the work again; and ask for questions. I believe that this top-down method helps introduce listeners to a challenging and/or unfamiliar composition, but from the questions, I often notice people want to know how to relate what they hear in the music to what I have said about it. They want to know if it is all right to have had some other reaction or interpretation than the ones I might have explicitly or implicitly presented. Sometimes they ask if or even assert that what I have said might not be relevant or understandable to the listener or performer who doesn't compose, and especially to the audience at large. Or the question is framed in another way: Who is the ideal listener? I have no definitive answers to such questions, since I don't believe there are any. I can only say that music takes time to learn and that musical experience is not confined to the period of time when one is listening to a performance—that musical study is part of that experience, that what one can hear is based on what one already knows, and so forth. From another standpoint, these questioners ask: what would I say if I were asked to teach them how to listen to my music? I take this question not as an invitation to legislate or demand that my music be heard in only certified ways and contexts, but to ask about what I have put into the work that I believe can be heard by others. It is frustrating to be asked such a good question at the end of a talk on my music since there is no time to answer it. I might bring up a few caveats, such as: When I say X can be heard, I need to also specify what it is heard as, and in what contexts. Or I might say that a very close look at the particularity of some passage from a piece might help one get an idea of what's there to hear and appreciate. In any case, this paper is an attempt to answer that question.

First Hearing

To begin, I need to think about what a serious listener might pick up from a first encounter with *Each Time*. Not surprisingly, composers want to know what the presumably "unbiased" and "objective" listener hears in their music, if not out of narcissism or to assuage doubts about their music's worth, then to know if they have been "successful" on their own terms. I don't believe one can ever know this, since a composer has a priori knowledge of her work precisely because she composed it and can only conjecture about what a listener might bring to it. However, as a listener to other composers' works—at concerts and especially in compositional tutorials—I am often called upon to immediately voice my reactions to a piece I have never heard before. And in the roles of writer and teacher about other composer's music, I may try to provide ways to help the listener get from the "facts" of the score to an appreciation of the work. In one case, I retraced the path I myself took from listening to a work for the first time to getting to that work's underlying structure. I am referring to my article, "Not Only Rows in Richard Swift's *Roses Only*," published in *Perspectives of New Music* in 1997. I wrote that text not only to express my appreciation of the relation between the compositional surface and what allows that surface to be the way it I heard it, but to show that one can piece together the structure from the particulars and how that process deepens and changes what one hears in the work. I will attempt something like this in this paper, but with the disclaimer I am only imagining what I might hear if I didn't know this piece.

In an actual performance, the concert ritual helps prepare the listener for attending to the work. If the piece starts out slowly, there is more time for one to get acquainted with the material and manner of the composition. (This is the case in *Each Time,* where the first compositional unit—a term I will explain later—is about 33 seconds long, consisting of six dyads spaced sparsely in that time span and variously articulated in all ranges of the piano.) As a piece goes on, one becomes familiar with the work's general character, finds places of immediate beauty and interest, and perhaps becomes aware of some general aspects of its structure. The listener may also notice whether or not it satisfies one's expectations based on one's previous knowledge and the opening of the piece, and if not, whether that is to its credit or not. And there are the great many perceptions of details that are not recalled until the work is heard again; this is one reason why multiple listenings are so important in learning a work. With longer and demanding works, it is difficult to "understand" much about the piece after one hearing, even if one likes it very much, and this might invite one back for another performance or to acquire a recording or score. Very often it is the performers' authenticity and virtuosity that brings off a new piece, as it should be.

In the case of *Each Time,* I imagine that the listener will readily perceive that the piece alternates between slow, spacious sections, like that at the beginning, where the listener and the pianist have time to relax, and faster, more mercurial, active, contrasting, phrasal textures that that take the pianist's hands from one position on the keyboard to another, often with dramatic effect. The listener might also notice that somewhere in the middle of the piece, its character changes. Octaves, rare in the first part, are now brought in multiply to provide thicker, more discontinuous and less contrapuntal textures and that six-note, even-paced melodies predominate here and there. If I were listening for the first time, I might hear the first part as a relatively smooth landscape with gentle hills and valleys, where the second section might suggest more rugged terrain produced by erosion and radical changes of weather.

After the performance, the listener might wonder if the second part is some sort of variation of the first or if it is different. As I will show later, both of these conjectures are true. The second part is indeed a transformation of the first, but it also has unique features that allow the musical materials in the first part to integrate and interpenetrate each other as well as providing keys to unlocking the structure that undergirds the entire piece.

Seven Corresponding Measures

So let us begin by comparing the two parts of *Each Time*, by examining seven corresponding measures from each part. These are shown in **Example 1** so that mm.78-84 from the first part is aligned with mm.213-19 of the second part, three measures of both sections on the first page of the example, and four on the second. On first glance, these passages don't seem to match in any great detail, nor do they seem to differ radically in character. However, a moment of inspection reveals that the music in the middle of the keyboard in each passage uses the same notes in the same order, but in different groupings. The range for these notes is the major-seventh from B below middle C (Called B3) to the Bb above (called Bb4). This is especially clear in the example's second measure of each passage. (Note in the second part how the notes B, Eb, G A D Ab form one of those even-paced melodies I mentioned above.) As for difference, the second passage includes many octave doublings, where the first passage does not. And the first passage is composed so that each measure includes all twelve pitch-classes, while the second part does not, although each measure except one has twelve pitches (not pitch-classes) not counting immediate repetitions. Thus, the overall effect of the two passages is distinct once one attends to these differences, which may subtly support an impression that, in addition to the shared middle range notes, the passages are somehow parallel. Later I will show exactly how these two passages, and the entire first and second parts of the piece, are related.

Compositional Units

From my comments on these passages, it can be inferred that I use the measure to delineate local aspects of structure. In point of fact, for more than twenty years, I have notated my music so that the measure indicates to the player and listener the most foreground *compositional unit* of a composition. Each compositional unit is a self-contained whole, but is also part of the flow. The pacing of these units by using different tempi and time signatures is an important part of my compositional practice. In my concerted music, the conductor's gestures therefore indicate to the players and audience much more than where the beat is and how it is to be divided, as they do in older music. In almost all of my pieces, the unit is also divided into layers or registers that remain invariant throughout a section or even throughout an entire piece. In *Each Time*, the entire range of the piano is divided into seven non-overlapping, adjacent registers, as shown in **Example 2**. The registers are numbered from 1 to 7, from top to bottom. The outer and middle registers employ 12 pitches, while registers 2, 3, 5, and 6 have 13 pitches.[1]

Looking again at the first measure on the top staff of Example 1—measure 78 of part one of *Each Time*—we see that the sequences of notes Eb F# F and C# are in register 1, G and B are in register 2, C E A Bb and D are in register 3, and the Ab is in register 4. None of the lower registers (5, 6, or 7) are used in this unit. Looking at the measure below in the example—measure 213 from part 2— we see that G Eb C Db and F contribute to register 2, the three octave Ab contributes to registers 4, 5, and 6 simultaneously, and the notes B, Bb, and Gb contribute to register 6.

The basic pitch-class material of this piece flows through the unit's registers, but never between and among them. The combinations of notes between and among the different registers in a unit function in analogy to what we call harmony or counterpoint in traditional music. To make the distinction between these two types of pitch-class deployment, I shall say the series of pitch-classes in the registers is *horizontal* and the combination of the contents of the registers in a unit is *vertical*.

In my music, there are rules for what kinds of pitch-class sequences and combinations may be used in the linear and vertical dimensions of a unit. In the first part of *Each Time*, the horizontal material in each register is a type of 55-note chain I will describe later, while the vertical material is the *aggregate*. An aggregate is a collection of all twelve-pitch classes. This means that each measure—a unit—contains one instance of each of

[1] In the registers that are 13 pitches wide, I can articulate an octave if the pitch-class can be represented by the bottom (and top) note of the register. I do this in a few places in part one of *Each Time*, to presage the rampant octaves in part two.

the twelve pitch-classes. The content of the registers in a unit will be adjacent portions of the chains that flow through the registers from unit to unit. This situation is known as *generalized combinatoriality* in the serial literature. As stated earlier, the top system of Example 1 satisfies these rules.

In the second part of the piece, the compositional unit also has portions of the 55-note chains in the registers, but the aggregates may be weighted. Weighted aggregates are derived from regular aggregates, but they are -classes aggregates themselves; they do not contain all twelve-pitches and some pitch-classes are duplicated. The bottom system of Example 1 is comprised of horizontal chains and vertical weighted aggregates, except for measure 218, which has only 11 pitches. One pitch of the weighted aggregate of that unit was deliberately left out to facilitate performance. The omitted note is the pitch B5 in register 3, which occurs in that register in the next unit. Since the pitch-class B also occurs in a different octave in the deficient measure, I had no problem leaving it out to make the passage a little easier to play.

Rhythm and Pacing

The compositional unit has another function; it can be assigned differing durations, thereby pacing the musical flow. This function is no more than a generalization of what is called harmonic-rhythm in tonal music, the speed at which chords change over time. When units are given the same durations, the flow is more or less even, even if the rhythmic values that articulate the pitch-classes within each unit may differ as to distribution and density. If the durations of units decrease over time, the music often becomes more intense and exciting; when the durations become longer the music will become more relaxed and spacious; fluctuating durations may induce feelings of turbulence, impermanence, or surprise.

In most of my music, long patterns of durational change are applied to the units so as to give a piece a characteristic time flow. I use different kinds of mathematical series to this end. In this piece, I take the durations of the compositional units in groups of five and gradually change them over time. This is not apparent in Example 1, since the pattern of change is evident only over longer spans of time. Therefore, in **Example 3** I have listed the time signatures for a series of units starting before to after the measures in Example 1. On the top of Example 3, we see the time signatures for measures 62 to 90 arranged in groups of five. The first five signatures show an erratic pattern of 5 4 3 6 3 that gradually changes by one change per group of five until the pattern is a series of 4s. Thus, over these measures, the pacing of the units gradually changes from uneven to regular. The part of this change that is notated in Example 1 happens toward the end of this process.

The pacing of units from mm.199 to 223 is given on the bottom of Example 3. Here an mildly decreasing pattern of 4 3 3 3 2, gradually changes into a series of ever more decreasing patterns ending with 5 4 3 2 1. As this process changes, the jump from the low value at the end of each line to the longer value at beginning of the next becomes more and more exaggerated. The effect is a cascade of density crescendos, each starting with less density and eventually ending with more. The measures in Example 1 that form part of this process do exhibit one cycle near the end of this wavelike progression.

Having discussed unit macrorhythm, we turn to the microrhythm within a compositional unit. Some serial composers have used duration or time-point series or arrays to determine the local rhythm, that is, the durations between adjacent time-point of notes or other musical events. For a number of reasons I have resisted this approach in favor of looser, more malleable techniques. In *Each Time*, the internal rhythms are subject to what I call *rhythmic rates*. In the piece I specified four rhythmic rates: progression by 3s (triplets, sextuplets, etc.), 4s (eighth-, sixteenth-, thirtysecond-notes, etc.), 5s (quintuplets, etc.) and 7s (septuplets etc.) Each unit is assigned 1 to 3 of these rates out of which the rhythmic durations and sequences are constructed. In Example 1, under each measure, there are numbers in parentheses that indicate which rates were to be used when I composed the music. One can see there that a given unit usually retains one of the rhythmic rates used in the previous unit.

As with the unit macrorhythm, there are long-range patterns specified for the change of rhythmic rate from unit to unit. This is revealed in **Example 4**. As in the previous example, units before and after the units in Example 1 are given. Here the successive rates are given in threes, which brings out the pattern of change. In mm.73-87 three of the rhythmic rates are employed, 3, 4 and 5. Each of the three possible pairs occurs on each line. Each line differs from the last exchanging the first pair or the second pair alternatively; after six lines (18 units) all permutations of the six pairs have been used. This permutation plan guarantees that one rate is retained from unit to unit as we saw in Example 1. In mm.207-233, the situation is similar, but 3 is substituted for 7, and sometimes the 5,7 pair occurs twice in a row. On the bottom line, the pattern of change is exhausted and units thereafter use three (all) or one of the rhythmic rates. These patterns begin anew with different selections of rates after each long and sparse section of 36 beats. These long sections are very extended compositional units, but written as a series of measures for practical reasons.

Compositions and Partitions

We see now that the seven-measure passages in Example 1, while useful for getting started in this description of *Each Time*, are really too short to give any more than a snapshot of the processes that drive the piece. They are also not long enough to show something else: that there are many dimensionally conjoined repetitions in the piece. In other words, while there is much diversity from unit to unit, units at a distance have affinities and associations that can be easily noticed and appreciated once we start looking for them.

One of the ways units can resemble each other is by the distribution their pitch-classes, that is, by the number of pitch-classes in each of the seven registers. There are two ways we compare the distributions of units. The first involves a simple mathematical concept: the *composition* of a number. Given a number n, we can express n as sum of other numbers paying attention to the order in which they are given. If we set n to 12, then the following number sequences are distinct "compositions of 12": 66, 152121, 543, 453, 211125, 57, etc. These examples confirm that the order in which the numbers that sum to 12 distinguishes one composition from another. We can use compositions of 12 to describe the distributions of pitch-classes in a unit. We simply write down the number of pitch-classes in each register (from 1 to 7). In **Example 5**, four units are given. The unit in **Ex. 5a** has 1 pitch-class in register 1, 0 pitch-classes in register 2, 6 in register 3, 3 in register 4, 0 in 5, 1 in 6, and 1 in 7. The composition is 1063011 as shown. Four measures later in the piece, there is another unit with the same composition, shown in **Ex. 5b**. Comparing the two units we see that the overall distribution of pitch-classes in registers makes the two units sound roughly similar, even though the notes are different and there is a rest in the middle of Ex. 5a and none in Ex. 5b. The way the notes are grouped and combined also contributes to the similarity. The broken sixth Eb G in the bass in 5a finds its opposite number in the sixth Eb-Gb in 5b. The two other sixths in 5a heighten this correspondence. The quicker opening three-note flicker in each unit also helps forge a connection. There is also a disagreement between the two units, for in the first the note Eb in register 6 is repeated, where the corresponding note in 5b is not. This shows that the compositions of a unit only specify the number of distinct pitch-classes in each register, not the number of times each of them might be repeated when the unit is composed out. For instance, I might have repeated the Eb ten times in unit of Ex. 5a, which would put a lot of action into register 6, thereby obscuring the fact that the unit has the same composition as in unit in 5b. I tend not to do this however, so that the compositions and partitions (see below) of a unit are not unduly veiled. (Let me say here that there is nothing wrong with hiding the pitch-class distribution of a unit with ample degrees of repetitive activity; for instance, it can be an important way of making connections between units with vastly different distributions.)[2]

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[2] We can compare pairs of compositions to see by how much they differ by taking the positive differences between corresponding numbers in each composition and summing them. For example, the comparison would give 22 as the difference between the compositions 1063011 and 0100470 since 1-0→1, 0-1→1, 6-0→6, 3-0→3, 0-4→4, 1-7→6, and 1-0→1 and 1+1+6+3+4+6+1 = 22. This comparative method would give a rough and ready measure of how much registral discontinuity occurs between successive units.

The units in **Exx. 5c and d** also share the same composition, in this case, 0100470. The two units clearly articulate their shared composition. Each has one high note (in register2), and notes in the middle low registers, registers 5 and 6. The 4 pitch-classes in register 5 find correspondences in Ex. 5c; Gb Bb dyad followed by the rising sixth C A in register 5 of Ex. 5c is echoed in Ex. 5d by the dyad Gb-Ab in register 5 and the rising sixth in register 6 at the end of the unit. While the units in Exx. 5a and b were only 4 units apart, Ex. 5c is in the first part of the piece and Ex. 5d is in the second, making their reference long range rather than local.

Another way to compare the pitch-class distributions of units is given by the concept of a *partition of a number*. A partition of a number is like a composition, but the order of numbers doesn't count. So, while 345 and 534 are different compositions of 12, they are instances of the same partition of 12. For instance, if a unit has the partition 9111000, one of its registers will have 9 pitch-classes, three others will have 1 pitch-class each, and the three others none. When we find that two units share the same partition, we are guaranteed that the distribution of pitch-classes in registers is the same in both but that the number of pitch-classes in specific registers does not have to be the same. So, units with the same partition have a similar feel with respect to distribution, but units that have the same composition are much more similar.

Example 6 shows many examples of units with different kinds of partitions. First we show some "even" partitions, where every number of the partition is the same or zero. Even partitions are easy to recognize because there are only two values for the number of pitch-classes in unit registers. Moreover, an even partition has only a few compositions.[3] In **Exx. 6a and b** we show the even partition 2222220 and in **Exx. 6c and d**, 4440000. We have seen the units in Exx. 6a and b before in Example 1, which suggests that the units in part 2 have the same partitions as their counterparts in part 1. This is a correct assumption, and provides another way in which the two parts of *Each Time* are related.

[3] Since we are usually attracted to the notes rather than the absence of notes in a register, the different compositions—the orderings of the numbers in an even partition—sound the same. To put this another way, if we leave out the zeros in an even composition, then the composition is equivalent to an even partition.

The 4440000 partition in Exx. 6c and d connects the two units since the registers in both present a higher tetrachord with two registrally adjacent tetrachords below. Moreover, the tetrachords in both units are all of the chromatic type, a 4-1[0123] set-class. The difference between the two units is that the latter is weighted while the former is not.

There are 65 partitions of the number 12 into 7 or fewer non-zero numbers. We may categorize these partitions in many ways in addition to even versus uneven. A partition may be wide as in **Ex. 6e**, where one register presents a relatively long sequence of pitch-classes and the others short or empty. Other partitions can be narrow as in **Ex. 6f**, in which there is material in all of the registers. Such distinctions between partitions have implication for the performance difficulty of a unit; a narrow partition will call for more large leaps than a wide one, which may lie under the hands without leaps.

As a final example of partitions, **Exx. 6g and h** present the four occurrences of the 4421100 partition in *Each Time*. The units that have this partition come in adjacent pairs and we have seen two of them in Example 1. Other partitions occur as many as 12 times in the piece, such as 5421000 and 7410000.

Compositions and partitions have been useful to me in profiling the distribution of pitch-classes in various compositional units. In fact, it was the possibility of varied and contrasting distributions of pitch-classes among aggregates in combinatorial arrays that first attracted me to serial composition. Since there are 1816 compositions of 12 into as many as 7 parts (without zeros) versus 65 partitions of 12 into as many as 7 parts, partitions remain the more likely way that units can be associated.[4] (In fact, it is somewhat amazing that there are any units that have the same compositions in *Each Time*,[5] but there are seven pairs of units that are of the same composition.)

[4] Incidentally, there are 2048 compositions of 12 (without zeros) and 77 partitions of 12.
[5] For instance, there are 111384 compositions of the number 12 into exactly 7 parts with zeros allowed and this is only a fraction of the number of compositions of 12 into up to 7 parts with zeros.

Intervals in Units

Up to now, we have concentrated on associations between units according to their distributions and rhythmic profile. Such comparisons are generic versus particular; they help us grasp important aspects of the characteristic ways this music moves in time as well as provide associations based on pitch-class and temporal distributions from one part of the piece to another, but they say little about the specific content of the units. So in the sequel, I will concentrate on the association of units by pitch-class content and other particulars.

Example 7 displays a number of units from *Each Time* each based on one or two basic intervals. Such units have a distinctive intervallic identity. **Ex. 7a**'s middle register displays a number of fourths and fifths. Even the high E and C# are related by two octaves and fifth to a temporally adjacent note in register 4. I have indicated this interval saturation with the notation "int 5,7" below the example. The same sequence of intervals strongly recurs in unit 171 in **Ex. 7b**, an extremely clear reference to the first occurrence in unit 50 (Ex. 7a). There is also an earlier and softer reference to unit 50 in unit 112 (**Ex. 7c**). Here the 5 and 7 intervals are in a difference register and not all of them are identical to their predecessors.

Intervals 1 and 11 subtly dominate unit 118 in **Ex. 7d**. I say subtly since there are other intervals in the example, but looking between the registers we see: int 1 between Bb and B; int 11 between Db and C; int 1 between the D-D# dyad; 1 from E to F; G overlapped by F# then G# produces ints 11 then 1; and A following the G# sounds a 1. A number of int 3s occur in **Ex. 7e**, while 3s and 6s are connected to form members of SC3-10[036] in **Ex. 7f**. Here the note sequences F B D, C F# A, and Db Bb E are each marked ***mp***, while the remaining non-adjacent notes are marked ***pp***.

Ex. 7g presents a series of notes, that, when taken in threes produce four successive augmented chords, or SC3-12[048] sets. This passage is also an example of a super-saturated unit since the first and second trichords, the second and the third, and the third and fourth, all produce SC6-20[014589]. The last example, **7h**, presents intervals 2, 4, 8, and 10 since the unit is partitioned into two whole-tone scales, SC6-35[02468A].

Each Time presents other units of this type, but the principle of emphasizing and cross-relating passages with certain set-classes occurs much more frequently at the hexachordal level.

Three Colored Rows

By now, the reader may be wondering if there are any referential twelve-tone rows in this composition. There are, but they are not fundamental to the pitch-structure of the entire piece. I built them into the structure of the 55-note chains I alluded to above, something I had not done in my other compositions employing long pitch-class chains. It is easy to find complete runs of twelve-tones in *Each Time*, not only because the first part's units contain aggregates, but because there are several units that employ the 12 0 0 0 0 0 0 partition, and the unit has a series of twelve different pitch-classes in one register. I also arranged that these runs should occur in middle ranges of the piano so they could be readily noticed by the listener and easily played by the performer. The next set of examples display such units. I begin with a row I call the "Red Row." For ease of reference in **Ex. 8a** I have transposed it so it starts on C-natural and labeled that form T0. **Ex. 8b** shows the T1 form of the Red Row spread out over many registers so it orders the aggregate of unit 40. The same row form occurs later in unit 126 in register 5, as shown in **Ex. 8c**. **Ex. 8e** indicates that the retrograde of the same row form (RT1) occurs much earlier in unit 27. Instances of the row occur later in the piece among the weighted aggregates of units in the second part of the piece; these forms are necessarily incomplete, but not so much so that their derivation from the Red Row is difficult to discern. Three of these incomplete specimens are found in **Exx. 8d, f, and g**; the Red Row occurs in retrograde, under T2, and the retrograde of that with the names of the missing notes given in parentheses.

The Red Row is not the only row in *Each Time*. There are the “Yellow” and “Blue Rows” as well. The T0 form of the Yellow Row is shown in **Ex. 9a** followed by three instances in **Exx, 9b, c, and d**. Two of these have the T10 form in the middle register, one in a linear form (Ex. 9b) and the other in a harmonic portrayal of exactly the same notes. The last example of the Yellow Row shows the RT8I form spread over many registers.

The Blue Row examples—from **Ex. 9e to 9h—**give the T0 form, two manifestations of the T4 form; one is complete in register 3, the other is incomplete in the five lowest registers passing though a triply-duplicated Ab. The retrograde of the T0 form occurs in unit 92 (Ex. 9h), mainly in the lowest registers.

Looking for more instances of the Red, Yellow, and Blue Rows turns up a total of 27 units that I deliberately ordered to reference these rows; however there may be more incomplete rows in the piece. Since there are 246 units in *Each Time,* this is only about 9 percent. Thus one may safely conclude that *Each Time* is not based on a row, or only on rows. Nevertheless, there is an interesting relationship among the three rows revealed in **Ex. 10a**. The three rows are related by rotation. Thus all 27 units are really based on one row, which can be designated as the Red Row. The abstract rotational associations of these rows are actually spelled out in two pairs of units shown in **Exx. 10b and c** and **Exx. 10d and e**. In the first pair, T6I of the Red Row occurs in unit 74 in Ex. 10b. The rotation of that Red Row by one position is shown in Ex. 10c, but that is identical to the T10I form of the Yellow Row. The same situation occurs between the Yellow and Blue Rows in units 114 and 221. In the first (Ex. 10d) we have the RT2I of the Yellow Row; the same row is found rotated by one position in unit 221 (Ex. 10e), which holds an incomplete version of the RT4I form of the Blue Row. Since only the last three notes of the RT4I(Blue Row) are missing, it is still easy to see and hear this rotational connection.

One of the reasons I composed the rotational identities among the Red, Yellow and Blue Rows as explicit musical relations was to suggest that rotation might be at work on other levels of the composition. When we get to discuss the overall compositional design of *Each Time* I shall explain this further.

Unit Order Associations

There are other kinds of ordering relations afoot in *Each Time*. One is the use of *unit order associations*; the other is the use of six-note even paced melodies. We have already seen examples of unit order associations in the correspondences between units ordered by the same row. A more general case is where the aggregate in one unit is used to order another. This can be done in many ways. **Examples 11 and 12** are devoted to illustrating such associations. For instance, the sequence of pitch-classes in unit 8 in **Ex. 11a** forms a linear aggregate that is repeated, but in different registers in unit 81 in **Ex. 11b**. I do not call the linear aggregate a "row," for this ordering is (I believe) not found in any other aggregate under any of the twelve-tone operations and it is not presented in one register alone. A similar case is shown with **Exx. 11c and d** except the relation between the ordering of the two units is by retrogression.

The order associations between the units in **Exx.11e and f** are more complex. I call it *vertical-horizontal exchange*. The are at least 28 examples of vertical-horizontal exchange in the composition. This involves the vertical presentation of the horizontal contents of one unit in another. The horizontal contents are the segments in the registers of a unit. In vertical-horizontal exchange, registral segments of one unit are found between and among the registers of another unit. This state of affairs depends on the partial orderings of the units involved and is not usually available between two arbitrarily selected units. Looking at Ex. 11e, we see that the segments in its four registers are found given in retrograde as sequences of pitch-classes distinguished by dynamics in Ex. 11f. For instance, the sequence Gb Bb Eb in register 5 in Ex. 11e is found in Ex. 11f as a sequence of pitch-classes at the dynamic level ***p*** in retrograde. Likewise, in Ex. 11e the two segments D C# and C G are found concatenated in retrograde at ***f*** in Ex. 11f. The segment B E F G# A is found in retrograde at ***mf***, but with two pitch-classes missing. This occurs because the unit in Ex. 11f is a weighted aggregate. All this is shown by the information written under Exx. 11f and g. This information also shows the vertical-horizontal exchange between the units is mutual. The content of the registers of Ex. 11g is found articulated by dynamics in Ex. 11f.[6]

Example 12 gives three units from the piece where the vertical-horizontal exchange is exact. I chose the units for this example because the first two are temporally adjacent in *Each Time*. From the annotations in these examples, we see that the segments in registers of **Ex. 12a** are articulated by dynamics in **Ex. 12b** and vice versa; there is no retrograde relation here. **Ex. 12c** has pitch-classes sorted and ordered by dynamics that refer either to the registers of Ex. 12a or the pitch-classes sorted by dynamics in Ex. 12b. The relation is not mutual; Exx. 12a and b refer to each other, not to Ex. 12c.

In any case, in Each Time, units that are related to others via vertical-horizontal exchange can be initially detected by the flux of dynamics, giving them a robust, fitful character. Of course, this is not definitive; rapidly changing dynamics can be used for other structural or expressive purposes as well.

Hexachordal Melodies

Each Time's second part introduces a new texture into the piece: the use of short evenly paced hexachordal melodies. I use the term melody loosely, but these items often seem singable as they pose no rhythmic problems and they are often in the same register. Such melodies occur in 34 units out of the 121 that comprise the second part. The melodies as such are what connect the 34 units, not their complete content. Except for two units, each unit has a different melody, articulating a different set-class. **Example 13** gives 11 examples of these melodies. The first eight were chosen only because they articulate hexachordal set-classes especially associated with twelve-tone theory. These are the six all-combinatorial hexachords and two others, the so-called P and Q hexachord, respectively, 6-30[013679] and 6-14[013458].[7] **Ex. 13a** is the last unit of the composition

[6] Again, the correspondence is not exact due to the weighting of Ex. 11f.
[7] The all-combinatorial hexachords all can map onto themselves both under transposition and inversion-followed-by-transposition and into their complements both under

and its melody's last five notes provide an instance of the important "linkset" that allows chains to be linked together. Except for the last example (**Ex. 13k**), the melodies are confined to one register, notwithstanding grace notes and octave doublings from other registers. Ex. 13k's melody strides over four registers (2, 3, 4, and 5).

The last three examples, **Ex. 13i-k**, give melodies that under suitable twelve-tone transformations can be overlapped to form the Red Row, as shown under Ex. 13k. This result is not the whole story about the melodies, for putting all them together in the manner of a jigsaw puzzle one can construct the chain that generates the content of the registers of successive units.

Begin and End Sets

Now I turn to other harmonic associations among units. The previous discussion touched on this subject by identifying the set-classes of the hexachordal melodies. Here I will talk about the begin and end sets of units.

We can divide any unit into two hexachords. The begin set comprises the first six distinct pitch-classes of the unit. The end set is the last six distinct pitch-classes. There is usually no ambiguity in finding the begin and end sets of a unit unless it begins or ends with a chord of more than six pitch-classes.

If the unit is an aggregate, then the begin and end sets are complementary, having no pitch-class in common. This means that the begin and end set have the same interval content, which in turn implies that the begin and end set are of the same set-class or of Z-related set-classes. Begin and end sets color the aggregate with the sonic profile of the

---

transposition and inversion-followed-by-transposition. The P hexachord (Petrushka) maps onto itself under transposition and into its complement under inversion-followed-by-transposition; the Q hexachord maps into its complement under transposition. Other hexachords either map into their complements only under inversion followed by transposition, or only onto themselves under inversion-followed-by-transposition, or have no special mapping properties. (Inversion-followed-by-transposition is one operation.)

set-class. (Consider the sonic difference between two aggregates, one that begins and ends with the diatonic hexachord (6-32[024579]) and the other that begins and ends with the chromatic hexachord (SC6-1[012345].) Of course, the more one knows the different "sounds" of the various set-classes, the more the begin and end sets of a unit affect that listener.

If the unit is a weighted aggregate, the begin and end sets of the unit have no particular relationship. They will, of course, share some pitch-classes, and in a few units of *Each Time*, the begin and end sets may be of the same hexachordal set-class usually because there are only six distinct pitch-classes in that unit.

Example 14 provides some examples. **Ex. 14a** shows one of the long units. It is an aggregate divided into two complementary diatonic hexachords. The choice of dividing this unit in this way was suggested by the fact I had already decided to place a linear hexachord melody that articulated the same hexachordal set-class in another of the long units (See Ex. 13e), therefore forging another set-class association. This set-class 6-32[024579] also divides unit 14 (**Ex. 14b**) and three other units of *Each Time*. **Ex. 14c** shows that unit 196 is a weighted aggregate divided into begin and end sets that are neither identical nor Z-related hexachordal set-classes, one of them 6-32 again. The other set-class is 6-27[013469], which connects with unit 29 because this unit (**Ex. 14d**) is divided into two complementary members of set-class 6-27. Further connections can be had to other units that contain 6-27 hexachords. Such "harmonic" connections between units proliferate because there are many units that house begin and/or end sets of identical set-classes.

Ex. 14e shows a unit with a normal aggregate divided into the complementary Z-related set-classes 6-40[012358] and 6-11[[023468]. **Ex. 14f** provides one the five or so units that are so weighted that they have only six distinct pitch-classes, in this case forming a member of set-class 6-40. **Ex. 14g** shows another possible situation with begin and ends in a weighted aggregate. Both sets are from the same set-class (6-30[013679]), but overlap, rather than complement each other. **Exx. 14h and i** show how this works for Z-related set-classes. Ex. 14h is an ordinary aggregate so the two Z-related sets are literally complementary, whereas the weighted aggregate in Ex. 14i divides into overlapping begin and end sets of the same Z-related type as Ex. 14h.

Sometimes a unit that is an aggregate can be partitioned into a super-saturated set-class linear aggregate. This means that not only the begin and end set of the unit will be from the same or Z-related set-classes, but that the aggregate can be partitioned more finely into overlapping hexachords of the same type(s). **Example 15** gives four instances of such units. **Ex. 15a** shows how the series of dyads that comprises the very first unit of *Each Time* composes out a super-saturated set-class sequence. The first three dyads given in union form the set B G# F# G A Eb, which is a member of SC6-39[012348]. Then the second through the four dyads give the set F# G A Eb D F which is a member of the Z-related SC6-10[013457], and so forth twice more to form one member of 6-36 and 6-10. So, all four sequences of three dyads are from the same Z-related set-classes. As one progresses through super-saturated sequences, dropping off older sets while adding new ones, the sonic flavor of the set-class remains the same even though the notes are changing; therefore super-saturated set-classes series project their set-classes even more strongly than the partitioning of a unit into begin and end sets.

The next two super-saturated set-class units in Example 15 immediately follow unit 1 in the composition. They saturate their units with Z-related set-classes 6-13[013467]/ 6-42[012369] (**Ex. 15b**) and 6-28[013579]/6-49[013479] (**Ex. 15c**). The annotations on the example show why I selected these partitions for the first three units of *Each Time*; the set-classes saturated in the units are the same as the outer hexachordal set-classes of the Blue, Yellow, and Red Rows respectively. To illustrate a super-saturated set-class series that does not use Z-related sets, I have given unit 15 in **Ex. 15d**. It overlaps 5 members of set-class 6-14[013458]. (There are 24 units that are super-saturated, none of them by the same hexachordal set-classes.)

Set-Class Networks

To summarize these set-class associations, it is important to understand that the two parts of the piece do different things with the hexachords. In the first half, each unit has hexachordal begin and end sets of the same or Z-related set-classes. Thus any unit can only associate harmonically with other units that share the same set-classes. (We can say that different set-classes partition the 121 units of the first part of the piece into equivalence-classes.) For instance, units 34, 65 and 118 are related because they contain set-class 6-1[012345] as begin, end, or super-saturated sets; units 39, 70, and 74 connect because they have the Z-related set-classes 6-4[012456]/6-37[012348].

The second part of the piece contains weighted aggregates in which the begin and end sets are usually not of the same set-class. These create associations between units in the first section that are not connected. Thus the two sections of the piece work together to form a complicated network of set-class associations that connects every unit to any other, if not directly, then via intermediate connections. **Example 16** presents this network. Set-classes are nodes connected by thick lines labeled by a “Z”, indicating that they are Z-related, or a thinner line labeled by a number. The number indicates which unit in the second part of *Each Time* connects the two set-classes as begin and end sets in a weighted aggregate. Each node on the chart also stands for the units in the first part that house that hexachord (and its Z-related correspondent). Because the network is connected—not comprised of unconnected parts—it is possible to (eventually) associate any set-class with any other by following paths on the network. This feature resembles the property of the chains that contain all 50 hexachordal set-classes.

The criterion for constructing the network was to keep it as small as possible. This means I had to make sure I used as many non-identical partitions with different set-classes of the weighted aggregates as possible. It took some time to work this out to my satisfaction, using charts generated by computer programs.

Summary

In the course of the previous discussion and musical examples of the units of *Each Time*, I have dropped hints and promised clarifications about the piece's overall structure. To prepare for the next part of the paper, let me review what I have already presented and elaborated. Each unit of the piece is found in either measures from 1/4 to 8/4, or is 36 beats long (written in a series of different measure lengths). A unit has pitch-class segments distributed in its seven registers whose content is either an aggregate or a weighted aggregate. The piece is in two parts, lasting 246 units with part two (units 126-246) derived from the first via aggregate weighting, a technique I have yet to describe in detail. The series of pitch-classes threaded through a given register of successive units forms a series of 55-pitch-class chains. This means that these chains determine the order of the units. I have also mentioned (with regard to Example 1) that the content of middle register (4) of the first part is the same in both parts of the piece. We can therefore conceptualize the structure of the piece as a long table or array of 246 columns and 7 rows, each array row containing successive segments of 55-note chains. Each array column is a potential unit containing 12 pitch-classes from parts of (up to) seven different chains. The columns up to and including column 125 contain no pitch-class duplications, where the columns after 125 to the end do (with a few exceptions). The distributions of pitch-classes in any column will be one the 65 partitions of the number 12 into as many as 7 parts. Later on, after I show how the array was made from the chains, I present parts of this array in Exx. 20 and 22.

Chains

All the pitch-class material in *Each Time*—the notes within and among the registers of units, the Red, Yellow, and Blue rows, the hexachordal melodies and the content of the begin and end sets of units—can be traced back to the chain in **Example 17**. What is the main property of this 55-pitch-class chain? Each of the fifty hexachordal set-classes in 12-tone equal temperament is found represented once and only once by a six-tone sequence somewhere in the chain. The chain therefore imbricates these hexachordal orderings and needs exactly 55 notes to do it.

Ex. 17a tells us that the pitch-classes are not represented equally in the chain; it contains 6 Cs but only 2 Gs, for instance. Furthermore, the chain is designed so it can link with other chains that are transformations of it under the familiar twelve-tone operations, transposition, inversion, and retrograde. With linking, the juncture from the end of one chain to the next will add no notes that bring in any hexachordal orderings not found in one chain or the other. Therefore the link is by five pitch-classes so that resulting double-chain will be 105 pitch-classes long with two representatives for each of the 50 hexachordal set-classes and that these pairs of representatives will be related by a twelve-tone operation. Ex. 17a shows how this works. The *linkset* is the first five pitch-classes of the chain, C A Bb B Ab, and the last five notes of the chain is the TBI or RT3 of the linkset. (The reason there are two operations that can relate the last five notes to the linkset is that the linkset itself remains the same under retrograde-inversion, specifically under RT8I.) This means the chain can link *to* a transform of itself under TBI or RT2I. In addition, the chain can link *from* a transform of itself under TBI or RT8I. **Ex. 17b**. shows the four linked chains in register 4 of the first part of *Each Time*. The same sequence is used in the same register in the second part. The bold entries are the pitch-classes in register 4 of Example 1; therefore these notes occur in mm.78-84 of part one and mm.213-219 of part two of *Each Time*. A complete description of chain linking is given below.

Example 18 identifies the placement of each representative of the 50 hexachordal set-classes in the chain. In the table, the pitch-classes of the chain are written from top to bottom in the second column with their order numbers in the first column. The hexachordal set-classes that begin with the pitch-class in the second column are written in the third column and their special roles in the piece are given in the fifth column, such as whether they form a six-note, even-paced melody (called “linear” in the table) in units of part two, or if they begin a transform of one of the Red, Yellow, or Blue Rows. This means that the rows and the melodies are all derived via twelve-tone operators from the chain, and conversely, that transforms of the rows and melodies explicitly stated in the units are found in the chain and its transforms that occupy a given register in the succession of units. Moreover, since every hexachordal set-class is found in the chain, all the begin and end sets of units can be related to each other through their presence in the chain.

The next three sections of this paper consider the construction of the array of *Each Time* from concatenated linked chains. Since this discussion is more technical, some readers may wish to pass over it and resume at the section headed "Compositional Features of the Array". From now on I shall often use integers to stand for pitch-classes to save space: 0 = "C"; 1 = "Db" or "C#"; 2 = "D"; etc. to: 9 = "A-natural"; A = "Bb" or "A#"; and B = "B-natural".

Relations Among the Members of the Chain-Class of C

Let C be the name of the chain of Example 17; the *chain-class of C* is all transformations of C related by transposition, inversion, and/or retrograde. The chain class is analogous to a row-class.

1. Notation.

```
C = 09AB8----B2103
```

In the chain C, 09AB8 is followed by other pitch-classes and ends with B2103. To show this we write

```
C = (09AB8,B2103)
```

2. Operating on Chains

r1 G(C) = (GX, GY)

Rule r1 is for operating on the chain C with the pitch-class operation G. X is the beginning of C and Y is the end of C. The chain G(C) is said to be a transform of C (under G).

r2 R(C) = (RY, RX).

Rule r2 is for operating with R (retrograde) on the transform C. R(C) is the retrograde (transform) of C.

r3 RG(C) = (RGY, RGX)

Rule r3 is for operating on the chain C with the pitch-class operation G and R.

3. Identities

i1 X = TBIY = 09AB8
i2 Y = TBIX = B2103
i3 X = RT8IX
i4 Y = RT2IY

4. Linking.

We are interested in linking transformations of C, so that the end of some transform G(C) is identical to the beginning of the transform H(C). So if G(C) = (P,Q), then H(C) = (Q,S). To this end, we derive transforms of C that preserve X or Y in C = (X,Y)

5. Derivations for linking

C = (X,Y)

TBIC = (Y,X)

since by i1 and i2, and by r1 (TBIX, TBIY) = (Y,X)

RT2I(C) = (Y, T6X)

Since by r3 RT2I(C) = (RT2IY, RT2IX)
and by i4 Y = RT2IY
and by i3 X = RT8IX so RT2I(RT8IX) = T6X

RT8I(C) = (T6Y, X)

Since by r3 RT8I(C) = (RT8IY, RT8IX)
and by i4 Y = RT2IY so RT8I(RT2IY) = T6Y
and by i3 X = RT8IX

RT9C = (X, T6Y)

RT3C = (T6X, Y)

First, by r2 RC = (RY, RX).

Then RC = (T2IY, T8IX)
since by i4 Y = RT2IY so RY = T2IY and
by i3 X = RT8IX so RX = T8IX.

Then RC = (T3X, T9Y)

since by i2 Y = TBIX so T2I(TBIX) = T3X

and by i1 X = TBIY so T8I(TBIY) = T9Y

Then by r1 RT9C = (T9T3X, T9T9Y) = (X, T6Y)

and by r1 RT3C = (T3T3X, T3T9Y) = (T6X, Y)

T6C = (T6X, T6Y)

T5IC = (T6Y, T6X)

These are derived by r1 by operating with T6 on C = (X,Y) and TBIC = (Y,X). With these transforms we have listed all the transforms of C that start or end with X, T6X, Y, or T6Y.

Definition: The sets X, Y, T6X and T6Y are called linksets.

6. Cycles of Linkings

The linking of chains with linksets X, Y, T6X and T6Y is shown on the following graph in **Example 19**. The graph shows that the set of transforms are analogous to tracing paths on the edges of a cube. One links transforms of C by following the arrows. Successive links will eventually form cycles.

2-cycles are had by following the doubled-headed arrows to and from a transform, as in from C to TBIC and back. C is linked via Y to TBIC and back via X; we have the linkset connections (X,Y) → (Y,X) → (X,Y).

There are three types of 4-cycles.

1. Following a path on the top or bottom of the cube.

    For example, C to RT2IC to TBIC to RT3IC to TBIC and back to C; we have the linkset connections (X,Y) → (Y,T6X) → (T6X,Y) → (Y,X) → (X,Y). (P RI R I cycle.)

2. Following a path on the front or back of the cube.

    For example, C to RT2IC to T6C to RT8IC back to C; linkset connections (X,Y) → (Y,T6X) → (T6X,T6Y) → (T6Y,X) → (X,Y). (P RI P RI cycle.)

3. Following a path on the right or left side of the cube.

    For example, C to TBIC to RT9C to RT8IC back to C; linkset connections (X,Y) → (Y,X) → (X,T6Y) → (T6Y,X) → (X,Y). (P I R RI cycle.)

7. Linking other transforms of C.

The eight transforms of C given above are linked via the linksets X = 09AB8, T6X = 63452, Y = B2103 and T6Y = 58769. This set of transforms of C is closed; no other transforms of C can be linked to them. We will call this set the *link coset 0*.

There are five other closed sets of eight C-transforms called *link cosets 1* through *5*. One derives coset n by transposing each member of coset 0 (and each member of the linksets) by n or n+6. Link cosets 0 to 5 partition the chain-class of C.

Constructing the Array of *Each Time*

The seven array rows of the array of *Each Time* are derived from chains linked via different link cosets.

```
Register 1 (top) uses link coset 5
Register 2 uses link coset 2
Register 3 uses link coset 5
Register 4 (middle) uses link coset 0
Register 5 uses link coset 3
Register 6 uses link coset 1
Register 7 (bottom) uses link coset 4
```

All link cosets contribute chains; link coset 5 is used twice (in array row 1 and 3). For this reason, only 30 members of the 48 members of the chain-class of C are employed.

The array was constructed in two successive parts called respectively *first* and *second parts*.

In each part, each array row[8] concatenating transforms of C starts and ends with the same link set. Therefore, in each array row the same linkset starts and ends the first part and the second part of the array.

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[8] As mentioned earlier, what appears in array row n will appear in register n of successive units (which are the successive columns of the array).

The Structure of the Array

Here is the assignment of transforms of C to each array row of the array.

array row	First Part	Second Part
1	T5C T4IC	RT2C RT1IC
2	T2C T1IC RT11C RT10IC	RT11C RT10IC T2C T1IC
3	RT8C RT7IC T11C T10IC	T11C T10IC RT8C RT7IC
4	T6C RT8IC T0C RT2IC	T6C RT8IC T0C RT2IC
5	RT0C T8IC RT6C T2IC	T3C RT5IC RT6C T2IC
6	T7C RT9IC RT10C T6IC	RT4C T0IC RT10C T6IC
7	RT7C RT6IC	T10C T9IC

The sequence of linked C transforms in the array can be derived from just two sequences:

A = T5C T4IC RT2C RT1IC (from array row 1)

B = T6C RT8IC T0C RT2IC (from array row 4, first or second part.

A is a P I R RI cycle of type 3 above.
B is P RI P RI cycle of type 2 above.

The following chart indicates the relationship of the array rows to cycles A and B. (ROTn is the rotation operator; it operates on a sequence of elements putting the last n elements (in order) first. For instance, ROT3(mnopq) = (opqmn).)

array row	First Part	Second Part
1	A	
2	T9A	ROT2(T9A)
3	ROT2(T6A)	T6A
4	B	B
5	ROT1(T2IB)	ROT3(T7IA)
6	ROT3(T11IA)	ROT1(T6IB)
7	ROT2(T5A)	

Compositional Features of the Array

In addition to having an elegant structure, the array was designed to implement particular compositional goals.

The use of only four linked transforms of C in the top and bottom array rows (versus eight in the other registers) is to weight the central 5 array rows, to save extreme high and low notes for special moments, and to prevent them from becoming tiring to the ear; this also reduces the number of very large leaps for the pianist.

Many of the transforms of C occur twice in the array, one in the first part and the other in the second part of the same array row. Thus many pitch-classes sequences will be found in two different places in the array, sometimes clearly highlighted, sometimes more covertly composed. As the previous chart showed, the content of array rows are related by rotation to the A or B cycle of chains. Rotation also relates the colored rows and the units illustrated in Ex. 10. Transforms of these rows are found overlapped starting at order positions 5 through 7 in the chain in Ex. 17a and b. So the rotational associations of compositional units containing colored rows alludes to an inherent feature of the chain as well as to the deployment of the A and B chain cycles in the array rows.

Array rows 2, 3, and 4 repeat exactly the same transforms, but in array row 4, as I have already pointed out, the sequence of transformations is also in the same order in both parts of the array. The placement of this feature in the middle range of the piano (and within the range of the human voice) helps make it aurally apparent that this array row provides an identical spine to each half of the array.

In array rows 5 and 6 only two transforms of C are shared between the first and second part of the array, but these two are the last of each part. This rhymes the two parts of the array. The top and bottom array rows (1 and 7) have unique transforms, but fewer chains.

The linksets of C and its transforms are chromatic and invariant under RTnI. Since they must begin and end transforms of C, they can function as introductions and cadences. This is very clearly presented in the last measure of *Each Time*. The first four units of the piece present seven linksets at once. At other points in the piece, a linkset can be heard in a register signaling the link of one chain to another. A good example is in units 94-95 (mm.107-08) or 216-217 (mm.243-44); the last measure of these pairs is given Exx. 6c and d. Three clearly articulated linksets can be heard in either of these unit pairs.

The First and Second Parts of the Array

The first part of the array was partitioned into aggregates (with horizontal weighing). In **Example 20** we show the first chains in each of the registers of the unpartitioned array. This is followed by the same array partially partitioned into the first four units of the piece. Each unit is an aggregate. The partitioning employs horizontal weighting so that the beginning of a register R in an array column Q may start with the same pitch-class as the pitch-class at the end of the previous array column P in register R, providing there are no intervening pitch-classes between P and Q in register R. Horizontal weighting occurs very frequently in the partitioned array (see Example 22, for instance). **Example 21** shows the music that corresponds to the partitioning given in Example 20.[9] (Each unit is preceded with the array column from which it is derived underneath stated first as it appears in Example 20, and then in the order chosen to be used in the unit, each pitch-class written under the notes of the music.)

As just stated, the first four units of part 1 contain the first linksets of each of the seven-array rows. The end of the first part of the array ends with the same linksets. Thus the second part of the array really continues after the linksets are completed in part one.[10] The

[9]Since the number of frequency of each pc in the chains is not equal, there is no way to construct an array of aggregates from chains without horizontal weighting.
[10] The end of the first part of the array has the end of a chain in each of its registers. Each chain starting the second part of the piece is already linked to the end of one in the first part of the piece. Therefore the second part of the array starts as the first part is

second part of the array is therefore in analogy with the first part starting with aggregate 5. The first four aggregates of the first part of the array are therefore unique—not found transformed later in the piece—and all are narrow partitions.

The second part of the array could have been but is not identical to the first part after aggregate 5; it uses different members of the chain-class of C as I have already shown. However, the linksets are identical to the ones at the end of part one. I could have partitioned the second part of the array into aggregates, but I decided to partition the second half exactly as the first (to within permutation of array rows[11]), therefore producing vertically weighted aggregates. (Compare **Exx. 22a and b**.) These weighted aggregates usually have fewer than 12 distinct pitch-classes, which implies that pitch-classes are doubled between the array rows of an aggregate. Sometimes there are as few as six distinct pitch-classes in the weighted aggregates.

To illustrate the partitioned correspondence between the two parts of the array, in **Example 22** I show aggregates 5-14 from the first part of the array, under which I show aggregates 126-135. Under the second array, I provide the set-class content of each weighted aggregate. (Obviously, a few of these aggregates are not actually vertically weighted, since they contain only twelve-elements in one array row, which in both parts of the array is a twelve-tone row.)

Example 22 gives only the first ten aggregates of the first two parts of the array for *Each Time*. But even from this sample, the assignment of array rows to registers gives one an idea of the potential gestural flow of pitch material over the succession of array aggregates, even though the orderings and alignments that occur in the units corresponding to each array column are not given. In composition, this birds-eye view of the array influences the more detailed planning of the ordering and rhythmic details of

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completing. Just as chains overlap by five pitch-classes, the array parts overlap by four aggregates.

[11] The permutation of the array rows from part one to two is as follows: array row 1 exchanges with row 7; row 2 exchanges with 3, and 5 exchanges with 6; 4 stays the same.

each aggregate both in planning and in execution—in what I call compositional stages 5 and 6 respectiviely in the section entitled "My Compositional Practice."

Origins of the Array

It should be clear now that constructing an array like that of *Each Time* is not easy. In fact, it is often the case that some combinations of chains, or whatever entities fill the rows of an array, may not be able to be partitioned into the kinds of entities one wants in the columns. Solutions are found by trial and error with the help of some simple heuristics. For *Each Time*, I did not have to do this work, for the array is derived (under T9I) from the array that forms the piano part in my *Old Forest* for piano and orchestra written about 10 months earlier.[12] That's when I struggled to compose the array; it took about two weeks of concerted work to create (with ample computer help).

Although the array for *Each Time* came already partitioned into aggregate and weighted aggregates, I still had to decide on what "legal"[13] orderings of each array column I would use to compose the units.[14] This can be done when one is composing on music paper, but I have found over the years, that examining each array column for its ordering potential according to different criteria can suggest many ideas for developing and articulating the

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[12] *Old Forest* uses the array in different ways from *Each Time*. For instance, in *Old Forest*: 1) the first half of the array is repeated after the second part, producing a three part form; 2) The three parts of the array are each followed by a six-part canon whose subject is derived from the chain; 3) the pacing of the array aggregates does not follow the same series of durations, and rhythmic rates are not used; 4) I did not plan the ordering of aggregates in the same way or to as great a degree; 5) the array, occurring the piano part, is sometimes accompanied by other chains in the orchestra that decorate some pitches in the piano part; 6) the orchestra has its own array based a single cycle of linked chains unfolding simultaneously with the piano array, slowly harmonically presenting the 50 hexachordal set-classes over the entire piece, once each; 7) The basic compositional unit is not the aggregate in the piano array, but each element of the series of 50 hexachords in the orchestra array.

[13] By legal orderings, I mean orderings of the aggregate that do not violate the orderings within each of its registers.

[14] The units of array, as used in *Old Forest*, had been already analyzed and composed to satisfy the compositional ideas for that work. Nevertheless, I had to do this work again, because *Each Time* has a very different form and conception from that of the concerto.

units and the way their content forms the work. In this case, I subjected each aggregate column to many computer programs to determine if it could be ordered into different set-classes, rows, linear hexachords, or partial ordering that were consistent with partial orderings of other columns. The output of these programs had to be sifted and correlated so as to determine which orderings I wanted to compose each unit in the piece. I therefore annotate each aggregate as to its *potential* properties and connections with others.[15] I emphasize the word "potential" because until these properties are composed out to present them as music—units—they are only latent. Moreover and importantly, details of local gesture, touch, and nuance arise in the process of implementing the potential properties of units. These moments of "suchness"—William Wordworth's "spots of time"—animate the compositional structure and bring other webs of association into being, both near and far. See the Appendix for a detailed discussion of the process of composing an aggregate column into a unit.

My Compositional Practice

Now that the construction of the array and its deployment has been described, I can put that work in context by providing a list of the stages I tend to follow as I compose. (Aspects of the composition of *Each Time* are indicated in parentheses.)

1. Initial ideas of the piece: its social, intellectual, and expressive functions; contexts and "meanings;" instrumentation; length; character; specific sonic images and continuities; and much more occur to me before I write down anything at all. (Ideas about time inspired *Each Time*.)[16]

[15] I often write a notes to myself next to the units in my sketches, that if I partition or articulate the pitch-class of the unit in such a way some property of the unit will be manifest or the unit will relate to some other unit in some specified way. Nevertheless, sometimes I do not follow these suggestions, for I see some other possibility, or the result doesn't "sound" or function right because of the choices I have just made in previous units.

[16] A similar kind of piece (with the same title) was actually conceived in 2002, but not written due to lack of clarity as to the relation of means to ends.)

2. Sketches and designs of form, processes, etc. Some of these are carried out mentally and not written down, if ever, until much later in the compositional process.

3. Decision as to the nature of the materials and their structures. (In *Each Time*, this involved the use of preexisting chains and arrays taken from *Old Forest*.)

4. Composition of the plan of the work with the help of computer programs to build and analyze arrays, etc. (Here I made decisions about array column pacing and rhythmic rates in *Each Time*, each column of the array was analyzed, and particular realization possibilities were chosen.)

5. Decision on the details of the musical realization of the plan (sometimes with more computer help). (For *Each Time*, I wrote out an annotated master array to help guide the next stage.)

6. Implementing the array/plan as music. This is what most people would call "composing." In some ways, this stage is like improvising on a figured bass or on jazz chord changes in real time.[17]

7. Editing the first draft; correcting mistakes, and adding articulations and dynamics that were intended but not notated to save time, etc.

8. Engraving the piece and parts for performance.

9. Rehearsals for first performance.

10. Performance, possibly followed by more changes and editing.

From this list, it should be clear that for me composition starts long (sometimes years) before the score is written. I do not consider items 1 to 5 to be "precompositional," as

[17] Just for the record, I write on music paper with a pencil.

opposed to stage 6. Rather, the stages prior to 6 represent the composition of the processes that shape the work. Each of these stages involves creative thinking and action. I do not consider a piece finished when stage 6 or 7 is complete, but only until the composition has been performed.[18] (Therefore, at the time of this writing, *Each Time* is not complete.) This means that I am not done with a work until I find a performance for a piece if it was not commissioned or requested. Stage 6 is, of course, when the "musicality" of the composer is most manifest, but it may take much less time than the other stages. For me, items 4 and 5 take much longer than 6, and 7 and 8 are also by and large longer, too. Moreover, Stage 6 might not determine all the details usually found in traditional scores; aspects of the work—its ordering and forces, for instance—may be chosen for each performance and the score may specify improvisation or indeterminate performance practices, with or without musical notation. In any case, just as stage 6 (the writing down of notes on paper, with or without specific plans) needs to be practiced again and again to develop skill and efficiency, so do all the other stages on the list.[19]

Each composer has to work out her compositional practice on her own. Therefore, I do not recommend or suggest that other composers compose the way I do. After all, it has taken a lifetime of music making for me to develop the requisite skills, techniques, conceptual contexts, and software, and I am still learning. Rather, the purpose of this paper was to do as I said at the outset—to describe in detail what I put into a work, and to undertake that right after I wrote it (that is, after stage 8 above).

The Time of *Each Time*

As promised, I shall devote the last part of this paper to describe how *Each Time* implements or instantiates Buddhist ideas about the phenomenology of time. As the

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[18] If a piece specifies improvisation, it is certainly not complete until it is performed. If one considers performance to be a form of composition or improvisation, then all pieces are not complete until the performance, and the performers may change a composition's details and identity as in response to their performances over time, even if the score does not change.

[19] I am fully aware that many composers I admire would never attempt to write music this way.

reader might have guessed, this has much to do with the details about the ways the content and deployment of the units range over the entire composition. But features of the units of *Each Time* also range beyond the work, most immediately to *Old Forest*, and then to other works of mine that employ chains that contain all the hexachordal set-classes—most of which use the same linkset. And of course, there are also associations to music written by other composers who have captured my imagination (such as Babbitt and Stefan Wolpe). These particular references are supplemented by generic connections to any works that make structural or sonic use of set-classes, ordered sets, or aggregates. The point is that the nature of internal reference within this composition is same as the external references that relate it to other works. In this sense, *Each Time* is a *piece* of music.

In Western music, music that successfully balances unity and diversity is valued. Unity is attained in an number of ways, which can perhaps be sorted into two categories: by association, based on repetitions and transformations of musical material such as a motive or rhythm; or hierarchically, based on the "reduction" of the work to a tonic note or an archetypical musical sequence. Association and hierarchy are not mutually exclusive, and musical analysts have shown how they interact in interesting and complicated ways. Diversity is simply the ways in which similar or different musical structures are implemented over time. Unity prevents diversity from becoming incoherent, and diversity prevents unity from becoming stagnant. Since the middle of the twentieth-century, progressive composers have been looking—among other things—for new ways to compose and think about musical form. Some have suggested that unity and coherence ought to be abandoned or that diversity be reduced to repetition or slow, obvious transformations.

What follows from the kinds of relations I have described in *Each Time* and pertain to many of my other compositions is that the kind of unity just described be substituted by interconnection, so a piece is rich and satisfying if it makes many inter and intra-connections between things and processes that are diverse in many different ways. This conception was suggested to me over many years by ideas and concepts in Buddhist philosophy, three of which I shall briefly enumerate below.

1. *Pratityasamutpada* is usually translated as “co-dependent arising” or “dependent origination.” We can read an explanation of this term in the Bahudhatuka Sutta, part 11, “When this exists, that comes to be. With the arising of this, that arises. When this does not exist, that does not come to be. With the cessation of this, that ceases.”[20] In other words, when something changes, the rest changes also. In this way, everything is related to everything else. This reflects a conception of causality found in Early Buddhist philosophy, that cause is equivalent to conditions—that there is no causal agency or substrate such that something “makes” something else happen. This is near to Hume’s definition of cause as things *constantly conjoined* with each other.

2. *Sunyata*, usually translated as “emptiness” or “voidness,” is the denial that things have inherent existence. All that a thing is, is the collection of its parts, which are not attributes of some existing entity. “‘And what, friend, is the deliverance of mind through voidness?’ . . . ‘This is called the voidness of a self or of what belongs to a self.’”[21]

The Buddhist philosopher, Nagarjuna (fl. in South India circa 100 CE), connected *sunyata* with *pratityasamutpada* arguing that all things are devoid of selfhood precisely because as separate objects they are reified out of their contexts and connections with other things.

3. *Indra’s web* is a visual metaphor used in Hua-yen Buddhism to illustrate the interdependence and interpenetration of all phenomena.

> Far away in the heavenly abode of the Great God Indra, there is a wonderful net [that] . . .stretches out indefinitely in all directions. [There

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[20] *The Middle Length Discourses of the Buddha*, translated by Bhikkhu Ñaa.namoli and Bhikkhu Bodhi. Boston: Wisdom Publications, 1995, p.927.

[21] From the Mahavedella Sutta, part 33, *The Middle Length Discourses of the Buddha*, p.394.

> is] a single glittering jewel at the net's every node, and since the net itself is infinite in dimension, the jewels are infinite in number. . . . If we now arbitrarily select one of these jewels for inspection . . .we will discover that in its polished surface there are reflected all the other jewels in the net, infinite in number. Not only that, but each of the jewels reflected in this one jewel is also reflecting all the other jewels, so the process of reflection is infinite.[22]

Indra's web brings together concepts of *pratityasamutpada* and *sunyata* with resonances of non-locality and holography. Nothing interferes with something else, all phenomena interpenetrate. That one thing is related to another thing does not inhibit it from being related to something else in the same or different way.

Such concepts support the musical character of *Each Time*. The units and chains mean nothing by themselves; they need each other to make each other noteworthy.[23] When the piece is performed they flow into each other rather than obtrude as separate or independent things. None of them "causes" any of the others, they simply act in concert to produce the composition's continuity/discontinuity. What one hears are not objects, but gestures—in a word, energy. Time is collapsed into a flowing present. Herman Hesse beautifully expresses this in his book, *Siddhartha*:

> [Siddhartha] once asked [Vasudeva], "Have you also learned that secret of the river; that there is no such thing as time?
>
> A bright smile spread over Vasudeva's face.
>
> "Yes, Siddhartha" he said. "Is this what you mean? That the river is everywhere at the same time, at the source and at the mouth, at the

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[22] Cook, Francis H.: *Hua-yen Buddhism: The Jewel of the Net of Indra.* University Park, Pennsylvania: Penn State University Press, 1977.
[23] For instance, when I pointed out that two or more units were related, only then did the units begin to have significance.

> waterfall, at the ferry, at the current and in the mountains, everywhere, and that the present only exists for it, not the shadow of the past, nor the shadow of the future?" (p.87)[24]

The Zen Philosopher, Dogen Kigen, who lived in 13th-century Japan, gives a complementary conception of time. Dogen's text *U-ji*, literally translated as "Being-time," concerns the equivalence of being and time.[25] As in the Siddhartha quotation, Dogen proposes that the past and future are not part of time, although as concepts they may be thought about in the present. Time occurs only when something takes place and vice-versa. So the process of presencing or taking place is no more or less than time. As one scholar puts it: "Dharmas [that is, events] do not move in time, but are time; dharmas are not juxtaposed to each other in spatial spread, nor is time segmental in temporal sequence."[26] This means that the here and now is not static or instantaneous, but a dynamic duration, full of change and impermanence, what Dogen calls "passage."

> "Passage" is, for example, like [the season] spring. Spring has a great many features, and these are called "passage." We should study that spring "passes" without anything outside itself. For example, the "passage" of spring always "passes through" spring.[27]

Moreover, the "movement" from one being-time to another is discontinuous, like waking up after deep sleep or from dreams. Since the name Buddha means the awakened one, being-time is at the heart of Buddhist experience, for each awakening is being-time. Experience is either a matter of "passage" and/or waking up—flow and/or quantization.

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[24] Hermann Hesse, *Siddhartha*, translated by Hilda Rosner, New York: New Directions Publishing Corporation, 1951. (*Siddhartha* was originally written in German in 1922.)
[25] Most of Dogen's texts are found in the collection of 95 essays he called the Shobogenzo, or "the treasury of the true dharma eye."
[26] Kim, Hee-Jim, "'The Reason of Words and Letters': Dogen and Koan Language" in *Dogen Studies*, William R. LaFleur, ed. Honolulu: University of Hawaii Press, 1985.
[27] Cleary, Thomas, trans., *Shobogenzo: Zen Essays by Dogen*, Honolulu, HI: University of Hawaii Press, 1986.

What we remember or plan/anticipate is just thinking, part of this continual presencing, which takes exertion, that is, something doesn't just happen, it exerts itself.

Dogen's ideas can lead one to understand music as time, not sounds occurring in time. Immediate and long-range structural relations are just aspects of passage. Each time you attend is time. Hence *Each Time*.

— December 28, 2005

Appendix: The Array and the Unit[28]

The reader familiar with serial composition, especially with arrays—what I have called "compositional designs"[29]—will note that in this paper I distinguish between an array column and a compositional unit. The array column is an abstract entity ready to be composed into music, and the unit is the result of that process. Nonetheless, we often speak of passages of serial pieces as instantiating or even being identical to arrays in locutions such as "the array begins at m. X." Certainly it is clear that the array is not the piece but contributes to it in some (hopefully) meaningful way, for the relation of an array to a piece is prospective, and as such—like a pitch-class to a pitch—it is one to many, not a deterministic mapping (like one-to-one or many-to-one). This simple point can be forgotten when doing analysis or writing music so that the properties of the array are assumed to be manifest in the music just because the array can be shown to have such properties. Writing music with a combinatorial twelve-tone array doesn't mean the listener will automatically be able to hear the local aggregate saturation or the rows that make up the array as such (or anything), or, if one determines that a hodge-podge of notes are rows based on an array, the passage does not suddenly become audibly or conceptually clear.

I therefore find it useful to make a distinction between parts of an array (or any other abstract compositional object) and a compositional unit. When composing *Each Time*, I decided that the array columns were to be composed into units. Yet, another piece might not be based on this correspondence; the unit might transgress the array boundaries of column and row and connect different parts of the array together, or not be determined by the array's structure (alone or at all). If measures correspond to units, the units would therefore no longer be coterminous with the array columns. Or one might not articulate

[28] This discussion is in an appendix because it is not only about the composition of *Each Time*, but concerns much larger compositional issue to which I only could only allude here and there in the body of the paper.
[29] See Robert Morris, *Composition with Pitch-Classes: A Theory of Compositional Design.* New Haven and London: Yale University Press, 1987; and "Compositional Spaces and Other Territories," *Perspectives of New Music*, 33/1-2 (1995).

units by measures in the first place, so that each array column might or might not each occur within a measure. In fact, compositional units need have nothing to do with arrays or other sorts of compositional entities or methodologies—nor does a composition have to be based on discrete or overlapping compositional units, either.[30]

To emphasize these important points about arrays and units, I have composed twelve-different units out of one column, number 53, from the array of *Each Time*. These are given in **Example 23.** These units are not "out-takes" of the piece, but rather music that might have found its way into it had my plans been different for the array, or—what is the same—if I were using the array in a new piece. The reader can also go to the score of *Each Time* to see how I composed the column into unit 53 (m.62).

Although there is no need to do so, for the sake of this demonstration I shall use the seven registers, the measure length and rhythmic rates assigned to the column as part of the plan for *Each Time*. I can therefore note associations between the units in Example 23 and those in the piece. In any case, the rhythmic rates are (3,4)—triplets and divisions of the beat into powers of two—and each unit example will last five beats in 4/4 time. The column is:

reg. 1	F# Bb Ab
reg. 2	F
reg. 3	
reg. 4	B C#
reg. 5	G
reg. 6	C
reg. 7	Eb A E D

[30] Although the music analyst might have good reason to assert that an array column is a unit, s/he can never know from the score alone if that was the composer's intention. That is why I do not call the compositional unit an analytic unit.

The composition is 3102114 and the partition 4321110. The column is in “barbell” spacing, meaning that the highest and lowest registers have more notes that the other registers, which makes it somewhat atypical of compositions in *Each Time*, because the entire array was composed with fewer chains in its outer registers.

Ex. 23a divides the column content into two complementary gestures, one up, the other down. Each phrase is a member of 6-35[02468A], the whole-tone scale set-class. The two major thirds stand out as the only simultaneities and they are marked ***f***. The first (G-B), interrupting the end of the triplet in beat one, might call to memory the minor third B-D that does something similar in unit 3 of *Each Time* (m.8). As shown under the example, the pitch-classes are sorted into two complementary members of set-class 6-1[012345] by dynamics.

The unit in **Ex.23b** is a super-saturated aggregate. Members of set-class 6-15[012458] imbricate to imbue the unit with the “sound” of that set-class. The soft, high grace note dyad Gb-Bb undermines the saturation slightly as it resounds the first two notes of the unit again in the middle, disturbing the ordering that forms the saturation. The begin and ends sets still clearly articulate 6-15, of course.

Ex. 23c makes a strong connection via vertical-horizontal interchange to the last unit (246) of *Each Time*. As shown, the material in registers of the weighted aggregate is differentiated by dynamics into horizontal segments in Ex. 23c. The hexachordal melody from unit 246 (ending with a linkset) strides in the example from the bottom to the top of the piano at ***mf*** in triplets. And like its counterpart in unit 246, an accented ***f*** note cuts across the melody.

The next two units make reference to the two ordered hexachords of the Red Row. In **Ex. 23d** dynamics untangle the two hexachords of T6I the Red Row. In contrast, the hexachords of T3I of the same row are easy to pickup in **Ex. 23e** since they hardly overlap. The first five pitch-classes of the first hexachord of the row starts the unit and progresses by even 16th notes; it concludes with the last 16th note of the unit, C#. The second hexachord of the row moves by triplets and fills in the gap between notes 5 and 6 of the first hexachord.

A trichordal partition of the aggregate into four members of set-class 3-3[014] organizes the aggregate column into the unit of **Ex23f**. The last two trichords are arpeggiated so that they pivot around the G and C# in the middle of the piano—a necessity because the notes are too far apart to be played as three-note chords by two hands.

The series of six units from **Exx.23g to 23j** have begin and ends sets that are from the same two Z-related set-classes, 6-17[012478] and 6-43[012568]. In other words, there are six ways the array column can be partitioned into this set-class pair. **Ex. 23h** involves a decelerating upward gesture (3, 2, then 1 notes per beat), while **Ex. 23i** ends with an accelerating downward gesture (1, 2, 3 notes per beat). **Ex. 23k** provides a texture rarely heard in *Each Time*; repetitions of pitch-classes "ring" the unit.[31] **Exx. 23j and l** differentiate their begin and end sets by giving them contrasting presentations.

After studying each of the twelve units in Example 23, the reader may note how, despite their differences, they all sound alike. This is no mystery; the same ordered sets in the same six registers underlie each unit. Because of their similarity, if all of the units were in the same piece, one would undoubtedly note their various appearances.

Yet, there is something artificial about illustrating the composition of a single array column into units, for we do not know what might precede or follow them. Would the composition and partition of surrounding units be similar or different? Would horizontal weighting tie—even literally—notes from past or to future units? What kinds of textures and continuities would frame a unit's musical actions? After all, context changes how we hear a unit; this is one of the meanings of pratityasamutpada (dependent origination). If we were to replace unit 53 of *Each Time* with one of the units in Example 23, the whole composition would be affected—links between the former unit 53 and others would be

[31] Such textures are more typical of some of my other piano pieces, such as *By Far* and *Changing the Subject*.

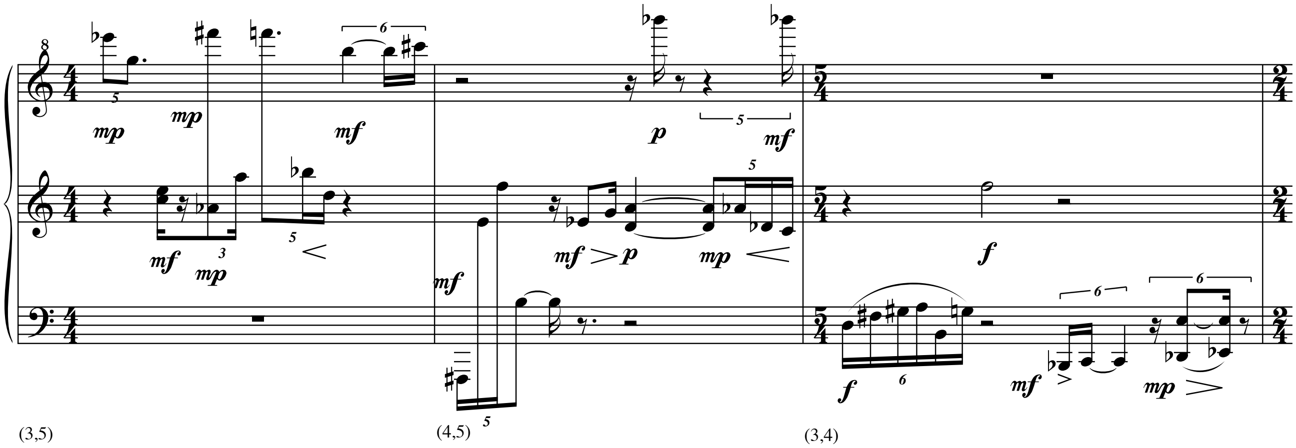
broken and the replacement would associate with the rest of the piece in new and perhaps unforeseen ways. (Of course, any experienced composer has more of less mastered the complex and subtle ways replacement affects musical form.) Moreover, whatever we felt was the character of the unit—its apparent sonic identity before we placed it in the context of *Each Time*—would also change once inserted. A unit really has no inherent, independent selfhood; it appears to be different things in different contexts, including that of being alone.[32] This is sunyata (voidness).

As I have said, there are a great number of legal orderings of an aggregate of seven registers, because pitch-classes in one register can be aligned alone or in "chords" with the pitch-classes alone or in chords in any other. This fact alone shows that composing (so-called) tonal music is much more structurally constrained than composing with arrays. Of course, working with arrays might *seem* more constrained because one has previously made music adhering to some variety of tonal syntax, such as that found in jazz or popular music.[33] However, as one becomes accustomed to array composition, it becomes clear that the opportunities for implementing reach of reference that do not compromise compositional individuality are vast. Imagination is what counts, not the contingencies of chains and aggregates in arrays.

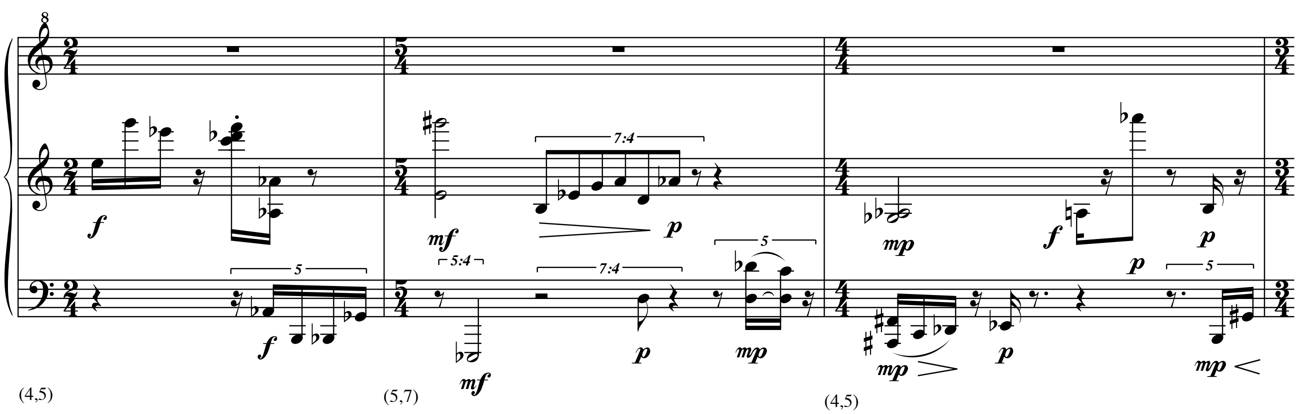
[32] We usually don't compose parts of a piece alone outside of a context then combine them later to form the piece. The units are composed into music according to their temporal and associative context with other units (which I accomplish in stage 6).
[33] When young composers first encounter the rules of common practice harmony or modal or tonal counterpoint (in a theory class), the possibilities at first seem few and daunting, especially if they are unfamiliar with music written according to those rules.

Example 1. Corresponding passages from first and second part of *Each Time*.

first part: mm.78-80.

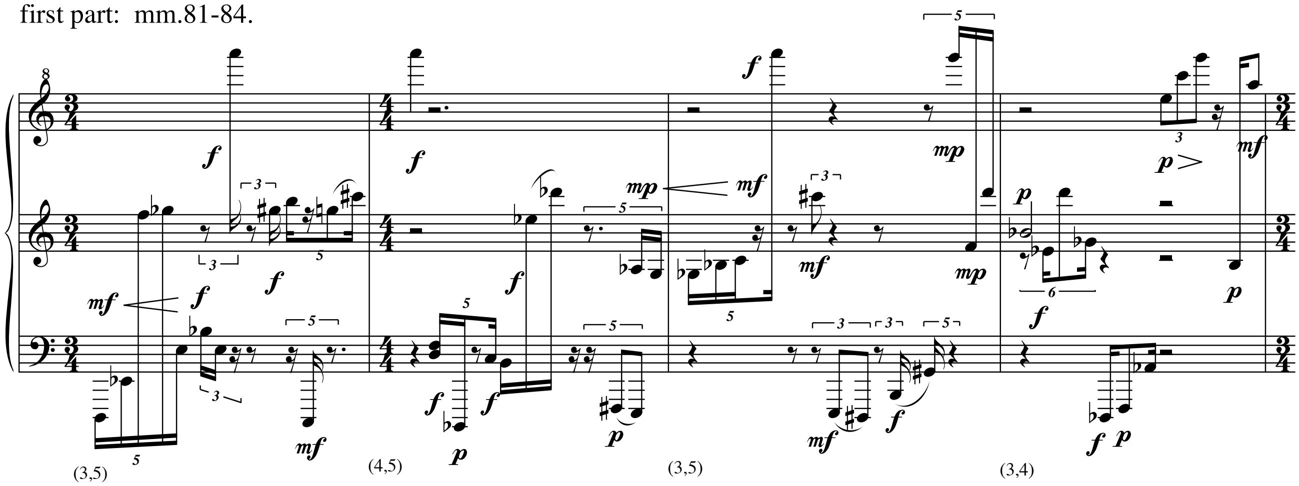


second part: mm.213-15.

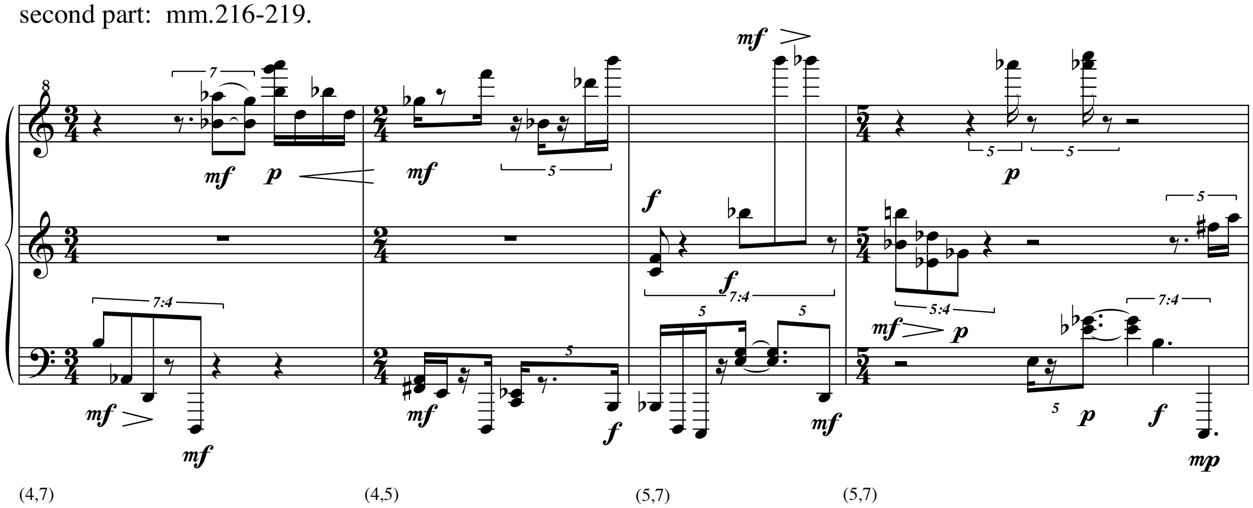


Example 1 continued.

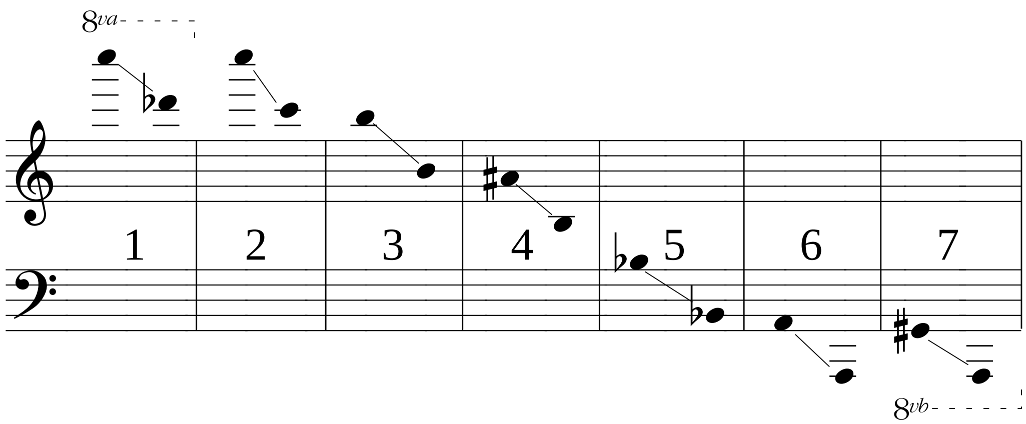
first part: mm.81-84.



second part: mm.216-219.



Example 2. Piano registers in *Each Time*.



Example 3. Time signatures in *Each Time*.

mm.62-90.

5/4	4/4	3/4	6/4	3/4
5/4	4/4	3/4	5/4	3/4
5/4	4/4	4/4	5/4	3/4
4/4	4/4	4/4	5/4	3/4
4/4	4/4	4/4	5/4	4/4
4/4	4/4	4/4	4/4	4/4

Measures shown in Example 1 are enclosed.

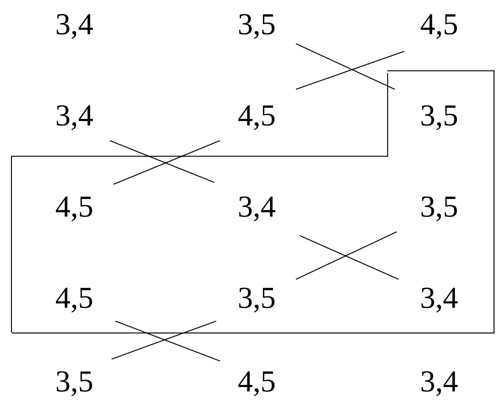
mm.199-223.

4/4	3/4	3/4	3/4	2/4
4/4	4/4	3/4	3/4	2/4
4/4	4/4	3/4	2/4	2/4
5/4	4/4	3/4	2/4	2/4
5/4	4/4	3/4	2/4	1/4

Measures shown in Example 1 are enclosed.

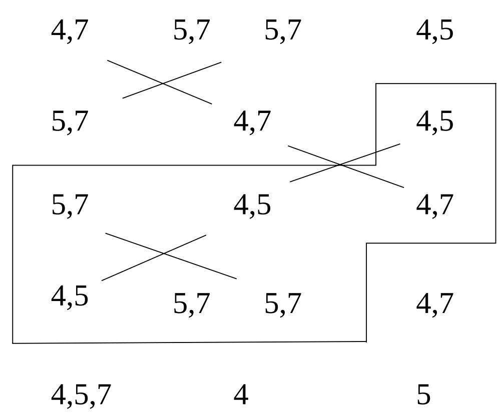
Example 4. Rhythmic rates in *Each Time.*

mm.73-87.



Rhythmic rates in
Example 1 are
enclosed.

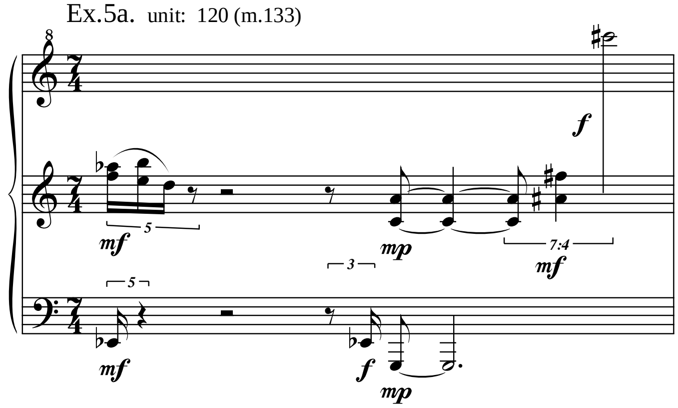
mm.207-223.



Rhythmic rates in
Example 1 are
enclosed.

Example 5. Compositions.

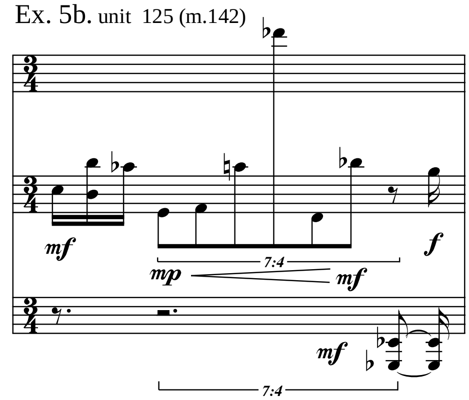
Ex.5a. unit: 120 (m.133)



composition 1063011

reg	pitch-classes	card
1	C#	1
2		0
3	Ab F E B D F#	6
4	A C A#	3
5		0
6	Eb	1
7	G	1

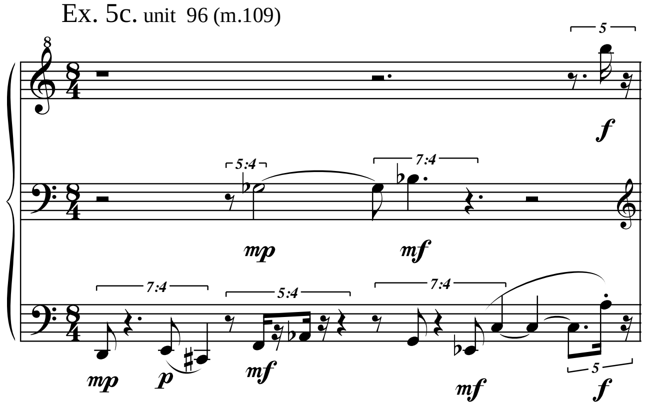
Ex. 5b. unit 125 (m.142)



composition 1063011

reg	pitch-classes	card
1	Db	1
2		0
3	C BAb A Bb G	6
4	E F D	3
5		0
6	Eb	1
7	Gb	1

Ex. 5c. unit 96 (m.109)



composition 0100470

reg	pitch-classes	card
1		0
2	B	1
3		0
4		0
5	Gb Bb C A	4
6	D E C# F Ab G Eb	7
7		0

Ex. 5d. unit 192 (m.215)

composition 0100470

reg	pitch-classes	card
1		0
2	Ab	1
3		0
4		0
5	Gb Ab A B	4
6	F# A#c Db Eb B G#	7
7		0

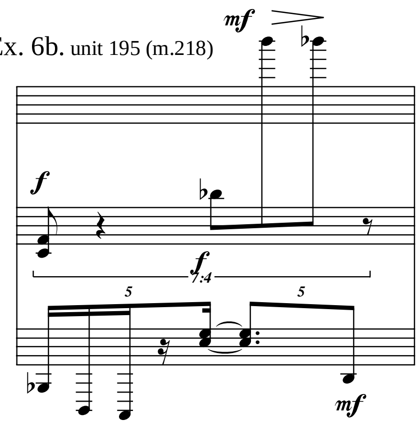
Example 6. Partitions.

Ex. 6a. unit 74 (m.83)

partition 2222220

reg	pitch-classes	card
1	A G	2
2	C# D	2
3		0
4	C F	2
5	Gb Bb	2
6	B G#	2
7	E D#	2

Ex. 6b. unit 195 (m.218)

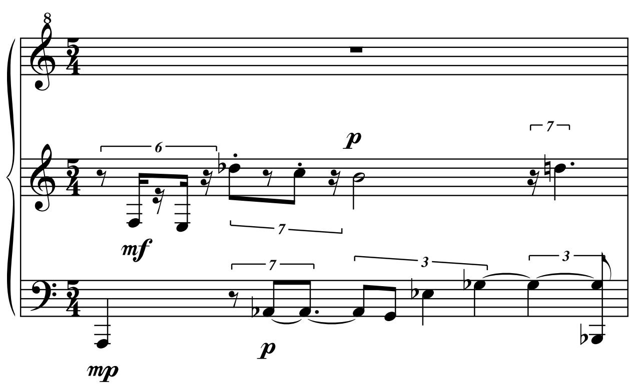


partition 2222220

reg	pitch-classes	card
1	B Bb	2
2		0
3	Bb B*	2
4	C F	2
5	G E	2
6	Bb D	2
7	D C	2

* omitted; B occurs in next measure

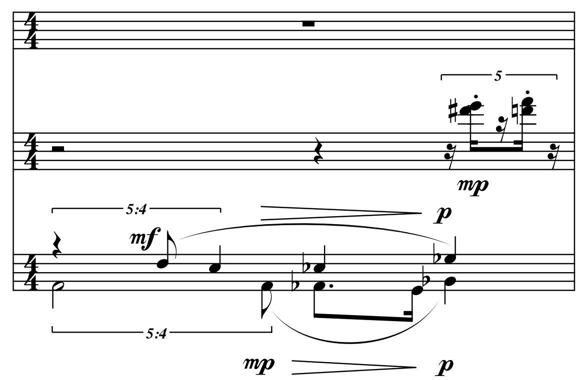
Ex. 6c. unit 95 (m.108)



partition 4440000

reg	pitch-classes	card
1		0
2		0
3	Db C B D	4
4		0
5	F E Eb Gb	4
6	A Ab G Bb	4
7		0

Ex. 6d. unit 216 (m.244)



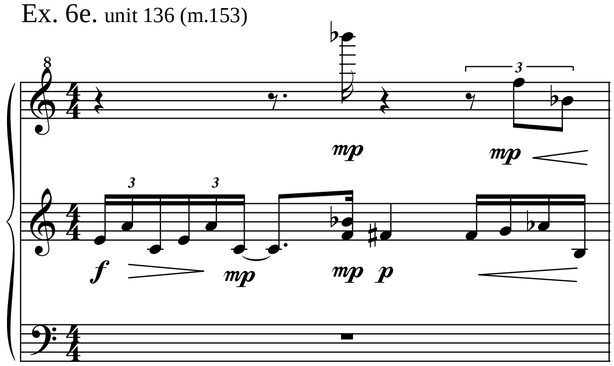
partition 4440000

reg	pitch-classes	card
1		0
2	E D# D F	4
3		0
4		0
5	F E Eb Gb	4
6	A Ab G Bb*	4
7		0

* transgresses onto bottom of reg 5
to permit pianist to reach it.

Example 6 continued.

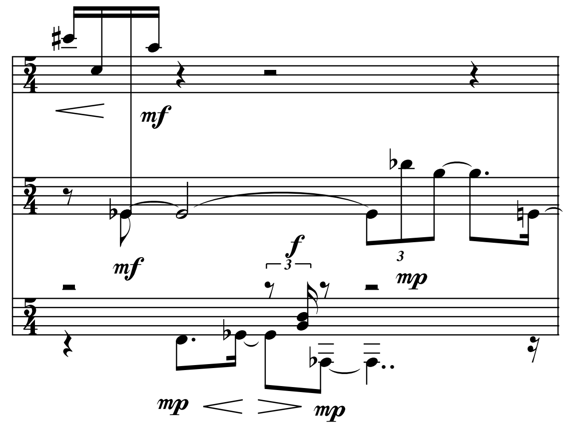
Ex. 6e. unit 136 (m.153)



partition 9111000

reg	pitch-classes	card
1	Bb	1
2	F	1
3	Bb	1
4	E A C F Bb F# G Ab B	9
5		0
6		0
7		0

Ex. 6f. unit 3 (m.8)

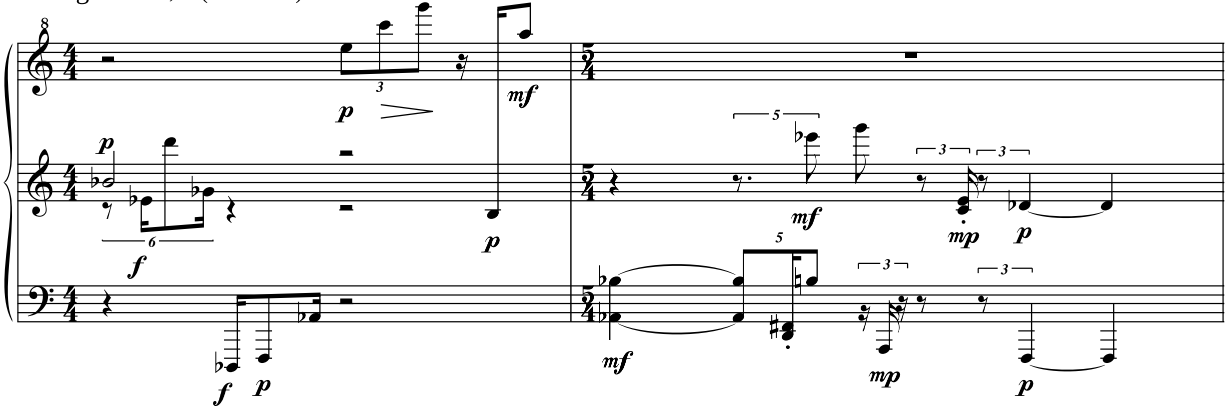


partition 2222211

reg	pitch-classes	card
1	C# A	2
2	C	1
3	Bb G	2
4	Eb E	2
5	B D	2
6	F Gb	2
7	Ab	1

Example 6 continued.

Ex. 6g. units 75,76 (mm.84-85)



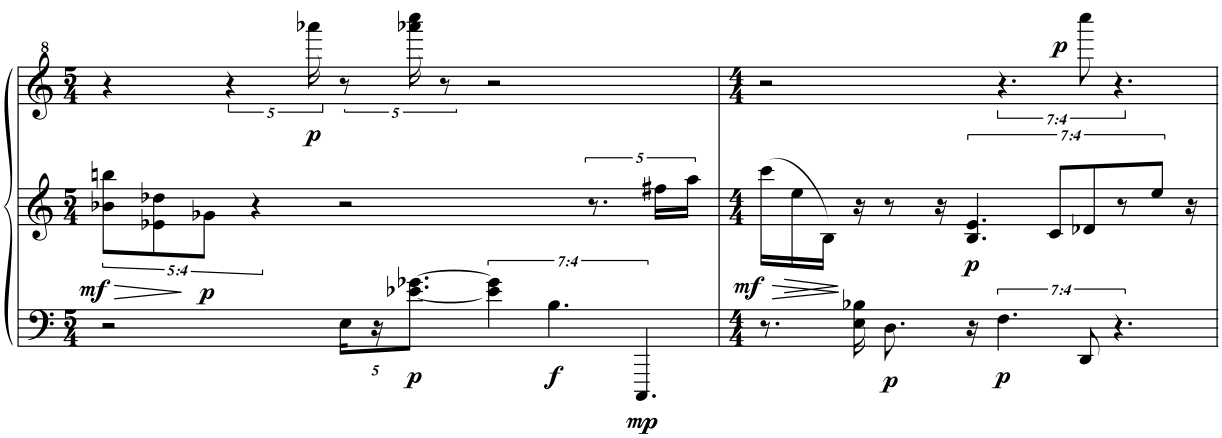
partition 4421100

reg	pitch-classes	card
1	G	1
2	E F C A	4
3		0
4	Bb Eb Gb F	4
5		0
6	Ab	1
7	Db F	2

partition 4421100

reg	pitch-classes	card
1		0
2	Eb G	2
3		0
4	B E C Db	4
5	Bb	1
6	Ab D F# A	4
7	F	1

Ex. 6h. units 196,197 (mm.219-220)



partition 4421100

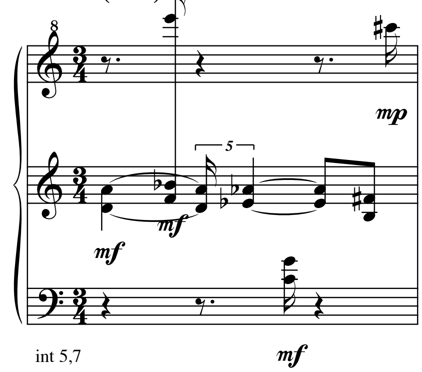
reg	pitch-classes	card
1	Ab C	2
2		0
3	B Db F# A	4
4	Bb Eb Gb B	4
5	E	1
6		0
7	C	1

partition 4421100

reg	pitch-classes	card
1	C	1
2		0
3	C E	2
4	B E C Db	4
5	E Bb D F	4
6	D	1
7		0

Example 7. Units with interval replication.

Ex. 7a. unit 50 (m.59)

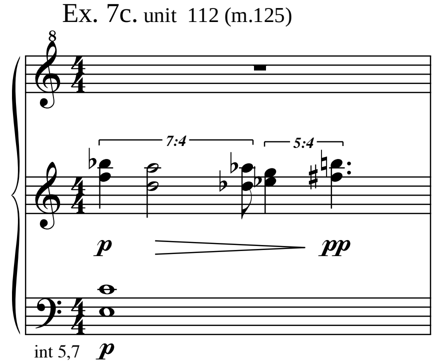


int 5,7

Ex. 7b. unit 171 (m.194)

int 5,7

Ex. 7c. unit 112 (m.125)



int 5,7

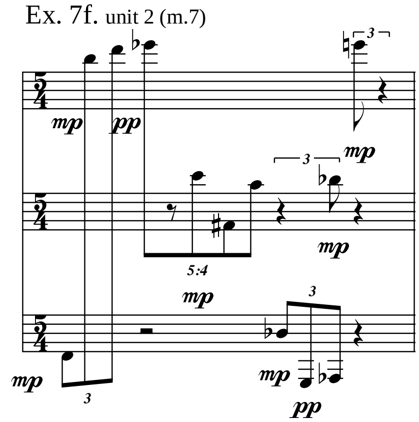
Ex. 7d. unit 118 (m.131)

int 1,11

Ex. 7e. unit 34 (m.39)

int 3, 9

Ex. 7f. unit 2 (m.7)



Ex. 7g. unit 54 (m.63)

int 4,8 SC3-12[048]

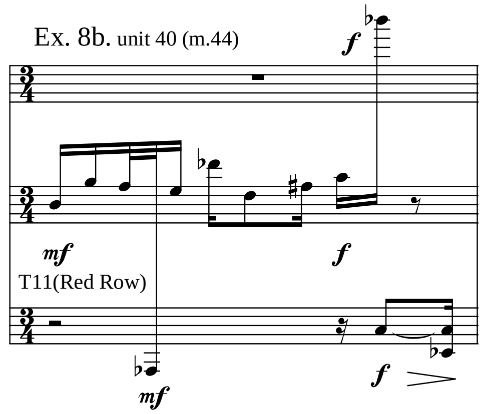
Ex. 7h. unit 22 (m.27)

Int 2,4,8,10 SC6-35[02468A]

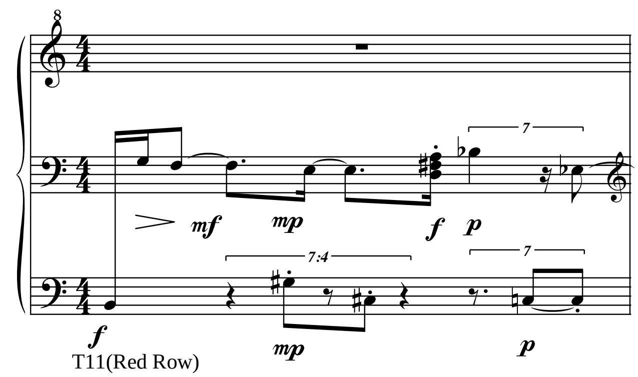
Example 8. Red Row.

Ex. 8a. T0(Red Row)

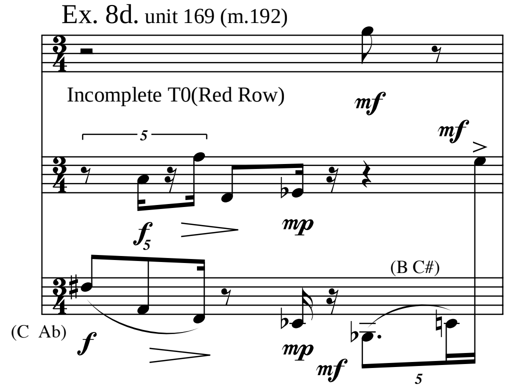
Ex. 8b. unit 40 (m.44)



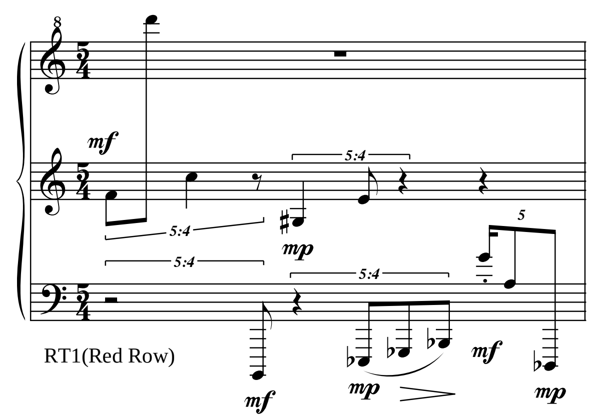
Ex. 8c. unit 126 (m.143)



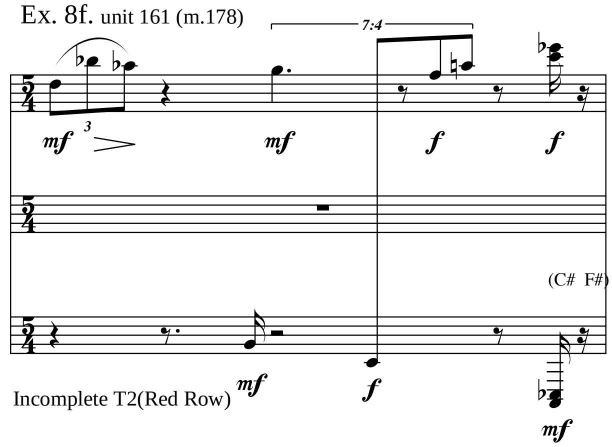
Ex. 8d. unit 169 (m.192)



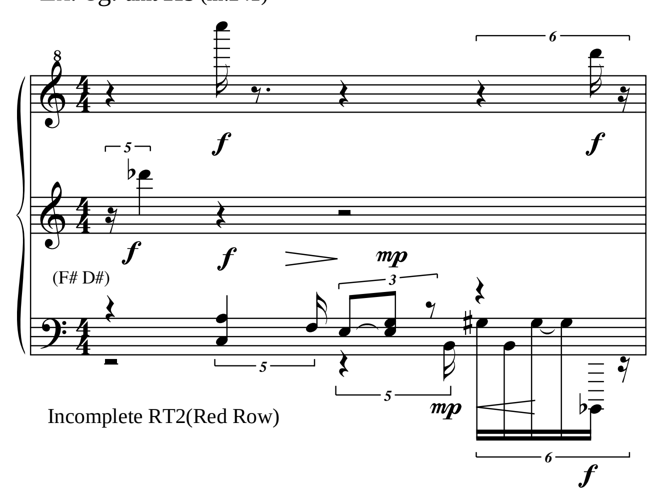
Ex. 8e. unit 27 (m.32)



Ex. 8f. unit 161 (m.178)



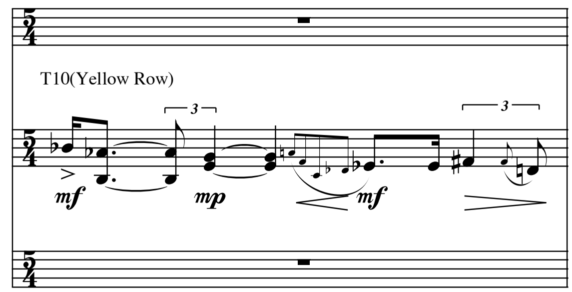
Ex. 8g. unit 213 (m.241)



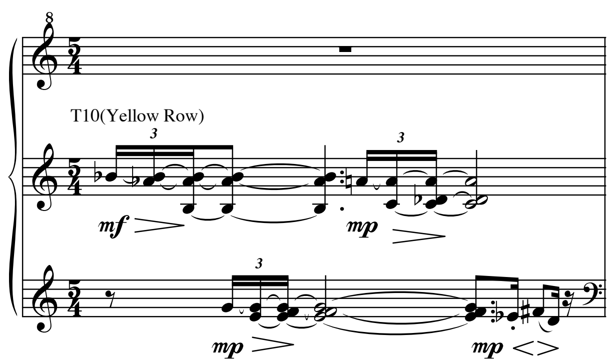
Example 9. Yellow and Blue Rows.

Ex. 9a. T0(Yellow Row)

Ex. 9b. unit 7 (m.12)



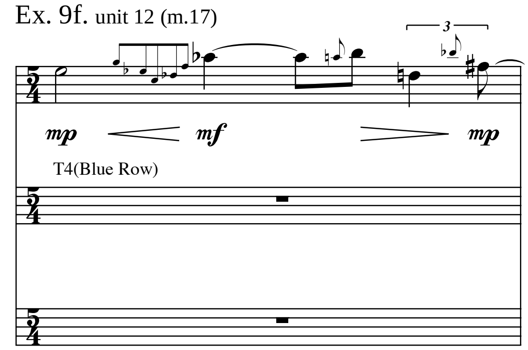
Ex. 9c. unit 128 (m.145)



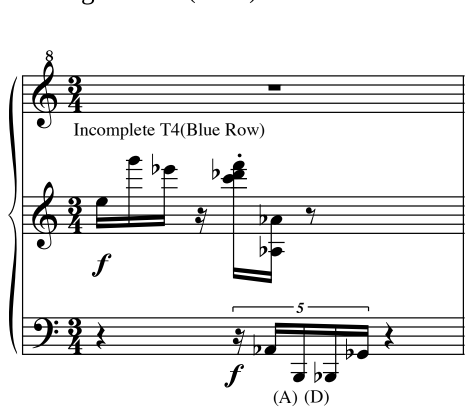
Ex. 9d. unit 110 (m.123)

Ex. 9e. T0(Blue Row)

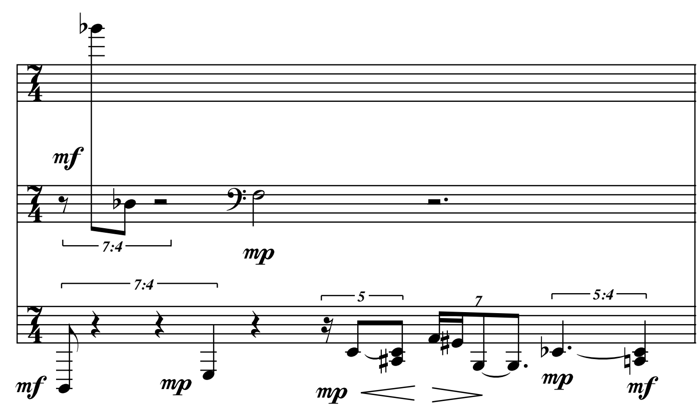
Ex. 9f. unit 12 (m.17)



Ex. 9g. unit 190 (m.213)

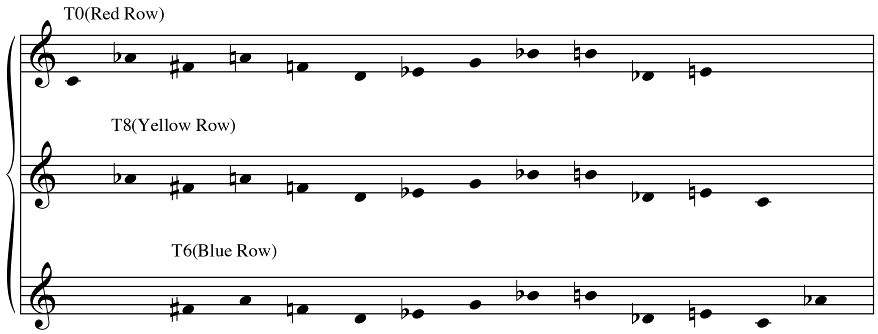


Ex. 9h. unit 92 (m.100)



Example 10. Row derivation.

Ex. 10a.

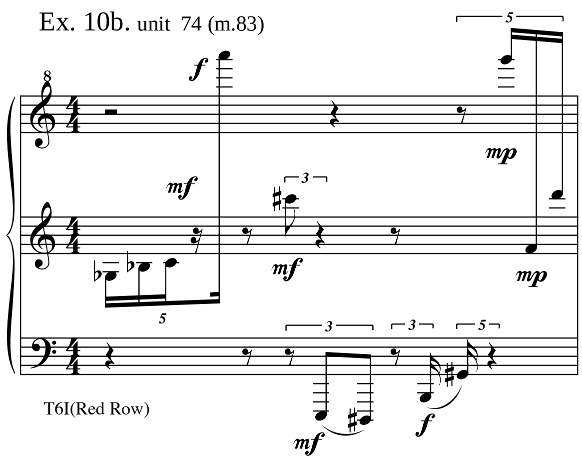


rot11(Red Row) = Yellow Row
rot10(Red Row) = Blue Row

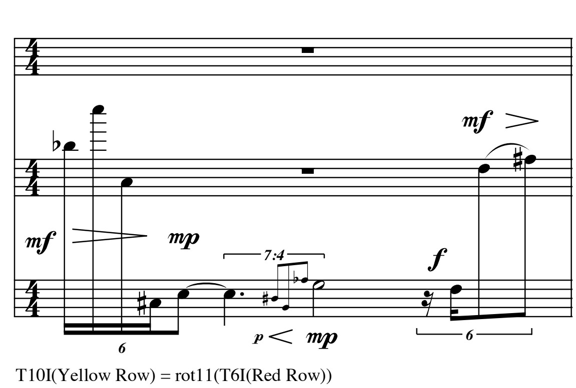
rot11(Yellow Row) = Blue Row
rot1(Yellow Row) = Red Row

rot2(Blue Row) = Red Row
rot1(Blue Row) = Yellow Row

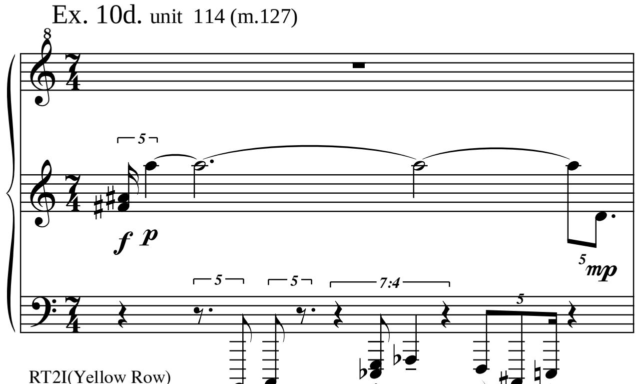
Ex. 10b. unit 74 (m.83)



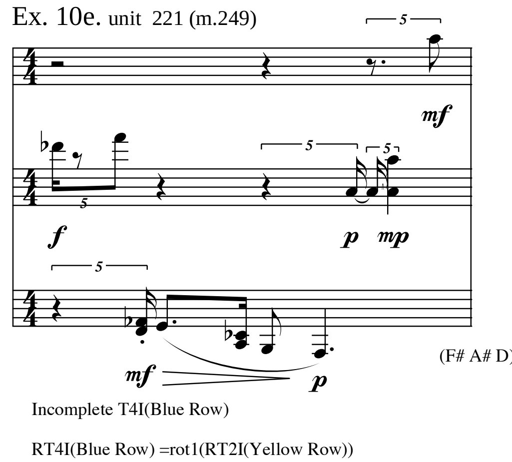
Ex. 10c. unit 100 (m.103)



Ex. 10d. unit 114 (m.127)

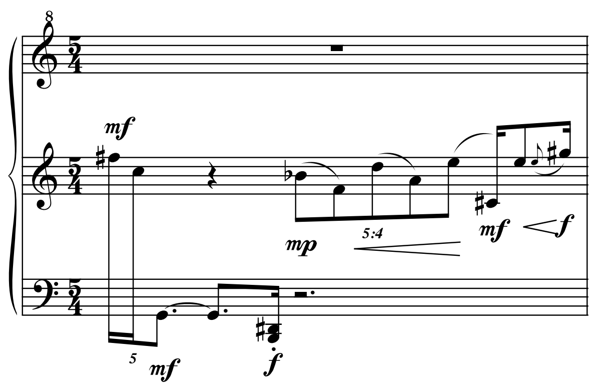


Ex. 10e. unit 221 (m.249)

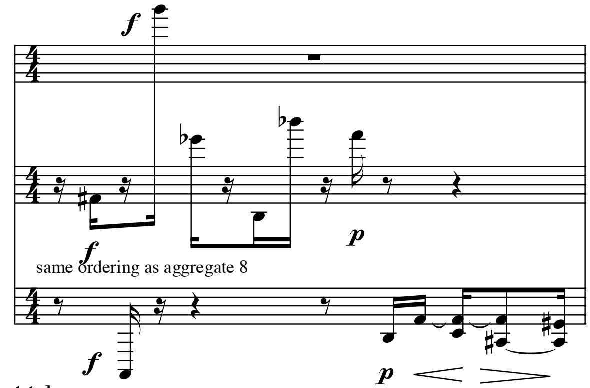


Example 11. Unit order associations.

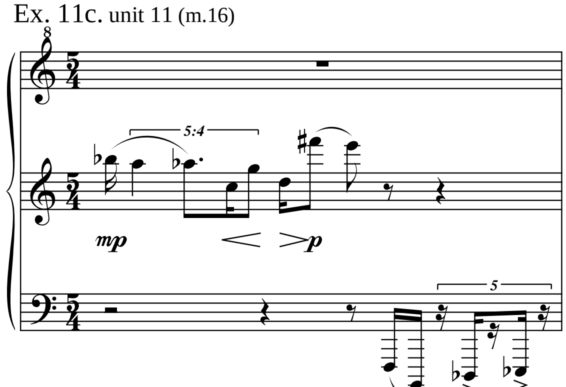
Ex. 11a. unit 8 (m.13)



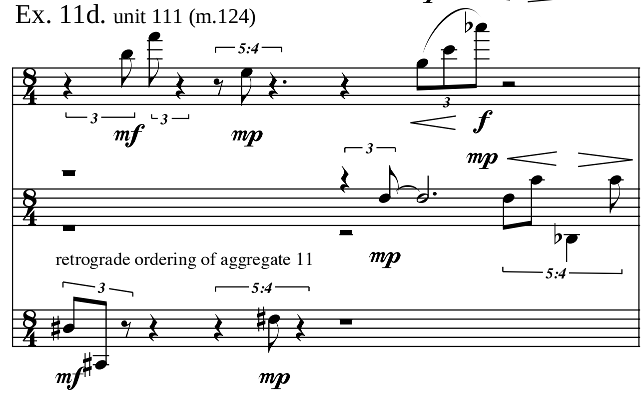
Ex. 11b. unit 81 (m.90)



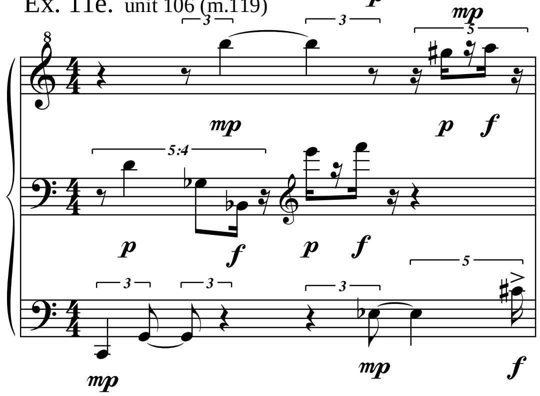
Ex. 11c. unit 11 (m.16)



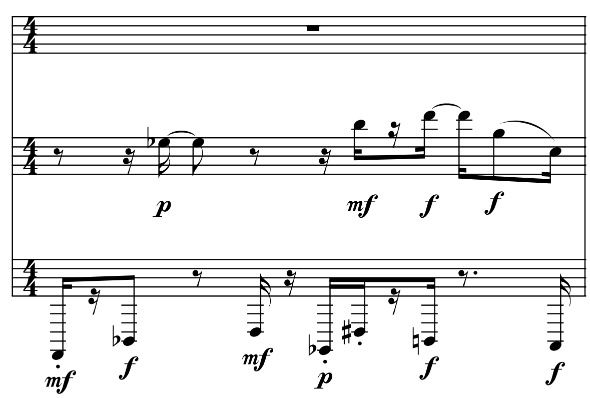
Ex. 11d. unit 111 (m.124)



Ex. 11e. unit 106 (m.119)



Ex. 11f. unit 105 (m.228)



unit 106

pitch-classes in register (high to low)

B E F G# A

D C#

Gb Bb Eb

C G

pitch-classes in dynamics (loud to soft)

f Gb F A C#

mp C G B Eb

p D Gb E G#

unit 205

pitch-classes in register (high to low)

D

Eb B G C

A Db F Bb F# D C

pitch-classes in dynamics (loud to soft)

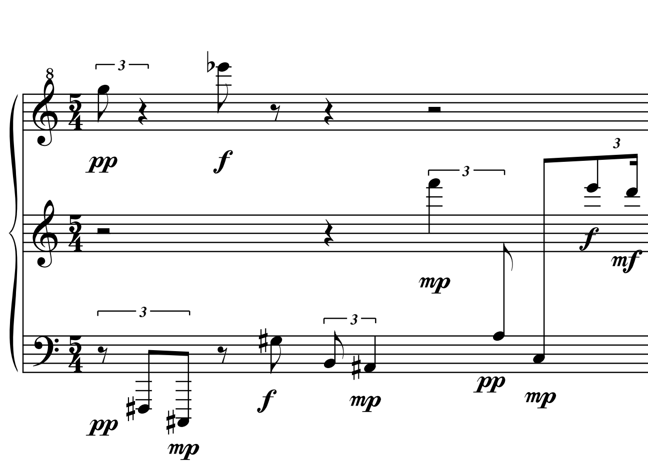
f Db D G C

mf A (G#) F (E) B

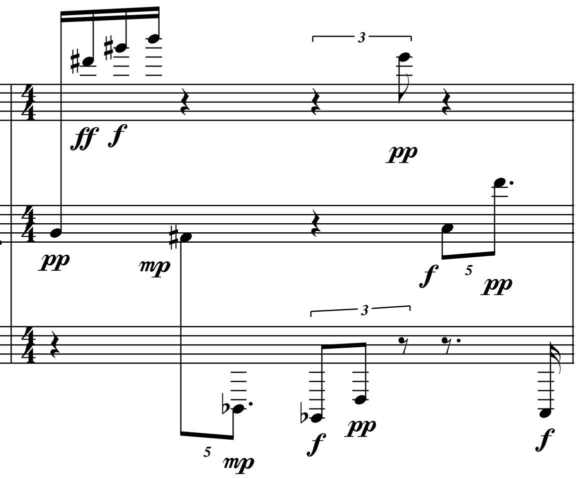
p Eb Bb F#

Example 12. Vertical-horizontal exchange.

Ex. 12a. unit 32 (m.37)



Ex. 12b. unit 33 (m.38)



aggregate 32

pitch-classes in register (high to low)

Eb

G F E D

G# B A# A C

F# C#

pitch-classes in dynamics (loud to soft)

f Eb G# B E

mf D

mp C# A# F C

pp G F# A

aggregate 33

pitch-classes in register (high to low)

D# G# B E

D

G F# A

Db Bb F C

pitch-classes in dynamics (loud to soft)

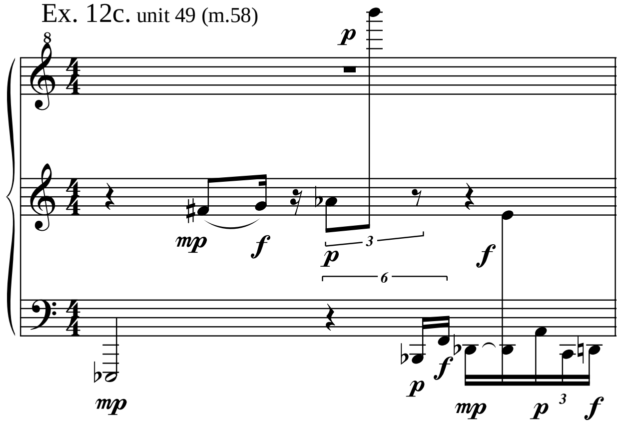
ff D#

f G# B Bb A C

mp F# Db

pp G F E D

Ex. 12c. unit 49 (m.58)



aggregate 49

pitch-classes in dynamics (loud to soft)

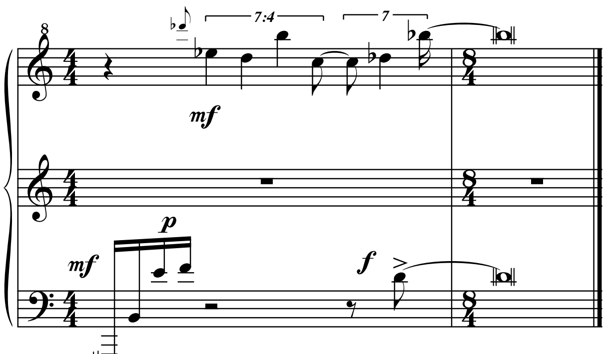
f G F E F

mp Eb F# Db

p Ab B Bb A C

Example 13. Linear hexachordal melodies in *Each Time*.

Ex. 13a. unit 246 (m.274-5)



<Eb D B C Db Bb> ∈ Set-Class 6-1[012345]

Ex. 13b. unit 224 (m.252)

<B G F C F# C#> ∈ Set-Class 6-7[012678]

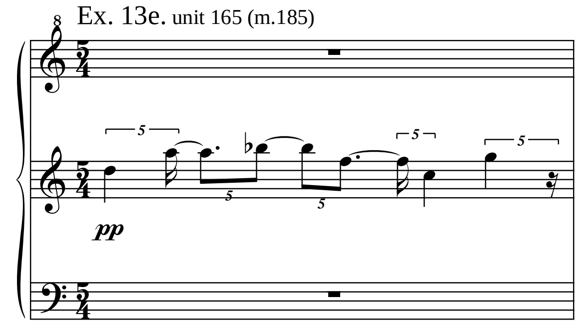
Ex. 13c. unit 158 (m.175)

<F Eb D C E G> ∈ Set-Class 6-8[023457]

Ex. 13d. unit 133 (m.150)

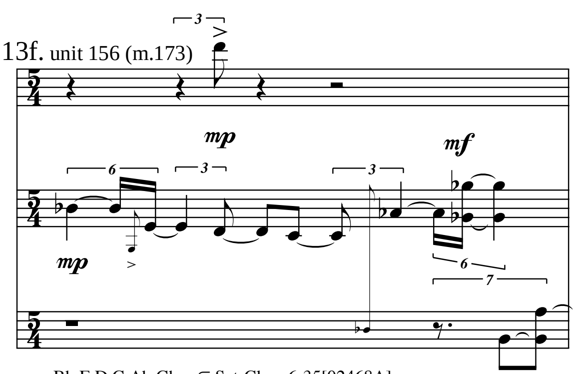
<Bb D F# B G Eb> ∈ Set-Class 6-20[014589]

Ex. 13e. unit 165 (m.185)



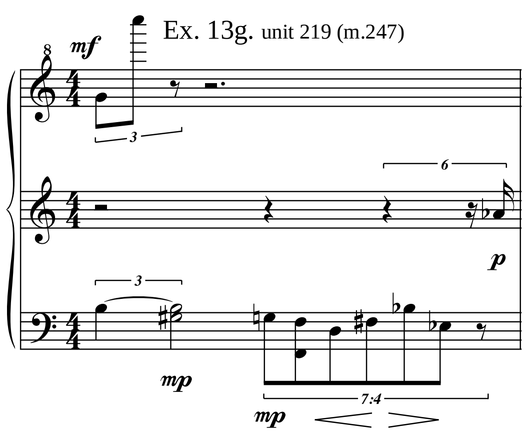
<D A Bb F C G> ∈ Set-Class 6-32[024579]

Ex. 13f. unit 156 (m.173)



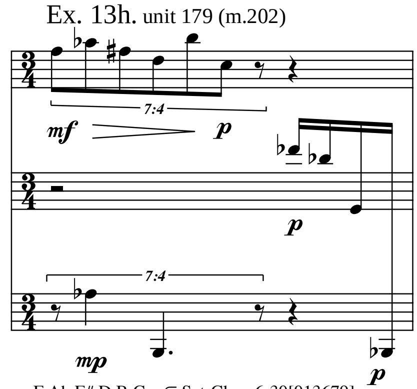
<Bb E D C Ab Gb> ∈ Set-Class 6-35[02468A]

Ex. 13g. unit 219 (m.247)



<G F D F# Bb Eb> ∈ Set-Class 6-14[013458]

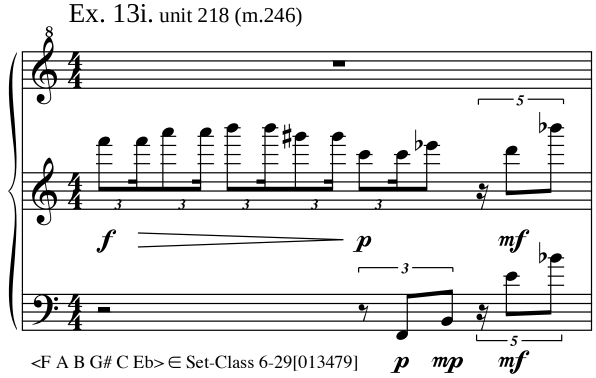
Ex. 13h. unit 179 (m.202)



<F Ab F# D B C> ∈ Set-Class 6-30[013679]

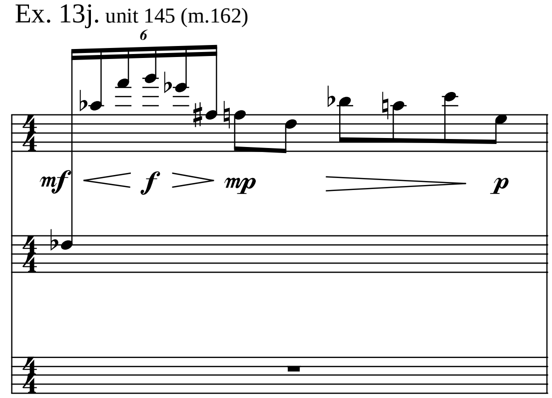
Example 13 continued.

Ex. 13i. unit 218 (m.246)



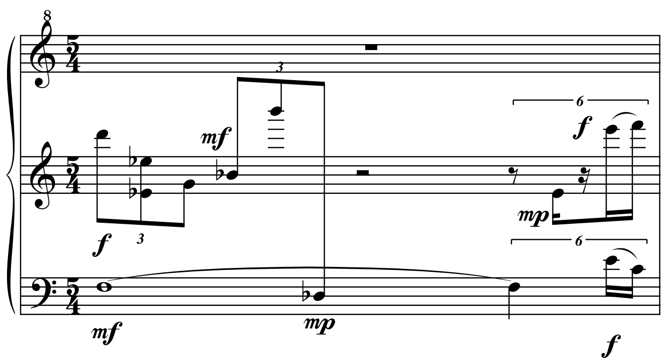
<F A B G# C Eb> ∈ Set-Class 6-29[013479]

Ex. 13j. unit 145 (m.162)



<F D Bb A C E> ∈ Set-Class 6-26[013578]

Ex. 13k. unit 163 (m.180)

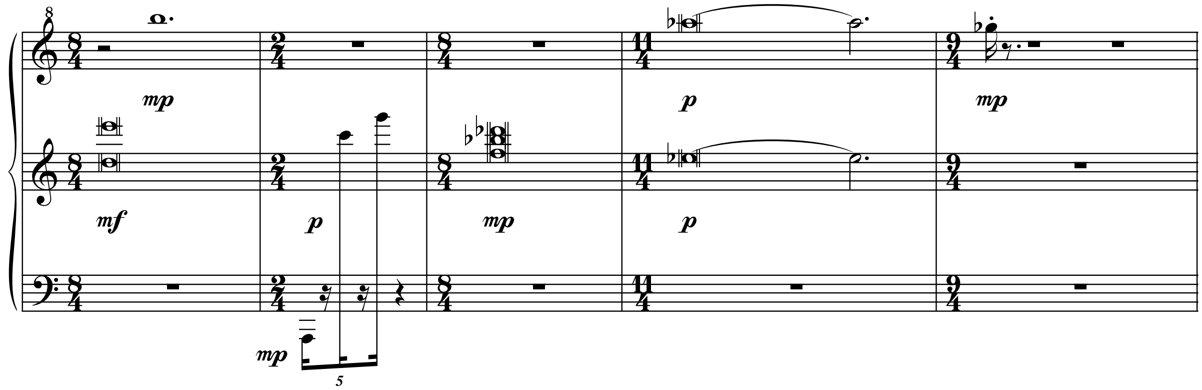


<D Eb G Bb B Db> ∈ Set-Class 6-15[012458]

```
The three hexachordal segments construct the Red Row

T5I<F A B G# C Eb> = <C G# F# A F D>

RT4<F D Bb A C E> = <A F D Eb G Bb>

<D Eb G Bb B Db>


             <C G# F# A F D>
                     <A F D Eb G Bb>
                         <D Eb G Bb B Db>
T0(Red Row) = C G# F# A F D Eb G Bb B Db E
```

Example 14. Begin and end sets in units.

Ex. 14a. unit 83 (m.91-96)



```
complementary set-class pair 6-32[024579]

E  B  A  C  G  | Db  Ab  Gb
D              | Bb  Eb
               | F
```

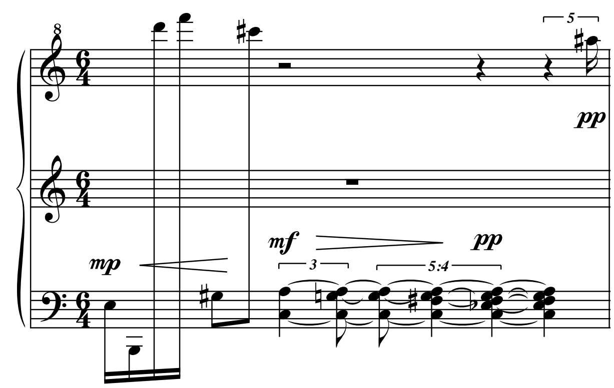
Ex. 14b. unit 14 (m.19)

```
complementary set-class pair 6-32[024579]

Bb  G  | A  F# G# E
Eb  F  |    B  C#
D   C  |
```

Ex. 14c. unit 196 (m.219)

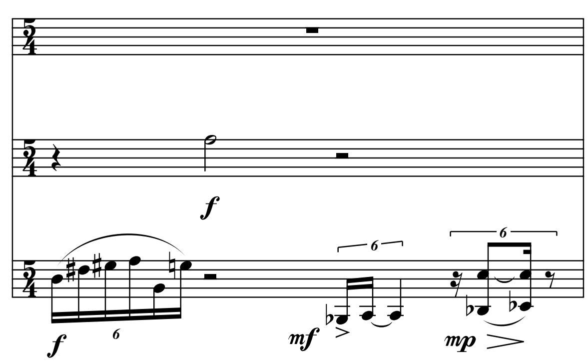
```
non-complementary set-class pair
6-32[024579] 6-27[013469]

B   Db  Gb Ab | E | C  B  C F# A
Bb Eb         |   | Ab
              |   | Gb
              |   | Eb
```

Ex. 14d. unit 29 (m.34)



```
complementary set-class pair 6-27[013469]

E B D F G# C# | A G F# Eb A#
              | C
```

Ex. 14e. unit 71 (m.80)



```
complementary set-class pair
6-40[012358]  6-11[023468]

D F# G# A B G | F Bb C E  Eb
              |        Db
```

Example 14 continued.

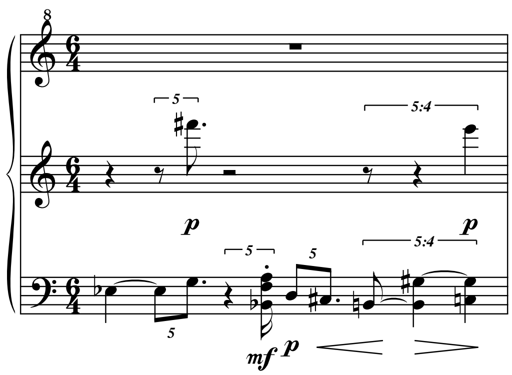
Ex. 14f. 166 (m.189)

```
sole set-class
6-40[012358]

Ab G# A B F# Bb A F# B Ab Eb
```

Ex. 14g. unit 239 (m.267)

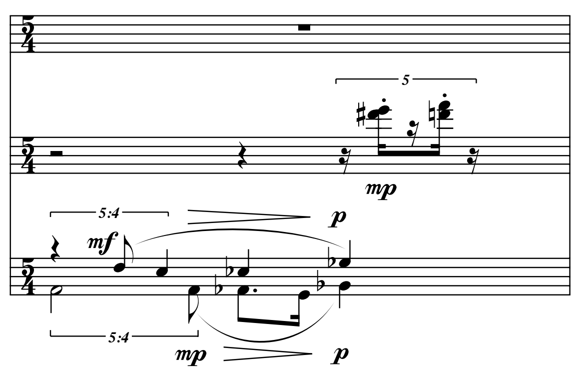
```
non-complementary set-class pair
6-30[013679] 6-30[013679]

D# E F# A Bb C  | F# A Bb C Bb
     A#         | A#        G
                |           E
                |           Db
                |           C
```

Ex. 14h. unit 39 (m.44)



```
complementary set-class pair
6-4[012456]  6-37[012348]

Eb G F# A  | B C# B G# C E
        F  |
        Bb |
```

Ex. 14i. unit 216 (m.244)



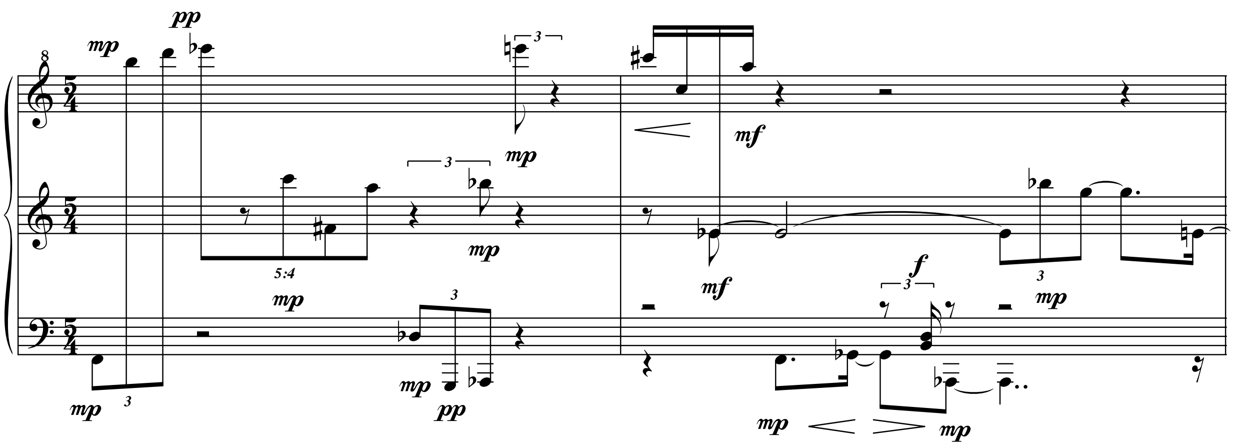
```
non-complementary set-class pair
6-4[012456]  6-37[012348]

A F E A Eb G | Gb E  F
        Ab   | Bb D# D
```

Example 15. Super-saturated set-class units.

Ex. 15a. unit 1 (m.1-6)

```
super-saturated aggregate
complementary set-classes
6-10[013457] 6-39[023458]

B   | F# | A  | D F | C Db | E
G#  | G  | Eb |     |      | Bb

______________ = 6-39
    _________________ = 6-10
         __________________ = 6-39
              __________________ = 6-10

(Blue Row outer hexachords)
```

Ex. 15b. unit 2 (m.7) Ex. 15c. unit 3 (m.8)

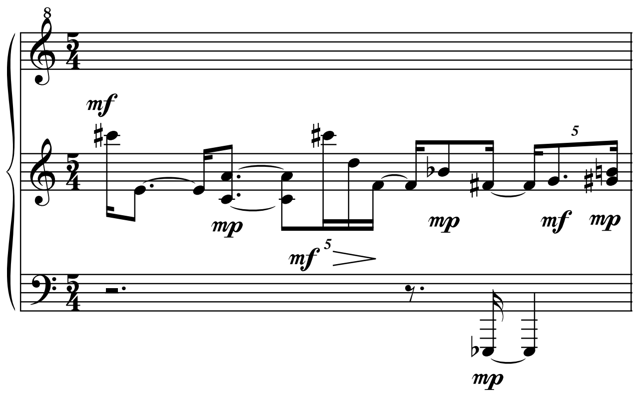


```
super-saturated aggregate
complementary set-classes
6-13[013467] 6-42[012369]

F B | D Eb | C F# | A Db | G Bb | Ab E

__________________ = 6-13
    __________________ = 6-42
   6-13 = __________________________
         6-42 __________________________

(Yellow Row outer hexachords)
```

```
super-saturated aggregate
complementary set-classes
6-28[0135679] 6-49[013479]

C# C | Eb A | F Gb | D | Ab Bb | G E
     |      |      | B |       |

____________________ = 6-28
      ____________________ = 6-49
     6-28 = ____________________
               6-49 ________________

(Red Row outer hexachords)
```

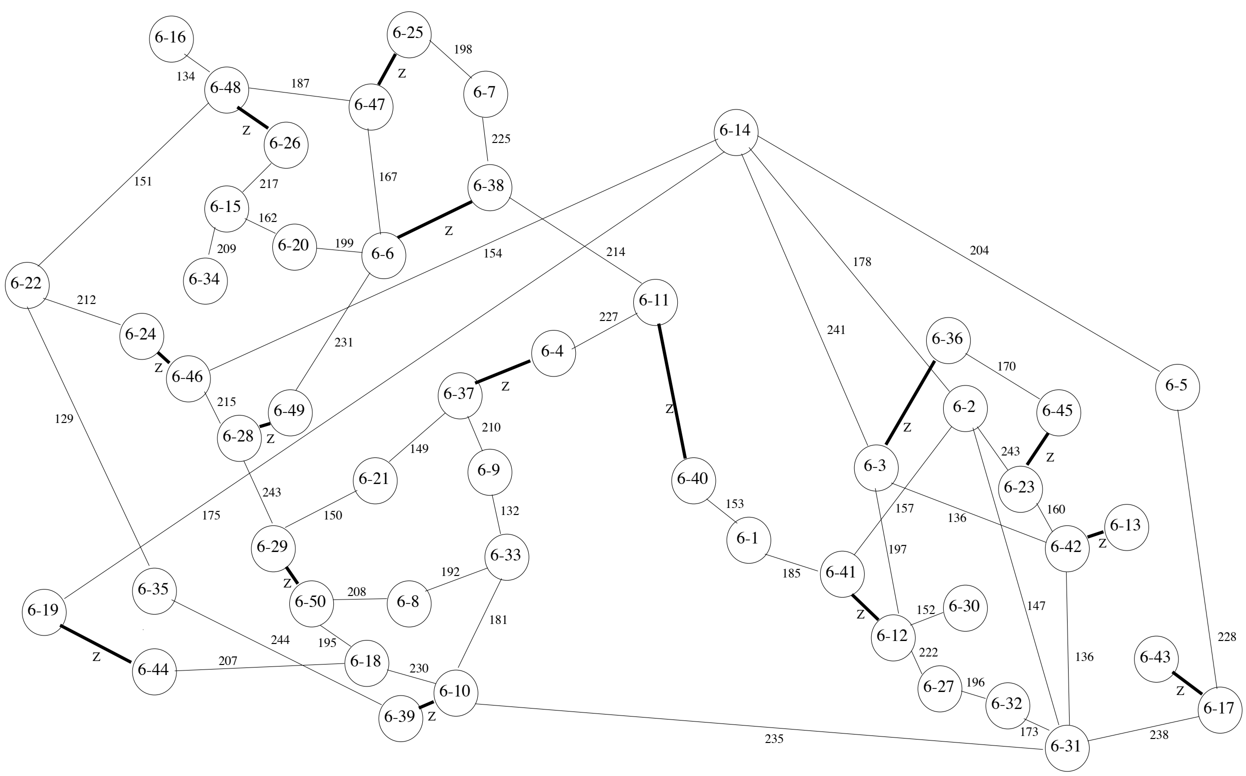
Example 15 continued.

Ex. 15d. unit 15 (m.20)



super-saturated aggregate
set-class 6-14[013458]

```
(C#) E  | A | C#  | D  F | Bb  | F# | G  | B
        | C |     |      |     | Eb |    | G#

      ____________________  = 6-14
         ______________________  = 6-14
              ________________________  = 6-14
         6-14 = ____________________
                 6-14 =   ___________________
```



Example 16. Network of hexchordal harmonic associations of units in *Each Time*.

Example 17. Information on the chain used in *Each Time*.

Ex. 17a. T0(Chain).

```
C A Bb B Ab   E D F C# Bb   B Eb F# G A  C Ab E B Eb
G A D Ab C#   C F Bb Eb F#  B E C C# D   F F# B Ab E
Bb C# F Eb D  C Ab F# E Bb  B D C# C Eb
```

Frequency of each pitch-class in chain:

C	C#	D	Eb	E	F	F#	G	Ab	A	Bb	B
6	5	5	5	5	4	4	2	5	3	5	6

```
linkset = C A Bb B Ab (at beginning of chain)
RT8I(linkset) = linkset (at beginning of chain)
TBI(linkset = B D C# C Eb (at end of chain)
RT3(linkset) = B D C# C Eb (at end of chain)
B D C# C Eb (at end of chain) is the same under RT2I.

Chain can link to TBI(chain) or RT2I(chain)
Chain be linked from TBI(chain) or RT8I(chain)
```

Ex. 17b. Linked chains in register 4 of the first (and second) part of *Each Time*.

T6(Chain):   F# Eb E F D
Bb Ab B G E F A C C# Eb   F# D Bb F A C# Eb Ab D G
F# B E A C   F Bb F# G Ab B C F D Bb   E G B A Ab
F# D C Bb E F Ab G F# A
| | | | |
| | | | |
RT8I(Chain): F Ab G F# A
Bb E D C Ab F# F Eb G Bb E C A D Eb F# G Ab E A
D F Bb Eb Ab G C F# B C#   F A E C Ab B C# D F A
Bb G Eb F# E C A Bb B Ab
| | | | |
| | | | |
T0(Chain):   C A Bb B Ab
E D F C# Bb B Eb F# G A   C **Ab E B Eb** **G A D Ab C#**
C F Bb Eb F# B E C C# D F F# B Ab E   Bb C# F Eb D
C Ab F# E Bb B D C# C Eb
| | | | |
| | | | |
RT2I(Chain): B D C# C Eb
E Bb Ab F# D C B A C# E   Bb F# Eb Ab A C C# D Bb Eb
Ab B E A D   C# F# C F G B Eb Bb F# D   F G Ab B Eb
E C# A C Bb F# Eb E F D
| | | | |

Bold entries are pcs in register 4 of Example 1.

Example 18. Imbricated hexachords in the chain.

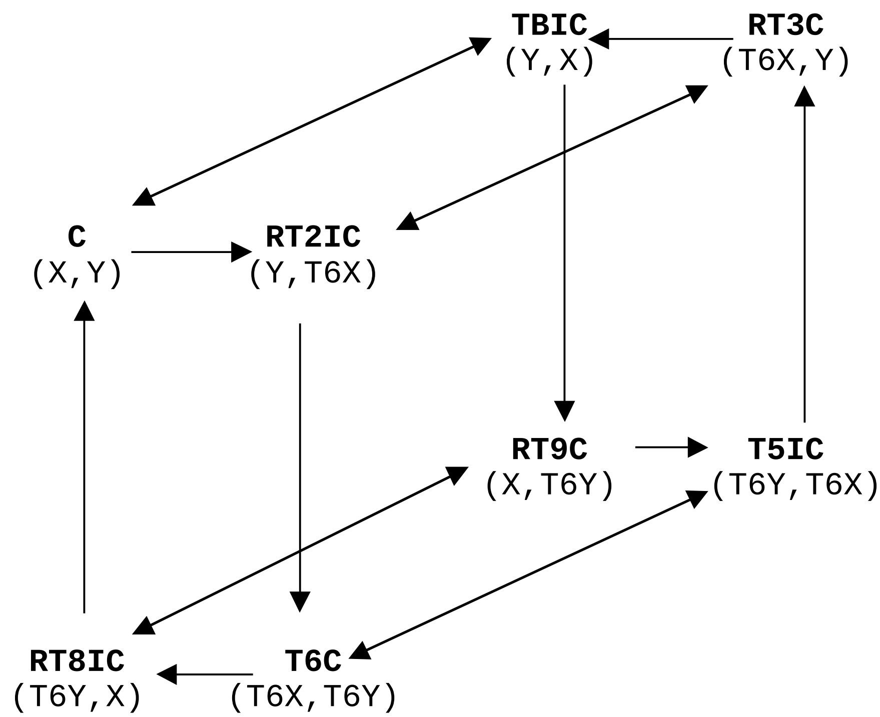
(read second column down to read successive pitch-classes in the chain)

#	PC	hexachord starting at #	Set-class	special sets
1	C	C A Bb B G# E	6-37	linkset X = C A Bb B G#
2	A	A Bb B G# E D	6-41	
3	Bb	Bb B G# E D F	6-30	linear at unit 179
4	B	B G# E D F C#	6-27	
5	G#	G# E D F C# Bb	6-49	T8(Red Row) starts here G# E D F C# Bb B Eb F# G A C linear at unit 218
6	E	E D F C# Bb B	6-13	T4(yellow row) starts here E D F C# Bb B Eb F# G A C G#
7	D	D F C# Bb B Eb	6-10	T2(Blue Row) starts here D F C# Bb B Eb F# G A C G#
8	F	F C# Bb B Eb F#	6-26	
9	C#	C# Bb B Eb F# G	6-31	
10	Bb	Bb B Eb F# G A	6-15	linear at unit 163
11	B	B Eb F# G A C	6-28	
12	Eb	Eb F# G A C G#	6-42	
13	F#	F# G A C G# E	6-39	
14	G	G A C G# E B	6-14	linear at unit 219
15	A	A C G# E B Eb	6-19	linear at unit 234
16	C	C G# E B Eb G	6-20	linear at unit 133
17	G#	G# E B Eb G A	6-16	
18	E	E B Eb G A D	6-48	linear at unit 233
19	B	B Eb G A D G#	6-17	linear at unit 191
20	Eb	Eb G A D G# C#	6-7	linear at unit 224
21	G	G A D G# C# C	6-6	linear at unit 130 and 131
22	A	A D G# C# C F	6-44	linear at unit 164
23	D	D G# C# C F Bb	6-46	linear at unit 145 and 203
24	G#	G# C# C F Bb Eb	6-32	linear at unit 165
25	C#	C# C F Bb Eb F#	6-25	linear at unit 134

Example 18 continued.

26	C	C F Bb Eb F# B	6-18	linear at unit 140
27	F	F Bb Eb F# B E	6-38	linear at unit 202
28	Bb	Bb Eb F# B E C	6-43	linear at unit 177
29	Eb	Eb F# B E C C#	6-11	linear at unit 229
30	F#	F# B E C C# D	6-9	linear at unit 237
31	B	B E C C# D F	6-3	linear at unit 226
32	E	E C C# D F F#	6-4	
33	C	C C# D F F# B	6-5	
34	C#	C# D F F# B G#	6-29	
35	D	D F F# B G# E	6-45	
36	F	F F# B G# E Bb	6-12	linear at unit 141
37	F#	F# B G# E Bb C#	6-33	
38	B	B G# E Bb C# F	6-50	linear at unit 232
39	G#	G# E Bb C# F Eb	6-47	
40	E	E Bb C# F Eb D	6-36	linear at unit 142
41	Bb	Bb C# F Eb D C	6-8	linear at unit 158
42	C#	C# F Eb D C G#	6-40	
43	F	F Eb D C G# F#	6-23	linear at unit 220
44	Eb	Eb D C G# F# E	6-21	linear at unit 211
45	D	D C G# F# E Bb	6-35	linear at unit 156
46	C	C G# F# E Bb B	6-22	linear at unit 159
47	G#	G# F# E Bb B D	6-34	linear at unit 155
48	F#	F# E Bb B D C#	6-24	linear at unit 186
49	E	E Bb B D C# C	6-2	linear at unit 245 (next to last unit)
50	Bb	Bb B D C# C Eb	6-1	linear at unit 246 (last unit)
51	B			linkset Y = B D C# C Eb
52	D			
53	C#			
54	C			
55	Eb			

Example 19. Graph of cycles of linking of members of the chain-class of C.



(Successive links may form cycles).

Example 20. Partitioning the array into the first units of *Each Time*.

unpartitioned chains at beginning of array

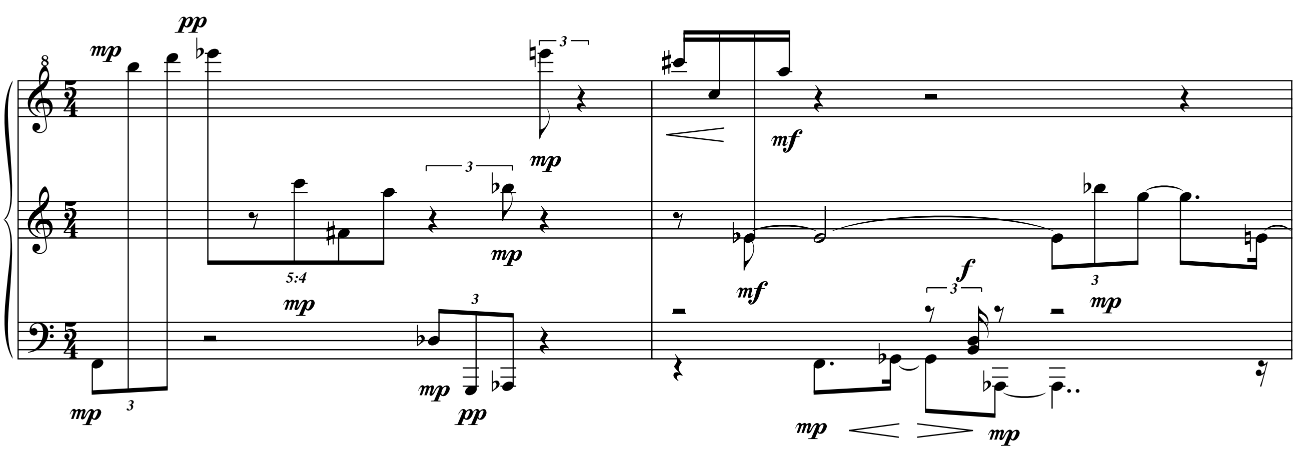
```
Register 1:T5:  5234197A6348B0251948027165A38B49567AB41936A8751B9347658
Register 2:T2:  2B01A647301589B2A6159B4A32705816234781A6037542A86014325
Register 3:RT8: B89A760248AB19604721A98072B61894A53B7048532B7691A047658
Register 4:T6:  63452A8B745901362A59138276B4905A678B052A47B98620A458769
Register 5:RT0: 3012BA46802351A48B652104B63A50182973B4809763BA15248BA90
Register 6:T7:  74563B90856A12473B6A24938705A16B7890163B580A9731B56987A
Register 7:RT7: A78965B1379A085B3610987B61A50783942A6B37421A65809B36547
```

first four units partitioned out of the chains.

```
Unit        : 1    2    3   4
             -----------------
Register 1: 5    234  19      7A6348B0251948027165A38B49567AB41936A8751B9347658
Register 2: 2    B0   0   01A 47301589B2A6159B4A32705816234781A6037542A86014325
Register 3: B89  9A   A7  7   0248AB19604721A98072B61894A53B7048532B7691A047658
Register 4: 6    6    34  452 8B745901362A59138276B4905A678B052A47B98620A458769
Register 5: 301  1    2B  B   46802351A48B652104B63A50182973B4809763BA15248BA90
Register 6: 74   5    56  3   90856A12473B6A24938705A16B7890163B580A9731B56987A
Register 7: A    78   8   896 B1379A085B3610987B61A50783942A6B37421A65809B36547
             -----------------
```

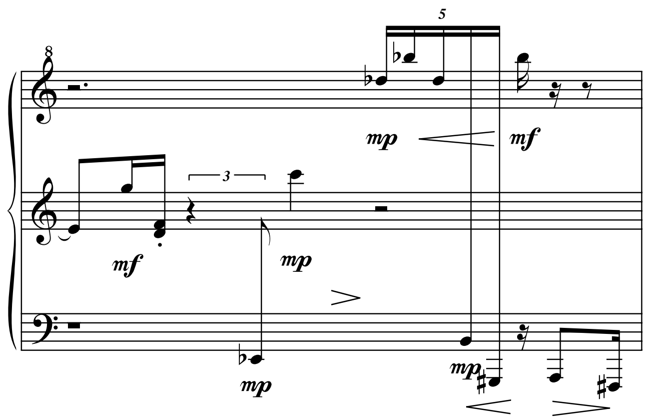
Example 21. First four units of *Each Time* (mm.1-9) derived from array.

```
Register 1: 5:                                     5
Register 2: 2:                                   2
Register 3: B89: B8                    9
Register 4: 6:              6
Register 5: 301:                       3               0   1
Register 6: 74:             7                                      4
Register 7: A:                                                     A
```



```
234:     2 3                        4     19:1     9
B0:    B         0                        0:   0
9A:                   9     A             A7:                        A 7
6:                     6                  34:   3                                  4
1:                         1              2B:                  2B
5:   5                                    56:       5   6
78:                           7 8         8:                     8
```

Example 21 continued.




```
-
01A:                       0    1  A
7:               7
452:     4     52
B:                                    B
3:                     3
896:                                    8   9  6
```

Example 22a. First part of array.

```
   : 5             6           7             8      9
    ---------------------------------------------------------
  1:               9
  2:
  3:                                         60248  AB1960472
  4:                           A8B745901362  A591   38
  5:               BA46802351
  6: 3B90856A1247  7                         73B
  7:                                                5
    ---------------------------------------------------------
```

```
   : 10          11       12             13       14
    ---------------------------------------------------
  1:                                              9
  2:             64       47301589B2A6   6159B4  A3270581
  3: 1           A98072
  4:                                     827     6B4
  5:                                     A
  6: B6A2493870                          0
  7: 5           5B13                    3
    ---------------------------------------------------
```

Example 22b. Second part of array.

```
     126           127         128           129    130
   ----------------------------------------------------------
  1:                                                0
  2:                                         9357B  1240937A5
  3:
  4:                           A8B745901362  A591   38
  5: B75841269A03  3                         3B7
  6:               328A046795
  7:               2
    ---------------------------------------------------------
SC: 12            10          12            7      10
  : 1             2           1             33     5
  :
```

```
     131         132      133            134      135
-------------------------------------------------------
  1: 0           068A                    A
  2: 4           10B3A5
  3:             31       1409A2568B73   3A2681  70B4925A
  4:                                     827     6B4
  5: 726A05B438                          8
  6:                                     2
  7:                                             2
    ---------------------------------------------------
SC : 10          8        12             7       9
   : 4           23       1              20      9
```

Example 23. Units based on array column 53 of *Each Time*.

Ex. 23a.

complementary set-class pair 6-35[02468A]

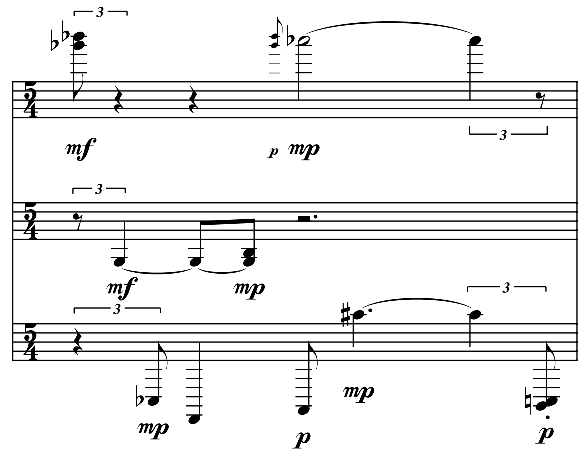
Eb A C# B F G	Bb Ab C E D Gb

complementary set-class pair 6-1[012345]
articulated by dynamics:

***f*:** Gb G Ab A B B

***p*:** C C# D Eb E F

Ex. 23b.

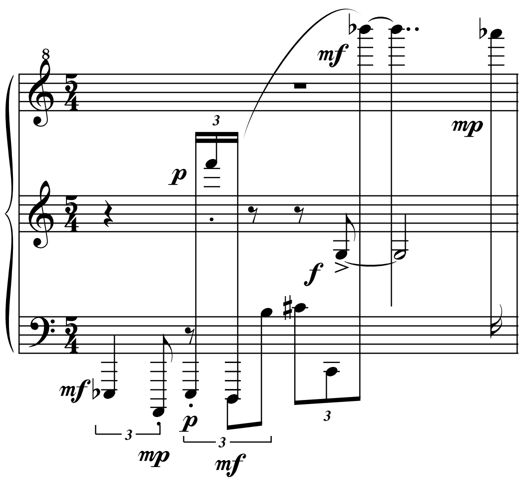


super-saturated aggregate
complementary set-classes
6-15[012458]

Bb Gb	G Eb	B A	Ab C	F Db	E D

_____________ = 6-15
_______________ = 6-15
_______________ = 6-15
_________________ = 6-15

Ex. 23c.



pitch-classes in dynamics (loud to soft)
articulate pitch-classes in registers
of (last) unit 246.

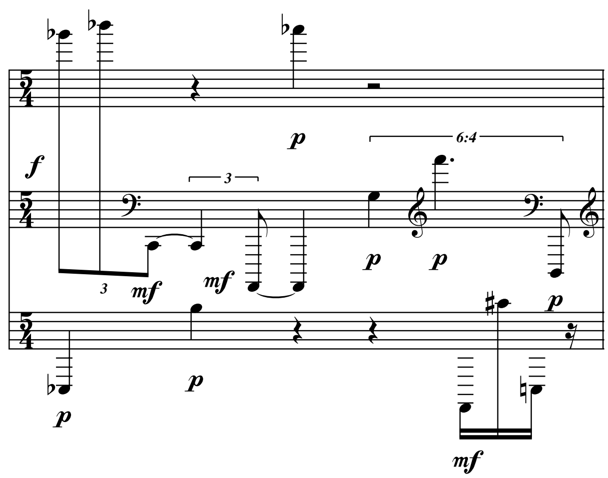
f D

mf Eb D B C Db Bb

mp F#

p E F (D)

Ex. 23d.



T6I of Red Row

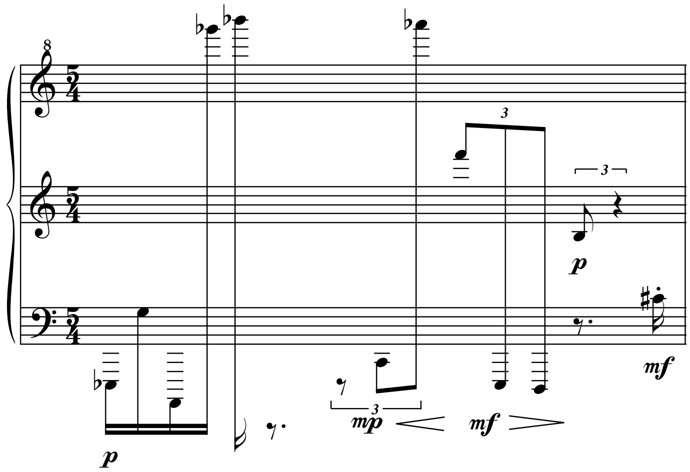
First hexachord:

***f-mf*:** Gb Bb C A C# E

Second hexachord:

***p*:** Eb B Ab G F D

Ex. 23e.



T3I of Red Row

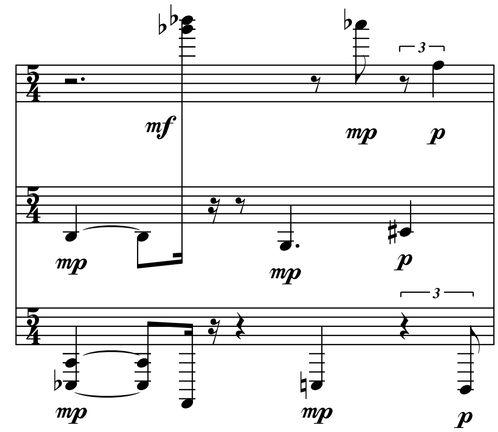
First hexachord:

sixteenth notes: Eb G A Gb Bb Gb

Second hexachord:

triplet notes: C Ab F E D B

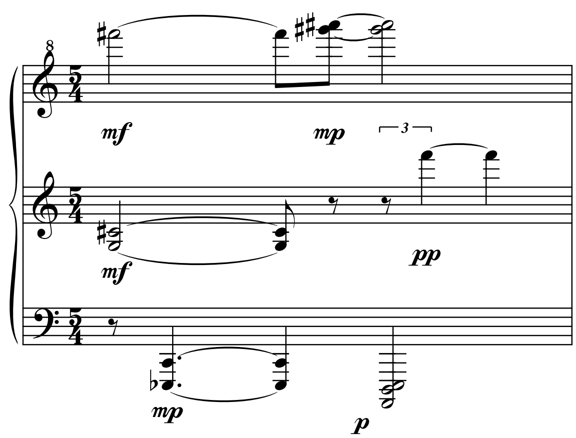
Ex. 23f.



partition of aggregate into four members of 3-3[014]

B	Bb		Ab		F	
C	Gb	G		C#		
Eb	A		E			D

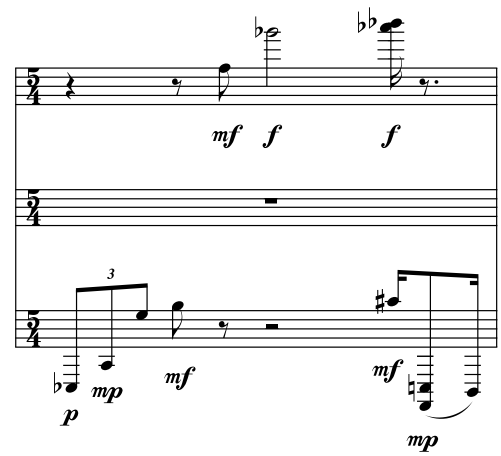
Ex. 23g.



complementary set-class pair
6-17[012478] 6-43[012568]

F#	C	A#	E	F
C#	Eb	G#	D	
B			A	
G				

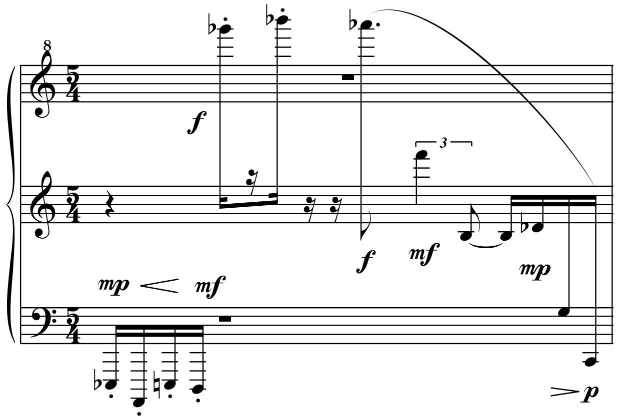
Ex. 23h.



complementary set-class pair
6-17[012478] 6-43[012568]

Eb	C	G	B	F	Gb	Bb	E	D
						Ab	A	
						C#		

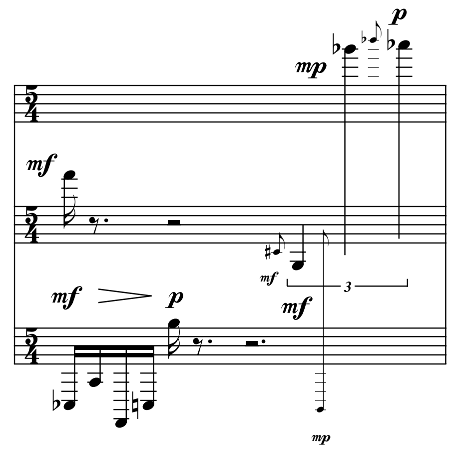
Ex. 23i.



complementary set-class pair
6-17[012478] 6-43[012568]

Eb A E D Gb Bb | Ab F B Db G C

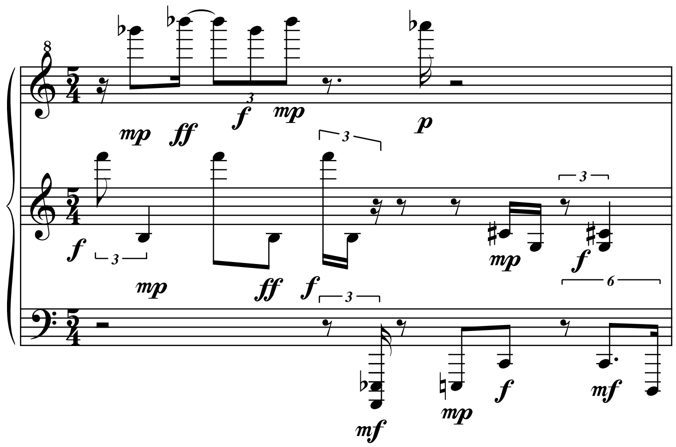
Ex. 23j.



complementary set-class pair
6-43[012568] 6-17[012478]

F C A E B | C# G D Gb Bb Ab
Eb |

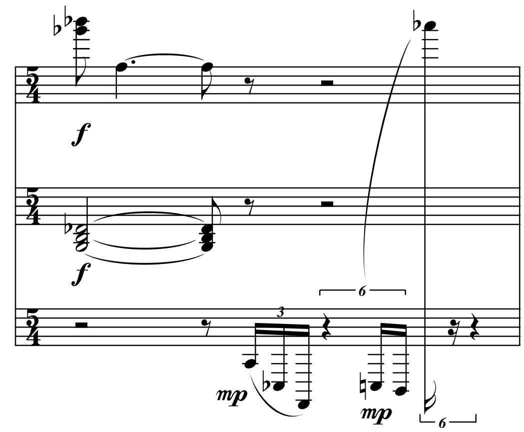
Ex. 23k.



complementary set-class pair
6-43[012568] 6-17[012478]

Gb Bb Eb | Ab C# G
F B A | E C D

Ex. 23l.



complementary set-class pair
6-43[012568] 6-17[012478]

Bb F | C Eb A E D Ab
Gb |
Db |
B |
G |