Part Two

2.1 *Trio* for Violin, Clarinet in A and Marimba: Basic Pitch and Rhythmic Structures

Trio for Violin, Clarinet in A and Marimba is a three-movement work which is constructed according to a detailed plan of layered transformations of a twelve-tone row. Initially, a sequence of transformations of the row was determined. This sequence was then layered on top of itself twice, resulting in three layers. All of the layers were then transformed. [Figure 20] First, the newly created layers were transposed either up or down three half steps. These transposed layers were then subjected to the four basic transformations (Transposition, Inversion, Retrograde, and Retrograde Inversion). These transformations were determined by cycling through the transformations first forward and then backward – that is, the transformations begin at the top layer with Inversion, move to Retrograde with the second layer, then move to Retrograde Inversion with the third layer before returning to the top layer to begin the reverse cycle with Retrograde Inversion. [Figure 21] This resulting layered structure forms the basis for the entire work.

Initial Sequence	P_3	P_4	P_6	P_{10}	P_8	P_7	P_5	P_2	P_1	P_9	P_{11}	P_0	P_7	P_1	P_7
	P_3	P_4	P_6	P_{10}	P_8	P_7	P_5	P_2	P_1	P_9	P_{11}	P_0	P_7	P_1	P_7
Layered Sequence	P_3	P_4	P_6	P_{10}	P_8	P_7	P_5	P_2	P_1	P_9	P_{11}	P_0	P_7	P_1	P_7
	P_3	P_4	P_6	P_{10}	P_8	P_7	P_5	P_2	P_1	P_9	P_{11}	P_0	P_7	P_1	P_7
Transformed	I_3	RI_4	P_6	R_{10}	R_8	P_7	RI_5	I_2	I_1	RI_9	P_{11}	R_0	R_7	P_1	RI_7
Layered	R_6	R_7	P_9	RI_1	I_{11}	I_{10}	RI_8	P_5	R_4	R_0	P_2	RI_3	I_{10}	I_4	RI_{10}
Sequence	RI_0	I_1	I_3	RI_7	P_5	R_4	R_2	P_{11}	RI_{10}	I_6	I_8	RI_9	P_4	R_{10}	R_4

Figure 20

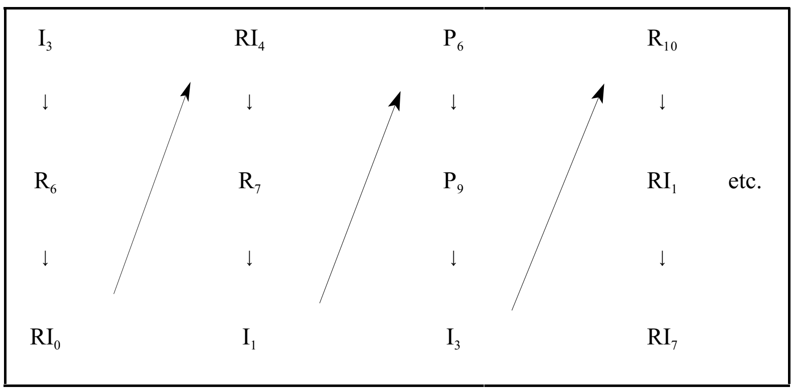


Figure 21

These three layered transformations of the twelve-tone row also form the underlying structure for each of the three movements. The first movement moves forward through the transformed layered sequence, the second movement moves forward through a multiplicative (M7) transformation of the transformed layered sequence, and the third movement moves through a retrograde of the transformed layered sequence. These underlying structures are then used to generate further layers.

Each of the *Trio*'s three movements is divided into three sections. In Movements II and III, all sections are of equal duration; in Movement I the first and third sections are equal in duration. Each of these large sections is further subdivided into three subsections. In Movements II and III, each of these subsections are also of equal duration; in Movement I, the outer subsections of the first and third section are equal while all of the middle section's subsections are identical in duration. Within these sections and subsections, further layers are created by adding retrogrades of the larger sections and even whole movements on top of the underlying structure, resulting in layers upon layers. These additional layers contain three times the material of the underlying structure and thus must move at three times the speed of the underlying structure. For instance, subsection 1b of the first movement places a retrograde of the entire first section on top of the second two rows of the underlying layer of the first section. [Figure 22] This additional layering of retrogrades of sections and movements on top of the underlying structure, itself already a layered construct, creates a situation in which the number of layers in operation over the course of the work varies over time, from a minimum of a single layer at the beginning of Movement I and end of Movement III to a maximum of nine in the middle of the first and second movements. The rather uncomplicated procedure of stacking pitch structures therefore results in a quite complex structure.

Retrograde Section 1, Movement I					
P_8	P_{10}	R_6	I_4	RI_3	
RI_{11}	I_1	R_9	P_7	P_6	R_0
R_5	I_7	RI_3	RI_1	I_0	
Section 1b, Movement I					
RI_4			P_6		
R_7			P_9		
I_1			I_3		

Figure 22

* * * * *

In addition to determining pitch succession the twelve-tone row is used to derive the rhythmic structure according to a duration row. Due to the complexity of the actual pitch structure which results from the above-described procedures, it was determined that a comparatively simple rhythmic structure would be appropriate. This structure assigns a constant duration value to each pitch class. These duration values are determined simply by their distance-plus-one, moving up by half-steps from the first note in the P_0 form of the row – specifically A♮. Thus, A♮ has a duration value of one (zero distance from A♮ plus one), A♯ a value of two (one half-step distant from A♮ plus one), B♮ a value of three, etc. [Figure 23] These duration values apply to the temporal distance, expressed in a standard note value, from the initial attack of the note to the initial attack of the following note.

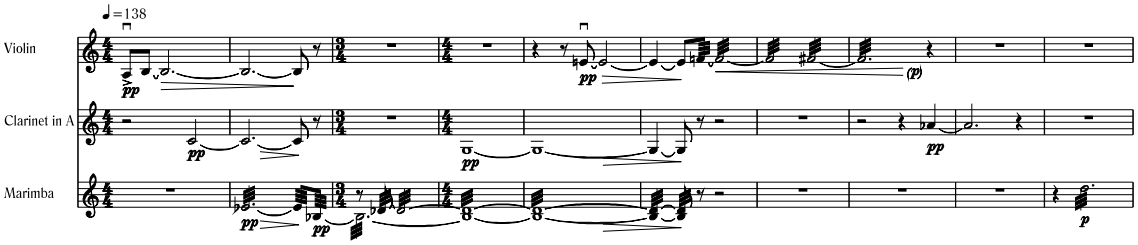
Pitch Class	A	A♯	B	C	C♯	D	D♯	E	F	F♯	G	G♯
Time-point value	1	2	3	4	5	6	7	8	9	10	11	12

Figure 23

The opening of the first movement uses the eighth note as the standard note value. When the duration values are applied to the succession of pitches in the twelve-tone row P_0, the attack points resulting are shown in Figure 24. The application of this combination of pitch succession and attack points is most easily shown in the opening measures of Movement I, where only one layer is present. [Example 1]

Pitch Class Succession, P_0	A	B	C	D♯	A♯	C♯	G	E	F	F♯	G♯	D
Note value												

Figure 24



Example 1

When applied to multiple layers, this pitch-rhythmic construct results in a rich and complex texture. The potential inherent in this system can begun to be seen with the commencement of the layered structure in the second half of section 1a of the first movement at measure 11 (the entirety of section 1a uses the eighth note as the basic rhythmic value). [Figure 25]

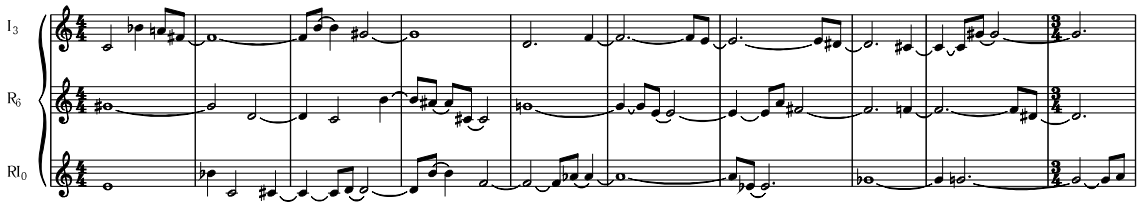


Figure 25

Section 1b of the first movement uses a dotted quarter note as the basic rhythmic value for the underlying layer (layer A). Since the top layer (layer B) must move at three times the speed of layer A, the basic rhythmic value for layer B is the eighth note, or one-third the standard note value of layer A. When the duration values are applied to the layered pitch structure, the attack points resulting are shown in Figure 26. The result of this layered pitch-rhythmic construct is shown in the opening measures of this section of the first movement, beginning at measure 21. [Example 2] As can be seen from the preceding examples, the duration of each note is not determined by the time-point system – only the moment of attack.

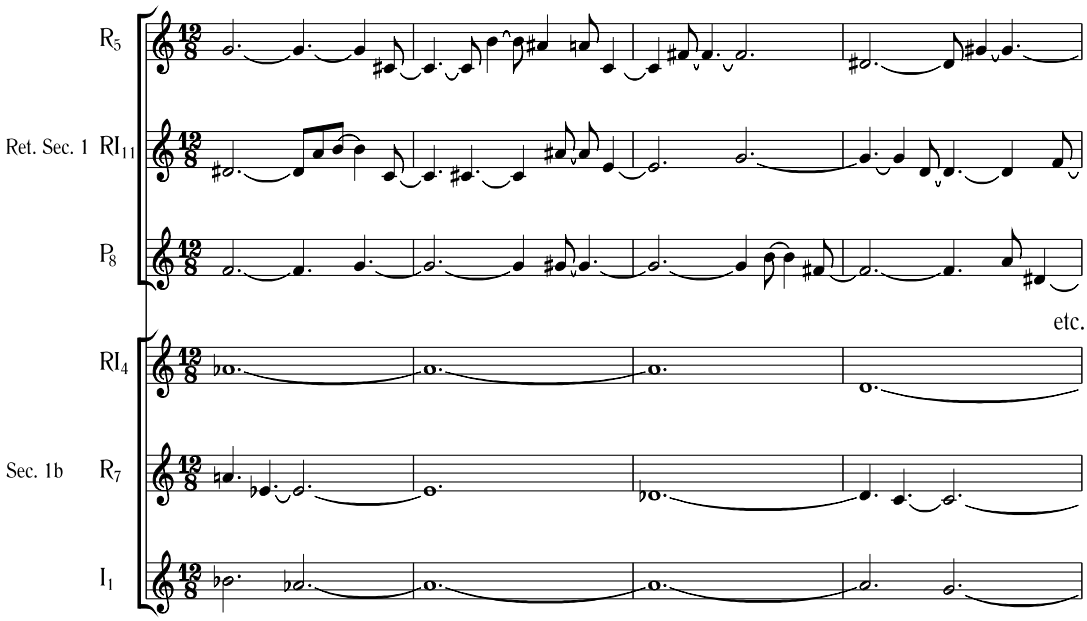
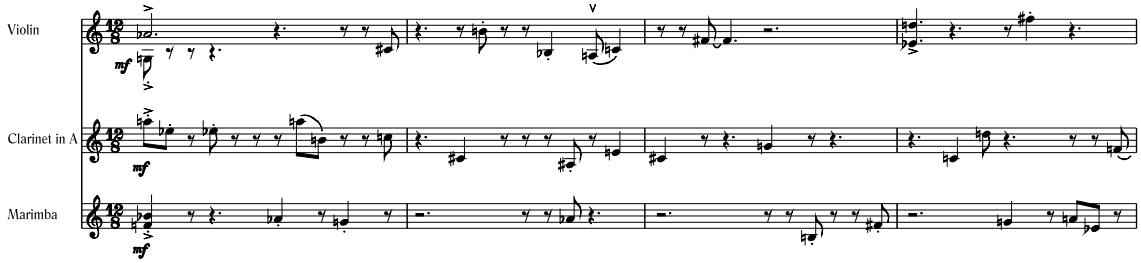


Figure 26



Example 2

2.2 *Trio*: Movement I

The underlying pitch layer of Movement I was shown in Figure 20. In section 1b, the retrograde of section one is layered on top of this underlying layer, with the retrograde layer moving at three times the speed of the underlying layer. In section two, a retrograde of the entire movement is layered on top, again moving at three times the speed of the underlying layer, and in section 3b a retrograde of section three is layered in the same manner as in the first section. Thus the number of layers in use changes over time (Appendix 2).

Beginning with a single layer (the initial statement of P_0), section 1a quickly moves to three layers (I_3, R_6, and RI_0). This changes to six layers with the start of Section 1b (Section 1b begins with P_8-RI_{11}-R_5 over RI_4-R_7-I_1). Section 1c is three layers throughout. [Figure 27]

Section	**Number of Layers**
Section 1a	1 → 3
Section 1b	6
Section 1c	3
Section 2a	6
Section 2b	9
Section 2c	6 → 4
Section 3a	3
Section 3b	6
Section 3c	3

Figure 27

Section 2a (beginning at measure 81 with I_7-I_{10}-P_4 over P_7-I_{10}-R_4) is six layers throughout. Section 2b moves to nine layers - although due to the construction of the layers, three would have to be considered "virtual" layers - since top layers of each of the middle subsections (1b, 2b, 3b) are retrogrades of their respective sections (1, 2, 3), and the top layer of section two is a retrograde of the whole movement, the top layer of section 2b is at the same time one-third of the retrograde of the entire movement and a retrograde of section two. Section 2c reverts to six layers and finally moves down to four layers. Section 3a begins at measure 185 with three layers. As in Section 1, this moves to six layers with the start of Section 3b and reverts back to three layers at Section 3c.

In this movement, all pitch layers are kept instrument-specific. That is, there is no sharing of pitches between the layered rows. For instance, the violin's underlying layer in Section 1 (after the opening statement of P_0) contains only the pitches of rows RI_0-RI_4-P_9-RI_1-P_5; the clarinet's underlying layer in this section contains only the pitches of rows I_3-R_7-I_3-RI_7-I_{11}; the marimba's underlying layer here contains only the pitches of rows R_6-I_1-P_6-R_{10}-R_8. In addition, the upper layers of each instrument are limited to the pitch retrogrades of their underlying layers. The violin's upper layer in section 1b thus contains a statement of the retrograde rows of its underlying Section 1 layer presented in reverse order: R_5-I_1-R_9-I_4-I_0. The upper layers of the clarinet are similarly the retrograde of its underlying layer, and the upper layers of the marimba also use only the pitches of its underlying layer in retrograde. [Figure 28]

Layer	Section 1	Section 2	Section 3
Violin Upper Layer	R_5-I_1-R_9-I_4-I_0	P_4-P_{10}-R_4-I_9-RI_8-I_9-P_4-R_5-I_8-P_4-R_5-I_1-R_9-I_4-I_0	P_4-P_{10}-R_4-I_9-RI_8
Violin Lower Layer	RI_0-RI_4-P_9-RI_1-P_5	R_4-RI_8-P_5-R_4-RI_9	I_8-RI_9-P_4-R_{10}-R_4
Clarinet Upper Layer	RI_{11}-I_7-RI_3-P_7-RI_3	I_7-R_1-P_7-I_3-R_{11}-P_0-RI_1-R_{11}-I_5-R_7-RI_{11}-I_7-RI_3-P_7-RI_3	I_7-R_1-P_7-I_3-R_{11}
Clarinet Lower Layer	I_3-R_7-I_3-RI_7-I_{11}	P_7-RI_5-P_{11}-I_1-R_0	P_{11}-RI_3-R_7-P_1-RI_7
Marimba Upper Layer	P_8-P_{10}-R_6-RI_1-P_6	I_{10}-RI_4-RI_{10}-P_0-R_2-RI_6-I_{10}-RI_2-P_2-RI_{10}-P_8-P_{10}-R_6-RI_1-P_6	I_{10}-RI_4-RI_{10}-P_0-R_2
Marimba Lower Layer	R_6-I_1-P_6-R_{10}-R_8	I_{10}-R_2-I_2-RI_{10}-I_6	P_2-R_0-I_{10}-I_4-RI_{10}

Figure 28

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Section 1a uses an eighth note as the basic note value in all layers for the duration row. In section 1b, the basic note value for layer A (the underlying layer) is doubled to become a quarter note. The basic note value for layer B (the retrograde layer) is one-third that of layer A, or a triplet eighth note. In the score this section is rewritten in compound time so that the basic note value for layer A became a dotted quarter note and for layer B a regular eighth note, with a tempo modulation (♩ = ♩.), for easier reading. In section 1c the basic note value reverts back to the eighth note with a corresponding tempo modulation (♩. = ♩) and change of meter back to simple time. Section two uses the same note values in working out attack points as section 1b. Section three follows the same rhythmic structure as section one (1a = 3a, 1b = 3b, 1c = 3c).

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The pitch/rhythmic matrices of the three instruments are combined into an essentially monophonic line which is systematically broken up by accumulations of simultaneities. The position and number of simultaneities are determined directly from the structure of the pitch row. Similar to the duration row structure, 1 was added to the distance from A♮ – the first note in the P_0 form of the row. The pitch series was thus transformed to the numeric sequence 1-3-4-7-2-5-11-8-9-10-12-6. This numeric sequence then defines the choice (and number) of simultaneities or individual notes; it is applied to the attack point structure which results from the combination of all three instruments. The numbers less than six are used to build up simultaneities of the same number, while those larger than six result in that number of single tones. This is shown in the opening measures of the movement [Example 1], where the first note is the first attack, the next three notes are built up into a three-note simultaneity, the next four pitches are built into a four-note simultaneity, and the next seven notes (only the first three are shown in the example) sound separately. Following this, the next two notes are built into a simultaneity, then follows a build-up of a five note simultaneity, the next fifty sound individually (11 + 8 + 9 + 10 + 12), and a six-note simultaneity completes the series.

2.3 *Trio*: Movement II

The pitch material for Movement II's underlying layer is generated from a matrix derived through a multiplicative transformation of the original series (shown in Appendix 1) – specifically, it is an M7 transformation of Movement I's underlying layer. A multiplicative transformation is an operation whereby a new pitch class is substituted for each pitch class in the original collection by multiplying the pitch class collection by some number *n* (where *n* is a *mod* 12 integer). The multiplicative transformation M1 yields the original collection, M11 yields the inversion of the original collection, M7 yields a cycle-of-fifths equivalence, and M5 yields a cycle-of-fourths equivalent. All other multiplicative operations fail to preserve the original number of distinct pitch classes of a collection upon which the operation is performed. M1, M5, M7, and M11 are one-to-one mappings; other operations are many-to-one. M2 and M10 map a collection into, at most, a whole-tone scale; M3 and M9 map it into at most a diminished seventh chord; M4 and M8 into at most an augmented triad; M7 into at most a tritone; and M0 into at most one pitch class. For twelve-tone operations, then, only the M7 and M5 operations, which interchange intervals 1 and 5 (and their complements), are relevant, though there is an interesting side-effect of the many-to-one operations – it is impossible generally to progress from a given collection to its operational equivalent and then back to the original collection through successive

applications of a many-to-one operation. It is always possible to do this with one-to-one mapping.[1]

Under the M1 and M11 transformations, the interval-content of the pitch structure is always preserved; under M5 and M7 transformations, perfect fourths (and perfect fifths) exchange places with minor seconds (and major sevenths). Thus multiplicative transformation transforms the interval content of pitch class collections. There are three ways in which this transformation can be accomplished (each of which end with the same result):

1. through multiplication of the pitch-classes of the original series by seven *mod* 12

2. through the reordering of pitch-class succession such that the ascending chromatic scale maps onto a cycle of fifths:

Chromatic scale:	0	1	2	3	4	5	6	etc.
Cycle of fifths:	0	7	2	9	4	11	6	etc.

3. through the transposition of all odd-numbered pitch classes by a tritone.[2]

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[1]Hubert S. Howe, Jr., "Some Combinational Properties of Pitch Structures," Perspectives of New Music 4/1 (1965), pp. 54-55.

[2]Wuorinen, Simple Composition, p. 99.

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Movement II, as with Movement I, is divided into three large sections; each of these sections incorporates two large layers (Appendix 3). The underlying layer has been discussed; the faster-moving layer is a retrograde of the entire work. That is, on top of the underlying layer of Section I is layered the retrograde of Movement III. The retrograde of Movement II is layered on top of the underlying layer of Section II, and the retrograde of Movement I is layered on top of the underlying layer of Section III. While the underlying layer uses an M7 matrix as described above, the retrograde layer uses the original matrix. This layered structure results once again in variation in the number of layers occurring over time. [Figure 29]

Section	**Number of Layers**
Section 1	2 → 4 → 6
Section 2	6 → (9) → 6 → 4
Section 3	6 → 4

Figure 29

Beginning with two layers (a simultaneous presentation P_0 over the M7 transformation of P_0), Section 1 quickly moves to four layers at measure eight (I_3-R_6-RI_0 over the continuation of the M7 transformation of P_0), and then on to six layers at measure twenty-two (the three layers of the retrograde of Movement III over the M7 transformations of I_3-R_6-RI_0). Since the retrograde of Movement III (the upper layer in this section) is itself the retrograde of the underlying layer of Movement I, what occurs

pitch-wise through this section is the beginning of an M7 canon – the original forms of the rows are presented moving at three times the speed of the M7 transformations of the same series. This structural canon is broken at the beginning of Section 2.

Section 2 (beginning at measure 127), begins with six layers, adds three 'virtual layers' in the middle, and concludes with four layers. The retrograde layer of this section is the retrograde of the movement itself (therefore using the M7 matrix). The middle portion of the movement, therefore, consists of the retrograde of the middle portion of the movement layered on top of – and contained within; therefore the 'virtual' nature of these layers – the retrograde of the movement as a whole, which is in turn placed on top of the movement's underlying layer. Finally, the section concludes with a brief move to four layers. Section 3 (beginning at measure 225), starts with six layers and at the end of the movement concludes with a brief seven-measure section which only contains four layers.

As with the first movement, the layers are kept distinct initially, but unlike the first movement, the layers are blended in the process of composition. That is, the layers are no longer kept distinct – instruments are free to use pitches from any of the layers currently occurring. [Figure 30]

Also unlike the first movement, no rhythmic alterations are used in this movement. The basic note value of the underlying layer is kept constant at the dotted eighth note, while the basic rhythmic value of the retrograde layer is kept constant at the eighth note – one-third the rhythmic value of the underlying layer.

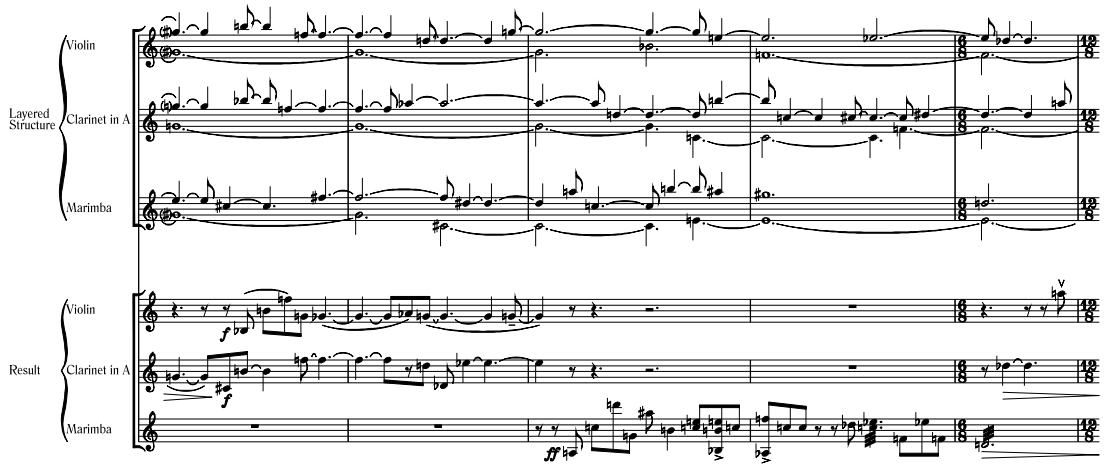

Figure 30

2.4 *Trio*: Movement III

Movement III, while similar in structure to the previous movements, is simpler in design, a choice in keeping with a traditional three-movement work. While somewhat less dense than the first two movements, providing a spaciousness and stillness that is absent from the previous movement, it still uses only procedures which first appeared in the prior movements. As with the first two movements, Movement III is divided into three sections each of which utilize a varying number of layers over time (Appendix 4). These large sections are the same as the first and third sections of Movement I in their structure; each is subdivided into three subsections, the middle of which layers a retrograde of the underlying layer section on top of the underlying pitch structure moving at three times the speed of the underlying layer. [Figure 31] The underlying layer itself is simply a retrograde of the underlying layer of the first movement.

Section	**Number of Layers**
Section 1a	3
Section 1b	6
Section 1c	3
Section 2a	3
Section 2b	6
Section 2c	3
Section 3a	3
Section 3b	6
Section 3c	3 → 4

Figure 31

This movement also utilizes a rhythmic structure which is similar to that of the first movement. All sections use a quarter note as the basic note value for the underlying layer – rewritten with a tempo modulation for easier reading in the sections which do not contain a retrograde layer (that is, sections 1a, 1c, 2a, 2c, 3a, and 3c) – while retrograde layers use a triplet eighth note. Unlike the situation in the first movement, the sections which contain a retrograde layer (and thus contain a large number of triplets) are not rewritten into compound time. As with Movement II, these layers, while kept separate during the pre-compositional process, are not kept distinct in the final result.