Theory and Practice 24 (1999)

1999 M.T.S.N.Y.S. Emerging Scholar Award

Metric Conflict in the First Movement of Bartók's Sonata for Two Pianos and Percussion

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In his article "Bartók's Octatonic Strategies," Richard Cohn argues that the first movement of Bartók's Sonata for Two Pianos and Percussion progresses from the dominance of interval class 4 to that of interval class 3.[1] Can one postulate a metric analogue for such a procedure, in which a dominating "dupleness" progresses to a dominating "tripleness"?

Certainly the movement begins in metric ambiguity, and progresses to clarification of the notated 9/8 meter. Does this simple explanatory model, however, adequately describe the metric processes occurring within the movement? In an attempt to answer this question, this analysis examines the rhythmic segments and metric hierarchies of the movement, investigating their interrelationships, and tracing their transformations.

THEORY

To facilitate this analysis, we first define temporal spaces, segments and subsegments within these spaces, and transformations on these segments.

Temporal spaces

For the purposes of this study, we define five interrelated temporal spaces consisting of time points. The definitions for the first four (m-, e-, modm-, and modetimes) adapt definitions found in Robert Morris's *Composition with Pitch-Classes*.[2] The fifth is my own contribution. Example 1 provides examples for each of the spaces.

M-time is defined as a measured time consisting of m-time points (m-tps) arranged in temporal order. The durations between each pair of m-time points are measured but not necessarily equal. The m-time points are labeled from 0, a midpoint, to "later" by increasingly positive integers and to "earlier" by increasingly

Example 1. Comparison of an ordered set of articulators in various spaces (Bartók, Fifth String Quartet, third movement, mm. 1–4)

a) m-time	X =	< 0,	1,	2,	3,	4,	5	>	
b) e-time	X =	< 0,	4,	6,	9,	13,	15	>	
c) modm-time	X =	< 0,	1,	2,	0,	1,	2	>	modulus = 3
d) mode-time	X =	< 0,	4,	6,	0,	4,	6	>	modulus = 9

modH $1^{18}\backslash(4+2+3)^2\backslash 9^2\backslash 18$

"minimal duration" = eighth note at the given tempo (in e-time, mode-time, and modH)

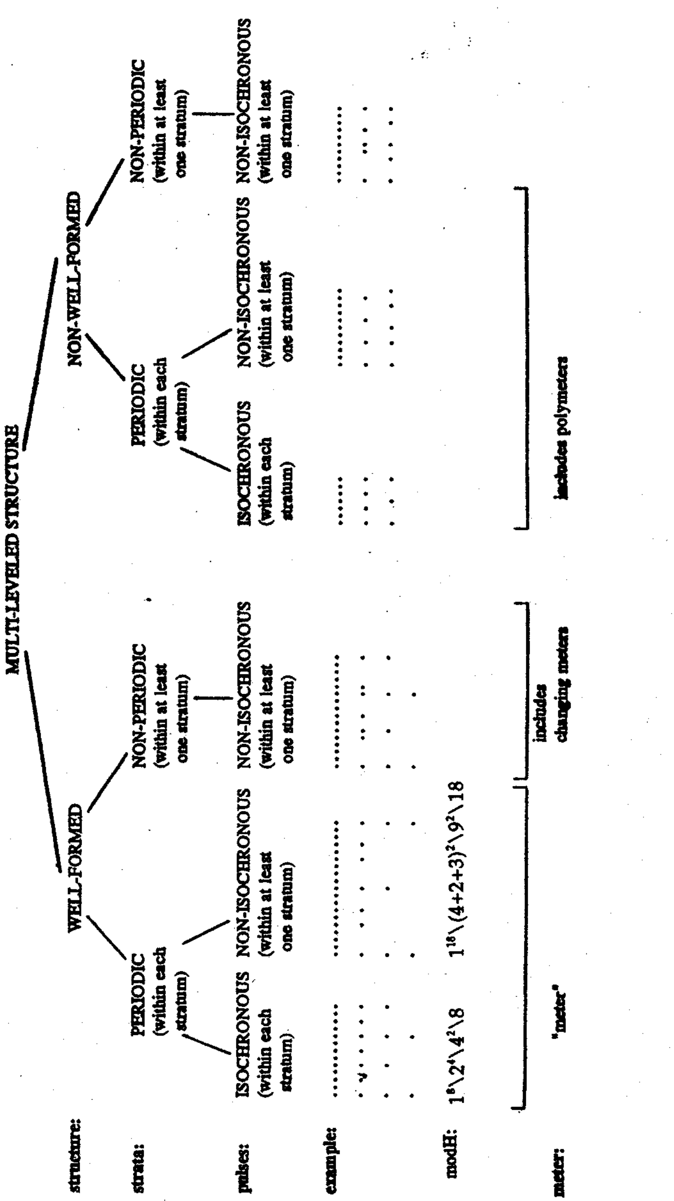
negative integers.[3] Example 1a shows the cello articulations beginning the third movement of Bartók's Fifth String Quartet as m-tps, taking the beginning of the movement as m-tp 0.

We also define e-time, a special case of m-time, in which durations between successive time points are equal. E-time consists of e-time points (e-tps) arranged in temporal order, labeled with successive integers from a midpoint 0 to "later" by increasingly positive integers and to "earlier" by increasingly negative integers. The duration between successive e-time points is called the "minimal duration" (henceforth min dur).[4] We define the min dur in relation to the musical pulse, generally choosing a convenient unit which allows note values to be expressed as integers.[5] Example 1b shows a set of articulators in e-time, taking the min dur as the eighth note, and the beginning of the movement as e-timepoint 0.

Both m-time and e-time can be modularized, choosing a modulus according to the musical context. Modm-time is defined as a set of m-time-point classes (m-tpcs) resulting from taking m-time points mod n. M-tpcs are labeled successively from 0 to n-1.[6] Modm-time aptly models meters incorporating non-isochronous beats (i.e., beats separated by unequal durations). The cello articulators of Example 1c, for example, express m-time-point classes 0, 1, 2 (mod 3).[7]

Similarly, mode-time of order n is a set of e-time-point classes (e-tpc) derived from an e-time by taking its e-tps mod n. E-tpcs are labeled successively with integers from 0 to n-1. E-time point classes, or "beat-classes," as David Lewin

Example 2. Modular hierarchies (modHs)



calls them, aptly represent the "beats" of musical meter.[9] Beats one, two, and three of a minuet, for example, can be represented as time-point classes 0, 1, and 2 in a mode-time of order 3. In Example 1d, the cello's repeating pattern establishes a modulus of 9 min durs, articulating tpcs 0, 4, and 6.

Although modular times can represent the modular aspect of meter, they fail to capture its multileveled aspects.[10] We therefore define a modular hierarchy (modH) as a temporal space comprising two or more pulse strata,[11] each stratum consisting of an e- or m-time. Each stratum may be periodic or non-periodic (periodic if its interpulse durations form a repeating pattern, and non-periodic otherwise). The strata in the hierarchy are ordered roughly from faster to slower, represented visually from high to low. (No two strata may occupy the same level.) The resulting modular hierarchy is well-formed if and only if all pulses occurring on any given stratum also occur on all higher strata.[12] The diagram in Example 2 shows multi-leveled structures which are well-formed and non-well-formed, periodic (all strata are periodic) and non-periodic (at least one stratum is non-periodic), isochronous (each stratum is isochronous) and non-isochronous (at least one stratum is non-isochronous). An example (borrowing the dot notation of Fred Lerdahl and Ray Jackendoff)[13] is found under each branch of the tree. Only those structures on the left portion of the example (that is, well-formed periodic modular hierarchies) represent what we traditionally call meter (although other portions of the diagram include changing meters and polymeters).

Modular hierarchies are labeled by listing their interpulse durations (measured in terms of a min dur) from fast to slow, separated by back slashes. The sum of durations on all levels must be equal. A duration x which occurs n times in succession can be represented as x^n. For example, in the leftmost example of Example 2, consider the top row of dots to represent equidistant pulses separated by the minimal duration. Then the example represents modH 1+1+1+1+1+1+1+1\2+2+2+2\4+4\8, or 1^8\$2^4$\$4^2$\8. If non-isochronous durations occur within a stratum, they are listed in order and separated by plus signs.[14] The example the second from the left then represents modH 1^{18}\$(4+2+3)^2$\$9^2$\18. This is the modH of Example 1, representing pulses separated by an eighth note (sub-tactus level), 4, 2, and 3 eighth notes (tactus level), one measure, and two measures.

Segments

Within each of these spaces, a segment (seg) is defined as an ordered set of elements in the space, associated with segs in other temporal spaces and non-temporal domains such as pitch-class, pitch contour, and timbre. Segs in m-time are termed m-segs, in mode-time mode-segs, and so on. A seg in an undefined space, or representing segs in different spaces, is simply called a seg. Segs are labeled with upper-case letters, and their members enclosed in angle brackets, e.g., X = $<x_0, x_1, x_2>$. A seg X is a subseg of a seg Y if and only if (1) all members of X are also members of Y, and (2) the temporal ordering of the members of X is preserved in Y. For example, given segs W, X, Y, and Z, as shown in Example 3a, W and X are subsegs of Z, while Y is not. Segs in the various spaces are distinguished with different type faces, as shown in Example 3b.

Example 3. Segments

a) subsegment (subseg)

X is a subseg of Y IFF 1) $x \in X \Rightarrow x \in Y$, and
2) x precedes y in X $\Rightarrow$ x precedes y in Y

e.g. Given	W = <0,1,2>,	Z = <0,1,2,3,4,5>	W is a subseg of Z
	X = <1,3,5>,	Z = <0,1,2,3,4,5>	X is a subseg of Z
	Y = <1,2,0>,	Z = <0,1,2,3,4,5>	Y is not a subseg of Z

b) segment typefaces

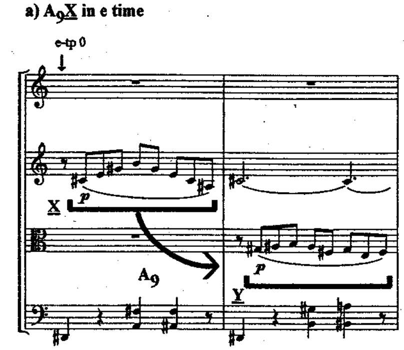
A seg in m-time	is written	$\underline{\underline{\mathbf{X}}}$
e-time		$\underline{\mathbf{X}}$
modm-time		$\underline{\underline{\mathit{X}}}$
mode-time		$\underline{\mathit{X}}$

Transformations

This paper defines two transformations on segs. The first transforms one seg into another; the second combines segs from distinct polyphonic voices. Examples are given in Example 4. (The min dur in Example 4 is the eighth note.)

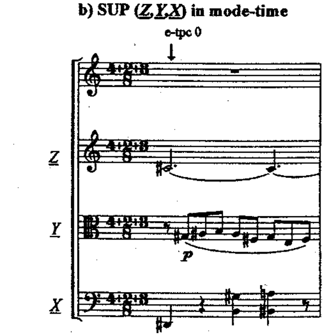
Example 4. Examples of transformations
min dur = eighth note

a) $A_9\underline{X}$ in e time



Given $\underline{X}$ = <1,2,3,4,5,6,7,8>
then $\underline{Y}$ = $A_9\underline{X}$
= <10,11,12,13,14,15,16,17>

b) SUP ($\underline{Z}$,$\underline{Y}$,$\underline{X}$) in mode-time



$$\mathrm{SUP}(\underline{Z},\underline{Y},\underline{X}) = \left\langle \begin{array}{ccccccccc} 0 & & & & & & & & \\ & 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 \\ 0 & & & & 4 & & 6 & & \end{array} \right\rangle \bmod 9$$

where $\underline{Z}$ = <0>, mod 9
$\underline{Y}$ = <1,2,3,4,5,6,7,8>, mod 9
$\underline{X}$ = <0,4,6>, mod 9

In m- or e-time, $\text{Addition}_n X$ (or $A_n X$) shifts seg X by n "minimal durations" "later" in time. Given that X is a seg of k time points $\langle x_0, x_1, x_2, \ldots, x_{k-1}\rangle$ and that Y is a set of k time points $\langle y_0, y_1, y_2, \ldots, y_{k-1}\rangle$, $A_n X$ shifts each element of X by n to form Y so that $x_i + n = y_i$ for all $x_i \in X$ and all $y_i \in Y$ (where n is any integer—positive, zero, or negative). (This transformation is isomorphic to transposition in pitch-space.) Example 4a shows e-seg X̲ shifted by nine eighth notes (locating e-time point 0 at the beginning of the fragment for convenience).

Given k segs within a temporal space, ordered in some temporal or non-temporal parameter as $X_0, X_1, X_2, \ldots, X_{k-1}$, $\text{SUPerimpose}(X_0, X_1, X_2, \ldots, X_{k-1})$ combines the segs, maintaining each in a distinct voice. The result is displayed in a two-dimensional array in which:

1) each row contains one seg
2) the rows from top to bottom contain segs $X_0, X_1, X_2, \ldots, X_{k-1}$ in that order
3) the location of elements from left to right indicates the relative temporal ordering of their beginning time points.

For example, the fragment shown in Example 4b can be expressed in mode-time as SUP (Z̲,Y̲,X̲), where Z̲ represents the attacks of the second violin, Y̲ the viola, and X̲ the cello.

ANALYSIS

We now turn to the analysis of the first movement of Bartók's Sonata for Two Pianos and Percussion.

Background and form

In a 1938 essay about the Sonata, Bartók writes that "I already had the intention years ago to compose a work for piano and percussion. . . . When the International Society for Chamber Music of Basle requested last summer that I compose a work for their Jubilee Concert on January 16, 1938, I gladly accepted the opportunity to realize my plan."[16] After describing the instrumentation of the work, Bartók goes on to delineate its formal structure. Example 5 interprets Bartók's description; "theme 3" in the diagram relabels what Bartók calls a "codetta" and "coda" in order to acknowledge the weight given to this material. Note the presence of four themes: i (introduction), 1, 2, and 3.

Analysis

Existing music-analytical literature has accorded the Sonata for Two Pianos and Percussion generous attention. Ernö Lendvai applies his axis system and Golden Section principles; János Kárpáti discusses motive, tonality, rhythm, and form. Roy Howat explores proportions, tempo relations, and tonal centers, and investigates sketches. Errol Haun examines symmetry, interval cycles, and modal constructions, and Elliott Antokoletz discusses "chromatic compression," "diatonic expansion," and Classical structure. Richard Cohn explains strategies of transpositional combination and their relation to octatonicism. Paul Wilson discusses pitch-class sets, and analyzes pitch hierarchy and function using graphing techniques. John Downey discusses the influence of folk music; Stephen Walsh remarks on orchestration; Karlheinz Stockhausen argues for the dominant role of rhythm.[17]

Although some of these authors (Lendvai, Kárpáti, Howat, Wilson, Downey, and Stockhausen) treat rhythmic aspects of the work, none examine the primary rhythmic segments of the work, their modular contexts, and their transformations. The following analysis of the Sonata's first movement identifies a central mode-segment, traces its manifestations and attendant modular transformations through the movement, and demonstrates a close relation between these modular transformations and the formal organization of the movement.

Example 5. Form in the first movement of Bartók's Sonata for Two Pianos and Percussion

Introduction	1–31	
Theme i		1–17
transition		18–31
Exposition	32–194	
Theme 1		32–40
Theme i		41–60
Theme 1		61–68
transition		69–80
Theme 2		80–99
transition		99–104
Theme 3		105–160
Theme 2		161–174
transition		175–194
Development	195–273	
A		195–216
B		217–231
A'		232–261
transition		262–273
Recapitulation	274–432	
Theme 1		274–291
Theme 2		292–331
Theme 3		332–432
fugato		
Coda	433–443	

Throughout the following analysis, the minimal duration will be the eighth note (unless otherwise stated).

1. Main segs

One basic mode-seg, P, underlies all four main themes of the movement. As shown in Example 6, P consists of the SUPerimposition of two mode-segs, E and B. Examples 6a and 6b show how mode-seg P underlies themes i and 1. In theme i (Example 6a), P's two component mode-segs E and B are articulated by piano I's right and left hand, respectively, and in theme 1 (Example 6b) by pianos and timpani, respectively.

Example 6. Mode-seg P: Themes i, 1

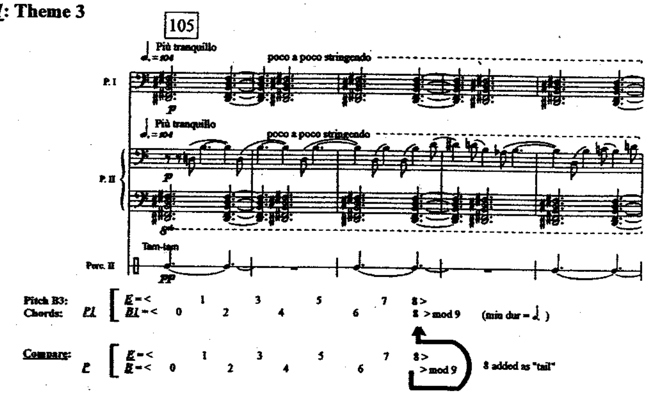
P [E=< 1 3 5 7 8> ; B=< 0 2 4 6 > mod 9

a) Theme i, Development Section A'

b) Theme 1, Exposition

As shown in the lower half of Example 7, mode-seg P1 is closely related to P. P1's constituent seg B1 relates to P's consituent seg B by adding e-tpc 8 onto its tail. Mode-seg P1 underlies the opening of theme 3: its subsegs E and B1 are articulated by piano II right hand's pitch B3's and the piano chords respectively. (Here the min dur = dotted quarter.)

Ex. 7 Mode-seg P1: Theme 3



As shown in Example 8, mode-segs P2 and P3 are subsegs of the primary mode-seg P. The constituent subsegs of P2 and P3 are subsegs of the constituent subsegs of P. Each measure of theme 2 (except mm. 85 and 90, shown in parentheses) expresses mode-seg P2 or P3.[18] Theme 2 differs from themes i, 1, and 3 in the roles that it assigns its constituent "B" and "E" segs. Whereas the "E" seg (the odd-numbered or offbeat tpcs) plays the primary melodic role in themes i, 1, and 3, the "B" segs (the even-numbered tpcs) do so in theme 2.

2. Modular conflict: 2 versus 3, 8 versus 9

(The reader is reminded that where the min dur = eighth note, mod 2 represents a quarter-note pulse, and mod 3 a dotted-quarter-note pulse.)

2.1 Theme i

The introduction theme (Example 9), as first presented, covers the chromatic range from D♮2 to A2, with its opening F♮2 lying in the center of this range. The statement expresses no clear metric structure. As shown in Example 9a, semitones parse it into mod 2, as do the local pitch maximum and minimum. However, as shown in Example 9b, Bartók's beaming, pitch-contour equivalences under Retrograde, and the rhythmic placement of the pitch-centric F♮2 and the pitches above it (mode-seg C) suggest mod 3. As shown in Example 9c, the latter interpretation is articulated when the full introduction theme reappears in the development by doubling in the left hand, and eventually (though not shown in the example) by attacks in the timpani as well.

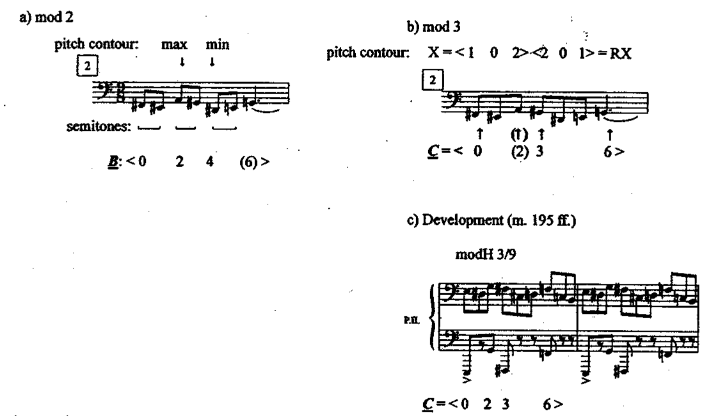
As shown in Example 10, the mod 3 potential of the theme is also suggested earlier than the development, in the exposition, when it appears divided into groups of three eighth notes.

2.2 Theme 1

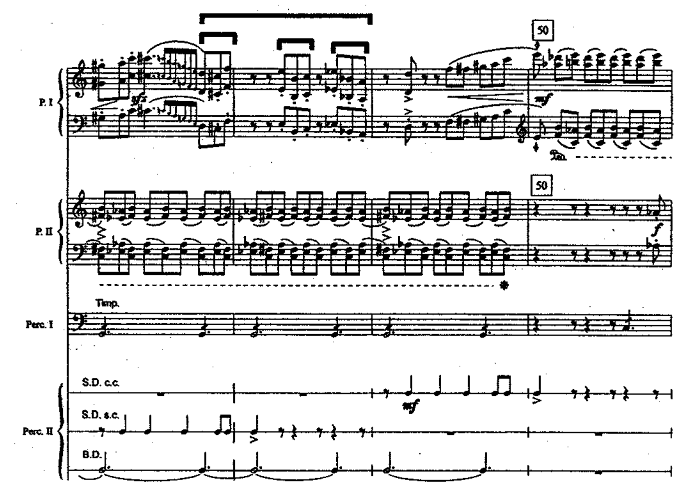
The first theme presents modular complexity of a different sort. Here the complexity is not one of ambiguity, but of conflict. Whereas the introduction theme parses into mod 2 or mod 3, the first theme clearly articulates mod 2. It does so, however, within the context of mod 9 (Example 11). Since 2 is relatively prime to 9, the durational pattern it generates either meets up with that generated by 9 at 18 units (2 × 9) (Example 11a), or forms an incomplete cycle within the confines of 9 units (Example 11b).[19] (Although this incomplete cycle may occur in any rotation within mod 9, Bartók confines himself primarily to the two arrangements shown in Example 11b.) The four units of 2 occurring at the beginning and end of these mod-hierarchical units suggest an intermediate unit of 8, resulting in the modHs shown in Example 11c.

Example 8. Mode-segs P2 and P3 (subsegs of P): Theme 2

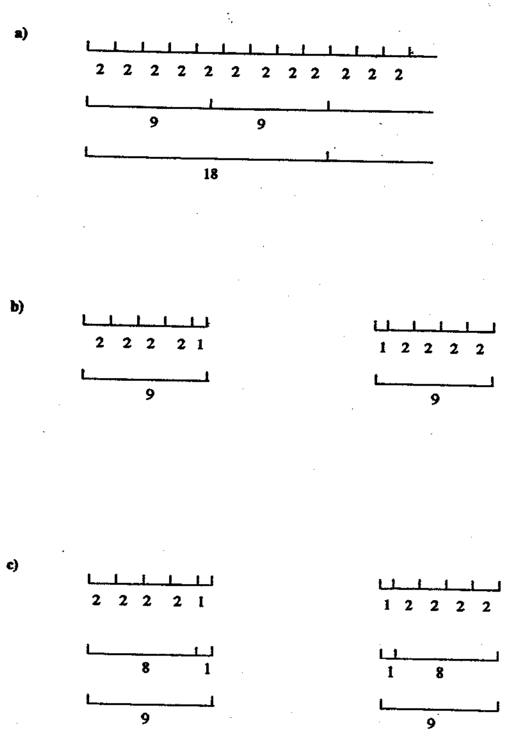
Example 9. Introduction Theme: mod 2 vs. mod 3



Example 10. Exposition Theme i: groups of 3



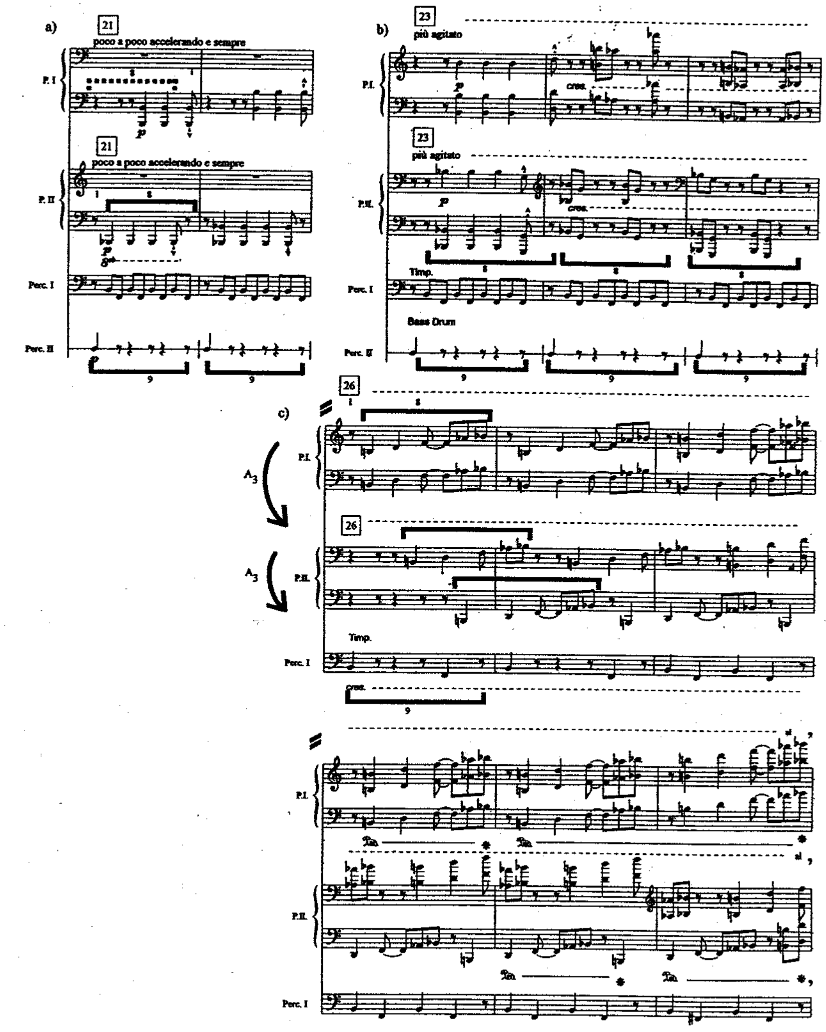
Example 11. Theme 1: mod 2 vs. mod 9



Example 12, the transition to the first theme, shows the interactions of "8" and "9" created by the articulation of mod 2 within the confines of mod 9. In Example 12a, the second piano's modH 1+8\9 is combined with its retrograde 8+1\9 (implied in piano I. Example 12c shows this modH 8+1\9 explicitly in m. 28 timpani). Example 12b shows mod 8 (pianos) becoming independent of mod 9 (bass drum), and conflicting with it. Example 12c displays 1+2+2+2+2\1+8\9 being shifted successively by A_3, and since the 8 consists of units of 2, a conflict between moduli 2 and 3 is thus articulated. This conflict of 2 and 3 also appears in the pitch domain: the intervals between the pitches of the bracketed motive in the pianos form the seg <3,3,3,2> (measuring in semitones).

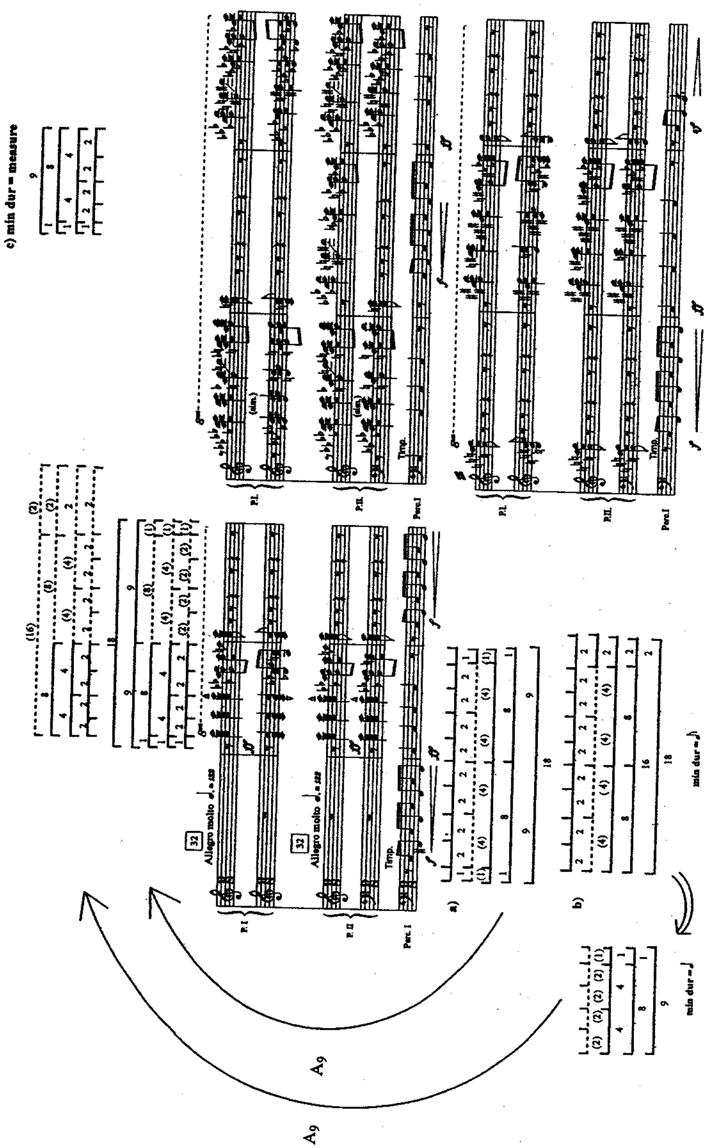
As shown in Example 13, the first theme displays new uses of 8 and 9 on several levels. The notation below the staff refers to the timpani, that above the staff to the pianos. Only the first two measures of each part are diagramed

Example 12. Transition to Theme 1: "8 and 9"



since the pattern repeats throughout the section. First (Example 13a), the timpani articulates modH 1+8+8+1\$9^2$\18, shifted by 9 min durs to the pianos so that 1+8 in the pianos occurs together with 8+1 in the timpani, and vice versa.[20] Second (Example 13b), the timpani can be viewed as modH 16+2\18. If the quarter note is

Example 13. Exposition Theme 1a: modH 1+2+2+2+2\1+4+4\1+8\9 or 2+2+2+2+1\4+4+1\8+1\9 on 3 levels (eighth note, quarter note, measure)

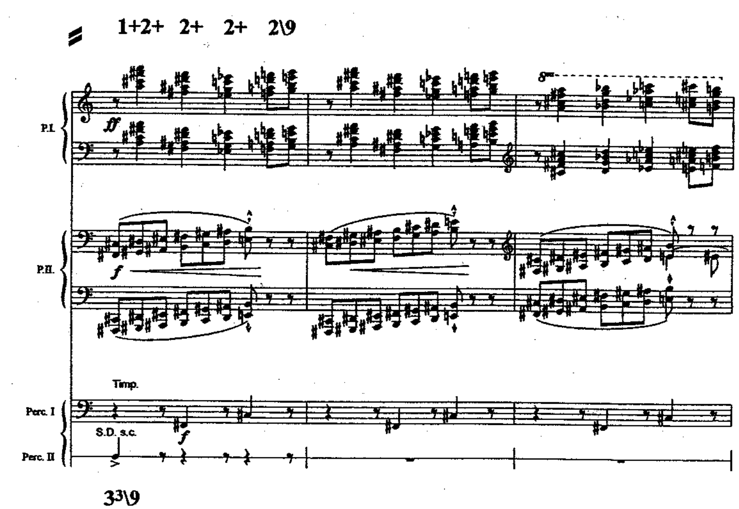


taken as the min dur (as shown on the left side of Example 13b), this modH translates into 8+1\9. Third (Example 13c), the structure of the entire section, taking the measure as the min dur, gives modH 1+2+2+2+2\1+8\9, if the initial bar is considered an upbeat to the entrance of the pianos. Thus the modH 1+8\9 or 8+1\9 plays a central role in the passage on three levels: that of the eighth note, the quarter note, and the measure.[21]

3.Modular progression: mod 2 to mod 3
3.1 Theme 1

As shown in Example 13a, the first theme begins with a clear articulation of mod 2. Over the course of the movement, the theme gradually moves to the articulation of mod 3, as shown in Examples 14–17. Example 14 shows that later in the exposition, first-theme material is set against a clear mod 3 in the timpani. Upon its return in the recapitulation (Example 15), condensed first-theme material articulates mod 3 as well as implying mod 3 by its A_3 relations with the following imitative voice. As shown in Example 16, the first theme's transformation against theme 3 in the

Example 14. Exposition Theme 1A: 1+2+2+2+2\9 set against 3^3\9



Example 15. Recapitulation Theme 1: modH $3^{3}\backslash 9$

Example 16. Recapitulation Theme 3: Return of Theme 1 modH $3^{6}\backslash 6^{3}\backslash 18$

Example 17. Coda: Final statement of Theme 1
mod 2

Example 18. Exposition Theme 2, modH 2+2+2+3\9, "cadential" $3^3\backslash 9$

Example 19. Recapitulation Theme 2, section 1

recapitulation is even more startling: here its note values clearly articulate mod 3.[22] Thus the first theme, over the course of the movement, progresses from clear articulation of mod 2 to that of mod 3.

The conclusion of the movement, however, casts this first-theme "resolution to mod 3" into doubt. As shown in Example 17, the movement closes with a final statement of first-theme material which restates its mod 2 implications, and calls the putative first-theme "resolution to mod 3" into question.

3.2 Theme 2

The second theme likewise shows a progression from mod 2 to mod 3, but in a more local way. As shown in Example 18, the theme's predominant division of 9 is 2+2+2+3\9; thus the unit of 2 moves to 3 at the end of each measure. Furthermore, the entire thematic statement concludes with the modular hierarchy $3^3\backslash 9$; thus the predominating mod 2 changes to mod 3 at the "cadence" of the section.

In the recapitulation, the mod-hierarchic structure of the second theme (min dur = eighth) relates to its mod-hierarchic structure (min dur = measure). The theme appears in four sections (mm. 292–300, 301–308, 309–16, 317–25), entering on pitch-classes A, F♯, C, and E♭ in turn.[23] Example 19 shows the first of these sections, and the modular hierarchies (min dur = eighth) which characterize the principal thematic material in the section. The characteristic modH for the section is noted at the beginning of the section (2+2+2+3\4+2+3\9); exceptions are labeled above the appropriate measures.[24]

Example 20 summarizes the modular hierarchies which characterize each of the four sections. The middle column shows the modular hierarchies (in terms of eighth notes); the right column displays the modular hierarchies (in terms of the measure). As the middle column shows, the thematic material of sections 1 and 4 uses multiple eighth-note modular hierarchies, while that of sections 2 and 3 uses only one eighth-note modular hierarchy. The same pairing of sections is maintained in the right column. Sections 2 and 3 articulate measure modH $2^4\backslash 4^2\backslash 8$. (The *dux* of the canon articulates this structure; it is shifted by a measure in the *comes* of the canon.) Sections 1 and 4 express measure mod 9. The subdivisions of this mod 9 on the measure level, namely 2+2+2+3 and 4+2+3, reflect the predominant subdivisions on the eighth-note level.

Example 20. Modular hierarchies in the primary thematic material of Recapitulation Theme 2

Section	min dur = eighth note	min dur = measure
1	2+2+2+3\4+2+3\9; 2+3+2+2\9; 2+2+3+2\9; 3\9	2+2+2+3\4+2+3\4+5\9
2	2+2+2+3\4+2+3\9	$2^4\backslash 4^2\backslash 8$
3	2+2+2+3\4+2+3\9	$2^4\backslash 4^2\backslash 8$
4	2+2+3+2\4+3+2\9; 2+2+2+3\4+2+3\9	2+2+2+3\4+2+3\4+5\9

The previous musical example (Example 19) provides an illustration. In piano II (the thematic voice of the section), 9 measures are subdivided into 4+5 measures by the rest and by registral change in the thematic voice, and into 4+2+3 measures by attacks of the triangle. Thus the section articulates 4+2+3 at the level of both the measure and the eighth note.

We shall now consider the correlation between formal structure and predominant modulus.

4. Form

The overall form of the movement was described earlier. The movement's smaller

sections often express either quaternary structure (four parts) or tripartite structure of the form AAB.

4.1 Quaternary structure

Quaternary structure is associated with sections where mod 2 dominates. The first theme in the exposition (Example 13), for example, clearly articulates mod 2, and displays quaternary form.[25] That is, as shown in Example 13c, the first section of the first theme (mm.32–40) consists of 9 measures, which comprise an introductory measure and four following groups of 2 measures each: 1+2+2+2+2\9.

The first theme's transformed appearance in section B of the development likewise takes quaternary form. As shown in Example 21, the section is based on three basic mode-segs X, Y, and Z. The section divides into two subsections (Example 21a, 21b) (mm.217–224, 225–232), with the percussion dropping out in the second subsection. Both subsections display quaternary structure. That is, the first subsection (Example 21a) articulates the seg <XX,YY,XX,YY> and thus modH $2^4\backslash 4^2\backslash 8$ (min dur = measure):

piano I / xylophone: X Y X Y
piano II / timpani: X Y X Y.

The second subsection (Example 21b) likewise expresses measure modH $2^4\backslash 4^2\backslash 8$ through the seg <XX,XX,YY,ZZ1>:

piano I: XX Y Z
piano II: XX Y Z1,

although this time the symmetry of two- and four-measure groups is disrupted by the combination of Z and Z1 into one measure.

The rearticulation of mod 2 in the first-theme material at the end of the movement also displays quaternary form. As shown in Example 22, the coda subdivides loosely into four sections, labeled AABA'.

4.2 Tripartite structure

On the other hand, sections dominated by mod 3 display tripartite form. For example, the A section of the development, shown in Example 23, expresses an aab tripartite form (mm. 195–202, 203–207, 208–216). (Here theme i forms an ostinato which clearly articulates mod 3.)

The first theme in the recapitulation (Example 24) provides another example of tripartite form. Recall that in the exposition the first theme expresses mod 2 and quaternary structure. In the recapitulation, as demonstrated earlier, the theme primarily articulates mod 3. This articulation of mod 3 is accompanied by a change from quaternary structure to tripartite structure. The example shows that the first-theme section in the recapitulation subdivides into three subsections (uppercase

Example 21. Development B: quaternary structure, based on segs X, Y, Z

mode-segs $\underline{X}$ = <0,1,3,5,8,0>
$\underline{Y}$ = <0,1,3,6,8,0>
$\underline{Z}$ = <0,1,3,5,7,0>

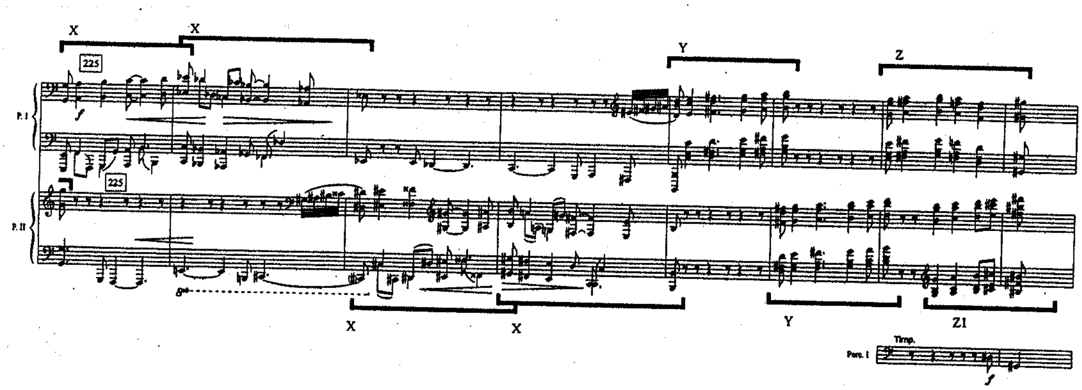
a) SUBSECTION 1

X X Y Y X X Y Y

modH $2^4\backslash 4^2\backslash 8$ (min dur = measure)

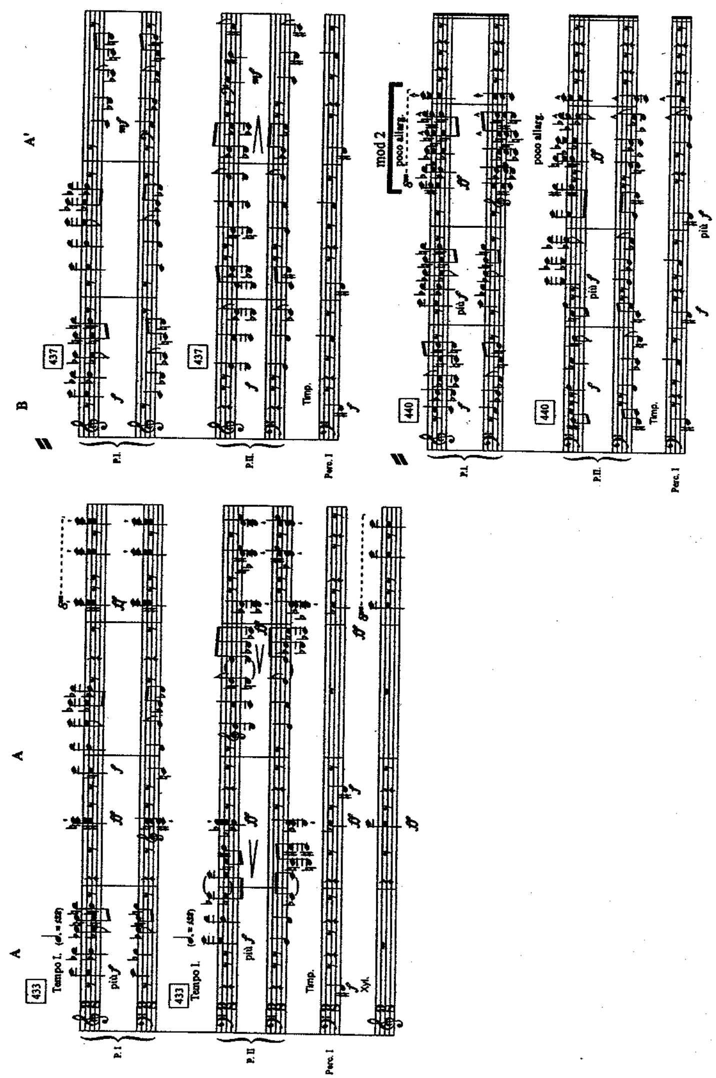
Example 21. (continued)

b) SUBSECTION 2



X X X X Y Y Z Z1

modH $2^4\backslash 4^2\backslash 8$ (min dur = measure) (transformed)

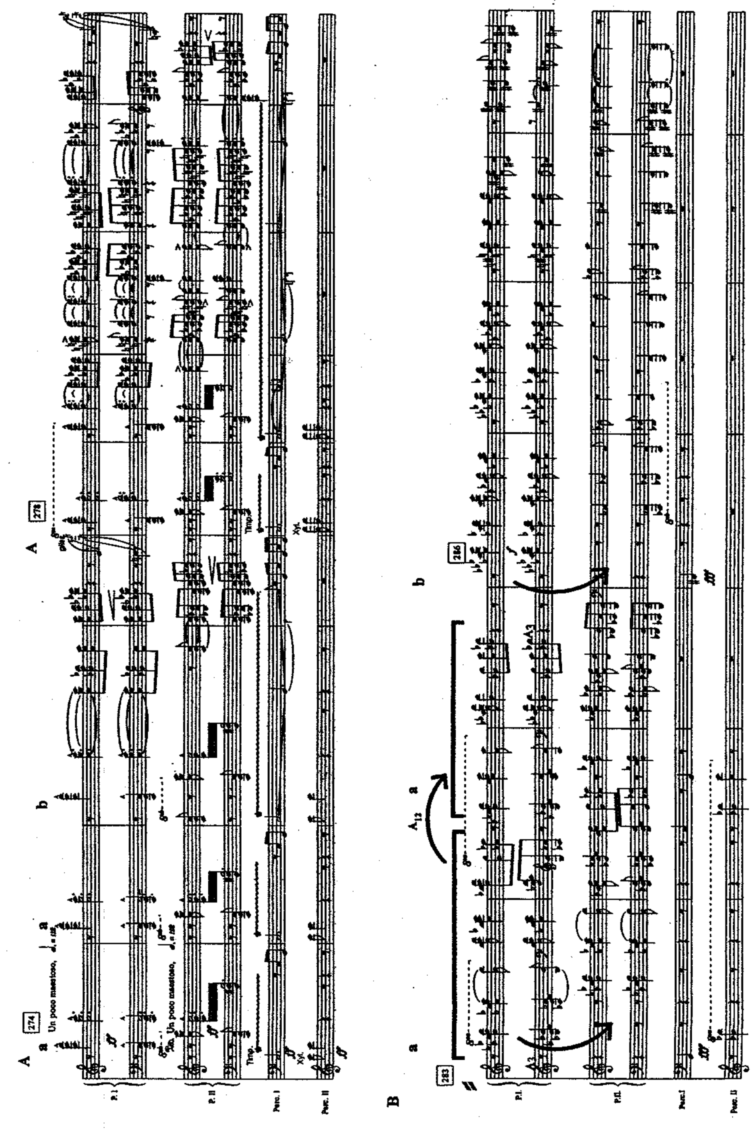


xample 22. Coda: quaternary structure.

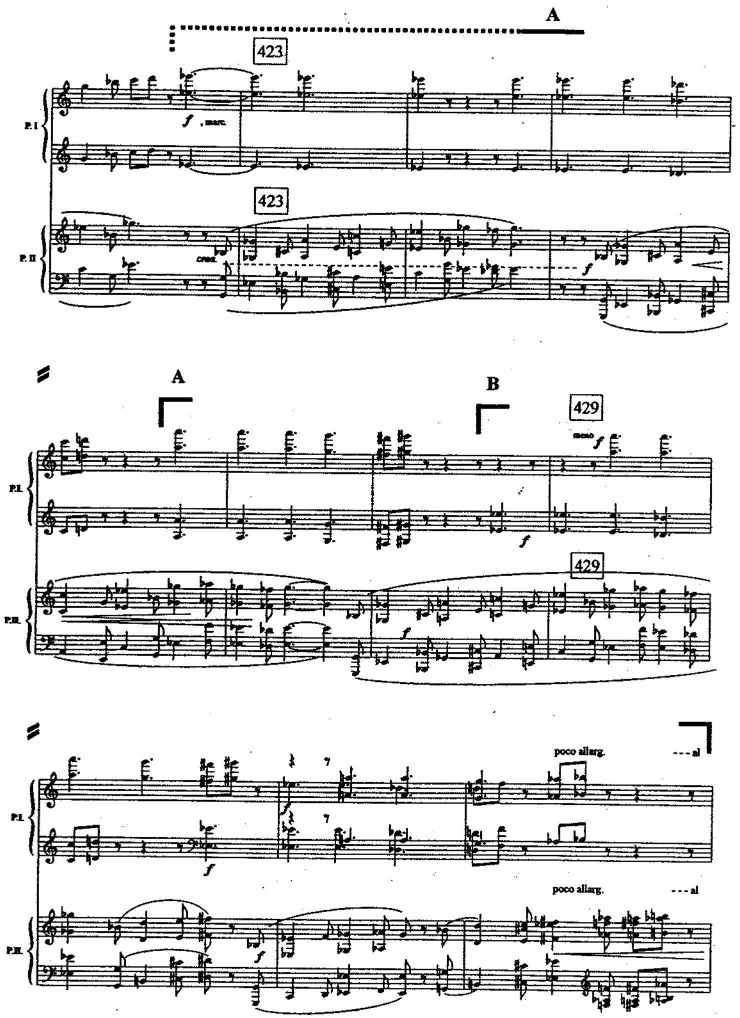
Example 23. Development A: aab form

Example 23 (continued)

ample 24. Recapitulation Theme 1: A A B form
aab aab



Example 25.



AAB) (mm. 274–277, 278–282, 283–291), on the T_5-related pitch levels C, F, and B♭. Furthermore, the first and third of these subsections themselves form smaller aab structures, converting the quaternary structure of the corresponding first and third sections of the theme in the exposition to tripartite form in the recapitulation.

In addition, as stated earlier, the first theme returns later in the recapitulation, over third-theme material (Example 25). Here too it clearly expresses mod 3, and an AAB structure (mm.422–426, 426–428, 428–432).[26]

Thus, since the mod 2 version of the first theme displays quaternary structure, and the mod 3 version tripartite structure, the first theme provides a particularly striking illustration of the association between modulus and small-scale structure.

5. Symmetry and asymmetry

Clearly, symmetry, whether in pitch or time, plays an important role in Bartók's music.[27] Interplay between symmetry and asymmetry forms an integral part of the temporal structure and processes of this movement.

The form of the movement displays this interaction of symmetry and asymmetry in various ways. Smaller-scale sections frequently display symmetry. For example, as shown in the earlier Example 5, ABA' form is articulated by the exposition first-theme area (theme 1—theme i—theme 1), the exposition second-theme area (theme 2—theme 3—theme 2), and the development. The large-scale form—exposition-development-recapitulation—is generally symmetric in nature, although the exposition and recapitulation (unlike that of the first movement of Bartók's Fifth String Quartet, for example) do not present symmetrical structures.[28] The presence of the introduction and closing fugato and coda, very different in nature from one another, also contributes to the sense of overall asymmetry.

The overall motion from mod 2 to mod 3 appears at first to express a directional and asymmetric process. However, this motion is offset by the reappearance of mod 2 at the end of the movement. Because of its placement at the movement's close, and its marking of *poco allargando*, this final mod 2 receives a weight disproportionate to its brevity. This reappearance of mod 2, then, introduces a hint of overall symmetry: mod 2—mod 3—(mod 2).

Mod 2 is generally set in an asymmetrical context: within 1+2+2+2+2\9 or 2+2+2+2+1\9 (or associated levels 2+2+2+3 or 4+2+3). Mod 3, on the other hand, generally occurs in a symmetrical context as an even subdivision of modH $3^3\backslash 9$. Mod 2 does represent symmetry, however, in two ways: (1) it often appears within a symmetrical structure $2^4\backslash 4^2\backslash 8$, and (2) the mod-hierarchic structure 1+2+2+2+2\1+8\9 frequently occurs concurrent with its retrograde 2+2+2+2+1\8+1\9, thus forming a symmetric structure via SUPerimpose.

Interestingly, the "asymmetric" mod 2 and "symmetric" mod 3 associate with "symmetric" quaternary structure and "asymmetric" AAB tripartite structure respectively. This association of "asymmetric" modulus with "symmetric" formal structure, and "symmetric" modulus with "asymmetric" formal structure itself produces a kind of symmetry.

CONCLUSION

The foregoing analysis has demonstrated that certain segs dominate the movement. In particular, mode-seg P underlies all of the main themes of the movement (themes i, 1, 2, and 3).

Furthermore, we have observed that interaction between duple and triple pervades the movement on various levels (eighth-note, dotted-quarter-note, and measure). Frequently this interaction takes the shape of modH $2^4\backslash 4^2\backslash 8$ versus 9. In addition, mod-hierarchical structures such as $1+8\backslash 9$ or $4+2+3\backslash 9$ often occur on several levels at once.

We have also shown that mod 2 and mod 3 associate with duple and triple formal structures respectively. That is, thematic material dominated by mod 2 displays quaternary form; that characterized by mod 3, tripartite AAB form. Theme 1 illustrates this association particularly well, displaying quaternary structure when in its mod 2 form (exposition, development), tripartite AAB form upon its conversion to mod 3 (recapitulation), and quaternary structure supporting the suggestion of mod 2 at the conclusion of the movement.

In one possible reading, "dupleness" represents ambiguity and asymmetry, and resolves eventually to "tripleness," associated with stability and symmetry. According to this reading, "dupleness" opens phrases, sections, the movement, while "tripleness" concludes them. This interpretation is supported by the reappearance of the introduction theme in mod 3 in the development, by the cadencing of the second theme's modH $2+2+2+3\backslash 9$ with modH $3^3\backslash 9$, and, most conclusively, by the gradual "conversion" of theme 1 from mod 2 to mod 3.

The reappearance of "dupleness" at the conclusion of the movement, however, suggests an alternate reading. In this alternate explanation, the return of "dupleness," despite its brevity, suggests a quasi-symmetrical structure: "dupleness"—"tripleness"—("dupleness"). (It also foreshadows the ending of the entire Sonata, which is clearly "duple.") Thus a covert symmetry pervades the movement, undermining apparent asymmetry in formal structures, modular structures and processes, and the interaction of the two.

NOTES

I would like to thank Robert Morris for reading an earlier version of this article, and for subsequent invaluable comments and suggestions, as well as Taylor Greer for his suggestions.

1. Richard Cohn, "Bartók's Octatonic Strategies: A Motivic Approach," *Journal of the American Musicological Society* 44/2 (1991): 296–297.

2. Robert Morris, *Composition with Pitch-Classes: A Theory of Compositional Design* (New Haven: Yale University Press, 1987).

3. This alters Morris's definition of "m-time" (Ibid., 305, 299) to include pulses separated by unequal durations.

4. This is Morris's definition of "m-time" (Ibid., 299).

5. For example, in a composition containing sixteenth notes and triplet eighth notes, 1/12 of a quarter note might be chosen as the minimal duration. A sixteenth note (regardless of tempo and thus regardless of actual length in seconds) would then equal 3 min durs, and a triplet eighth note 4 min durs. (This definition of the minimal duration in relation to the musical beat at a given tempo allows time-point patterns to be compared at different tempi. It also allows us to consider time-point patterns performed with deviations such as rubato, accelerando, or ritardando as equivalent. In such cases, within the given tempo, the minimal duration represents an equivalence class of durations defined by the musical pulse. In our m-time, this notion of durational equivalence is generalized to notated inequalities.)

6. This is an adaptation of Morris's definition of "mod-time," and his concepts of "u-time" and modular "u-time" (Ibid., 301, 24, 305).

7. This modeling of the passage as a non-isochronous triple meter faithfully represents Bartók's notated meter signature (4+2+3)/8.

8. Modular e-time (mode-time), derived from e-time, is Morris's "mod-time," derived from Morris's "m-time" (Ibid., 301).

9. David Lewin, *Generalized Musical Intervals and Transformations* (New Haven: Yale University Press, 1987), 23.

10. These multiple levels include, for example, the "hypermeter" of tonal metric theory.

11. This definition is indebted to the definition of meter in Maury Yeston, *The Stratification of Musical Rhythm* (New Haven: Yale University Press, 1976), 66.

12. This definition of well-formedness was suggested to me by Robert Morris in a conversation (June 1997), and relates to Yeston's, Krebs's, and Cohn's notions of metric

consonance (Yeston, *Stratification*, 78; Harald Krebs, "Some Extensions of the Concepts of Metrical Consonance and Dissonance," *Journal of Music Theory* 31 (1987): 99–120; Cohn, "Metric and Hypermetric Dissonance in the Menuetto of Mozart's Symphony in G minor, K.550," *Intégral* 6 [1992]:7–9). See also Metrical Well-Formedness Rule 2 in Fred Lerdahl and Ray Jackendoff, *A Generative Theory of Tonal Music* (Cambridge, Mass.: MIT Press, 1983), 69.

13. Lerdahl and Jackendoff, *Generative Theory*, 19.

14. This labeling system works for periodic modu-hierarchies, but becomes cumbersome for non-periodic ones.

15. Each of these levels is articulated by some aspect of the musical surface. The two-measure level, for example, is expressed by the two-measure cello introduction, followed by statement-answer pairs in violin and viola.

For factors contributing to the determination of a modular hierarchy from a musical surface, see Lerdahl and Jackendoff, 73–85; Lewin, "Some Investigations into Foreground Rhythmic and Metric Patterning," in *Music Theory: Special Topics*, ed. Richmond Browne (New York: Academic Press, 1981), 101–137; H. C. Longuet-Higgins and Christopher Lee, "The Rhythmic Interpretation of Monophonic Music," *Music Perception* 1/4 (1984), 424–41; Christopher Lee, "The Perception of Metrical Structure," in *Representing Musical Structure*, ed. Peter Howell, Robert West, and Ian Cross (New York: Academic Press, 1991), 59–128; Richard Parncutt, "A Perceptual Model of Pulse Salience and Metrical Accent in Musical Rhythms," *Music Perception* 11/4 (1994), 409–64.

16. Béla Bartók, "About the Sonata for Two Pianos and Percussion," in *Béla Bartók Essays*, ed. Benjamin Suchoff (Lincoln: University of Nebraska Press, 1992), 417.

17. Ernö Lendvai, "Makrokosmos, Sonata for Two Pianos and Percussion," chapter in *The Workshop of Bartók and Kodály* (Budapest: Editio Musica Budapest, 1983); János Kárpáti, "Sonata for Two Pianos and Percussion," chapter in *Bartók's Chamber Music*, tr. Fred Macnicol and Maria Steiner (Stuyvesant, New York: Pendragon, 1994; orig. Hungarian edn. 1976); Roy Howat, "Sonata for Two Pianos and Percussion," in *The Bartók Companion*, ed. Malcolm Gillies (London: Faber and Faber, 1994), 315–30; Errol Haun, "Modal and Symmetrical Pitch Constructions in Béla Bartók's 'Sonata for Two Pianos and Percussion'" (D.M.A. diss., University of Texas at Austin, 1982); Elliott Antokoletz, "Organic Expansion and Classical Structure in Bartók's Sonata for Two Pianos and Percussion," in *Bartók Perspectives*, ed. Antokoletz, Victoria Fischer, Benjamin Suchoff (Oxford: Oxford University Press, 2000), 77–94; Richard Cohn, "Transpositional Combination in Twentieth-Century Music" (Ph.D. dissertation, University of Rochester, 1987); Cohn, "Bartók's Octatonic Strategies,"(cited in note 1); Paul Wilson, *The Music of Béla Bartók* (New Haven: Yale University Press, 1992); John Downey, *La musique populaire dans l'oeuvre de Béla Bartók* (Paris: Université de Paris, 1964); Stephen Walsh, *Bartók Chamber Music* (London: BBC, 1982); Karlheinz Stockhausen, "Bartók's Sonata for Two Pianos and Percussion," *New Hungarian Quarterly* 11/40 (1970): 49–53.

18. As Norman Carey pointed out to me (2 April 1999), the two "exceptional" measures (mm. 85, 90) require greater concentration on the part of the performer since they lie outside the predominating "system."

19. The <2,2,2,2,1> or <2,2,2,3> division of a mod 9 universe provides an example of the class of rhythmic patterns discussed by Jeff Pressing in "Cognitive Isomorphisms in Pitch and Rhythm in World Musics: West Africa, the Balkans and Western Tonality," *Studies in Music* (University of Western Australia) 17 (1983): 38–61. Generated by 2, the smallest integer relatively prime to the size of the universe, the patterns contain 5 and 4 elements, respectively, representing the closest integers to half the size of the universe. (Pressing discusses universes of size 7, 8, 12, 16, but not 9.)

20. This phenomenon has been described as shifted 4/4 meters. See, for example, Kárpáti, "Sonata for Two Pianos and Percussion," 411.

21. In all three cases, the 1+8\9 modH can be further broken down into 1+4+4\1+8\9. In the first case (min dur = eighth), the piano entrance at m. 33 features an accent marking which divides 8 into 4+4. In the second (min dur = quarter), the timpani change from eighth notes to quarter notes divides 8 into 4+4. In the third case (min dur = measure), the pitch structure of the thematic material divides 8 into 4+4. That is, the first two piano statements state the interval 3 above and below the central pitch C (which, incidentally, reflects the interval 3 spanned above and below pitch F♯ in the introduction theme), while the melodic lines of the third and fourth statements provide complete pentatonic sets.

22. Note, however, that the articulation of mod 3 is accompanied by mod 6 (rather than mod 9); this is typical of the movement.

23. These pitch-classes express what Ernö Lendvai calls the "tonic axis" (*Workshop of Bartók and Kodály*, 330).

24. These mod-hierarchies address the thematic voice (piano II) only; the accompanying figuration in piano I presents a very different structure.

25. Many authors have remarked upon the "quaternary" structure of this exposition of theme 1, and its relation to folk melodies. See, for example, Downey, *La musique populaire*, 359.

26. The form here could also be interpreted as AABB (mm. 422–426, 426–428, mm. 428–430, mm. 430–432), although the imitative texture and pitch-class content of the two B sections links them together.

27. For discussions of pitch or pitch-class symmetry in Bartók, see, for example, Elliott Antokoletz, *The Music of Béla Bartók* (Berkeley: University of California Press, 1984);

Antokoletz, "The Music of Bartók: Some Theoretical Approaches in the USA," *Studia Musicologica* 24/supplement (1982): 67–74; Jonathan Bernard, "Space and Symmetry in Bartók," *Journal of Music Theory* 30/2 (1986): 185–201; Wallace Berry, "Symmetrical Interval Sets and Derivative Pitch Materials in Bartók's String Quartet No. 3," *Perspectives of New Music* 18 (1979–80): 287–379; Cohn, "Inversional Symmetry and Transpositional Combination in Bartók," *Music Theory Spectrum* 10 (1988): 19–42; and Perle, "Symmetrical Formations in the String Quartets of Béla Bartók," *Music Review* 16 (1955): 301–12. Haun ("Modal and Symmetrical Pitch Constructions," see note 17) examines symmetrical pitch structures in the Sonata for Two Pianos and Percussion.

Bartók's use of symmetrical forms such as arch form is also well documented by Bartók himself in *Béla Bartók Essays*, ed. Benjamin Suchoff (Lincoln: University of Nebraska Press 1992), 414–15, as well as by many others.

28. In the first movement of Bartók's Fifth String Quartet, the material of the exposition appears in reverse order and loosely inverted in the recapitulation.

Heinrich Schenker, Modernist: Detail, Difference, and Analysis

Nicholas Cook

Schenker the modernist? In all sorts of ways it is an absurd proposition: think of his views on Stravinsky, on mass culture, on America, or his dismissive claim that "those who have been . . . left behind by art call themselves modern!"[1] And yet the weapons with which Schenker fought not only modernism as such but also many other manifestations of the modern world might be seen as precisely those of a modernist. For instance, his identification of issues of art and ethics, his ability to be talking about the usage of slurs at one moment and the loss of spiritual direction in the modern world at the next, was not just a Viennese trait (as above all embodied in the writings of Karl Kraus) but a central feature of European modernism as represented by, say, Gropius or Le Corbusier. Then again, there is his formalism, his insistence that artistic value is grounded in precise and demonstrable relationships between the constituents of the artwork: in this sense Schenker's *Urlinie*, and hence Schenker's Haydn, Mozart, and Beethoven, are as much modernist constructions as Schoenberg's serialism or Le Corbusier's *Modulor*. Paradoxically, it is because he saw their works as epitomizing what we might see as modernist values that Schenker advocated a return to the masters. Through his method, he reinvented classical music under the sign of modernism.

In this paper, however, I want to go beyond this by suggesting that there is something characteristically Viennese about Schenker's ambivalent modernism, and I do this by setting it against its contemporary context. At first sight, the attempt to read Schenker's work in light of the cultural melting pot that was *fin-de-siècle* Vienna might seem to be frustrated by his relative lack of documented engagement with other contemporary arts. But, as a resident of Vienna, Schenker literally lived in the middle of artistic controversy, to the extent that it revolved round material culture and the built environment. And what he must have seen in the streets and shops of the city is an astonishing variety of buildings and artefacts ranging from the sinuous arabesques of the *art nouveau*, today a symbol of the *fin de siècle*, to stripped-down, modernist designs some of which still retain a contem-