Studying Perle's Motivic Processes through Contour Transformation

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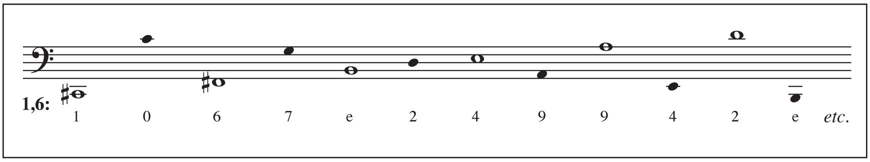
Teachers of 20th century analytical techniques often bypass George Perle's music in their curricula, since the majority of Perle's compositions emanate from his theory of "twelve-tone tonality." Few college theory teachers are sufficiently conversant with Perle's twelve-tone tonality to lead students in analyses of this body of music. Perle's theory is a compositional method based on the intersection of interval cycles and symmetrical pitch class collections. Yet his method is analogous to tonal theory in its utilization of scales, chords, and hierarchical relationships. Moreover, in most of his compositions Perle reveals a penchant for traditional forms and developmental techniques. This article contends that Perle's predilection offers the college teacher an ideal means of access into this music. Nowhere is this more evident than in his *Woodwind Quintet No. 4*, which captured the Pulitzer Prize for Music in 1986. Perle's *Quintet* contains four movements: Invention, Scherzo, Pastorale, and Finale. Each of these movements adheres to a traditional formal design: the Invention is based on the Baroque contrapuntal model, the Scherzo comprises alternating scherzo and trio sections, the Pastorale follows a ternary form, and the Finale reprises the main motives of the preceding movements, but in new contexts.

This article aims to demonstrate how a college theory teacher may present Perle's music from a perspective that integrates aspects of his innovative compositional method with familiar formal structures and developmental processes. We will begin by introducing the essential components of twelve-tone tonality and observing how these components comprise the fundamental pitch material in the first movement of the *Quintet*, the Invention. We then will reveal how Perle's invention conforms to the traditional procedures of the Baroque model, focusing specifically on the processes Perle employs for motivic development.

Introduction to Twelve-Tone Tonality

The interval cycle provides the foundation for the system of twelve-tone tonality. Perle uses two inversionally related interval cycles in alternation to form a "cyclic set," as seen in the ascending and descending interval 5 (perfect 4th) cycles in Example 1.[1] The ascending cycle is shown in whole notes; the descending cycle is shown in stemless black noteheads. Integers 0 to 11 represent the 12 pitch classes, with C = 0, C♯ /D♭ = 1, D = 2, and so on. B♭ and B are represented by integers 10 and 11, replaced by the single-digit entities 't' and 'e' respectively.[2] In this formation any given pitch class forms a pair of sums with its neighbor notes. These sums repeat throughout the cyclic set and are called "tonic sums." The tonic sums provide the cyclic set with its name; the cyclic set in Example 1 is 1,6.[3]



Example 1: Inversionally related P4 cycles combine to form cyclic set 1,6

Any two vertically aligned cyclic sets form an "array," and give the array its name. In Example 2a, two cyclic sets built from interval 5 cycles combine to form the array 4,9/1,6. Cyclic sets of different intervals may also combine to form arrays, as shown in Example 2b, in which the array 9,e/1,6 comprises cyclic sets built with interval 2 and interval 5 cycles. To create melodic and harmonic

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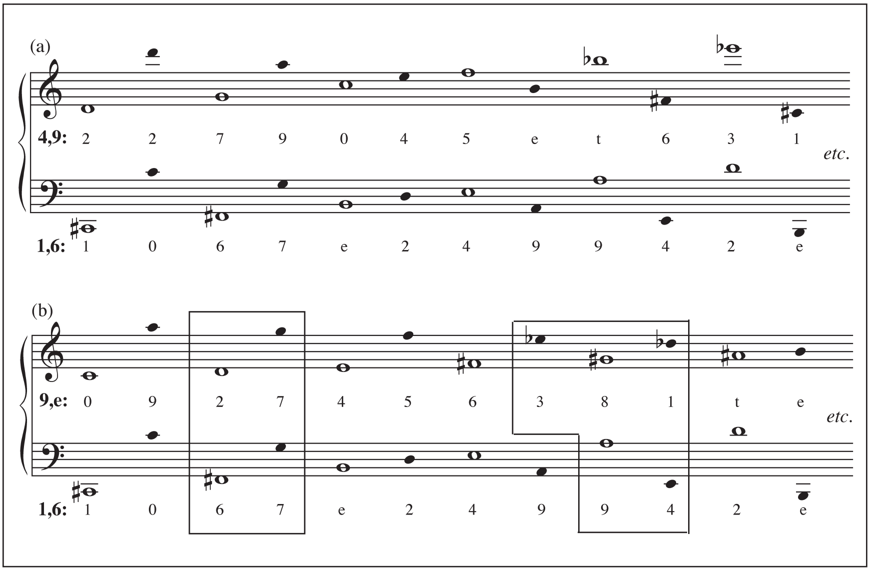
[1] Readers seeking further information on Perle's theory of twelve-tone tonality may consult any of the following sources: Thomas Patrick Carrabré, "Twelve-Tone Tonality and the Music of George Perle" (Ph.D. diss., City University of New York, 1993); Gretchen C. Foley, "Pitch and Interval Structures in George Perle's Theory of Twelve-Tone Tonality" (Ph.D., University of Western Ontario, 1999); Gretchen C. Foley, "Arrays and K-Nets: Transformational Relationships within Perle's Twelve-Tone Tonality" (*Indiana Theory Review* 23, 2002: 69-97); Dave Headlam, "Tonality and Twelve-Tone Tonality: The Recent Music of George Perle" (*International Journal of Musicology* 4, 1995 : 301-33); *George Perle, Twelve-Tone Tonality* (Berkeley, CA: University of California Press, 1977, 1996); *George Perle, The Listening Composer* (Berkeley, CA: University of California Press, 1990), and Stephen L. Rosenhaus, "Harmonic Motion in George Perle's 'Wind Quintet No. 4'" (Ph.D. diss., New York University, 1995).

[2] The pitch classes are shown here as specific pitches for purposes of illustration. In practice they may be notated in any register.

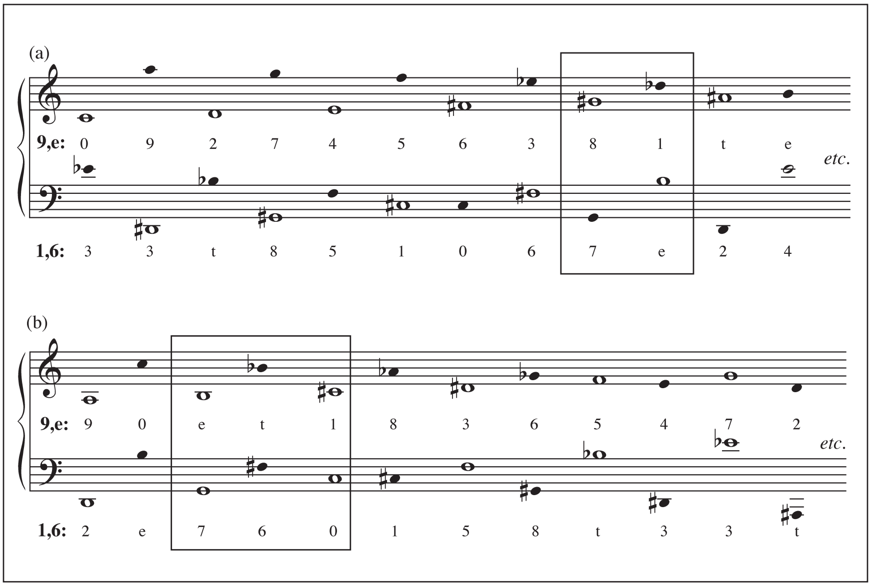
[3] The cyclic set 1,6 may begin with any pitch class, as may any other cyclic set. Moreover, all cyclic sets eventually wrap around to their beginning pitch classes.

material Perle takes segments from the cyclic sets of arrays and combines them into units of varying size. Example 2b illustrates two possible segmentations in array 9,e/1,6: a tetrachord {2, 7, 6, 7} and a pentachord {3, 8, 1, 9, 4}.



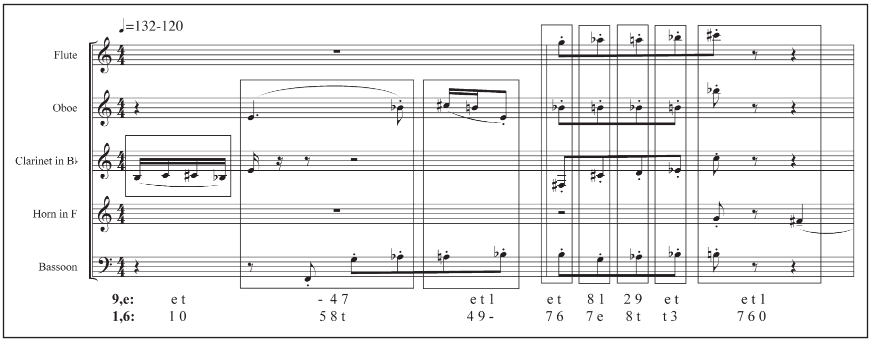
Example 2: (a) Array 4,9/1,6 constructed from two cyclic sets of the same interval (P4), and (b) Cyclic sets of different intervals (M2 and P4) combine to form array 9,e/1,6, with tetrachordal and pentachordal segmentations

The position of the cyclic sets is not fixed within an array. Rather, the cyclic sets may shift horizontally in relation to one another in the manner of a slide rule, thereby creating different vertical alignments between the cyclic sets. This flexibility allows the array to function as a rich resource for generating compositional material. For instance, the lower cyclic set 1,6 shifts in Example 3a, creating new possibilities for segmentation, such as the tetrachord {8, 1, 7, e}. Furthermore, either the same or different partitions of an interval cycle may be used within the context of the same cyclic set. In Examples 2b, 3a, and 3b the cyclic set 9,e utilizes both cycles [0-2-4-6-8-t] and [1-3-5-7-9-e] in inversional relationships, rather than just one cycle or the other.



Example 3: Segments of cyclic sets, in two different alignments, of array 9,e/1,6. (a) Tetrachord [8-1-7-e] created from two dyadic segments, and (b) Hexachord [e-t-1-7-6-0] from two trichordal segments of cyclic sets

The segments from the array typically appear at the musical surface as unordered collections of pitches. We can observe Perle's compositional disposition of array segments in the first two measures of the Invention. Example 4 shows tetrachordal, pentachordal, and hexachordal units extracted from the array 9,e/1,6. The careful reader will note that these segments do not occupy adjacent positions in the array itself. In fact, the units segmented in Example 3a and b appear as the second and fifth segments in m.2 of the Invention. Thus, the composer may move freely within and among the cyclic sets in the array. In addition, there is no obligation to use the entire array, and the music may modulate to any other array at any time. Hence, the array serves as a pre-compositional resource; the analyst may discover segments of the array in individual melodic lines, interweaving among different lines, and as vertical sonorities such as chords. That is, the two-voice texture suggested by an array may be realized in an infinite number of surface musical settings, as determined by the composer.



Example 4: Segmentation of mm.1-2 (Perle's "Invention" from *Wind Quintet No. 4*)

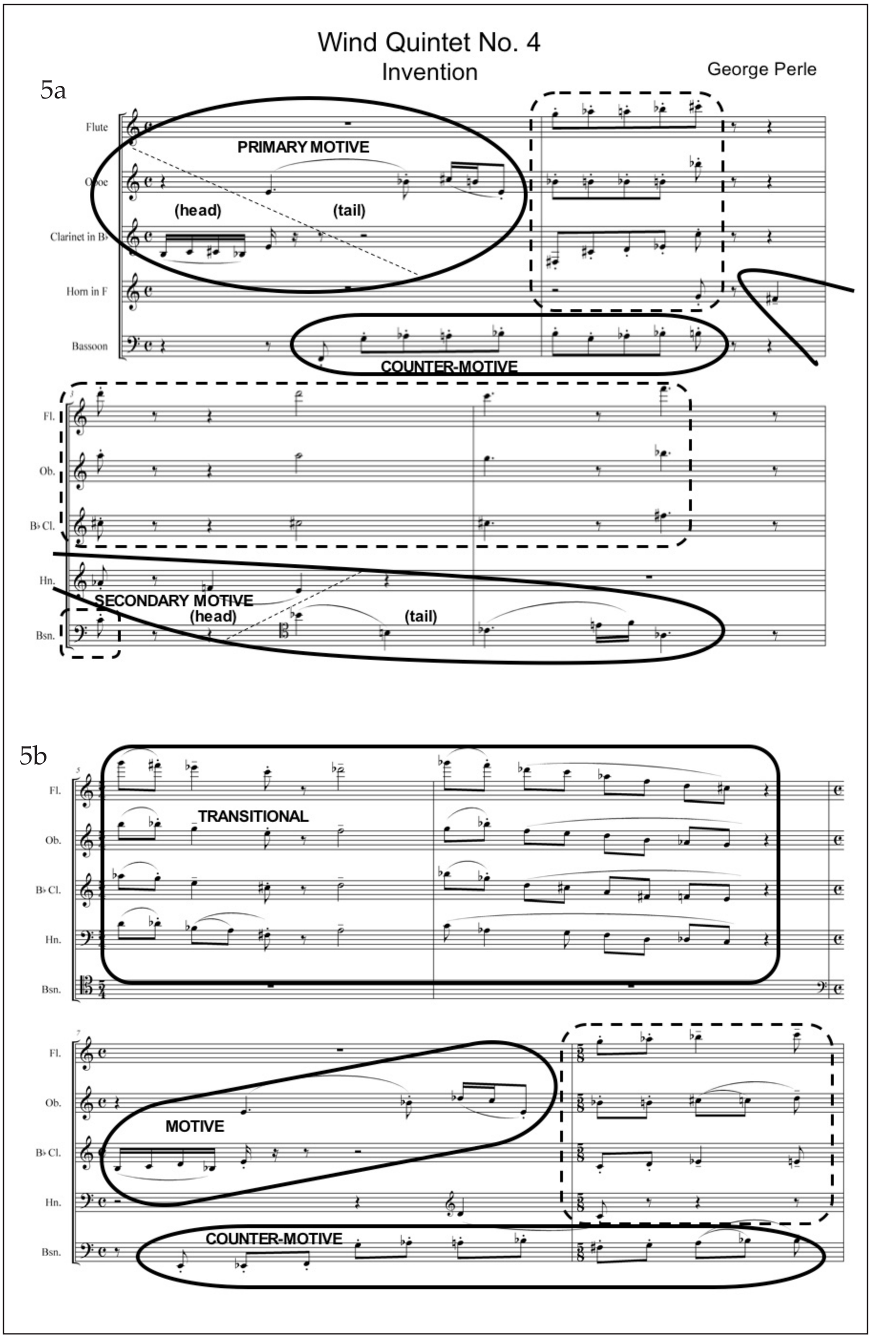
The Components of the Invention

We could analyze the entire piece in this way to deepen our understanding of how the theory of twelve-tone tonality is utilized in composition; however, this type of analysis does not lend itself readily to aural comprehension. Surprisingly, a more conventional analytical approach will garner more easily accessible observations. Despite the uniqueness of the theory, most of Perle's works are formally structured according to traditional compositional designs. This movement is named "Invention" precisely because it follows the conventional plan of the Baroque invention.

An invention is a short contrapuntal piece for two voices based on the development of motivic material. There is no standard model of the invention as a form *per se*; it is better understood as a procedure, as evidenced by the wide variety of structures and formats of inventions in the musical canon. Nonetheless, certain features emerge as common to most inventions: motives, counter-motives, and episodic passages.

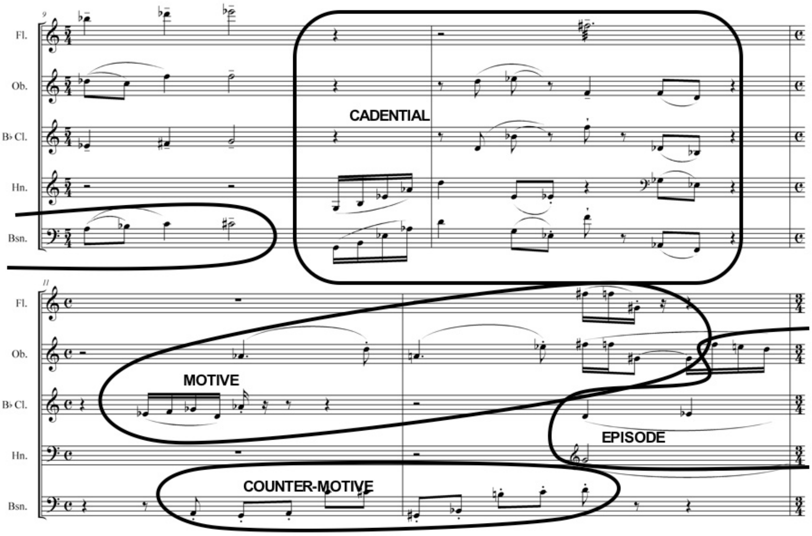
Perle's invention opens with the first statement of the primary motive, divided into two parts. The clarinet presents the head of the motive; the last note of the head dovetails with the first note of the tail, played by the oboe. The counter-motive appears more or less consistently with the tail of the motive throughout the invention, and is heard first in the bassoon. Virtually all statements of the counter-motive feature homophonic accompaniment, as shown in the dotted segmentation of the other instruments in m. 2 of Example 5.[4]

[4] It should be noted that homophonic accompaniment is a distinct departure from more traditional invention textures.

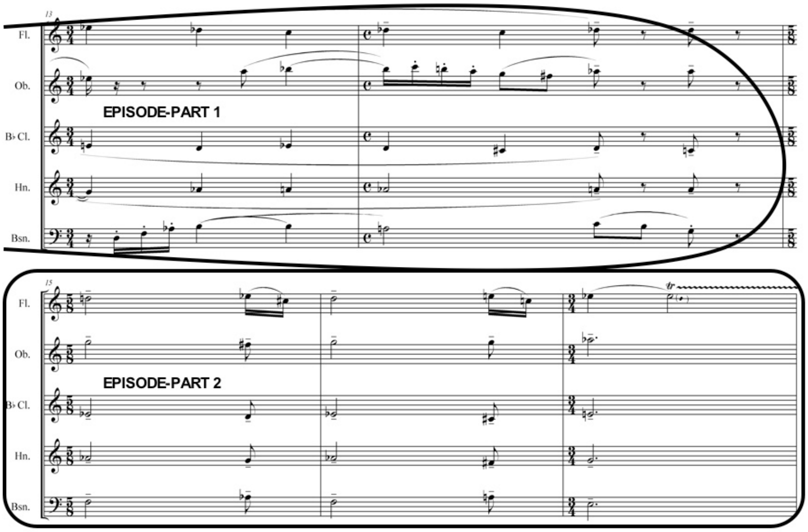


Example 5: Main elements in Perle's Invention, mm. 1-17 (a) mm. 1-4 and (b) mm. 5-8.

5c



5d



Example 5: Main elements in Perle's Invention, mm. 1-17 (c) mm. 9-12 and (d) mm. 13-16.

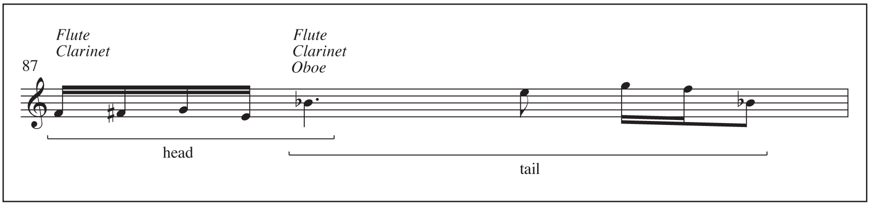
Perle follows the first statement of the counter-motive with a secondary motive. Like the primary motive, the secondary motive is divided into a head (played by the horn) and a tail (played by the bassoon), which overlap each other by one note. The remaining instruments again provide chordal accompaniment. This secondary motive is not as prevalent as the primary motive, but it does appear at significant formal junctures in the invention.

As with all inventions, this piece proceeds by alternating motive entries with episodic passages. Episodes are intended to provide relief from continuous statements of the motive. In Perle's invention even the episodes constitute two parts, with a contrapuntal first part followed by a homophonic second part. This textural contrast is analogous to that of the primary motive and chordally accompanied counter-motive. Throughout the piece one may encounter passages that are too short to be episodic. Such passages are often more readily understood as transitional or cadential in function. Example 5 highlights a cadential passage in mm. 5-6.

In addition to the homophonic passages mentioned above, Perle's invention departs tradition from another standpoint: Most inventions are composed for two voices, but Perle's is scored for five. Nonetheless, through careful combinations of the five instruments of the wind quintet, Perle conveys an impression of two independent parts.

Transformations of the Primary Motive

Perle's approach to this invention is based *not* on the traditional tonic-dominant relationships of diatonic tonality, but on the underlying symmetrical relationships of twelve-tone tonality. Yet we clearly hear the piece as an invention because of Perle's adherence to the standard procedure of alternating the principal components of motive, counter-motive, and episode. The primary motive appears in fourteen statements over the course of this invention. Each statement has been transformed by some contrapuntal process. Example 6 shows the simplest of these transformations in the final entry in m. 87, a straightforward transposition of the primary motive by T6.



Example 6: Transposition of primary motive by T6, m. 87

Perle incorporates many of the conventional means of motivic development throughout this invention. In addition to transposition, Perle utilizes inversion, sequence, intervallic change, fragmentation, extension, contraction, and augmentation. He applies these techniques to both of the distinct components of the primary motive–the head and the tail. In many cases, the tail itself further divides into two subsets for separate transformations. For the most part the characteristic rhythms of the head and tail remain intact in each appearance, thereby facilitating recognition of the primary motive underlying the various transformations.[5] In addition, the listener will recognize the primary motive because of its distinctive contour. We may describe this contour in general terms as a small arch plus leap for the head, and a larger arch for the tail.

Joseph N. Straus has discussed contour recognition in his textbook on post-tonal theory:

> As listeners, we may sometimes find it easier to attend to the general shapes of music, its motions up and down, higher and lower. These are aspects of musical *contour*. To make sense of musical contour, we do not need to know the exact notes and intervals; we only need to know which notes are higher and which are lower.[6]

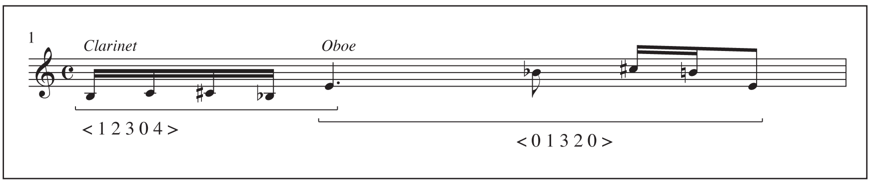
This is particularly helpful in listening to Perle's invention, where we hear motivic statements as clearly being related by transposition or inversion, although the relationship is not exact in terms of interval sizes. Straus asserts that "approaching contour

[5] Due to the relative stability of the rhythm in the primary motive, issues of rhythm will not be pursued further in this article, except in cases where rhythmic change is a specific means of motivic transformation.

[6] Joseph N. Straus, *Introduction to Post-Tonal Theory*, 3rd ed. (Upper Saddle River: Prentice Hall, 2005), 99.

in this way permits us to discuss musical shapes and gestures with clarity."[7]

As a result, we will approach our study of the motivic transformations in Perle's invention from the perspective of contour analysis. We will employ Robert Morris's method for representing the contour of a fragment, in which each pitch is assigned an integer based on its position in relation to the other pitches within the contour.[8] The lowest pitch is designated as 0, the highest pitch is designated the integer that is one less than the cardinality of the fragment. Thus, the pitches comprising the primary motive in m.1 [B^{3}-C^{4}-$C\sharp^{4}$-Bb^{3}-E^{4}-Bb^{4}-$C\sharp^{5}$-B^{4}-E^{4}] are represented by the contour segment <123045764>. Since Perle frequently treats the head and tail to separate transformations in the invention, Example 7 displays individual contour segments for each component, with the head as <12304>, and the tail as <01320>.

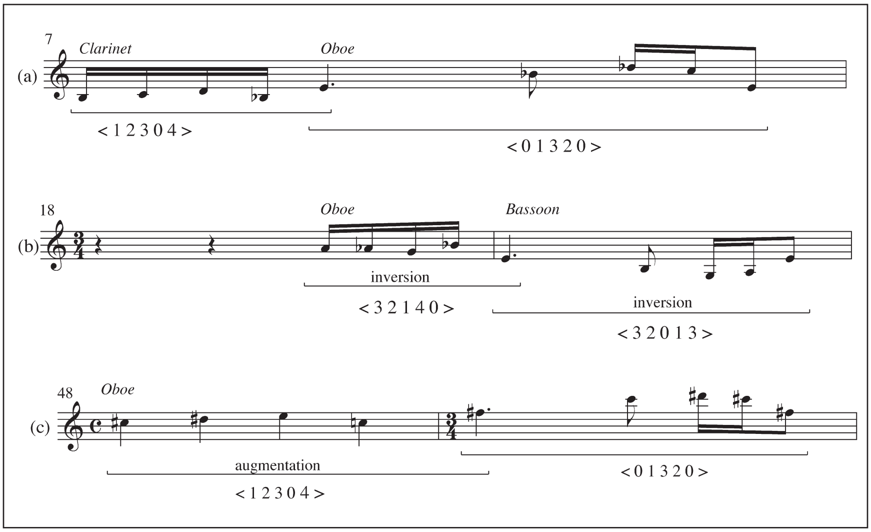


Example 7: Contour segments of primary motive's head and tail, m. 1

The contour designations for the motive's head and tail also apply to the modified primary motive in m.7. Example 8a shows that one pitch differs in each of the head (clarinet) and the tail (oboe). Nonetheless, the listener will recognize the gesture to be the primary motive, due to its identical melodic contour, rhythm, and instrumentation. The changes in pitch presumably occur to ensure conformity with the underlying array of twelve-tone tonality. As illustrated earlier in Example 4, the primary motive in m. 1 belongs to array 9,e/6,1, whereas in m. 7 Perle has modulated to array t,e/6,1.

[7] Straus, 100.

[8] Robert Morris, *Composition with Pitch-Classes: A Theory of Compositional Design* (New Haven: Yale University Press, 1987), 26-33.

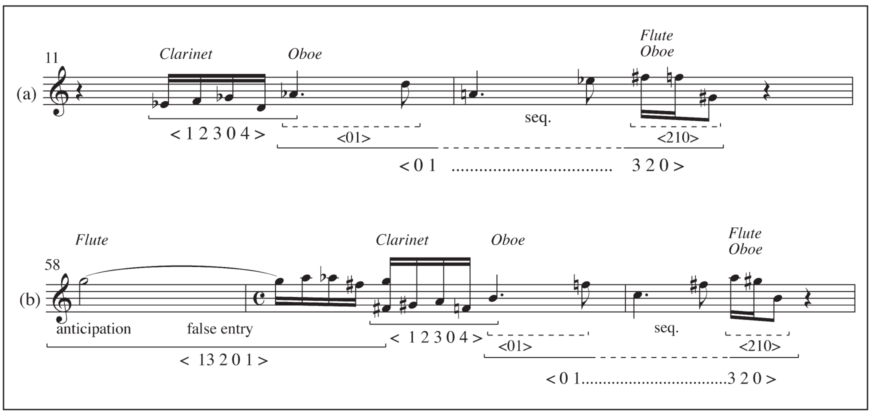


Example 8: Developmental processes applied to statements of the primary motive: (a) Intervallic change in m.7, (b) inversion in mm. 18-19, and (c) augmentation in mm. 48-49

Measures 18-19 contain the first primary motive to be transformed by inversion in this invention, as demonstrated in Example 8b. In a contour inversion the highest pitch of the contour shifts to become the lowest, the lowest pitch moves to become the highest, and so on for each pitch of the gesture. Thus, while the original contours of the head and tail are <12304> and <01320> respectively, the contour of the inverted head in m. 18 is <32140>, and the inverted tail in m. 19 is <32013>. The primary motive has been displaced metrically by two beats in this statement, although its rhythmic values remain intact, thereby assisting the listener in recognizing the gesture as the primary motive, despite its inversion.

The primary motive undergoes several transformations in mm. 48-49. As illustrated in Example 8c, the second and third notes of the motive have moved by T3, while the remaining notes of the motive have shifted by T2. This seemingly inconsistent transpositional process does not disrupt the overall contour, but permits the pitch class material to conform to the current array of 1,3/t,5. Additionally, the motive contains some changes in rhythm as well as pitch: the head appears in augmentation, while the tail retains its original durational values.

Perle also applies several different transpositional operations to the motivic statement in m. 11. Example 9a shows how the pitches of the head have shifted upward, not by a single consistent value, but by T4 for the first, fourth, and fifth notes, and by T5 for the second and third. Nonetheless, since this fragment retains the same rhythm, instrumentation, and <12304> contour, it is clearly recognizable as the head. The tail in m.12 has been expanded by the addition of two pitches. This addition results in a considerably different contour representation: <0143520>. Upon closer inspection, however, we see that Perle has simply repeated the first two notes of the tail in sequence, retaining their original durational values. If we exclude this sequential expansion from consideration for the moment, the tail maintains its <01320> contour. Sequential expansion of the tail occurs in several motive statements throughout the invention, and is systematically applied to either the first two pitches or the last three. As a result, we shall hereinafter refer to these segments as the tail's first and second subsets, represented by contour segments <01> and <210>, respectively.



Example 9: Transformation of primary motive through (a) sequential expansion in mm. 11-12, and (b) anticipation, false entry, and sequential expansion in mm. 58-60

False entry is another device utilized by Perle in this invention, as evidenced in Example 9b. In m.58, the flute enters with an anticipatory sustained pitch, followed by four sixteenth notes. Although this rhythmic gesture suggests the onset of the primary motive, its contour proves it to be a false entry: <13201>. Dovetailing the last note of the flute's false entry, the clarinet enters in m. 59 with the head of the true motive (with its pitches transposed by

T7 and T8), followed by tail stated in the oboe. The tail again is expanded in length; the oboe presents the tail's first subset and a sequenced repeat, then the flute joins the oboe to conclude this motivic statement with the second subset.

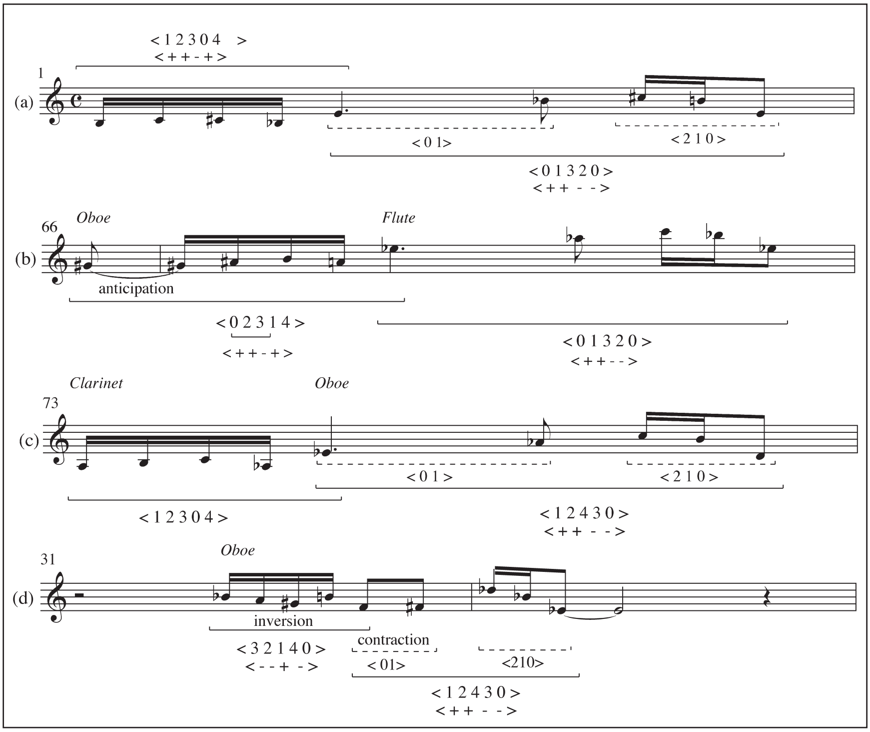
Contour Adjacency Series of Motivic Transformations

In the remaining statements of the motive, Perle uses other contours that are similar but not identical to those of the primary motive's head and tail. We may recognize the similarity through an array of symbols introduced by Michael Friedmann.[9] This theorist represents the ordered intervals of a contour in what he calls the "Contour Adjacency Series," or CAS. Friedmann uses the + sign for an ascending interval, the – sign for a descending interval, and the integer 0 to signify a repeated note. Example 10a illustrates how, in the first statement of the primary motive in m.1, the CAS of the head is < + + - +>, and the CAS of the tail is < + + - - >.

The CAS enables us to recognize the motive despite the various transformations of its contour. In m.67, the oboe sustains a pitch that then launches into another entry of the motive, as shown in Example 10b. In this statement, however, the contour of the head has been altered, due to the application of different transpositional values (T9, Tt, and Te). Consequently, it appears that the first and fourth notes exchange their contour position, indicated by the contour label <02314>, versus the <12304> of the original motive's head. Nonetheless, the more general CAS remains unchanged between the two heads, as < + + - +>, allowing the listener to recognize this segment as the motive's head. Likewise, the pitches of the tail have undergone different transpositional operations (Tt and Te), although the contour positions and the CAS remain unchanged.

The opposite situation obtains in the ensuing motive entry of m. 73, as demonstrated in Example 10c. In this statement the contour of the head is unchanged, but the tail's contour, as <12430>, is modified from the original contour of <01320>. Nonetheless, Perle establishes an audible connection to the original tail by retaining the contours of the individual subsets, <01> and <210>. As a result, the CAS of the tail stays constant, as <+ + - ->.

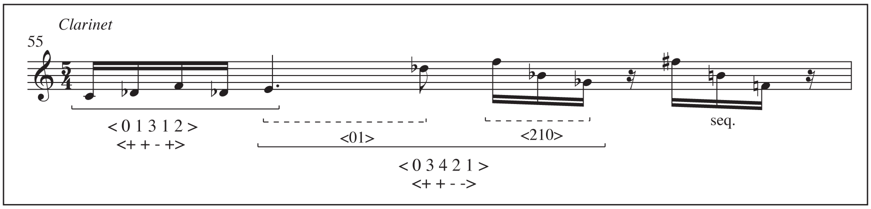
[9] Michael Friedmann, "A Methodology for the Discussion of Contour: Its Application to Schoenberg's Music," *Journal of Music Theory* 29 (1985): 223-248.



Example 10: Contour Adjacency Series (CAS) of (a) initial motivic statement in m. 1, (b) statement with head in modified contour, mm. 66-67, (c) statement with tail in modified contour, m. 73, and (d) statement with inverted head and tail in modified contour, mm. 31-32

Example 10d demonstrates how Perle subjects the motive to contraction in mm. 31-32. The motive is played in its entirety by a single instrument, the oboe. Perle shortens the note joining the head and tail from a dotted quarter to an eighth note, thereby reducing the motive's length. Yet Perle maintains the separate identities of the head and tail by differing their contour transformations. The head of the motive appears in inversion; the tail's two subsets retain their individual contours although their intervallic successions have been altered. These alterations result in a modified contour for the tail, as <12430>, although the CAS is still <+ + - ->.

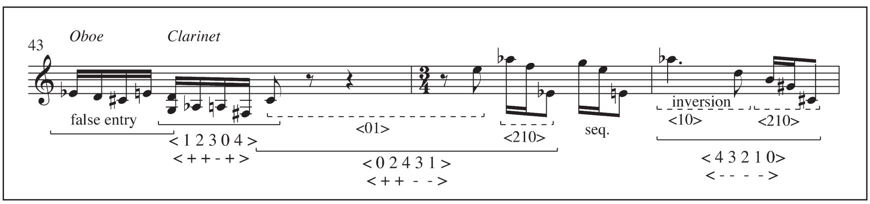
The developmental processes applied to the remaining motivic entries prove rather more complex. In Example 11, the clarinet states a transformed primary motive in m. 55, with both the head and the tail comprise different contours, as <01312> and <03421>. In both cases, however, their CAS are the same as those of the original head



Example 11: CAS of motive with modified contours of head and tail, m. 55

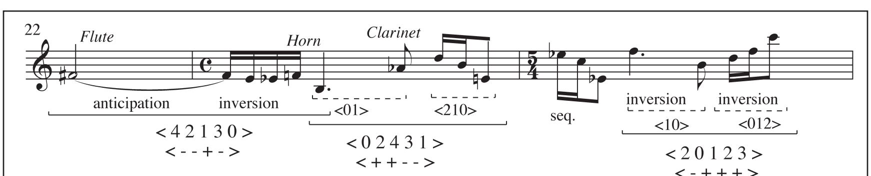
and tail. A modified sequential repeat of the second subset extends the length of the tail.

In m. 43 an inverted false entry in the oboe precedes the clarinet's statement of the motive head, given in Example 12. While the head's contour is the same, the time span between the tail's first and second note has been extended by one beat. In addition, the tail is extended by a sequential repetition of its second subset, followed by another statement of the tail. The first subset in this repeat is inverted while the second is not, resulting in an entirely new, descending contour, <43210>, and new CAS <---->.



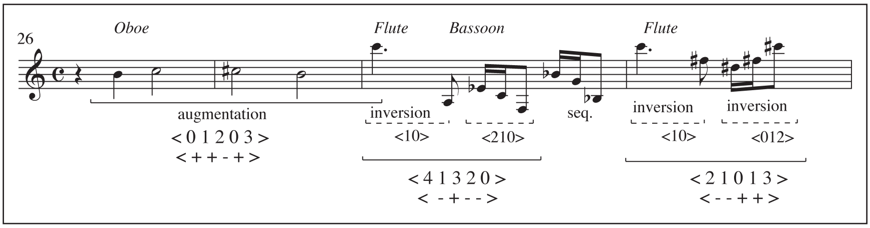
Example 12: CAS of false entry preceding statement of motive, then CAS of with modified tail, expanded by sequenced second subset, followed by repeated tail with inverted first subset

Example 13 presents the motive entry in mm.22-24, which comprises an inverted head with modified contour, resulting from switching the highest and second-highest pitches (the first and fourth notes in the head). Nonetheless, the CAS of the head remains an intact inversion. In the tail, the second subset is repeated in



Example 13: CAS of motive with inverted head and modified tail, followed by repeat of tail with inverted subsets

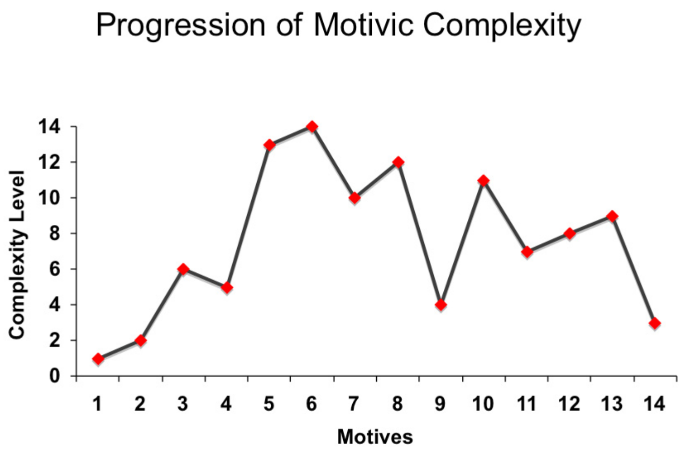
sequence, and then the entire tail is repeated, with both subsets separately inverted. This treatment in the repeated tail forms another new contour, <20123> and corresponding CAS of <-+++>.



Example 14: CAS of motive with augmented, modified head and tail with inverted first subset, followed by repeated inverted tail with modified contour

The most complex transformation of the motive occurs in mm. 26-29, as shown in Example 14. In this statement the oboe presents the head in a modified augmentation, with a different contour, <01203>, although the general CAS <++-+> is preserved from the original head. The tail contains a sequenced repeat of its second subset, followed by both subsets in inversion. In addition, the careful observer may note an interesting transpositional relationship between the tails of the successive statements in m. 24 and 29. In the latter, the first iteration of the tail is an interval 1 transposition, while the sequence is transposed by interval 7. In the repeated tail, the first subset is higher by an interval 7, while the second subset is an interval 1 higher.

We have examined the motives in this invention not in order of occurrence, but in order of the increasing complexity of their transformations. If we instead study the motives chronologically, we will discover that Perle places the most intense transformations midway through the movement and near the end, similar to the design of most other inventions. The graph in Example 15 is a subjective rendering of the complexity of the motives in this invention. The accompanying table below the graph summarizes the developmental processes applied to each motivic statement. We may observe how the most complicated transformations begin to occur just before the midpoint of the invention, with a second surge in complexity about two-thirds of the way, with a decrease in intensity as the invention draws to a close.



Motivic Statement	Measure numbers	Motivic Process
1st	m. 1	initial statement of the motive
2nd	m. 7	one note different in the head and tail
3rd	mm. 11-12	sequential expansion
4th	mm. 18-19	inversion
5th	mm. 22-24	anticipated, inverted, modified head and repeated tail
6th	mm. 26-29	augmented and modified head, inverted and repeated tail
7th	m. 31	contraction, inverted head, modified tail
8th	mm. 43-45	false entry, inverted and repeated tail, sequential expansion
9th	mm. 48-49	augmentation
10th	m. 55	modified head and tail, sequential expansion
11th	mm. 58-60	anticipation, false entry, sequential expansion
12th	mm. 66-67	modified contour
13th	m. 73	modified contour
14th	m. 87	transposition

Example 15: Chronological progression of motivic complexity

Summary

Although this is a non-tonal piece based on Perle's unique compositional theory of twelve-tone tonality, the techniques and processes of the Baroque invention are readily accessible. The basic tonal relationships of the invention are absent (such as key relationships and harmonic cadences), yet the main components of the invention are easily detected through continuity of texture, rhythm, and instrumentation, and most notably through Perle's use of traditional motivic processes, resulting in a variety of contour transformations. Efforts to integrate the more conventional, standardized art forms and newer compositional methods will empower teachers of 20th century analytical techniques to include Perle's compositions in their curricula. Indeed, this article contends that such integration will present new vistas for the next generation of students by introducing them to a body of music that is innovative and exciting.

Selected Bibliography

Friedmann, Michael. "A Methodology for the Discussion of Contour: Its Application to Schoenberg's Music." *Journal of Music Theory* 29/2 (1985): 223-48.

_______. "A Response: My Contour, Their Contour." *Journal of Music Theory* 31/2 (1987): 268-74.

Marvin, Elizabeth West and Paul Laprade. "Relating Musical Contours: Extensions of a Theory for Contour." *Journal of Music Theory* 31/2 (1987): 226-67.

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

Perle, George. *The Listening Composer*. Berkeley, CA: University of California Press, 1990.

_______. *Twelve-Tone Tonality*. 2nd ed. Berkeley, CA: University of California Press, 1996.

Straus, Joseph N. *Introduction to Post-Tonal Theory*. 3rd ed. Upper Saddle River, NJ: Prentice Hall, 2005.