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Symmetrical Form and Common-Practice Tonality

Robert P. Morgan

I. THE RELEVANCE OF SYMMETRY

It may seem counterintuitive to apply so potentially rigid a concept as symmetry to something as flexible and processive as form in tonal music. Yet precisely here, where musical surfaces are constantly changing and in motion, it proves instructive to measure degrees of exact symmetrical correspondence, especially if the degree is exceptionally high. Formal analysts, moreover, while not inclined to submit symmetry itself to serious scrutiny, have always attended to symmetrical correspondences. Symmetry, perhaps the most basic of what Hegel calls "the relations of the abstract understanding," forms a virtually unavoidable constant against which we can evaluate the inconstancies of art and, indeed, life itself.

Recognition of correspondences, both spatial and temporal, is vital to the way we organize experience. The deep-seated human need for design and order tends to favor symmetrical patterns. We grasp varied experiences by viewing complex structures as combinations of simpler ones, reducing the amount of information to be processed. Symmetry allows us to apprehend objects and events as a synthesis of matching components, coordinating our field of perception and abetting our memory; above all, it invites us to see wholes as the necessary outcome of a joining of complementary parts.

Scientists thus search for symmetrical relationships in confronting the complexities of the physical world. The understanding of nuclear structure and planetary motion, to take two extremes, stems largely from a grasp of nature's regularities. The physicist Richard Feynman has commented: "Symmetry seems to be absolutely fascinating to the human mind. We like to look at symmetrical things in nature, such as perfectly symmetrical spheres like planets and the sun, or symmetrical crystals like snowflakes, or flowers which are nearly symmetrical." The mathematician Hermann Weyl is even more synoptic: "Symmetry, as wide or as narrow as you may define its meaning, is one idea by which man through the ages has tried to comprehend and create order, beauty, and perfection."[1]

This article is a revised and significantly extended version of a lecture given at the University of North Carolina, Chapel Hill a decade ago and subsequently reworked as the keynote address for the annual meeting of the Society for Music Theory in Montreal in November, 1993. Richard Cohn and Ramon Satyendra contributed significantly to the current version, making numerous helpful suggestions after reading an earlier draft. Martin Golubitsky of the Department of Mathematics at the University of Houston, whose book *Fearful Symmetry* (co-authored with Ian Stewart, cited in footnote 8 below) was an important stimulus, kindly answered several questions addressed to him.

[1]Richard Feynman, *The Character of Physical Law* (Cambridge, Mass.: MIT Press, 1967), 84; Hermann Weyl, *Symmetry* (Princeton: Princeton University Press, 1952), 5.

It is not surprising, then, that symmetrical concepts, both strictly and broadly defined, have been applied to music, an art so heavily dependent upon repetition, contrast, and balance; or that musical theorists and analysts like to focus on patterns of exact or near symmetrical correspondence. A symmetrical perspective enables one to see an individual musical unit not just as an isolated event, but as part of an encompassing structure generated by that unit: the part is understood as meshed in the whole, while the whole emerges as a direct outcome of the part's own structure, the consequence of a process of strict duplication.

Like virtually all Western music, the music of the common-practice period is characterized by formal correspondences of various kinds. Such correspondences usually do not form exact symmetries, however, even at the phrase level. This stems partly, no doubt, from distaste for too much repetition and regularity—for predictability, that is, the negative side of the symmetrical coin. But it also results from the nature of the tonal system itself, where the idea of strict symmetry must yield priority to a more fundamental, non-symmetrical principle: goal-directed tonal motion. For tonality comprises not only the abstract collections of diatonic pitches (plus their chromatic alterations), which have significant symmetrical properties of their own, but various asymmetrical syntactical functions, harmonic and linear, that transform these collections into a full-fledged compositional language.

Exact symmetry contradicts the unidirectional character of these syntactical functions. Harmonic motion from tonic to dominant is functionally distinct from motion from dominant to tonic, as is linear motion directed toward, as opposed to away from, the tonic. More generally, the various functional distinctions between diatonic scale degrees depend upon their asymmetrical locations within the total chromatic. In any given composition, music moving away from a tonic is normally unlike music that approaches one, and music extending a tonic unlike music that defines one. Whereas the formal units in a strictly symmetrical structure are theoretically interchangeable, those of tonal music are not.[2]

A significant body of recent scholarship has nevertheless shown that nineteenth-century music underwent a notable expansion in the use of symmetrical pitch relationships, accommodated in various ways to the conventions of common-practice tonality. Among matters addressed are the abandonment of an exclusively monotonal framework for a multitonal one with two (or possibly more) key centers competing in a "tonic complex," each a sort of mirror of the other; the saturation of diatonic tonality through chromatic inflection, producing less differentiated pitch structures often of a symmetrical cast; and increased reliance on symmetrical octave divisions in both local and extended tonal motions.[3]

[2]This asymmetrical, unidirectional character of tonal music is brought out clearly in Schenker's tonal theory. The bass of the Schenkerian *Ursatz* is symmetrical, the second half mirroring the first about an axis located on the fifth scale degree. But the bass alone does not make an *Ursatz*, nor does it produce tonality; and with the addition of the top voice, symmetry is broken by unidirectional motion, from a less to a more stable form of the tonic triad. For Schenker, then, tonality is forward-directed, even at the *Ursatz* level; and the asymmetry becomes still more pronounced at middleground levels, the bass divider being displaced ever further from the midpoint.

[3]The literature is too large to cite comprehensively, but the following suggests its scope: Gregory Proctor, "Technical Bases of Nineteenth-Century Chromatic Tonality: a Study of Chromaticism" (Ph.D. diss., Princeton University, 1978); Harald Krebs, "Alternatives to Monotonality in Early Nineteenth-Century Music," *Journal of Music Theory* 25/1 (1981): 1–16; Deborah J. Stein, "The Expansion of the Subdominant in the Late Nineteenth Century," *Journal of Music Theory* 27/2 (1983): 153–80; Robert Bailey, "An Analytical Study of the Sketches and Drafts," in *Wagner: Prelude and Transfiguration from* Tristan and Isolde, Norton Critical Score (New York: Norton, 1985), 113–46; Richard Taruskin, "From Chernomour to Kashchei: Stravinsky's Harmonic Angle," *Journal of the American Musicological Society* 38/1 (1985): 72–142; Howard Cinnamon, "Tonic Arpeggiation and Successive Equal Third Relations as Elements of Tonal Evolution in the Music of Franz Liszt," *Music Theory Spectrum* 8 (1986): 1–24; Allen Forte, "Liszt's Experimental Idiom and Music of the Early Twentieth Century," *19th-Century Music* 10/3 (1987): 209–28; Christopher Lewis, "Mirrors and Metaphors:

Though none of these studies focuses on symmetry in form, they address issues closely related to those that concern us here, and provide strong evidence of a heightened interest in symmetrical formations in nineteenth-century music.

It is useful to speculate on the historical meaning of these developments. Since symmetrical pitch relationships play a much more prominent role in twentieth-century music than in nineteenth-century music, one is inclined to view such earlier manifestations, which involve superimposing symmetrical features over an asymmetrical tonal framework, as part of a gradually emerging prehistory of post-tonal music.[4] This inevitably influences the way we view music history of the past two hundred years: while it does not necessitate abandoning the idea that a break separates tonal from post-tonal music, it does encourage a more gradualist view of that break—one modeled more along classical Darwinian lines, say, than on the "catastrophic" ones recently favored (for example, in Thomas Kuhn's theory of scientific paradigms).[5]

There is much to recommend a gradualist position. The idea that the more innovative compositional practices associated with the early twentieth century appeared without precedent—that some composers simply, and suddenly, began writing music largely unrelated to what they had previously known—seems extremely improbable. The development of compositional procedures—symmetrical or otherwise—associated with the disruption of common-practice tonality would appear rather to support a "last straw" theory, according to which a process of cumulative change provokes a moment of crisis: a final incremental step, in principle no different from its predecessors, engenders a change far exceeding anything previously encountered. Though precise identification of this step, or the moment when it occurs, may elude us, there is nothing mysterious about the process: like water reaching a boiling point, a final change in degree produces a fundamental change in kind. The more one studies music composed prior to the First World War, the more likely it seems that something of this sort took place, gradually transforming "nineteenth-century music" into "twentieth-century music."

The literary critic and phenomenologist Maurice Merleau-Ponty has made a similar point with respect to the history of

Reflections on Schoenberg and Nineteenth-Century Tonality," *19th-Century Music* 11/1 (1987): 26–42; Richard Cohn, "Properties and Generability of Transpositionally Invariant Sets," *Journal of Music Theory* 35/1–2 (1991): 1–32; Patrick McCreless, "An Evolutionary Perspective on Nineteenth-Century Semitonal Relations," in *The Second Practice of Nineteenth-Century Tonality*, ed. William Kinderman and Harald Krebs (Lincoln: University of Nebraska Press, 1996), 87–113. Proctor ("Technical Bases") argues that these developments warrant distinguishing a nineteenth-century chromatic tonal system from the eighteenth-century diatonic one, the two existing independently as well as in combination.

[4]Though strict formal symmetry is exceptional even in twentieth-century music, it appears with sufficient frequency to complement the very widespread use of symmetrical pitch relationships in that repertoire. The general significance of symmetry in post-tonal music is well documented. See, for example, György Ligeti, "Entscheidung und Automatik in der *Structure 1a*," *Die Reihe* 1 (1958): 38–63; Leland Smith, "Composition and Precomposition in the Music of Webern," in *Anton Webern: Perspectives*, ed. Hans Moldenhauer and Demar Irvine (Seattle: University of Washington Press, 1966), 86–101; David Lewin, "Inversional Balance as an Organizing Force in Schoenberg's Music and Thought," *Perspectives of New Music* 6/2 (1967): 1–21; George Perle, *Twelve-Tone Tonality* (Berkeley: University of California Press, 1977); Pieter C. van den Toorn, *The Music of Igor Stravinsky* (Berkeley: University of California Press, 1983); Elliott Antokoletz, *The Music of Béla Bartók* (Berkeley: University of California Press, 1984); Jonathan W. Bernard, *The Music of Edgard Varèse* (New Haven: Yale University Press, 1987); Robert P. Morgan, "The Eternal Return: Retrograde and Circular Form in Berg," in *Alban Berg. Historical and Analytical Perspectives*, ed. David Gable and Robert P. Morgan (Oxford: Oxford University Press, 1991), 111–49.

[5]Patrick McCreless ("An Evolutionary Perspective") makes a similar point regarding the development of chromaticism, also invoking evolutionary theory. On paradigm shifts, see Thomas S. Kuhn, *The Structure of Scientific Revolutions* (Chicago: University of Chicago Press, 1962).

language. Beginning with an architectural example, the transformation of space by the addition of Filippo Brunelleschi's dome for the Florence cathedral, Merleau-Ponty asks if the new space Brunelleschi brought to realization—"discovered"—with his cupola had been there previously. It was there, he says, but "as if it were unaware of its existence; it [was] not there 'for itself.' " Turning to language, he reframes his argument in evolutionary terms:

> In the same way, one must give up trying to establish the moment in which Latin becomes French. Grammatical forms begin to be efficacious and outlived in a language before being systematically employed. A language sometimes remains a long time pregnant with transformations which are to come; and the enumeration of the means of expression in a language does not have any meaning, since those which fall into disuse continue to lead a diminished life in the language and since the place of those which are to replace them is sometimes already marked out—even if only in the form of a gap, a need, or a tendency.[6]

Merleau-Ponty's view of historical development as an overlapping and emergent process offers a useful perspective from which to consider the role of symmetry both in common-practice music and in later compositional developments. In his terms, the exact point at which tonal music gives way to post-tonal music is, as in the mutation of Latin into French, unspecifiable: features characteristic of the latter are anticipated in the former, and those of the former linger in the latter. Symmetrical construction, then, while not fully contained within the language of tonality, is an idea marked out by that language—"pregnant with transformations to come"—as a "gap."

The present essay addresses the filling of this gap, and is particularly concerned with three related issues: 1) the concept of symmetry and its application to musical form; 2) the manner and extent to which formal symmetry can be accommodated within the normal procedures of common-practice tonality; and 3) the development of one emphatically symmetrical form in tonal music, established during the common-practice period and extended into the early years of the present century, transforming a nineteenth-century practice into a twentieth-century one without accentuated break. Engagement with the first issue provides basic definitions. The second leads to a consideration of the complex relations between symmetry and symmetry-breaking in tonal form, a rich topic that can only be touched upon here as a counterbalance to our main concern, strict symmetrical construction. Finally, the third reveals that the seemingly universal drive for symmetrical formation was, in at least one formal type, strictly realized within a functionally tonal context. Although the evolution of this one strictly symmetrical construction represents but a single strand in the complex web of nineteenth-century music, it offers striking confirmation of Merleau-Ponty's idea that a given practice can bridge two seemingly distinct domains.[7]

[6]Maurice Merleau-Ponty, *Signs*, trans. Richard C. McCleary (Chicago: Northwestern University Press, 1964), 5. Meyer Shapiro also notes, with reference to "the non-homogeneous, unstable aspect" of artistic style, "the importance of considering in the description and explanation of a style . . . the obscure tendencies toward new forms." Meyer Shapiro, "Style," reprinted in *Aesthetics Today*, rev. ed., ed. Morris Philipson and Paul J. Gudel (New York: New American Library, 1981), 146.

[7]This evolution need not be understood as teleological in nature, working through some inner mechanism toward a better, or at least more economical, technical solution, or toward the revelation of some previously hidden musical truth. Following Merleau-Ponty, I prefer to see it as filling in a particular space—here occupied by strictly symmetrical musical relationships—that becomes available within a certain compositional environment, opening up a range of new possibilities. This creates, to quote Michel Foucault (Merleau-Ponty's pupil), "a field of possible options" explored through new strategies. Though non-teleological, the process is not fortuitous but gives rise to a set of related compositional procedures that can be examined for the degree to which they are systematic and undergo meaningful historical evolution.

II. THE CONCEPT OF SYMMETRY

This section provides a brief, informal introduction to the concept of symmetry and to the principal symmetrical operations applicable to music and musical form. The idea of symmetry dates back to classical Greece and was originally applied to such general notions as harmony, balance, proportion, and regularity. Only in the late eighteenth and early nineteenth centuries did the term begin to take on the more specialized geometrical and mathematical meanings common today in the sciences and music theory. Though this stricter meaning is adopted here, more general senses remain in wide use. Music theorists and analysts, for example, especially when dealing with common-practice forms, commonly speak of symmetry with reference to approximate rather than absolute correspondences.[8]

The concept of symmetry can be applied to a wide range of phenomena, including physical objects (elementary particles, geometric figures, planetary systems), abstract systems (laws of physics, mathematical relations, pitch systems), and processes taking place in time (chemical reactions, biological processes, a segment of music). Though the particular operations vary depending upon the system, the basic principles can be illustrated through any of these. For present purposes we will begin with examples from two-dimensional space and then move to pitch-class space, which is the sole musical dimension that has been extensively examined in symmetrical terms. This is well-known terrain, but will serve to introduce concepts that remain valid when we turn to a less familiar third topic, time symmetry. Time symmetry is critical for our primary concern, symmetry in musical form. This is addressed in the subsequent section of the paper.

Symmetry, even strictly defined, is essentially a matter of degree. Absolute symmetry (infinite degrees of all possible symmetries) means absolute indistinguishability; and while the idea provides an essential conceptual limit, it is of little practical value. Objects that are symmetrically structured normally possess only partial symmetry ("degrees of symmetry"), which can be viewed as the result of a break in a more encompassing symmetry—as the latter's remainder, so to speak. Symmetry-breaking, then, produces patterns that may possess symmetry as well, though of a lower degree; and symmetrical features may well remain even beyond the line separating the purely symmetrical from the asymmetrical (no degree of symmetry). The property of symmetry can thus be understood as a graded series, extending from absolute through successively lower degrees to asymmetry. This series does not provide a chronology of how less symmetrical systems come into being (though in certain circumstances it

[8]While the approach to symmetry taken in this article is rigorous, it is also informal. In particular, the mathematical aspects of symmetry, though of considerable importance in recent pitch theory, are not required for illuminating the formal issues that are of concern here. There are numerous books dealing with symmetry, a classic study being Weyl's *Symmetry,* cited in footnote 1. Among others are Adolph Baker, *Modern Physics and Antiphysics* (Reading, Mass: Addison-Wesley, 1970); Bas C. van Fraassen, *Laws and Symmetry* (Oxford: Oxford University Press, 1989); István Hargittai, ed., *Symmetry: Unifying Human Understanding* (New York: Pergamon Press, 1986); A. V. Shuybnikov and V. B. Koptsik, *Symmetry in Science and Art* (New York: Plenum Press, 1974); and Joe Rosen, *Symmetry Discovered* (Cambridge: Cambridge University Press, 1975). An excellent general introduction is Ian Stewart and Martin Golubitsky, *Fearful Symmetry* (Oxford: Blackwell, 1992), which touches upon various aspects of symmetry in science, mathematics, and everyday experience, and which was especially helpful in shaping my own formulations, particularly with regard to temporal symmetry. More particularized studies are Doris Schattschneider, *Visions of Symmetry* (New York: W. H. Freeman, 1990), a detailed and generously illustrated treatment of the artist M. C. Escher; and Douglas R. Hofstadter, *Gödel, Escher, Bach* (New York: Vintage Books, 1979), which examines recursivity in general in music, mathematics, and the visual arts. For a classic study assuming a broader definition of symmetry as a balance of opposed forces, see D'Arcy Wentworth Thompson, *On Growth and Form* (Cambridge: Cambridge University Press, 1917).

may); rather, it offers a logical structure against which any system can be measured for degree of regularity.

In this study emphasis is placed on symmetry itself and thus on systems (pieces of music) that display the quality emphatically; but the focus can, and at times does, shift to symmetry-breaking instead. The emphasis on symmetry should thus not be taken to imply that purely symmetrical forms are in any way superior. On the contrary, it could rather be argued that some degree of asymmetry is almost always desirable in music, and virtually always present. In this connection it is instructive to quote what the science historian James Gleick says about the modern "reinvention" of geometry. Having characterized Euclidean geometry as "a powerful abstraction of reality," inspiring a "philosophy of platonic harmony," Gleick notes that it is nevertheless incapable of dealing with many of the world's complexities: "Clouds are not spheres. . . . Mountains are not cones. Lightning does not travel in a straight line. The new geometry mirrors a universe that is rough, not rounded, scabrous, not smooth. It is a geometry of the pitted, pocked, and broken up, the twisted, tangled, and intertwined. . . . The pits and tangles are more than blemishes distorting the classic shapes of Euclidian geometry. They are often the keys to the essence of a thing."[9]

The point to be stressed, however (and kept in mind throughout this article), is that the concepts of symmetry and symmetry-breaking are mutually implicative, and acquire full value only in combination.[10] In addition, symmetry can be differently defined for different uses. The operations presented in this section are those required for present purposes. But some of these, particularly involving temporal symmetry, extend beyond the scope of the term as normally applied to music; while others, which might be suitable in different contexts (including musical ones), are omitted.[11]

1) *Spatial Symmetry.* In its modern definition, symmetry applies to the quality that allows certain objects, patterns, or sets of relationships to remain invariant when subjected to a certain group of transformations. In two-dimensional space this group comprises the geometric transformations: rotation, reflection, and translation (displacement). Although all objects, including asymmetrical ones, possess a single degree of symmetry, remaining unchanged under the identity operation, the degree can range from the asymmetry of a human hand to the infinite rotational and reflectional symmetry of a circle.

Other two-dimensional figures illustrate various degrees of reflectional and rotational symmetry. Bilateral triangles have onefold reflectional symmetry (one axis about which they can be inverted without change) but no rotational symmetry; equilateral triangles have threefold reflectional symmetry (three axes about which they can be inverted) and threefold rotational symmetry (three positions to which they can be rotated about a central axis); a square has fourfold reflectional and fourfold rotational symmetry; and a pentagon has fivefold reflectional and fivefold rotational symmetry.

[9]James Gleick, *Chaos* (New York: Viking Penguin, 1987), 94.

[10]Awareness of the continuity between symmetry and asymmetry has led the psychologist Michael Leyton to argue, in his book *Symmetry, Causality, Mind* (Cambridge: MIT Press, 1992), that asymmetry is always experienced as a distortion of symmetry. He thus maintains that our sense of symmetry underlies everyday cognitive activity and, in particular, our awareness of time and history: it is "the means by which shape is converted into memory" (2). From this emerges a definition of symmetry as "absence of process-memory" and of asymmetry as "the memory that processes leave on objects" (7).

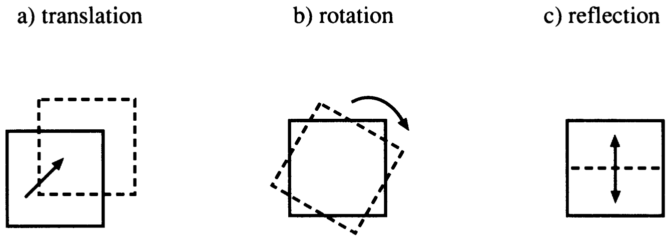
[11]For example, this paper confines itself to operations that leave size invariant, but for other purpose one might want to include as well "symmetry dilation," an operation that increases or decreases size (spatial or temporal) by powers of two. If symmetry is defined broadly as the systematic application of some operation that leaves an object "unchanged," however, the compass assumed here falls comfortably therein. But the line between what is changed and unchanged—what is accepted as a "duplicate"—may vary depending upon perspective.

When applied to figures such as these, rotation and reflection preserve position in space, as well as size and shape; but symmetry also encompasses translation, the displacement of objects in planar space. Unlike rotation and reflection, translation is not applicable to individual elements, but to series of elements recurring at regular intervals along a planar axis, as in certain wallpaper patterns, or M. C. Escher's regular-division periodic drawings, or Andy Warhol's serial portraits.[12] The translation operation moves one element to another by an interval of displacement, or some multiple thereof, along a horizontal or vertical axis (or both), leaving the pattern unchanged. Strictly speaking, it assumes an infinite extension of the periodic pattern, though the notion is commonly retained for bounded designs. One simply intuits the design as a fragment from an infinite series, as we do when we speak, for example, of a tile pattern as symmetrical.

Example 1 illustrates these three basic symmetrical transformations applied to a square in two-dimensional space.[13]

2) *Pitch-Class Symmetry*. Symmetrical pitch-class collections, by analogy, are those that remain invariant in pitch-class space under a group of transformations. Before sets are considered, pitch-class space itself warrants brief consideration, as it differs from two-dimensional space in two essential ways: 1) it contains only twelve locations; and 2) it has significant symmetrical properties of its own: twelvefold rotational and twelvefold transpositional symmetry. The rotational character stems from cyclicity: each pitch class returns to its initial position after traversing the other eleven equidistant positions by chromatic scale or circle of fiths. (Pitch space is non-cyclic, but need not concern us here.) It is this rotational-cyclical aspect that prompts theorists to represent pitch-class space as circular in form—though, strictly speaking, it is polygonal, sharing the symmetries of a twelve-sided polygon. Cyclicity also makes translation equivalent to rotation, since in this space the former also eventually leads back to its starting point.[14] Rather than these designations, however, "transposition" will be used here, following standard musical practice.

Example 1. Symmetrical transformations of a square



Pitch-class sets are collections occupying positions in pitch-class space. If unordered, they are subject to the same symmetrical operations applicable in that space: transposition (rotation about the cyclic space), and inversion (reflection about a line transversing the center of the space). If ordered, they are subject to one additional transformation: retrograde (reflection about a line passing through the center of the linear space defined by the ordered set).[15]

[12]Warhol's portraits repeat structurally identical images (with or without surface variations) in a square or rectangular grid. They include "Marilyn Monroe (Twenty Times)" (5 × 4 grid), "Troy Donahue" (7 × 8 grid), and "Philip Johnson" (3 × 3 grid). Escher's complex and varied periodic creations are discussed in Schnattschneider, *Visions of Symmetry*.

[13]These illustrations are based on Figure 2.4, "Symmetries of the Plane," in Stewart and Golubitsky, *Fearful Symmetry*, 35.

[14]This can be clarified by a spatial analogy. A decorative band with a regularly repeating design is, when laid out horizontally in physical space, symmetrical only under translation; but if it is wrapped around a vase, so that it becomes circular, the translations (which are still there) become rotations. It should be added that "rotation," as used here, has a different inflection from the one normally found in set theory, where it refers to the permutation of elements in an ordered series.

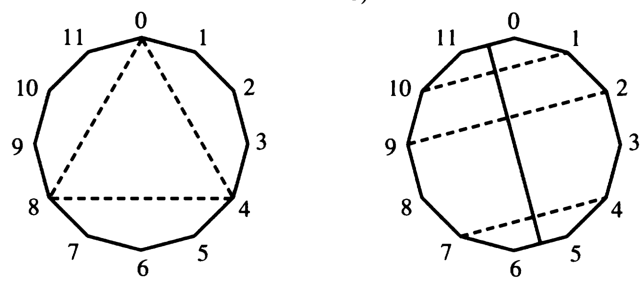
[15]It should be kept in mind that pitch-class sets, both ordered and unordered, are—like pitch-class space itself—purely relational structures,

A pitch-class set with transpositional symmetry, then, is one that divides pitch-class space into equidistant smaller segments, reducing its twelvefold symmetry to a more limited order. The simplest instances are 6-35 (the whole-tone scale, with sixfold symmetry), 4-28 (the diminished triad, with fourfold), 3-12 (the augmented triad, threefold), and 2-6 (the tritone, twofold). Just as pitch-class space is isomorphic with a twelve-sided polygon, so these sets are isomorphic with, respectively, a hexagon, a square, a triangle, and a straight line. Example 2a illustrates the "triangular" 3-12, positioned within the encompassing space. All the other transpositionally symmetrical sets are based upon these four "primitive" sets, adding one or more pitches equally to each of their pitches. Since these additions combine with the notes of the primitives to form identical subsets within some larger set—for example, (0,1,3) and (6,7,9) within 6-30 (0,1,3,6,7,9)—the subsets also map into one another under transposition. Only five such additional sets can be formed, four based on tritone division—4-9 (0,1,6,7), 4-25 (0,2,6,8), 6-7 (0,1,2, 6,7,8), and 6-30 (0,1,3,6,7,9)—and one based on major-third division—6-20 (0,1,4,5,8,9). The four primitives and five extensions, along with their nine complements, exhaust the possibilities. (Sets have identical symmetries with their complements, a redundancy that explains why no extension was derived from 4-28: if a single note is added to each member the result is 8-28, 4-12's complement. With 6-35 the result is 12-1, the total chromatic.)

Whereas transpositional symmetry is derived from equal octave division, inversional symmetry is derived from corresponding placement about a reflection line that divides the pitch-class space into two mirroring halves. For example,

Example 2. Representations of pitch-sets in pitch space

a) b)



(0, 4, 8) (1, 2, 4, 7, 10, 11)

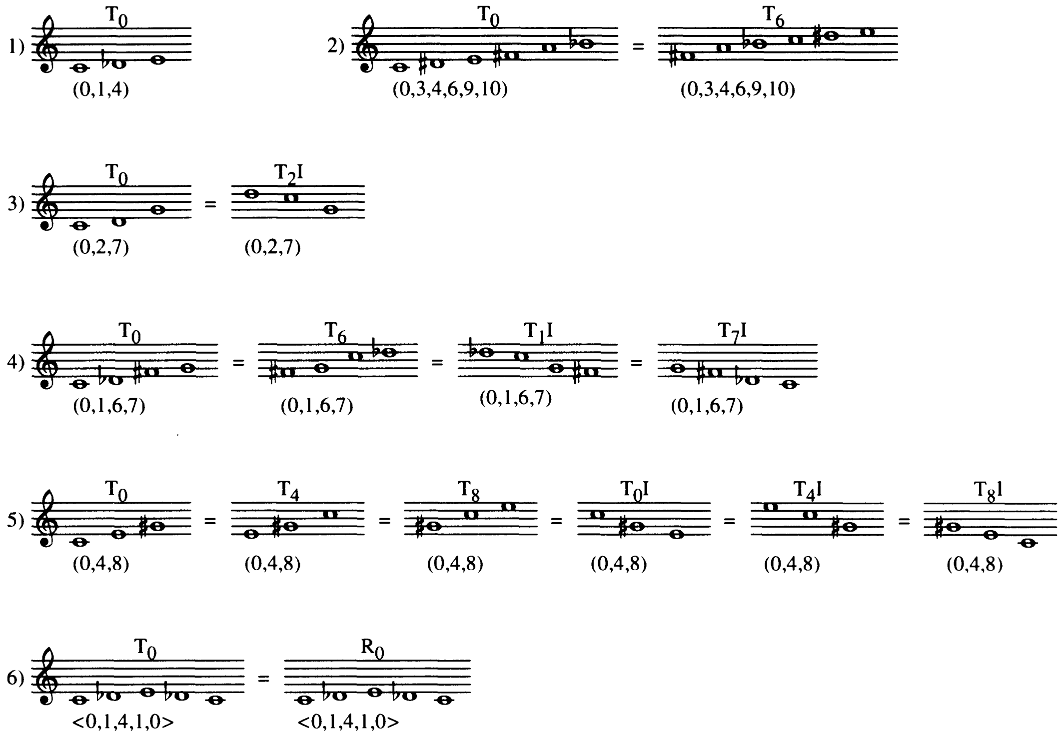
(0,2,7) reflects about a line from 1 to 7, (1,2,4,7,9,10) about a line from 5½ to 11½ (recalling that reflections occur at half the rotational angle). Example 2b illustrates the latter set's location in pitch-class space.

With one exception, sets with transpositional symmetry are also inversionally symmetrical. This applies to all four primitives, since they divide the octave equally and are thus symmetrical about reflection lines (2-6 about one line, 3-12 about three, 4-28 four, and 6-35 six); and four of the five extensions are inversional, since their added notes produce inversionally symmetrical subsets with the notes they join. For example, 6-7's two subsets, (0,1,2) and (6,7,8), are inversionally symmetrical about (1) and (7). The exception is 6-30, whose two subsets, (0,1,3) and (6,7,9), are only transpositionally, but not inversionally, symmetrical. Since inversional symmetry does not require equal octave division, relatively few inversionally symmetrical sets are also transpositionally symmetrical.

Example 3a offers several sets and their transformations to illustrate different degrees of pitch-class symmetry: 3a1 remains invariant only under the identity operation and is thus

independent of time: their possible realization in physical space is irrelevant to their status as sets. (This is equally true of pitch sets and pitch space.) Thus within the domain of sets, the concept of retrograde has a spatial or logical order, not a temporal one: a retrograde set, as a set, goes "forwards" and "backwards" without reference to time (like a series of letters on a page).

Example 3a. Pitch-set symmetries

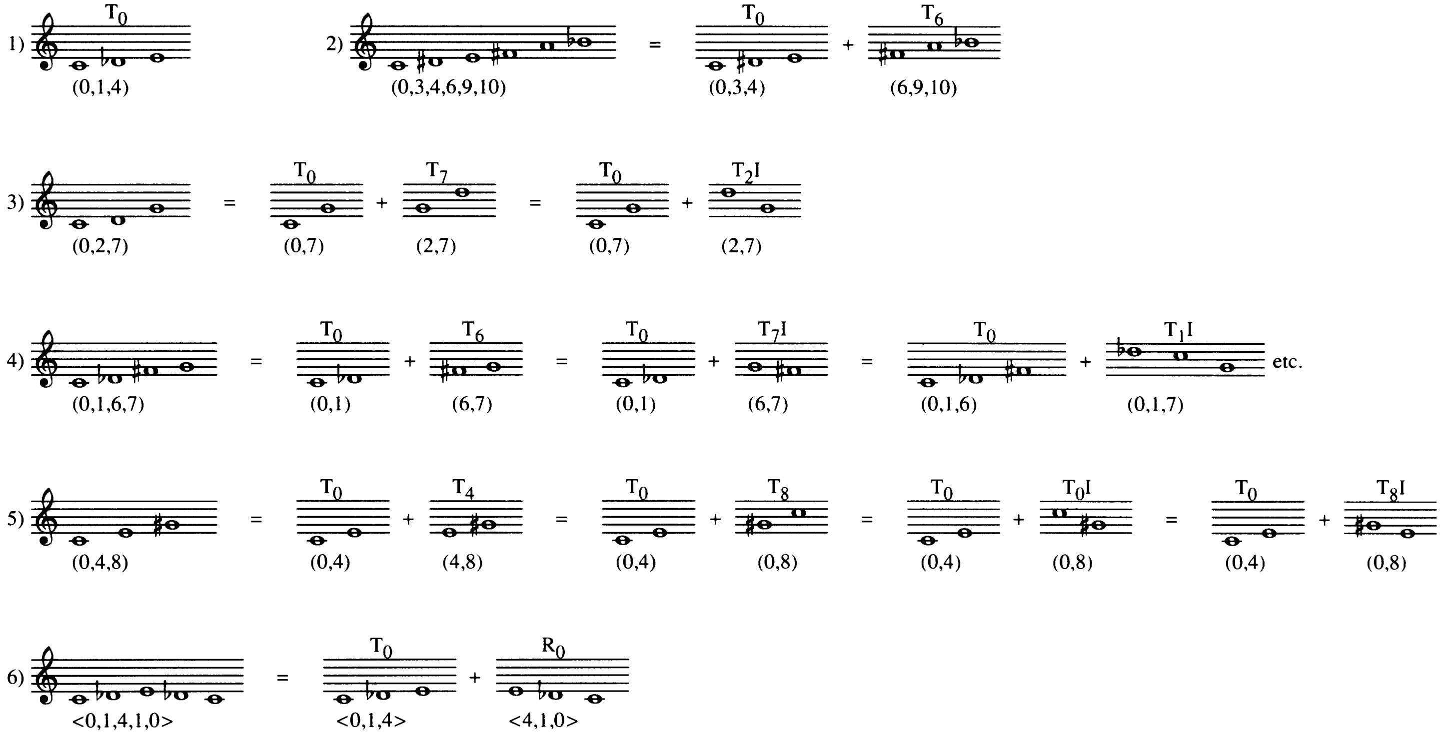


asymmetrical; 3a2 has twofold transpositional symmetry (the identity operation plus one other); 3a3 onefold transpositional and onefold inversional symmetry; 3a4 twofold transpositional and twofold inversional symmetry; 3a5 threefold transpositional and threefold inversional symmetry; and 3a6 is an ordered collection with onefold retrograde symmetry.

Pitch-class symmetry is defined here, as is normally the case, with reference to the complete set. But since a symmetrical system can be formed by applying a symmetrical operation to (at least) one of its components, it is equally possible to define any symmetrical set by its generation from one or more subsets.[16] This is illustrated in Example 3b, using

[16]Generative approaches to pc set theory, emphasizing processes rather than objects, have gained increasing currency in recent years. See especially Robert D. Morris, *Composition with Pitch-Classes: a Theory of Compositional Design* (New Haven: Yale University Press, 1987); Perle, *Twelve-Tone Tonality;* and Cohn, "Properties and Generability." The transformational approach developed by David Lewin, notably in *Generalized Musical Intervals and Transformations* (New Haven: Yale University Press, 1987), also reflects this turn.

Example 3b. Symmetrical set generation from subsets



the same sets as Example 3a: 3b1, being asymmetrical, cannot be generated from a subset; 3b2 is generated by transposition from (0,3,4); 3b3 by both transposition and inversion from (0,7); and so on.

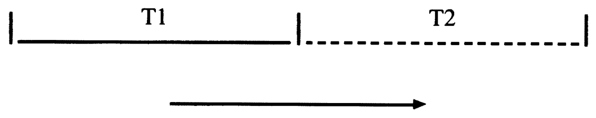
Consistent with the recursive nature of all symmetries, the generating operations used to produce symmetrical sets are the same as those that define the set's symmetry: all sets with transpositional symmetry can be generated by transposition, those with inversional symmetry by inversion, and those with retrograde symmetry by retrograde. (It does not follow, however, that all sets generated by transposition are also transpositionally symmetrical, as comparison of 3a3 and 3b3 reveals.)

As observed in connection with transpositional symmetry, some sets are cyclic: they have a periodic interval pattern (ip) that sums to 12 so that the set returns to its starting point when rotated without generating new pitch-classes. The ip can have a single recurring interval, as does the <3,3,3,3> of (0,3,6,9,(0)), or a periodically recurring series that sums to 12, as does the <1,2,3,1,2,3> of (0,1,3,6,7,9,(0)). Non-cyclic sets, on the other hand, do not partition the octave equally. It follows from this that all transpositionally symmetrical sets are cyclic and all cyclic sets are transpositional, and that the only inversionally symmetrical sets that are cyclic are also transpositional.

3) *Time Symmetry*. Temporal symmetry forms an essential component of all dynamic symmetrical systems, such as planetary motions, or the rotations of hands on a clockface (as opposed to the static clockface itself), or the passage of musical events (as opposed to atemporal pitch-sets). A temporally symmetric system, then, is one in which an event occurs regularly, separated by a recurring time-interval, and thus remains invariant under displacement by that interval. The basic idea is analogous to that of two-dimensional translational symmetry: corresponding to the regular recurrence of patterns in space, an event recurs at regular intervals in time. Or viewed from the perspective of time rather than the event: a given measure of time, defined by the temporal event, recurs after displacement in time (just as, spatially translated, a measure of space, defined by a spatial pattern, recurs after displacement in space). Here too infinite extension, forwards and backwards along the time axis, is assumed, though one commonly speaks of bounded time segments as symmetrical, intuiting an infinite extension.

Modeling time as a horizontal line, temporal translation can be represented as in Example 4, corresponding to the spatial representation in Example 1a. From this it follows that both spatial and temporal translation encompass two related components: a recurring unit of space or time (represented in Examples 1a and 4), equal to the displacement interval; and the spatial or temporal pattern—the "event"—that defines that unit (not represented in Examples 1a and 4). The pattern may or may not itself be symmetrical. The recurring figures in Escher's translational prints, for example, are almost never individually symmetrical, while the recurring geometrical figures in tile floor patterns normally are. Most

Example 4. Time translation



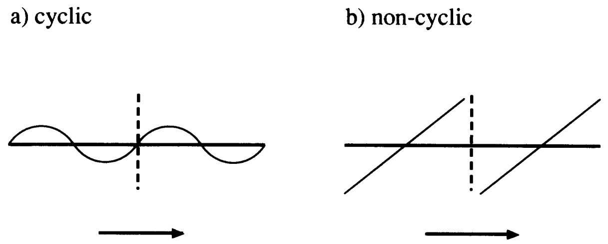
T1 original time-unit T2 translated unit

temporal patterns, since they are processive, are not symmetrical—though a steady tone, repeated at regular intervals, provides one simple instance.

In addition to distinguishing between the recurring temporal and spatial units and the patterns that define them, one can also distinguish—as in translational pitch-class symmetry—between linear patterns and cyclical patterns. The spatial and temporal units of translational symmetry are themselves always cyclical, since they continue without break until repeated; and thus all periodic patterns, spatial and temporal, have an aspect of cyclicity. But the pattern that fills this unit, whether internally symmetrical or not, may be either linear, breaking off before repeating, or cyclical, leading back without break to its repetition. The difference with regard to spatial translation is illustrated by comparing a repeating, cyclical sinus-wave design (Example 5a) with a repeating, non-cyclical sawtooth-wave design (Example 5b). Similarly, in temporal translation the dynamic processes that define the time-units may be linear or cyclical: interrupted before repeating, as in a series of pulses, or continuing without break, as in a planetary orbit).[17]

[17] This use of "cyclical," applicable to both symmetrical and asymmetrical patterns, is closely related, but not identical, to the more limited, strictly defined "cyclic" used to describe certain symmetrical systems (here previously encountered with reference to pitch-class space and cyclic pitch-class sets).

Example 5. Cyclic and non-cyclic translational symmetry



As with other types of symmetry, time symmetry is a matter of degree. An object with absolute time symmetry—a rock—remains unchanged under all time translations (at least measured within human time-frames); while a completely asymmetric process—a turbulent flow of water—undergoes constant change in time, never repeating.[18] More interesting are dynamic systems that fall between these extremes, where symmetry is broken and then reestablished when the system repeats (as in the twelve-hour period of the hands of a clock).

Time symmetry, like other types, can be conceived in terms of the overall time unit or as generated by translation of a smaller unit. (As always in such cases, the symmetry is formed not by the newly generated unit—the duplicate—alone, but by its combination with the original unit.) From the latter vantage, time symmetry is seen as a recursive process that generates periodic structures in which new content emerges from old content through various strictly defined repetition devices—a very useful lens through which to view musical form.[19]

III. SYMMETRY AND MUSICAL FORM

Musical form, broadly defined, resembles all dynamic systems in that it involves two interacting components: the musical events themselves and the abstract temporal units, independent of their content, delineated by these events. One can thus distinguish musical time—the time consumed by musical events—from musical space—the purely relational features, encompassing both pitch and rhythm, that fill this time. The time/space relationship can be crudely characterized as one between container and content. Though musical space (content) includes duration, it does so only as a succession of ordered relationships that, while they can be placed in time, are not themselves in time. And though musical space also encompasses pitch-class space, it is distinct: its configurations are not abstract collections but actual musical events, characterized by rhythm, register, dynamics, and the like.[20]

This latter, more limited sense applies to systems possessing rotational symmetry (among them twelve-tone pitch-class space and certain transpositionally symmetrical sets), which form a "cyclic group." The less restricted "cyclical," which from this point will be used exclusively here, is beneficial for understanding aspects of musical form.

[18]Although absolute temporal symmetry, strictly defined, is nonexistent in music, certain minimalist compositions, such as portions of Lamont Young's *The Tortoise, His Dreams and Journeys,* where almost nothing seems to change, tend toward this condition. Absolute temporal asymmetry occurs in exceptional cases such as John Cage's series of Variations, or his *Fontana Mix,* where each moment is—at least in principle—different from all others.

[19]Since writing this paper, and thanks to Ramon Satyendra, I have discovered Scott Kim's *Inversions* (Peterborough, N.H.: Byte Books, 1981). Kim, primarily concerned with visual symmetries involving writing (many of his symmetrical letterforms, legible both forwards and backwards and/or rightside up and upside down, are included), offers the following definition: "When you say that something is symmetrical, you mean that it can be described in terms of a systematic copying *rule* (the form) and a basic *module* (the content). Applying the rule to the module recreates the whole" (82). (Kim's "form," or "rule," corresponds to my "operation," whereas my "form" corresponds more closely to what he calls the "whole.") This dynamic conception of symmetry also relates to the transformational approaches mentioned in footnote 16 above, but these tend to focus on the transformations themselves, rather than—as here—the overall temporal-formal result.

[20]The term "space" has often been applied to music and has recently been developed in rigorous theoretical contexts, especially by Morris, *Composition with Pitch-Classes,* and Lewin, *Generalized Musical Intervals and Transfor-*

Formal symmetry thus encompasses both temporal and spatial components, but what is of primary interest is how the two interact. If both are symmetrical, repeating periodically, there is complete symmetry. But a lesser degree of formal symmetry, with only one component strictly duplicated (and thus symmetrical) is also possible. Since within the context of musical form the repetition of a pitch-durational pattern always generates the time required to contain it, content symmetry always produces temporal symmetry, and thus complete symmetry. Temporal symmetry, however, can appear with either exact or only partial content duplication. Though the former is our chief concern, we begin with the latter.

1) *Partial Content Duplication.* Since musical events do not themselves need to be symmetrically related to define symmetrical time-units, but only sufficiently associated to make the units seem related, formal symmetry is often of a purely temporal nature, composed of regularly recurring time units without exact content duplication. Purely temporal symmetry is common in tonal music, as evident in the propensity for metrical relationships at various levels of rhythmic structure; and its significance is reflected in a very sizable body of music theory.[21]

The eight-measure phrase opening the Menuetto II of Mozart's E♭ major Piano Sonata K. 282, Example 6, provides an instance. The music projects time-periods that form strictly symmetrical patterns (beats group into bars, bars into hyperbars, hyperbars into subphrases), yet the content varies throughout. The symmetry of the passage thus stems from an abstract, quadratic time-grid, not strict correspondence in

mations, who distinguish among various sub-categories, such as chromatic and diatonic pitch and pitch-class space, harmonic space, time-point space, and contour space. Symmetry and musical space have been linked most famously by Schoenberg in "Composition with Twelve Tones": "the employment of [the] mirror forms corresponds to the principle of the *absolute and unitary perception of musical space.*" *Style and Idea,* ed. Leonard Stein (Berkeley: University of California Press, 1984), 225. But theorists have long recognized spatial-symmetrical attributes in tonal music, most notably in graphic depictions of the "circle of fifths." Peter Westergaard offers a witty discussion of such representations in "Geometries of Sounds in Time," *Music Theory Spectrum* 18/1 (1996): 1–21. The spatial-temporal distinction is treated in Robert P. Morgan, "Musical Time/Musical Space," *Critical Inquiry* 6/3 (1980): 527–38. For a philosophical-historical account, see Edward A. Lippman, "Music and Space" (Ph.D. diss., Columbia University, 1952).

[21]This theoretical tradition, reaching back to Gottfried Weber and Moritz Hauptmann and still alive today (for example, in William Rothstein's work), is committed not only to finding temporal symmetries but to explaining non-corresponding units as departures from "ideal," corresponding ones. Such theorists need not ignore musical content, since even so basic a question as why one hears a temporal unit as a unit demands reference to musical events. When they deal with content, however, they normally forsake the realm of pure symmetry to pursue relationships between a symmetrical time-frame and asymmetrical content. Even those committed to this way of thinking, moreover, usually acknowledge that purely durational symmetry eventually yields at more extended spans to organic, goal-directed processes produced by actual events. As determined a symmetrist as Hugo Riemann thus writes: "The eight-measure phrase, with its four distinctions between weight of measure (1. odd-numbered measures [1,3,7,9], 2. even-numbered measures, 3. subphrase ending, 4. phrase ending) already allows room for a broad development; and differentiated weight in spans of more than four measures can hardly continue to be experienced rhythmically, but only according to relationships of thematic structure." Hugo Riemann, *Grosse Kompositionslehre* (Berlin und Stuttgart: Verlag von W. Spemann, 1902) 1: 49–50. ["Der achttaktige Satz mit seinen vier Gewichtsunterscheidungen für die Taktschwerpunkte (1. ungeradzahlige Takte [1,3,5,7], 2. geradzahlige Takte, 3. Halbsatz-Ende, 4. Satz-Ende) gibt schon einer recht breiten Entwicklung Raum and ein verschiedenes Gewicht in noch grösseren Abständen als von 4 Takten wird doch wohl schwerlich mehr rein rhythmisch, sondern nur noch an den Beziehungen der thematischen Gestaltung empfunden."] Among studies exploring quasi-symmetrical time-proportions in large-scale form, three may be mentioned: Ernó Lendvai, *Béla Bartók: an Analysis of His Music* (London: Kahn and Averlii, 1971); Jonathan Kramer, *The Time of Music* (New York: Schirmer Books, 1988); and Roy Howat, *Debussy in Proportion* (Cambridge: Cambridge University Press, 1983).

Example 6. Mozart, Piano Sonata K. 282, Menuetto II, mm. 1–8

content. And it is precisely the complex, nuanced relationship between the rigid symmetries of the temporal frame and the deviations of content that enlivens the form.

These irregularities, moreover, actually help articulate the symmetry of the time-structure. The three-beat tonic accompanimental pattern of m. 1 is set off against the closely related but different pattern of m. 2, as is the m. 1 downbeat melodic arrival from the suspended one in m. 2: that is, dissimilarities distinguish the two measures just as correspondences link them. Similarly, mm. 1–2 are clearly related to mm. 3–4, yet set off from them by melodic variation. Finally, the second four measures contrast with the first through triplet-dominated rhythm and a shift of the sixteenth-note figure from upbeat to downbeat; yet at the same time the latter measures grow out of and extend the former, continuing their upward trajectory (balanced by descending scalar motion) and completing an unbroken linear-harmonic motion extending from m. 1 to m. 8.

Non-correspondence is particularly emphasized as the final cadence approaches: while m. 6 echoes m. 5, quasi-sequentially, maintaining the grouping established in mm. 1–2 and 3–4, the last two beats of m. 7 interrupt the pattern, echoing m. 6 and thus creating a breaking effect released only at the cadence. Although this compromises temporal symmetry at the two-measure level, it allows the final four measures to unfold as a single unit: symmetry is broken at the two-measure level so that it can be reestablished at the four-measure level, just as the phrase is completed. Such lower-level symmetry-breaking followed by reestablishment at a higher level is typical. In addition to countering the blandness of metrical regularity, it underscores the conflict-resolving larger correspondence (here 4 + 4), shifting weight toward the close. Similarly, at a still higher level, the harmonic-linear motion that spans all eight measures, which does not support the 4 + 4 temporal division, helps define the larger 8 + 8 symmetry that occurs when a new eight-measure unit follows (not shown). This give-and-take between symmetry-breaking and symmetry-affirmation informs virtually all tonal music.[22]

There will always be some degree of content correspondence between symmetrically related time-units (otherwise they would not sound related); and the closer the correspondence, the more strongly overall symmetry is evoked. This is illustrated by that most common of tonal forms, the parallel antecedent-consequent period, where the consequent mirrors the antecedent faithfully until the final cadence. Examples are presented in the next section, preliminary to the discussion of purely symmetrical periods.

2) *Full Content Duplication.* Complete formal symmetry combines exact repetition of content with repetition of the time-unit.[23] This occurs when the content of a generating unit (itself usually asymmetrical) undergoes some symmetrical operation, which is combined with time translation. The time-unit must repeat exactly; but the content can undergo three different kinds of duplication: literal, transposed, or reflected, with the last subdivided into inversion, retrograde, and retrograde inversion.[24]

By way of summary, Example 7 provides diagrammatic representations of the different types and degrees of formal symmetry determined by content duplication.

A) Literal duplication. Though complete formal symmetry with literal content duplication is common in tonal music, it can assume only a circumscribed role within this goal-directed, tension-release framework. Since what is structurally most essential in such music derives from a reconciliation of opposed forces, not a balance of identical ones, repetition can supply confirmation but not synthesis: it extends temporally but adds nothing tonally.

Exact repetition thus occurs in restricted formal contexts. In the contrasting theme of the first movement of Mozart's E♭ major Piano Sonata K. 282, mm. 9–15, shown in Example 8, a short subphrase is exactly repeated to produce a larger one: mm. 9.2–10.1 recur in mm. 10.2–11.1. This symmetrical pair is followed by a longer contrasting unit (mm.11.2–13.1), however, subsuming it within a larger, assymmetrical whole (a 1+1+2 sentence). The generating unit, typically, tends itself toward symmetry: the oscillating top-voice motion between B♭4 and F5, ornamented by neighbors, along with a symmetrical I–V^4_3–I progression, creates a delicately poised balance that leaves the unit weakly bounded, requiring continuation. The literal repetition thus functions as a delay, diminishing rather than increasing stability.

[22]The fact that the content of the right hand is temporally out of phase with the left in the first four measures (though not the second), and thus works against the temporal symmetry, provides another example of the complex interplay between symmetrical and non-symmetrical features in this music. Unfortunately, however, it is necessary to limit discussion here, and in subsequent musical examples, to only the most basic features pertaining to symmetry.

[23]Some leeway is left for variation between originals and duplicates in the examples of exact content symmetry offered here. Although precise specification of the line separating exact from non-exact repetition may in certain instances be difficult, it should suffice for present purposes to say that, according to the definition here, "exact" repetition allows for variation in only the most superficial features of the original. Such alterations can nevertheless have formal significance, as will become apparent in the discussion of several of the examples.

[24]It should be noted that, when combined with time translation, the standard symmetrical operations associated with pitch-class sets assume a somewhat different character. Literal repetition, for example, is not equivalent to the identity operation, nor is it trivial, since it is associated with a newly generated time unit (whose content it supplies). And whereas a pitch-class set is transpositionally symmetrical only when it maps into itself, any transposition of musical content is associated with a degree of formal symmetry in that it produces a new time-unit of equal length, and thus translational time-symmetry. Finally, unlike transpositionally symmetrical sets, formal transposition need not produce a self-enclosed cyclical structure, although it may.

Example 7. Types of symmetry distinguished by content repetition

1 No Content Duplication (time symmetry)

| a || b |

a = generating unit
a ≠ b

2 Partial Duplication

| a || a' |

a = generating unit
a partially = a'

3 Full Duplication (complete symmetry)

a) literal

| a || a |

a = generating unit
a = a

b) transposed

| a1 || a2 |

a1 = generating unit
a2 = transposition of a1

c) reflected
(inversion, retrograde, retr/inv.)

| a1 || a2 |

a1 = generating unit
a2 = mirror of a1

All bracketed time-units are identical in duration.

The continuation (m. 11.2ff.), by contrast, is strongly directed. It immediately takes up the preceding F5–G5–F5 with faster surface rhythm, and extends the upward direction to B♭5 before descending from F5 through a strong linear progression to B♭4 (mm. 11.3–13.1). Though asymmetrical in content, it balances the combined first two measures temporally. Following a deceptive cadence (m. 13), the phrase is extended by a varied repetition of its second half with greater surface acceleration, plus a subsequent cadential confirmation. The symmetrical repetition thus yields to a goal-directed process incorporating symmetry-breaking as well as symmetry-affirming features.[25]

The threat of formal open-endedness in literal repetition is significantly countered if the generating unit is cyclical, leading back to and overlapping with its repetition. In the first two-measures of Mozart's C major Piano Sonata, K. 279,

[25]Again Mozart's content-defined temporal units (here in both hands) fail to correspond with the metrical units of the notated meter, either at the measure or half-measure level—an important matter whose discussion would take us too far afield.

Example 8. Mozart, Piano Sonata K. 282/i, mm. 9–15

Example 9, the opening event is a root-position tonic triad with a tonic top voice, which, when the generating unit leads back to it, supplies both the unit's cadence and the opening of its repeat (m. 3.1). Here the unit is so strongly end-directed one may wonder how the piece can get underway (no doubt explaining why such constructions are rare at the beginning of complex compositions). As in the previous example, the generating unit itself evokes symmetry through quasi-inversional contour in the outer voices: C5 (m. 1) to A5 (m. 2.1, the exact midpoint) to C5 (m. 3.1), simultaneously mirrored in the bass by C3 to F2 to C3. When the repetition returns yet again to the opening tonic position (m. 5.1), however, a more extended, processive phrase begins, retracing more deliberately the top-voice motion of the symmetrical units: from C5 up to A5, as upper neighbor of G5 (twice, m. 7 and m. 9, the latter repeated m. 11), then returning from G5 to C5 in a harmonically supported linear descent. Once again, the symmetrical opening is absorbed within a larger group.

Due to their closing character, such cyclical repetitions (often recurring several times) function most commonly as cadential confirmations, repeatedly circling back to a previously established cadential chord. One of countless examples appears at the close of the finale of Beethoven's F minor Piano Sonata op. 2, no. 1, Example 10, where the symmetry of the repetition is again underscored by simulated reflections

Example 9. Mozart, Piano Sonata K. 279/i, mm. 1–12

in the generating unit: top-voice oscillations between F4 and F6 (mm. 189–191.1), with neighbor-note figures at both extremes. Here the pattern breaks after a single repetition, the top-voice remaining in the upper register (m. 194) before descending through four octaves to F2, the final F4–F2 inversionally mirroring the initial F4–F6.

Sometimes cyclical confirmations exploit octave equivalency to descend (or more occasionally, ascend) so that the repetition takes place in a different octave. The three-measure generating unit at the close of the first movement of Mozart's C minor Piano Sonata K. 457, Example 11, overlaps with its repetition an octave lower (m. 179ff.), and the repetition then descends an additional octave. Cyclical symmetry is thereby conjoined with a developmental process (registral descent) that has strong closing implications. The interplay of symmetrical and non-symmetrical elements is also found in the generating unit itself: downward transposition of the opening falling-fourths, C–G (m. 176) to A♭–E♭ (m. 177) and F–C (mm. 178–79), producing a quasi-symmetrical descent through the octave (C4–C3 in the left hand, mm. 176–79), combines with a processive 1 + 1 + 2 metrical grouping (masked by the fourth-measure overlap). The symmetrical features largely give way at m. 182.1, however, when the right hand omits the tonic return, and a closing segment is added that brings down the stranded G3 of m. 181.4 to the final C3.

Example 10. Beethoven, Piano Sonata Op. 2, No. 1/i, mm. 189–96

Example 11. Mozart, Piano Sonata K. 457/i, mm. 176–85

B) Transposed duplication. Transposed duplication also appears frequently in eighteenth- and nineteenth-century music; but like exact repetition, it rarely articulates complete formal units. In the opening of the last movement of Haydn's E♭ major Piano Sonata Hob. XVI:50, shown in Example 12, the first, tonic phrase (mm. 1–8) is exactly repeated, transposed (diatonically) to the key of the second scale degree (mm. 9–16). But a third phrase returns to the tonic (mm. 17–28), subsuming the previous two within a larger sentential structure. The tendency of strict repetition to destabilize formal relationships is even more evident here, since the shift away from the tonic increases tension (especially given the lack of harmonic movement). The longer and more explosive third phrase breaks the symmetry and resolves the tension.

While transpositional symmetry rarely defines complete formal units in tonal music, there is nevertheless a marked increase in transpositional repetition in nineteenth-century music. Strict transposition is normally interrupted, however, incorporated within a larger, processive structure. This is true even when the transpositional scheme is combined with equal division of the octave, so that continued transposition leads back to the tonic. Such frequently cited octave cycles as those found in Schubert's *Rosamunde* Overture and Schumann's *Novelette* no. 1 (both by minor third), or Liszt's *Consolation* no. 1 (by major third), are all projected through differentiated content, with the generating unit varied as the cycle nears its end, allowing for a stronger tonic close.[26]

Under extraordinary circumstances, strict transpositional symmetry can nevertheless be found in complete formal units in nineteenth-century music—as in certain appearances of the Eternal Sleep motive from Wagner's *Ring,* where it reflects the otherworldly quality of the motive's dramatic associations. A version that appears in the third scene of Act 3 of *Die Walküre,* Example 13, has a two-measure model (mm. 1617–18) followed by three sequences, moving tonally through major thirds: A♭–E, E–C, C–A♭, A♭–E (the second A♭ spelled G♯); and since each unit overlaps with its repetition, the passage is also formally cyclical.[27]

Since these measures are clearly set off from the surrounding ones, transpositional symmetry here, exceptionally, encompasses a relatively complete formal unit. (There is also a discernable E major tonal orientation, heavily dependent upon a pedal E in the timpani; the preceding and subsequent formal segments are also in E.) Since nothing differentiates the last arrival, however, the form is open-ended: the sequence could in principle continue indefinitely.[28]

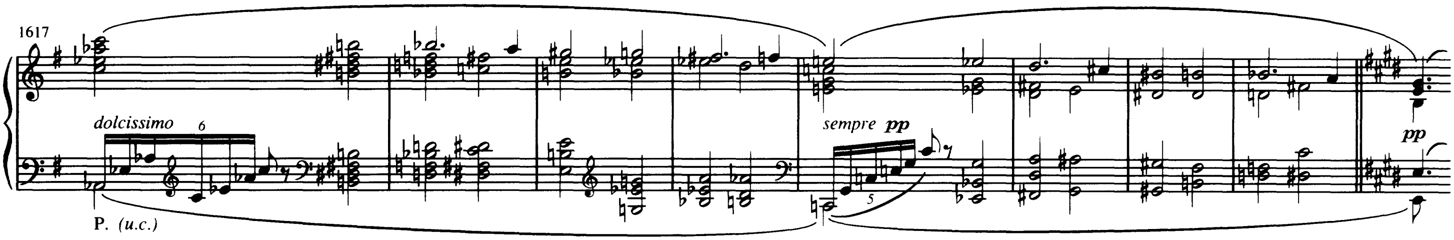
[26]Approximate—as opposed to exact—transpositional symmetry is relatively common. An extended example with incomplete (non-cyclical) octave division, opens Chopin's F♯ minor Nocturne, op. 48, no. 2, where mm. 3–11, moving from i to v, overlap with a transposed repetition, mm. 11–23, moving from v to II. The transposition is altered by an interpolation, however, strengthening the cadence on II; and the cadential chord is changed to major and extended. The entire opening unit, mm. 1–28, is then repeated, untransposed (mm. 29–56). Given this near-symmetrical form, one might be inclined to see C♯ as a symmetrically positioned medial axis between F♯ and G♯; yet its contextually unambiguous function as V, and of G♯ as V of V and F♯ as I, undermines any suggestion of a pitch symmetry with C♯, rather than F♯, as center.

[27]Here, more than in other examples considered, there are divergences, particularly in the second of the four two-measure units, where the second and third harmonies differ. These only involve (in addition to orchestration) the inner voices of passing chords, however, and thus do not affect the outer-voice structure or underlying sequential pattern.

[28]Brian Hyer offers some suggestive comments on the tonal features of this motive and their connection to an earlier, fragmented version in "Reimag(in)ing Riemann," *Journal of Music Theory* 39/1 (1995): 111–16. The motive's evolution throughout the *Ring* is notable, from its first, not-quite-symmetrical statement earlier in *Die Walküre,* Act 3, Scene 3, through this symmetrical one plus others in *Siegfried,* to the last act of *Die Götterdämmerung,* where it loses symmetry again. (It also acquires augmented-triad harmonization in the Prelude to *Siegfried,* Act 1.)

Example 12. Haydn, Piano Sonata Hob. XVI:52/iv, mm. 1–28

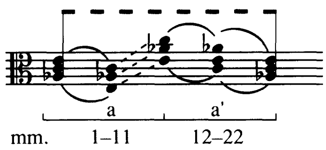
Example 13. Wagner, *Die Walküre* III/iii, mm. 1617–25



In those cases, still more exceptional, where tonal definition is avoided entirely, strict formal symmetry can encompass extended, self-contained formal units. The introduction to Liszt's *Faust* Symphony projects equal major-third division in both overall pitch motion and harmonic structure. As sketched in Example 14, the overall motion is defined by a generating unit (a, mm. 1–11), which prolongs the controlling augmented triad, plus a single transposition at T_8 (a′, mm. 12–22), retaining this same triad. A critical alteration appears in the transposition: the unaccompanied melodic motion E5–G♯5 (A♭) from m. 3.4 becomes C6–C6 at m. 14.4, simply repeating (instead of C6–E6), so that the transposition continues a major third lower, at T_4 instead of T_8. This change produces cyclicity: since the generating unit falls a major third, the transposition can only begin where that unit ends (actually an octave higher) and end where it begins if it falls two major thirds rather than one.

Though the introduction has only a parenthetical function within the movement's overall C major tonality (it returns unaltered roughly halfway through as a sort of tonal-formal island), in Liszt's later compositions, where he occasionally abandons traditional tonal functions entirely, transpositional symmetry is sometimes employed to project the principal tonal motion of an entire composition. Example 15 sketches the first of the two late piano pieces entitled "Die Trauer

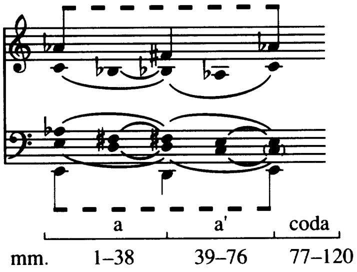
Example 14. Liszt, *Faust* Symphony, mm. 1–22, analytical sketch



Gondel" (1882), also based on major-third division, which begins with an extended opening segment (a), mm. 1–38, that is transposed down by wholestep (a′) in mm. 39–76. Since the combined tonal motion of the two sections, each of which descends a wholestep internally as well, is a major third, the pitches of the original augmented triad are restored. A third section, mm. 77–120, is not symmetrically related, but functions as a coda, prolonging the final augmented sonority and returning the outer voices to their original registers. Perhaps uniquely in nineteenth-century music, symmetrical form, tonal cyclicity, and harmony here join to form a completely self-enclosed structure—one that is achieved, however, at the expense of common-practice conventions.[29]

[29]I have discussed these two Liszt pieces, along with other compositions based on diminished-seventh and augmented-triad prolongations, at more length in "Dissonant Prolongations: Theoretical and Compositional Precedents," *Journal of Music Theory* 20/1 (1976): 49–91.

Example 15. Liszt, *The Funeral Gondola,* I, analytical sketch



C) Mirrored duplication. Even more rarely encountered is mirror repetition, except in the specialized domain of learned contrapuntal practice. A few non-contrapuntal instances will be considered later, but here we focus briefly on questions of formal symmetry in mirror canons. Mirror devices survived into the common practice period as a holdover from Medieval and Renaissance music, where they were relatively common, though almost always combined with free voices. (Complete formal retrogrades such as Machaut's Rondeau "Ma fin est mon commencement" are extremely unusual.) Such devices persisted into the common-practice period, but were set apart from normal compositional practice as a showcase for contrapuntal ingenuity. And of the three mirror types, only inversion remained common.

Strict inversional canons, however, are not formally symmetrical, at least not if the imitating voice follows the *dux,* as is normal, after an interval of time. For as with all canons in which the leading voice temporally precedes the imitation, the counterpoint heard in conjunction with the leading voice at a given moment will not mirror what is heard in the following voice at the corresponding moment. A special kind of simultaneous inversional relationship appears in the two mirror fugues from Bach's *The Art of the Fugue,*[30] where each fugue exists in two forms, one an exact inversion of the other. But though the two are notated together as a symmetrical pair, one placed above the other, they cannot be played in combination, but only individually; and individually they are not symmetrical.

Unlike inversional canons, retrograde canons are formally symmetrical whether the voices begin separately or (as usual) simultaneously. The first of the five *Canones diversi* from Bach's *Musical Offering,* notated as a single line read simultaneously forwards and backwards, can be viewed as a two-part formal structure with a generating unit (the first half) and retrograde repetition. But since this canon is conceived as an uninterrupted line combined simultaneously with its retrograde, rather than as two discrete units, there is no central formal articulation to define the retrograde form. Phenomenologically considered, the retrograde is spatial, not temporal, for it articulates a single time-unit. This applies as well for that rarest of mirror types, the retrograde-inversion canon.[31]

There is at least one canon by Bach that has a distinct generating unit (itself asymmetrical), but its formal symmetry is transpositional rather than retrograde. This is the *Canon per tonos,* fifth of the *Canones diversi,* which opens with a unit that modulates upwards by wholestep and is then transposed until it returns to the starting point. Given appropriate octave adjustments, this is a perpetual canon, and like all such canons it is cyclically symmetrical. But perpetual canons do not normally have, as here, generating units, and thus return to

[30]The two pairs are numbered 16 and 18 in the Breitkopf & Härtel edition (Leipzig, 1926), but elsewhere sometimes 12 and 13.

[31]An example of such a canon by Johann Christian Lobe, whose symmetry allows it to be read either right side up or upside down, is included along with other canons illustrating rarified contrapuntal devices in Ebenezer Prout, *Double Counterpoint and Canon* (New York: Greenwood Press, 1969 [1893]), in the chapter "Curiosities of Canon," 235–73.

their openings by asymmetrical routes. And while the *Canon per tonos* is symmetrical, only its generating unit is canonically conceived, the remainder being derived by transposition.[32]

IV. FORMAL SYMMETRY AND THE PARALLEL PERIOD

The tonal form most commonly associated with symmetry is the parallel period, with antecedent and consequent phrases that are similar in content and equal in length. Since the consequent must provide a more conclusive ending than the antecedent, however, the two phrases are normally not identical, and thus only simulate symmetry. Fully symmetrical parallel periods can nevertheless be constructed, as we shall see. But before turning to these exceptional cases, we begin with a consideration of the role of symmetry-breaking in more standard types. Though the most common tonal layout for the parallel period is I–V / I–I (both phrases beginning on the tonic, the first cadencing on the dominant and the second on the tonic), the three chosen here take alternative routes: I–I / I–I; I–V / ii–I, and I–V / V–I.

In the I–I / I–I period of Chopin's A major Prelude, op. 28, no. 7, Example 16, the simulation of symmetry is especially pronounced, the exact durational correspondence being coupled with unusually close content correspondence. The Prelude's two phrases are virtually identical in surface rhythm, texture, and contour, and there is absolute rhythmic regularity at the two-measure level. Exact correspondence breaks when the top-voice is altered to C♯ in m. 11, leading to a new chord in m. 12 (V^7/ii). Though the change is striking, it confirms tonal conventions: while the particular chord is a surprise, something like it, signaling a new ending, is expected.[33] Typically, the symmetry-breaking moment is accompanied by a rhetorical flourish, here an unprecedented harmonic turn. Closer correspondence between antecedent and consequent is subsequently reestablished (here underlined by the phrases' shared tonic cadences), restoring a degree of symmetrical balance; yet the final cadence is clearly differentiated, approached by faster harmonic rhythm (one measure each of ii and V in mm. 13–14, versus V alone in mm. 5–6), and provided with a more stable melodic goal (tonic in top voice in mm. 15–16, versus the third in mm. 7–8).

In the I–V / ii–I period opening Mozart's Piano Sonata in D major, K. 576, Example 17, the consequent begins a major second higher, simulating transpositional symmetry (in diatonic space). There is also a suggestion of inversional correspondence (the framing melodic motion D4 to E5 of the first phrase is reflected back E4 to D5 in the second), as well as close correspondence between the two cadential chords. Yet since the antecedent's I–V is answered asymmetrically by ii–(V)–I, the correspondence is not exact. The second cadential chord, for example, transposes the first one +5 harmonically, but −2 melodically. Again the symmetry-breaking moment leading to the final cadence is dramatically marked: mm. 6.6–7.4, while derived from mm. 2.6–3.4, have faster surface rhythm and greater upward extension (to B5).

The I–V / V–I period offers the possibility of pure mirror symmetry, as discussed below; but such periods are normally no more symmetrical than others. The correspondence between the two phrases opening the finale of Beethoven's C minor Piano Sonata op. 10, no. 1, Example 18, is close, and the second retains the first's 1 + 1 + 2 grouping. Yet the latter

[32] Hofstadter discusses the *Canon per tonos* in *Gödel, Escher, Bach,* 10–11, 717–19, as part of his examination of recursive structures ("strange loops" or "tangled hierarchies," he calls them) in different cognitive domains, including music, art, mathematics, and logic.

[33] The mistaken idea that m. 12 of the Chopin breaches classical conventions formed the basis of a "deconstructivist" reading of the Prelude presented at a session of the 1987 AMS Conference in New Orleans.

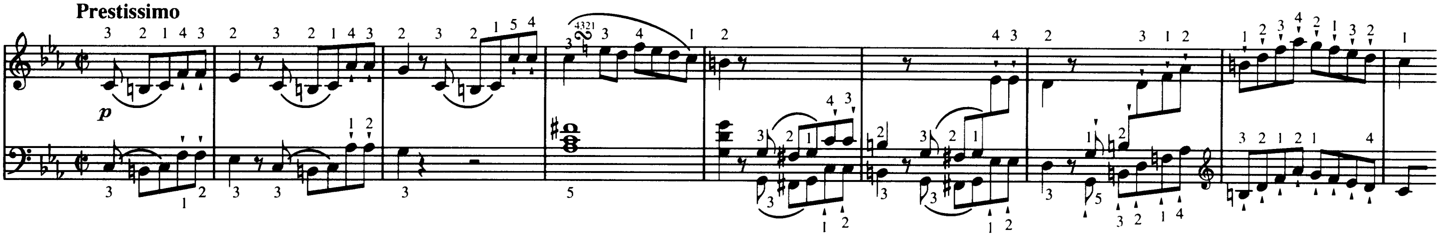
Example 16. Chopin, Prelude Op. 28, No. 7

Example 17. Mozart, Piano Sonata K. 576/i, mm. 1–8

introduces an explosive arpeggio when symmetry is broken in mm. 6–7; and it starts below and extends above the first, surrounding it, making the whole seem almost as much a single process as a synthesis of two.

Despite the critical role played by symmetry-breaking in the parallel period, common-practice composers were consistently drawn to the form's symmetrical potential, favoring consequents that closely mirrored their antecedents. This should come as no surprise, given the deep attraction of symmetry. But what *is* surprising is that the inclination could be, and under certain circumstances was, fully realized, giving rise to a type of purely symmetrical period. It is possible to trace a developmental path encompassing these periods—far less traveled, to be sure, than the one defined by asymmetrical periods, but spanning much of the common-practice period. Since this path yields the most emphatic symmetrical forms in the tonal literature, yet evidently has remained previously unexamined, it is of special interest here and will

Example 18. Beethoven, Piano Sonata Op. 10, No. 1/iv, mm. 1–8



occupy us almost exclusively from this point. It includes periods of two kinds, one retrograde and the other transpositional. We begin with the former, far rarer type.

The often cited Menuetto al Rovescio from Haydn's Piano Sonata in A major of 1773, Hob. XVI:26, Example 19, is a I–V / V–I period with two phrases of equal duration.[34] Here, exceptionally, Haydn capitalizes upon the symmetrical possibilities of this progression: he exactly retrogrades the antecedent in the consequent.

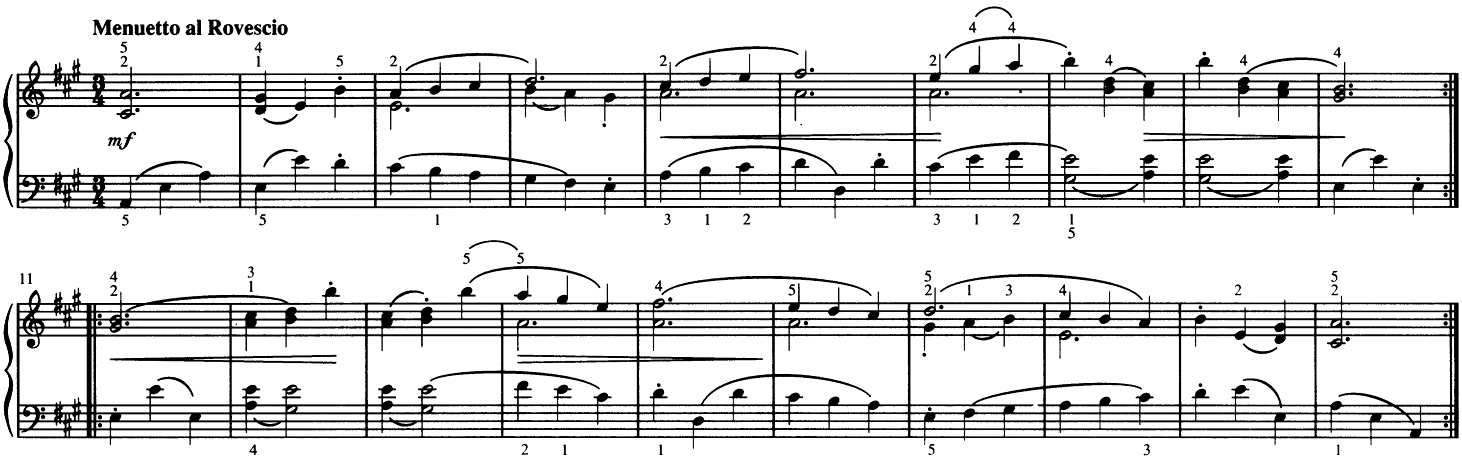
Sense is conferred on the backward motion through a number of clever stratagems, most obviously the construction of the first phrase from two palindromic progressions, I–V–I and I–IV–I, that remain unchanged when reversed. This phrase is also provided with a linear progression that moves from the tonic A4 (m. 1) up through the octave to the second scale degree, B5 (m. 8), then back down to B4 at the closing half cadence (m. 10), which works equally well backwards (it produces the same underlying $\hat{1}$–$\hat{2}$ / $\hat{2}$–$\hat{1}$ progression found in Example 17). Acceleration of harmonic rhythm is even provided as the consequent approaches the final cadence: omission of the inner voices of the V^4_2 chord at m. 2.3 enables it to become a dominant preparation (ii^6) at m. 19.1.

[34]This movement is a piano transcription (transposed up a major second) of the Minuet from the Symphony No. 47 in G Major, composed the previous year.

Measured by classical norms, the minuet nevertheless has certain peculiarities. Though the intensification of activity in mm. 8–9 of the antecedent seems normal enough, where it leads to an important cadence, it sounds decidedly—if charmingly—bizarre when retrograded near the *beginning* of the consequent, mm. 12–13, especially since it produces an unprecedented syncopation in the harmonic rhythm. The sudden return to the upper octave provides an expressive jolt that initially seems forced, yet plays itself out effectively over the long descent during the remainder of the consequent. Perceptual differences between antecedent and consequent also extend to the rhythmic groupings: those antecedent measure-groups linked by upbeats to melodic half notes, mm. 3–4 and mm. 5–6 of the first phrase, for example, are repositioned to mm. 4–5 and 6–7 of the second. The retrograde thus sounds essentially like normal ("forward") music. (The fact that listeners may not recognize the second phrase as a reversal of the first does not defeat the idea: a mirror structure under time produces a possible, comprehensible result, not necessarily a recognizable transformation.[35])

[35]Attack and decay characteristics, which are asymmetrical and immediately perceptible when reversed, are ignored, since the concern here is with the disposition of musico-spatial content in time, not the acoustical properties of its realization.

Example 19. Haydn, Piano Sonata Hob. XVI:26/iii, mm. 1–20



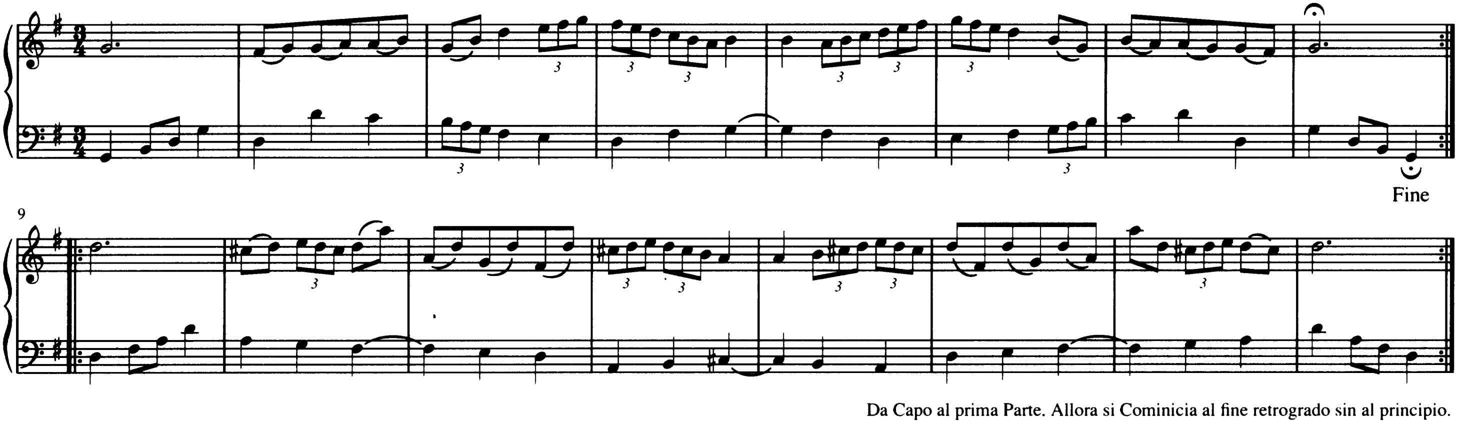
This Minuet and its Trio, also a retrograde period, are evidently the only two such compositions by Haydn. There is a somewhat earlier example by C. P. E. Bach, a Minuet in C major published in 1770, also a I–V / V–I period, which resembles the Haydn in overall layout but is simpler in detail.[36] An even earlier instance, a *Menuetto cancrizante* (entitled "Die Sonne im Krebs"), Example 20, appears in Gregorius Joseph Werner's *Der curiose musikalische Instrumentalkalender* of 1748, a set of twelve suites. Unlike Haydn's, this minuet has three sections instead of two (the third being a *da capo*), with each section forming a self-enclosed retrograde; and the generating units of all three lead into their respective retrogrades without significant articulation. Although the middle section anticipates the tonal scheme of the Haydn (I–V mirrored by V–I), the generating units in the outer sections are tonally circular (I–I) and thus retain their overall course when retrograded.[37]

Perhaps not surprisingly, retrograde periods had a brief history, with apparently none published after Haydn. Indeed, retrograde construction seems generally to have gone into eclipse toward the end of the eighteenth century (except for occasional appearances in contrapuntal contexts, such as Beethoven's *Hammerklavier* Sonata, op. 106/iv), emerging again only in the early years of the twentieth. Recently a palindrome (though not a period), perhaps unique in nineteenth-century music, was discovered in Schubert's opera

[36]A score is included in *Nagels Musik-Archiv* 65 (C. P. E. Bach, Kleine Stücke für Klavier), ed. Otto Vriesländer (Hanover: Verlag Adolph Nagel, 1930), 8.

[37]The Werner minuet was brought to my attention by R. Larry Todd, who discusses it in "Joseph Haydn and the 'Sturm und Drang,' " *The Music Review* 41/1 (1980): 172–96. Todd also considers the Haydn minuet, though his main concern is the decidedly asymmetrical placement of dynamics in the orchestral version. (He speculates that Haydn, who became Werner's assistant in 1761, may have known the earlier retrograde.) The Werner is published in *Das Erbe deutscher Musik* 31, ed. Fritz Stein (Kassel: Nagels Verlag, 1956), 50.

Example 20. Gregorius Joseph Werner, *Der curiose musikalische Instrumentalkalender, Menuetto cancrizante* ("Die Sonne im Krebs")



Die Zauberharfe, where a nineteen-measure segment returns later in strict retrograde; but since 309 measures intervene between original and retrograde, the whole cannot be considered symmetrical.[38]

V. THE TRANSPOSITIONAL PERIOD

Interest in symmetrical periods did continue into the nineteenth century, but with a shift in mode of generation: from retrograde to transposition, with the transposition reflected about a central tonic axis. Both antecedent and consequent go forward; but the antecedent moves away from the tonic—usually by perfect fifth, to the dominant—while the consequent moves back by the same interval—if by fifth, from subdominant to tonic.

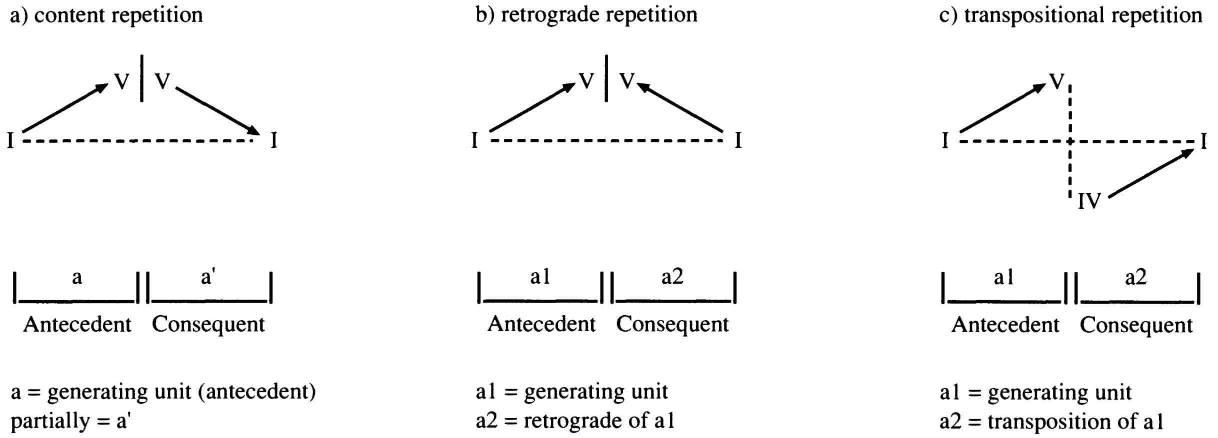
To facilitate comparison, Example 21 provides diagrammatic representations of three different period types, corresponding to those listed in Example 7 as 2, 3c, and 3b, respectively: a) the I–V / V–I partially symmetrical period (as in Beethoven's op. 10, no 1, Example 18); b) the I–V / V–I retrograde period (as in Haydn's A major piano sonata, Example 19); and c) the I–V / IV–I transpositional period.[39]

At first glance the period in Example 21c seems tonally normal: a first phrase directed toward the dominant is answered by a second directed toward the tonic. But since IV and V are symmetrically positioned around I, creating an enclosed, quasi-circular structure, the motion back to I is defined by the same content—transposed—as the motion away from I. The final tonic cadence thus mirrors the preceding dominant cadence, with nothing setting it off as unique. Since this contradicts normal practice, such periods

[38]Brian Newbould, "A Schubert Palindrome," *19th-Century Music* 15/3 (1992): 207–14.

[39]It should be noted that the harmonic functions given here indicate framing harmonies, not reductions of the underlying tonal structure. Though this may seem unusual to those accustomed to a Schenkerian perspective, it is essential for an account of transpositional construction.

Example 21. Periods distinguished by content repetition



remain uncommon; yet they appear with sufficient frequency in nineteenth-century music to form a distinct development, giving voice, along with related tendencies, to the era's more-than-casual interest in symmetry.[40]

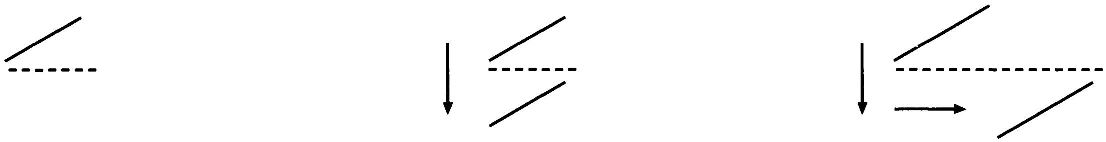
[40]Interest in symmetry is also reflected in the period's theoretical literature. This was brought out in section III above in connection with purely temporal symmetry; but it is also evident in dualistic conceptions of harmonic generation, which are in fact founded upon the same relationship as the transpositional period: subdominant and dominant as inversionally symmetrical poles to the tonic. Since dualistic theory assumes an abstract, spatial perspective, however, rather than the concrete, temporal one assumed here, it does not address formal matters. For a survey of the dualistic tradition, covering such nineteenth-century figures as Moritz Hauptmann, Arthur von Oettingen, Hugo Riemann, and Bernhard Ziehn, as well as predominantly twentieth-century ones such as Wilhelm Schröder, Georg Capellen, and Arnold Schoenberg, see David W. Bernstein's "Symmetry and Symmetrical Inversion in Turn-of-the-Century Theory and Practice," in *Music Theory and the Exploration of the Past,* ed. Christopher Hatch and David W. Bernstein (Chicago: University of Chicago Press, 1993), 377–407. A more detailed treatment appears as part two of Daniel Harrison's *Harmonic Function in Chromatic Music* (Chicago: University of Chicago Press, 1994), 215–322.

Since the repetition returns to the harmony with which the original unit began, transpositional periods project a kind of tonal cyclicity—though it is unlike that of a transpositionally symmetrical pitch-class set, since neither the original unit nor the complete period maps into itself under transposition. What makes the period emphatically symmetrical, however, beyond the symmetry produced by any strictly transposed content repetition, is that the phrases are symmetrically centered about a tonic axis.

This is clarified by considering the framing roots of the overall progression—I, IV, and V—as a pitch-class set. With the tonic as 0, the set is (0,5,7), normal order (5,7,0). Though this set can be generated by transposition (for example by transposing the subset (0,7) at T_5, the level of the transpositional period), it is not itself transpositionally symmetrical, but only inversionally symmetrical at T_0I, positioning (0) as the axis. The period thus weds transpositional cyclicity—<0,7> (I–V) transposed at T_5 to <5,0> (IV–I), cycling (0) back to (0)—with inversional symmetry about (0). This is

Example 22. Generation of transpositional period

a) original b) + spatial translation c) + time translation



illustrated graphically in Example 22: a line rising from a horizontal axis (a), representing the initial phrase (I–V), is translated first spatially, so that it rises to the axis (b), representing IV–I, and then temporally, so that it follows the original (c). The layout of 22c (corresponding to Example 21c) is used for all subsequent diagrams of transpositional periods.[41]

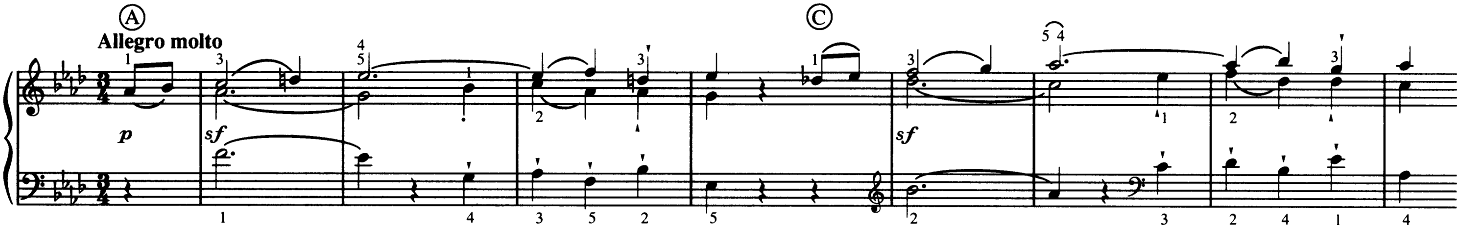
The opening eight measures of the Scherzo of Beethoven's Piano Sonata in A♭ major, op. 26 of 1800, Example 23a, form such a period. (As in all future examples, antecedent and consequent are labeled Ⓐ and Ⓒ.) Since the opening tonic is weakly defined, one might view the antecedent simply as a dominant-directed progression, and the consequent as a tonic-directed response. Yet the suggestion of I at the opening is unmistakable (it becomes explicit at m. 53), particularly since the preceding movement closes with an A♭ tonic triad, also with A♭4 in the top voice, giving rise to an enclosed motion both beginning and ending on the tonic.

Despite exact symmetrical correspondence between the two phrases, Beethoven also creates an overall processive motion, achieved partly by downplaying I at the beginning (and thus also IV in the consequent), suggesting an asymmetrical V (antecedent) to I (consequent) progression. He also diminishes the oppositional, mirroring relationship by transposing the consequent a fourth higher rather than a fifth lower. This enables the upward linear direction of the first phrase, A♭4–E♭5, to continue in the second, D♭5–A♭5, rising through the octave instead of returning to A♭4 in a circular manner (Example 23b). The tonal distinction between the opening pitches of the two phrases, the A♭4 of the first appearing after the ending of an A♭ major movement while the D♭5 of the second has no tonal support, also contributes: D♭ (m. 4.3) sounds like a minor inflection of a normal, asymmetrical octave division, with A♭4–E♭5 answered by E♭5–A♭5.

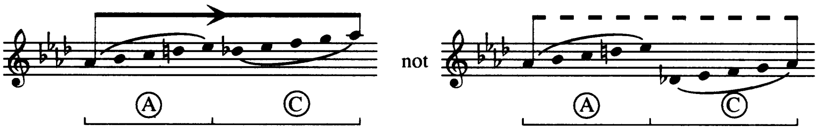
This period and its slightly varied repetition (not included in the example) comprise the first section of an ABA′ form. Beethoven breaks the symmetry in the reprise, exploiting the

[41] This focus on the transpositional period as the most emphatic manifestation of formal symmetry in common practice music raises questions concerning the extent to which the same kind of formal symmetry finds expression in more extended tonal forms. An adequate response would require a lengthy discussion, indeed a separate article of comparable length to the present one. It should be evident, however, that any formal recapitulation linking content return with tonal return—or in the case of secondary key groups with transposition—reflects a symmetrical disposition, even if the repetition is not exact; and that this disposition is considerably enhanced if, as in the transpositional period, the music that leads back to the tonic return corresponds to music formerly directed away from it. This is a practice with deep roots in common-practice music, evident for example in seventeenth- and eighteenth-century binary forms in which material preceding the first double bar reappears in transposition before the second, and in sonata forms with subdominant reprises.

Example 23. a) Beethoven, Piano Sonata Op. 26/ii, mm. 1–8



b) Beethoven, Op. 26/ii, mm. 1–8, analytical sketch

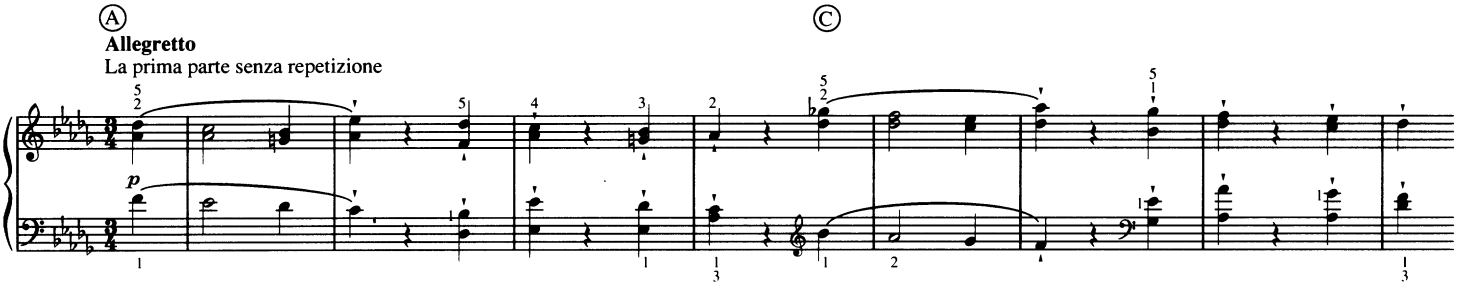


weak tonic opening to create a formal-tonal overlap (m. 45), thereby fashioning a continuous, asymmetrical tonal motion that spans both middle section and return. The symmetry of the period itself is also broken when it is repeated at m. 52 (with exchanged voices), offering a dramatic registral expansion as the final cadence approaches (mm. 53–60). Thus the opening symmetry does not penetrate deep into the movement.

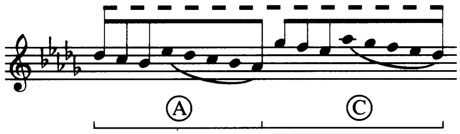
A second Beethoven example, written at approximately the same time, opens the Allegretto of the Piano Sonata in C♯ minor, op. 27, no. 2, Example 24a. Here too the initial tonic (D♭ major) is deemphasized as an upbeat chord in first inversion that passes immediately to the dominant (though it retains, as in op. 26, the tonic—but not the mode—of the preceding movement). The consequent again transposes the antecedent up by fourth; but since here the top voice of the antecedent outlines a falling fourth (D♭5–A♭4), its transposition upwards (G♭5–D♭5) brings the top voice back to its point of origin (Example 24b). (Just how peculiar such circularity is can be appreciated by imagining the identical period repeated continuously, allowing the consequent to join with the antecedent in projecting a well-defined octave descent, A♭5 in m. 6 to A♭4 in m. 4, creating considerable ambiguity as to what is antecedent, what consequent.)

As in op. 26, the period is repeated in varied form (not shown), with syncopations, the two statements comprising the first section of an ABA′ form. The opening material is again altered when it returns following the middle section, with the repeat omitted and the syncopations incorporated into the second subphrases of the original antecedent and consequent. More significantly, the consequent is extended, reaching a high point (mm. 33.3–34.2) followed by a much stronger close. Here again, the more strictly symmetrical aspect has only local formal significance.

Example 24. a) Beethoven, Piano Sonata Op. 27, No. 2/ii, mm. 1–8



b) Beethoven, Op. 27, No. 2/ii, mm. 1–8, analytical sketch



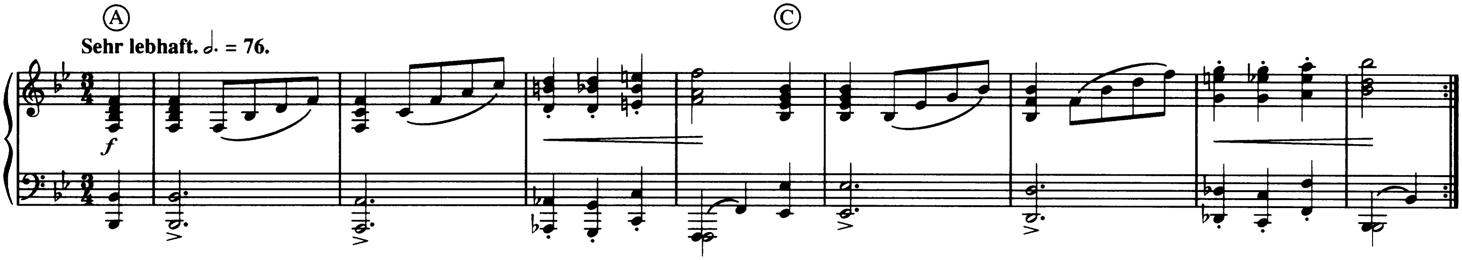
Though these two passages do not exhaust the examples of Beethoven's transpositional periods,[42] we will now turn to a later instance, the opening of Schumann's 1840 *Faschingsschwank aus Wien,* op. 26, Example 25a. The passage follows the layout of Beethoven's op. 26, with a rising linear motion in the antecedent, (B♭4)–C5–D5–E♮5–F5 (mm. 3–4), overlapping and continuing in the consequent, (E♭5)–F5–G5–A5–B♭5 (mm. 7–8), creating a unified upward progression (Example 25b). Unlike Beethoven, however, Schumann does not deemphasize the opening tonic, though he does similarly break the symmetry when the period returns after a middle section: the first phrase is refashioned to begin on ii and end on IV, allowing the consequent (unaltered) to pick up where the antecedent left off, uniting the two in a single goal-directed progression.[43]

Later in the movement, in the eight-measure period that opens the first contrasting section, mm. 87–94 (Example 26a), there is a more striking example of exploitation of

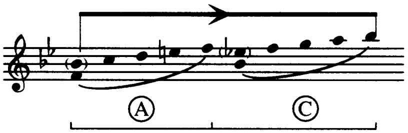
[42]For an interesting example within a larger form, though with some surface variations and an aborted final cadence, see the contrasting theme of the opening movement of the String Quartet in A minor, op. 132, mm. 160–67 and 224–32.

[43]Schumann also departs from Beethoven in allowing the symmetrical features of the opening period to influence the movement as a whole. Not only does the passage recur four times, rondo-like, reasserting the subdominant/tonic polarity, but the movement's contrasting key areas mirror this polarity: E♭ major, the subdominant itself, appears twice; and the other two prominent keys are symmetrically positioned relative to the subdominant-tonic complex (in mixed-mode diatonic space): G minor (relative minor of B♭ major, mediant of E♭ major) and F♯ major (relative major of E♭ minor, submediant of B♭ minor).

Example 25. a) Schumann, *Faschingsschwank aus Wien* Op. 26/i, mm. 1–8



b) Schumann, Op. 26/i, mm. 1–8, analytical sketch



the tonal ambiguities inherent in symmetrical construction. Though this too is a transpositional period, the order of its two tonal motions is reversed: the antecedent moves from IV to I in E♭ (mm. 86.3–88.2), and the consequent from I to V (mm. 90.3–92.2). (Each phrase is immediately repeated, but this does not affect the overall structure.) This exchange further undermines the role of the tonic, which instead of opening and closing the period now closes the first phrase and opens the second. Indeed, since the period ends with a full cadence on V, rather than I, it would be quite possible to hear B♭ as tonic were it not for the unambiguous E♭ segment that follows (not included in the example).

In the coda Schumann exploits this E♭/B♭ ambiguity by bringing back the same music, untransposed, to project the other side of the complex: E♭ as subdominant rather than tonic (Example 26b). Despite the new B♭ key signature, the return is identical except for one critical change: a pedal B♭ under the opening four measures converts the entire initial four-measure subphrase into an elaborated IV$^6_4$ chord. This breaks the symmetry and projects B♭ as uncontested tonic (the key is also well established both immediately before and after the passage). Transpositional symmetry is preserved, but only if the pedal is ignored. And since the pedal redefines the tonal relationships so that the two phrases lose their balanced position about an E♭ axis, the period becomes modulatory: a IV–I phrase in E♭ (the subdominant) is transposed as IV–I in B♭ (the tonic).

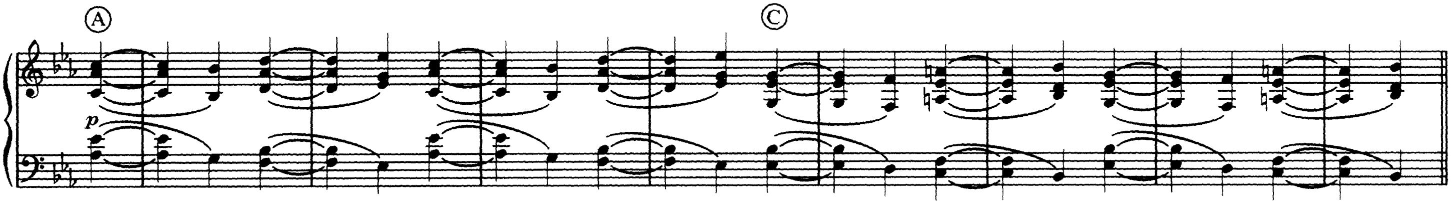
E♭: IV–I / I–V (Example 26a)

becomes

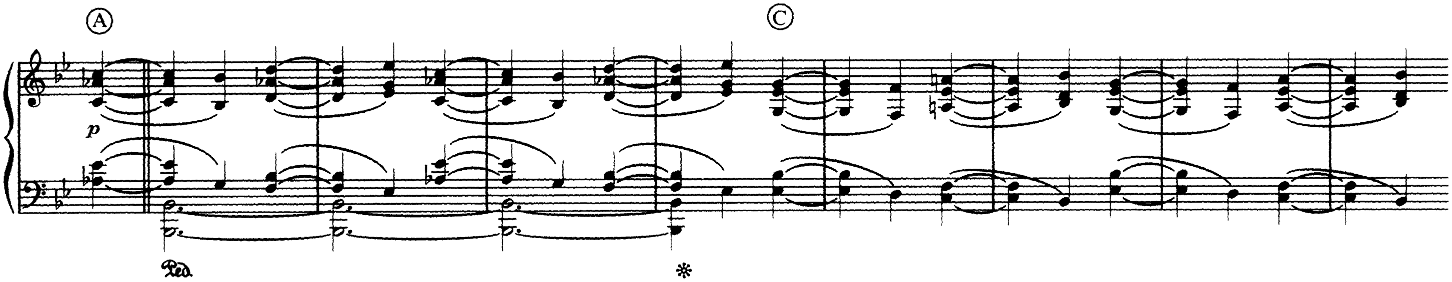
B♭: $\frac{\text{IV–I}}{\text{IV}}$ / IV–I (Example 26b)

Despite the frequent use of transposition as a compositional resource throughout the nineteenth century, exact

Example 26. a) Schumann, *Faschingsschwank aus Wien* Op. 26/i, mm. 87–94



b) Schumann, Op. 26/i, coda, mm. 1–8

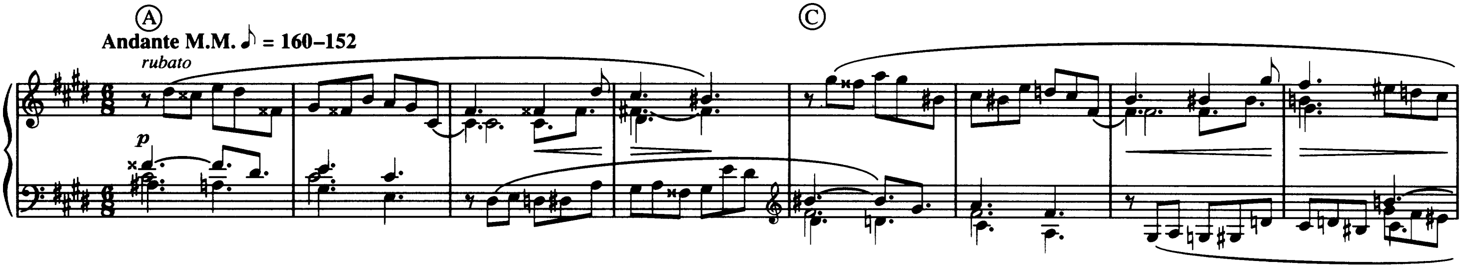


transpositional forms, though common at the subphrase level, remain exceptional in larger, enclosed forms, including that of the transpositional period. Near the end of the century, however, one composer explored the symmetrical period more intensively than any of his predecessors, eventually extending it into the realm of twentieth-century compositional practice. This was Scriabin, for whom symmetrical transposition formed a basic component of both his tonal and post-tonal compositional practice. Scriabin's well-known attraction to symmetrical pitch structure is thus rooted in his earlier work, and it is tied to an equal, and correlated, attraction to symmetrical form.

Symmetrical constructions appear in Scriabin's earliest published music. The Prelude in E minor op. 11, no. 4, for example, written in 1888 at the age of sixteen, begins with an opening i–v phrase, immediately followed by its transposition, v–ii. The transposition remains exact until the last beat, which is altered to usher in a third, asymmetrical phrase that returns to i. Indeed, transpositional schemata of all kinds, and at all formal levels, abound throughout Scriabin's work, though the focus here is limited to I–V / IV–I periods drawn from his shorter piano pieces.

Scriabin's transpositional tendencies are often viewed negatively, but they should be understood as an integral part of a more general, historically productive feature of his work: the development of new compositional possibilities through reduced differentiations among previously distinct tonal and formal functions. This is most immediately evident in the

Example 27. Scriabin, Piano Prelude Op. 15, No. 5, mm. 1–8



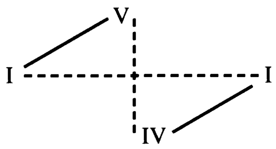
increasingly similar harmonies he used, regardless of their specific compositional roles, particularly symmetrical or near-symmetrical structures such as the whole-tone and octatonic configurations favored in his later years. But it also finds expression in formal matters, and nowhere more than in the reflecting phrases of the transpositional period.

In tracing the development of the I–V / IV–I period in Scriabin, one comes to recognize how ideally suited this form was for his particular purposes. While Beethoven and, to a lesser degree Schumann, tended to downplay the period's symmetry, Scriabin exploited it fully, even in earlier instances dating back to the op. 15 and op. 16 piano Preludes of the mid-1890s. Almost all important formal boundaries in the Prelude in C♯ minor op. 15, no. 5, for example, are associated with dominant sonorities, compounding the idea of reflection. The first phrase of the opening eight-measure transpositional period, Example 27, opens on a secondary dominant, V^4_3/V, which moves chromatically through an augmented sixth chord to i^6_4 and then to i^6 (m. 2); and it cadences on V^7 in m. 4. Since the consequent is then transposed down by fifth (mm. 5–8), it begins with the same chord as the antecedent ends (V^7 becomes V^4_3 of V/IV), now redirected toward the subdominant, and closes with a half cadence on the tonic degree ($I\sharp^{\natural 7} = V^7$/IV).

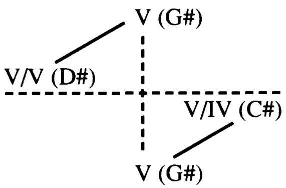
The period's tonal relationships, already weakened by the symmetrical layout, are rendered even more uncertain by the dominant sonorities associated with all four phrase-framing harmonies. Since all mirror each other in sound, it is difficult to distinguish their functions relative to the tonic, dominant, or subdominant scale degrees (at least without considering the continuation of these measures). Example 28 offers two graphic representations of the opening period. The first, 28a, shows the underlying I–V / IV–I functional schema from which the period is derived (corresponding to Example 21c); while 28b shows the actual chords associated with the phrase extremes, indicated as dominants to scale degrees in C♯ minor (leaving aside questions of prolongation structure), plus the letter names of the pitches upon which each chord is rooted. Two significant and complementary differences emerge when this second graph is compared with 28a: the chords ending the first phrase and beginning the second no longer fall at corresponding points on opposite sides of the vertical axis (representing distance from the tonic) but are aligned with it, since they have the same root; and those beginning the first phrase and ending the second are no longer aligned with the horizontal axis (representing the tonic) but fall on opposite sides, since they have different roots. The overall tonal motion, that is, is no longer balanced around a tonic axis (C♯)

Example 28. Scriabin, Op. 15, no. 5 (mm.1–8)

a) underlying tonal frame



b) initiating and terminating dominants



c) hypothetical continuation

D# - G# - C# - [F# - B - E - A - D - G - C - F - A# -] (D#)
C#: V/V - V - V/IV [IV . . . .] (V/V)

but moves clockwise around the circle of fifths, from V/V (D♯) (m. 1) to V (G♯) (mm. 4–5) to V/IV (C♯) (m. 8). The first phrase thus opens with one dominant and closes with another a perfect fifth lower, while the second phrase opens with this second one and closes with another an additional fifth lower. If this process were to continue—a possibility the music seems to invite, since the second phrase is an exact duplicate of the first and thus would connect with a third phrase exactly as the first to the second—it would traverse the circle of fifths and eventually lead back to the starting point, as indicated in Example 28c. And since this larger cycle would return to the opening dominant (V/V), it too could repeat *ad infinitum.*[44]

A variation of the I–V / IV–I period appears in the Prelude in C major op. 33, no. 3 of 1903, Example 29, where, unlike previous periods considered, both antecedent (mm. 1–6) and consequent (mm. 7–12) are divided into two equal subphrases, also quasi-symmetrically related (labeled a1/b1 and a2/b2 in the example). Each subphrase cadences on one of the period's four tonal pillars: a1 on I (m. 3), b1 on V (m. 6), a2 on IV (m. 9), and b2 on I (m. 12).[45] Each subphrase begins, however, with a one-measure unit that elaborates a D♭ major chord (♭II of the tonic), labeled separately as X (mm. 1, 4, 7, and 10), which remains untransposed throughout and thus changes tonal function within each new phrase. Since this period comprises the entire piece, moreover, the complete composition is basically symmetrical, combining literal and transpositional repetition.

Example 30 graphs some of the properties of the period. Level a shows its derivation from the basic transpositional model; level b gives the transpositions of the root progression that defines all four phrases: and level c displays the antecedent-consequent structure and its subphrases, the un-

[44] Though the Prelude begins on V/V rather than I, the opening period's derivation from the I–V / IV–I schema is uncontestable. This is so despite an ambiguous prolongational structure: does the first measure prolong the tonic, consistent with the schema in Example 28a; or, since the m. 2 tonic leads to another V/V chord in m. 3, resolving to V in m. 4, do the first three measures prolong V/V, consistent with both Example 28b and the hypothetical 28c? But in either case the presence of the tonic in m. 2 removes any doubt that the piece is in C♯ minor and that the opening chord is thus V/V and the cadential chord the dominant of that key—and thus that it is derived from the I–V / IV–I schema. (The question of key only becomes an issue when the following phrase proves to be an exact transposed duplicate.)

[45] It might be argued that these cadences represent dominants rather than tonics, but only if they are taken individually. If one considers the four in relation to one another, the first and fourth are unambiguously tonics.

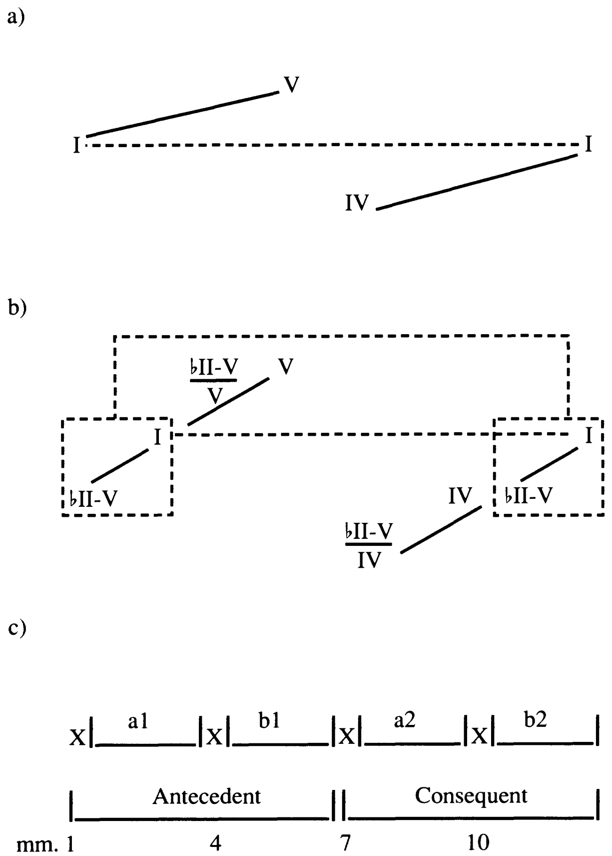
Example 29. Scriabin, Piano Prelude Op. 33, No. 3

transposed first measures being labeled separately as X. An unusual feature is revealed at level b. Although the layout of the consequent's second subphrase, b2, duplicates the second of the antecedent, b1, which it transposes, it provides an *untransposed* repetition of the harmonic progression of the antecedent's *first* subphrase, a1 (graphically indicated by placing the two within rectangles connected by a dotted line). The period thus assumes a cyclical aspect, increasingly important in Scriabin's music.

Here, where the symmetrical period encompasses the entire piece, there is no possibility of later establishing a firmer tonal footing. This explains various surface variations in the underlying pattern, introduced to direct the overall motion, asymmetrically, toward the final cadence. The X unit, for example, undergoes a series of rhythmic compressions: the original sixteenths become triplets in subsequent statements, while the number of attacks decreases. And as if in response, the subsequent two-measure units move closer to these openings: separated by two beats of rest in the first subphrase, one in the second, three-quarters in the third, and none in the fourth. In addition, the first measure of the consequent's first subphrase (m. 8) uses the slower rhythmic format of the antecedent's *second* subphrase (m. 5), rather than its first (m. 2); and the consequent's second subphrase further decelerates this unit, inserting a quarter rest (mm. 10.3–11). Finally, the V–I chords of the closing cadence are more heavily voiced and the tonic chord varied by replacing the previous descending arpeggiations with an afterbeat confirmation. All these symmetry-breaking elements work together to produce greater finality, superimposing a more processive, end-directed surface over the underlying formal symmetry.[46]

[46]The missing flats before the two D's in the final dominant (m. 11.3) are presumably an editorial omission (especially since the D's on the first beat,

Example 30. Scriabin, Op. 33, No. 3



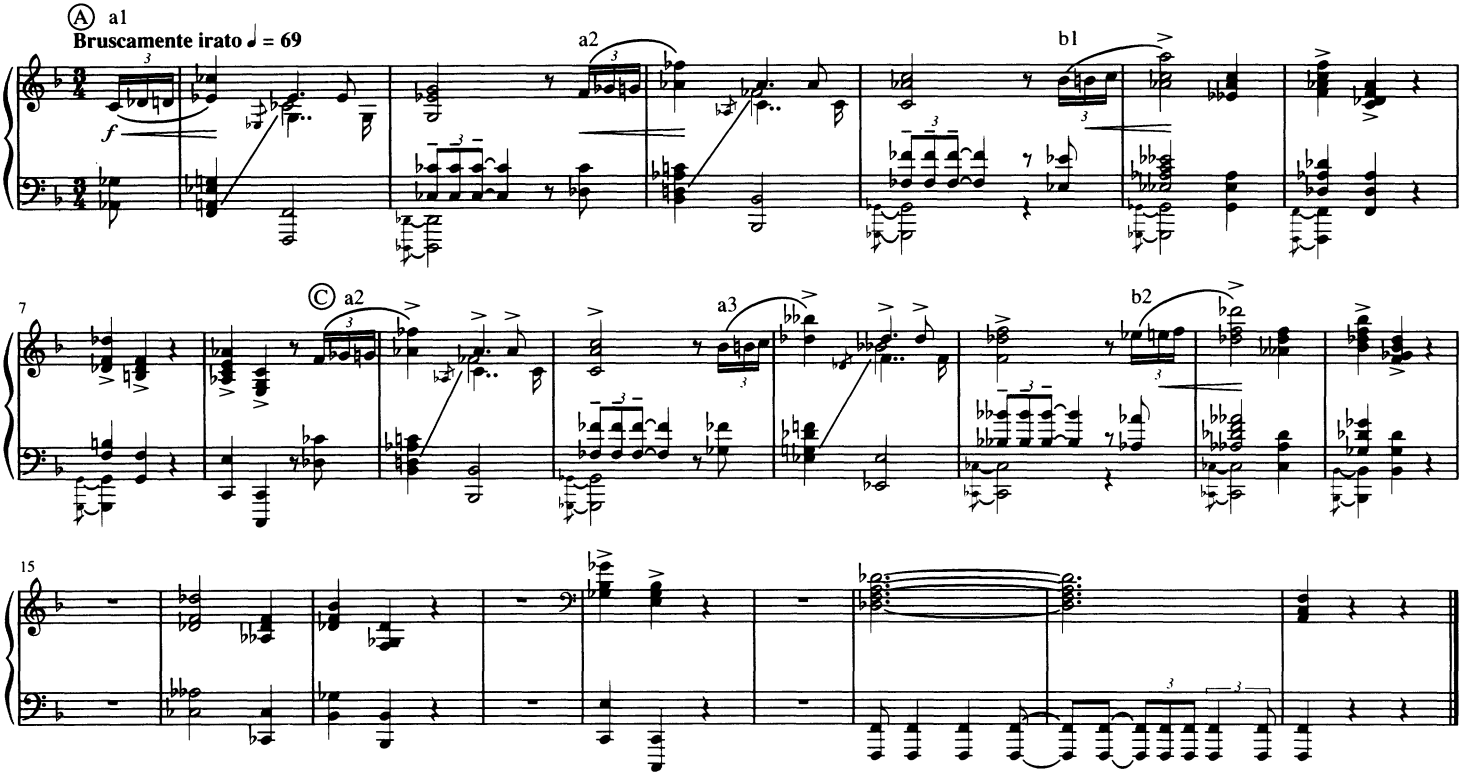
Scriabin continued exploring the transpositional period as he approached the edges of tonality in the first decade of the twentieth century, and his symmetrical processing of functional tonality had profound consequences for his future development. The Prelude op. 49, no. 2 in F major of 1905, Example 31, for example, consists of a single transpositional period with antecedent and consequent divided into subphrases, with each phrase (sentence-like) containing three subphrases (labeled a1/a2/b1 and a2/a3/b2). But here, even though the antecedent still cadences on V (m. 8) and is answered by a consequent cadencing on I (m. 23), virtually all of the sonorities used are whole-tone complexes sounding like altered dominants. Indeed, the only non-whole-tone chords are the two cadential ones, each lasting one quarter, plus two Neapolitan dominant preparations (m. 6 and m. 14, the latter repeated in m. 17). Though these triads assure some degree of tonal focus, the dominant role itself is assumed by whole-tone sonorities (the sole exception being the tonicized V in m. 8).

Even the opening F tonic (if one can still use this term) is represented by a dominant-like whole-tone chord (m. 1). (The opening upbeat chord has a decorative function, leading to the first whole-tone complex that is composed out.) Its significance is also underplayed by its position as central chord in a three-chord progression moving downward by third, conferring more structural weight on the subsequent D♭ chord (m. 2). D♭ also provides the starting point when the first subphrase (a1, mm. 1–2.2) is transposed up by perfect fourth (a2, mm. 2.3–4.2). And since the sequential repeat of the first phrase as a whole (mm. 1–8) is likewise transposed up a fourth in the consequent, the latter begins with the same music as subphrase a2 (mm. 8.3–10.2 = 2.3–4.2), producing an interlocking relationship between the two complete phrases: while the consequent transposes the antecedent by fourth, it opens with an *untransposed* repetition of the latter's *second* subphrase.

This relation is indicated by connected rectangles in level b of Example 32, with the tonal motion indicated by chord

held over from the previous measure, are indisputably flat). Their absence would create an unprecedented breach of pitch symmetry in the a and b subphrases.

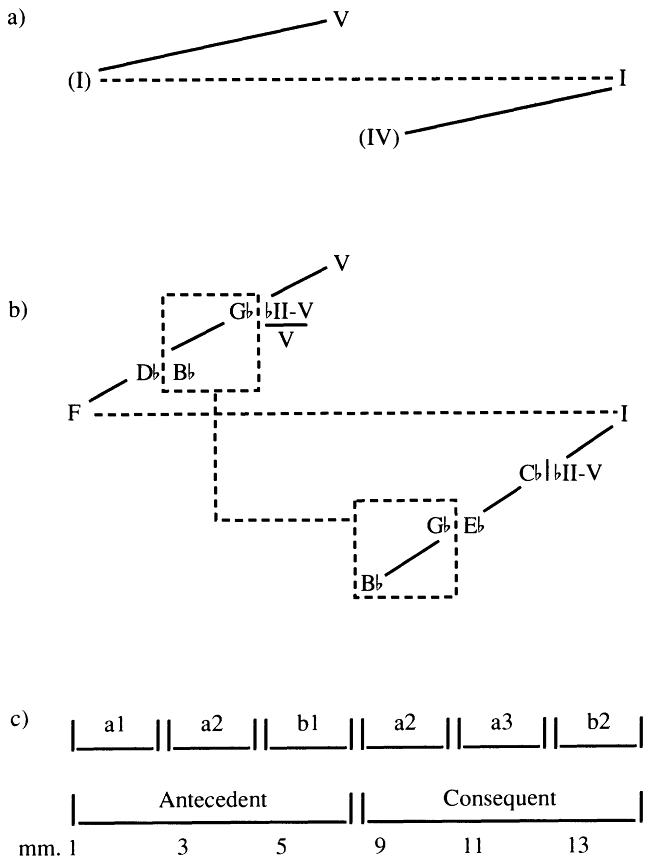
Example 31. Scriabin, Piano Prelude Op. 49, No. 2



roots in the bass for the first two subphrases and by functions for the third. Level a shows the basic functional schema from which the period is derived (with the opening I of the antecedent and IV of the consequent placed in parenthesis to indicate their lack of tonal definition). Level c shows the antecedent and consequent phrases and their subphrases in relation to these tonal events.

Curiously, this consequent mimics the Classical parallel period by beginning with an untransposed repetition of the antecedent. But instead of repeating its opening subphrase, it repeats the second. Despite the symmetrical pairing, the consequent thus picks up at a point already attained within the antecedent, so that the motion of the first phrase is not just reflected in, but continued by the second. (An earlier,

Example 32. Scriabin, Op. 49, No. 2



simpler instance was noted in op. 15, no. 5, Example 27.) Though the first cadence (m. 8) intervenes between the two identical subunits, preventing elision and thus complete tonal continuity, the Prelude, looping back upon itself to an earlier point, adumbrates a kind of continuously evolving structure that is, fully realized, impossible within the I–V / IV–I layout.[47]

Though the tendency toward tonal cyclicity is evident to a degree in all of the Scriabin compositions already considered, and especially in op. 49, no. 2, the perfect-fifth motions of traditional tonality preclude strict cyclicity: if the first phrase moves from I to V and the transposition continues from that point, the consequent ends on II, not I—and thus the need to "shift down" from V to IV between the two periodic phrases. Otherwise a third, asymmetrical phrase must be added, returning to the tonic (as in op. 11, no. 4); or alternatively, if symmetry is to be maintained, a series of additional transpositions spanning the entire circle of fifths (as imagined in Example 28c). True formal cyclicity requires an antecedent that traverses half the complete tonal distance, allowing the consequent to pick up where the antecedent ends and traverse the remainder; and the only interval that permits this is the tritone.

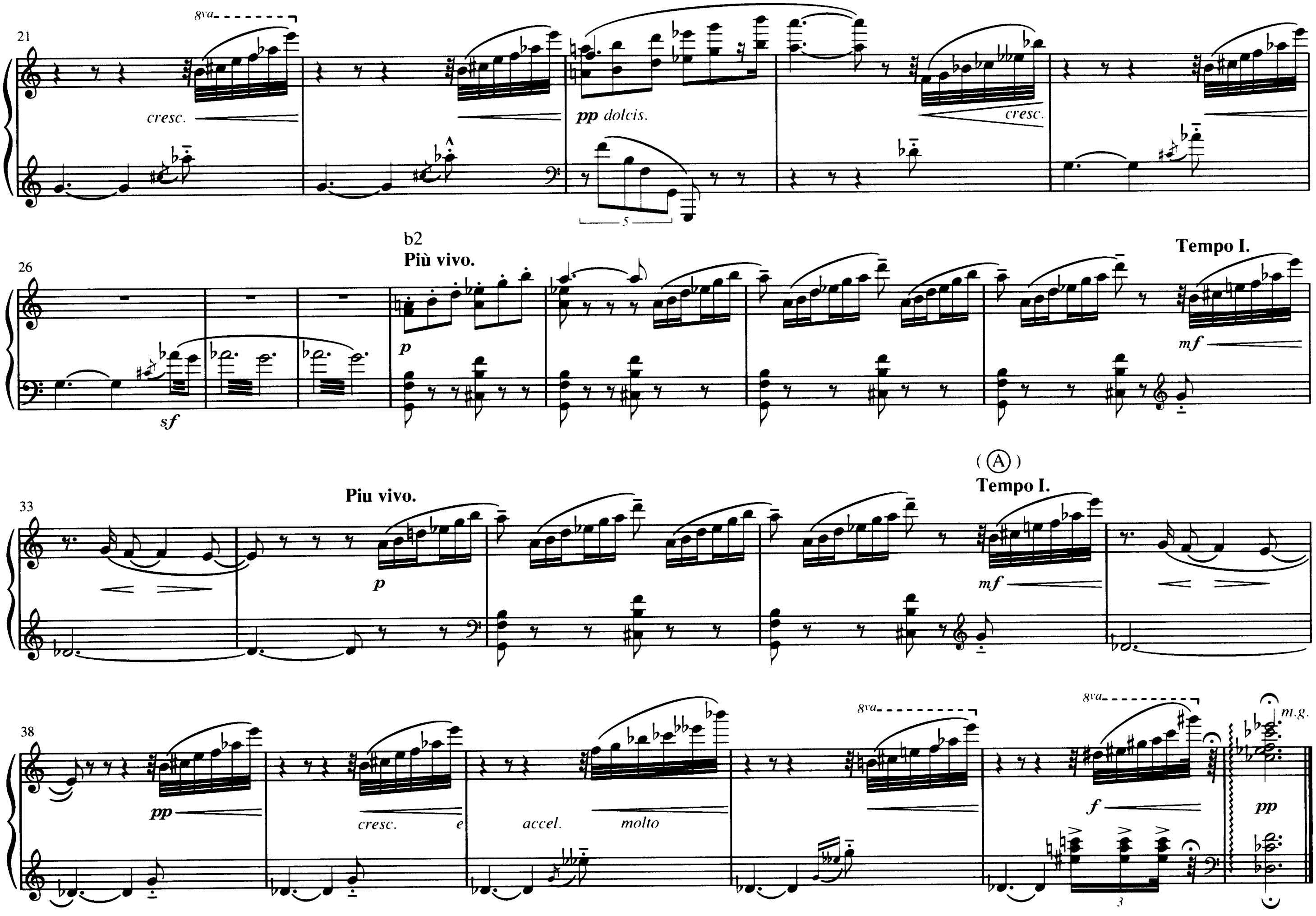
While op. 49, no. 2, with its still detectable perfect-fifth foundation, can only suggest an unbroken cycle, later, when Scriabin's music becomes even more rigorously symmetrical, full cyclicity emerges. The *Poème,* op. 69, no. 2, Example 33, a "mystic-chord" composition of 1913 that mediates between whole-tone and octatonic configurations, provides an example.[48] It too consists of a single transpositional period, with antecedent and consequent phrases subdivided into two parts (the second at a faster tempo): a1 and b1 (mm. 1–18),

[47]Scriabin again superimposes a more processive rhythmic surface and registration on the underlying structure: three one-measure rests are inserted (mm. 15, 18, 20), a segment is repeated in a lower octave (mm. 13–14 in mm. 16–17), and the first of the two cadential chords, again elaborated (by another whole-tone sonority), is now extended to three measures (cf. m. 8.2 and mm. 21–23).

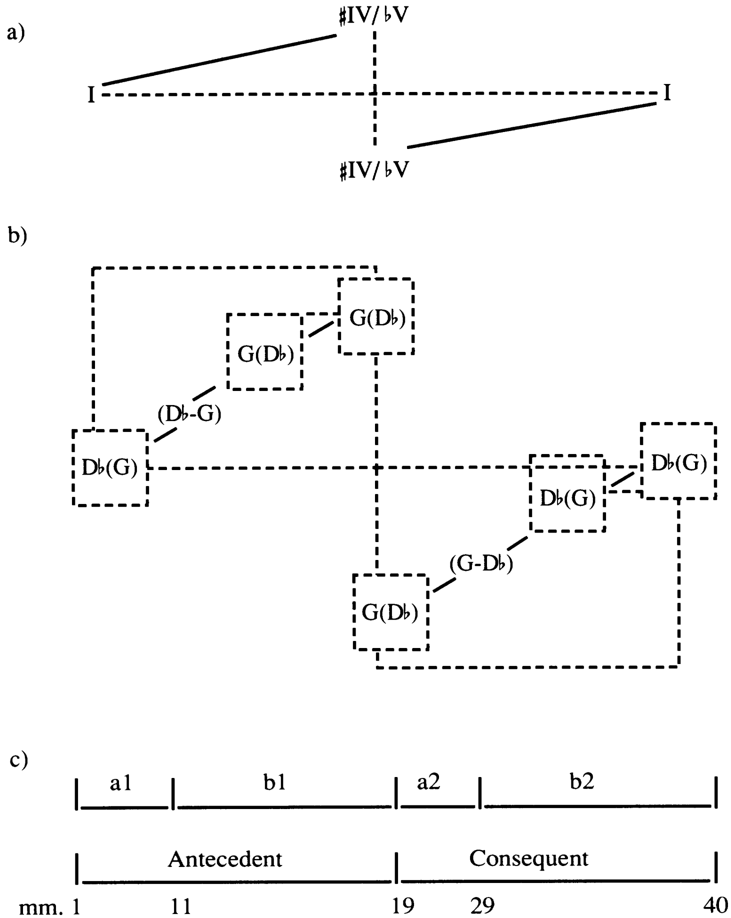
[48]Another example is the octatonic Prelude op. 74, no. 3, for which an analytical introduction is provided in my *Anthology of Twentieth-Century Music* (New York: Norton, 1992), 25–29.

Example 33. Scriabin, *Poème,* Op. 69, No. 2

Example 33 [*continued*]



Example 34. Scriabin, Op. 69, No. 2



followed by a2 and b2 (mm. 19–36). But here the latter is transposed by tritone; and since the antecedent also moves away from its starting point by tritone, and leads without break into its own transposition, the consequent continues the motion and carries it back to the starting point. Though a second antecedent then begins, it is interrupted after the first few measures by a brief extension leading to a sustained closing chord. We shall see that this partial second return, while departing from the strict transpositional-period prototype, is essential for the form's overall symmetry, which remains virtually absolute to the end.

The period's overall layout is displayed in Example 34 and reveals both similarities and differences with previous ones. Level a displays the basic schema, with its tritone-based transformation of the fifth-based pattern (Roman numerals are used to facilitate comparison, though the functions are obviously no longer in force). Level b shows the basic D♭–G tritone relationships that underlie the entire piece (discussed below), with linked rectangular boxes indicating some of their interconnections. And level c gives the antecedent and consequent phrases, plus their paired subdivisions. Since the formal units are virtually continuous, only a single line separates the internal divisions. The line separating antecedent from consequent, m. 19, is placed in the middle of the transposed return of the opening D♭–G unit, as that unit both continues the antecedent and initiates the consequent; the one closing the consequent, on the other hand, encompasses the entire (untransposed) return of mm. 1–4 (mm. 37–40), since the second antecedent is not completely realized.

Critical for this plan is the retention of a single transpositionally symmetrical subset throughout all but the final two measures: the tritone-generated, tritone-saturated 4-25 (11, 1, 5, 7). Self-reflecting tritone relationships permeate the surface. The opening left-hand G–D♭ returns to open the consequent as D♭–G, m. 19; and the opening right-hand arpeggio and its transposition by tritone in mm. 1–3, from B4 then F5, is answered in mm. 18–21 by arpeggios from F5 then B5. The G–D♭ tritone also regulates the larger motion through a gradual shift of emphasis during the antecedent from one pitch to the other, followed by a shift back in the consequent. Thus in the D♭–G pair that dominates the left hand in mm. 1–4 and 7–10, D♭ is longer and on the downbeat; and it is the bass of the chord underlying mm. 5–6. In the second (faster) subphrase (m. 11ff.) this changes, with D♭ and G providing bass notes for alternating three-note chords, identical within transposition and equal in duration, though with D♭ still on the downbeat. Following this more equal weighting, the scale tips to the other side as the consequent begins (m. 19ff.), D♭ becoming the upbeat and G the longer downbeat. Finally, the consequent as a whole reverses this process, the faster section (m. 29ff.) bringing more equal weighting and the return of the opening (m. 37ff.) reestablishing emphasis on D♭.

The overall tonal motion is thus not only unusually gradual but unusually reflexive, always mirroring some aspect of the D♭/G relationship. Continuity and interconnection are further enhanced by the recall of mm. 1–2 in mm. 14.6–16 (represented at level b by a second rectangle), momentarily interrupting the faster music of b1. But this recall transposes mm. 1–2 up by tritone and thus simultaneously anticipates the beginning of the consequent, untransposed: the tritone equivalency thus conjoins flash-back and flash-forward. And because the beginning of the consequent is unmarked by any special articulation, it sounds as much like a continuation as a repetition, an ending as a beginning, underscoring the formal cyclicity.

This explains why the antecedent returns a second time at the end. Just as the consequent grows out of the antecedent, ending and beginning elided in a single event, so the return of the antecedent, also anticipated in the preceding faster segment, mm. 33–34, grows out of the consequent (m. 37ff.). There is no reason why this period could not continue to cycle, with m. 37 looping back to its duplicate, m. 1, at each recurrence. Unlike in the previous Scriabin works governed by an overall transpositional scheme, in the *Poème* no surface adjustments are made to direct the piece toward a unique close—at least not until the very end, where symmetry is finally broken when the antecedent reappears. The first two measures return without change (mm. 37–38), but the third is slightly varied, with B4 retained as the starting note of the right-hand arpeggio (m. 39), delaying the motion upward to F5 until m. 40; and, a more significant departure, the upward arpeggiations then continue from B5 and D♯6, provide a unique upbeat gesture to the final chord.[49]

Continuity is also enhanced by another anticipation: the softer and slower "pre-echo" of the melodic idea in mm. 11–12 of the second, faster subphrase is interpolated into the right hand in mm. 5–6. Not only is part of the consequent thus embedded in the antecedent, but part of the second portion of the antecedent is embedded in its own first half. The latter, moreover, is itself anticipated, as the melodic material of mm. 5–6 is a variant of the opening right-hand arpeggio. The degree of self-reflexivity is remarkable: maximum continuity is here achieved, paradoxically, through maximum duplication.

Given the upward tritone transposition controlling both form and tonal motion in op. 69, no. 2, the consequent must shift down an octave if it is to end in the same register as the antecedent began, achieving maximum cyclicity; but since antecedent and consequent overlap, the adjustment cannot be made where they join (mm. 18–19). It is made instead at

[49]Though the final chord, as expected, is built on D♭, it does not contain the ubiquitous tritone component G. This omission is consistent, however, with a tendency found throughout Scriabin: cadential resolutions tend to be marked by a lowering of the level of chromaticism. The late, borderline tonal pieces thus usually end with pure triads (even though the triad may be the only one in the piece), while the symmetrical, post-tonal pieces often end with less symmetrical sonorities, like this "dominant ninth."

m. 24.6, following the pre-echo that interrupts the repeating gestures of the consequent's a2 segment. Scriabin assures maximum registral continuity by doubling the melody at the octave in the preceding two measures (mm. 23–24), the sole departure of the consequent from the antecedent (excluding transposition). Like everything else in the piece, this doubling is Janus-faced, the upper octave looking back to the previous register while the lower looks forward to what comes, their simultaneous sounding encapsulating the overall reflectiveness.

VI. SYMMETRY AND THE INFINITE

Scriabin's *Poème* is an instance of virtually complete formal symmetry. Since it is in addition almost perfectly cyclical, its endings and beginnings overlapping to form an enclosed loop, it suggests the possibility of infinite recycling—a possibility rejected, as in other examples considered, by breaking symmetry for a unique close. But there is at least one nineteenth-century transpositional period that forgoes a conventional close: Chopin's Mazurka op. 7, no. 5, composed in 1831, given as Example 35. Other than a four-measure introduction, it consists entirely of an antecedent phrase, repeated (a1 and a1′, the latter with slight variations), and its transposed consequent, also repeated (a2 and a2′). The former moves from V to I in C major (mm. 5–8 and 9–12), the latter from V to I in G major (mm. 13–16 and 17–20).

If one chooses G as tonic, Chopin's period corresponds to a reversed version of the transpositional period: I–IV / V–I. This reading is inconsistent with Chopin's key signature, however, and seems otherwise strained (though not incoherent). But if one takes C, as the signature suggests, the antecedent begins on V and ends on I, while the consequent begins on II (inflected as V/V) and ends on V—a reading that is perhaps even more problematic than the first, since it shifts the axis of symmetry from tonic to dominant, leaving the period open.

G: I (V / IV) – IV / V – I
C: V – I / II (V / V) – V

But, in fact, Chopin's period is equally open whether G *or* C is chosen, since the purely symmetrical tonal-formal structure cannot provide convincing closure in either key. This remains true in spite of slight differences in the two phrases and in the written-out repeats. The top-voice alteration and new 5–6 voice-leading in the tenor (G3–A3) at the cadence in m. 12 of the antecedent (cf. m. 8), for example, do not provide more weight, but rather support the connection to the consequent. Similarly, the extension of the melody to F♯5 rather than E5 at m. 19 in the consequent (cf. m. 15), and the absence of melodic alteration or 5–6 exchange in m. 20 (cf. m. 12) allow the cadence in m. 20 to return more smoothly to the antecedent. In addition, unbroken melodic motion in mm. 12 and 20 keeps things underway.

As in Scriabin's op. 69, no. 2, the two phrases thus lead in and out of one another, the first directed toward the second, the second back to the first, without decisive articulation. As a result, both phrases sound like antecedents—or alternatively, like consequents. There is no longer any evident distinction, and thus no way to determine if the piece is in G major or C major: both seem equally plausible and equally implausible, with no symmetry-breaking adjustment to provide a unique close. (Nor do the introductory G's in mm. 1–4 help: they could be equally tonics or dominants.)

Like Scriabin's *Poème,* then, the Mazurka circles back upon itself symmetrically, offering the possibility of unceasing continuation. Chopin, however, unlike Scriabin (and others considered), confirms the possibility, writing under the final measure "*Dal segno senza Fine,*" sending his Mazurka into eternity. It is a gesture made possible not by harmony, moreover, which is normal throughout, but by the radically symmetrical tonal-formal layout. The "*senza Fine*" fulfills a promise latent in all of the periods we have encountered: the

Example 35. Chopin, Mazurka Op. 7, No. 5

recasting of tonal form to release its full symmetrical potential. In Merleau-Ponty's terms: these periods probe the possibilities of a new means of expression, exploring a gap more comprehensively filled only in twentieth-century music.

Chopin's Mazurka reveals another way in which nineteenth-century music underwent transformation: through exploitation of geometric and inorganic—that is to say, symmetrical—form. The latter exposed tonality's mirror image—its uncanny double, as it were, at once familiar yet strange.[50] A consequent that reflects its antecedent

[50]In his essay on the uncanny, Freud links the quality with a "repetition-compulsion" and notes that it is often associated (by others, not himself) with recurrences in which automatic, mechanical processes are at work. As in the antecedent phrase of a symmetrical period, something familiar undergoes mechanical replication and is thereby rendered strange. Sigmund Freud, "The Uncanny," *Collected Papers 4,* trans. Joan Riviere (London: Hogarth Press,

undermines the foundations of the quintessential tonal form, the parallel period, replacing the completion of an unbalanced first term through a balancing, more stable second, with a second that merely mirrors the first. No sublimating synthesis joins the two in a higher unity. The second points back to the first, the first forward to the second, engendering an image of perpetual regeneration never reaching fulfillment.

This brings out the reverse side of symmetry's evocation of eternity: its threat of unending duplication, and thus incompletion. The transpositional period reconfigures tonal form as a system of infinite referrals, leading from antecedent to consequent and back again, each signifying the other but nothing beyond. Tonality is thus made to assert—with paradoxical rigor—the open-endedness and uncertainty that, for better or worse, confronts those of us living in the present century. Musical form takes on a more contemporary cast—most immediately audible in Scriabin's *Poème,* no doubt, but implicit in all of the pieces considered.

Symmetry, rigorously conceived, responded to the need for a kind of musical expression largely denied to composers working strictly within common-practice conventions. Not unlike expanded chromaticism, which fostered new approaches to tonal and formal organization (and with which it would eventually merge), symmetrical construction brought to phrase and key relationships a new impulse dependent upon a more contingent notion of musical completion. It thereby bridged a significant gap separating nineteenth- from twentieth-century music.

1953), 368–407 (especially 390–91 and 378). This may help explain the widespread distrust of strict symmetry found throughout the common-practice period, during which tonal language was widely believed to be natural and organic. The ambivalence of Schoenberg in this regard, as a composer who matured just as the period was coming to an end, is doubly revealing. Despite his evident pride in developing in his idea of twelve-tone music a symmetrical basis for twentieth-century compositional practice, initiating a turn from the organic to the geometric, Schoenberg consistently expressed misgivings about mechanical construction, in particular sequential repetition. See, for example, his *Harmonielehre* (Vienna: Universal, 1922 [1911]), 338.

ABSTRACT

This article is a study of symmetry, briefly as applied to objects in two-dimensional space and pitch-class space, then more extensively to musical form. Despite the limited presence of complete symmetry in tonal music, the concept—along with the related one of symmetry-breaking—is helpful for understanding this music's formal properties. Special attention is given to a rare kind of antecedent-consequent period in which symmetry—in some cases retrograde, but more commonly transpositonal—is rigorously preserved. Its evolution is traced in compositions by Haydn, Beethoven, Schumann, Chopin, and Scriabin.