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· 22 ·

Rhythm in twentieth-century theory

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We have seen in the previous chapter how Riemann attempted to consolidate various trends in nineteenth-century rhythmic theory, synthesizing rhythm, meter, agogics, and phrase structure within his overarching theory of harmonic functionality. As was perhaps inevitable with such a comprehensive project, various tensions and problems remained in Riemann's mature theory. Many early twentieth-century theorists such as August Halm, Ernst Kurth, and Hans Mersmann were critical of Riemann's accentual theory, and so in part the history of rhythmic theory, at least at the beginning of the century, can be characterized as "a reaction to Riemann." In addition, there were other musical and intellectual developments which shaped twentieth-century rhythmic theory, among which can be mentioned:

1. There were new ideas of motion and time, from physics, philosophy, and psychology, that led a number of theorists to place musical energetics and motion at the center of their approach to rhythm.
2. Schenker's theory of tonality and tonal dynamics influenced a number of approaches to rhythm and the temporal unfolding of musical events, especially amongst North American theorists in the second half of the century.
3. Developments in linguistics and gestalt psychology influenced "architectonic" approaches to rhythm, engendering structuralist theories that emphasize the hierarchical aspects of rhythm and form.
4. Radical changes in musical style, especially the rise of atonality and serialism, demanded new conceptions of rhythm and meter. This led to various prescriptive theories of rhythm that were often developed (and commented upon) by the composers themselves.

This chapter will selectively review the work of theorists and musicians from each of these four areas. To be sure, these are loose categories, and many theorists have made significant contributions in more than one (e.g., Wallace Berry, who discussed motion and impulse as well as the hierarchic aspects of meter and phrase structure). Yet each is united by a common set of assumptions and concerns, and these are often revealed by the use of a shared terminology, a distinctive set of metaphors, and common descriptive strategies, including notational practices. These terms and metaphors will be

noted at the head of each section, as they are markers for discursive engagement amongst theorists of the same and successive generations.

Rhythm, motion, and time

In the twentieth century a number of theorists have regarded motion and movement as the essential substrate of musical rhythm and form. These theorists sought to account for rhythm in terms of dynamic or "energetic" processes, rather than in the architectural arrangement of musical elements – in terms of temporal becoming, as opposed to being. Their emphasis on the kinetic qualities of music and musical experience was influenced by contemporaneous trends in philosophy and psychology, and in their work one finds references to phenomenology (Husserl, Heidegger, and Merleau-Ponty), gestalt psychology (Wertheimer and Koffka), and temporal philosophy (James, Bergson, Langer, and Whitehead). Common images and metaphors are of waves (in Kurth and Zuckerkandl), impulses (in Berry) and projection and expectation (in Neumann and Hasty), as well as a concern with the experience and understanding of musical duration and tone succession.

Kurth. In emphasizing rhythmic processes, rather than the forms created by those processes, these theorists stood in opposition to Riemann and his later emphasis on formal archetypes for rhythmic structure. Indeed, in some sense their approach harks back to Riemann's earlier conception of dynamic shading (see **Chapter 21, p. 684**). In Riemann's mature theory the fundamental rhythmic gesture is one of intensification and then relaxation, an upbeat-to-downbeat pairing that has its antecedents in Momigny's *levé–frappé* archetype. Moreover, each measure, pair of measures, and four-bar phrase is an element in an upbeat–downbeat relationship, and collectively they form a symmetrical, eight-bar rhythmic schema. Ernst Kurth (1886–1946) recognized many of these same elements, but rejected the rigidity of the eight-bar schema in favor of a more flexible and continuous approach to musical rhythm. Indeed, with Kurth we have what is probably the most thorough and far-reaching energeticist view of music ever articulated. (see **Chapter 30, pp. 939–44** for further discussion of Kurth's energeticist views).

Kurth accounts for rhythmic gestures from small to large in terms of a nested set of waves or wave-like motions. As Rothfarb has noted: "Short-range formal segments consist of localized surges called 'constituent waves,' which contribute to more broadly paced 'developmental waves.' These in turn mount toward huge 'symphonic waves.'"[1] All of these elements are understood through their relation to the larger symphonic wave. Kurth's views on motion and melody expressed here and in his earlier

1 Rothfarb, *Ernst Kurth as Theorist*, p. 191.

writings are very similar those of August Halm, who said simply "motion is the life of music."[2] Thus Kurth's waves are not temporal "containers" for various rhythmic forms, but rather consist of motion itself. From these waves one then gains a sense of musical space, a space that flows from the rhythmic shapes which themselves are the phenomenal traces of the symphonic waves: "The sense of space is always a reflection of the sense of form. For the sense of space, being evoked by formal processes in the first place, is also contingent upon the particular, stylistically variable type of formal processes for the nature of its aural experience."[3]

Zuckerkandl. Kurth's theory of rhythm and form influenced Lorenz's approach to Wagner and Kurt von Fischer's approach to Beethoven, as well as Toch's *The Shaping Forces of Music*. The theorist who most directly engaged Kurth's ideas of motion and the wave-metaphor to describe such motion, however, was Viktor Zuckerkandl (1896–1965). Zuckerkandl was born and educated in Vienna, and came to the United States prior to World War II. His work is equal parts philosophy, music cognition, and music theory. Zuckerkandl uses the image of a wave to build a theory of meter:

> A measure, then, is a whole made up, not of equal fractions of time, but of differently directed and mutually complementary cyclical phases. But since in time there can be no real going back, and hence, strictly speaking, no real cyclical motion either, since, therefore, every new beat does bring us to a new point in time, the process can be better understood and visualized as a wave . . . which also best corresponds to our sensation of meter. Our sympathetic oscillation with the meter is a sympathetic oscillation with this wave. With every measure we go through the succession of phases characteristic of wave motion: subsidence from the wave crest, reversal of motion in the wave trough, ascent toward a new crest, attainment of the summit, which immediately turns into a new subsidence.[4]

Note that these waves are both in the music and in the listening ear – the "sympathetic oscillations" noted above. Zuckerkandl gives an illustration of the metrical wave in the opening measures of Chopin's A major Polonaise (see Figure 22.1). He notes that "the tones fall upon the wave that they themselves have generated; the wave imparts its motion to the tones" (p. 171). In this way Zuckerkandl acknowledges the antinomy between rhythm and meter: "Such is the case in all metrical music. To put it metaphorically: the ground upon which the tones fall is itself in wave motion. The wave is the meter; rhythm arises from the different arrangements of the tones on the wave" (p. 172). Rhythm is the temporal gestalt that emerges from our interaction with tones and the metrical waves they generate. Like Kurth, Zuckerkandl acknowledged that larger, more complex waves could be composed of smaller component waves, though Zuckerkandl did not extend his waves to symphonic dimensions.

2 Halm, *Die Symphonien Anton Bruckners*; trans in Rothfarb, *Ernst Kurth as Theorist*, p. 8.
3 Kurth, *Bruckner*, p. 338; trans. in Rothfarb, *Ernst Kurth: Selected Writings*, p. 191.
4 Zuckerkandl, *Sound and Symbol*, p. 168. (All subsequent citations from Zuckerkandl will be from this work.)

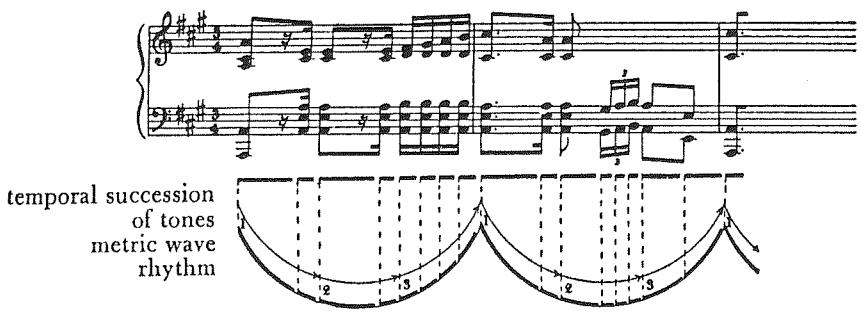


Figure 22.1 Metric wave analysis of Chopin, Polonaise in A major, from Zuckerkandl, *Sound and Symbol*, p. 171

Zuckerkandl's more radical claim is that metrical music makes time itself perceivable. First, he held that motion in its purest sense inhered in and was perceivable in music: "Tonal motion is the most real motion" (p. 139). But of course nothing really moves. So Zuckerkandl goes on to note: "We have come to know – music itself has taught us – that no objects and no object space are necessary to motion. For tonal motion begins precisely where all that – things and their space – comes to an end. But we can name one factor without which motion cannot be, that is, time" (p. 151). But where does this time exist? Zuckerkandl answers: "The time that is at work in music – whose work, indeed, music to an essential degree is – this time cannot be 'in me,' it is not 'my' time. It is where music is; I find it where I find music" (p. 245). Thus for Zuckerkandl, music "both is time and is a symbol of time."[5]

Berry. The Canadian composer and theorist Wallace Berry (1928–91) was also fundamentally concerned in his writings with rhythm and motion. His work in musical rhythm is in large part a response to that of Cooper and Meyer as well as Cone. For Berry, musical structure involves "the punctuated shaping of time and 'space' into lines of growth, decline, and stasis hierarchically ordered."[6] He then goes on to address the subject of motion:

> The concept of musical *motion* is critically allied to the concept of progressive, recessive, and static events and event-complexes. To the extent that motion is a useful concept in musical experience, it may be said to reside in factors of three kinds, of which the most important is that involving changing qualities in contiguous sonorous events. (p. 7)

The three kinds of factors Berry mentions are (1) periodic articulations, (2) intensity changes in successive sound events, and (3) changes in "height" relative to the ambitus of the pitch field. This last factor is akin to changes in intensity, but Berry notes that

5 Jacobs, in Macey, ed., *Encyclopedia of Time*, p. 454.

6 Berry, *Structural Functions in Music*, p. 5.

because it creates the illusion of a spatial field "it has [a] special significance and is usefully regarded as a distinct factor" (p. 8).

Berry's discussion of meter hinges upon his notion of *impulse*:

> *Meter, then, consists of units (large and small at various structural levels) formed by differentiations in the musical events* in what we shall describe as diverse "impulse functions." If there is differentiation it is expressed in some parameter or complex of parameters. *Meter is that aspect of structure articulated as accent-delineated groupings within the attack (event) sequence, and the proportional interrelations of such groups at all levels.* (p. 318, italics in original)

All musical parameters may thus contribute to the formation of metrical impulses, and a metrical impulse may inhere at the highest level of musical structure (cf. Cone's notion of a "structural downbeat"). Berry distinguishes four types of impulses: (1) *initiative impulses*, which "initiate a metric unit" and function as metrical accents, (2) *conclusive impulses*, which are the last in a reactive series and are metrically weak, (3) *reactive impulses*, which are relatively passive or absorptive and which carry the force of the initial initiative impulse, and (4) *anticipative impulses* which "direct energy toward an initiative [impulse]," and thus function as upbeats or anacruses (p. 327). The anticipative-initiative impulses are analogous to the arsis and thesis of Riemann's binary metrical taxonomy, and Berry's reactive and conclusive impulses would seem to capture the phases of subsidence and reversal in Zuckerkandl's description of the metrical wave. Unlike Zuckerkandl or Kurth, however, Berry seems more interested in isolating the various components of the metrical motion than in modeling their continuity.[7]

Neumann. While theorists like Kurth, Zuckerkandl, and Berry concerned themselves with categories and descriptions of motion, Friedrich Neumann (1915–) seems more concerned with the connection(s) between successive musical events. He begins his *Die Zeitgestalt* with an examination of the temporal relationship between a pair of durations. While this is similar to Riemann's basic categories of arsis and thesis, for Neumann their relationship is not given *a priori*, but arises from the emerging temporal relationship between them. He gives the following diagram and explanation (see Figure 22.2):

> Given the two events A and B, *two* discriminations are defined, one from A to B and one from B to a concomitant, unknown potential limit (S), such that the intervals A–B and B–(S) are, in fact, equal (ex. 2). The existence of this potential limit is immediately known to us when a third event C enters. We are then easily, and with great accuracy, able to say whether C coincides with (S) (ex. 3a), or if it enters earlier (ex. 3b) or later (ex. 3c) . . . An uninterrupted whole made up of two discriminations of equal duration and determined by two events and a potential limit we shall call a "*rhythmic pair.*"[8]

7 Note that in "Metric and Rhythmic Articulation in Music" Berry cites Riemann's *Musikalisches Dynamik und Agogik* (1884), but he does not cite Kurth or Zuckerkandl.

8 Neumann, *Die Zeitgestalt*, pp. 18–19; trans. in Hasty, *Meter as Rhythm*, pp. 96–97.

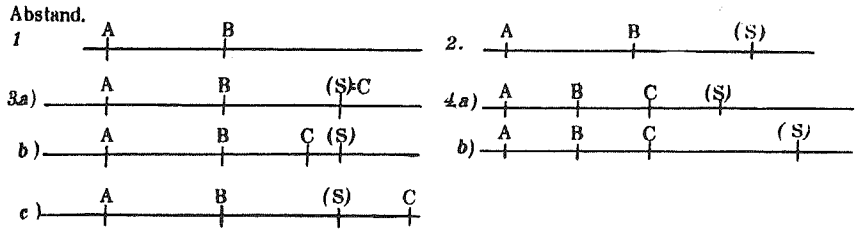


Figure 22.2 Neumann's formation of a rhythmic pair (taken from Hasty, *Meter as Rhythm*, p. 97)

Neumann makes it clear that meter is wholly separate from rhythm, and that the rhythmic experience of equality is prior to any sense of meter-as-measurement. He goes on to describe the quality of motion and time within the rhythmic pair:

> Now further, in order to experience the temporal *content* of the rhythmic pair it is necessary that we set out and traverse the pair as a closed event that is surveyed in advance. Here two opposed qualities are revealed to us with some clarity. Namely, on the way from [point] A to [point] B temporal consciousness is directed predominantly toward the future, toward the arrival of B. This state we will label as *expectation* (*Erwartung*). From B to [a future point] S, however, the direction of our attention is reversed; consciousness glances back toward the past stretch A–B and avoids any thoughts of the coming potential limit (S) in order that the wholeness of the pair not be disturbed. This state we will label *recollection* (*Erinnerung*), and expectation and recollection form complementary qualities whose order may not be reversed without destroying wholeness. It lies in the nature of expectation that it *intensifies* with the growth of duration, and in the nature of recollection that it *dies away*.[9]

The distinction between expectation and recollection underlies the rhythmic distinction between "strong" and "weak" (or rhythmic accent vs. unaccent), but this maps onto rhythm and meter in different ways:

> In general . . . in the stronger parts recollection and immediate comprehension predominate, and in the weaker parts, expectation. An important consequence emerges in this connection. In the metrical the difference between stressed and unstressed parts is a *graduated* one, i.e., even the unstressed part has a certain stress, if, nevertheless, a weaker one. However, in the rhythmic, which looks toward content, stressed and unstressed parts *are set in logical opposition* – the unstressed point to the future, the stressed to the past.[10]

Thus it is because the motion from A to B engenders expectation, and B to (S) recollection, that the rhythmic pair naturally tends to be heard as weak to strong (as in Riemann). Furthermore, as Hasty has noted, "Neumann does not find it necessary to reduce other formations to an underlying *Paarigkeit*. Rather, by expanding the catalog

9 Ibid., pp. 19–20; p. 97. 10 Ibid., p. 39; p. 40.

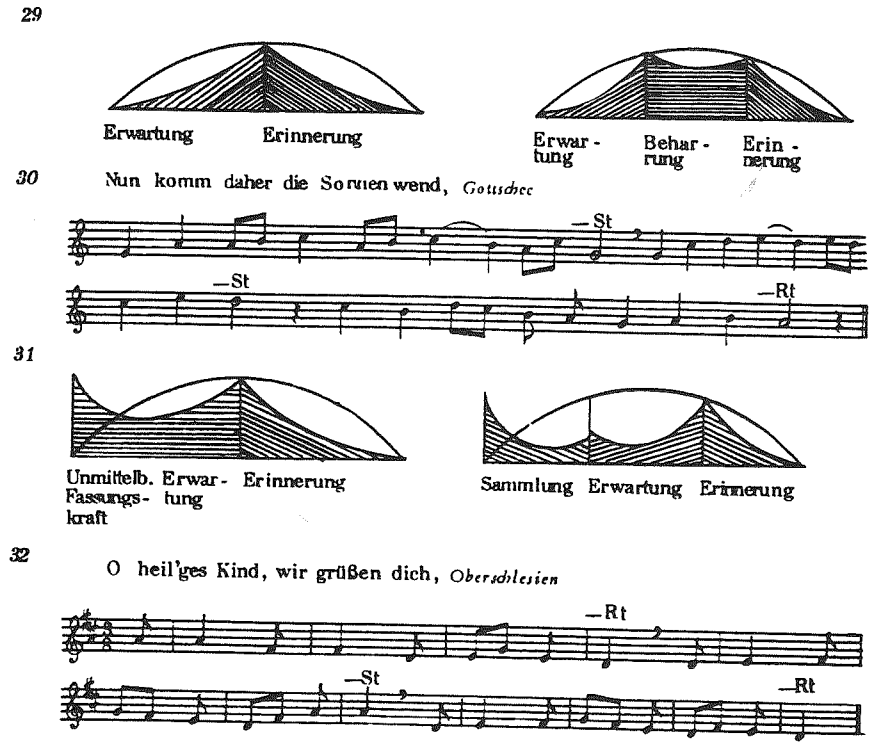


Figure 22.3 Neumann's dynamic shadings (taken from Hasty, *Meter as Rhythm*, p. 99)

of rhythmic qualities Neumann is able to describe three- or five-part schemes and variations within the two-part scheme as fully particular *Zeitgestalten* . . . These schemes include more complex tone sequences as well as 'time shapes' that encompass many bars."[11] Thus in addition to expectation (*Erwartung*) and recollection (*Erinnerung*), Neumann includes phases of persistence (*Beharrung*) and accumulation (*Sammlung*) (see Figure 22.3).

Neumann's approach and models for various *Zeitgestalten* informs Christopher Hasty's *Meter as Rhythm*, published in 1997. Hasty's approach to rhythm and musical time is also strongly influenced by Bergson's and Whitehead's discussions of time and temporal experience. When we listen to a tone, Hasty claims we have a sense of the musical present, a "feeling of growth, a feeling of continually new and expanding duration, and a feeling of [the] potential for becoming" (p. 72). A beginning such as a tone onset is for Hasty a "potential for duration." A second tone concretizes this

11 Hasty, *Meter as Rhythm*, p. 99.

)tential into an actual duration, and if the duration is neither too long or too short ;iven the limits of our perceptual faculties), this "determinate duration" may be pro- cted forward to anticipate the onset of a third event: "If durational determinacy is nked to the effect a duration has or can have on the formation of other events, we may)eak of degrees or types of determinacy . . . A specific sort of determinacy charac- :rizes the durations we call metrical" (p. 78). Contra Neumann, Hasty seeks to re- nite rhythm and meter by viewing meter as a particular kind of rhythmic process. ike Neumann, Hasty has a variety of categories to describe different projective pro- :sses (e.g., *arsic* vs. *anacrustic* continuations of projective process, and a special cate- ory of *deferral*, akin to *Beharrung*, that is involved in the formation of triple meters). ı addition, Hasty examines the ways in which projective potentials may be hierarchi- ally embodied.

)lifton. Thomas Clifton (1935–78) also considered the problem of the musical resent, though his concern was with the present of a broader scope. The phenomen- logical terms "protention," "retention," and "horizon" – which are taken from Husserl – are the keys to Clifton's account of the musical present. Clifton begins with etention, which is not to be confused with memory:

> Husserl characterizes retention as a kind of memory, called "primary remembrance" (*primäre Erinnerung*), distinguishable from the secondary sort of memory which is cut off from the felt present. Retention clings to events happening now, qualifying the real now with a wider, phenomenal now. Just as importantly, the retended object is mod- ified by the actually present sensations of that object. Retention is a form of memory which is articulated with the present, the two interacting with and influencing the content of each. We say that retentions endure, while memories are invoked.[12]

f retention is the relationship between current and prior events in "the present," pro- ention involves two analogous relationship(s) between current and subsequent events:

> Protention is the term for a future which we anticipate, and not merely await. Awaiting, like recollection, implies a disengagement from the present, whereas, experientially, the now which we perceive is colored by the way we intend a future. (p. 62)

)rotention, then, is much like the projection of a definite duration (Hasty), the :rwartung phase of the *Zeitgestalt* (Neumann), the anticipative impulse (Berry), or the ising crest of a metrical wave (Zuckerkandl). Collectively protentions and retentions :reate a boundary around the "musical present" (see Figure 22.4). The "present" may nean this tone, or this motive, or this phrase, or this piece, or this concert:

> All three temporal modes are always there, but not there in the same way; they are always distinguishable, but also always relatable; and finally, all three temporal modes

12 Clifton, *Music as Heard*, p. 59.

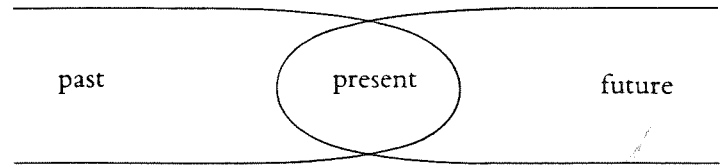


Figure 22.4 Musical horizons, from Clifton, *Music as Heard*, p. 65

> are permeated with actualities and possibilities in varying degrees, so that the past is never completely irrevocable, and the future is never completely predetermined or undetermined. Merleau-Ponty said it much more simply: "The past . . . is not past, nor the future future." (p. 65)

Rhythm in Schenkerian theory

While Heinrich Schenker wrote voluminously on the nature of harmony, counterpoint, and form (see **Chapter 26, passim**), his comments on rhythm represent a very small portion of his work. While the first generation of Schenker's students (such as Ernst Oster and Felix Salzer) were concerned with editing and translating Schenker's texts as well as elaborating his theories of tonality and form, it was the following generation of students who extended Schenker's work in the rhythmic domain by fleshing out the brief remarks Schenker makes on rhythm and meter in *Free Composition* as well as by attending carefully to the rhythmic aspects of his analytical notation.

Following Schenker's dicta, many of the concepts and metaphors used by Schenkerian theorists to discuss rhythm are borrowed from the pitch domain. Thus one finds discussions of tonal rhythm, rhythmic and metrical "dissonance," and techniques of rhythmic (as opposed to pitch) reduction. Most of these theorists also share a common presumption that rhythmic structures are organized by or otherwise dependent on pitch organization. While Schenker and his followers are sensitive to differences amongst structural levels, their discussions of rhythm, like those of pitch, are strongly recursive.

Schenker's comments on rhythm and motion at the most abstract levels of structure are somewhat contradictory. On the one hand, he unequivocally states that:

> The fundamental structure is arrhythmic.
>
> Rhythm can no more exist in the fundamental structure than it can in a strict-counterpoint *cantus firmus* exercise.
>
> Only when, through voice-leading transformations, linear progressions arise in the

> upper and lower voices of the middle ground, does a rhythmic ordering issue from the necessity of counterpointing the voices against each other. (p. 15)[13]

Yet elsewhere in *Free Composition* Schenker says that:

> Since it is a melodic succession of definite steps of a second, the fundamental line signifies motion, striving toward a goal, and ultimately the completion of this course. (p. 4)

Schenker's use of the term "signifies" is telling here – not that the line moves, or creates motion, but that the fundamental line is a sign of motion. Carl Schachter is able to accommodate this tension between arrhythmia and motion by making a distinction between *tonal* versus *durational* rhythm:

> What produces the patterned movement, the rise and fall of musical rhythm? I believe that there are two sources, one of them specifically musical, the other shared with other rhythmic phenomena. The purely musical one flows from the succession and combination of tones, *for the tonal system itself has rhythmic properties.*[14]

According to Schachter, tonal rhythm stems from the "recurrence of a tone after one or more different ones, the octave relationship, chordal and linear associations, consonance and dissonance," while durational rhythm stems from "a complex pattern of durations, emphases, and groupings which do not arise from the tones."[15] Thus Schachter is able to claim:

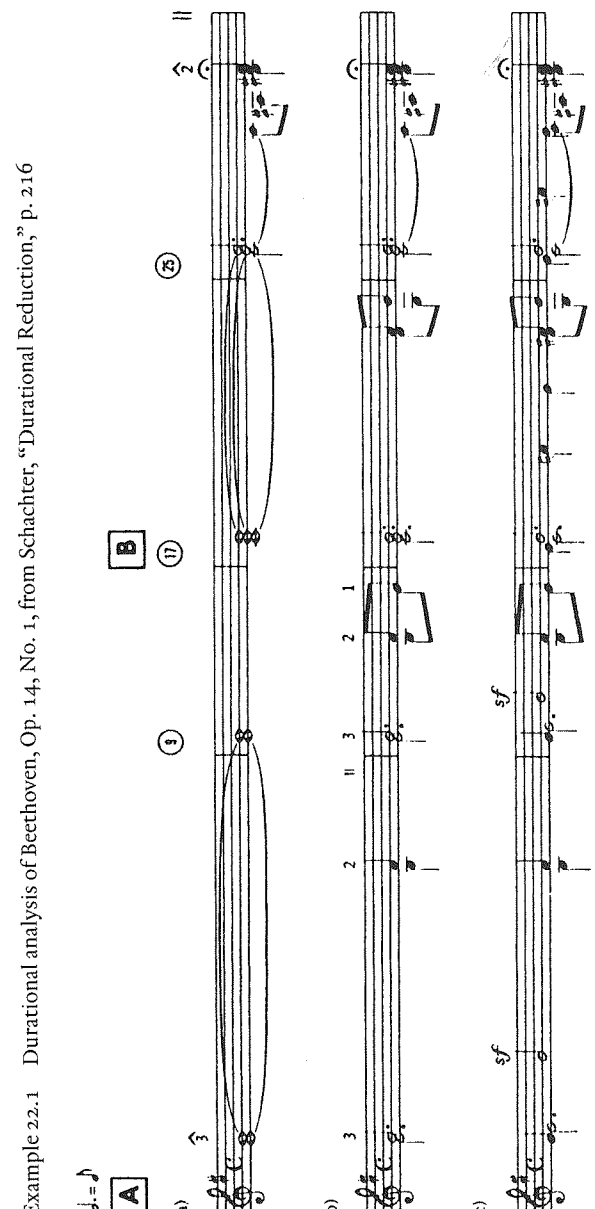
> Is the *Ursatz* arrhythmic, as Schenker maintained? My answer to this questions is a qualified no. I believe that progressions in the fundamental structure embody tonal, but not durational rhythm.[16]

Schachter goes on to note that tonal rhythm and durational rhythm may interact, as they "combine into a single continuum, sometimes supporting, sometimes diverging from, sometimes even contradicting one another."[17] In order to illustrate and explore their interaction, he develops a methodology of *durational reduction*, based on some principles first given in Schenker's *Der Tonwille* (see Example 22.1). Schachter says that durational reduction may be

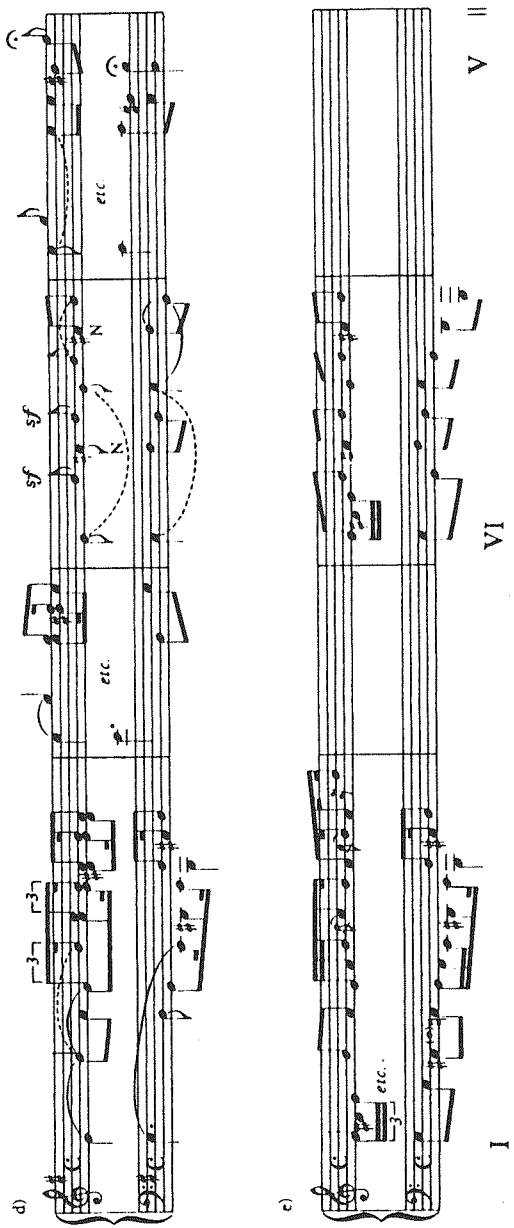
> applied to and coordinated with significant structural levels of voice leading; in other words, durational reduction combined with a reduction, in Schenker's manner, of the tonal contents . . . By indicating tonal events in durational proportion and by specifying the larger metrical divisions, such an approach can sometimes clarify aspects of rhythmic organization not directly revealed by graphic analyses that deal mainly with voice leading and harmony.[18]

Schenker himself acknowledges the role durational rhythm plays in the creation of meter in his comments on repetition:

13 All quotations of Schenker are from *Free Composition* unless otherwise noted.
14 Schachter, "A Preliminary Study," p. 313. Here also Schachter acknowledges Zuckerkandl regarding the "rhythmic character of the scale" (p. 314). 15 Ibid., p. 313. 16 Ibid., p. 317.
17 Ibid., p. 313. 18 Schachter, "Durational Reduction," p. 198.



Example 22.1 Durational analysis of Beethoven, Op. 14, No. 1, from Schachter, "Durational Reduction," p. 216



Example 22.1 (*cont.*)

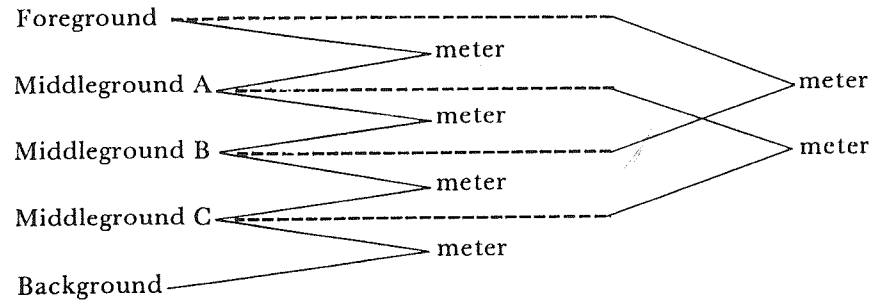


Figure 22.5 Interactions between rhythmic levels, from Yeston, *Stratification*, p. 67

> Repetition is also a prerequisite to meter and rhythm. Without repetition a metric scheme is inconceivable. But even repetitions that make up a metric scheme, like all foreground repetitions, are clarified and confirmed only by the background and middleground. (p. 118)

Schenker also states unequivocally that "all rhythm in music comes from counterpoint and only from counterpoint" (p. 15). Given that counterpoint involves the interaction between two or more melodic lines, in the case of rhythm one must speak of two or more tonal or durational "strata," to use the term coined by Maury Yeston. Yeston makes this contrapuntal condition clear in his statement: "A meter will never appear on any single stratum, but it will arise from the interaction of two strata, one of which must always be a middleground level" (p. 67).[19] Figure 22.5 gives Yeston's diagram for this interactive process, whereby a slower stratum, to use Yeston's term, "interprets" the organization of events on a faster level: "Hence the middleground is the interpretation of the foreground; it provides the accents by which foreground events may be grouped" (p. 68), and thus "all rhythmic patterns of middleground levels are determined exclusively by pitch criteria . . . chosen on the basis of principles of tonal structure" (p. 84).

Schachter moves away from Yeston's strict pitch-to-rhythm approach with respect to the formation of meter. Schachter notes that meter is "more closely bound to durational than to tonal rhythm," though of course "very frequently, however, aspects of tonal rhythm underscore the meter."[20] For Schachter, metrical accent is a phenomenal property of the music-as-heard:

> The listener's awareness of time spans automatically produces accents that punctuate his experience of the music; *these accents result from the heightened attention attracted by the boundary points of the spans* . . . The accents thus produced are true *metrical accents* –

19 All quotations of Yeston are from *The Stratification of Musical Rhythm*.
20 Schachter, "A Preliminary Study," p. 318.

metrical because they arise directly out of the listener's awareness of the equal divisions of time that measure the music's flow.[21]

Schachter also notes that there are limits to meter and metrical accent, as there are limits on our perception of equivalent time spans: "Over very long spans of time, therefore, meter ceases to be directly available to the listener, who receives little or no help in determining whether the time intervals are really equivalent."[22]

Interactions between layers of durational and/or tonal rhythm may produce more complex aggregate rhythmic structures. Yeston lays out two broad categories of interaction between strata:

> The first is one in which the rate of any level of motion in a piece can be expressed as a simple multiplication or division (by an integer greater than 1) of the rate of any other level of motion in the piece. The resulting structure . . . may be characterized, metaphorically, as *rhythmic consonance* . . . The second broad category under discussion extends the convenient metaphor and may be characterized as *rhythmic dissonance* . . . [whenever] there are found to be two levels in a piece that cannot be expressed as a simple multiplication or division of each other. (pp. 77–8)

Yeston was not the first to apply the consonance/dissonance distinction to describe and categorize various rhythmic and metrical structures. Harald Krebs has noted that "both composers and theorists often have employed terms originally developed in connection with pitch theory" to describe rhythmic phenomena, and notes the use of rhythmic "dissonance" by Schillinger, Sachs, Hlawicka, and Cooper and Meyer (see Figure 22.6); similarly Schachter acknowledges the use of the term by Seeger.[23] Krebs then refines Yeston's definition of metrical dissonance:

> Metrical dissonance, unlike consonance, requires the presence of at least three levels – a pulse level and at least two interpretive levels that provide conflicting groupings of the pulses. The [metrical] conflict can arise in two ways. First, the cardinalities of the two interpretive levels may be different and not related by an integral common factor . . . [Second,] conflicting groupings of a pulse level can also arise from the non-aligned superimposition of at least two interpretive levels of the same cardinality.[24]

Schachter also considers "alternative and conflicting metrical patterns," including ambiguity of downbeat location, ambiguity of hypermetrical organization, and the interaction between simultaneous meters.[25] Krebs's expanded taxonomy of rhythmic and metrical dissonance has been given further discussion by Cohn, Kamien, and Samarotto.[26]

21 Schachter, "Aspects of Meter," p. 5. 22 Ibid., p. 16.
23 See Krebs, "Some Extensions," p. 99, and Schachter, "Aspects of Meter," p. 26.
24 Krebs, "Some Extensions," p. 103. 25 Schachter, "Aspects of Meter," pp. 29–36.
26 Cohn, "Dramatization of Hypermetric Conflict"; Kamien, "Conflicting Metrical Patterns"; Samarotto, "Strange Dimensions."

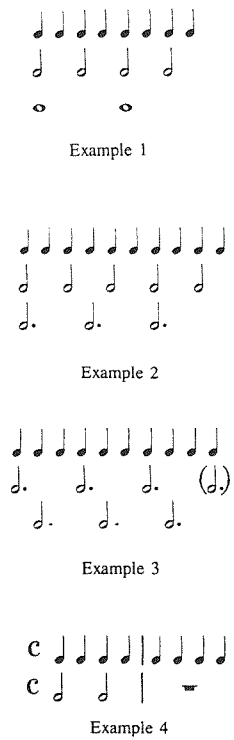


Figure 22.6 Varieties of metrical dissonance, from Krebs, "Some Extensions," p. 102

For Schenker, some rhythmic structures are normative:

> Since the principle of systole and diastole is inherent in our very being, metric ordering based on two and its multiples is the most natural to us. (p. 119)

> Measure orderings in odd numbers (such as 3 or 5) have their roots in a duple ordering in the background and middleground; this brings into clear relief the fact that metric schemes involving the numbers 3 and 5 are man-made and not as natural as duple orderings. (pp. 119–20)

Schenker then goes on to describe the process of rhythmic expansion (*Dehnung*):

> An expansion follows from one or more measures of a metric prototype. There must be an organic relationship. Despite the fact that prototype and derivation follow one another in direct succession, their relationship can be recognized only from the middleground and background. (p. 124)

William Rothstein has explored the relationships between rhythmic prototypes and their variants from a theoretical perspective that is equal parts Heinrich Schenker and

Heinrich Koch. Rothstein uses the term *phrase rhythm* to describe rhythmic structures that involve both phrase structure (which may contain both tonal and durational rhythms) as well as hypermeter.[27] He then discusses various techniques of phrase rhythm, including overlaps, elisions, prefixes, suffixes, and various types of internal expansions as they may be applied to prototypical phrases and hypermeasures.

Architectonic approaches to rhythm

Cooper and Meyer. A number of theorists, mainly North American and mainly from the last third of the century, have focused on the hierarchical aspects of meter and rhythm. Consider the following dictum by Grosvenor Cooper and Leonard Meyer, who collaborated on an influential study of rhythm and meter in 1960 while both taught at the University of Chicago:

> As a piece of music unfolds, its rhythmic structure is perceived not as a series of discrete independent units strung together in a mechanical, additive way like beads, but as an organic process in which smaller rhythmic motives, while possessing a shape and structure of their own, also function as integral parts of a larger rhythmic organization. (p. 2)[28]

In order to account for the relationship(s) between parts and wholes, the various parts must be identified, articulated, and related to each other. Such "architectonic" analyses indicate how units on one level nest to form higher-level structures, and they typically concern themselves with determinations of grouping, accent, and hierarchical super- and subordinate relationships. These analyses often represent the final state of a passage or piece, that is, rhythmic relationships as they are understood in retrospect. At the same time, many architectonic analyses of rhythm take a bottom-up (as opposed to a top-down) approach, starting with the smallest units of the foreground and then moving to larger and larger structural units, at times extending to the highest levels of form. From this view form becomes an aspect of rhythm; for example, Cone has claimed:

> Certain general rhythmic principles underlie common formal units . . . [and] the *same principles, working on higher levels* [italics mine] and more comprehensive formal sections, can ultimately be invoked to explain an entire composition as one all-embracing rhythmic impulse.[29]

Cooper and Meyer give a comprehensive account of rhythm and form that is based on a few accentual archetypes:

27 Rothstein, *Phrase Rhythm in Tonal Music*, p. 12.
28 All quotations of Cooper and Meyer are from *The Rhythmic Structure of Music*.
29 Cone, "Musical Form and Musical Performance," p. 39.

> Rhythm may be defined as the way in which one or more unaccented beats are grouped in relation to an accented one. The five basic rhythmic groupings may be differentiated by terms traditionally associated with prosody . . . Since, as noted above, rhythmic organization is architectonic, more extensive rhythmic structures – phrases, periods, etc. – as well as shorter, more obviously rhythmic motives exhibit these basic patterns. (p. 6)

They then list the basic patterns – iamb (Weak–Strong), anapest (W–W–S), trochee (S–W), dactyl (S–W–W), and amphibrach (W–S–W). These are not simply musical analogs to the poetic feet, as found in eighteenth-century theory (e.g., as shown in **Example 21.1, p. 665**) and even the earlier medieval rhythmic modes (as shown in **Figure 20.1, p. 630**). The patterns of Cooper and Meyer involve not durations, but beats, though duration plays a role in defining beats. In defining their archetypes as groups of beats, their analytical methodology commingles meter and rhythm. Beats are defined as pulses that are counted in a metrical context. Accent is more difficult to define – as they themselves acknowledge:

> One cannot at present state unequivocally what makes one tone seem accented and another not. For while such factors as duration, intensity, melodic contour, regularity, and so forth obviously play a part in creating an impression of accent, none of them appears to be an invariable and necessary concomitant of accent . . . Accent is a relational concept. There can be accents only if there are unaccents (weak beats) and vice versa. In this sense there is no such thing as a series of accents or a series of weak beats. If all stimuli are alike, there is only a series of pulses. An accent, then is a stimulus (in a series of stimuli) which is *marked for consciousness* in some way. (pp. 7–8)

Given this normative fluctuation between accent and unaccent, there will tend to be one or two weak beats between every strong beat, and this tendency constrains the number of possible grouping patterns.

Cooper and Meyer first examine rhythms on lower architectonic levels, that is, the ways in which each of the five basic groups can fit into various meters (e.g. S–W patterns in duple meter, then in triple meter, and so forth). They note how grouping and meter may or may not be congruent, how a passage may have more than one possible grouping (and how performance may effect grouping), how groups may overlap, and how even the simplest patterns often involve some hierarchic nesting amongst groups and subgroups. They then move on to composite groups on higher structural levels. Their treatment of a passage from the beginning of the first Bourrée of Bach's English Suite in A major is given in Figure 22.7. They continue to use their archetypes through the highest levels of structure, and conclude their book with an analysis of the first movement of Beethoven's Eighth Symphony as a giant anapest (pp. 183–203).

Lerdahl and Jackendoff. Of all of Cooper and Meyer's claims, it is their treatment of large spans of music as accented and unaccented that has received the most criticism,

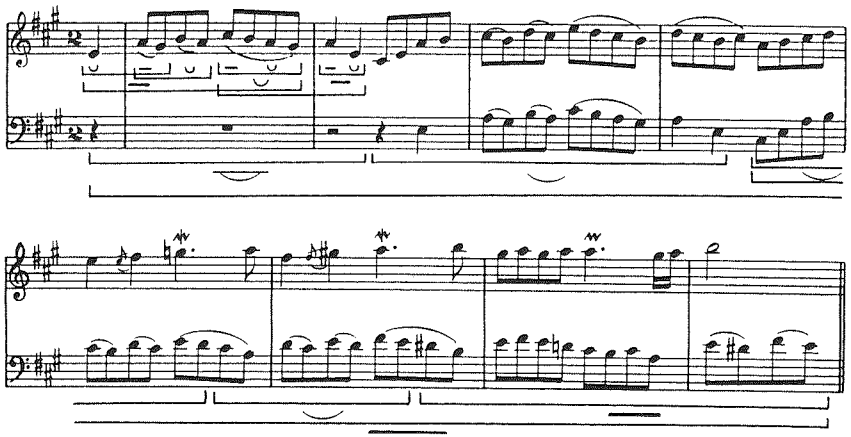


Figure 22.7 Nested levels of rhythm in the Bourrée of Bach's English Suite in A major, from Cooper and Meyer, *The Rhythmic Structure of Music*, p. 69

and indeed, Meyer himself has backed away from this position.[30] Another aspect of Cooper and Meyer's theory that is both a strength and a weakness is how they have rhythm and meter inseparably intertwined. While they acknowledge that various grouping structures occur in and are dependent upon particular metrical contexts, Cooper and Meyer's analyses only indicate a single hierarchy – nested patterns of accentuation. In distinction to Cooper and Meyer, the music theorist and composer Fred Lerdahl and the linguist Ray Jackendoff collaborated on an important study of tonal music strongly influenced by theories of prosodic structure in language.[31] They treat rhythm and meter as independent though inter-related hierarchies: one of durational groups, and another of metrical time points.[32] Each is governed by its own set of well-formedness and preference rules. The grouping hierarchy, which extends recursively from the highest levels of structure down to the foreground, is an inclusive nesting of time spans. Groups must be contiguous, smaller groups must be wholly contained within larger groups, and larger groups are exhaustively partitioned into smaller groups. Under special conditions groups may overlap, but overlaps are understood as a surface transformation from an underlying non-overlapped structure.

Lerdahl and Jackendoff treat the metrical hierarchy as a pattern of beats.[33] Beats do

30 See Schachter, "A Preliminary Study," pp. 306–07; Kramer, "The Time of Music," pp. 88–89; and Meyer, "A Pride of Prejudices," p. 250.

31 All quotations from Lerdahl and Jackendoff are from *A Generative Theory of Tonal Music*. A broader discussion of the epistemological underpinnings of their theory is found in Chapter 3, pp. 99–102.

32 Moreover, in Lerdahl and Jackendoff's theory the rhythmic and metrical hierarchies are two components of a more comprehensive analytical system which also includes higher-level time-span and durational reductions (pp. 8–11).

33 Their treatment of the metrical hierarchy has its antecedents in Komar, *A Theory of Suspensions*.

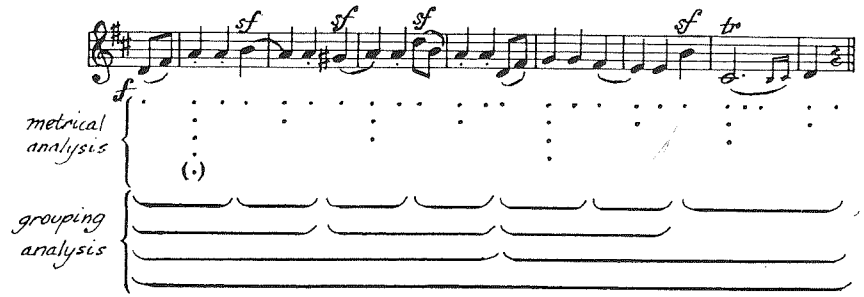


Figure 22.8 Meter–rhythm interaction in Haydn's Symphony No. 104, minuet, from Lerdahl and Jackendoff, *A Generative Theory of Tonal Music*, p. 26

not have duration; rather, they are "idealizations, utilized by the performer and inferred by the listener" that are read off the grouping structure. Metrical patterns thus arise in response to rhythmic regularities in the foreground (p. 37). As such, metrical levels must be isochronous (i.e., consist of equally spaced beats), and each metrical unit must consist of either two or three beats. Every articulation in the music must correspond to a metrical articulation at some level. As regularity is attenuated on higher levels of structure, so too is meter; as a result, Lerdahl and Jackendoff relegate the metrical hierarchy to the lower levels of structure (p. 21).

In Figure 22.8, the grouping hierarchy consists of a series of nested durations, while the metrical hierarchy is expressed by the pattern of dots immediately below the staff. Lerdahl and Jackendoff stress that "groups do not receive metrical accent, and beats do not possess any inherent grouping" (p. 26). Both the metrical and grouping patterns emerge through the operation of a set of preference rules assigned to each hierarchical domain. While Lerdahl and Jackendoff's well-formedness rules delimit what grouping and metrical structures are possible, the preference rules choose among possible structures to a maximally preferable analysis of the meter and grouping in a given context. These preference rules take into account symmetry, parallelism, gestalt principles of pattern formation, and style-specific syntactic cues. While the well-formedness rules are held to be universal, the preference rules may be tailored to a particular musical culture or style.

Lerdahl and Jackendoff's separation of rhythm and meter also helps clarify the definition of accent. Cooper and Meyer make a distinction between accent and stress: "Stress . . . means the dynamic intensification of a beat, whether accented or unaccented. Thus a stress, no matter how forceful, placed on a weak beat will not make that beat accented" (p. 8). Stress is analogous to Lerdahl and Jackendoff's *phenomenal accent*, and they include not only dynamic emphasis but also relative length, sudden changes in timbre or texture, and so on. They further distinguish between *structural accent*, "caused by the melodic/harmonic points of gravity in a phrase or section," and *metrical*

accent, created by the hierarchical persistence of a beat (p. 17). Each category of accent tends to accrue to a particular hierarchical level: phenomenal accents are most salient on the foreground, metrical accents on the levels immediately above the foreground, and structural accents on middleground and higher levels. Lerdahl and Jackendoff's three types of accent are similar to David Epstein's categories of stress, rhythmic accent, and metrical accent.[34] While Lerdahl and Jackendoff distinguish structural and metrical accents on the basis of the difference between time-span and time-point relationships, Epstein's accentual categories stem from his distinction between a "chronometric time" consisting of beats, measures, and metrical accents versus an "integral time" which contains pulses, rhythmic groups, and hence both rhythmic accent and stress.

Extending the metrical hierarchy above the notated barline gives rise to hypermeter, a term generally ascribed to Edward Cone, wherein individual measures "behave as a single beat."[35] Beethoven's "Ritmo di tre battute" in the Scherzo of the Ninth Symphony is an obvious example, but hypermeter is more than a notational conceit.[36] In a true hypermeter, meter is operative beyond the musical foreground, though theorists differ as to just how far meter may extend to higher levels of structure. Lerdahl and Jackendoff have argued for a hypermeter of limited scope, usually no more than two to four *hyperbeats* (pp. 21–25). Their use of the term "hyperbeat" refines Cone's definition, as it is not measures (that is, spans of time) which function as the elements of a hypermeasure, but the metrically accented beats at one level which form hyperbeats on the next-highest level. Like Lerdahl and Jackendoff, Joel Lester has argued that extensive hypermeters are relatively rare, and cautions against confusing regularity of phrase structure with hypermeter proper.[37] In contrast, Arthur Komar, Wallace Berry, and Jonathan Kramer have given analyses of the metrical hierarchy for entire movements.[38] Figure 22.9 gives Kramer's analysis of the first movement of Beethoven's Sonata in C minor, Op. 13, which is quite detailed.

Kramer. Kramer explicitly relaxes Lerdahl and Jackendoff's metrical well-formedness rules, which require isochronously spaced beats and downbeats – note the irregular spacing of "beats" on levels b and c in Figure 22.9.[39] Instead, he focuses on the creation of higher-level metrical accents which serve to articulate each hyper-measure. These hyper-accents are high-level points of initiation; indeed, Kramer's conception of metrical accent draws on Berry's concept of impulse noted above. By defining higher-level metrical accent in terms of an initiation which accrues to a time point, Kramer is able to avoid the problem of accented spans that arose in Cooper and Meyer's rhythmic analysis of entire movements.

34 Epstein, *Beyond Orpheus*, pp. 60–62. 35 Cone, *Musical Form and Musical Performance*, p. 79.
36 Even in the Beethoven Scherzo hypermeter is more than a notational conceit. See Cohn, "The Dramatization of Hypermetric Conflicts." 37 Lester, *The Rhythms of Tonal Music*, pp. 163–67.
38 Komar, *Theory of Suspensions*; Berry, *Structural Functions*; Kramer, *The Time of Music*.
39 All Kramer quotations are from *The Time of Music* Kramer's analysis of Op. 13 is indebted to Komar's analysis of the same piece – see *Theory of Suspensions*, pp. 151–61.

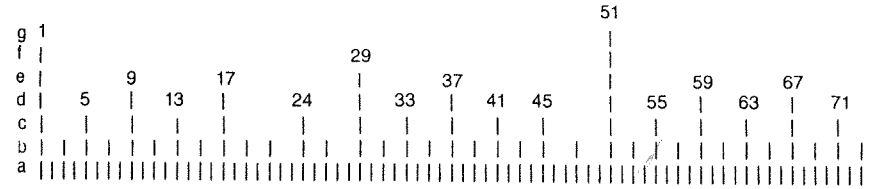


Figure 22.9 Hypermetric analysis of the entire second movement of Beethoven's Op. 13, from Kramer, *The Time of Music*, p. 119

Kramer's discussion of musical rhythm, meter, and form is notable not only for its treatment of architectonic structure, but also for its treatment of what might be termed "anti-architectonic" music – the rhythmic analysis of pieces which resist listening and analysis in terms of the relationships between their parts and wholes. He outlines a continuum of temporal coherence and order, from the most continuous, contiguous, and teleological arrangement of musical elements to the most fragmentary and dissociated musical structures. He begins with a definition of *linearity*: "Let us identify linearity as *the determination of some characteristic(s) of music in accordance with implications that arise from earlier events of the piece*" (p. 20). Kramer is careful to distinguish between linearity versus continuity: "nonlinearity should not be equated with discontinuity, since discontinuities can acquire their force by violating linear as well as nonlinear implications" (p. 22). Likewise, linearity, though typical of tonal compositions, may also be present in atonal compositions (e.g., in pieces or sections that are characterized by a constant thickening of texture, increase of dynamics, or acceleration). Linear time may involve more than a simple chain of syntactic entailments. Kramer describes the possibility of *multiply directed linear time*, one that "depends on underlying linearity being perceptible even when not presented in linear order" (p. 46).

A composition may abandon linearity all or in part. According to Kramer, *nonlinearity* is the "principle of composition and listening in which events are understood as outgrowths of general principles that govern entire pieces" (p. 453) and is exhibited by "pieces in which the texture, motivic material, and rhythmic figuration are virtually constant," as in the case of many minimalist compositions (p. 40). A piece that is almost or entirely nonlinear creates a radically different kind of temporality: "A nonlinear composition in moment time does not really begin. Rather, it simply starts, as if it had already been going on and we happened to tune in on it . . . [similarly, it] ceases rather than ends" (p. 50). Thus pieces like Stockhausen's *Gesang der Jünglinge* or Ives's *The Unanswered Question* involve high degrees of nonlinearity, as do pieces that are composed and/or performed with various degrees of indeterminacy.[40]

40 On varying types of indeterminacy, see Cage, "Indeterminacy," in *Silence*, pp. 35–40.

When there is no fundamental linearity and when the music is markedly discontinuous, the result is *moment time*, a term Kramer uses following Stockhausen's notion of *moment form*:

> These forms do not aim toward a climax, do not prepare the listener to expect a climax, and their structures do not contain the usual stages found in the development[al] curve of the whole duration of a normal composition . . . They are forms in a state of always having already commenced, which could go on as they are for an eternity . . . an eternity that is present in every moment.[41]

While moment time may seem extreme, beyond it lies *vertical time*. A piece which attempts to create vertical time contains a single, static moment as its entire essence. Such pieces have no hierarchical structure whatsoever – there are no parts, nor relationships among them, only a singular whole. The result, according to Kramer, "is a single present stretched out into an enormous duration, a potentially infinite "now" that nonetheless feels like an instant. In music without phrases, without temporal articulation, with total consistency, whatever structure is in the music exists between simultaneous layers of sound, not between successive gestures" (p. 55). Thus, the apprehension of vertical time involves the absence – indeed, the very impossibility – of temporal arrangement. It is the absence of time itself, and as Zuckerkandl has noted:

> Should time vanish, all motion must instantly vanish too, tonal motion not excepted. A God enthroned beyond time in timeless eternity would have to renounce music . . . [as] temporal omnipresence would make the revelation of audible beauty impossible. It argues against God's timelessness. Are we to suppose that we mortals, in possessing such a wonder as music, are more privileged than God? Rather, to save music for Him, we shall hold, with the Greeks, that God cannot go behind time. Otherwise what would He be doing with all the choiring angels?[42]

Rhythm in post-tonal music

The discontinuity and nonlinearity that is characteristic of post-tonal compositions creates many challenges for rhythmic theory and analysis. One way of meeting these challenges is to focus on the compositional process, rather than analytically tracing the complex surfaces and forms which result. Indeed, it is not surprising that rhythm in post-tonal music receives extended attention in the writings of composers of multiserial or totally serialized music (e.g., Stockhausen, Babbitt, Krenek, Boulez), since for these composers rhythm was an important element in their systematic treatment of all musical parameters. More surprisingly, perhaps, is the extent to which many of these

41 Stockhausen, *Texte zur elektronischen und instrumentalen Musik*, p. 199, cited in Kramer, *The Time of Music*, p. 201. 42 Zuckerkandl, *Sound and Symbol*, p. 151.

composers were versed in temporal philosophy. Thus we find composers such as Koechlin, Stravinsky, Boulez, Sessions, and Carter citing the likes of Bergson, Langer, Suvchitsky, or de Selincourt in their own remarks on the rhythmic aspects of composition and musical structure. Other theorists and composers have confronted the challenge of post-tonal rhythmic theory and analysis more directly, and have addressed such topics as the description and segmentation of a rhythmic surface in post-tonal music and the metrical implications of the twelve-tone system. Many of these writers (e.g., Babbitt, Lewin, Morris, and Roeder) have developed sophisticated theories of rhythm and tools for rhythmic analysis using the language and methods of mathematical group theory.

A basic doctrine of post-tonal theory and analysis is that there are essential isomorphisms between pitch and time, and so there are substantive parallels between pitch and temporal phenomena. As we have already noted, Schachter has remarked that the "tonal system itself has rhythmic properties."[43] Composers of post-tonal music extend this notion to assignations of rhythmic and quasi-rhythmic properties rooted in the chromatic pitch universe. For example, Stockhausen does not even separate rhythm and pitch into ontologically separate domains. Rather, he notes that pitches and rhythms both involve periodic phases between successive impulses, with a threshold of about one-sixteenth of a second as the boundary between the two:

> Our sense-perception divides acoustically-perceptible phases into two groups; we speak of *durations* and *pitches* . . . Until a phase-duration of approx. $^1/_{16}''$, we can still just hear the impulses separately; until then, we speak of "duration," [even] if of one that becomes extremely short. Shorten the phase-duration gradually to $^1/_{32}''$, and the impulses are no longer separately perceptible . . . one [now] perceives the phase-duration as the "pitch" of the sound. (p. 10)[44]

Stockhausen draws parallels between the overtone series for pitch and categorical values for duration (see Figure 22.10). He claims: "What is such a series of proportions, $^1/_1, ^1/_2, ^1/_3, \ldots ^1/_{12} \ldots$, when applied to time-phases? . . . That is nothing more nor less than a *harmonic or overtone series*" (p. 16).

Just as one may have a complex tone which contains several composite partials, so too one may speak of composite rhythm or meter, what Stockhausen terms a *formant spectrum* (pp. 17–18). This leads him to claim that:

> The difference between *metre* and *rhythm* is exactly that which we discern between the "fundamental tone" and the "tone-colour" of sound-spectra; the fundamental phase (metric fundamental) is defined by the periodic main intensity-maxima (the heaviest accents), and these result from the formant-structure . . . Shifting the basic metric period is thus akin to modulation, while changes of patterning within the basic period are not. (pp. 19–20)

43 Schachter, "A Preliminary Study," p. 314.
44 All quotations of Stockhausen are from " . . how time passes . . ."

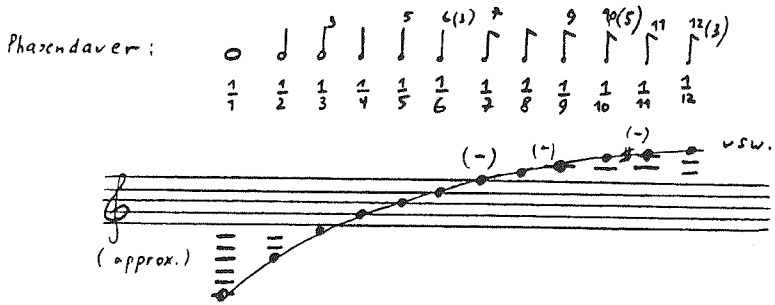


Figure 22.10 Rhythmic durations as a harmonic series, from Stockhausen, "How Time Passes," p. 16

Elliott Carter has explicitly termed such shifts of the basic metric period "metric modulations," though Carter often uses a series of shifts, along with coordinated changes in the notated durations, to create an effect whereby one part of the texture seems to maintain a steady beat while another continuously speeds up or slows down.[45] Stockhausen also suggests that one may partition the range of perceptible durations into various octaves, just as one may partition the range of audible pitch space:

> The composition of durations has at its disposal a *chromatic scale of durations over approx. seven octaves*, between 8″ and $^1/_{16}$″, and in every 2 : 1 relationship, the chromatic scale of twelve durations, fixed by metronome markings, repeats itself. Together with the seven or eight pitch-octaves, *musical time* would thus be circumscribed in fourteen or fifteen *time-octaves*, in which the composer proportions phase-relationships both in the sphere of duration and in that of pitch. (p. 21)

Going beyond Stockhausen's time-octaves, Boulez draws the distinction between "smooth" versus "striated" varieties of space for pitches and time for durations: "pulsation is for striated time what temperament is for striated space; it has been shown that, depending on whether partition is fixed or variable, defined space will be regular or irregular; similarly, that the pulsation of striated time will be regular or irregular, but systematic."[46] Thus just as the semitone partitions the octave into sub-modules, so too do pulses divide a larger module into smaller units of time. The difference between a constant versus a shifting tempo is the difference between two different modularities of musical time:

> *Straight time*, corresponding to straight space, will, whatever the partition, observe a constant module; in other words, the original values being comprised between two limits, the derived values will be comprised between the multiples of the relationship defined by these two limits. *Curved time*, on the contrary, will cause the derived values

45 Carter, "Music and the Time Screen," in *The Writings of Elliott Carter*, pp. 349–50.
46 Boulez, *Boulez on Music Today*, p. 91.

> to depend upon a function of the relationship defined by these two limits . . . Whatever the module, *regular time* will be that in which partition remains fixed; *irregular*, where partition varies (according to a defined numerical proportion or to the tempo).[47]

Messiaen claimed there are isomorphisms between symmetrical scale forms (his modes of limited transposition) and his symmetrical durational patterns, what he termed "non-retrogradable rhythms":

> Modes which cannot be transposed beyond a certain number of transpositions, because one always falls again into the same notes; rhythms which cannot be used in retrograde, because in such a case one finds the same order of values again – these are two striking impossibilities . . . Immediately one notices the analogy of these two impossibilities and how they complement one another, the rhythms realizing in the horizontal direction (retrogradation) what the modes realize in the vertical direction (transposition). After this first relation, there is another between values added to rhythms and notes added to chords . . . Finally, we superpose our rhythms . . . [and] we also superpose our modes.[48]

> These modes are divisible into symmetrical groups; these rhythms, also, with this difference: the symmetry of the rhythmic groups is a retrograde symmetry. Finally, the last note of each group of these modes is always *common* with the first of the following group; and the groups of these rhythms frame a central value *common* to each group.[49]

While composers struggled individually to find ways to extend the principles of serialism beyond the pitch domain, there were marked differences between European and North American approaches to the serialization of rhythm. Milton Babbitt has given an extended discussion of the issues of rhythm within the context of serial technique. Given that a twelve-tone series is essentially a series of intervals, and thus a function of the relative difference between successive pitches, he notes that one cannot simply translate pitch-differences to durational differences:

> There is no apparent basis for constructing duration classes by designating as elements of the same durational equivalence class those durations which differ by a multiple of 12 or any other number. The temporal analog of pitch interval is translatable only as "the difference between durations." Even without arguing the dubious perceptual status of this notion, the ordered succession of such differences remains invariant under transposition if and only if one assumes difference classes as a result of applying transposition modularly, and therefore embracing the assumption of duration classes in its most unrealistic form.[50]

Babbitt thus recognizes some limits to the pitch–time isomorphism. As a result, he focuses on orderings of and relationships between time-points within a measure which has twelve distinct positions – and so one may speak of time-point equivalence classes:

> The notion of meter is made an essential part of the systematic structure. The equivalence relation is statable as "occurring at the same time point with relation to the

47 Ibid., p. 93. 48 Messiaen, *The Technique of My Musical Language*, p. 13. 49 Ibid., p. 21.
50 Babbitt, "Twelve Tone Rhythmic Structure and the Electronic Medium," p. 161.

measure." The "ascending" ordered "chromatic scale" of twelve time points, then, is a measure divided into twelve equally spaced time points.[51]

While Babbitt discussed the various ways pitch-class operations such as transposition, inversion, and the like can be applied within this particular context (i.e., a multiserial composition), Robert Morris describes how these operations can be applied to any ordered series of time points.[52] Given some reference point 0, and a minimum duration which defines the interval between time-points, one may then consider a set of time-points derived from this series (see Figure 22.11).

The series in Figure 22.11a may be transposed *n* units to the right or left by adding or subtracting n to the value of each time point in the set. The set as a whole may be subject to augmentation or diminution (multiplied by some value of n), retrograded (multiplying each value by −1, which Morris labels as inversion since −1 is the inversion operator in pitch and pitch-class space), or both, as in Figure 22.11b. Note how in both Figures 22.11a and 22.11b the various operations preserve the durational shape of the original time-point set. In Example 22.11c we see how these time-point series, sets, and operations may also be mapped into a modular time-point space. Here the series {3578} is transformed by a variety of multiplicative operations. In a modular space these operations do not preserve the durational shape of the series; indeed, in the last instance, the operation maps two values onto the same location, reducing the number of elements by one.

In contrast to the accounts given above, other theorists, particularly in North America, have sought analytical methodologies independent of the compositional process. To be sure, as in the analysis of pitch relationships, a tenet of post-tonal rhythmic analysis is that "beneath the complex surface exists a considerable degree of regularity."[53] For example, Allen Forte developed a method for systematically searching for patterns of duration by cataloguing and ordering all possible correlations between note onsets and offsets through his "proportional graphs," a linear representation of all of the durations in the musical texture expressed in terms of the smallest common duration present, and "attack–release partitions," an ordered presentation of the aggregate pattern of durations and silences, again expressed in terms of the smallest common durational unit.[54] These graphs and partitions may then be used in the search for durational patterns, including rhythmic motives (which may be manifest on different structural levels) as well as symmetrical orderings of durations and durational complexes. In many instances, by backtracking from durational regularities one can find important pitch configurations and relationships (i.e., viewing rhythmic configurations as the durational residue of a pitch-to-rhythm compositional process). Forte also notes that pitch and rhythm may relate to each other on a more equal and more complicated footing: "the pitch-class set structure of [some of Webern's] works . . . is

51 Ibid., p. 162. 52 Morris, *Composition with Pitch Classes*, pp. 299–307.
53 Forte, "Aspects of Rhythm in Webern's Atonal Music," p. 90. 54 Ibid., p. 90.

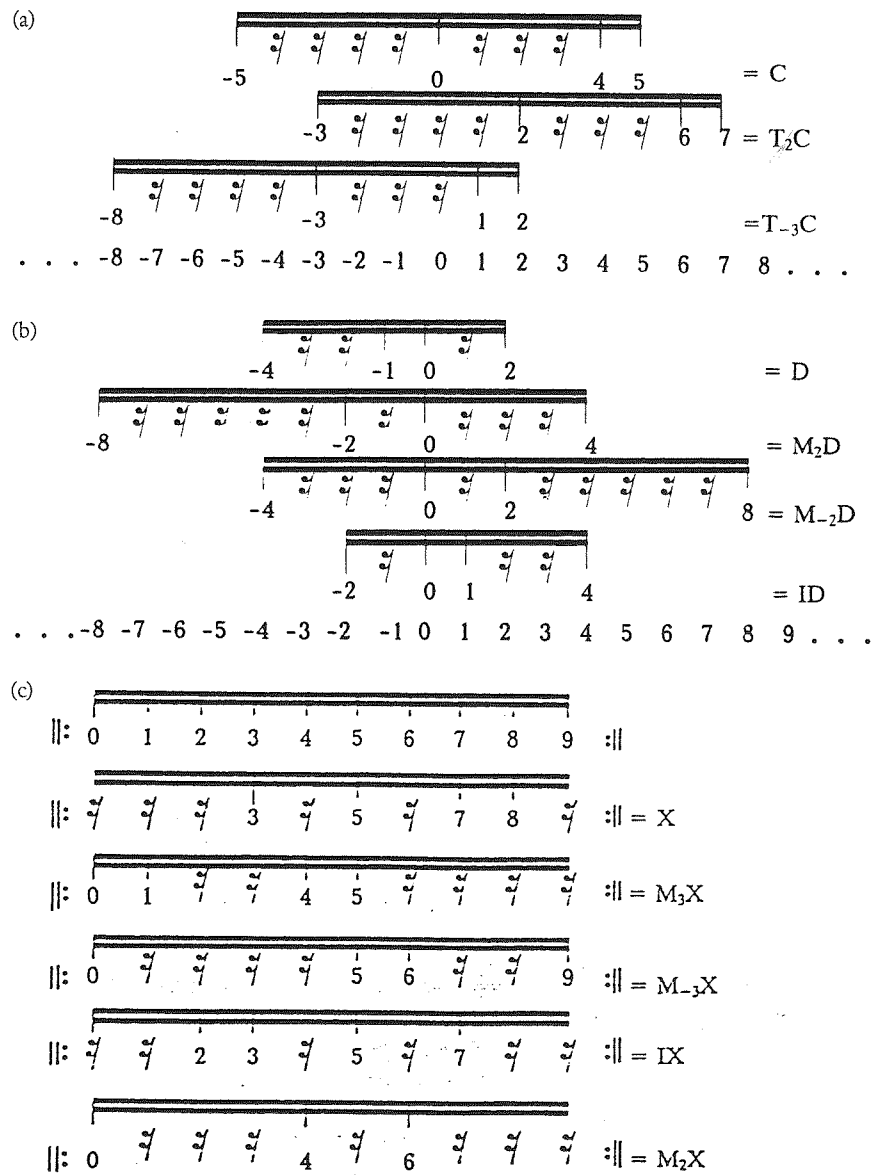


Figure 22.11 Manipulations of time-point series, from Morris, *Composition with Pitch Classes*, pp. 300–03

intimately allied to the fundamental rhythmic structures of the work. Perhaps even more important, it can be tentatively concluded that the relations among pitch-class sets in terms of intersections, unions, and complements have structural analogues in the relations among rhythmic formations in terms of combinations and partitions of durations."[55]

While Forte specifically eschews any appeal to meter in his account of durational patterns, Martha Hyde argues for the cogency of meter in serial music. Her principal thesis is that

> In tonal music, well-defined principles determine the equivalence or commensurability of pitch events and so regulate the articulation of rhythmic strata derived from them. These tonal principles – such as the rules of voice-leading and harmonic progression, or the role of triadic structure – can produce middleground pitch events that recur regularly, providing an important source of rhythmic accent. An analogous process operates in Schoenberg's twelve-tone music: structural principles determine analogous functions for various pitch events, recurrence of these analogous pitch events produces middleground rhythmic strata, and, as in tonal music, middleground strata make up a key source of rhythmic organization.[56]

Thus Hyde's methodology is overtly and strongly pitch-to-rhythm, and her main task is to show how specific recurrences of various pitch-class sets form a middleground stratum (following Yeston) which serves to organize lower-level articulations and produce metrical accents through their interaction.

David Lewin has developed a general approach to rhythm, including post-tonal rhythm, using the tools of mathematical group theory.[57] Different types of rhythmic relationships may be considered in the context of various conceptual spaces: ordered time-points, modularly ordered time-points, durational quotients, durational quotients in a modular durational space, durational differences, and durational differences in modular duration space. In each type of musical space one may explore various categories of equivalence classes and transformations. For example, precedence relationships can be considered in the first time-point space, while tempo differences (i.e., the same pattern of durations performed at different tempi) may be construed relative to the first durational space. Lewin also notes how different compositional approaches to rhythm, such as Babbitt's system of twelve beat-classes, or Carter's proportionally modulating tempi, correspond to particular rhythmic spaces – a modular time-point space and a proportional duration space, respectively (p. 23). In so doing, Lewin neatly sorts out how different approaches to musical time will give rise to different classes of similarity relationships.

Lewin is also sensitive to the ontological and epistemic difficulties various rhythmic spaces entail. As he points out, there is a fundamental "bootstrapping problem" for

55 Ibid., p. 109. 56 Hyde, "A Theory of Twelve-Tone Meter," p. 25.
57 All quotations of Lewin are from *Generalized Musical Intervals and Transformations*.

rhythmic and metrical analysis, since there are no absolute values for durations or beats, as there are for pitches: "The notion of '*an*' abstract conceptual time-unit, a unit by which we measure [duration] . . . is a notion fraught with methodological problems" (p. 62). Similarly, in pursuing various isomorphisms between pitch and rhythmic operations, one may give rise to analytical concepts that are strongly counter-intuitive, such as when a transformation gives rise to a negative duration, since "it is not clear what intuition we could possibly be modeling, when we stipulate a duration t that lasts not only less than no time at all, but also *measurably* less than no time at all" (p. 29). Thus the ability to conceive of certain temporal spaces and compositional operations within them does not always translate into musically intelligible relationships, and analytical claims that are rooted in those kinds of rhythmic spaces should be treated cautiously.

In *Meter as Rhythm*, Christopher Hasty also takes a generalized approach to rhythm and meter that is independent of tonal structure. Hasty, drawing upon the process-oriented temporal philosophies of Alfred North Whitehead and Henri Bergson, among others, argues for a projective approach to musical time. In particular, he conceives of meter as a product of the projective fields engendered by a series of durations (or hierarchical complexes of duration). Rather than searching for an underlying order or simplicity, as do Forte and Hyde, Hasty seeks to explain precisely how the musical surfaces of some post-tonal music are rhythmically complex, as well as why such complexity is often difficult to perceive and understand. A complex rhythmic surface is one which thwarts our innate ability to make temporal projections, as we routinely do when confronted with a regular series of relatively short temporal articulations. In some cases durational complexity may attenuate our sense of projection, while in others it may defeat it entirely.[58]

As can thus be seen, theories of musical rhythm have varied widely over the course of the twentieth century. Different kinds of theories and analytical methodologies have arisen depending upon a theorist's commitment to a particular repertoire and its musical syntax, in other cases commitment to a psychologically informed view of musical structure, and yet in other cases commitment to a particular temporal philosophy. As the work of music theorists in the domain of rhythm, motion, and time has become even less insulated, the boundaries separating the four areas of rhythmic theory laid out at the beginning of this chapter have become quite blurred at the century's end. And while millennial predictions are almost always precarious, at the beginning of the twenty-first century we seem to be witnessing the re-emergence of purely speculative approaches to musical rhythm, the likes of which have not been seen since the days of Hauptmann and Riemann.

58 For an instance of the former (attenuation) see Hasty's discussion of Webern's Op 22, pp. 257–75; for an instance of the latter (obliteration) see Hasty's discussion of Lutoslawski's *Jeux Vénitiens*, pp. 293–95.

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