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**Metric Hierarchy in Music by Bartók, Copland and Stravinsky**

**by**

**Peninah Kanovsky**

A dissertation submitted to the Graduate Faculty in Music in partial fulfillment of the requirements for the degree of Doctor of Philosophy, The City University of New York.

2002

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## Abstract

### **Metric Hierarchy in Music by Bartók, Copland and Stravinsky**

by

**Peninah Kanovsky**

**Advisor: Professor Joseph Straus**

The background pulsations in music, the beat and the meter, serve to orient the listener through the rhythmic events of a musical work. In many early twentieth-century musical works, however, though evenly spaced beats exist on a low level, their groupings at the metric level are not uniform. Beats are arranged in groups of varying lengths, two beats, three beats, sometimes more, not always adhering to an apparent pattern.

Determination of a hierarchical metric framework in such cases is thus problematic.

This study focuses on music by Copland, Bartók and Stravinsky, who extensively use beat groupings of varying lengths in their musical works. It maintains that in many cases, metric regularity and periodicity underlie the apparent variability of the beat groupings. Regular meter is used as a starting point in writing and interpreting the music, but goes through a transformation process that distorts the regular meter, so that a new, irregular one is created. The irregular meter is thus derived from an **implicit periodic metric prototype** that has been transformed by the composer to an irregular version by adding or deleting beats.

The definition of meter is expanded to include beats of variable durations called **flexible beats**. Similarly, the definition of hypermeter is expanded to include hyperbeats of

variable durations called **flexible hyperbeats**. When irregular meter and hypermeter are treated as regular groups of flexible beats and hyperbeats, rather than flexible groups of fixed beats and hyperbeats, metric hierarchy can be found in depth, from submetrical levels to hypermeasures.

## **Acknowledgments**

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# Metric Hierarchy in Music by Bartók, Copland and Stravinsky

## Chapter 1: Introduction

In a broad sense, rhythm in twentieth-century music can be divided into two categories. The first category is **beat-based rhythm**, in which music incorporates a regular basic pulse at its rhythmic foundation. The basic pulse, however, is not always grouped evenly. It may be arranged in groups of varying lengths - two pulses, three pulses, sometimes more, in no apparent pattern. The second rhythmic category in twentieth-century music is **non beat-based rhythm**, in which the rhythmic activity in musical time does not have a perceived basic beat or regular underlying rhythmic pulsation. This study deals with the category of beat-based rhythm in music of the early twentieth-century with particular reference to music by Copland, Bartók and Stravinsky.

Beat-based rhythm is also an integral characteristic of tonal music.<sup>1</sup> However, the organization of beat-based rhythm in tonal music differs from its counterpart in early twentieth-century music. In most tonal music (excluding recitative-like passages and cadenzas), pulses group in regular periodicities, forming pulses at higher levels, each encompassing a longer time span. Those higher level pulses, in turn, group into further periodicities, eventually reaching the status of the “counting beat” (or *tactus*,) whose regular grouping and accentual scheme form the **meter**. In many cases, periodicity also

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<sup>1</sup> In this dissertation, the term “tonal music” refers to common-practice tonality where functional harmony is present. Accordingly, musical works quoted in this dissertation, such as Copland’s *Appalachian Spring* and Stravinsky’s *Les Noces*, that do have a tonal center but do not employ functional harmony are not considered part of the tonal repertoire.

occurs at higher levels, forming **hypermeters**. This multileveled periodicity produces the **metric hierarchy**.<sup>2</sup>

In early twentieth-century music, however, the organization of beats is different. While beat-based rhythm employs a consistent regular pulse at a low level, its grouping at the metric level is often not uniform. This phenomenon has consequently been termed **metric irregularity**.<sup>3</sup> The inability to create equal time spans at a level as low as the metric level impedes the formation of a conventional, tonal-based metric hierarchy.

This study will show that metric irregularity can also be seen to be governed by metric periodicities and that metric periodicities can be demonstrated at many levels of structure. As a result, it will be possible to demonstrate and perceive hierarchical structures that include irregular meters.

This study illustrates perceptual metric hierarchy in beat-based music of Copland, Bartók and Stravinsky, who incorporate many irregular groupings of beats in their works. It will show that while at one level of perception, one hears shifting accents and unpredictable beat groupings, in many cases, at a parallel level of perception, one interprets and hears those irregular groupings as metrically regular. This study further

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<sup>2</sup> Most theorists agree that periodicity is inherently hierarchical. See for example, Arthur Komar, *Theory of Suspensions* (Princeton: Princeton University Press, 1971); Maury Yeston, *The Stratification of Musical Rhythm* (New Haven: Yale University Press, 1976); Carl Schachter, "Rhythm and Linear Analysis: A Preliminary Study," in *The Music Forum* 4 (1976), 281-334; "Rhythm and Linear Analysis: Durational Reduction," in *The Music Forum* 5 (1980), 197-232; and "Rhythm and Linear Analysis: Aspects of Meter," in *The Music Forum* 6 (1987), 1-59; Lerdahl and Jackendoff, *A Generative Theory of Tonal Music* (Cambridge, MA: MIT Press, 1983); Joel Lester, *The Rhythms of Tonal Music* (Carbondale, IL: Southern Illinois University Press, 1986); Jonathan Kramer, *The Time of Music* (New York: Schirmer Books, 1988); and William Rothstein, *Phrase Rhythm in Tonal Music* (New York: Schirmer Books, 1989). William Benjamin notes, however, that some atonal works have only one level of pulsation, rendering them periodical but not hierarchical. See William Benjamin, "A Theory of Musical Meter," *Music Perception* 1/4 (1983): 372.

<sup>3</sup> Joel Lester, *Analytic Approaches to Twentieth-Century Music* (New York: Norton, 1989), 18; Justin London, "Some Examples of Complex Meters and their Implications for Models of Metric Perception," *Music Perception* 13/1 (1995): 70.

shows how a metric interpretation of irregular beat groupings uncovers relationships within and between musical passages that would not have been apparent otherwise.

Several theorists have discussed periodicity and hierarchy in early twentieth-century music. Dahlhaus and Lester apply the idea of a **lengthened beat** to odd-numbered meters where the number of beats per measure is greater than three. Dahlhaus gives Bartók's *Aksak* rhythm as an example of a  $\frac{4}{4}$  meter with a slightly lengthened final beat ( $\frac{2}{8} + \frac{2}{8} + \frac{2}{8} + \frac{3}{8}$ ).<sup>4</sup>

Figure 1.1 illustrates the *Aksak* rhythm used in Bartók's *Six Dances in Bulgarian Rhythm*.



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**Figure 1.1:** An example of the *Aksak* rhythm, where the last beat is elongated

Lester gives an example from Bartók's *Contrasts* in  $\frac{(8-5)}{8}$  ( $3 + 2 + 3 + 2 + 3$ ) for which the performer needs to learn how to count beats of different lengths, since the tempo is too fast to count in eighth notes (figure 1.2).

<sup>4</sup> Carl Dahlhaus, "Problems of Rhythm in the New Music," in *Schoenberg and the New Music*, trans. Derrick Puffet and Alfred Clayton (New York: Cambridge University Press, 1987), 48.



**Figure 1.2:** The fast tempo forces the use of a beat in different lengths.

However, Lester implies and Dahlhaus stresses that “the prerequisite for this phenomenon of the ‘lengthened beat’ ... is that the rhythmic grouping is repeated regularly, thereby constituting a bar.”<sup>6</sup> A rhythmic pattern that consists of groupings of  $2/8 + 3/8 + 3/8$  produces a triple-meter as long as beat 1 contains  $2/8$ , and beats 2 and 3 contain  $3/8$ . Any permutation of the groupings, such as  $3/8 + 3/8 + 2/8$  or  $3/8 + 2/8 + 3/8$ , upsets the equilibrium of the meter.

Lester’s and Dahlhaus’s idea of adding the “lengthened beat” to the realm of meter expands the definition of meter. In tonal music, the rhythmic pattern that constitutes a bar has to contain beats of equal duration. But in their discussion of early twentieth-century music, Lester and Dahlhaus allow beats to be of different durations within a specific meter, as long as they carry the same rhythmic pattern from one occurrence to another.

<sup>5</sup> Lester, *Analytic Approaches to Twentieth-Century Music*, 20-21.

<sup>6</sup> Dahlhaus, “Problems of Rhythm in the New Music,” 48.

Unfortunately, Lester and Dahlhaus do not further develop the idea of metric expansion. Consequently, the regularity constraint that is imposed on irregular beats yields regularity: irregular groups of beats occurring regularly are no longer irregular. Moreover, the regularity constraint also contradicts the definition of a "lengthened" beat. A "lengthened beat" should be equivalent to a single beat regardless of its specific place in the order of the rhythmic groupings. There is no reason for the order of the groupings to be a prerequisite.  $3/8 + 3/8 + 2/8$  and  $3/8 + 2/8 + 3/8$  should both be perceived as triple-meter even though the order of the  $3/8$  and the  $2/8$  in the two rhythmic groupings is not identical. In this study, I will use a "flexible beat" that could be either lengthened or shortened from a fixed beat under certain perceptual constraints. A flexible beat will be allowed to appear on any beat of a measure, and will then be part of an expanded definition of meter that uses flexible beats as its components.

Messiaen, in his treatise *The Technique of My Musical Language*, talks about a similar concept, the **added value**. The added value is a short value, added to any rhythm, whether by a note, rest or dot.<sup>7</sup> However, Messiaen's idea is not geared toward lengthening the beat while remaining within a metric grid. On the contrary, Messiaen wishes to eliminate any sense of simple rhythm and meter. According to Messiaen, once the added value is inserted into a simple metric rhythm, its metric balance is transformed, accents are shifted, and the new rhythm will not bear traces of the rhythm it has been derived from:

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<sup>7</sup> Olivier Messiaen. *The Technique of My Musical Language*. trans. John Satterfield (Paris: Alphonse Leduc Editions Musicales. 1956). 16-17.

In practice one will rarely hear the simple rhythm before addition of the added value.<sup>8</sup>

Figure 1.3 brings two examples of added values inserted into simple rhythm:

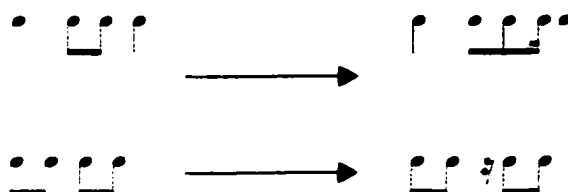


**Figure 1.3:** Examples of Messiaen's concept of **added value**. A sixteenth note or sixteenth-rest inserted into these simple rhythms is claimed to obscure the sense of meter.<sup>9</sup>

In Messiaen's works, the added notes not only obscure the sense of meter, but go even further to disrupt the regular pulse of the music. For the music of Copland, Bartók and Stravinsky, however, where a regular pulse usually dominates, Lester's and Dahlhaus' concept of **lengthened beats** is more appropriate.

The issue of periodicity (and implicitly, of hierarchy) has also been addressed by Pieter van den Toorn and Gretchen Horlacher in studies of Stravinsky's music.<sup>10</sup> Both authors base their theories on the assumption that metric irregularities in twentieth-century music are rooted in the periodicity that dominated musical practice during the preceding three hundred years. Both believe that the composer and the listener use

<sup>8</sup> Ibid., 16.

<sup>9</sup> Ibid., musical examples no. 6, 7 and 8.

<sup>10</sup> Pieter van den Toorn, *The Music of Igor Stravinsky* (New Haven: Yale University Press, 1983); Gretchen Horlacher, "Metric Irregularity in *Les Noces*: The Problem of Periodicity," *Journal of Music Theory* 39/2 (1995): 285-309.



**reinterpretation**, the composer relies on the listener to adjust the meter according to shifts of contextual accents.<sup>13</sup> A melodic fragment that has been introduced in a metrically stable environment is metrically reinterpreted when it is repeated at a metrically shifted location. Two downbeats are then created, each belonging to a different moment of perception: the initial downbeat is perceived as such because of the metric activity preceding it. The following downbeat is newly perceived because of the contextual association it evokes. Horlacher also incorporates van den Toorn's concept of **background meter** into her concept of **metric reinterpretation**, showing how salient points of articulation arise at locations where the meter reinterpretation and the external metric grid coincide.

Figure 1.5 illustrates Horlacher's interpretation of the opening of the second tableau in *Les Noces*. In this passage, the eighth notes act as the fixed pulse, while shifts of accents occur at higher levels. Arrows at the quarter-note and dotted half-note levels mark the reinterpretation of accents.

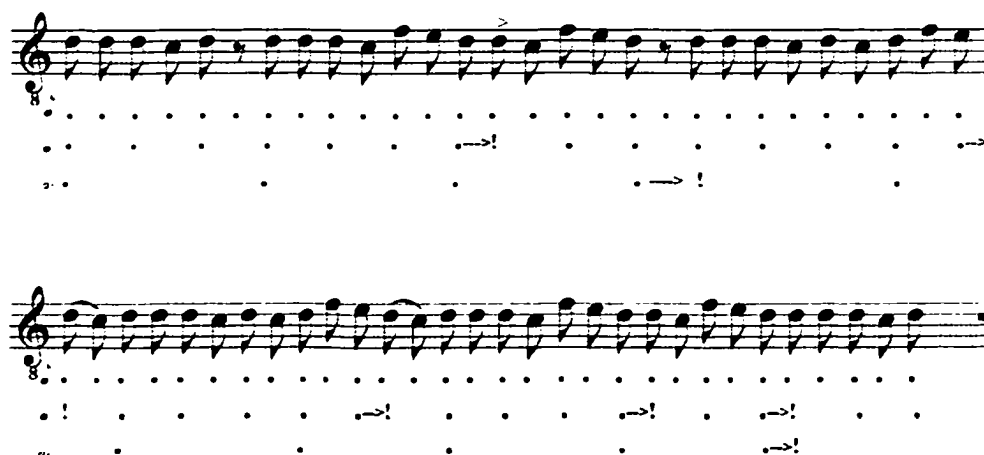


**Figure 1.5:** Horlacher's reinterpretation of the opening of the second tableau in Stravinsky's *Les Noces*.<sup>14</sup>

<sup>13</sup> Horlacher, "Metric Irregularity in *Les Noces*...." 290-291.

Though I find Horlacher's approach compelling, her approach can be further enhanced if attention is given to retroactive adjustment as well. What becomes of the note from which the beat has shifted? Where does it belong in the metric hierarchy? Additionally, Horlacher does not adjust the metric level at the time of the beat shift. This breaks down the hierarchical compatibility between the levels of beat and meter, where beat and metric time points should coincide.

I share van den Toorn's and Horlacher's assumption that complex rhythm is closely associated with tonal rhythmic practices. I nevertheless propose a different approach to the manner of this association. Like van den Toorn, I believe in background periodicity, but not through correspondence between periodic downbeats and phrase articulations. Instead, I show in this study that many metric irregularities stem from an implicit periodic metric prototype that has been **transformed** by the composer to an irregular version by adding or deleting beats. The metric grids of such prototypes are not motivically compromised by the surface rhythm. Rather, they enable the listener to mentally recognize any missing or extra beats. Furthermore, on the listener's side, added beats, deleted beats and shifted downbeats may be perceived differently at a higher level of periodicity. Thus, instead of flexible groups of fixed beats that result from Horlacher's metric reinterpretation, irregular meter is treated as regular groups of **flexible beats** (beats of slightly different durations), leading to the creation of a hierarchical structure for passages of so called "irregular meter."

In sum, this study will show that:

- Metric regularity and periodicity underlie complex rhythmic surfaces.
- Metric hierarchy can be found in depth, from submetrical levels to hypermeasures.

The findings of this study have important implications for stylistic practice in this period, for perceptual listening strategies and above all, for theoretical inquiry.

Stylistically, this study shows that twentieth-century rhythm was not abruptly disconnected from pre-twentieth-century traditions. Style evolves through continuity and creativity relies on past practices to create new ones. Copland, Bartók, and Stravinsky are three composers who are exemplary of such creativity in the early twentieth century, so connections should and are made between some of their musical practices and the conventional practices used before them.

Perceptually, this study shows that by using a listening strategy that falls back onto known and entrained meters of pre-twentieth-century music, hierarchical metric structures can be discerned beneath an irregular metric surfaces. This study also shows how deeper level hierarchy reveals hypermetric relationships between successive phrases.

Theoretically, this study offers a solution to the long-standing problem of interpreting beat-based, metrically irregular music within its historically stylistic context. By combining a listener-oriented methodology with a stylistically connected approach, this study presents a new theoretical basis for the study of rhythm. It allows an expansion of metric definition that lies within the capabilities of human perception.

Chapter 2 addresses the perceptual basis for expanding the definition of meter. It discusses the idea of flexible beats and the process of metric prototype derivations and transformations. Chapter 3 formally defines the expansion of meter, terming it the **X-beat meter**. The chapter illustrates the use of the X-beat meter by interpreting complex rhythmic surfaces in works such as Stravinsky's "Sacred Dance" from *The Rite of Spring* and Copland's *Appalachian Spring*. Chapter 4 considers musical examples that do not

conform to an X-beat meter, but nevertheless do stem from metric prototypes. Some of the examples used are Stravinsky's *Les Noces* and Copland's *El Salón Mexico*. Chapter 5 expands the concept of X-beat meter to the deeper, hypermetric level in the metric hierarchy, thereby implementing flexibility in the metric hierarchy as a whole. The examples used are mostly short but complete compositions, such as Bartók's "Change of Time" from *Mikrokosmos* and variation 16 from Copland's *Piano Variations*.

## Chapter 2

### Flexible Beat and Meter: A Lenient Look at Periodicity

This chapter examines the metric hierarchy and its flexibility in both performance practice and listeners' perception. Our tendency to allow deviations in periodicity durations at different levels of the metric hierarchy serves as the basis for constructing an alternate metric hierarchy, one that is flexible rather than metronomic. Flexibility in the metric hierarchy is then related and applied to various metric issues in early twentieth-century musical works.

Beat and meter are associated with periodicity - a sequence of evenly distributed durations over which complex rhythmic patterns are superimposed. Although periodicity seems to play a secondary role in the realm of rhythm, it is central, for it is the interaction between the underlying periodicity and the diversity of the superimposed rhythmic patterns that makes a musical work interesting. Furthermore, the existence of periodicity in music strongly imparts a sense of continuity, linking together diverse rhythmic and melodic activities through its constant pulsation.

Most theorists agree that periodicity is inherently hierarchical.<sup>1</sup> The shortest notated duration in a musical work forms the lowest periodicity level in the hierarchy. The periodicities of that level group in twos or threes to form equally spaced periodicities of longer durations, thus forming a higher level in the hierarchy.<sup>2</sup> Grouping of periodicities

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<sup>1</sup> See chapter 1, footnote 1.

<sup>2</sup> The tendency to group equally spaced sounds by twos or by threes has been termed *subjective rhythm*. See Paul Fraise, "Rhythm and Tempo," in *The Psychology of Music*, ed. Diana Deutsch (New York: Academic Press, 1982), 153. Essens generalizes this observation concluding that similarly, in hierarchical representation of periodicities, a high order level relates to the level below it by division to 2 or 3 equal durations. See Peter Essens, "Hierarchical Organization of Temporal Patterns," *Perception and*

continues until at some point the process no longer has cognitive relevance.<sup>3</sup> The two most important levels in the periodic hierarchy are the **beat level** and the **metric level**. The metric level organizes the beat level into repetitive patterns of strong and weak beats. Performers and listeners use these two levels as referents to other levels in the hierarchy and as the basis upon which they fit the rhythmic patterns of a specific work. From now on, the periodic hierarchy will be called the **metric hierarchy**, the beat will indicate the specific beat level which is organized by the meter, and the metric level will denote the level that organizes the beats. All other levels will be referred to as **periodicities**. Figure 2.1 is an example of a metric hierarchy in duple-meter, where the beat is at the quarter-note level and the meter is at the half-note level.

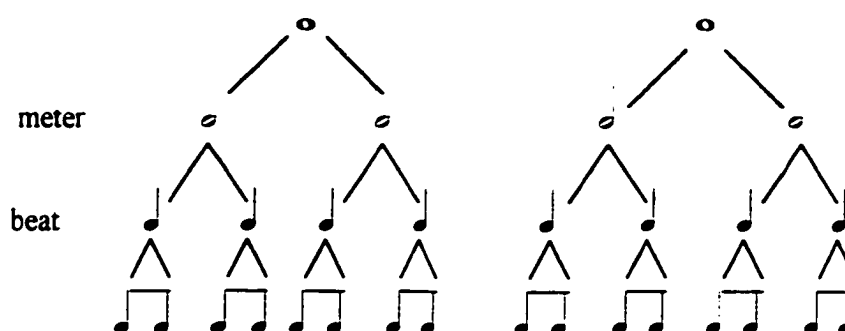


**Figure 2.1:** Example of metric hierarchy in duple-meter. One of the levels will function as the beat level, while the level above it will function as the metric level.

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*Psychophysics* 40/2 (1986): 72.

<sup>3</sup> The issue of whether meter is functional in the high levels of the hierarchy is controversial. While Komar and Kramer argue that meter can extend to the highest level of the hierarchy, Schachter, Rothstein and Lerdahl and Jackendoff believe that meter is relevant only at foreground and middleground levels.

The metric hierarchy functions as the clocking device for the rhythmic patterns in a musical work. The periodicities in the hierarchy govern the timing of the work just as minutes and hours govern our day to day activities. However, the metric hierarchy is not set as rigidly as the time hierarchy. In the time hierarchy, the choice of time-unit stands in direct correlation with the type of activity that is performed. Short activities are usually measured in short time units such as seconds and/or milliseconds, while more time-consuming activities are measured in longer time units such as hours and/or minutes. Once a time unit is chosen, it is consistently used throughout the activity. Furthermore, the duration of a time unit is a constant: an hour always equals sixty minutes, a minute always equals sixty seconds, and so on.

On the other hand, in the metric hierarchy, the relation between the tempo of a musical work and the choice of beat level is more complex: a designation of *presto* does not necessarily mean that the referent beat level should be faster than an *andante*. It simply means that the beat level of the *presto* will encompass more periodicity levels and thus be higher up in the metric hierarchy than the beat level of the *andante*. For example, a *presto* of  $\text{♩} = 80 \text{ MM}$  where the referent beat level is a half note will not be faster than an *andante* of  $\text{♩} = 80 \text{ MM}$  where the referent beat is a quarter note. The perception of *presto* stems from the high-level position of the referent beat in the metric hierarchy (figure 2.2).

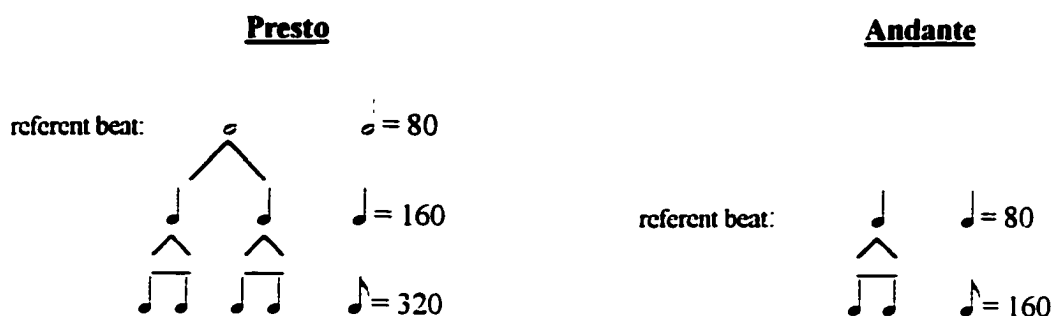


**Figure 2.2:** While in both cases, the referent beat equals 80MM, the higher the level of the referent beat, the faster the tempo.

Once a beat level is chosen, it may still change in the midst of a performance. Furthermore, the duration of the beat is known to be flexible for expressive purposes: *rubato*, *accelerando* and *ritardando* are the most obvious examples of beat expansions and contractions that do not affect the beat level.

Flexibility in determining a beat level and the ability to maintain it despite fluctuations in its duration have been studied extensively in recent years.<sup>4</sup> These studies have dealt mostly with beat flexibility in stable metric environments. However, these studies also suggest that in early twentieth-century music, even though rhythmic surfaces are not considered "periodic" in the conventional sense, metric hierarchy can exist. In this chapter, I

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<sup>4</sup> See, for example, Alf Gabrielsson, "Perception and Performance of Musical Rhythm," in *Music, Mind and Brain: the Neuropsychology of Music* (New York: Plenum Press, 1982), 159-170; Alf Gabrielsson, "The Complexities of Rhythm," in *Psychology and Music: the Understanding of Melody and Rhythm*, ed. Thomas J. Tighe and W. J. Dowling (New Jersey: Lawrence Erlbaum Associates, 1993), 93-120; Peter Essens, "Hierarchical Organization of Temporal Patterns," in *Perception and Psychophysics* 40/2 (1986): 69-73; Andrea Halpern, "Perceived and Imagined Tempos of Familiar Songs," in *Music Perception* 6/2 (1988): 193-202; W. J. Dowling and D. C. Harwood, *Music Cognition* (London: Academic Press, 1985), 178-201; Paul Fraise, "Rhythm and Tempo," in *The Psychology of Music*, ed. Diana Deutsch (New York: Academic Press, 1982), 149-180; Paul Fraise, "A Historical Approach to Rhythm as Perception," in *Action and Perception in Rhythm and Music*, ed. Alf Gabrielsson (Stockholm: Royal Swedish Academy of Music, 1987), 7-18; Stephen Handel, *Listening* (Cambridge, MA: MIT Press, 1989); Eric Clarke, "Categorical Rhythm Perception: an Ecological Perspective," in *Action and Perception in Rhythm and Music*, ed. Alf Gabrielsson (Stockholm: Royal Swedish Academy of Music, 1987), 19-33.

shall first summarize the studies that have been done on rhythmic flexibility in stable metric environments. I will then apply the results of these studies to rhythmic issues in early twentieth-century music, such as odd-numbered compound time signatures and mixed meters.

## Flexible Issues in Stable Metric Environments

### 1. Determination and Perception of Beat and Meter

The meter signature usually, but not always, denotes the beat level. The choice of beat level is dependent most of all upon the tempo of the piece. Conductors, for example, do not conduct in four beats in a *Presto* or *Allegro Molto* in 4/4 because it would be uncomfortable for the conductor and confusing to the players. Instead, an *alla breve* beat will more likely be used. On the other hand, many slow movements written in 2/2 are conducted in 4/4, since otherwise, considerable time would elapse between beats, rendering the surface rhythm unclear. The *Andante* from Mozart's *Eine kleine Nachtmusik* and the introduction to Schubert's *Symphony no. 9* in figure 2.3 are two such examples.



Mozart, *Eine kleine Nachtmusik*, second movement<sup>5</sup>

<sup>5</sup> Max Rudolf, *The Grammar of Conducting* (New York: Schirmer, 1969), 35.



Schubert. *Symphony No. 9*. Introduction to the first movement<sup>6</sup>

**Figure 2.3:** These excerpts are usually conducted as 4/4 rather than 2/2, since in an *andante*, the tempo of a quarter-note beat is musically more sensible than a half-note beat.

Studies have shown that the choice of beat level is limited to a certain range of periodic frequencies: London claims that "listeners tend to choose periodicities as beats when those fall between 70 and 120 beats per minute."<sup>7</sup> Dowling and Harwood place the lower limit closer to 40 beats per minute.<sup>8</sup> Fraisse notes that "if one asks...subjects to continue isochronous sequences by tapping, one finds that the variability of these sequences is minimal around the interval of 600 msec [100 beats per minute], that it increases a little for shorter intervals, and increases substantially beyond 1200 msec [50 beats per minute]."<sup>9</sup> We can thus assume that a comfortable beat lies between 50 and 120 beats per minute, the ideal beat being around 100 beats per minute. It is important to stress, however, that boundaries of perception are not clear-cut. Therefore, a gray area should be assumed at the upper and lower limits of the comfortable beat.

<sup>6</sup> Ibid., 203.

<sup>7</sup> Justin London, "Some Examples of Complex Meters and their Implications for Models of Metric Perception," *Music Perception* 13/1 (1995): 63.

<sup>8</sup> Dowling and Harding, *Music Cognition*, 187.

<sup>9</sup> Fraisse, "Rhythm and Tempo," 156.

The tendency to choose a beat in a certain comfortable range raises interesting issues in several eighteenth and nineteenth-century works where the designated tempo is too fast for the notated beat to act as the referent beat. Instead, the measures become the referent beats. Since measures are not always grouped in consistent duple, triple or quadruple units, the new "meter" becomes irregular. Lester notes that composers used the measure as a referent beat as a way around regular meter.<sup>10</sup> In this study, the term **metric misrepresentation** will denote such cases in which the meter does not accurately reflect beat perception.

In Beethoven's *Piano Sonata in D major, op. 28*, mm. 48-62, the measures act as beats at  $\phi = 72\text{MM}$ . The quadruple grouping of measure-beats in mm. 48-55 change into a duple grouping at mm. 56-57, to a triple grouping at mm. 58-60 and back to a duple grouping at m. 61 (figure 2.4).

What is intriguing about the "measures as beats" cases is that despite the grouping irregularity, listeners do adjust quickly to these inconsistencies and no theorist has ever labeled them as ametric.<sup>11</sup>

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<sup>10</sup> Lester, *The Rhythm of Tonal Music*, 107-108.

<sup>11</sup> Andrew Imbrie labels such cases as "metrically ambiguous" in "Metrical Ambiguity in Beethoven," *Beethoven Studies*, ed. Alan Tyson (New York: Norton, 1973), 45-66. Imbrie distinguishes between conservative listeners who will cling to an established pattern until forced to seek another and radical listeners who will quickly adopt a new pattern as it occurs. Christopher Hasty, in *Meter as Rhythm* (New York: Oxford University Press, 1997), defines meter as an ongoing process of discovering a projective pattern that is either satisfied or denied. Therefore, for Hasty, meter does not need to be continuous or contiguous.

beats per measure: [1] 2 3 4]

$\text{♩} = 72$

Piano

Piano

Piano

Piano

Beethoven's *Piano Sonata op. 28* in D Major

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**Figure 2.4:** Beethoven's *Piano Sonata op. 28*, mm. 48-62. The measures act as beats and therefore a higher level meter emerges: mm. 48-55 are in quadruple meter, mm. 56-57 change to duple-meter, mm. 58-60 change to triple meter and mm. 61-62 return to duple-meter.

To understand the limitations in choosing a beat level and our ability to adjust to certain inconsistencies, we must first understand the different processes that our memory performs upon the perceptual information it receives. Information is first channeled through

the **echoic memory**, then passed on to the **working memory** and finally processed by the **long-term memory**.<sup>12</sup>

**Echoic memory** is sensory and precognitive. It is stored as a carbon copy of the information received, its contents not analyzed. Sub-beat levels are usually perceived that way. Rhythmic patterns below the beat level are not heard as individual durations, but as **gestalts** (preanalytical, emotional and immediate):

Instead of measuring individual durations against the background of an internally generated metric grid, the listener recognizes sub-pulse rhythms by their qualities of evenness or unevenness, twoness or threeness, accentedness or unaccentedness, and so on.<sup>13</sup>

3

Two quarter-note beats divided into  are not perceived as two periodicities changing to three periodicities, but as two units, one having a duple quality, the other having a triple quality.

The capacity of the echoic memory is limited to a window of about two seconds. This window slides forward in time, discarding old information as new input is received.

The **working memory**, which is also called the **short-term memory**, is the next stage in information processing. It is at this stage that periodicities are perceived. The working memory receives the sensory information as input and attempts to organize it into meaningful units such as beats, measures and musical phrases. By attaching such tags to sequences of sounds, the working memory enables us to retain information longer than the echoic memory. The capacity of the working memory is between five and nine chunks of

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<sup>12</sup> Candace Brower discusses this issue in "Memory and the Perception of Rhythm," *Music Theory Spectrum* 15/1 (1993): 19-35, which I summarize here.

<sup>13</sup> *Ibid.*, 25.

information, a chunk being a meaningful unit based on prior learning. The more the material is recursively organized, the larger the meaningful chunks may be, and the longer they may be retained in the working memory. Since periodicity is recursive, the existence of a metric hierarchy in a musical work aids us in perceiving its large scale patterns.

The working memory can process both foreground and middleground metric levels. These are the levels in which periodicities can be discerned. However, the foreground metric level is processed differently than the middleground level. At the immediate foreground, usually at the beat level, listeners use an **entrainment** strategy to perceive periodicities:

...the listener entrains to regularly recurring accents heard in the music, generating internal markers to correspond to those in the music.<sup>14</sup>

As long as a downbeat remains in echoic memory, the listener is able to use entrainment to expect and predict the location of the following downbeat. A delayed or premature downbeat comes as a surprise. However, when moving to middleground levels, entrainment is no longer possible, since the echoic memory of one downbeat fades by the time the next downbeat appears. Therefore, at middleground levels, a **counting** strategy is used. Measures and hypermeasures are counted in groups of twos or threes. The counting strategy is more analytical than the entrainment strategy, and thus, more flexible:

When using an entrainment strategy, we are likely to hear a change in the spacing of phenomenal accents as syncopation, and we expect equilibrium to be restored by bringing phenomenal and metric accents back into phase.

Once we shift to counting strategy, however, we cease to hear syncopations, since we adjust to changes in the spacing of events by simply adding or

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<sup>14</sup> Ibid., 26-27.

subtracting measures. As a result, at higher levels of the metric hierarchy, large-scale syncopations give way to metric expansions and contractions.<sup>15</sup>

Consequently, at middleground levels, a metric interpretation can be retrospectively adjusted if a conflict in grouping patterns is encountered.

It needs to be stressed that there is no clear-cut boundary where the entrainment strategy ends and the counting strategy begins. There is certainly a gray area where both strategies are at play and the listener may choose one strategy or another. This gray area of indeterminacy is related to the range of the comfortable beat. At a tempo of ♩ = 60MM, for example, one beat lasts one second. If the meter is triple or quadruple, the imprint of the downbeat in one measure is significantly reduced when reaching the next measure (figure 2.5). At this stage, since the counting strategy is already at play, syncopation is not the only perceptive solution to misplaced accents.



**Figure 2.5:** Triple and quadruple meter at ♩ = 60 MM exceed the limit of the *echoic memory*, which last only 2 seconds. In such cases, since the imprint of the downbeat in one measure is significantly reduced when the next measure comes along, the counting strategy is a viable alternative to the entrained strategy.

Our ability to adjust to the metric inconsistencies in Beethoven's *Sonata op. 28* is a result of this counting strategy. The designated tempo per measure in this Sonata is around 72MM. A span of two measure-beats takes about 1.7 seconds to complete, very close to the two-second limit of the echoic memory. Consequently, each downbeat measure-beat will begin to fade as the next downbeat measure-beat arrives, even more so when the groups of

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<sup>15</sup> Ibid., 28-29.

measure-beats are at 3 and 4 measure-beats per group. The change to a two-measure count at m. 56 and then to a three-measure count at m. 58 is thus quite easily accepted by simply using the counting strategy.

On the other hand, in the “Scherzo” of Beethoven's *Seventh Symphony*, where the tempo indication is 132MM per measure, more than two measures can fill the echoic memory at once. Consequently, each downbeat is kept fresh in the listener's memory. I believe that this accounts for the strong feeling of syncopation at measures 12 and 14, where the accent falls on a weak beat (figure 2.6).

beats per measure:                      upbeat    | 1      2      3      4 |    | 1

$\text{♩} = 132$

Violin I

Violin II

Viola

Violoncello & Cb

2    3    4 |    | 1    (>)    3    (>)    | 1

8    12    14

cresc.    sf

cresc.    sf

cresc.    sf

cresc.    sf

cresc.    sf

Beethoven, *Symphony No. 7, "Scherzo"*, mm. 1-15

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**Figure 2.6:** Since the tempo is so quick, more than four measures can be retained in the echoic memory at any given moment (in two seconds, more than four measures go by). Since the downbeat measure-beats are kept fresh in the listeners' memory, the accents on the weak measure-beats in mm. 12 and 14 are not turned in to new downbeats, but are rather felt as syncopations.

When all the resources of the working memory are exhausted, information processing is handed over to the **long-term memory**. In the long-term memory, information cannot be fully retained. To do so will require extensive mental resources, which, if diverted to that purpose, will impair our ability to process events of the present that are constantly flowing. Instead, the long-term memory uses the working memory to extract and store traces of past experiences, such as rhythmic and melodic motives used earlier in the musical work. This information is not stored serially and therefore cannot be periodical. Consequently, large-scale temporal relationships that exceed the capacity of the working memory are perceived qualitatively rather than quantitatively:

...at background levels we recognize symmetrical grouping structure by the regularity of large-scale pattern repetition and recurrence. Episodic memory plays an important role in our ability to perceive such symmetries, making it possible for us to compare the durations of large segments of a musical work through the similarity of their contents.<sup>16</sup>

The long-term memory can thus accommodate instances of metric instability if larger scale relationships can be found. Such relationships include balanced, partially balanced, symmetrical and partially symmetrical phrases, which can be perceived at higher levels of the metric hierarchy.

In sum, periodicities can only be perceived in the working memory, where analytical and cognitive decisions are made on fully retained, sequential information. The working memory can process foreground and some middleground levels of the metric hierarchy, but deep middleground and background levels are handled by the long-term memory.

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<sup>16</sup> Ibid., 33.

By linking the limits of metric hierarchy to the capacity limits of the working memory, and by linking accentuated metric perception to the limits of the echoic memory, we can get a tangible sense of our abilities and limitations in metric perception. These abilities and limitations will serve as a basis to my contention that metrical structures can be heard in both foreground and middleground levels of metrically complex works.

## 2. Inconclusive Beat Level

Determining a beat level is not always conclusive. Since several levels of the metric hierarchy may fall within the range of the working memory, more than one level of the hierarchy may be applicable to serve as the beat level. Halpern reports that in listening to duple-meter patterns, subjects were equally comfortable with a sense of beat at either every beat or every other beat in a 2/4 measure.<sup>17</sup> Christopher Lee argues that listeners are prepared to revise their metrical interpretation if they find counter-evidence before the bar has been established as a metrical unit. One reason for metric revision is to remain within a comfortable rate of the beat.<sup>18</sup>

The ease with which a listener can revise a metric interpretation is due to parallel processing in perception and cognition: "The auditory perceptual system considers each possible grouping in parallel, before settling on the most probable organization of the elements into events."<sup>19</sup> The mind can hear and process more than one level of periodicity at

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<sup>17</sup> Halpern. "Perceived and Imagined Tempos of Familiar Songs." 196.

<sup>18</sup> Christopher Lee, "The Perception of Musical Structure: Experimental Evidence and a Model." in *Representing Musical Structure*, ed. by P. Howell. R. West and I. Cross (San Diego: Academic Press, 1991). 98.

<sup>19</sup> Handel. *Listening*, 200.

any time, making it possible to easily transfer to different beat levels while listening to a performance.

In performance practice, the conductor's choice of beat can sometimes be crucial to the interpretation of a piece:

It may happen that there is a choice between two ways of beating, both technically correct, but having different effects on the musical interpretation.

...If one beats the smaller rhythmic values..., the weak beats are played with more intensity. On the other hand, the indication of fewer strokes can result in a broader flow of the music. Thus the mode of beating may have a marked influence on the meter of the music, which in turn can affect the interpretation of a whole piece.<sup>20</sup>

In sum, in a stable metric environment, tempo and interpretation are the two main parameters that need to be considered in determining the beat level. Since tempo and interpretation in a stable metric environment do not usually change within a self-contained musical section, the ability to revise a metric interpretation is rarely put to use. A change of beat level within a self-contained musical section is more applicable in early twentieth-century music, where parameters besides tempo and interpretation must be considered in determining the beat level.

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<sup>20</sup> Max Rudolf. *The Grammar of Conducting*. 257-258.

### 3. Keeping a "Steady" Beat

Keeping a steady beat is what every performer strives to achieve. However, psychologists have shown that cognitive and performance aspects of beat and meter are far from accurate. Metronomic performance can be found only in mechanical musical devices such as music boxes and computer-generated music. Live musical performances, as a rule, deviate from mechanical regularity. Deviations occur at all levels of the metric hierarchy, at the sub-beat level, the beat level, half-measure level, measure level and so on.

In a recent experiment, a comparison was made between five pianists in the performance of the theme in Mozart's *Piano Sonata in A major*.<sup>21</sup> The results have shown that the quarter notes were shortened and the eighth notes were lengthened in the measures containing a quarter-eighth-note sequence (figure 2.7). The ratio between those two durations in all performances never approached 2:1, but rather concentrated around 1.7:1.



Mozart, *Piano Sonata in A major*, mm. 1-4<sup>22</sup>

**Figure 2.7:** In performances of Mozart's *Piano Sonata in A major*, the ratio between quarter notes and eighth notes was never exactly 2:1. The ratio was closer to 1.7:1, since the quarter notes were habitually shortened and the eighth notes were habitually lengthened.

<sup>21</sup> Alf Gabrielsson, "Once Again: The Theme from Mozart's *Piano Sonata in A Major* (K. 331), a Comparison of Five Performances," in *Action and Perception in Rhythm and Music*, ed. Alf Gabrielsson (Stockholm: Royal Swedish Academy of Music, 1987), 81-104; Gabrielsson, "The Complexities of Rhythm," 116-117.

<sup>22</sup> Gabrielsson, "The Complexities of Rhythm," 116.

Another study showed that when a ratio of 3:1 was called for (such as  $\text{♩} \cdot \text{♩}$ ), its performance lay somewhere between 2:1 and 3:1, depending on the musical context (marches, for example, are usually played closer to their notated durations).<sup>23</sup>

It is interesting to note, however, that while notated simple ratios such as 2:1 are executed at more complex ratios (average of 1.7:1), notated complex ratios (non-integer ratios such as 2.5:1 (5:2) and 3.5:1 (7:2)) are performed with a strong tendency toward integer ratios (2:1 and 3:1 respectively).<sup>24</sup> Gabrielsson experimented with these opposing findings, and discovered that when either short times (200-300 msec) or long times (450 - 900 msec) are performed repeatedly, the variability of the repeated duration can reach a ratio of 1.55 and still belong to the same durational category. He therefore concluded that

1. The ratio of 1.55 is the dividing point between two sorts of time.
2. If two durations belong to the same category, there is a tendency to equalize these durations.<sup>25</sup>

Gabrielsson describes this process as **assimilation** rather than **equalization** since the equalization is not absolute. Such assimilation is true in all areas of human perception and is generally known as **categorical perception**:

In everyday experience we perceive cars starting, glass breaking, thunder rolling, or children crying rather than the frequencies, attack characteristics, dynamics, durations, etc. that go to make up these sounds. We perceive

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<sup>23</sup> Gabrielsson. "Perception and Performance of Musical Rhythm." 167.

<sup>24</sup> Essens. "Hierarchical Organization of Temporal Patterns." 70.

<sup>25</sup> Gabrielsson. "Perception and Performance of Musical Rhythm." 167.

events rather than sensations...<sup>26</sup> Categorical perception functions so as to separate essential structural units or events from non-structural information: in other words it separates the invariants of a perceptual context from the uncontrolled variations, or perceptual *noise*, that inevitably accompany them.<sup>27</sup>

In rhythmic perception, the crucial invariant is meter. Once a metric structure is established, deviations are either expressive (*rubato*) or inaccurate, but nevertheless categorically correct.

The boundaries between durational categories in music are not absolute. The metrical context has considerable influence on the interpretation of individual durations. Eric Clarke compared listeners' responses to even and uneven divisions of a beat (figure 2.8). He discovered that when intervening durational ratios were inserted between 1:1 () and 2:1 () (  ), the cutting point in the interpretations was dependent upon whether the ratios were presented in a duple-meter or triple-meter context.

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<sup>26</sup> Clarke. "Categorical Rhythm Perception." 20.

<sup>27</sup> *Ibid.*, 22.

% of  responses (identification)

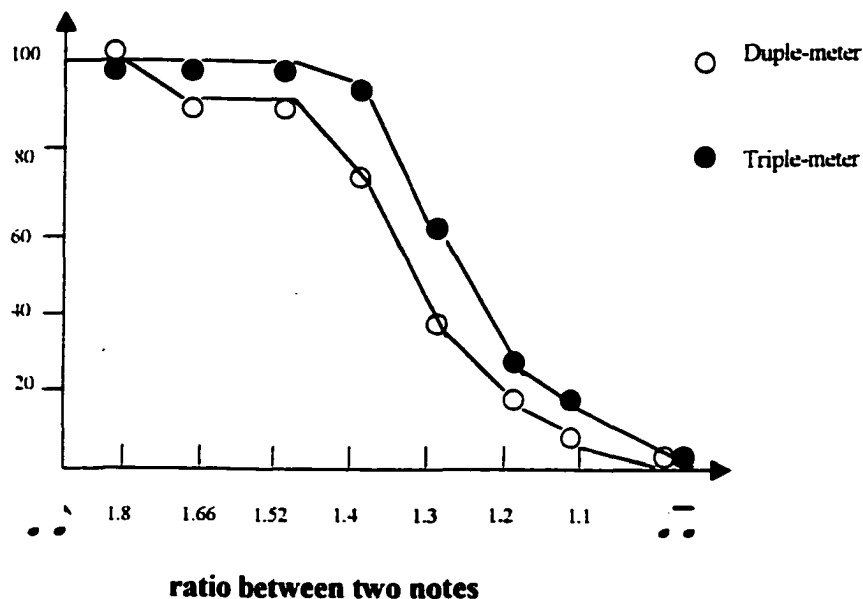


**Figure 2.8:** Depending on the metric context, ambiguous rhythmic situations can go either way. An interpretation of either an even or uneven division of the beat is plausible.<sup>28</sup>

In a duple-meter context, a beat division in the ratio of 1.4:1 was still ambiguous. About 30% of the responses still identified it as an even division of the beat (). Even

at 1.5:1, in the context of duple-meter, about 20% of the responses were in favor of an even division. On the other hand, in a triple-meter context, at a beat division of 1.4:1, over 90% of the responses already affiliated this ratio with the uneven 2:1 ratio (). Thus, in ambiguous rhythmic situations, where the ratio between two durations is around the cutting point of 1.4:1 and 1.5:1, interpretation can go either way. In such cases, the metric environment will usually be the determining factor. Figure 2.9 shows an ambiguous

<sup>28</sup> Ibid.. 24-26.

rhythmic pattern that can be interpreted as either a "lazy" uneven rhythm in triple meter or as an even rhythm in duple-meter with a heavy accent on the first note.

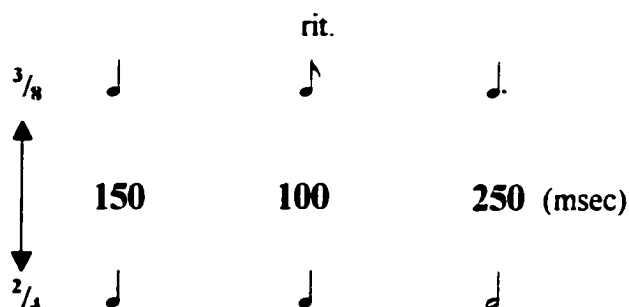


**Figure 2.9:** A sequence of ratios 150:100:250 (equivalent to 1.5:1:2.5) can be interpreted either in a triple or duple-meter context. In a triple-meter context, the eighth note is stretched somewhat through at *ritardando*. In a duple-meter context, the first note receives a heavy accent, thereby stretching its duration.<sup>29</sup>

In sum, a stable metric environment is more indeterminate than is generally assumed. In a self-contained musical unit, more than one level in the metric hierarchy can be used as the beat level. Periodicities and rhythmic durations are neither performed nor heard as notated. The latter indeterminacy is nevertheless governed by categorization. Listeners do seek stable structures, constantly attempting to assimilate non-conforming durational ratios into discrete categories. These opposing facts point to two types of continuities that are sought in a musical performance. One continuity lies in the regularity of the beat that ties the disparate musical events together. The other continuity pertains to the musical content. A certain amount of metric flexibility is required to attain the musical flow of motives, phrases and larger musical units.

<sup>29</sup> Ibid., 32

In early twentieth-century music, where metric stability is often compromised, the elastic properties of beat and meter aid us in eliciting meter in substantial musical segments such as complete phrases. I shall now present problematic issues of beat and meter in early twentieth-century music and solve them by applying the results of the above-mentioned studies on rhythmic perception.

### **Problematic Issues of Beat and Meter in Early Twentieth-Century Music**

#### **1. Odd Number of Beats in a Measure (greater than three)**

When a measure contains an odd number of beats such as five and seven, it is difficult to group the beats evenly. While it can be argued that five equally spaced beats may indeed be grouped into equally spaced measures, this is likely to be true only in very fast tempos. Otherwise, as mentioned above, beat sequences that are longer than three beats are instinctively grouped into groups of twos and threes.<sup>30</sup> 5-beat measures will thus be divided as 2+3 or 3+2, and 7-beat measures will be divided as 3+2+2, 2+3+2 or 2+2+3. The unequal grouping of five beats and seven beats disrupts the metric hierarchy, which is first and foremost based on equally spaced durations within a specific level. Dahlhaus resolves this problem, claiming that as long as the beat grouping is consistent throughout, the metric regularity is not disrupted.<sup>31</sup> Justin London concurs, explaining that the metric hierarchy

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<sup>30</sup> See footnote 2.

<sup>31</sup> Carl Dahlhaus, "Problems of Rhythm in the New Music," in *Schoenberg and the New Music*, trans. by Derrick Puffet and Alfred Clayton (New York: Cambridge University Press, 1987), 48.

remains intact in such cases because the unevenly grouped level is cushioned between evenly grouped levels above and below. Thus, although one level may be asynchronized with other levels, one irregularity within a prevalent regularity does not topple the hierarchy.<sup>32</sup> A well-known example, dating from as early as the late nineteenth-century, is the second movement of Tchaikovsky's *Sixth Symphony* of 1893, which is written in 5/4 (figure 2.10). While the beat is an evenly spaced quarter note and the measures are in a repetitive 5/4, the level in between is unevenly grouped as 2+3 quarter notes.



Tchaikovsky, *Symphony No. 6*, second movement, mm. 1-4

**Figure 2.10:** In Tchaikovsky's *Sixth Symphony*, second movement, the beat is an evenly spaced quarter note, the measures are a repetitive 5/4, but the level in between is unevenly spaced as 2+3 groups of quarter notes. Since this unevenly spaced level is "cushioned" between two evenly spaced levels, it does not topple the metric hierarchy.<sup>33</sup>

While Tchaikovsky's use of 5/4 is an exception in nineteenth-century compositional practice, twentieth-century works in odd-numbered meters abound. Figure 2.11 shows Bartók's "Bulgarian Rhythm" from *Mikrokosmos*, Vol. IV as an example.

<sup>32</sup> London, "Some Examples of Complex Meters..." 64-69.

<sup>33</sup> *Ibid.*, 64.



Bartók, "Bulgarian Rhythm" from *Mikrokosmos*, Vol. IV

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Figure 2.11: An example of an odd-numbered meter in early twentieth-century music.

## 2. Metric Misrepresentation: Notation vs. Perception

In early twentieth-century works, **metric misrepresentation** is more common than in tonal music.<sup>34</sup> Therefore, metric irregularities should first be analyzed to determine if the notated meter indeed indicates the referent beat. The opening of Stravinsky's *Octet* is a case in point. In the first four measures of this work, the notated meter and the phrase structure are out of phase (figure 2.12). The musical segment consists of two similar phrases under a metric signature of 3/4. However, since the beginning of the second phrase is delayed by one beat, the beat groupings do not conform to  $4 \times 3/4$  but are rearranged as  $3+4+3+2$ .

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<sup>34</sup> See p. 18.

Flute

Clarinet in Bb

Bassoon 1

Bassoon 2

Trumpet in C

Lento  $\text{♩} = 76$

*p* *mf* *p* *sfp* *sfp* *p* *sfp* *sfp*

Stravinsky, *Octet*, mm. 1-5

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**Figure 2.12:** At a metric signature of  $\frac{3}{4}$ , the beat groupings at the opening of Stravinsky's *Octet* are arranged as 3+4+3+2.

Nevertheless, this section actually sounds metric, though in duple, not triple-meter. The reason behind this perception is the tempo indication. Although the metric signature is  $\frac{3}{4}$ , the tempo indication is designed for an eighth note,  $\text{♩} = 76$ . If, as the meter signature suggests, the quarter note acts as the beat, its tempo will be  $\text{♩} = 38$ . As noted earlier, this tempo is beyond the comfortable range of beat perception, thus forcing the listener to use the eighth note as a beat. The use of the eighth note here as the basis of metric interpretation yields a duple-meter that is consistent throughout the four opening  $\frac{3}{4}$  measures (figure 2.13).

1 2 1 2 1 2 1 2 1 2 ....

Lento ♩ = 78

Flute

Clarinet in Bb

Bassoon 1

Bassoon 2

Trumpet in C

Stravinsky, *Octet*, mm. 1-5

**Figure 2.13:** When the eighth note is used as the referent beat, a consistent duple-meter emerges at the opening of Stravinsky's *Octet*.

Corroboration for this interpretation is found just before the *Allegro*, at rehearsal 5 (figure 2.14). The melodic and rhythmic pattern of the first three notes in m. 1 of the introduction (three descending quarter notes, second quarter note being a trill) reappear at rehearsal 5 in duple, not triple-meter. Thus, at rehearsal 5, the notated measures move in phase with the heard measures. Each two heard measures correspond to one notated measure.

The image contains two musical staves. The top staff shows a descending melodic motive in triple meter, marked *sfp*. A bracket above the first three notes is labeled "descending motive". Below the staff, text reads: "The melodic motive of three descending notes at the beginning of Stravinsky's *Octet*, notated in triple meter." A large downward-pointing arrow connects this staff to the bottom staff. The bottom staff shows the same descending melodic motive in duple meter, marked *Allegro*. A bracket above the first three notes is labeled "descending motive". Below the staff, text reads: "descending melodic motive just before the *Allegro*, notated in duple meter". The bottom staff is numbered 5 and 6.

Figure 2.14: The melodic motive at the beginning of the *Octet*, notated in triple meter, reappears just before the *Allegro* in duple-meter.

### 3. Mixed Meters: Introducing the Flexible Beat

In early twentieth-century music, uneven beat grouping in a measure is not necessarily consistent throughout. A 2+3 grouping in one measure may easily switch to a 3+2 grouping in the next measure. Furthermore, irregular groups of beats are often not cushioned between levels of regularly grouped periodicities in the metric hierarchy. Usually only the lower level of periodicity exists, while all the periodic groupings above it are irregular. In Stravinsky's *Rite of Spring* and *Symphonies of Wind Instruments*, for example, the meter changes at nearly every measure. The concept of the **flexible beat**, which is the

focus of this study, is introduced in this section as a basis for a hierarchical perception of changing meters.

Some cases of mixed meters fall into the category of metric misrepresentation, as described on p. 18. In these cases, the notated irregular beat groupings are not perceived at the metric level, but rather at a deeper, hypermetric level. A case in point is at rehearsal [132] of the *Rite of Spring*, where the meter alternates irregularly between  $\frac{3}{4}$ ,  $\frac{2}{4}$  and  $\frac{4}{4}$  (figure 2.15).



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**Figure 2.15:** At rehearsal [132] in the *Rite of Spring*, the meter alternates irregularly between  $\frac{3}{4}$ ,  $\frac{2}{4}$  and  $\frac{4}{4}$ .

The tempo indication for the mixed meter is  $\text{♩} = 52$ , at the lower limit of the comfortable beat. However, the perceived beat could just as well be an eighth note, its tempo holding at the ideal comfortable beat,  $\text{♩} = 104$ . As a result, the real meter becomes a consistent duple, while the changing pulse groupings are heard at a deeper level, the hypermetric level (figure 2.16).



count beat, or from a four-count beat to a three-count beat through use of the counting strategy (as occurs in Beethoven's Op. 28, figure 2.4.)

Of course, in many cases, Brower's counting strategy cannot apply. In such cases, conventional metric hierarchy cannot exist. Nevertheless, the following facts remain:

1. A low level periodicity is present.
2. The rhythmic activity above that level lies well within the range of the working memory which constantly seeks recurring accentual patterns.
3. Listeners use categorical perception in distinguishing between different sorts of time.
4. Cognitive parallelism enables listeners to easily transfer between beat levels.
5. Listeners seek continuities even in discontinuous surfaces.

The above tools are at the listener's disposal at all times, pointing strongly toward the tendency and ability to elicit a metric presence even in mixed metric contexts.

The first phrase of *Symphonies of Wind Instruments* is a case in point (figure 2.18).

The musical score shows a piano accompaniment with a clarinet and tuba. The piano part has a steady eighth-note pulse. The clarinet and tuba parts have more complex rhythms. Above the clarinet staff, there are boxes containing the numbers 1, 2, 1, 4, 3, 1, which likely represent beat counts or accents. Below the piano staff, there are labels for 'beats' and 'downbeat' at measures 1, 3, and 5. The tempo is marked as quarter note = 144.

Stravinsky, *Symphonies of Wind Instruments*, 1947 edition. mm. 1-6

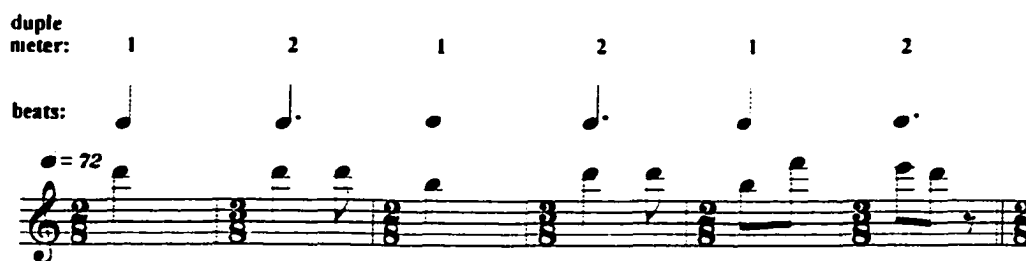
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**Figure 2.18:** When using the eighth note as a referent beat, the sense of downbeat on the 5<sup>th</sup> eighth note is displaced by the arrival of a downbeat on the 6<sup>th</sup> eighth note.

The tempo indication for *Symphonies* is  $\text{♩} = 144$  ( $\text{♩} = 72$ ). Although a beat at a tempo of 72MM is definitely in the range of the comfortable beat, a beat tempo of 144MM is not necessarily out of the question.

Examining the score with the eighth note acting as the beat level, measure 1 and the first two eighth notes of measure 2 establish an accentual pattern consistent with duple-meter. The top voice accentuates the downbeats, while the other voices emphasize the second beat of each measure. The duple-meter is disrupted in measure 2 by two conflicting beats, beat 5 and beat 6 of the phrase. While beat 5 initially sounds like a downbeat, it is immediately displaced by the definite downbeat of beat 6, which is emphasized by the alignment of the top voice and accompaniment. Retroactively, after the displacement, beat 5 does not belong anywhere. This is not a case of two successive downbeats, but a displaced downbeat. The function of beat 5 as a downbeat has been changed, but to what?

The answer to this question lies in the measure level. When the measure level is used as the beat level (beat =  $\text{♩}$ ,  $\text{♩} = 72\text{MM}$ ), beat 5 in figure 2.18 definitely belongs with beats 3 and 4. A duple-meter emerges again, but without the displacement of downbeats (figure 2.19):



Stravinsky's *Symphonies of Wind Instruments*

**Figure 2.19:** When using the measure level as the referent beat, a duple-meter without displaced downbeats emerges. However, some beats are longer in duration than others at the ratio of 1.5:1. This ratio is acceptable since it falls within the limits of the equality category.

In this interpretation, beats 2 of measures 1 and 2 are longer in duration than the other beats of the phrase. However, the ratio between the duration of the long beats (3 sub-beats) and their expected duration in that level (2 sub-beats) is 3:2 (or 1.5:1). This ratio still falls within the ratio limits of the equality category, its boundary holding at 1.55:1.

Van den Toorn also interprets this passage in duple-meter at the quarter-note level. Figure 2.20 illustrates the duple-meter superimposed upon the surface meter.<sup>35</sup> The difference between the interpretation offered in this study and van den Toorn's interpretation is in the perceptibility of the result. Van den Toorn's interpretation is theoretically valid but perceptually problematic. While the first, second and fourth downbeats in the re-barréd measures coincide with accentuated notes, the third downbeat falls in mid-duration of a melodic quarter note. Furthermore, the accents generated through the alignment of melody and accompaniment in mm. 3 and 5 of the surface meter are not expressed in the new re-barring.

re-barréd measures: 1 2 3 4

re-barréd beats: 1 2 1 2 1 2 1 2

♩ = 72

Piano

Stravinsky's *Symphonies of Wind Instruments*, mm. 1-6

**Figure 2.20:** Van den Toorn's interpretation of the opening measure of *Symphonies*. While theoretically valid, this interpretation is difficult to hear because of misalignment of some re-barréd downbeats and surface meter downbeats, specifically, third re-barréd downbeat.

<sup>35</sup> Pieter van den Toorn, *The Music of Igor Stravinsky* (New Haven: Yale University Press, 1983), 231.

On the other hand, the interpretation that is offered in this study maintains the accentual patterns of the surface meter and relies on auditory categorization abilities to perceive the duple-meter.

Our tendency to seek continuities, our use of categorical perception and our ability to revise metric interpretations enable us to generate metric hierarchies even in mixed metric contexts such as Stravinsky's *Symphonies*. In this study, a beat that is of flexible duration within the limits of categorical perception will be called the **flexible beat**. The flexible beat will always assume the durational category of its musical context. Accordingly, we might interpret the flexible beat in *Symphonies of Wind Instruments* as either a stretched triplet (♩ ♪) or as a stretched dotted eighth plus sixteenth note (♩. ♪), as shown in figure 2.21.

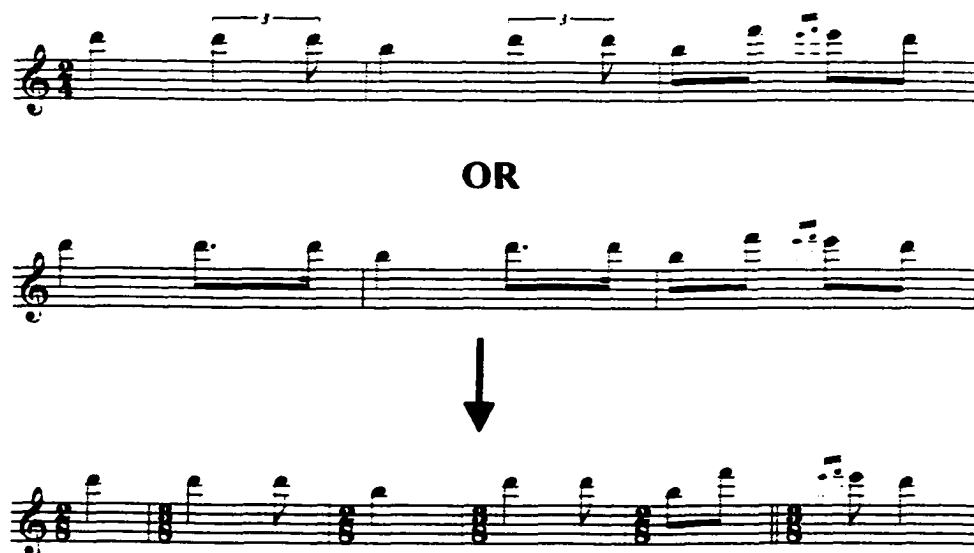


Figure 2.21: The flexible beat in *Symphonies* could be interpreted as either a stretched triplet or a stretched dotted-eighth sixteenth note.

It is important to emphasize that this kind of flexibility is not perceived as *rubato*. A *rubato* is used for expressive purposes and pertains to a musical scenario that calls for such expressiveness. In many works of early twentieth-century music, the character of the music does not call for *rubato* since it tends to be more percussive in character. An expanded or contracted beat in such cases is rarely heard as an expressive *rubato*. Our ability to assimilate such irregularities into a regular mold does not stem from expressive allowances but from categorical allowances. This distinction makes the flexible beat more generalized than a *rubato* because it depends, not on the character of the music, but on our own inner tendencies, to allow deviations in beat durations.

### **The Metric Prototype**

The interpretation of the opening of *Symphonies of Wind Instruments* as a flexible duple-meter already hints that the flexible beat is perceived in the context of an entrained metric preconception. The fixed beat is a familiar, habitual norm. It is therefore used as the basic premise of comparison in interpreting deviations from the norm, e.g., flexible beats. Since fixed beats group into metric schemes, all instances of flexible beats will also correspond to regular metric schemes, or **metric prototypes**.

#### **1. Metric Prototypes in Tonal Music**

The idea that a metrical schema can accommodate a good deal of stretching and compression without losing its identity has been abundantly demonstrated by Heinrich

Schenker, particularly in tonal music. Schenker defines and illustrates this phenomenon in *Free Composition*.<sup>36</sup> He defines **metric prototype** as the bar group that serves as a basis of an **expansion**, an expansion being a durational enlargement of a bar (or hypermeasure). In an expansion, the meter of the prototype no longer exists in the immediate foreground, but withdraws to a higher level that is not literally expressed.

Schenker interprets the problematic excerpt in Beethoven's *Piano Sonata op. 28* (discussed earlier in this chapter) as an expansion (figure 2.22). Instead of using the counting method in the changing groups of measure-beats, Schenker retains the 4-measure groups by transferring them to a higher level in the hierarchy. The irregularities of the foreground are explained as expansions. Schenker does not specify clearly whether listeners use the higher level, the foreground or both in interpreting the irregular metric phenomenon.



Beethoven, *Piano Sonata op. 28*, first movement, mm. 52ff.

**Figure 2.22:** Schenker's interpretation of Beethoven's *Piano Sonata op. 28* as an expansion. The quadruple meter is transferred to a higher level, while the expansion occurs in the foreground.<sup>37</sup>

<sup>36</sup> Heinrich Schenker, *Free Composition*, trans. and ed. Ernst Oster (New York: Longman, 1979), 124. Schenker's term is *metrisches Vorbild*. See *Der freie Satz*, 2<sup>nd</sup> ed., revised by Oswald Jonas (Vienna: Universal Edition, 1956), 192.

<sup>37</sup> Heinrich Schenker, *Free Composition, Supplement: Musical Examples*, trans. and ed. Ernst Oster (New York: Longman, 1979), fig. 148.4.

Carl Schachter elaborates on this definition, stressing its purely metric properties:

The basis of an expansion is not the tonal rhythm of a diminution but the contents of a metrical unit, usually a bar, belonging to a larger unit or **prototype**. The expansion transforms the unit into a longer span, quite possibly one with an elaborate metrical structure of its own. The expansion would then form a bar-grouping within a larger bar-grouping.<sup>38</sup>

## 2. Metric Prototypes in Twentieth-Century Music

While in tonal music, a metric prototype and its expansions are implemented at the hypermetric level, in twentieth-century music, metric prototypes invade the metric level as well. Consequently, beat groups and singular beats may also serve as a basis for expansion or contraction, yielding the flexible beat. In this thesis, the term metric prototype is used only in reference to the metric level. It is defined as follows:

A **metric prototype** is a closely related metric configuration of a non-metric musical surface. The criterion used in relating a non-metric surface to its metric prototype is **minimal adjustment**, that is, adding or omitting a short duration to one of the beats in the non-metric surface. Figure 2.23 shows that in a series of grouping  $2/8+2/8+3/8$ , the related prototype would probably be in  $3/4$ , where one of the eighth notes of the last group would be omitted.

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<sup>38</sup> Carl Schachter, "Aspects of Meter" in *Music Forum*, 41.



**Figure 2.23:** An irregular grouping of  $2/8 + 2/8 + 3/8$  usually corresponds to a prototype in  $3/4$ .

On the other hand, figure 2.24 shows that a series of grouping  $2/8 + 3/8 + 3/8$  will invite an interpretation of either a  $3/8$  or a  $9/8$  meter, since the minimal adjustment would be an addition of an eighth note to the first group of eighth notes:



**Figure 2.24:** An irregular grouping of  $2/8 + 3/8 + 3/8$  usually corresponds to a prototype in  $9/8$ .

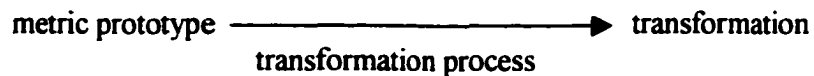
Every beat-based non-metric surface has a related metric prototype, since equidistant beats can always be grouped into higher-level equidistant periodicities simply by omitting or adding the necessary beats. Thus, the intriguing aspects of a metric prototype are not simply in its existence but in

1. the relationship between the prototype and the surface rhythm that represents it, and
2. the perceptual result that is gained by rhythmically manipulating a metric prototype.

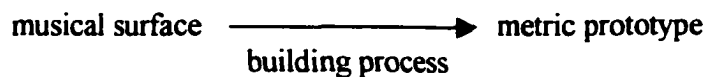
### 3. Building versus Transformation Processes

The nature of the relationship between a non-metric surface and its metric prototype can be regarded from opposite standpoints:

1. A **transformation process**, in which the metric prototype is changed into a non-metric musical surface. The non-metric surface is then called the **transformation**.



2. A **building process**, in which the non-metric musical surface is adjusted to fit a particular metric prototype. In this process the prototype is **derived** from the musical surface using metric and melodic cues.



The building process is thus the reverse of the transformation process and vice versa.

### 4. Explicit and Implicit Prototypes

The choice of deriving or transforming a metric prototype depends on the nature of the prototype, whether it is **explicit** or **implicit**:

A metric prototype is considered **explicit** if it satisfies the following conditions:

1. The prototype either appears in the music or is known to be the origin of the music (for example, use of folk tunes as prototypes.)

2. There is a clear process that leads from the prototype to its transformation.
3. The prototype contains the same melodic material as its transformation.

A metric prototype is considered **implicit** if it satisfies **any** of the following conditions:

1. The prototype does not appear in the music.
2. The prototype appears in the music but does not show a clear route to its transformation.
3. The prototype is only a partial element of its transformation.

Comparison between metric prototypes and their transformations provides a better understanding of both the underlying metric structure of a musical work and the special effect that the metric transformation casts upon the music. In the following chapters, explicit and implicit metric prototypes are compared to the notated music, showing both the transformation processes and their perceptual consequences.

## Chapter 3

### Flexible Beat as Basis for Local Meter

Thus far we have established the legitimacy of the flexible beat and its connection to a metric prototype. This chapter shows how the flexible beat is instrumental in perceiving periodicity and hierarchy in early twentieth-century music. It formally expands the definition of meter to include the flexible beat as an acceptable component, and demonstrates its use through musical examples.

To understand the importance of expanding the definition of meter, let us first examine the power of the flexible beat in maintaining continuities in seemingly ametric musical surfaces.

As shown in Chapter 2,<sup>1</sup> at a certain range of tempos, a series of five beats that are grouped as 2/8 and 3/8 will not be perceived as five fixed beats grouped irregularly, but rather as two higher level flexible beats. Beat 1 encompasses two eighth notes, while beat 2 is "lengthened" by an eighth note. The two flexible beats adhere to a metric prototype in 2/4.

Figure 3.1a illustrates a meter that is equivalent to the number of its seven beats, namely, a meter of 7/8. However, if a beat grouping of (2/8, 2/8, 2/8) follows 7/8, a 7/8 meter can no longer apply since the number of beats is now six, not seven. Figure 3.1b shows an alternative interpretation for 7/8, where beat groupings are interpreted at a higher level, as flexible beats, producing a metric equivalency to 3/4 with an added eighth note.

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<sup>1</sup> See the analysis of Stravinsky's *Symphonies*, pp. 39–42.

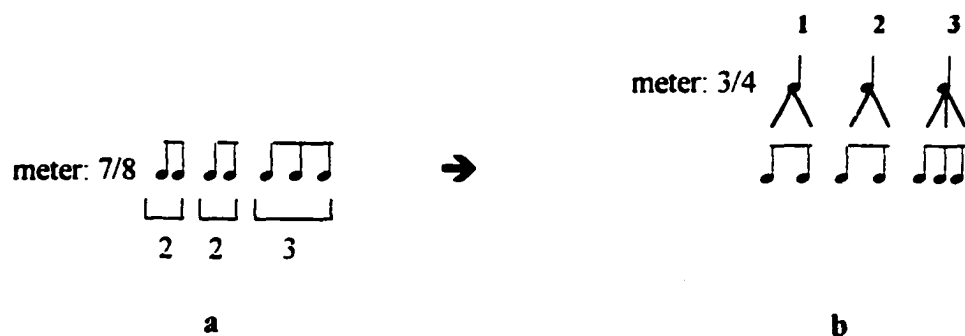


**Figure 3.1:** A meter of 7/8 (3.1a) could also be interpreted as a metric equivalency of  $\frac{3}{4}$  with an added eighth note (3.1b).

Through the use of flexible beats, both series of beat groupings,  $(\frac{2}{8}, \frac{2}{8}, \frac{3}{8})$  and  $(\frac{2}{8}, \frac{2}{8}, \frac{2}{8})$ , adhere to a metric equivalency of  $\frac{3}{4}$  (figure 3.2):

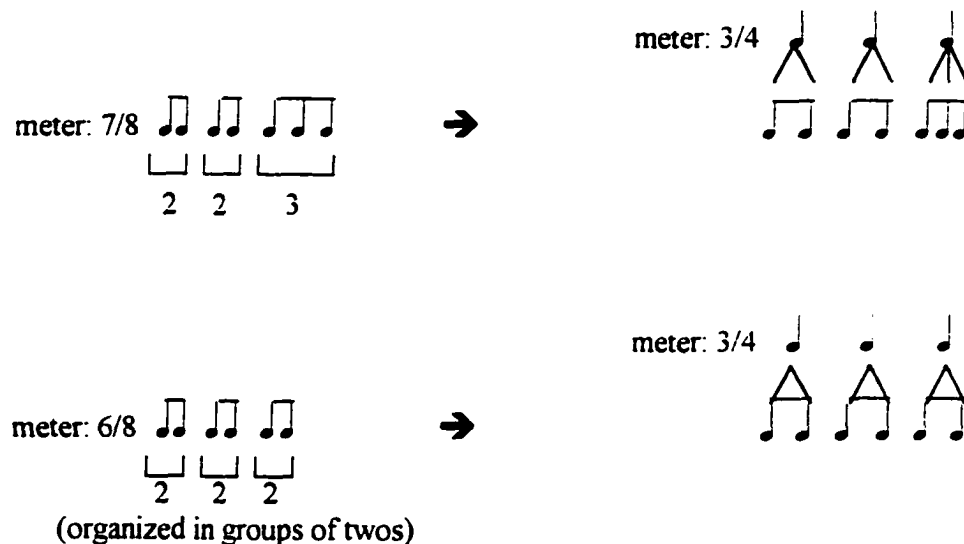


**Figure 3.2:** By using flexible beats as the referent beats, many irregular grouping of fixed beats adhere to the same metric equivalency.

Similarly, triple-meter equivalency applies to other beat groupings as well, such as  $(\frac{2}{8}, \frac{3}{8}, \frac{3}{8})$ ,  $(\frac{3}{8}, \frac{2}{8}, \frac{3}{8})$  and  $(\frac{3}{8}, \frac{3}{8}, \frac{3}{8})$ . It lends validity to hierarchical interpretation of

irregular meter, since irregular groups of fixed beats become fixed groups of irregular (flexible) beats on a higher level.

The above examples show that beat groupings of different time spans, ordered or unordered, can be interpreted as hierarchical and are closely related to metric prototypes. Nevertheless, such beat groupings cannot be interpreted as metric, since conventional meter does not accommodate beats of changing duration. We shall therefore define a new meter, the **X-beat meter**, which is an expansion of conventional meter. The first part of this chapter deals with the formal definition of the X-beat meter. The second part of this chapter illustrates the usefulness of the X-beat meter in understanding the rhythmic organization of early twentieth-century musical works written in mixed meter.

### **The X-beat Meter**

**I:** In order to include the flexible beat in any metric scheme, the **X-beat meter** is defined.

**Definition 1:** An **X-beat meter** is a meter that contains X flexible beats.

The duration of each beat (eighth, quarter, etc.) is not specified. That is because the essence of the flexible beat is that its duration can change without affecting the metric identity of its groupings. Figure 3.3 shows how both 4x2/4 and 4x3/8 are in 4-beat meter even though one grouping moves in quarter notes and the other in eighth notes.

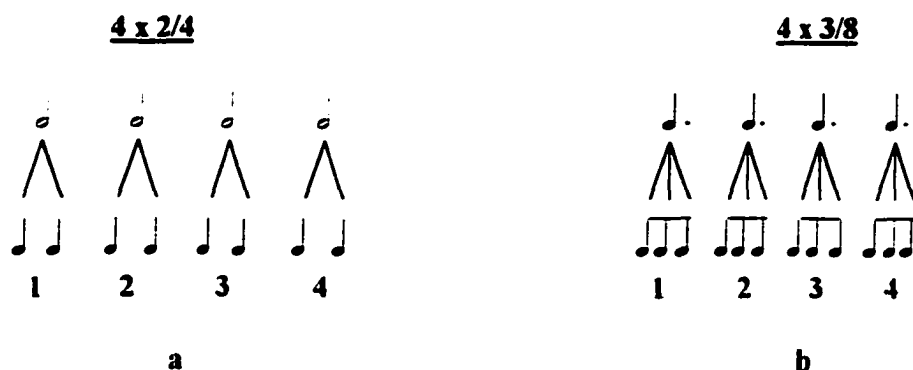


Figure 3.3: In both examples, a and b, the 4-beat meter applies.

**II:** The connection between flexible beats and equidistant beats is made through a **transformation scheme**.

**Definition 2:** A **transformation scheme** maps the way beats are transformed from a **metric prototype** to their final layout, by either lengthening or shortening their duration.

A transformation scheme of a measure will be denoted by a series of beats,  $b_x$ , where;

$b$  indicates the prototypical beat duration, for example,  $b=3/8$  denotes a prototypical beat duration of a dotted quarter note (3/8). The prototypical beat should conform to the rules of a comfortable beat.

$x$  indicates the order number of the beat within the measure, for example:  $b_2$ ,  $b=2/8$  refers to the second beat of a measure, the beat being a quarter note (2/8).

A **lengthened beat** is marked as a double-underlined duration,  $\underline{\underline{b_x}}$ .

A **shortened beat** is marked as a crossed-out duration,  $\cancel{b_x}$ .

Examples:

$\underline{b}_x$ ,  $b=2/4$ : a lengthened half note.

$b_x$ ,  $b=1/4$ : a shortened quarter note.

$(b_1, \underline{b}_2, \underline{b}_3, b_4)$ ,  $b=1/4$  is a transformation scheme in which a prototype in 4/4 meter is transformed into a 4-beat meter, the second and third beats being lengthened.

**III:** The ratio between the prototypical beat and any lengthened or shortened beat will not exceed (1:1.5) (see discussion in chapter 2, pp. 26-31).

**IV:** Metric interpretation of a musical passage depends on its compliance with the following rule:

The **X-beat metric rule**: Unordered rhythmic groupings are considered metrically viable only if there exists an **X-beat meter** on a higher level in the metric hierarchy, of which flexible beats fall within the range of the comfortable beat (figure 3.4):

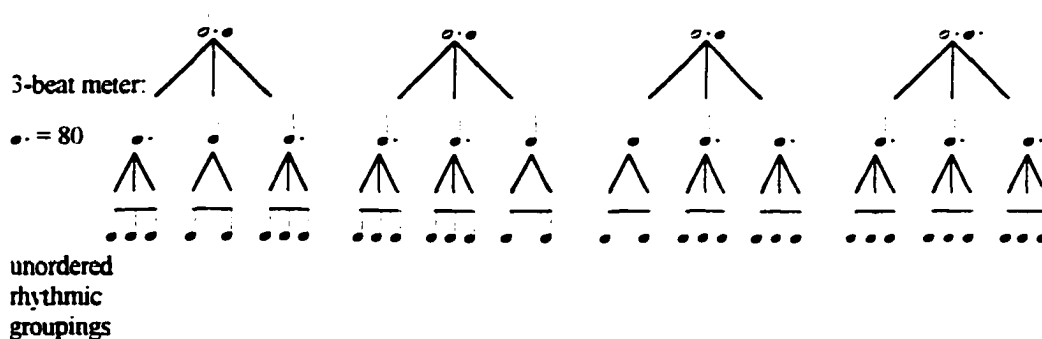


**Figure 3.4:** The X-beat meter can exist on a higher level in the metric hierarchy only if its flexible beats fall within the range of the comfortable beat.

## Use of the X-beat metric rule

This section illustrates two uses of the **X-beat metric rule**:

1. Through the X-beat metric rule, different cases of irregular rhythmic groupings fall smoothly into one of the categories of traditional meters.
2. The X-beat metric rule facilitates a gradual shift from one meter to another within the same musical work.

### 1. Unordered irregular rhythmic groupings.

The following three examples show how unordered irregular rhythmic groupings yield the same metric identity. Bartók's *Concerto for Orchestra, IV*, Stravinsky's *Sacred Dance* from the *Rite of Spring*, and an excerpt from Copland's *Appalachian Spring* all begin with successive ordered rhythmic groupings. However, all three eventually stray away. I will show that despite the change in the order and size of the rhythmic groupings, the metric identity in these three examples is actually not disturbed.

#### 1a. Bartók's *Concerto for Orchestra, IV*

The opening theme of the fourth movement in Bartók's *Concerto for Orchestra* adheres to a 2-beat meter despite changes in time signatures. Mm. 4-9 are consistent in their alternation between 4/8 and 5/8, yielding a transformation scheme that alternates between  $(b_1, b_2)$  and  $(\underline{b}_1, b_2)$ ,  $b=1/4$ . The prototype of this passage can be derived from the musical surface by simply omitting one of the repeated pitches at each 5/8 measure, A# or F#. Figures 3.5a and 3.5b show the transformation scheme of mm.4-9 and their related prototype.



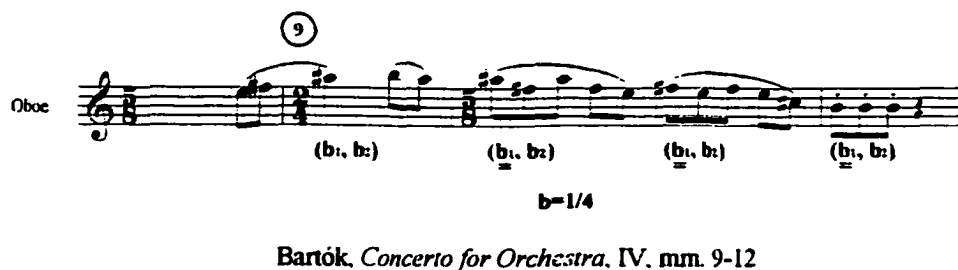
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Figure 3.5a: Ordered alternation between 2/4 and 5/8 (lengthened 2/4)



Figure 3.5b: The related prototype of mm. 4-9.

Since the alternation is ordered, the meter can be tagged as  $(4+5)/8$ . Nevertheless, after two repetitions of this metric scheme, the rhythmic pattern changes (mm. 9-12) and the transformation scheme becomes  $((b_1, b_2), (\underline{b}_1, b_2), (\underline{b}_1, b_2), (\underline{b}_1, b_2))$ . Figures 3.6a and 3.6b show the unordered transformation scheme of mm. 9-12 and their related prototype:



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Figure 3.6a: Change of pattern in mm. 9-12. Only a lengthened 2/4 is used in mm. 10-12.



Bartók. *Concerto for Orchestra*. IV. prototype of mm. 9-12

**Figure 3.6b:** The related prototype of mm. 9-12.

By using the **X-beat meter** concept, the change in the order of rhythmic groupings at the end of the phrase poses no problems. The phrase in its entirety is in a 2-beat meter, adhering to the **X-beat metric rule** in which duple periodicity exists one level above the irregular rhythmic groupings (figure 3.7).

2-beat meter:



Bartók. *Concerto for Orchestra*. IV. mm. 4-12

**Figure 3.7:** The passage in a consistent 2-beat meter.

The change of rhythmic pattern at the end of the phrase is actually closely aligned with traditional rhythmic practices, applying the concept of a "drive to the cadence." If the whole passage were written in 2/4, a typical "drive to the cadence" would consist of successive eighth notes as opposed to the former quarter notes at the beginning of each alternating measure (figure 3.8).



**Figure 3.8:** A drive to the cadence consisting of successive eighth notes.

Bartók uses the same strategy here. The penultimate measures of the passage utilize the utmost number of eighth notes possible under the metric framework, and that is the  $(b_1, b_2)$  measure (figure 3.9).



**Figure 3.9:** The “drive to the cadence” in Bartók’s *Concerto for Orchestra* is shown in **a**. **b** shows the alternative: continuation of the rhythmic pattern but loss of the “rushing” effect.

Through the use of the **X-beat metric rule**, a deeper understanding of this passage is achieved. It explains both the smooth rhythmic flow that is felt despite the irregular groupings, and the reason behind the change in rhythmic groupings towards the end of the passage.

### 1b. Stravinsky’s “Sacred Dance” from *The Rite of Spring*

“Sacred Dance” has long been a famous example of Stravinsky’s use of mixed meter. Figure 3.10 illustrates the quick changes in time signatures in the course of the first fourteen measures:

142 + 1

♩ = 126

Stravinsky's "Sacred Dance" from *The Rite of Spring*. 1947 edition.

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**Figure 3.10:** Mixed meter in the opening of "Sacred Dance."

The following analysis shows how the X-beat metric rule produces a 3-beat meter despite the seemingly irregular surface meter. Though the analysis focuses on the fourteen opening measures of "Sacred Dance", the same analysis is applicable to the thirty-one measures that comprise the first section of the dance.

Melodic patterns and tempo indication play an important role in determining the *beat meter* in this excerpt. Melodically, a motivic pattern is repeated several times. This motive consists of three syncopated chords followed by a generally descending melodic line. The first two occurrences of this motive are identical both melodically and rhythmically, creating a regularity of four measures at a higher metric level (figure 3.11).

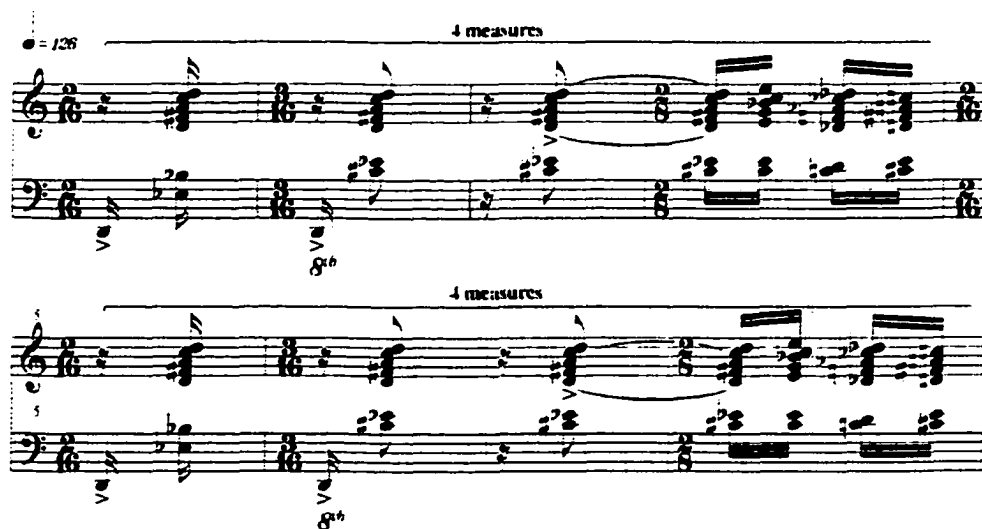


Figure 3.11: Identical repetitions of the motive, both melodically and rhythmically.

The tempo indication for the “Sacred Dance” is at  $\text{♩} = 126$ . The quarter note acts as the working beat since its tempo falls within the range of the comfortable beat. Consequently, measures in meters of  $\frac{2}{16}$  (i.e. an  $\frac{1}{8}$ ) and  $\frac{3}{16}$  that move at a rate of  $\text{♩} = 252$  and  $\text{♩} = 189$  respectively, are interpreted not as individual measures, but as components of larger perceived measures.

Analyzing the excerpt with the quarter note as the working beat yields a 3-beat meter. The identical melodic patterns at the opening of the “Sacred Dance” fit into a triple-meter mold. The two succeeding instances of the melodic pattern adhere to the 3-beat meter, some beats being shortened and some being stretched by a sixteenth note. Figure 3.12

summarizes the transformation scheme of the opening fourteen measures as  $(b_1, b_2, b_3)$ ,  $(b_1, b_2, b_3)$ ,  $(b_1, b_2, b_3)$ ,  $b=1/4$ . Figure 3.13 reconstructs the prototype in 3/4 time. Figure 3.14 extends the 3-beat meter analysis to the entire opening section of "Sacred Dance".<sup>2</sup> Note the expansions that are added at the end of some 3-beat measures, a practice used in tonal music as well.

interpretation in  
3-beat meter:

The figure displays three systems of musical notation, each consisting of a treble and bass staff. Above each system, a sequence of notes on a single staff represents the 3-beat meter interpretation, with labels  $b_1$ ,  $b_2$ ,  $b_3$ , and  $b_1$  above the first system, and  $b_2$ ,  $b_3$ ,  $b_4$ , and  $b_2$  above the second system, and  $b_3$ ,  $b_1$ ,  $b_2$ , and  $b_3$  above the third system. The musical notation below shows the corresponding notes and chords in 3/4 time, with some measures containing expansions. The first system is labeled with a measure number '6' above the treble staff. The second system is labeled with a measure number '6' above the treble staff. The third system is labeled with a measure number '11' above the treble staff.

Figure 3.12: The 3-beat interpretation of the opening of "Sacred Dance."

<sup>2</sup> Some chord notes in figure 3.14 have been omitted for clarity purposes.



**Figure 3.13:** The prototype of the opening measures of "Sacred Dance" in triple-meter (3/4).

# Stravinsky, "Sacred Dance", [142]+1 to [149]

interpretation in

3-beat meter: b1

b2

b3

b1



b2

b3

b1

b2



11

b3

b1

b2

b3



13 expansion.... b1 b2

19 b3 b4 b2 b3

24 expansion b1 b2

28 b3 b1 b2 b3

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**Figure 3.14:** 3-beat meter analysis of the opening thirty-one measures of "Sacred Dance". Note the expansions that are added at the end of some 3-beat measures, a practice used in tonal music as well.

### 1c. Copland's *Appalachian Spring*

The following example introduces alternative X-beat metric interpretations. It shows that melodic considerations can override the tendency to choose a working beat on the merit of the comfortable beat range alone.

Towards the end of Copland's *Appalachian Spring*, mm. 438–448, Copland introduces a passage of highly irregular meter. The passage, however, does have motivic sense. A short motive, consisting of a three-note upbeat followed by an upward motion, is repeated several times. At the same time, notes of short durations are progressively added, contributing to the highly irregular meter (figure 3.15):

The musical score for Copland's *Appalachian Spring*, measures 438–448, is presented in two systems. The first system shows the motive in strings, woodwinds, brass, and strings. The second system shows the expanded motive in brass & strings and orch. The tempo is marked as quarter note = 184.

Copland's *Appalachian Spring*, mm. 438–448

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**Figure 3.15:** After two identical repetitions, the motive is expanded both rhythmically and melodically through eighth-note additions.

The tempo indication of  $\text{♩} = 184$  is definitely beyond the range of the comfortable beat. By using the half note as the beat level ( $\text{♩} = 92$ ), the following 2-beat meter emerges:  $[(b_1, \underline{b_2}), (b_1, \underline{b_2}), (\underline{b_1}, \underline{b_2}), (b_1, \underline{b_2}), (b_1, \underline{b_2})]$ ,  $b=1/2$  (figure 3.16).

The musical score is presented in three systems, each with a treble and bass staff. The first system is labeled "2-beat meter: b1 b2 b1 b2" with "b2" underlined. The second system is labeled "b1 b2 b1 b2" with "b2" underlined. The third system is labeled "b1 b2 b1" with "b2" underlined. The tempo is indicated as "♩ = 184 (♩ = 92)".

**Figure 3.16:** Reinterpretation of the passage in 2-beat meter. The half note is used as the beat, at  $\text{♩} = 92$ .

I find, however, that a 2-beat meter may not be the best possible interpretation of this excerpt. If Copland meticulously accentuated each quarter note and dotted quarter note, he obviously expected each of them to be played with intensity.

4-beat meter: b1 b2 b3 b4 b1 b2 b3 b4 b1

b2 b3 b4 b1 b2 b3 b4

b1 b2 b3 b4 b1

**Figure 3.17:** Reinterpretation of the passage in 4-beat meter. In this case, the quarter note is used as the beat. Even though its tempo is extremely fast ( $\text{♩} = 184$ ), choosing the quarter note as the beat level may be justified for performance purposes.

The use of 2-beat meter, however, cannot capture this effect: the more notes a beat encompasses, the broader the flow of the music. Thus, in a 2-beat meter, where many notes make up a beat, the individuality of the notes is sacrificed for the flow of the music (see chapter 2, footnote 17). The use of the quarter note as the beat level, however fast it might be, will therefore be a more appropriate metric interpretation of this passage. In the resulting 4-beat meter, the intensity of each accentuated note is captured (figure 3.17).

## 2. Shifting meters

This section shows how the flexible beat functions as a connector between changing X-beat meters. The flexible beat enables, in some cases, a gradual shift from one X-beat meter to another. Successive phrases progressively change their rhythmic groupings, ultimately reaching a desired metric goal.

Following, are two examples of shifting meters. In Copland's *Appalachian Spring*, shifting X-beat meters reinforce the melodic development of a short passage. In Bartók's *Concerto for Orchestra, IV*, shifting X-beat meters connect sections of different meters.

## 2a. Copland's *Appalachian Spring*

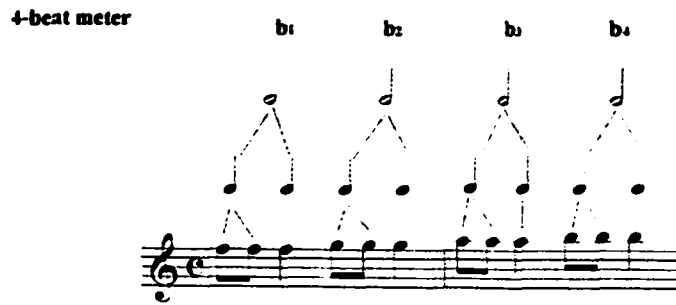


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**Figure 3.18:** Copland's *Appalachian Spring*, orchestral score, mm. 119-32

Copland exploits the idea of shifting meters in mm. 119-32 (figure 3.18). In this passage, Copland presents a metric and melodic prototype (mm. 119-20). The prototype consists of four ascending notes in quadruple-meter. It is progressively transformed both rhythmically and melodically until it reaches a metric and melodic goal at the end of the excerpt (mm. 129-31).

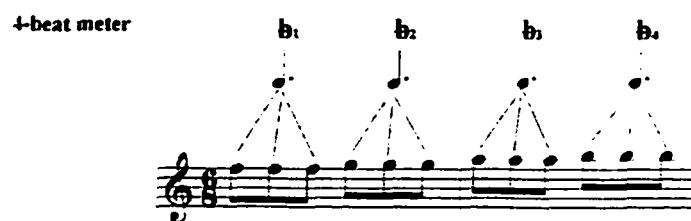
Figure 3.19 shows the prototype (mm. 119-20), which is the first statement of the motive. Each of the four ascending notes (f, g, a, b) occupies a duration of a half note, which is also the comfortable beat ( $\text{♩} = 80$ ). This results in a 4-beat meter:  $(b_1, b_2, b_3, b_4)$ ,  $b=2/4$ .



Copland, *Appalachian Spring*, mm. 119-120

**Figure 3.19:** The prototype in 4-beat meter, the working beat being a  $\sigma$ .

Following its presentation, the prototype is manipulated in successive statements. Figure 3.20 displays the second statement of the melodic motive (mm. 121-22), which now appears in 6/8 meter. The tempo ( $\sigma = 120$ ) and the static pitch content of each grouping of 3/8, keeps the functional meter at 4-beat meter, each 3/8 becoming a single beat. Since the half-note working beat has been shortened to a dotted quarter note, the transformation scheme for this statement is  $(b_1, b_2, b_3, b_4)$ ,  $b=2/4$ .



Copland, *Appalachian Spring*, mm. 121-122

**Figure 3.20:** Second statement of the motive in 4-beat meter, the transformation scheme being  $(b_1, b_2, b_3, b_4)$ ,  $b=2/4$ .

There is, however, an alternate metric interpretation of statement 2. A beat at a tempo of 120 is a comfortable beat, but so is a beat of double duration at a tempo of 60.

Therefore, choosing a dotted quarter note as the beat level is not the only choice. A beat level of dotted half note, acting as an expansion of the quarter note is just as possible.

Figure 3.21 illustrates statement 2 with a transformation scheme of  $(\underline{b}_1, \underline{b}_2)$ ,  $b=2/4$ .

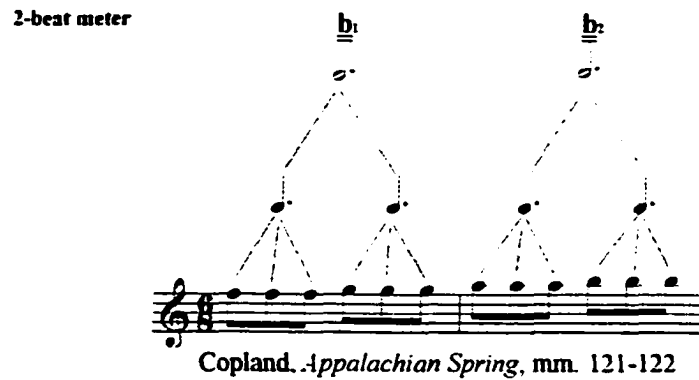


**Figure 3.21:** Second statement of the motive in 2-beat meter. the transformation scheme being  $(\underline{b}_1, \underline{b}_2)$ ,  $b=2/4$ .

The double interpretation of the statement 2 is crucial in connecting it metrically to the following statements.

The next four statements of the motive (mm. 123-28) serve as progressive developments of the motive, ultimately leading to the final statement of the motive at mm. 129ff. These developments are marked by changes in the pitch content, melodic organization, and metric identity.

In pitch content, the motive is transposed up five steps in the C major collection (figure 3.22):

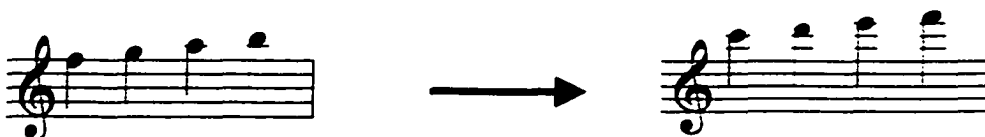


**Figure 3.22:** In the developmental statements of the motive, the pitch content is transposed up a fifth.

The C acts both as the resolution of the augmented fourth, and as the beginning of the transposition. The transposed motive leads to the high point of the passage, G, at m. 129. The G also acts both as the resolution of the ascending fourth before it, and as the beginning of the next statement. Figure 3.23 summarizes the melodic progression mm. 119-29.



**Figure 3.23:** C is the goal of the F-B motive. G is the goal of the transposed motive. C-F.

The transposition to C-F, however is not stated in full. Instead, the motive is reduced to a 2-pitch fragment, which gradually recovers its components at each successive statement. Alongside the melodic development, the metric identity of the motive progresses as well. The X-beat meter of each statement is always coordinated with the number of pitches being stated.

### **The stages of development:**

In statement 3 (m. 123), only two pitches of the linear ascent are stated: C and D. The equidistant beats in the 4-beat meter are shrunk in duration from the  $\frac{3}{8}$  duration for each beat in statement 2 to a  $\frac{2}{8}$  duration. However, two alternate possibilities arise: a half-note beat or a flexible half-note beat. Interpretation through a half-note beat, shown in figure 3.24, raises melodic and accentuation problems: the two resulting beats do not correspond to the pitch change from C to D. They also contradict the accent placed on the D.

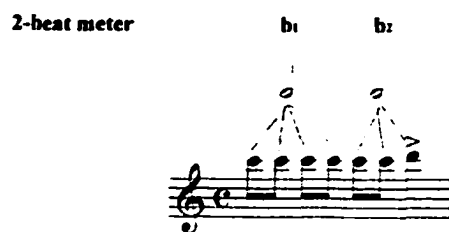


**Figure 3.24:** From statement 3 onward, the motivic components are gradually recovered. Here, in statement 3, only two pitches are used. The metric identity is contracted as well. Above is one possible metric interpretation, though it contradicts the timing of the pitch change and the accentuated D.

A flexible half-note beat, illustrated in figure 3.25, makes more sense melodically, since it moves in phase with the change in pitch and accentuation. It also continues the 2-beat interpretation of the preceding statement. On the other hand, this interpretation cuts off considerably the duration of the second beat, to the point that the second beat cannot even be considered as a flexible beat. Whatever alternative is chosen, though, statement 3 is characterized as a 2-beat meter.

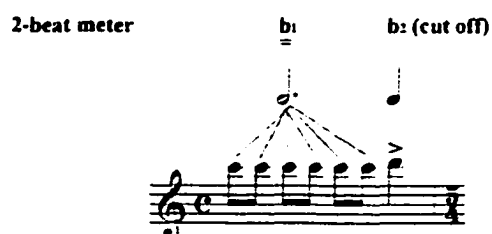


**Figure 3.25:** An alternate metric interpretation of statement 3. The 2-beat meter is in phase with the pitch change and the accentuation, but the second beat is cut off to the point that it cannot be considered a flexible beat (the ratio between the two beats is more than 1.5:1.)

Figure 3.26 shows statement 4 (mm. 124-5), where the third pitch of the linear ascent, E, is added. The metric identity of this statement changes to 3-beat meter, staying in phase with the number of pitches presented. The transformation scheme for statement 4 is thus ( $\underline{b}_1$ ,  $b_2$ ,  $b_3$ ),  $b=2/4$ .

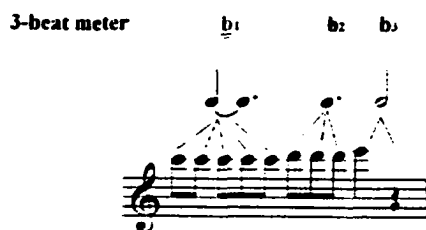


**Figure 3.26:** Statement 4 changes to 3-beat meter, staying in phase with the change to 3 motivic pitches.

Figure 3.27 shows statement 5 (mm. 125-6). The pitch content remains the same, and thus the metric identity is still at 3-beat meter. The transformation scheme remains at ( $\underline{b}_1$ ,  $b_2$ ,  $b_3$ ),  $b=2/4$ , but whereas in statement 4  $\underline{b}_1$  was expanded by a single eighth note, in this statement it is expanded by two eighth notes.

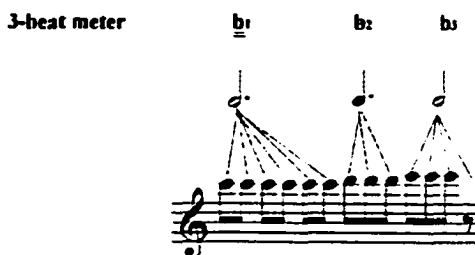


**Figure 3.27:** Statement 5 retains the 3-beat meter, but expands  $b_1$  by two eighth notes.

Figure 3.28 shows statement 6 (mm. 126-8), where the pitch content is finally restored in full. The metric identity again stays in phase with the pitch change, turning into a 4-beat meter ( $b_1, b_2, b_3, b_4$ ),  $b=2/4$ .

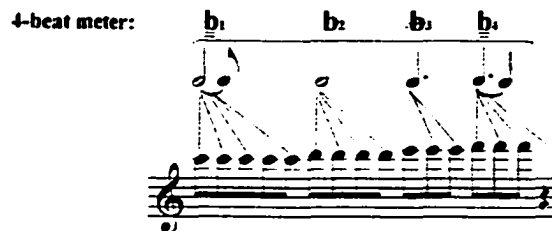


**Figure 3.28:** The ambiguous metric interpretation of statement 5 serves as a metric connection to both previous and following statements.

Figure 3.29 shows the last statement of the motive (mm. 129-131), where both the metric and pitch development reach their goal. In pitch content, the linear ascent of the fourth C-F reaches the fifth G, just as F-B of the first two statement reached the goal C in statement 2. Furthermore, the long ascending trend is now counterbalanced through a descent of a fifth, from G back to C (m. 132). Similarly, the meter of the last statement finally attains stability, presenting the descending pitches in triple meter.



**Figure 3.29:** A metric stability is reached in statement 6, where all beats are of equal duration.

Nevertheless, the insertion of the stable 3-beat meter in a framework of a 4/4 meter disrupts this stability. The stable 3-beat meter prevails only fleetingly, just to be returned to 4-beat meter at the resolution to C (figure 3.30). A full circle is thus reached, to the metric identity of the initial statement of the motive.



**Figure 3.30:** The 3-beat meter is superimposed on a 4-beat framework, resolving only at the resolution to C.

This example shows anew how the **X-beat meter** concept enables a deeper understanding of the metric organization of a passage than would be possible otherwise. The self-contained section from *Appalachian Spring* is melodically and metrically connected, moving gradually towards melodic and metric goals. These goals are reached through constantly changing melodic and metric groupings, carefully calculated as stepwise expansions of an initial motive. Figure 3.31 summarizes the melodic and metric process in mm. 119-32:

119

motivic prototype in quadruple-meter      motive in 2-beat meter

b1    b2    b3    b4    b1    b2

121

2 pitches, 2-beat meter    3 pitches, 3-beat meter    3 pitches, 3-beat meter

b1    cut off b2    b1    b2    b3    b1

126

4 pitches, 4-beat meter

b2    b3    b1    b2    b3    b4

129

triple-meter in a quadruple-meter context

b1    b2    b3    b1    b2    b3    pause    b1

Figure 3.31: Summary of the melodic and metric process in mm. 119-132.

## 2b. Bartók's *Concerto for Orchestra*, IV

Shifting meters are found extensively in the fourth movement of Bartók's *Concerto for Orchestra*. Bartók uses uneven compound meters such as 5/8 and 7/8 to shift from one even meter to another.

Uneven compound meters such as 5/8 and 7/8 are not unusual in early twentieth-century music. As noted above, their internal division is usually unequally clustered in groups of two and three beats: 5/8 can be grouped as 2+3 or 3+2, 7/8 can be grouped as 2+3+2, 3+2+2 or 2+2+3. Depending on the context, such uneven divisions frequently pull toward an even distribution of beats: 5/8 is pulled toward either 4/8 (2/4) or 6/8. 7/8 is pulled toward either 6/8 or 8/8.

A composer can use the ambiguity of such uneven compound meters to move smoothly from one even meter to another. In this example, Bartók exploits the double interpretation of 5/8 and 7/8 throughout the fourth movement of *Concerto for Orchestra*. 5/8 and 7/8 never really stand alone as rightful meters in this movement. They are always best regarded as some distortion of a duple, triple or quadruple-meter.

As stated in example 1a, the opening theme of the fourth movement of Bartók's *Concerto for Orchestra* is perceived as a 2-beat meter. Measures in 2/4 are divided into two even beats -  $(b_1, b_2)$ ,  $b=1/4$ . Measures in 5/8 are divided into two uneven beats -  $(\underline{b}_1, b_2)$ ,  $b=1/4$ . For equivalency purposes, the transformation scheme in figure 3.32 is expressed in terms of an eighth note:  $(\underline{b}_1, b_2)$ ,  $b=2/8$ .

2-beat meter:

Bartók, *Concerto for Orchestra*, IV, mm. 4-12

**Figure 3.32:** 2-beat meter at the opening of Bartók's *Concerto for Orchestra*, fourth movement.

In example 1a, the 5/8 meter was interpreted as a 2-beat meter, its transformation scheme being  $(\underline{b}_1, b_2)$ ,  $b = 2/8$ . However, 5/8 may also pull toward 6/8, still remaining in the realm of 2-beat meter, but with a different transformation scheme of  $(b_1, \underline{b}_2)$ ,  $b = 3/8$ . Bartók uses this ambiguity to glide gracefully into the second theme at m. 43 (figure 3.33). He isolates the 5/8 in a two-measure accompaniment (mm. 40-1) before turning it to 6/8 at m. 42. The 6/8 meter is then immediately transformed to its related meter of 3/4 at m. 43.

Violin I

Violin II

Viola

Cello

Double Bass

40 41 42 43 44 45 46

$(\underline{b}_1, \underline{b}_2) = (\underline{b}_1, \underline{b}_2)$      $\frac{6}{8}$      $\frac{3}{4}$      $(\underline{b}_1, \underline{b}_2, \underline{b}_3)$      $\frac{3}{4}$   
 $\underline{b} = 2/8$      $\underline{b} = 3/8$      $\underline{b} = 2/8$

Bartók, *Concerto for Orchestra*, IV, mm. 40-47

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**Figure 3.33:** A smooth change from 2/4 to 6/8 through an intermediate 5/8 that can be interpreted in either context.

A different procedure takes place at the transition to 8/8 at the third theme, as illustrated in figure 3.34. Groups of 3/8 and 2/8 in the accompaniment are regrouped to form a total of 8/8 ( $3+2+3$ ) at m. 75, generating a 3-beat meter ( $\underline{b}_1, \underline{b}_2, \underline{b}_3$ ),  $\underline{b} = 2/8$ . The 3-beat meter is superimposed over a 4-beat meter in the melody at m. 77, turning into 4-beat meter only in the next measure (m. 78).

Oboe

Clarinet in Bb

Bassoon

Horn in F

Violin I

Violin II

Viola

Violoncello

Double Bass

(b1, b2) (b1, b2) (b1, b2) (b1, b2) (b1, b2, b3) (b1, b2, b3) (b1, b2, b3) melody & accompaniment coordinated

also: (b1, b2) (b1, b2) 4 superimposed

Bartók. *Concerto for Orchestra*, IV, mm. 71-78

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**Figure 3.34:** A smooth change in mm. 71-75 from a 2-beat meter to a 3-beat meter through the double interpretation of 5/8 and the close relationship between 6/8 and  $\frac{3}{4}$ . Mm. 77-78 move smoothly from 3-beat meter to 4-beat meter through the superimposed meters in m. 77.

The transition from 2/4 to 4/4 through 6/8 and 3/4 is summarized at mm. 140-2, where measures of 2/4, 6/8, 3/4 and 4/4 are juxtaposed without the mediating 5/8 (figure 3.35).



Bartók, *Concerto for Orchestra*, IV, mm. 139-142

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**Figure 3.35:** Towards the end of the movement, the metric transitions are summarized without the mediating 5/8.

This chapter has presented a variety of cases in which application of the flexible beat leads to X-beat metric interpretations. These musical excerpts were also understood in relation to metric prototypes, altogether permitting an understanding of the rhythmic organization in terms of hierarchy, and thus in structural depth.

## Chapter 4

### Explicit and Implicit Prototypes in Non-Metric Contexts

We have shown how, through the flexible beat, surface rhythmic irregularities can be understood as local pockets of X-beat meters. Nevertheless, there are many instances of rhythmic irregularities that do not conform to X-beat meters, but do have a strong connection to a specific metric structure. Assume a passage in a working beat of  $\bullet = 100$  that strongly suggests a triple-meter but is disrupted by measures of duple-meter (figure 4.1).

$$\bullet = 100$$

$$\frac{3}{4} \bullet \bullet \mid \bullet \bullet \mid \frac{2}{4} \bullet \bullet \mid \frac{3}{4} \bullet \mid \frac{2}{4} \bullet \mid \frac{3}{4} \bullet \bullet \bullet \mid \bullet \parallel$$

**Figure 4.1:** Example of a passage in triple-meter, disrupted by measures of duple-meter.

Since the metric irregularities occur at the level of the beat, the passage cannot conform to a 3-beat meter.<sup>1</sup> Nevertheless, it can be considered closely related to a metrically stable prototype in triple-meter (figure 4.2):

$$\bullet = 100$$

$$\frac{3}{4} \bullet \bullet \mid \bullet \bullet \mid \bullet \bullet \bullet \mid \bullet \mid \bullet \mid \bullet \bullet \bullet \mid \bullet \parallel$$

**Figure 4.2:** The prototype of figure 4.1 in triple-meter.

<sup>1</sup> For the passage to conform to a 3-beat meter, the flexible beats, in this case  $\frac{3}{4}$  and  $\frac{2}{4}$ , should fall within the comfortable beat range. That is not the case here, since a flexible beat of  $\frac{2}{4}$  is performed at 50 MM and a flexible beat of  $\frac{3}{4}$  is performed at 33 MM. See the X-beat meter rule in chapter 3, p. 53.

Passages that lack an X-beat meter but do relate to a metric prototype can be said to have an **underlying** meter. Comparison between prototypes and their transformations provides a better understanding of both the underlying metric structure of a musical work and the special effect that the metric transformation casts upon the music. In the following examples, explicit and implicit prototypes are compared to the notated music, showing both the transformation processes and their perceptual consequences.

### 1. Rhythmic Manipulation of a Folk Tune in the Opening of Copland's

#### *El Salón Mexico*

In *El Salón Mexico*, a metrically regular prototype (the folk tune on which the work is explicitly based) is transformed via rhythmic augmentation and diminution into a metrically irregular resultant.

The opening of *El Salón Mexico* is derived from two measures of a Mexican folk tune, P1 in 6/8, followed by P2 in 3/4. P1 and P2 are shown in figure 4.3.



**Figure 4.3:** The Mexican folk tune, *El Palo Verde*, upon which *El Salón Mexico* is based.<sup>2</sup>

<sup>2</sup> These melodies are printed in Ruben Campos, *El Folklore y la Musica Mexicana* (Mexico: Talleres graficos de la nacion, 1928).

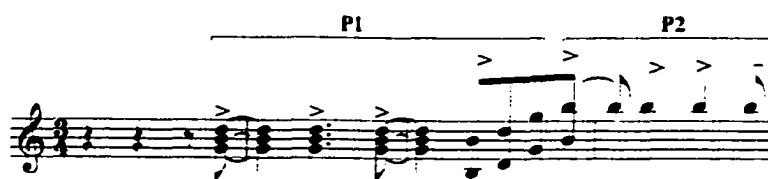
Juxtaposition of 6/8 and 3/4 is a common practice in Mexican folk music. The two time signatures are closely related since they share an identical metric level of a dotted half note (figure 4.4).



**Figure 4.4:**  $\frac{6}{8}$  and  $\frac{3}{4}$  are identical in a higher level of the metric hierarchy, e.g. at the dotted half-note level.

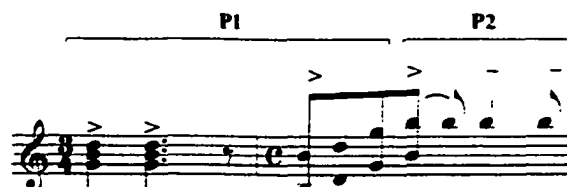
At the opening of *El Salón Mexico*, Copland rhythmically manipulates P1 and P2, producing three different transformations (figure 4.5):

transformation 1:



Copland, *El Salón Mexico*, mm. 1-4

transformation 2:



mm. 5-6

### transformation 3:



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**Figure 4.5:** The three transformations of the Mexican folk tune exhibited in figure 4.3.

At first glance, these transformations are not metrically compatible. According to the accentuation pattern, the opening section can be re-barred as shown in figure 4.6:



**Figure 4.6:** The opening section of *El Salón Mexico*, re-barred.

Further analysis, however, shows a strong metric connection among all repetitions.

### **The Transformation Process**

P1 is expanded to twice its length, from 6/8 to 12/8. The eighth notes are grouped in threes, setting the functional beat at a dotted quarter note ( $\text{♩} = 126$ ). The beat count at each repetition of P1 becomes a 4-beat count, albeit a flexible beat count:  $\text{♩} \text{ ♩} \text{ ♩} \text{ ♩}$  is

followed by  $\bullet \bullet \bullet \bullet$  which is then followed by  $\bullet \bullet \bullet \bullet$ . The transformation scheme is thus (b1, b2, b3, b4), (b1, b2, b3, b4), (b1, b2, b3, b4),  $b = 3/8$ , as shown in figure 4.7:



Figure 4.7: The three transformations of P1.

Essentially, the series of dotted quarter notes is manipulated by omitting eighth notes from beats in various locations. These omissions produce ratios of 2:3 which, as noted in chapter 2,<sup>3</sup> are still acceptable as belonging to the same metric category. The accented quarter notes point to an interpretation of quarter notes as beats despite the fact that their pace exceeds the limit of the comfortable beat.<sup>4</sup>

P2, which is in 3/4, is similarly manipulated. An eighth note is either added or deleted to the last beat of P2 in the following pattern:  $\bullet \bullet \bullet \bullet$ ,  $\bullet \bullet \bullet \bullet$ ,  $\bullet \bullet \bullet \bullet$ . The transformation scheme is thus (b1, b2, b3), (b1, b2, b3), (b1, b2, b3),  $b=2/8$ , as shown in figure 4.8:

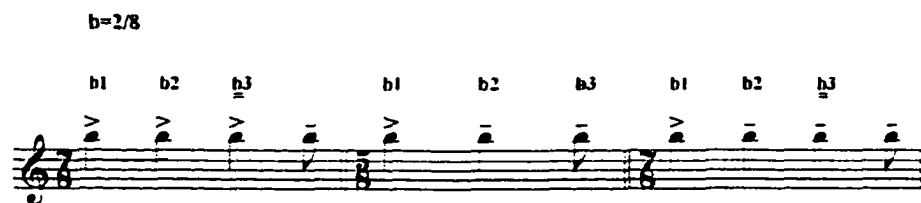


Figure 4.8: The three transformations of P2.

<sup>3</sup> Pp. 29-30.

Technically, the metric scheme of P1+P2 has been transformed from 2+3 prototypical quarter-note beats with a common deeper level of dotted half note (6/8 of P1 acting as a duple-meter) to a flexible beat series of (4+3, 4+3, 4+3) with no common deeper level. Perceptually, the transformation goes even further: in the two instances where an eighth note is added to P2, the flexible beat count is at 3, since the ratio of 2:3 is an acceptable ratio for identical categorization (figure 4.9).



**Figure 4.9:** Durations at a ratio of 2:3 can be categorized as equal. They can thus be perceived as individual beats that belong to the same level in the metric hierarchy of flexible beats.

However, when an eighth note is omitted from the last beat at the second repetition, a ratio of 2:1 is formed between the adjacent beats. This ratio exceeds the limit of equal categorization and thus perceptually lumps the third beat together with its preceding beat. The 3-beat measure is transformed into a 2-beat measure (figure 4.10), changing the overall transformation scheme of P1+P2 to (4+3, 4+2, 4+3).



**Figure 4.10:** Durations at a ratio of 2:1 cannot be categorized as equal, and thus cannot be perceived as separate beats.

---

<sup>4</sup> see the Copland example in chapter 3, pp. 64-67.

The above interpretation shows that despite the rhythmic and metric disparity between the three repetitions of the opening motive, they are all derived from one explicit metric prototype of a 6/8 followed by a 3/4. The metric scheme of the three transformations is  $4+3 \rightarrow 4+2 \rightarrow 4+3$  flexible beats. Figure 4.11 illustrates how, by placing the transformation with the deleted beat (4+2) in between the two other transformations, Copland creates an equivalent framework (4+3 flexible beats) around the exception (4+2 flexible beats):

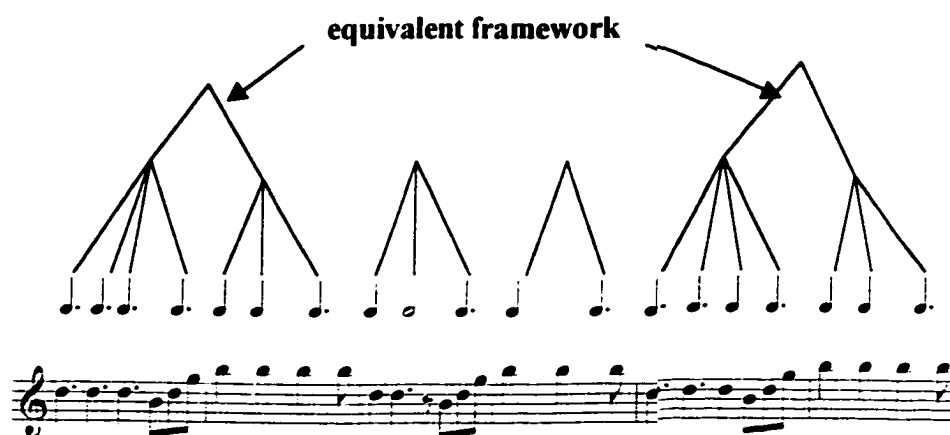


**Figure 4.11:** Copland creates a higher level metric relationship in the opening phrase of *El Salón Mexico*.

## 2. Pitch Emphasis through Beat Deletion in Stravinsky's *Les Noces*

In the opening of *Les Noces* (figure 4.12), an implicit prototype in triple-meter is transformed via rhythmic diminution to serve as a tool in emphasizing a central pitch, E. The transformation does not conform to a 3-beat meter because the metric irregularities occur at the level of the beat.



Stravinsky, *Les Noces*, mm. 1-10

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**Figure 4.12:** The first phrase of *Les Noces* implies triple-meter.

E dominates in this phrase since it always lands on a downbeat. In some cases the E appears alone, while in other cases it is paired with D. The E in measure 5, though barred as 2/8, is musically attached to the following D. This is due to its association with the identical melodic and rhythmic pattern in measures 2-3 (figure 4.13)



**Figure 4.13:** Melodically, the D in m. 6 is attached to the E in m. 5, following the identical pattern in mm. 2-4.

Through this barring change, Stravinsky hints at his prototype: the new barring at measures 5-6 seemingly corrects measure 3 by adding on its missing beat at measure 6. At the same time, it distorts measure 2 by omitting a beat from the E in measure 5 to preserve the overall rhythmic pattern of measures 2-3. However, the notated change in the barring of measures

5-6 is not heard as such, but is rather heard as its previous occurrence in mm. 2-3. Thus, mm. 5-6 can be re-barréd as mm. 2-3, 3/8 followed by 2/8, as shown in figure 4.14:

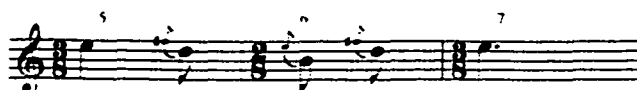


**Figure 4.14:** Rebarring mm. 5-7 to follow the pattern of mm. 2-4.

The prototype from which the passage is derived is partially stated by Stravinsky in mm. 45-51 (figure 4.15). At that point Stravinsky rewrites part of the passage in fixed triple-meter. The filled-in notes (d' on the downbeat of measures 46 and 49) stand out in their lack of grace notes, as opposed to all other notes, excluding E, that have always been adorned with grace notes.



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**Figure 4.15:** The opening motive is repeated in mm. 45-51 in consistent triple-meter. The previously duple measures stand out because they are filled in with notes that lack grace notes.

The implicit prototype of the first phrase is consequently constructed in figure 4.16.



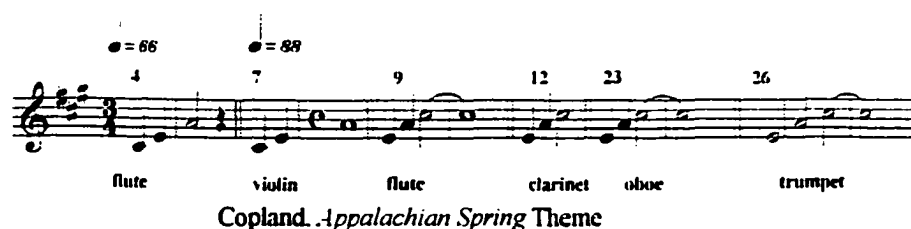
**Figure 4.16:** The implicit prototype of the first phrase of *Le: Noces*.

The prototype is transformed so that the absence of the beat always occurs when the pitches venture further away from E, i.e. to the B below. This excursion is consequently forced to sound as a unbroken unit with no downbeat until the return to E. The significance of E as an anchor pitch is thus intensified rhythmically, substituting a tonal scenario where the E would be emphasized harmonically. Keeping the triple-meter throughout would have introduced an additional accent in between the occurrences of E. This would have lessened the effect of E as a focal downbeat.

### 3. Different Metric Contexts for the Main Theme in Copland's *Appalachian Spring*

The main theme in Copland's *Appalachian Spring* is constructed from a developing melodic and metric prototype. The metric flexibility of the developing prototype is used to branch in different metric directions at consequent metric transformations of the theme.

The prototypical motive first appears in the introduction at mm. 4-5 as a short upbeat-downbeat motive of three notes. The budding motive begins as an upward arpeggiation of an A major triad, first stated on C#, then on E (figure 4.17). The metric identity of the motive is not fixed, appearing sometimes in duple/quadruple-meter and sometimes in triple-meter.



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**Figure 4.17:** The developing prototype, stage I: upward arpeggiation of a major triad.

The prototypical motive develops further in the course of the music. It does so independently from the theme that is based on it, i.e., the theme is heard twice in the *allegro* before the motive appears again at mm. 162 ff. and mm. 201 ff. The motive develops both melodically and metrically.

Melodically, a note in downward motion is added to the motive at mm. 162 ff. This note reshapes the motive in an arch-like contour, as opposed to its previously upward contour (figure 4.18).



Copland. *Appalachian Spring* Theme

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**Figure 4.18:** The developing prototype, melodically, stage II: addition of a note in downward motion.

At mm. 201 ff., the motive is further expanded: the upward arpeggiation of the major triad is complemented by a downward arpeggiation. This shapes the phrase in a broader arch than before (figure 4.19):



Copland, *Appalachian Spring* Theme, mm. 201-205

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**Figure 4.19:** The developing prototype, melodically, stage III: addition of a downward arpeggiation.

Both expansions of the initial motive, the one created by a descending note, and the one created by a downward arpeggiation of a fourth plus major third, turn out to be important characteristics of the theme that is based on this motive. The descending note marks the beginning of each phrase in the theme. The downward arpeggiation is used as the climactic point of the theme, both in range and pitch (figure 4.20).

Copland, *Appalachian Spring* Theme, mm. 78-97

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**Figure 4.20:** The theme that is based on the prototypical motive. The upward arpeggiation together with the descending note mark the beginning of each phrase. The downward arpeggiation is used in a climactic point.

Metrically, the prototypical motive develops in two different directions: At mm. 162 ff. it is presented in triple-meter while at mm. 201 ff. it is presented in quadruple-meter (figure 4.21):

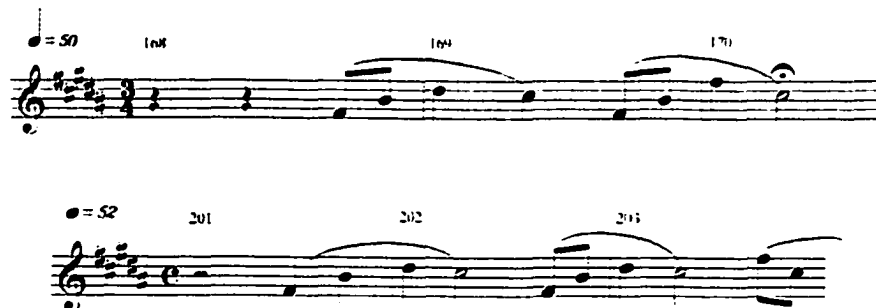


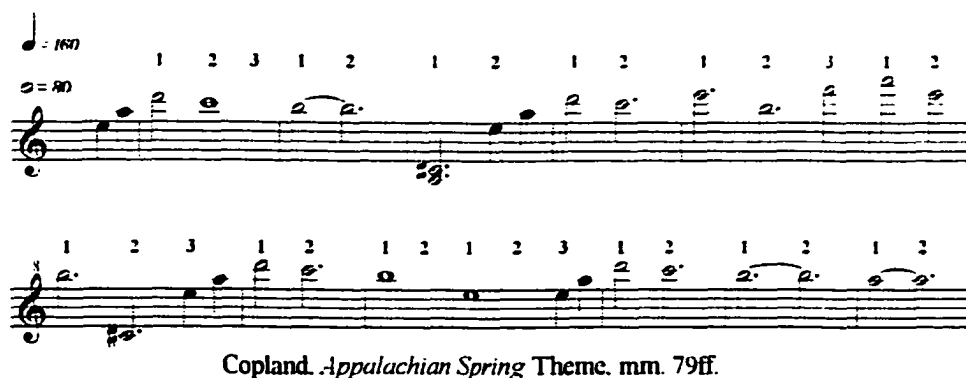
**Figure 4.21:** The developing prototype. two metric directions: triple and quadruple.

Since the prototype is metrically non-committal (it is expressed both in triple and quadruple-meter), it opens a door to diversifying the metric presentations of the theme that is based on it. Copland, however, does not use the quadruple-meter in the presentations of the theme. Instead, he uses its simplified relative, the duple-meter.

The theme occurs four times in the course of the music. These four occurrences will be referred to as T1, T2, T3, T4. With the exception of the third occurrence of the theme which is in strict duple-meter, all other occurrences use implications of both triple and duple-meter, thus mirroring the alternate metric presentations of the prototypical motive.

T1 is metrically the most erratic. The first measure, which consists of three beats organized rhythmically as long-short, cues us to an underlying triple-meter. Triple-meter, however, does not materialize due to two contradictory elements in the accompaniment. On the one hand, Copland superimposes the theme onto a steady 4/4 accompaniment, thus disrupting the triple flavor of the theme. On the other hand, Copland maintains higher level rhythmic stability by coordinating the beginning of the thematic phrases with those of the

accompaniment (see figure 4.20). These contradictory elements lead to metric compromises in the presentation of the theme. Figure 4.22 presents T1, re-barred according to accentual patterns.



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**Figure 4.22:** The first occurrence of the theme, T1, re-barred: metric ambiguity.

T2 is more distinct metrically, largely due to the fact that the accompaniment is not actively dominant as before, and thus does not impose its metric framework upon the theme. The first phrase of the theme is presented in 2-beat meter, while the following phrases are presented in 3-beat meter. Copland maintains the 3-beat meter by dividing 8 beats of two adjacent 4/4 measures into three flexible beats of 3+3+2 quarter notes (mm. 140–41 and mm. 143–44). Figure 4.23a presents T2 in its notated meter. Figure 4.23b presents T2 re-barred according to accentual patterns:

a

b

Copland. *Appalachian Spring* Theme. mm. 135ff.

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**Figure 4.23:** 4.23a presents T2 in its notated meter. 4.23b presents T2 re-barred: the first phrase is in 2-beat meter. The following phrases are in 3-beat meter.

In T3, the tempo fixes the quarter note as the beat, thus conforming the whole passage into a strict in duple-meter. The duple-meter of T3 balances the triple flavor of T1 and T2. Figure 4.24a and figure 4.24b present T3 in the notated and re-barred fashion respectively.



a



b

Copland. *Appalachian Spring* Theme. mm. 452ff.

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**Figure 4.24:** 4.24a presents T3 in its notated meter. 4.24b presents T3 re-barred in consistent duple-meter.

T4 blends the two metric variants of the prototypical motive in the most consistent way. The upbeat and downbeat of each phrase in the theme is presented in 3-beat meter, while the conclusion of each phrase is presented in 2-beat meter. The last phrase of T4 ends with two dotted whole notes, leaving the meter open to interpretation. 4.25a presents T4 in its notated meter. 4.25b presents T4 re-barred, resulting in a consistent alternation between 3-beat and 2-beat meter:

The image displays two musical staves, labeled 'a' and 'b', representing the 'Appalachian Spring' Theme by Aaron Copland. Both staves are in treble clef and 4/4 time, with a tempo marking of  $\text{♩} = 69$ . Staff 'a' shows the original notation with various note values and rests. Staff 'b' shows the same melody re-barred to create a consistent alternation between 3-beat and 2-beat phrases. Above staff 'b', the number of beats for each measure is indicated: 3, 2, 3, 3, 2, 2, 2, 3, 2, 2. Below staff 'b', the re-barred measures are grouped with beat counts: 3, 3, 2, 2, 3, 3, 3 or 2, 3 or 2.

Copland. *Appalachian Spring* Theme. mm. 656ff.

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**Figure 4.25:** 4.25a presents T4 in its notated meter. 4.25b presents T4 re-barred, resulting in a consistent alternation between 3-beat and 2-beat meter. The upbeat and downbeat of each phrase is presented in 3-beat meter, while the conclusion of each phrase is presented in 2-beat meter.

The metric prototype for the theme of *Appalachian Spring* is extraordinary in the sense that it is noncommittal. It portrays the idea that a mix-and-match metric combination can stem not only from one, but also from two possible metric prototypes. Therefore, a theme based on such non-committal prototypes does not have to conform fully to one specific meter throughout, but can be a transformation of one prototype in some sections, and a transformation of another prototype in other sections.

#### 4. A Prototype Adjacent to its Transformation: Stravinsky's "Game of Two Cities"

##### From *The Rite of Spring*

In some cases, an explicit prototype is adjacent to its transformation. Adjacency of a prototype to its transformation clarifies to the listener what is redundant or missing in the transformation, thus facilitating metric adjustment. The following example, from Stravinsky's *Rite of Spring*, shows the use of this technique.

The tempo indicated for "Game of Two Cities" is  $\bullet = 166$ , fixing the beat at a half note ( $\circ = 83$ ). The tubas and trombones that enter at measure [57]+4 emphasize the beat at every half note: the trombones on the downbeat are answered by the tubas on the second beat. In the following measure, however, the tubas answer earlier than expected, on the second quarter note of the measure (figure 4.26).

$\bullet = 166$

[57] + 4                      [57] + 5

Trumpet in C 1

Trumpet in C 2

Trombone

Tuba

*f*                      *sim.*

Stravinsky, *Rite of Spring*. "Game of Two Cities". 1947 edition.

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**Figure 4.26:** Measure [57]+4 is divided equally into two half notes. However, in the following measure, the tubas' early entrance divides the measure unequally into 1+2 quarter notes.

We thus have a prototype in duple-meter in a beat duration of half note, which, by omitting a quarter note, is technically transformed into triple-meter with a beat duration of quarter note:  $2/2 - 1/4 = 3/4$ . Nevertheless, though the meter is *technically* changed, *perceptually* it does not. To perceptually adhere to the technical transformation would mean shifting from one beat level to another in a matter of 1-1.5 seconds. The preferable solution would be staying within one beat level and accepting a contracted beat:  $\bullet \bullet \rightarrow \bullet \bullet$ . This perception is musically strengthened by the accompaniment: the tuba emphasizes the second beat at measure [57]+4 so strongly, that at measure [57]+5, even though the duration of the first beat is cut in half (2:1 ratio), the entrance of the tuba still marks the beginning of the second beat. This is an exception to the categorization limit of 3:2 ratio, which I believe is justified for two reasons:

1. The transformation appears immediately after its explicit prototype.
2. There is a strong link between the tuba and the perception of the second beat.

The context in which the above two measures appear, further sheds light on Stravinsky's ingenuity in manipulating metrical structures: The two measures immediately preceding the prototype are notated as 4/4 followed by 3/4 (figure 4.27).

$\bullet = 166$

**57** + 2                      **57** + 3

*f*

Stravinsky, *Rite of Spring*, "Game of Two Cities"

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**Figure 4.27:** The two measures preceding the previous excerpt also alternate between  $\frac{4}{4}$  and  $\frac{3}{4}$ .

As mentioned above, a tempo of  $\bullet = 166$  is beyond the range of a comfortable beat. Thus a half note is the working beat in this section. As in the previous case, since the  $\frac{4}{4}$  turns to  $\frac{2}{2}$ , the question that arises is what happens to the  $\frac{3}{4}$ ? There are two possibilities. Either the working beat will shift to the quarter-note level,  $\bullet = 166$ , or the whole measure will become one beat at  $\bullet = 55$  (figure 4.28). The solution of a contracted half note, which

worked well in the previous case, is not plausible here since there is no musical reinforcement for such an interpretation.



**Figure 4.28:** The working beat can be either a  $\text{♩}$  or a  $\text{♪}$ .

The two possible interpretations are out of range of the official comfortable beat ( $\text{♩} = 166$  and  $\text{♪} = 55$ ) but close enough to the range limit for the decision to go either way. However, both Stravinsky's use of static harmony and the crescendo that leads to the following measure hint strongly that the composer's intention was to consider this measure as one beat.

Indeed, Stravinsky explicitly states those intentions several measures later, at rehearsal [58] (figure 4.29). The previous excerpt is repeated with identical instrumentation, harmony and melody, save a tiny "correction" - the first two eighth notes of the earlier excerpt, which are actually a repetition of the third eighth note, are now omitted. Thus, the prototype is an excerpt in  $3/2$  and its transformation is a  $3/2$  with an expanded third beat.

♩ = 166

58

Bassoon

Contrabassoon

Cornet 1

Cornet 2

Cornet 3

Cornet 4

Violoncello

Contrabass

*f*

Stravinsky, *Rite of Spring*, "Game of Two Cities"

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**Figure 4.29:** Rehearsal [58] acts as a metric prototype to the problematic excerpt at [57] + 3. Using the half note as the working beat, the excerpt is translated into a 3/2 meter, while the closely related excerpt at [57] + 3 is an expanded version of the prototype.

In sum, we have two explicit prototypes and their transformations enclosed within one another. The inner two measures present a prototype followed by a transformation, whereas the outer measures present a transformation followed by a prototype. The metric configuration of the entire excerpt put together is:

3/2 (expanded) - 2/2 (prototype) - 2/2 (contracted) - 3/2 (prototype).

4/4+3/4

4/4

3/4

4/4+2/4

The combination of 4/4+3/4 is repeated twice, but the interpretation in each case differs in accordance to its musical context. The first instance of 4/4+3/4 is interpreted as one unit and therefore translates into an expanded 3/2 measure. The second instance of 4/4+3/4 is interpreted as a repetition, and therefore translates into a 2/2 measure + contracted 2/2 measure.

### Summary

The excerpts brought together in this chapter do not conform to a consistent X-beat meter. It is clear, however, that both the application of flexible beats and the existence of explicit or implicit prototypes are instrumental in creating a semblance of meter. The semblance can vary widely. In some cases, especially when the prototype and its transformation are adjacent, the metric connection proves very strong, enabling metric compromises that would otherwise be impossible (for example, Stravinsky's "Game of Two Cities.") In other cases, such as *El Salón Mexico* and *Appalachian Spring*, the metric connection is more tenuous, but through the awareness of an existing prototype, explicit or implicit, we become more sensitive to metric structures that are embedded in the various transformations.

## Chapter 5

### Hypermetric Organization in a Flexible Metric Environment

The preceding chapters dealt solely with two levels of the X-beat metric hierarchy, namely the flexible beat and X-beat meter. In this chapter, the flexibility is extended to higher levels of the hierarchy as well. The concepts of flexible beats, X-beat meter and their metric prototypes are transferred to and used at the hypermetric level. They are referred to as flexible hyperbeats, X-hyperbeat hypermeter and hypermetric prototypes respectively.

A flexible hyperbeat is a measure that does not conform to the X-beat meter of its surrounding measures. For example, in a 2-beat meter context, a measure of three beats will be considered as an expanded hyperbeat at the hypermetric level. An X-hyperbeat hypermeter is a hypermeter in which its hyperbeats are allowed to expand and contract. A hypermetric prototype is the hypermeter that is derived from an X-hyperbeat hypermeter.

In tonal music, regularity issues have been discussed regarding higher levels of the metric hierarchy. All levels above the metric level are called *hypermetric levels*, but most discussions relate to the level immediately above the metric level.

Lester and Rothstein are two scholars who deal extensively with hypermeter. They both differentiate between hypermeter, which is equivalent to meter, and phrase structure, which paces structural events:

Hypermeter, if it is to be analogous to meter, must concern itself with groupings of equivalent pulses, not with the pacing of structural events – a related, but clearly separate phenomenon.<sup>1</sup>

Hypermeter refers to the combination of measures on a metrical basis...including both the recurrence of equal-sized measure groups and a definite pattern of alternation between strong and weak measures. Phrase structure refers to the coherence of musical passages on the basis of their total musical content – melodic, harmonic and rhythmic. Hypermeter and phrase structure may coincide or they may not; their agreement or conflict represents a basic compositional resource.<sup>2</sup>

Rothstein notes that not all tonal music is composed of hypermeasures. Improvisatory pieces, such as Baroque toccatas, Classic fantasias, and recitative-like passages, often avoid forming hypermeasures so that their rhapsodic or capricious quality can be projected. Hypermeter is most common in pieces that are either intended for dancing or are meant to suggest the dance, because in dance, regularity is one of its chief qualities.<sup>3</sup>

Even where hypermeter exists, it is usually not consistent throughout.

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<sup>1</sup> Lester, *The Rhythms of Tonal Music*, 159.

<sup>2</sup> William Rothstein, *Phrase Rhythm in Tonal Music* (New York: Schirmer Books, 1989), 13.

<sup>3</sup> *Ibid.*, 13.

Just as the agreement or conflict of hypermeter and phrase structure is a compositional resource, so is the contrast between metrical regularity (hypermeter) and irregularity (absence or modification of hypermeter.)... There exist definite techniques by which composers can change regular hypermeasures into irregular measure groups of all kinds.<sup>4</sup>

Lester summarizes theorists' views on hypermeter at different levels of the metric hierarchy as follows:

All theorists agree that the background is ametric in the sense that we understand meter at the foreground. All theorists agree that shortly below the level of the fundamental structure, the pacing and proportions of formal divisions in the piece come into play. Subdivisions of larger sections give the phrase lengths, with or without extensions, contractions and other alterations. Finally, all theorists agree that up to the measure level, meter functions. It is between the measure level and the phrase level that disagreements arise between those who would assert metric relationships (Schachter, Berry, Komar) and those who do not recognize meter much above the primary metric level.... The preference for or against metric structuring for one or more levels above the primary metric level is a matter of interpretation, not a provable position.<sup>5</sup>

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<sup>4</sup> Ibid., 13-14.

<sup>5</sup> Lester, 216.

Given that hypermeter is not strictly regular in tonal music, this chapter does not try to discover such regularity in long stretches of early twentieth-century music. Instead, the following examples will show the effect of hypermetric organization on different musical aspects:

1. It will show how the levels of meter and hypermeter interact with one another. For example, in some of the presented cases, the hypermeter functions as a regulator to the irregular metric level below it.
2. It will show how hypermeter interacts with other musical aspects, such as melody and structure. In such cases, the hypermeter creates, together with melodic manipulation, a sense of forward and developmental motion. It functions then as a substitute to goal directed harmonic progressions, which are weakened in early twentieth-century music.

# 1. Hypermetric Regularity within Bartók's "Change of Time" from *Mikrokosmos*

## Change of Time

$\text{♩} = 250 \quad (\text{♩} = 125)$  Bartók

The musical score consists of five systems, each with a piano (Piano) and grand piano (Pno.) part. The time signatures change frequently throughout the piece. The first system is marked *f* and *sf*. The second system is marked *p* and *sf*. The third system is marked *f* and *sf*. The fourth system is marked *cresc.* and *ff*. The fifth system is marked *ff*. The score is written in a key signature of one flat (B-flat).

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**Figure 5.1:** In Bartók's "Change of Time," time signatures constantly change in the first twenty measures.

This example (figure 5.1) intends to show that despite surface metric irregularities in Bartók's "Change of Time," both an X-beat meter and an X-hyperbeat hypermeter exist. Though the hypermeter does change during the work, each change is held throughout a significant period of time.

Repetitive rhythmic and melodic patterns determine the hypermetric groupings. Figure 5.2 shows the repetitive melodic and rhythmic pattern in mm. 1-17. The repeated pattern is of four notated measures.



**Figure 5.2:** A melodic and rhythmic pattern is repeated every four measures.

Although the time signature changes at each measure, the repeated pattern conforms to eight flexible beats that equal to one hyperbeat. The hyperbeats are grouped as antecedent-consequent phrases, creating two hypermeasures of two hyperbeats each (figure 5.3).

|                 |                               |                |
|-----------------|-------------------------------|----------------|
| hyperbeats:     | 1 (antecedent)                | 2 (consequent) |
| meter           | ?                             |                |
| flexible beats: | 1   2   3   4   5   6   7   8 | 1   2          |

**Figure 5.3:** Each repeated pattern consists of eight flexible beats that equal to one hyperbeat. The grouping of the beats, however, is open to interpretation.

The grouping of the beats, however, is open to interpretation. Although an 8-beat meter is possible, listeners tend to arrange periodicities in small groups of twos or threes.<sup>6</sup> Since the score of “Change of Time” does not contain accentual cues, several beat groupings are possible:

1. A grouping of 2+3+3 flexible beats. This interpretation adheres to the notated barring except for the 3/8 measure in each hyperbeat that is annexed to the following 5/8 measure as a flexible beat.
2. A grouping of 3+3+2 flexible beats. This interpretation relates closely to a 3-beat meter, where the *Sf* on the last note of the 5/8 measure may hint at a truncated 3<sup>rd</sup> beat.
3. A grouping of 4+4 flexible beats, where each phrase begins with a 2-beat upbeat measure. This interpretation is the most conservative, since it both adheres to the notated barring and is grouped evenly.

The possibilities of X-beat meter underlying the “change of time” are therefore 3-beat meter, 4-beat meter or a repetitive pattern of 2+3+3 flexible beats (figure 5.4). It is thus the hypermeter that regulates an ambiguous X-beat meter.

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<sup>6</sup> See Chapter 2, footnote 2

beats:     1   2       1   2   3       1       2   3       1   2

or:       1   2       3   1   2       3       1   2       1   2

or:       upbeat       1   2   3       4       1   2       3   4

Figure 5.4: The three interpretations in flexible beat grouping.

Melodically, the two antecedent-consequent phrases oscillate around the axis G. The first phrase stretches upward a third, but dips a second below G. The second phrase flips the intervals surrounding G, dipping a third and rising a second.

At measure 18, though the rhythmic pattern remains, the melodic line changes by ascending through C to a high point E (figure 5.4).



**Figure 5.4:** At measure 18, the melodic line leaves the G-axis and ascends to E through C.

This signals a rhythmic and metric developmental stage as well. It is followed by four hypermeasures of duple-hypermeter (figure 5.5). These hypermeasures are shorter than the hypermeasures in mm. 1-17, since the number of beats at the metric level is two, not eight. This creates a forward momentum.

The antecedent-consequent relationship is preserved in the first two hypermeasures. The oscillation around E is similar to the oscillation around G in the first section. In the antecedent, the melody reaches a third upward and a second downward, while in the consequent, the tables are turned. The fourth hypermeasure, beginning at m. 27, although it seems to begin a consequent to the third hypermeasure, turns out to be a beginning of yet another stage in the developmental process. As before, the melodic pattern changes first, leading to yet another rhythmic and hypermetric change as well.

hyperbeats: 1 2 1 2 1

beats: 1 2 1 2 1 2 1 2 1 2

Piano

Pno

Pno

The figure shows three systems of musical notation. The first system is for Piano, with measures 21-27. The second system is for Pno, with measures 28-31. The third system is for Pno, with measures 32-33. Above the staves, hyperbeats and beats are indicated. The Pno part in measures 28-31 has a melodic change, marked with 'E' and 'G'.

Figure 5.5: The E-axis in mm. 21-27 breaks away after a melodic change in mm. 28-31.

Instead of oscillating around the axis E the melody in the bass breaks away (figure 5.6), first descending through an octave and then ascending to the initial significant note G at measure 32. A single hypermeasure of triple-hypermeter (truncated from an expected 4-measure hypermeter) is followed by one hypermeasure of quadruple-hypermeter, thus ending the piece.

hyperbeats: 1 2 1 2 3

beats: 1 2 1 2 1 2 1 2 1 2

27

Piano

E

32

Pno.

G

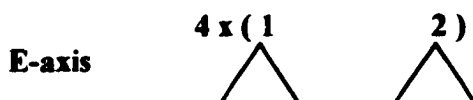
**Figure 5.6:** The E-axis returns to the initial center. G. in m. 32. During the process, the hypermeter changes as well.

Figure 5.7 summarizes the hypermetric organization and its correlation with the different melodic axes.

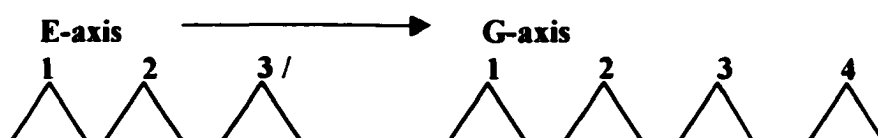
### mm. 1-20



2 hypermeasures of duple-hypermeter (ambiguous X-beat meter) plus one hyperbeat.

**mm. 21-28**

4 hypermeasures of duple-hypermeter (2-beat meter), momentum created by the metric change.

**mm. 29-35**

2 hypermeasures of quadruple-hypermeter (first one truncated, 2-beat meter), momentum created in first hypermeasure through the break-away from static melody to an ascending scale.

**Figure 5.7:** There are two directional melodic moves in this piece. Each directional move corresponds to a change in the rhythmic pattern, as well as a change in one of the metric levels (either metric or hypermetric). G-axis breaks away from static oscillation and ascends to E (mm. 17-20). The E-axis, in turn, breaks away and returns, through both descent and ascent, to G (mm. 27-32).

## **2. Double-edge Hypermeter in Bartók's "Unison" from *Mikrokosmos***

Bartók's "Unison" illustrates how a dual metric identity in the theme leads to different possibilities of hypermetric prototypes. Those possibilities are later realized in the music at subsequent occurrences of the theme, both metrically and hypermetrically.

**Unison**

Bartok

♩ = 108

hyperbeats: 1 2 3 1 2 3 1 2

Piano

Pno

**T1**

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**Figure 5.8:** The theme (T1) is presented in triple-hypermeter but with changing time signatures at the metric level.

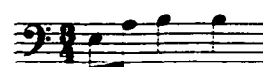
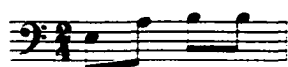
Figure 5.8 shows the theme (T1) organized in strict regularity of two measures in duple-meter plus one measure in triple-meter. An antecedent-consequent relationship exists between the first two sets of three measures, while the two following sets of measures simply repeat the first two. The hypermeter of T1 is thus regular at three measures, though the measures themselves are of unequal length of two beats, two beats, and three beats.

Since the working beat for “Unison” is the quarter note, the flexible beat concept can not be applied, hence the irregularity at the metric level. However, a **flexible**

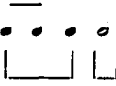
**hyperbeat** does exist. The hyperbeat equality of the first two hyperbeats leads us to believe that the prototype of the hypermeter should be duple. The dilemma is whether the third hyperbeat/measure is expanded from a prototype of one hyperbeat of duple-meter, or is it contracted from two hyperbeats of duple-meter. Determining the prototype of the third hyperbeat will determine the prototype of the hypermeter, whether it consists of three hyperbeats or four hyperbeats. Figure 5.9 shows the two possible prototypes for the third hyperbeat.

**Prototype possibilities of third hyperbeat**

$\frac{2}{4}$ :  prototype is one hyperbeat (measure) expanded to  $\frac{3}{4}$ : 



**OR**

$\frac{2}{4}$ :  prototype is two hyperbeats (measures) contracted to  $\frac{3}{4}$ : 

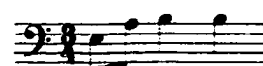


**Figure 5.9:** The hypermetric prototype can be built by either expanding or contracting the triple-meter measures. That results with either a triple or quadruple hypermetric prototype.

Bartók plays on this ambiguity in the next two occurrences of the theme. He uses the quadruple hypermetric prototype at the second occurrence (T2), and the triple hypermetric prototype at the third occurrence (T3).

**T3** (figure 5.10) is regular at both the metric and the hypermetric levels.  
(excluding a cut-off in the last hypermeasure, which leads to the ending section )

The image displays a musical score for two instruments, Piano (Piano) and Flute (Flu), in 3/4 time. The score is divided into two systems. Above the first system, the hyperbeats are marked as 1, 2, 3, 1, 2. Above the second system, the hyperbeats are marked as 3, 1, 2, 3, 1, 2 (3 truncated). The Piano part consists of a treble and bass staff, and the Flute part also consists of a treble and bass staff. The music is written in a key with one sharp (F#) and a 3/4 time signature. The score illustrates a regular hypermeter with a triple hypermetric prototype.

### T3

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**Figure 5.10:** T3 is regular in both metric and hypermetric levels. The triple-hypermeter conforms to the triple hypermetric prototype.

In **T2** (figure 5.11), Bartók keeps the irregularity at the metric level, using a different combination of 2-beat and 3-beat measures at each hypermeasure. However, the hypermeter remains fixed at four hyperbeats, albeit flexible hyperbeats.

hyperbeats: 1 2 3 4

flexible  
beats: 1 2 3 1 2 1 2 1 2

17

1 2 3 1 2 3 1 2 1 2

21

1 2 1 2 3 1 2 3 1 2

**T2**

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**Figure 5.11:** The flexible quadruple-hypermeter conforms to the quadruple hypermetric prototype. The meter is irregular, changing from 3-beat to 2-beat meter and vice versa.

**T2** is the most interesting of the three occurrences of the theme because of its metric irregularity. Bartók seems to change the metric organization haphazardly at each hypermeasure. Nevertheless, there is an organized process at work, one that creates a directionality and forward motion in **T2** that is not present in either **T1** or **T3**.

Bartók progressively expands the hypermeasures by adding beats at the metric level (figure 5.12). In the first two hypermeasures, Bartók adds one extra beat at each hypermeasure. In the first hypermeasure there is one measure of triple-meter plus three measures of duple-meter (the triple-meter measures, here and in the following hypermeasures, extend over the barline because they are variations of corresponding measures in **T1**.) In the second hypermeasure, there are two measures of triple-meter plus two measures of duple-meter. In the third hypermeasure, Bartók expands further, but this time, not by adding beats but by creating an expanded flexible beat within the second measure. Numerically, however, Bartók added the durational value of another quarter note, the equivalent of another beat. In the fourth and last hypermeasure, Bartók adds yet another beat, thus ending the expansion. The durational expansion is organized, and a forward motion is created by progressing from a duration of nine quarter notes to twelve quarter notes at the rate of one quarter note per hypermeasure.

9 quarter notes (9 beats)

flexible  
beats: 1 2 3 1 2 1 2 1 2

10 quarter notes (10 beats)

1 2 3 1 2 3 1 2 1 2

11 quarter notes (10 flexible beats)

1 2 1 2 3 1 2 3 1 2

12 quarter notes (11 flexible beats)

1 2 1 2 3 1 2 3 1 2 3

T2

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**Figure 5.12:** The irregular meter has an underlying linear progression of phrase lengths: from nine quarter notes in the first phrase to twelve quarter notes in the fourth phrase.

Bartók connects **T2** and **T3** durationally by using the same overall duration of the first hypermeasure in both **T2** and **T3**, which is nine quarter notes. In **T3**, which is in triple meter, a triple-hypermeter is the norm. At the beginning of **T2**, however, Bartók creates the same nine quarter notes from four flexible hyperbeats notes in a 4-hyperbeat hypermeter.

Figure 5.13 summarizes the hypermetric and metric organization in the three presentations of the theme:

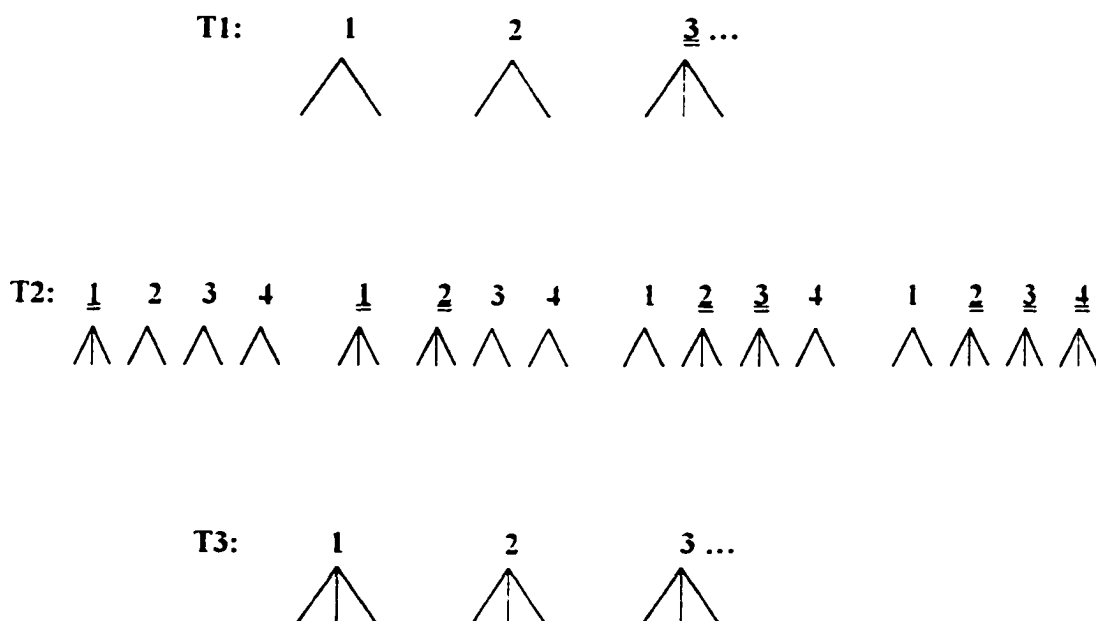


**Figure 5.13:** **T1** is presented in 3-hyperbeat hypermeter and consistent pattern of irregular meter. However, the hypermetric prototype is ambiguous.  
**T2** is presented in 4-hyperbeat hypermeter but with irregular meter.  
**T3** is the most stable metrically. It is presented in regular triple-hypermeter and regular triple-meter.

### 3. From *Piano Variations* by Copland: Discovering Regularity within the Irregularity

#### Piano Variations

$\bullet = 176$   
132 **A** Copland

Piano

*mf sf mf ff mf*

**B**

Piano

*f ff mf ff mf ff*

**A'**

Piano

*mf f ff mf*

Piano

*ff mf f ff*

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Figure 5.14: Time signatures change rapidly in variation 16 of Copland's *Piano Variations*.

The variation in figure 5.14, from Copland's *Piano Variations*, is another illustration of the existence of X-beat meter and X-hyperbeat hypermeter beneath metric irregularities. It further shows that due to a developmental process in the middle section, B, both the X-beat meter and the X-hyperbeat hypermeter are not constant in that section. The variation is organized as an ABA' form. A and A' are identical melodically but are slightly different rhythmically. B can be considered as a developmental section since it manipulates both melodic and rhythmic aspects of A.

### Section A

hyperbeats:      1                      2                      1                      2                      1

---

flexible  
beats:      1      2      1      2              1      2              1      2              1      2

---

or:      1      2      1      2              1      2              1      2              1      2

**Figure 5.15:** 2-beat metric regularity underlies section A. The hypermeter is flexibly duple as well.

Section A (figure 5.15) is essentially in 2-beat meter, the prototype being either duple (2/4) or sextuple (6/8). The two possibilities are suggested in measures 3 and 4, immediately following the ambiguous 5/8 of measures 1 and 2. In either choice of prototype, measure 6 is problematic. It is the only measure that is durationally too short to hold two flexible beats. However, since measures 5-6 partially repeat measure 1-2, measure 6 does not sound as part of measure 5, but rather as a cut-off measure

Hypermetrically, A consists of four hypermeasures of 2-hyperbeat hypermeter, the last two hypermeasures creating a consequent to the first two hypermeasures

### **Section B**

The development section, B (figure 5.16) begins as A – one hypermeasure consisting of two 2-beat measures. In the remaining measures, however, Copland uses the same idea that Bartók used in *Unison*. He slowly adds on a fixed rhythmic value until the return to A'. Measure 11, which is in 8/8, corresponds to the rhythmic pattern of measures 5 and 6, i.e., one measure of 5/8 and one measure of 3/8. The next two measures each add an eighth note, making up one measure of 6/8 and one measure of 4/8. The next two measures add yet another eighth note to each measure, resulting in one measure of 7/8 and one measure of 5/8. The meter of the last measure – 5/8, reaches the meter needed for the repeating A' section.

flexible  
hyperbeats:     1                    2                    1                    1

flexible  
beats:            1           2     1           2           1           2     3           1           2

Piano

Pno

**Figure 5.16:** Section B is in 2-hyperbeat hypermeter. Underlying the irregular meter is a linear progression of eighth notes.

The linear progression of added rhythmic values disrupts the 2-beat meter that was prevalent in section A. Measure 11 does not sound like two measures, even though it repeats measures 5-6 of section A. This is due to the fact that measure 11 is not preceded by identical material as in section A, thereby lacking the melodic and rhythmic connection that existed between measures 1-2, 3-4 and measures 5-6. Instead, measure 11 sounds like an expansion of measure 9, thus turning it into a 3-beat measure

Hypermetrically, B can be described as four hypermeasures. The four hypermeasures are not divided into equal groups of two hypermeasures as in section A. The first hypermeasure stands alone, while the remaining three hypermeasures create a

forward motion from a cut-off hyperbeat up to an expanded hyperbeat, ultimately leading up to A'.

### Section A'

A' (figure 5.17) is identical to A, excluding the rhythmic durations of the last two measures. The second to last measure is stretched to three beats, a pseudo written *rubato* before the end.

A' uses the same pairing of time signatures as B, but not in a linear order. This further explains the discrepancy in rhythmic values between A and A' in the last two measures. A' and B are thus rhythmically balanced, while A is missing an eighth note to be balanced with B.

flexible hyperbeats:      1                      2                      1                      2                      1

flexible beats:      1      2      1      2      1      2      1      2      1      2

Piano

6/8 -      4/8      5/8 -

Pre

3/8      5/8      5/8

**Figure 5.17:** The pairing of time signatures in A' is identical to the pairing in B, but it does not appear in linear order. Thus, B and A' are rhythmically balanced.

Figure 5.18 summarizes the hypermetric and metric organization in Copland's variation

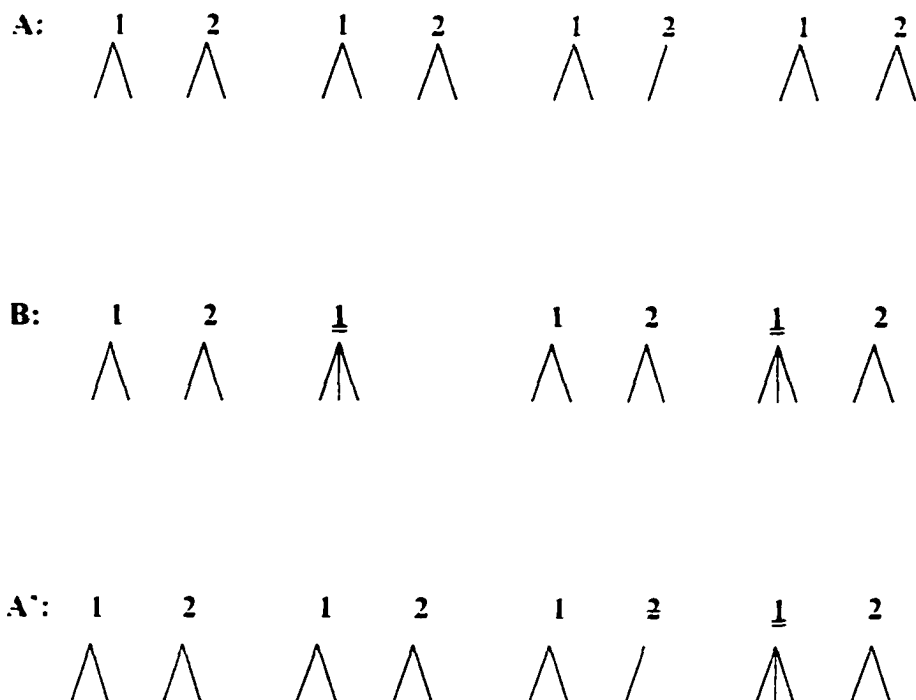


**Figure 5.18:** Each section in Copland's variation consists of four hypermeasures in 2-hyperbeat hypermeter. The X-beat meter is generally duple. It is disrupted in the developmental section .B. where a linear progression of added rhythmic values occurs, and then in A', where the number of beats is matched to that of B

#### 4. Stravinsky's *Les Noces*: Melodic and Hypermetric Connection in the Opening of the Second Tableau

The example in figure 5.19 illustrates a case where an X-beat metric and an X-hyperbeat hypermetric beginning changes in subsequent occurrences. The changes result from slight alterations that are administered to two basic melodic patterns. The two basic melodic patterns, **P1** and **P2**, are presented and then repeated in different sequences. The different sequences of P1 and P2 are labeled as A, A<sup>1</sup>, A<sup>2</sup>, A<sup>3</sup>, A<sup>4</sup>. A, A<sup>1</sup> and A<sup>2</sup> are presented as one unit, while A<sup>3</sup> and A<sup>4</sup> are presented after intervals of different musical material.

The musical score consists of three systems, each with a Tenor staff and a Percussion staff. The first system begins at measure 27 and contains the sequence A, P1, P2, P2. The second system contains the sequence A<sup>1</sup>, P1, P2, P1, P2, with dynamic markings *f* under the second and fourth measures. The third system contains the sequence A<sup>2</sup>, P2, P2, P1. The Percussion staff in each system shows rhythmic accompaniment with various note values and rests.

Figure 5.19 shows two systems of musical notation. The first system, labeled  $A^3$ , contains measures 30 through 33. It features a Tenor staff with two P2 patterns followed by two P1 patterns, and a Percussion staff with a corresponding rhythmic accompaniment. The second system, labeled  $A^4$ , contains measures 34 through 37. It features a Tenor staff with one P1 pattern followed by two P2 patterns and one P1 pattern, and a Percussion staff with a corresponding rhythmic accompaniment.

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**Figure 5.19:** Two basic melodic patterns. P1 and P2 are presented in different sequences at the opening of the Second Tableau in Stravinsky's *Les Noces*.

In both melodic patterns, d is the primary note. P1 stresses the d-axis through a lower neighbor note, c. P2 emphasizes the d-axis from both below and above: c from below, and f and e from above (figure 5.20).

Figure 5.20 shows two melodic patterns, P1 and P2, on a single staff. P1 is a four-note sequence starting on d, with a lower neighbor c. P2 is a five-note sequence starting on d, with notes c, f, and e above it.

**Figure 5.20:** The pitch d is the axis in both P1 and P2. In P1, a lower neighbor note highlights d, while P2 adds on two notes from above: f and e.

When taking notated accents into account, all the A<sup>1</sup>'s generally conform to 3-beat meter (figure 5.21). The metric prototype is in triple-meter. Accented beats that are contracted to half their size, may be interpreted either as joined to a preceding beat or may be considered as cut-off beats. Non-accented beats that are contracted to half their size would normally be joined to another beat. In this case, however, strong melodic connection to P1 and P2, of which metric identity is a 3-beat meter, results in an ambiguous X-beat metric interpretation in non-accented beats.

**A**

flexible beats: 1 2 3 1 2 3 1 2 3

27

A<sup>1</sup> 1 2 3 1 2 3 1 2 3

or: 1 2 3 1 2 3 1 2 3

A<sup>2</sup> 1 2 3 1 2 3 1 2 3

A<sup>3</sup>

1 2 3 1 2 3 1 2 3

or: 1 2 3 1 2 3 1 2 3

30

A<sup>4</sup>

1 2 3 1 2 3 1 2 3

or: 1 2 3 1 2 3 1 2 3

33

Figure 5.21: Through re-barring, 3-beat meter emerges with some exceptions and ambiguities.

In all sequences, the two melodic patterns are present. In A and A<sup>2</sup>, P2 is more prevalent, appearing twice, while P1 appears only once. This accounts to the 3-hyperbeat hypermeter of sections A and A<sup>2</sup>. A<sup>2</sup> repeats A, but is shifted by one measure. A<sup>1</sup>, on the other hand, is even handed. Each melodic pattern appears only once, accounting for the 2-hyperbeat hypermeter. Thus, on the one hand, section A<sup>1</sup> creates a forward motion, due to the shortened hypermeter, but on the other hand, its melody is distributed more evenly (figure 5.22).

**A**

hyperbeats: 1 2 3

flexible beats: 1 2 3 1 2 3 1 2 3

27

**A<sup>1</sup>**

1 2 3 1 2 3 1 2 3

**A<sup>2</sup>**

1 2 3 1 2 3

$A^3$  and  $A^4$  remain in 3-beat meter, but continue to change hypermetrically (figure 5.23). They are no longer in 3-hyperbeat, but in 4-hyperbeat hypermeter. The 4-hyperbeat hypermeter balances the two melodic patterns, P1 and P2, sounding two of each. In  $A^3$  (rehearsal 30),  $A^2$  is repeated melodically, with an added instance of P1.  $A^4$  shifts back one measure, thus repeating A, but with the added measure of P1 at the end.

**$A^3$**

|       |       |          |   |          |   |
|-------|-------|----------|---|----------|---|
| 1     | 2 (2) |          |   | 3        | 4 |
| 1     | 2     | <u>3</u> | 1 | <u>2</u> |   |
| or: 1 | 2     | 3        | 1 | 2        | 3 |

[30]

**$A^4$**

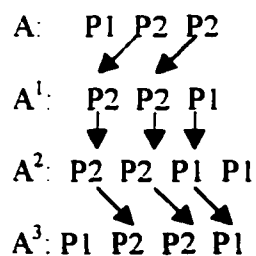
|   |   |   |   |          |   |
|---|---|---|---|----------|---|
| 1 | 2 |   |   | 3        | 4 |
| 1 | 2 | 3 | 1 | <u>2</u> |   |
| 1 | 2 | 3 | 1 | 2        | 3 |

[33]

**Figure 5.23:** The 4-hyperbeat hypermeter of  $A^3$  and  $A^4$  balances the frequency of P1 and P2 in each sequence.

Figure 5.24 summarizes the melodic, hypermetric and metric schemes of the five sequences:

**Melodic scheme**



### **Hypermetric and metric scheme**

A: 3-hyperbeat hypermeter / 3-beat meter

A<sup>1</sup>: 2-hyperbeat hypermeter / 3-beat meter (forward motion)

A<sup>2</sup>: 3-hyperbeat hypermeter / 3-beat meter

A<sup>3</sup>: 4-hyperbeat hypermeter / 3-beat meter

A<sup>4</sup>: 4-hyperbeat hypermeter / 3-beat meter

**Figure 5.24:** the melodic, hypermetric and metric scheme of the five sequences: A A<sup>1</sup> A<sup>2</sup> A<sup>3</sup> A<sup>4</sup>.

### **Summary**

In all the above examples, taken from works by Bartók, Copland and Stravinsky, flexible hyperbeats are consistent with the rules set for a flexible beat environment. This shows that by expanding the definition of meter and hypermeter as we know it in tonal music, an expanded but viable hierarchy emerges. The levels of flexible beats and flexible hyperbeats interact with each other in the same way that fixed beats and fixed hyperbeats interact in a fixed metric hierarchy.

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