8 Rhythm in Post-tonal Music

A Modernist Primer

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Post-tonal Rhythm's Legacy

Composers coming of age in the early twentieth century inherited from the Western European art tradition at least two ways to articulate temporality, both dependent on the highly organized language of tonality and a vocabulary of proportionally related durations (whole notes, half notes, quarter notes, etc.). This musical time evokes an ordered, continuous flow – a sense of moving forward toward a goal, one where complexity arises from possible diversions in an ongoing flow and a pattern of metric accent. The temporal identities are determined by their placement within a phrase and within a hierarchical, fundamentally periodic series of beats, measures, and hypermeasures; for example, a chord may occur on a beat within a measure and (often) a hypermeasure, and also at the beginning, middle, or end of a phrase.

This kind of temporality is highly dependent on tense. An event may occur not only before others, but also in the past, making its identity malleable: we may anticipate its identity before it happens, adjust its identity as it happens, and again reconsider it once it is over. In other words, while we often think of time as an arrow, it reaches forward with a strong reference to its own earlier movements. This evolution of identity relies in large part on our sensations of regularity: when phrases have typical lengths and metric accentuation proceeds periodically, these modes of articulation permit deviations such as phrase expansion and syncopation. In Western musical notation, flow is shown in the left-to-right display of musical scores, and the articulation of that flow is generally represented with durational symbols, time signatures, and barlines. These symbols form a reasonably accurate guide to time's articulation into discrete durations and groups of durations, and to the generally periodic accentuation of meter, measurements that can be perceived across small spans of time and larger ones. Our sense of rhythm is intimately connected to our experiences of bodily movement, especially our abilities to perceive and anticipate regularly occurring beats.[1]

As Western tonal music became increasingly chromatic, the regularities of Western tonal temporality began to break down. Additionally, composers were increasingly aware of music outside of Western Europe, and of scientific and psychological ideas about time and sequence that questioned

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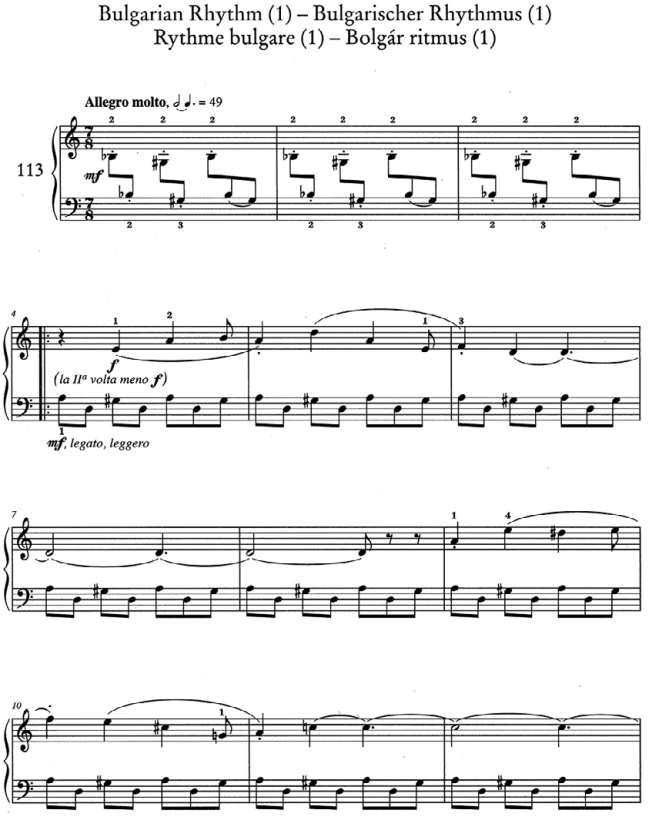
a simple relationship of cause and effect. The relatively simple relationship between rhythmic notation (as indicated via scores) and its perception no longer held as composers wrote music whose phrase boundaries, phrase rhythm, and metric identities became much less regular. In the following close readings of four musical excerpts (by Bartók, Stravinsky, Copland, and Messiaen), I will demonstrate a number of ways in which post-tonal music stretches, and even breaks, concepts and practices associated with Western European tonal art music as it forges new, modernist temporalities which match and make possible new pitch organizations.

Bartók's Hybrid Composition

Let's begin with Example 8.1a, a short piano piece from Book IV of the collection *Mikrokosmos* by Béla Bartók, finished in 1939. This collection of



8.1a Bartók, "Bulgarian Rhythm" (*Mikrokosmos* #113).

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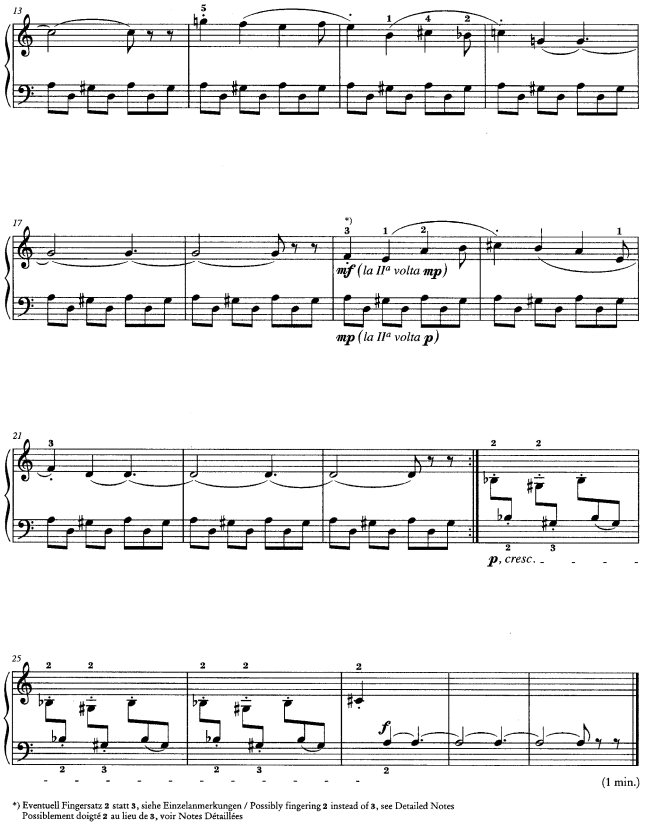

8.1a (*cont.*)

153 short piano solos, organized in six books of increasing difficulty, was written with a pedagogical aim: to teach piano skills while it also introduced Eastern European folk practice and more "modern" melodies, harmonies, and rhythms to players.[2] A particularly challenging skill in #113 is learning to play in $\frac{7}{8}$, the "Bulgarian Rhythm" referenced in the piece's title.[3]

This piece is notated entirely in what is commonly called an "asymmetric" meter – $\frac{7}{8}$ – because seven cannot give rise to a single longer pulse of either two or three eighths. Notice that the opening alternation of B♭ and G♯ in mm. 1–3 groups the constant eighth pulsations into a pattern of 2+2+2+1, and Bartók beams the eighths in the left hand in 2+2+3 throughout the piece. This inequality undoubtedly arose from Bartók's long and thorough study of Eastern European folk music, and the particular irregularities given here, along with the speedy articulation of the eighths, suggest that the piece uses an "aksak" rhythm.

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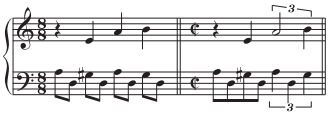
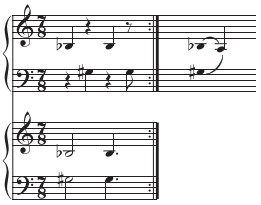
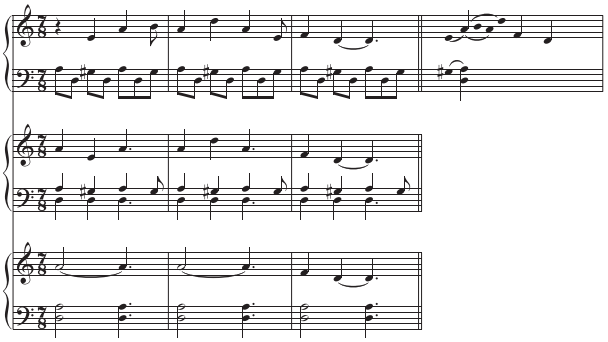


8.1b $\frac{8}{8}$ and cut-time recompositions of m. 4





8.1c Durational reduction of first phrase

"Aksak" can be translated as limping, slumping, or stumbling, apt words whose qualities become especially evident when compared to the more typically common-practice $\frac{8}{8}$ and cut-time re-compositions given in Example 8.1b. Even so, a critical feature of this piece's irregularity is its periodic repetition of $\frac{7}{8}$ and the steadiness of its internal patterns. These emerging pitch and durational patterns align with László Vikárius's conception of hybridity in art music, where meaning and comprehension arise in reference both to folk tradition and European tonal practice. Example 8.1c presents mm. 1–3 and mm. 4–6 in the manner of Carl Schachter's durational reductions, where both durational and pitch patterns combine to create an emerging profile for $\frac{7}{8}$ from a series of continuous eighths, to one of 2+2+2+1, to one of 4+3, a periodic succession of long-short. The reduction proceeds from top to bottom on the three staves in Example 8.1c, and to the right of the top staff is a simple sketch showing pitch priority. This reduction derives both from Western tonal art music and the chromatic vocabulary used by Bartók.

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The 4+3 reading is potentially metric, in that we may experience two beats, the first of which is stronger than the second (or in the language of metric theorist Christopher Hasty, is a dominant beginning followed by a continuation) and the second of which is interrupted just a little too soon by a return of the first.[4] The tempo of the piece reinforces this reading. Music cognition researchers recognize a "sweet spot" for a tactus that lasts somewhere around 60 beats per minute (600 milliseconds [ms]); at the notated tempo, a quarter lasts about 292 ms (pretty short for a tactus), a half note lasts 584 ms (about right), and a dotted eighth lasts 438 ms (on the short side).[5] At the given tempo, a duple meter whose second beat is a little shorter than expected includes a repeating sequence of durations 584+438 ms.[6]

This metric reading draws our attention to a common trait of early modernist music, the possibility of an uneven tactus, that is, a beat whose value can vary within a certain durational range. Justin London describes these kinds of meters as non-isochronous, noting that they are extremely common in non-Western folk repertories, and that they commonly feature continuous articulations at the "sub-tactus" level (here the repeating eighths), because their continuous repetitions helps one recognize and "absorb" the irregularity. London argues that because the degree of inequality between 3 and 4 is small – in mathematical terms, 3 and 4 are a maximally even division of 7 – they can be recognized as non-isochronous, functional beats within a measure.[7] Hasty might focus more on the sensation of interruption we may feel when the return of material comes an eighth early, and also on our ability to feel the equality of a duration spanning seven eighths as a measure, helping us to anticipate when a new beginning may occur next.[8] A recording of the piece made by Bartók meticulously observes the right-hand phrasing, whose span across the measure and staccato markings accent the notated downbeat. He also emphasizes the inequality of beats with a slight lean in the left hand from each measure's final G♯ into the subsequent downbeat A.[9]

The phrase rhythm of a passage such as this may also be characterized as hybrid. While the four-bar model associated with Classical-era pieces did not remain as powerful in later nineteenth-century tonal music, the rhythms of proportion, the pacing of harmonic change, and tonal motion toward a cadence still define the temporality of phrases. Table 8.1 diagrams the formal shape of the piece, identifying an introduction and coda and functional labels and cadences for each of the four phrases. When the opening B♭and G♯ converge on A, a symmetric center as well as the consonant fifth above D, the introductory mm. 1–3 elide into the

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Table 8.1 Formal diagram of "Bulgarian Rhythm"

Measures:	
1–4	Three-bar introduction; overlaps into m. 4
4–8	Exposition; initial five-bar shape with cadence at third bar (m. 6) and external expansion
9–14	Sequential development; repeats five-bar phrase rhythm with an open cadence at m. 11
15–19	Further sequential development with same phrase rhythm and another open cadence
20–24	Closing phrase: returns to cadence from m. 6 at its third bar (m. 22)
25–30	Coda: returns to introduction, extending it to the five-bar length in the main body of the piece

expository first phrase, enduring through mm. 4–8. This phrase cadences in the manner of a perfect authentic cadence as the melody descends through a D-minor arpeggiation in mm. 5–6 (see the sketch on Example 8.1c for more detail), resting upon D halfway through m. 6. The latter half of that measure through m. 8 is (using William Rothstein's terms for phrase rhythm) an external expansion, reinforcing the arrival of D.[10] Notice that the cadence in this five-bar phrase arrives at its halfway point, a modernist take on a more typical model of expanding a four-bar phrase with a single bar of external expansion.

The second phrase, from mm. 9–14, follows suit, arriving at its cadence at m. 11, and resting on the dissonant C until m. 14; its melodic sequence of mm. 4–6 marks it as developmental, and its harmonically open cadence promises additional phrases of similar shape and temporality. In fact, Bartók provides two more five-bar phrases, the second of which closes fully on the lower D. The composer enhances closure with a six-bar coda taken from the introduction, this time holding the A until the end of the piece.

My more general point is that while the rhythmic features of this piece – its metric and formal temporality – vary from Western tonal art practice, they are highly dependent on its models. Its exceptional features include a tactus that may have a variable length (within limits, an issue developed below), and phrases whose internal rhythm may follow different paths, even if their durations are proportionally related. Given these irregularities, different listeners and performers may reach different interpretations, originating in their familiarity with Western tonal traditions, Eastern European folk music, and preferences for regularity more generally.

The Limits of Irregularity: Stravinsky's *Rite*

The next example stretches concepts of phrase and meter even further. Like the Bartók example above, Igor Stravinsky's ballet the *Rite of Spring* also derives some of its irregular rhythmic and pitch features from folk music (in this case from Russia), filtered through his Modernist habits.[11] Stravinsky's music is often associated with repeating short, fragmental melodies whose frequent alternations create a series of contrasting blocks. The challenges to rhythm as measurable flow can be severe: How can we engage with continual interruption? Is there any order amidst the seeming chaos?[12]

The dance entitled "Glorification of the Chosen One," from the second part of Stravinsky's *Rite of Spring*, whose opening is given in Example 8.2a (in the two-piano version of the *Rite*) and in Example 8.2b (in a format explained below), demonstrates this considerably more complicated rhythmic vocabulary. In this portion of the dance, the Chosen One – the virgin who is sacrificed for the good of the community by dancing herself to death – has been identified, and stands in the middle of a circle of maidens who honor her with extreme, repetitive leaps.[13] This dance is preceded at R103/2 by the repetition of a chord eleven times (marked by the very rare time signature $\frac{11}{4}$), whose quarter-note pulsation is a backdrop to "Glorification."

What follows this pulsation are two varied "blocks" of material, a main motive called "A" and a vamp figure, whose initial appearances are bracketed on Example 8.2a. "A" is an alternation of a harmonized bass pitch A and a fragmental, chromatic melody that ascends and descends via step to and from G, often notated in $\frac{5}{8}$ bars. The vamp consists of an alternation in quarter notes of a bass line and its accompaniment in upper voices. The format of Example 8.2b lays out one possible segmentation of the first fifteen measures in a manner I've described elsewhere as an "ordered succession," a term meant to capture the tension between the "radical" discontinuous successions of a block form and the residues of continuity in how blocks proceed and are ordered. [14]

This passage is considerably more complex, and more irregular, than the Bartók excerpt. The sensation of "stop-and-start" endures throughout the excerpt: just when we manage to entrain to a pulse, it fails to continue. The first iteration of motive A at R104 features the germ of the irregularity: we immediately experience two different versions of a beat, both arising from the same fundamental tonal convention; when a harmonized chord with a clear bass note is followed by an upper-voice response, we typically

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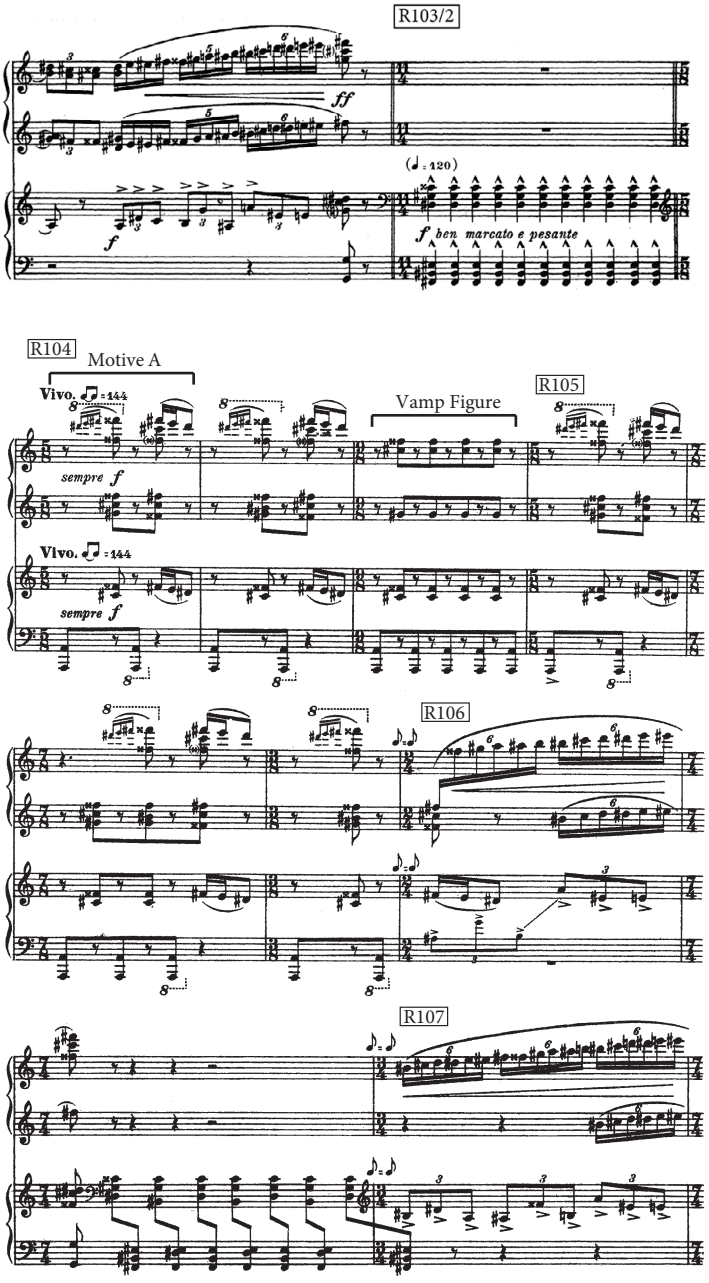

8.2a Stravinsky, opening of "Glorification of the Chosen One," two-piano version.

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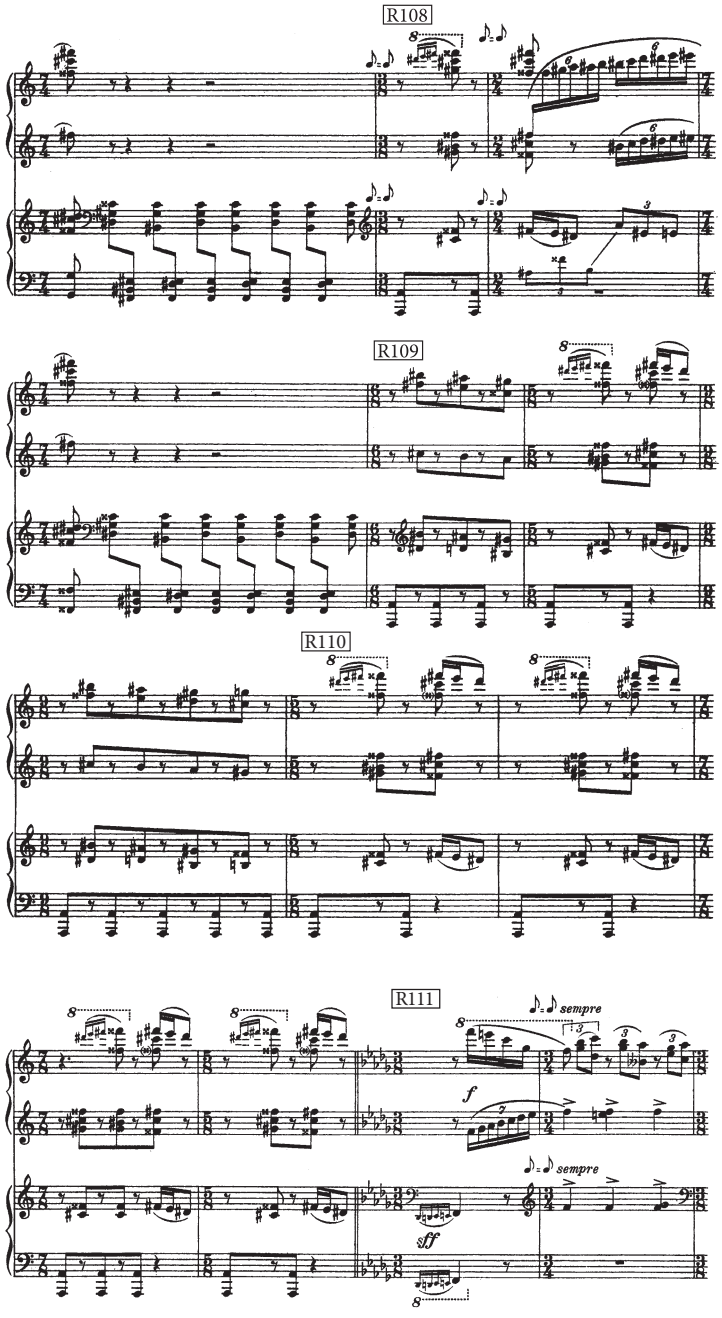

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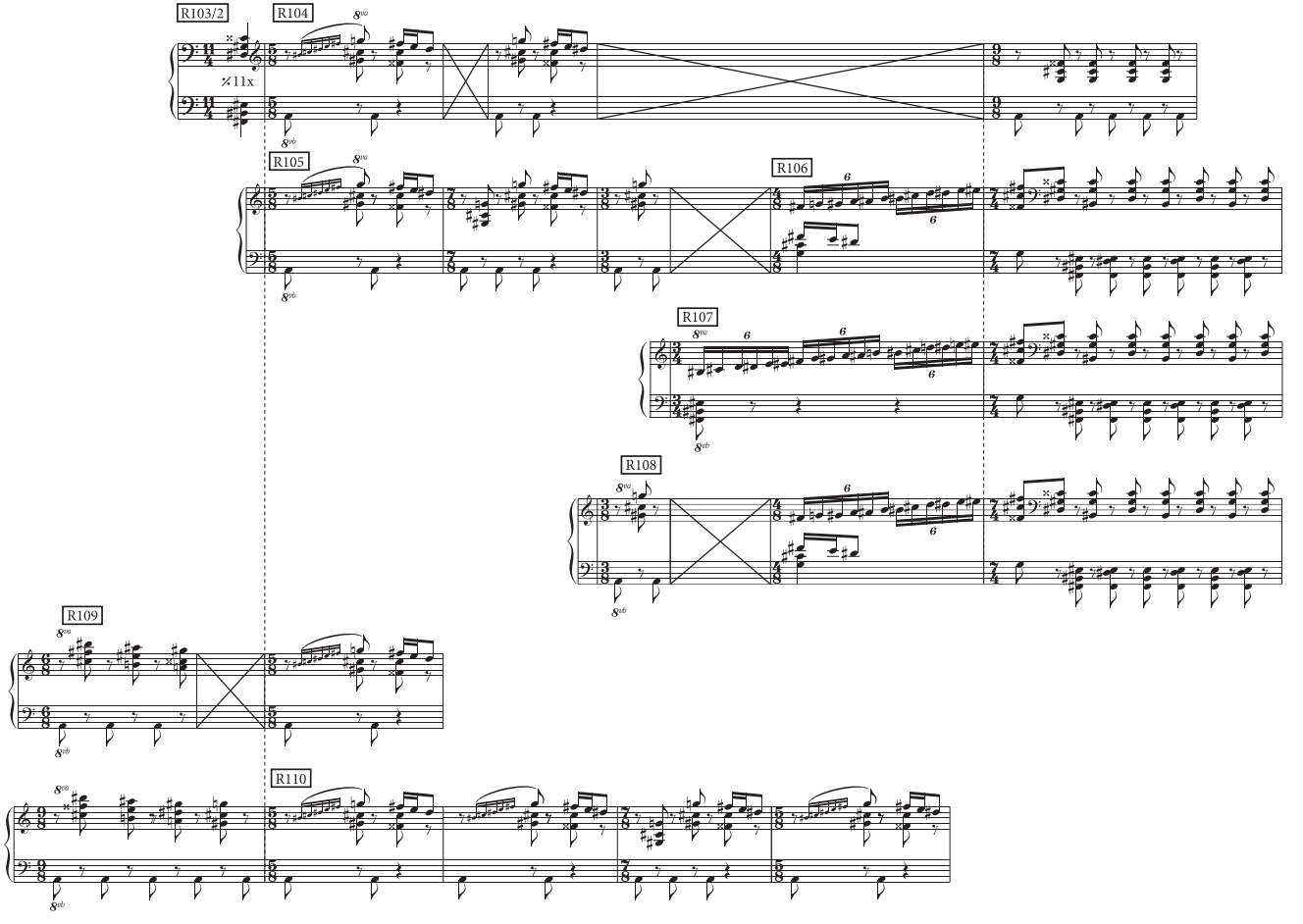
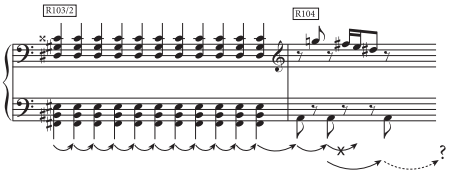
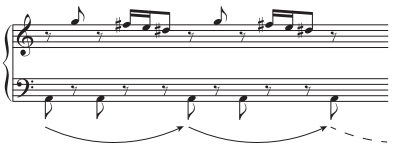


8.2b Ordered succession of R104–R110



8.3a Quarter-note pulse leading to the start of the dance



8.3b Motive A's $\frac{5}{8}$ bar

assign the start of a beat to the bass note.[15] In the first measure of "Glorifications," this pattern first lasts two eighths, and then three eighths, reflected in the $\frac{5}{8}$ meter signature. The second notated measure repeats the 2+3 pattern.[16]

The inequality within each measure, a 2+3 modernist take on a "boom-chick" pulsation, interrupts the flow of its melody in its successive returns, as the two possible recompositions of Example 8.3 demonstrate. Example 8.3a attempts to capture the bumpy feeling with the first notated measure of the dance (R104), given the preceding quarter-note pulsations. However, given the quick tempo, Example 8.3b demonstrates how we may continue from R104 into R104/3, more attuned to the completion of two "equal" bars each lasting five eighths.[17] In this second reading, we absorb the duration of five eighths as predictive, and we will expect the third notated measure to begin when it does. In this way, the example mimics the irregularity found in the Bartók example. That third measure of R104, however, returns to the more tonally familiar alternation of upper and lower registers, serving as a "vamp": its lack of melody suggests that we are in a holding pattern, and it lasts long enough to "even out" or replace the earlier measures with a quarter-note pulse. But when the vamp ends at the fourth notated measure (R105), we encounter another bump in the early arrival of the A motive. Notice the unprecedented sounding of two bass note A's one right after the other as R104/3 passes into R105.

This very irregular series of events characterizes Stravinsky's rhythmic practice in his "Russian" period, and serves as a precedent for countless composers whose rhythmic/metric styles reach beyond the maintenance of equal pulsation, even when the shorter durations within of a pulsation are non-isochronous. However, were this passage endlessly chaotic, it would

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risk losing the listener's interest. In fact, as "Glorification" continues, critical regularities emerge, serving as goal posts and reset buttons. Among them are the exact reiteration of the five-eighth A motive every time it reappears, a predilection for that motive to appear twice in a row, and the likelihood that a quarter-note pulsation will follow the two-bar statement of the motive.

These frequent sensations of disruption become the focal point of a dance based largely on brute repetition: our engagement is enhanced both by the intrusion of events when we don't yet expect them, along with a growing sense of recognition as repetitions accumulate, impressions dependent almost entirely on rhythm. For example, as we enter the "early" return of the motive at R105, we might experience that measure quite differently than we did at R104: we recognize it as a return that plays out as expected, rather than an altered version of a tonal figuration.[18] We may also await another iteration of this foundational measure, as well as the return of the "vamp" figure. Finally, when we hear the vamp move back to the motive, we may also come to hear the completion of a second formal unit, comparing it to the surprisingly typical phrase rhythm of the first three notated measures: in these opening measures, the two equal iterations of the motive are followed by a vamp lasting about the same length, providing a sense of balance.

This extremely "close reading" depends on hearing the passage many times over; yet I argue that its interest arises from the sophisticated interplay of irregular rhythms with more familiar notions of rhythmic/metric regularity. While it would be tedious to continue through the passage in such detail, let me draw attention to a few other tricks Stravinsky has up his sleeves. The second phrase, given by the second system of Example 8.2b, is nearly identical to the first, but one small change has an enormous rhythmic effect. Although two identical iterations of the A motive begin the phrase, the second appears just a quarter note late, having been delayed by a seeming momentary early return to the vamp (R105/2, the first quarter of the $\frac{7}{8}$ bar). It sounds as if the vamp has intruded within motive A, and as a result, this imperfect A must repeat itself a third time (the $\frac{3}{8}$ bar at R015/3) before proceeding to the vamp, albeit it a quarter note too early.[19] The resultant phrase rhythm of this second phrase is a development of the first: beginning as expected, it interrupts motive A at its start (R105/1) and as it tries to finish (R105/3).[20]

Consider also how the passage concludes, from R109 through R110 (the fifth and sixth systems of Example 8.2b). Previously beginning always from G natural, motive A grows! Its new start on B♯ (R109), descends by step to

D♯, passing through seven pitch classes, as if it were filling in a modernist scale. Moving initially off the beat by quarter note, the new melody seems to accelerate to reach its destination; in its second iteration, (final system of Example 8.2b), the scale reaches G seemingly early – without the accompanying chromatic grace notes – before continuing with motive A. What follows is an elongated sequence of motive A, suitable to close the first "period" of the dance: at R110, motive A returns first in its typical two-iteration form, references the $\frac{7}{8}$ version from phrase 2, and then "cadences" into a final $\frac{5}{8}$ repetition.

In the Bartók piano piece, measures are internally irregular, but they consistently repeat a single larger duration. By contrast, across this series of phrases Stravinsky frequently juxtaposes a quarter-note pulse with a dotted-quarter pulse in bars of changing length. Because their motivic content is fixed, however, we can learn to navigate these seemingly unruly rhythms. For example, we learn to recognize the $\frac{5}{8}$ bar (and its extension into $\frac{7}{8}$), taking in their irregular identities. Furthermore, throughout the passage, the return of the "vamp" figure signals counting by quarters, and the return of the motive signals 2+3. We may even distinguish "typical" metric irregularities from atypical surprises. For example, we may experience a jolt when a $\frac{5}{8}$ bar – motive A – is interrupted as it closes (see the $\frac{3}{8}$ bars in the second and fourth systems). The outcome is controlled chaos, a modernist metric practice that enhances Stravinsky's blunt repetitions.

Rhythmic Counterpoint

Example 8.4a is taken from the second movement of Copland's Symphony for Organ and Orchestra (later set for orchestra alone as Symphony No. 1) from 1924. The movement, entitled "Scherzo," is notable for a pervasive motivic figure in the orchestral parts, as bracketed in the clarinet parts of the opening measure. Although the movement is notated in $\frac{3}{4}$, this figure establishes a dotted-quarter pulse; however, where the strongest of the three eighth-note pulses occurs is an open question. Because the two versions of the figure – on D–C and A–G – are offset by an eighth note, the accented eighth can potentially occur on the A that begins the movement, or the G–C fifth, as shown in Example 8.4b. Because C and G occur simultaneously and suggest a resolution from A and D to G and C, the second reading seems more likely. However, accent marks on A, G, and C leave a little room for interpretation, and orchestration and performance choices make both readings viable. Moreover, as we shall see, Copland

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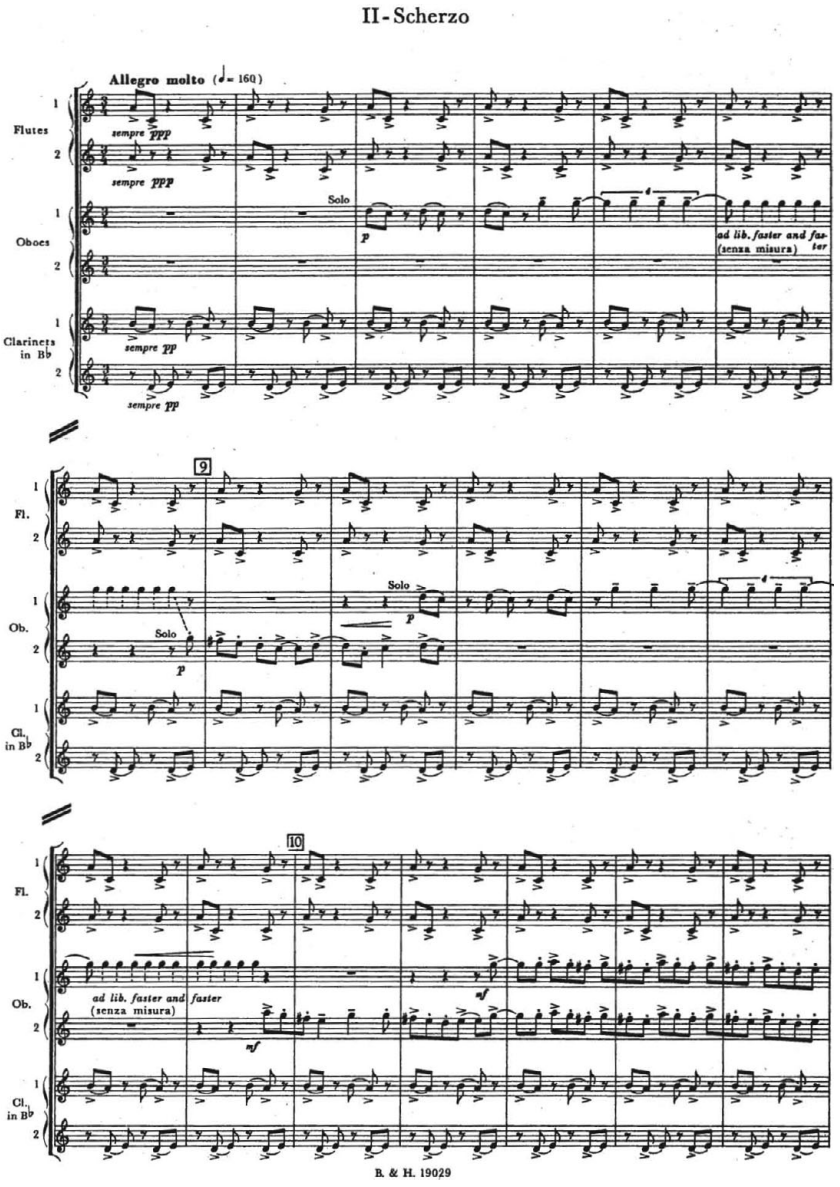

8.4a Copland, Symphony for Organ and Orchestra, "Scherzo," opening.

highlights the first reading later in the movement. In fact, this movement underscores a common feature in twentieth-century music, the superimposition and juxtaposition of competing metric organizations where neither reading is primary. This composition from Copland's early period uses metric complication to invoke the character of a modernist scherzo.

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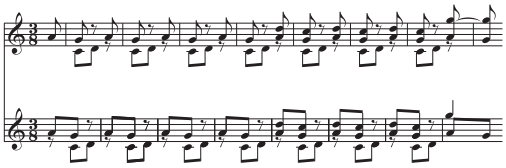
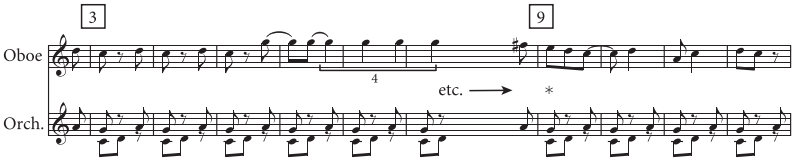


8.4b One possible $\frac{3}{8}$ barring of the opening



8.5 Metric challenge and synchronization of oboe melody

In m. 3, an oboe melody begins in synchronization with the A–G figure, adding a D above the A and doubling the C an octave higher. After three iterations it reaches up to the next higher G, but breaks out of the rhythmic ostinato. Its increasingly faster iterations of G push against the dotted-eighth tactus, an effect Copland specifies in his instructions as "senza misuro."[21] At R9 the oboe melody returns to eighths and quarters, as shown on Example 8.5, rebarred in the C-oriented version of $\frac{3}{8}$ so as to help the listener evaluate the pitch structure in a metric context. Notice that it briefly completes the C–G fifth with a triadic E (marked with an asterisk on Example 8.5) but continues in a more dissonant way.[22]

In tonal music, rhythmic challenges to an ongoing periodic pattern are normally heard as syncopations, especially when the stable pattern is in the bass (here, the D–C). For example, in the C-oriented version of $\frac{3}{8}$, we can characterize the A–G iterations as a metric "displacement dissonance" because they replicate the same tactus with a different starting point.[23] In post-tonal music textures like these are often called polyrhythmic, and even polymetric in cases where competing strata set forth more than one potential metric interpretation. For example, when the oboe melody breaks out of the ostinato, it seemingly moves at a different tempo and its metric relationship with the other music is momentarily obscured.

While the evidence for a perceivable polymeter – one where we attend fully to the accentual distinctions and anticipatory features of meter – has been shown to be weak at best, this example does invoke two simultaneous rhythmic strands, neither of which subsumes the rhythmic identity of the other.[24] Especially remarkable is the music spanning Rehearsal 12a through Rehearsal 15, given as Example 8.6. While the orchestral ostinati continue

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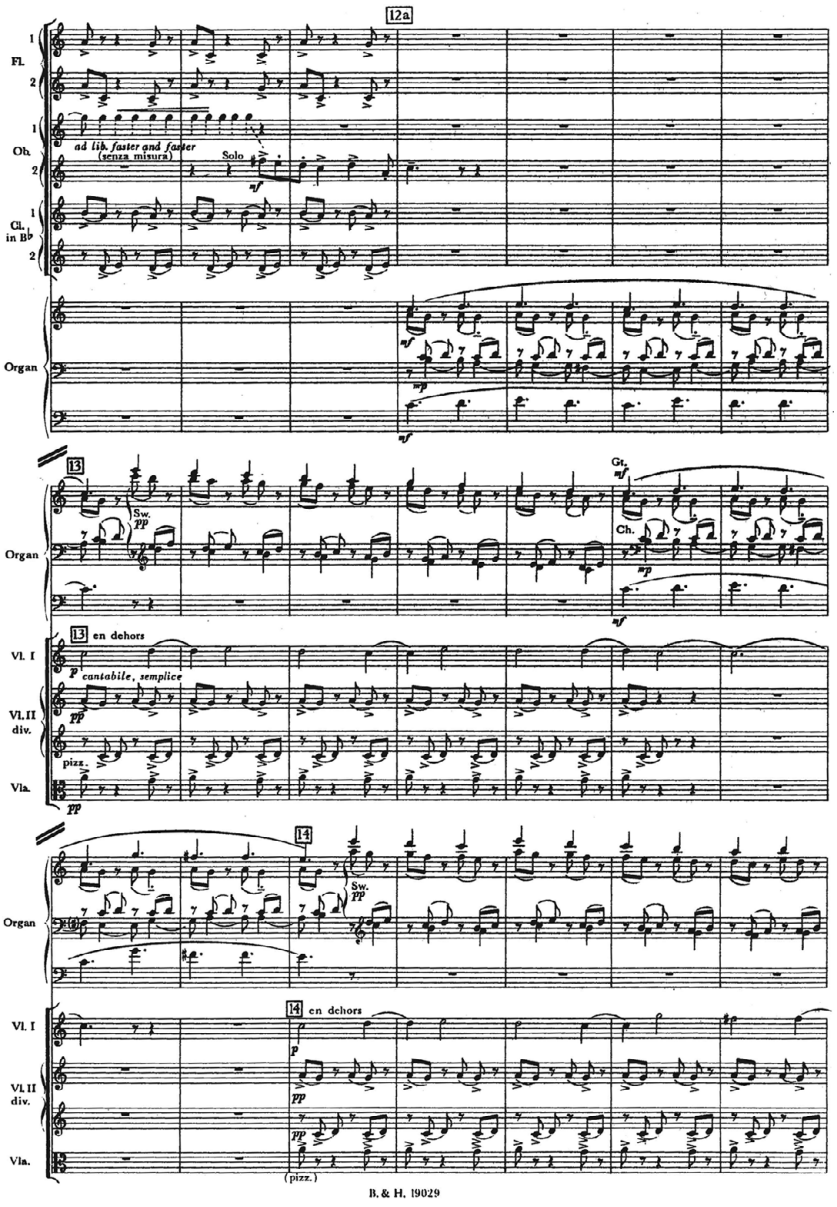
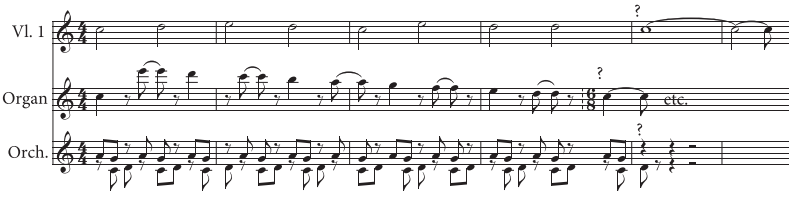


8.6 Organ melody at R12a

their iterations, organ and first violin alternate a familiar folk tune whose equal durations proceed at two different rates. Notice that at R12a, the organ moves entirely in dotted quarters (notably with a downbeat favoring the ostinato's A), whereas the violin tune proceeds entirely in half notes.[25] The effect is like an off-kilter call-and-response: rather than a continuous



8.7 Violin melody rebarred in $\frac{4}{4}$

single meter, we hear the alternation of a tactus as it switches between a dotted quarter and a half note, with a possibility of a "multiply metric" overlap between the two sections.[26]

Perhaps because the tune moves in equal values (be those dotted quarters or half notes), because it moves primarily by step, and because the metric organization of the accompanimental ostinato itself has two possible identities, the ostinati almost immediately take on the metric identities of the organ or violin, while each asserts its own meter ($\frac{6}{8}$ or $\frac{4}{4}$). Example 8.7 rebars the violin version of the tune in $\frac{4}{4}$ to highlight this effect; notice that here too the ostinato A appears on a downbeat, and that the descending scale from E down a tenth to C in the accompanying organ part moves in tandem with it, sounding momentarily as syncopated.

Post-tonal composers exploit the spectrum of perceptual possibilities inherent in these textures, from subjecting one line to the metric organization of the other to hearing them as nearly completely separate motions.[27] In this particular example, we are more likely to switch between duple and triple meters, reinterpreting familiar materials with new metric identities, a violation of a tonal metric preference to maintain a metric identity.[28] Other post-tonal composers layer musical strata in ways that suggest near independence, as if two different pieces are playing simultaneously. These pieces reach an important juncture in the efficacy of meter as an organizing rhythmic device; their multiplicity makes them worthy of repeated hearings, and often these dense textures are repeated literally or nearly literally, perhaps demanding from listeners a certain ongoing metric flexibility.

The Precision of Duration

When do rhythmic practices become so irregular that we no longer measure time through counting and phrase rhythm? This is clearly a rhetorical question, for individuals differ not only in their willingness and ability to reference earlier models, but also in what they might experience as

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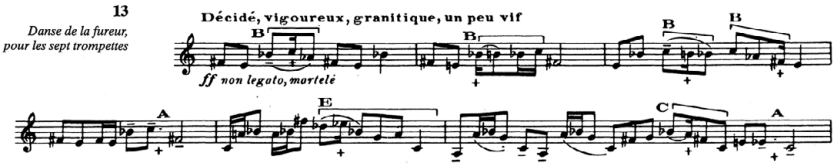

8.8 Messiaen, *Quartet for the End of Time*, VI, opening.

counting. The above analyses lean heavily on one's ability to recognize patterns in order to anticipate subsequent events, but plenty of post-tonal music explores instead a wider diversity of rhythmic styles. In these cases, events that engender one's sense of metric accent – that is, of time "marked for consciousness"[29] – may be too sporadic or irregular to provoke one's anticipation of another such accent. Additionally, while one may apprehend the boundaries of phrases, s/he may not sense motion through them. The next example may serve as a challenge to the measurements of meter and phrase rhythm, although it is highly rhythmically driven.

The opening measures of the sixth movement of Olivier Messiaen's *Quartet for the End of Time* are reproduced as Example 8.8; this reduction of the movement comes from Figure 13 in the composer's 1944 *Technique de mon langage musical* where Messiaen describes in great detail how he conceived of his rhythmic vocabulary.[30] Three of the composer's innovations include "additive and subtractive" rhythms, "non-retrogradable" rhythms, and an isorhythmic technique for creating complex polyrhythms. The notations on Figure 13, including plus signs and identifications of rhythmic motives with letters, point to some of these techniques, each of which provides new opportunities for the measurement of time.

All instruments play this rhythmically complicated melody. The first notated measure begins with a stepwise descent, from F♯ to E in equal eighths. This motive is answered on beat two by a stepwise descent from B♭ to A♭, but not before B♭ rises by the same distance to C, a sixteenth-note additive rhythm that breaks the pattern of equal eighths and also fills out the emerging whole-tone scale.[31] Messiaen writes that the plus sign under the C indicates it is an "added value," and that is "complicates" motive B.[32] Added values always lengthen a given duration, here by a half, resulting at the given tempo in a very short duration. More generally, added values can elongate any duration as long as it can be quantified proportionally. The wide variety of possible augmentations and diminutions of durations is demonstrated in a table given as his Example 24.[33] Messiaen writes that this

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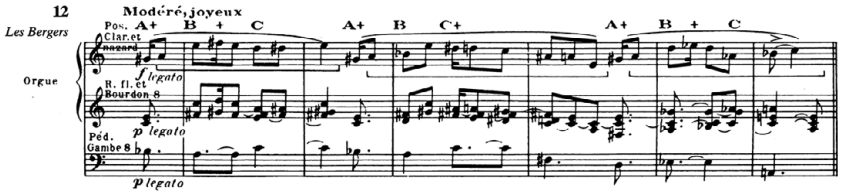

8.9 The interpretation of additive rhythms

practice produces "ametrical" music, but a close examination of the first phrase in Example 8.8 (mm. 1–4) shows a careful, ordered introduction of durations that stretch and interrupt the division of a quarter pulse by two eighths.

In mm. 1–2, the added value appears only in the second notated beat (Messiaen has made beat divisions clear with his beaming), and in both cases the elongation adds a fifth sixteenth to beats that otherwise last a quarter note. As the phrase continues, Messiaen's added values elongate beat 3 (m. 3) and in the final measure of the phrase (m. 4), he elongates the downbeat by two sixteenths and the second beat by one, creating the sole pitch lasting three sixteenths (C).

This tiny addition, creating "beats" of six and five sixteenths, slow down the fourth measure, thereby helping bring the phrase to a cadence on the opening pitch F♯. Messiaen remarks that the added values help create motion through melodies, writing that they enhance the preparation toward an accent, and elongate descents to goal notes.[34] For example, in his Figure 12, given here as Example 8.9, the added sixteenth at the opening (marked A) elongates the ascent up to the accented figure B, and the added sixteenth in the third notated measure (on D♯, marked with letter C) strengthens and elongates the descent down to the E in the next measure. Similarly, Messiaen comments that the elongated C (m. 4, marked by letter A) in Example 8.8 – the only time a pitch lasts three sixteenths in the first phrase – helps "slacken the descents by elongating their penultimate note."[35]

The second phrase in Example 8.8 only complicates the succession of rhythms more, and as the passage continues it seems unlikely that we can actively predict when an eighth note will be extended, especially given that sixteenths are not always added values. From where does our interest in this very intricate rhythmic experience originate? I suggest that we may be more engaged in enjoying the sudden twists and turns of a limited set of durations than in anticipating the return of given patterns; after all, this movement's title references the sounding of seven trumpets signaling the apocalypse, music we might expect to be other-worldly.[36]

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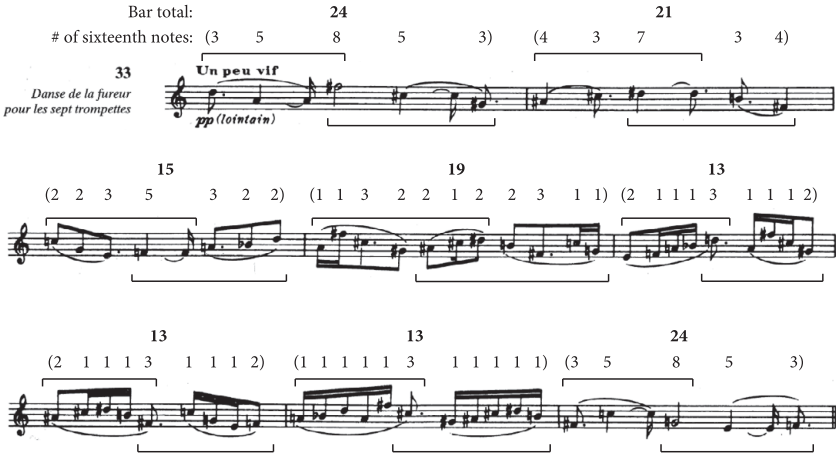

8.10 Non-retrogradable rhythms that form a larger isorhythm at Rehearsal F.

Many of the rhythms Messiaen creates with added values are symmetric, or as he calls them, non-retrogradable. Although not all non-retrogradable rhythms form challenges to the creation of traditional meter, those he values most exhibit embedded rhythms based on his principles of augmentation and diminution, and may last more than the necessary three durations it takes to form a non-retrogradable rhythm. In these cases, "all rhythms divisible into two groups, one of which is the retrograde of the other, with a *central common value*, are nonretrogradable."[37] Figure 33 (reproduced here as Example 8.10) from his treatise demonstrates complex examples, including the middle portion of the movement (Rehearsal F) we are studying.

Each of the notated measures is a non-retrogradable rhythm, and like the rhythms that open the movement, these are also carefully ordered, not only within measures, but in the passage as a whole. At first glance we can see that a slower set of durations (three, five, and eight sixteenths) gradually evolves into measures whose non-retrogradable rhythms contain nearly all sixteenths (as shown by the internal subdivisions above each of the seven measures of Example 8.10.) As a consequence, the measures themselves get shorter. The seven-bar pattern is repeated as an isorhythm (notice the repetition of the first measure's rhythm appears as the eighth measure in Figure 33). The sequence of pitches within this complex isorhythm is also patterned: Messiaen repeats a sixteen-pitch class sequence (notice that the D-major triad repeats beginning on the seventeenth duration), and in combination with the longer seven-bar isorhythm, the melody's repetitions are continuously varied by new rhythmic settings.[38]

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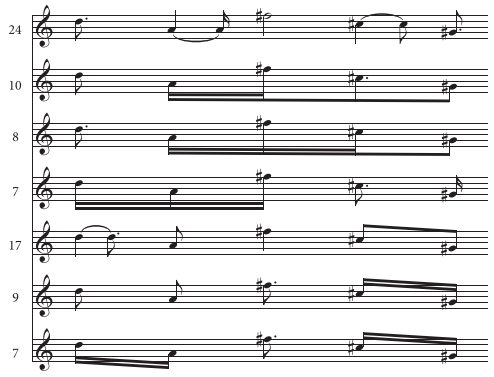

8.11 Rhythmic variations of pitch ostinato.

Hearing the melody return as the isorhythm speeds up and then returns to its slower durations is an exquisite experience of encountering microscopic variations among melodic repetitions while also hearing the pace gradually speed up and then slow down rather suddenly. For example, consider the four durational settings of the opening measure, easily recognizable as a D-major triad followed by two descending leaps of a fourth, given as Example 8.11. The five-note ordered segment is vertically aligned for comparison, and the numbers to the left show how long each segment lasts. Pitches endure from one to eight sixteenths, and successions of sixteenths are common, but no particular pattern emerges. As an idiosyncratic set of durations unfolds, the pace of the pattern speeds up, slows down, and speeds up again, eventually to become nothing but sixteenths (in music not shown here).

Although these practices are interesting unto themselves as compositional techniques, they also affect our experience of temporality in new ways. They create dizzying changes of speed, asking us to enjoy the minute differences between sixteenths and eighths without reference to a continuous pulse, while also shaping our sense of flow across longer spans, from nearly even to bumpy to driven. Remember that four performers play these complicated rhythms in unison and octave doubling, fully exposing their abilities to coordinate precisely with one another; the unending stream of finely graded durations in constant variation requires them to realize in time the exquisite durational differences of one, two, three, or more sixteenth notes.[39] Their efforts are virtuosic, pushing the boundaries of temporal action and perception.

Messiaen frequently wrote that he wanted to invoke mystical, supernatural qualities in his music, suggesting that the appeal of these rhythms lies

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not in their exact perpetual measurement, but rather something more transcendent:

> Let us think now of the hearer of our modal and rhythmic music; he will not have time . . . to inspect the nontranspositions and the nonretrogradations . . . to be charmed will be his only desire. And that is precisely what will happen: in spite of himself he will submit to the strange charm of impossibilities: a certain unity of movement (where beginning and end are confused because identical) in the nonretrogradation, all things which will lead him progressively to that sort of *theological rainbow* which the musical language . . . attempts to be.[40]

The composer's words border on the ecstatic, especially in invoking the image of a rainbow, a figure whose span is indivisible – without beginning or end. Amidst the unending stream of irregular rhythmic attacks (for this music rarely rests) arises the possibility of a continuity unarticulated by formal breaks. We may recognize returns of the D-major triad as the music begun in Example 8.10 cycles through a meticulously ordered process, and along the way we may also experience sensations of resolution (i.e., pitches E–F and A–B♭as leading tone to tonic) but we likely do not experience clear phrase boundaries or a directed motion through phrases. Instead Messiaen directs us toward the mystical impossibility of an eternal, plentiful time, full of complex, endlessly diverse activity.

The Fullness of Time

In the four preceding analyses I have suggested how composers challenge common methods of measuring rhythm – counting (following metric organization), chunking (marking boundaries of phrases), and comprehending durations (perceiving lengths in proportional relation to one another). The analyses are samples of a much larger set of experimentations too lengthy to cite, and constantly growing. Composers such as Witold Lutoslawski, György Ligeti, John Cage, Steve Reich, and Arvo Pärt help us question the limits of counting and boundary articulation, among many others.[41] Composer and theorist Jonathan Kramer takes a broader view of post-tonal rhythmic novelty in defining more ephemeral categories of musical time, distinguishing between linear and non-linear time, and describing music exhibiting multiply directed, moment, and vertical time. Underlying most of these characteristics is a set of fundamental questions about time as it is experienced simply in the present tense – be that the current moment or an ongoing eternal present – compared to time as experienced as passage – be that the distant past, or

simply the preceding seconds. How can we measure "rhythm" in music that breaks or eschews articulations? What are the outer limits of perceiving acceleration and deceleration? How can we experience extreme densities of texture as temporal? How do we experience the passage of time in music characterized by great rhythmic complexity and no fixed temporal referent? Only time will tell.[42]

Endnotes

1 For a good introduction to how we rely on various cognitive time mechanisms for both beat-based rhythms and non-beat-based rhythms, a helpful distinction in post-tonal music, see M. Henry and J. Grahn, "Music, Brain, and Movement," in R. Ashley and R. Timmers (eds.), *Routledge Companion to Music Cognition* (Routledge, 2017), 63–73. For information on music and movement, see also D. Levitin, J. Grahn, and J. London, "The Psychology of Music: Rhythm and Movement," *Annual Review of Psychology*, 69 (2018), 51–75.

2 Malcolm Gillies (*Grove Music Online*, https://doi.org/10.1093/gmo/9781561592630.article.40686, accessed Nov. 14, 2018) writes that these pieces were meant to be learned alongside music from the Western tonal tradition, suggesting a possible reliance on tonal metric practice: "Bartók stressed that his collection did not present a complete 'progressive method', but rather a base to which works by other composers, such as Bach and Czerny, should be added. In a letter to Boosey & Hawkes of 13 February 1940, he explained that he saw *Mikrokosmos* as a bridge leading from his own 20th-century shore to an older one, either through 'centuries-old folk music' or through such typical devices of older art music as canon and imitation."

3 László Vikárius describes "Bulgarian rhythm" as "the continuous employment of an asymmetrical metre throughout a piece, referred to by the Romanian folklorist Constantin Brăiloiu's term as *aksak*, or 'lame rhythm'" (55). He notes that other adjacent pieces in the *Mikrokosmos* such as #115 are meant to introduce how to play $\frac{7}{8}$ in easier contexts; L. Vikárius, "Bartók's Bulgarian Dances and the Order of Things," *Studia Musicologica*, 53 (2012), 55 and 59.

4 C. Hasty, *Meter as Rhythm* (Oxford University Press 1997). For a review of Hasty's book in accessible language, see G. Horlacher, "Review of *Meter as Rhythm* by C. Hasty," *Intégral*, 11 (1997), 181–90.

5 The relationship between tempo and perception of the tactus is discussed in J. London, *Hearing in Time: Psychological Aspects of Musical Meter*, 2nd ed. (Oxford University Press, 2012), Chapter 2.

6 The notated measure would thus last just over a second, a "mensurally determinate" duration, that is, one that can be mentally replicated with a high degree of accuracy, enhancing its metric potential. See Hasty, *Meter as Rhythm*, and Horlacher's review of Hasty. See also S. Arom, "L'aksak: Principes et typologie," *Cahiers de musiques traditionnelles*, 17 (2005), 11–48, where aksak is defined in part by tempo.

7 London, *Hearing in Time*, Chapters 7 and 8. Of course, someone with cultural competence in hearing seven beats as metric may not hear this piece as deriving from a model based on Western art music at all.

8 Multiple ways of hearing this kind of metric irregularity in Bartók's music are considered in G. Horlacher, "Bartók's 'Change of Time': Coming Unfixed," *Music Theory Online*, 7.1 (2001).

9 The recording was issued in 1952 by Columbia as ML 4419 in the "Meet the Composer" series.

10 William Rothstein defines external expansions as additions to the external boundaries of phrases, that is, musical material that precedes the phrase's presentational beginning and musical material that follows its cadence; W. Rothstein, *Phrase Rhythm in Tonal Music* (New York: Schirmer Books, 1989).

11 Richard Taruskin writes voluminously about Stravinsky's modernist take on Russian folklore. For a discussion that focuses specifically on the *Rite*, see Chapter 12 of R. Taruskin, *Stravinsky and the Russian Traditions* (University of California Press, 1996).

12 Debates about the extent to which metric periodicity operates in Stravinsky's music are frequent, and often characterized (using terminology developed by Andrew Imbrie for counting in Beethoven) along a spectrum of conservative to radical, depending on how easily one breaks away from periodic counting; A. Imbrie, "'Extra' Measures and Metrical Ambiguity in Beethoven," in A. Tyson (ed.), *Beethoven Studies* (New York: W. W. Norton & Company, 1973), 45–66. Pieter Van den Toorn, in *Stravinsky and the* Rite of Spring (University of California Press, 1987), describes the debate in Chapters 3 and 4. I attempt to capture aspects of both stances.

13 In an early version of the scenario, Stravinsky writes that the other maidens celebrate her (the Chosen One) in a "boisterous martial dance." See Taruskin, *Stravinsky*, 874 and more generally 860–91. The reader is encouraged to view Millicent Hodson's restoration of Nijinsky's choreography of this dance; one possible link is https://youtu.be/9phS4Piiq2o. It's impossible to know how much this version represents Nijinsky's choices, although Hodson researched available archival evidence extensively. Here, the choreography serves two purposes. First, some of the irregularities in the *Rite* may have arisen as much from bodily rhythm as from musical rhythm (the work was first a ballet before it was a concert piece). Second, seeing dancers repeat movement sequences of variable length, as well as hearing these irregularities, is especially powerful. Analyses that connect the choreographic rhythm with the dance include M. Hodson, *Nijinsky's Crime against Grace: Reconstruction Score of the Original Choreography for* Le sacre du printemps (Stuyvesant, NY: Pendragon, 1997); M. Hodson, "Death by Dancing," in S. Neff, M. Carr, and G. Horlacher (eds.), *The Rite of Spring at 100* (Oxford University Press, 2017), 47–80; and G. Horlacher, "Rethinking Blocks and Superimposition: Form in 'Ritual of the Two Rival Tribes,'" in Neff et al. (eds.), *Rite*, 331–83.

14 G. Horlacher, *Building Blocks: Repetition and Continuity in the Music of Stravinsky* (Oxford University Press, 2011), especially Chapter 2. Although the score is reduced to mostly outer voices (sometimes in octave displacement for ease of reading), all of its measures are present.

15 F. Lerdahl and R. Jackendoff, *A Generative Theory of Tonal Music* (MIT Press, 1983) is often cited as a fundamental text about tonal meter formation. They maintain in one of their metric preference rules that we prefer a metrically stable bass part when other parts contradict it. See especially Chapters 3 and 4.

16 A 3+2 hearing is not impossible, deriving from a sense of the melodic G falling to the F♯. More generally, people may differ in using a bass line or a melodic line as a metric marker.

17 The tempo is unusually marked two tied eighths, *not* one quarter, = 144. Perhaps Stravinsky displayed the tempo by subdividing a quarter into two eighths because the initial core measures last one eighth longer than a quarter; keeping track of the duration of eighths is critical for the performers and conductors.

18 While this analysis has omitted key discussions of pitch structure, it is worth noting that the chordal and melodic configurations also invoke both tonality and a modernist chromaticism as they gain individual, stable identities. The chord mimics a dominant-seventh chord (with A as its root) in its content and spacing, while the melody descends by step through the very familiar Stravinskian 0134 octatonic tetrachord.

19 Notice that while the third iteration of the motive is barred differently ($\frac{5}{8}$ is followed by $\frac{7}{8}$, $\frac{3}{8}$, and $\frac{4}{8}$), motive A is almost always five eighths long. This is one of many examples where notated barring obscures the nature of motivic return in Stravinsky's music. The passage is littered with changes of meter signature, and includes signatures of $\frac{3}{8}$, $\frac{4}{8}$, $\frac{5}{8}$, $\frac{6}{8}$, $\frac{7}{8}$, $\frac{9}{4}$, and $\frac{7}{4}$. Whether these signatures express one's perception of heard meter is open for question, although it's worth noting that $\frac{5}{8}$ appears in seven of the fifteen bars.

20 The quarter-note pulsation of the vamp's second appearance (at the second bar of R106) is *not* interrupted at its end, a small rhythmic detail that demonstrates how significant a duration an eighth note is in this dance.

21 I speculate that the movement is barred in $\frac{3}{4}$ in order to make clear the durations of this accelerating oboe line. Notating these durations in $\frac{3}{8}$ would be nearly impossible. In 1944, Copland wrote about the difficulties of notating rhythmically complicated post-tonal music, noting the possibility that barlines may not always represent "heard" meter, and pointing to the necessity for easily read notation in ensemble music.

22 The reference to Stravinsky's use of ostinato is fairly clear, as described by G. Murchison, *The American Stravinsky: The Style and Aesthetics of Copland's New American Music, the Early Works, 1921–1938* (University of Michigan Press, 2012). She traces how Copland learned about Stravinsky's music via Nadia Boulanger, and how Copland's modernist music in general relies on

post-tonal rhythmic vocabularies. See especially Chapter 2, and analyses of this symphony on 48–53.

23 H. Krebs, *Metrical Dissonance in the Music of Robert Schumann* (Oxford University Press, 1999) generalizes a theory of metric dissonance for tonal music.

24 For a discussion of cognitive evidence for perceiving simultaneous contrasting metric perceptions, see E. Poudrier and B. H. Repp, "Can Musicians Track Two Different Beats Simultaneously?," *Music Perception*, 30 (2013), 369–90. Also pertinent is John Roeder's concept of pulse streams, where superimposed voices with contrasting rhythmic organizations can be tracked in how they support or contrast with one another; J. Roeder, "Interacting Pulse Streams in Schoenberg's Atonal Polyphony," *Music Theory Spectrum*, 16 (1994), 231–49.

25 The tune is taken from the eighteenth-century French folk tune "Au clair de la lune," likely an homage to Nadia Boulanger, with whom he was studying, who arranged the commission of the work and who premiered it on organ with the New York Symphony Orchestra under Walter Damrosch in 1925. This premiere was Copland's first time hearing how his metric effects sounded in his chosen orchestrations.

26 G. Horlacher, "Multiple Meters and Metrical Process in the Music of Steve Reich," *Intégral*, 14 (2000), 1–33, introduces the term "multiple meter" to describe much of Steve Reich's music; the term suggests that we may perceive a piece like *Piano Phase* in more than one meter over multiple repetitions (as opposed to perceiving two meters at the same time).

27 See for example music by Charles Ives, Elliott Carter, and György Ligeti, among others.

28 Lerdahl and Jackendoff, *Generative Theory*, include among their metric preference rules the inclination for metric parallelism.

29 G. W. Cooper and L. B. Meyer, *The Rhythmic Structure of Music* (University of Chicago Press, 1963), 8.

30 For discussions of rhythm, including the use of non-Western music and bird song as rhythmic resources, see O. Messiaen, *Technique de mon langage musical*, John Satterfield (trans.) (Paris: Alphonse Leduc [1944], 1956) and *Traité de rythme, de couleur, et d'ornithologie* (Paris: Alphonse Leduc, 1994).

31 Messiaen identifies the mode of this passage as his mode VI in his modes of limited transposition, in which the whole-tone scale is a subset. Beginning on C, this mode contains C, D, E, F, F♯, G♯, A♯, and B. See Figure 350 in Messiaen, *Technique*.

32 See Messiaen, *Technique*, Chapter 3 and the annotated musical excerpt on page 2 in the musical example for the initial discussion. The brackets on Messiaen's Figure 13 are meant to indicate the "large rhythmic divisions," and appear only with additive durations; Messiaen notably does not call them beats.

33 Added values are described as augmentations and diminutions in Messiaen, *Technique*, 18, and a comprehensive demonstrative table is on page 3 in the

figures chapter. Messiaen's interest in non-Western music, and especially the music of India, is a likely origin for his ideas.

34 See Messiaen, *Technique*, Chapter 3, Section 3 and their related musical examples.

35 Messiaen, *Technique*, 17.

36 See the Bible's Book of Revelations, Chapters 8–11. Messiaen wrote this quartet while in a German prison camp during the Second World War and makes many references to apocalyptic themes.

37 Messiaen, *Technique*, 20, and Chapter 5 more generally.

38 Vincent Benitez describes Messiaen's ideas about time, order, and duration, connecting the composer's ideas about time with his desire for order (including in his serial compositions), and for his reliance on ideas of philosopher Henri Bergson. V. Benitez, "Reconsidering Messiaen as Serialist," *Music Analysis*, 28 (2009), especially 270–73 and Example 2, for a discussion of Messiaen's use of ostinato where measurement and timelessness are both essential elements, and 280–84, for a discussion of how number provides order and Messiaen's exploration of the ideas of Gaston Bachalard.

39 Messiaen's concern with rhythmic order appears also in his geometric approach to music described by J. Hook, "Rhythm in the Music of Messiaen: An Algebraic Study and an Application in the Turangalîla Symphony," *Music Theory Spectrum*, 20 (1998), 97–120.

40 Messiaen, *Technique*, 21.

41 Howard Smither lists a plethora of rhythmically complicated post-tonal works for the first part of the twentieth century, including many examples worthy of further study; H. Smither, "The Rhythmic Analysis of 20th-Century Music," *Journal of Music Theory*, 8 (1964), 54–88.

42 Countless authors have speculated on what an unmeasurable or eternal time might be like. Robert Hatten describes musical "plenitude" as a compositional premise based on "saturation or repleteness"; R. Hatten, *Interpreting Musical Gestures, Topics, and Tropes: Mozart, Beethoven, Schubert* (Indiana University Press, 2004). Jonathan Kramer might use the labels "vertical time" or (drawing from Stockhausen) "moment time"; J. Kramer, *The Time of Music: New Meanings, New Temporalities, New Listening Strategies* (New York: Schirmer Books, 1988).