2. Space-Time Movements in György Ligeti's Piano Concerto: Polymeter and Conflicting Meter in Historical and Intercultural Perspective

György Ligeti's "Space-Time" and the "Generalized Hemiola"

The polyglot, boundary-defying conceptions of György Ligeti, driven by artistic curiosity, have been widely praised, and his collected writings published in German posthumously in 2007 impressively demonstrate the rhizome-like ramifications of his thinking in and about music, as also aptly demonstrated by the polymorphic vividness of the structures in his music since *Apparitions* (1958–59). From the very beginning, Ligeti, in his own energetic manner, absorbed impulses from often heterogeneous areas of the arts and sciences, and idiosyncratically interwove them into an asymmetrical, open maze of sounds and thoughts. Still, it should be emphasized how intensively, but also "art-typically" Ligeti engaged with scientific thinking, especially since the beginning of the 1980s, for example in the areas of chaos theory, fractal geometry, and artificial intelligence. At the beginning of his essay "Paradigmenwechsel der achtziger Jahre" (1988), Ligeti emphasizes that he does not write "'scientific' music, do[es] not use calculations, nor algorithms […], realize[s] only [his] own ideas, but deal[s] with analogous ideas from other areas. Complexity or complex patterns have always attracted [him]."[74] Not least, Ligeti's view of European or indeed "global" music history was given new impetus by these search movements (for example, through the discovery of the *ars subtilior*) and a no less consequential turn toward music genres from Africa, Java, Bali, Melanesia, China, and Korea, with their specific structures and underlying ways of thinking.[75]

The reception of sub-Saharan African genres, which include the ensembles of *ongo* horns of the Central African Banda Linda, songs of the Aka pygmies, the *kiganda* music of the *amadinda* xylophones in Uganda as well as the *mbira* lamellophone music of the Shona in Zimbabwe, form just one layer in an eclectic chain of associations in Ligeti's thinking and compositions in the 1980s. As outlined earlier in this book, intercultural reception processes in European music of the twentieth and twenty-first centuries have often been (and still are) integrated into comparably universalist aesthetic-conceptual designs, reaching out in a self-reflexive and complex manner in the most diverse directions and determining a reception model that I have attempted to characterize with the term "interpenetration" (→ II.6). Such reception strategies proceed structurally, associatively, and transformatively and are based on analogous formations and cross-connections between different contexts and discourses – something that is particularly characteristic of Ligeti's approach.

In the case of sub-Saharan music, Ligeti's particular interest was in gestalt paradoxes and illusionary effects, which are also reflected in fractal geometry or M. C. Escher's visual paradoxes, such as the waterfall or staircase, which seem to be constantly falling or rising but in

74 Ligeti, "Paradigmenwechsel der achtziger Jahre," 116 ("keine 'wissenschaftliche' Musik, verwende keine Kalküle, keine Algorithmen […], verwirkliche nur [seine] eigenen Vorstellungen, doch beschäftige [er sich] mit analogen Vorstellungen in anderen Bereichen. Komplexität beziehungsweise komplexe Muster [hätten ihn] immer angezogen").

75 On Ligeti's reception of African music see especially Ligeti and Bouliane, "Stilisierte Emotion," Taylor, "Ligeti, Africa and Polyrhythm," Scherzinger, "György Ligeti and the Aka Pygmies Project," Scherzinger, "Remarks on a Sketch of György Ligeti," and Taylor, "Hemiola Maximal Evenness and Metric Ambiguity in Late Ligeti." Ligeti's relation to mensural organization in works by *ars subtilior* composers is mentioned in Günther, "Die Ars subtilior" and explored in Schütz, "Wiedergeburt der Ars subtilior?"

fact always return to their starting points. Comparable musical phenomena include above all "inherent patterns," as described in detail in *amadinda* music by Gerhard Kubik:[76] phenomena emerging in aural perception in a kind of relief from interlinked rhythmic-melodic lines. Starting from other African contexts, Steve Reich's music had already been crucial to exploring such patterns (labeled "resulting patterns" by Reich) over ten years earlier (→ II.6).[77] Gerhard Kubik's and Simha Arom's structuralist and cognitive ethnomusicological approaches had a significant impact on Ligeti. Both researchers assume a fundamental alterity between African and European music, rhythm, and the underlying ways of thinking – an *a priori* assumption of ethnomusicology as a whole that had remained unquestioned for decades but has been harshly criticized for some twenty years from postcolonial perspectives. The central argument in Kofi Agawu's criticism, for instance, is that research committed to Western knowledge discourse has construed "African rhythm" as extraordinarily complex in order to categorize it as something categorically different from European rhythmic phenomena. Inevitably, however, this almost completely obscures the rhythmic complexity of Western music in the twentieth century.[78] Agawu concludes:

> A determined researcher could easily show that the sum of isolated experiments in rhythmic organization found in so-called Western music produces a picture of far greater complexity than anything that Africans have produced so far either singly or collectively. One could, in short, quite easily invent "European rhythm."[79]

Ligeti points out Kubik's interpretation of sub-Saharan musical practices as particularly significant for his reorientation in the 1980s, saying that it led him to develop an analogous conception of musical spatiality in his own work:

> Gerhard Kubik has shown that, in another culture, categories of our European ways of thinking are not valid, that there is a completely different way of experiencing time, space, and form. This is a way of thinking in certain patterns that arise from movements, a culture in which movement, language, dance, and also spatial configurations are conceived differently than in European culture.
>
> What this way of thinking shares with my work is the idea of a unity of time and space. […] I think in musical structures and forms in which the temporal is actually conceived spatially – as if everything were present at the same time. In the second movement of my *Requiem*, in the Piano Concerto, and also in the Cello Concerto, there are formations that cannot be compared with

76 See, among others, Kubik's essays "The Phenomenon of Inherent Rhythms in East and Central African Instrumental Music," "Die Amadinda-Musik von Buganda," "Kognitive Grundlagen afrikanischer Musik," and "Theorie, Aufführungspraxis und Kompositionstechniken der Hofmusik von Buganda." Kubik refers in detail to Ligeti's compositional techniques in conversation with the author in Kubik and Utz, "Auf Entdeckungsreise durchs Universum." See also Arom, Duchesneau, and Marx, "A Kinship Foreseen."

77 For more detail, see Reich's essays "Gahu – A Dance of the Ewe Tribe in Ghana" and "Non-Western Music and the Western Composer."

78 See especially Agawu, "The Invention of 'African Rhythm,'" and Agawu, *Representing African Music.* An updated and concise historical account on art music in Africa that is multiply indebted to forms of rhythmic complexity, can be found in Scherzinger, "Art Music in a Cross-Cultural Context" and Scherzinger, "Afrika."

79 Agawu, "The Invention of 'African Rhythm,'" 386.

> the traditional concepts of melody, harmony, and rhythm. They are very differently conceived, static forms. They seem to stand in front of us as if they were objects and did not unfold in time.[80]

This "frozen turbulence"[81] can actually be experienced again and again in Ligeti's music, though the aforementioned characterization of an "annihilation" of the temporal dimension could easily be refuted by a formal analysis of specific works, since the often "spiral-like" processes in Ligeti's works, including the famous *Kyrie* of the *Requiem* (1963–65) referred to by Ligeti, and even more clearly the paradigmatic works of the 1980s such as the first or sixth Piano Etudes (1985), formally point toward central moments of conflict, which does indeed imply a decisive temporal, sometimes almost deterministic, strategy.[82] So perhaps it would be more accurate to say that Ligeti's music plays out in a musical "space-time" in which spatial and temporal characteristics – state and process – are formative for our reception of the music, constantly re-orienting ourselves in the ever-changing mixtures of not exclusively present-oriented or goal-oriented states.

Works in which these characteristics appear in a particularly mature and varied manner are the three volumes of Ligeti's Piano Etudes (1984–97)[83] and his Concerto for Piano and Orchestra (1985–88).[84] Following on from some passages of the Piano Concerto, Ligeti's connection of historical-European and African formations of polyrhythm, polymeter, conflicting meter, and their different dimensions will be addressed and expanded upon with the aim of showing areas of friction in Ligeti's original forms of intercultural and historical reception.

The relationship between Ligeti's spatial metaphoricism and the compositional significance of conflicting meters is clearly demonstrated by some passages from the third movement of the Piano Concerto, which Ligeti described as "the most succinct example of illusionary rhythm and illusionary melody so far."[85] This is easy to see at the beginning of the movement (Ex. 5.10) and, thanks to a clear difference in color, it is not difficult to grasp perceptually how successive

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80 Ligeti, "Paradigmenwechsel der achtziger Jahre," 117–118 ("Gerhard Kubik hat gezeigt, daß in einer anderen Kultur Kategorien unserer europäischen Denkweise keine Gültigkeit haben, daß es eine ganz andere Weise gibt, Zeit, Raum und Form zu erleben. Dies ist ein Denken in bestimmten Mustern, die aus Bewegungen entstehen, eine Kultur, in der Bewegung, Sprache, Tanz und auch Raumkonfigurationen anders aufgefaßt werden als in der europäischen Kultur. Gemeinsam mit meiner Arbeit ist darin die Vorstellung einer Einheit von Zeit und Raum. […] Ich denke in musikalischen Strukturen und Formen, in denen das Zeitliche eigentlich räumlich konzipiert ist – so als ob alles gleichzeitig anwesend wäre. Im zweiten Satz meines *Requiems*, im Klavierkonzert, auch im Cellokonzert gibt es Formationen, denen man mit den herkömmlichen Begriffen Melodie, Harmonie, Rhythmus nicht beikommt. Es sind ganz anders gedachte, statische Formen. Sie scheinen vor uns zu stehen, als ob sie Objekte wären und sich nicht in der Zeit entfalten würden.")

81 Ligeti and Bouliane, "Stilisierte Emotion," 61 ("gefrorene Turbulenz").

82 See, for example, Haapamaki, "Order in *Désordre*," 40–44.

83 Analytical examinations of the piano etudes can be found in Bouliane, "Imaginäre Bewegung," Wilson, "Interkulturelle Fantasien," Rothkamm, "Ordnung in der Unordnung," Scherzinger, "György Ligeti and the Aka Pygmies Project," Haapamaki, "Order in *Désordre*," and Polth, "'nicht tonal und nicht atonal.'" See also the composer's notes in Ligeti, "Études pour piano," "Études pour piano – Premier livre," and "Études pour piano – Deuxième livre."

84 Analytical studies of the Piano Concerto are provided by Willmann, "Gebannte Zeit," Steinitz, "A qui un hommage?," and Huber, *Das zeitgenössische Klavierkonzert*, 85–134. See also the composer's notes in Ligeti, "Zu meinem Klavierkonzert" and "Zum Klavierkonzert."

85 Ligeti, "Zu meinem Klavierkonzert," 298 ("das bislang prägnanteste Beispiel für Illusionsrhythmik und Illusionsmelodik").

pulse layers enter. First the sixteenth-notes in the piano are established, indicating the smallest basic rhythmic value on which the other pulses are built. In measure 2 the left hand adds dotted eighths, which are in turn adopted by the flute in measure 5. In measure 6, a descending melodic movement appears in the right hand in values of seven sixteenths, and in measure 9 the viola joins in with straight quarter-notes, resulting in a ratio of 1:3:4:7.

The special nature of the space-time structures in Ligeti's works since the early 1980s may well be seen in his attempt to create a sense of levitation or "lift-off" by superimposing various pulsations and accents:

> If this music is played correctly, at the right speed and with the right accentuation within the individual layers, after a certain time it will "lift off" like a plane after take-off: the rhythmic event, too complex to be followed in detail, hovers above us.[86]

Such a situation undoubtedly occurs at the moment of greatest density in the same movement. Example 5.11 shows a schematic representation of this passage, in which the ratio 1:4:5:6:7:9:11 is formed. All seven layers appear in the piano part (the orchestra merely doubles the 9/16 layer), indicating related techniques in the works for solo piano, the Piano Etudes, whose first book was written immediately prior to (and partly probably in parallel with) the concerto.

Ligeti summarized these compositional procedures with the term "generalized hemiola" and described their historical and cultural reference points most extensively in 1987, in a conversation with Denys Bouliane published in 1989.[87] Ligeti traces a wide arc from the basic definition of the "hemiola," that is, the rhythmic ratio of three against two, to its extension from Chopin to Debussy, the discontinuous superimposition of different "pulses" in his own sixth Piano Etude, examples from Mozart, Scriabin, Ives, Messiaen, and Stockhausen, to the African Banda Linda and the music of the Aka Pygmies. Ligeti (as emerges from Arom's investigations) sees the peculiarity of the rhythmic organization in the African genres, in comparison to the explicit simultaneity of different meters in Mozart's "Imbroglio" (the famous superimposition of three dances with different meter in *Don Giovanni*), Charles Ives's *The Fourth of July*, or Karlheinz Stockhausen's *Gruppen*, in the fact that they do not describe polymeter, but rather a polyrhythm in which "different rhythmic patterns can be accommodated […] in the same basic pulse,"[88] whereas "there is no simultaneity of different meters."[89] Ligeti uses Alfons Dauer's term *Nennwert*[90] (nominal value; today's more common terms for this phenomenon are "Ele-

86 Ligeti, quoted in Dibelius, *György Ligeti*, 234 ("Wenn diese Musik richtig gespielt wird, also in richtiger Geschwindigkeit und mit richtiger Akzentuierung innerhalb der einzelnen Schichten, wird sie nach einer gewissen Zeit 'abheben' wie ein Flugzeug nach dem Start: Das rhythmische Geschehen, da zu komplex, um im Einzelnen verfolgt zu werden, geht in ein Schweben über.").

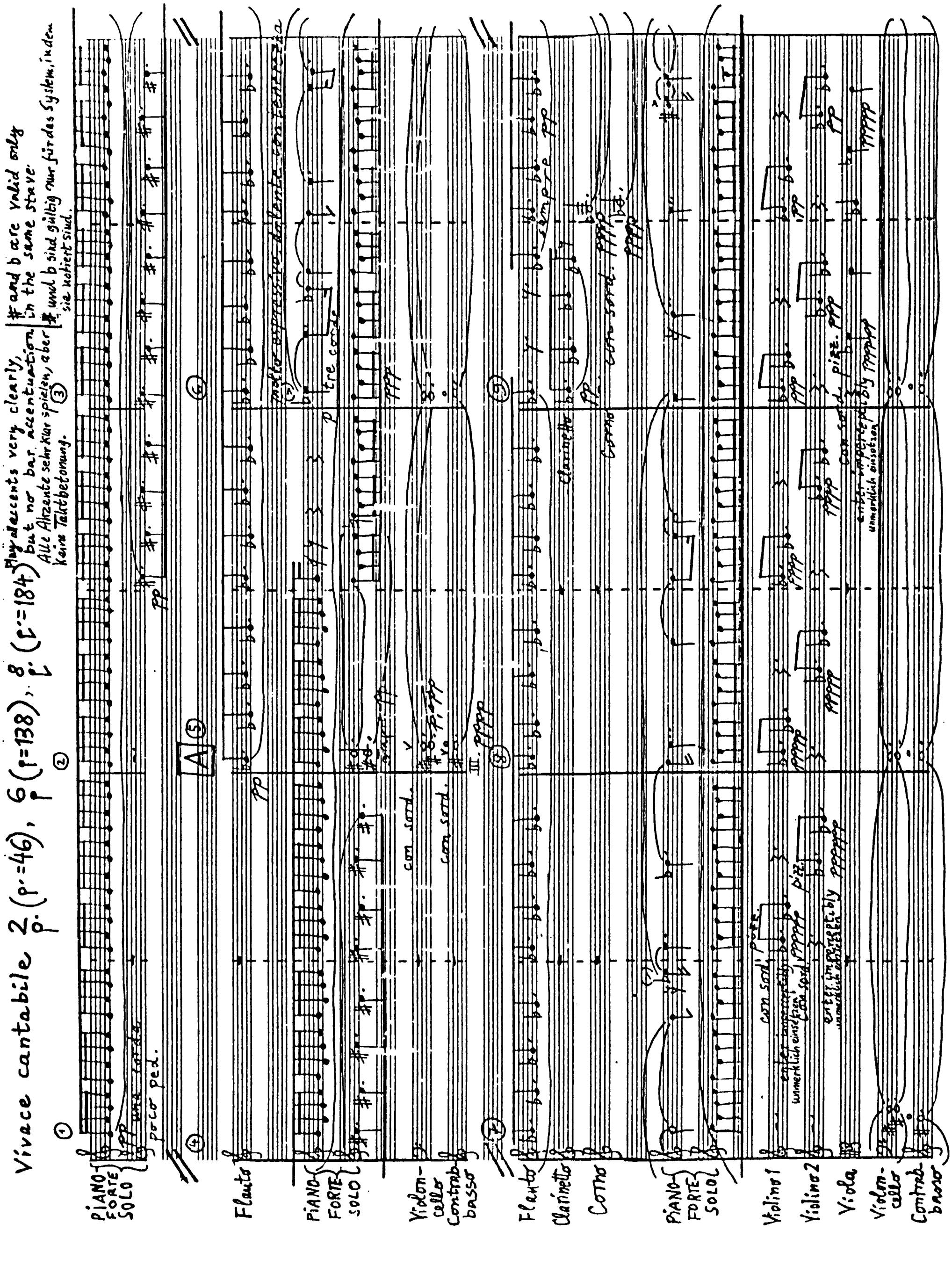
87 Ligeti and Boulaine, "Stilisierte Emotion" (conversation from 08/07/1987). Unfortunately, this highly informative and rich conversation was not included in the edition of Ligeti's *Gesammelte Schriften*.

88 Ibid., 52 ("verschiedene rhythmische Patterns […] im selben Grundpuls unterbringen").

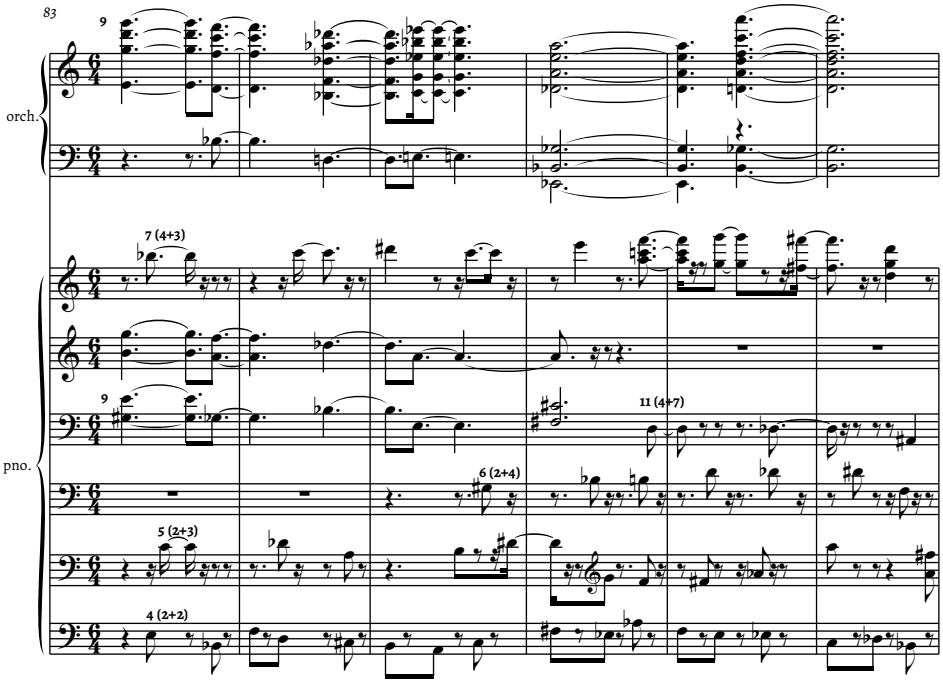
89 Ibid., 53 ("weil es […] keine Gleichzeitigkeit von verschiedenen Metren gibt"). This rejection of the concept of polymeter can possibly credited to Ligeti's exchange with Simha Arom whom Ligeti met for the first time around 1985 when the original French edition of Arom's book on Central African music appeared (see Arom, Duchesneau, and Marx, "A Kinship Foreseen"). Arom denies the concept of polymeter for African music, in opposition to earlier ethnomusicological approaches such as that of Arthur Morris Jones (*Studies in African Music*) and dedicates an entire chapter to this question (Arom, *African Polyphony and Polyrhythm*, 179–212).

90 See Dauer, "Musiklandschaften in Afrika."

Example 5.10: György Ligeti, ***Concerto for Piano and Orchestra****, third movement, mm. 1–9* (Copyright © 1986 by Schott Music GmbH & Co. KG, Mainz)



Example 5.11: György Ligeti, ***Concerto for Piano and Orchestra****, third movement, mm. 83–85, layers*



mentarpulsation"[91] [elementary pulsation] or "density referent"[92]) and describes this crucial aspect of African music in detail in his foreword to Simha Arom's seminal study *African Polyphony and Polyrhythm*:

> For composition, [Simha Arom's fundamental work] opens the door leading to a new way of thinking about polyphony, one which is completely different from the European metric structures, but equally rich, or maybe, considering the possibility of using a quick pulse as a "common denominator" upon which various patterns can be polyrhythmically superimposed, even richer than the European tradition.[93]

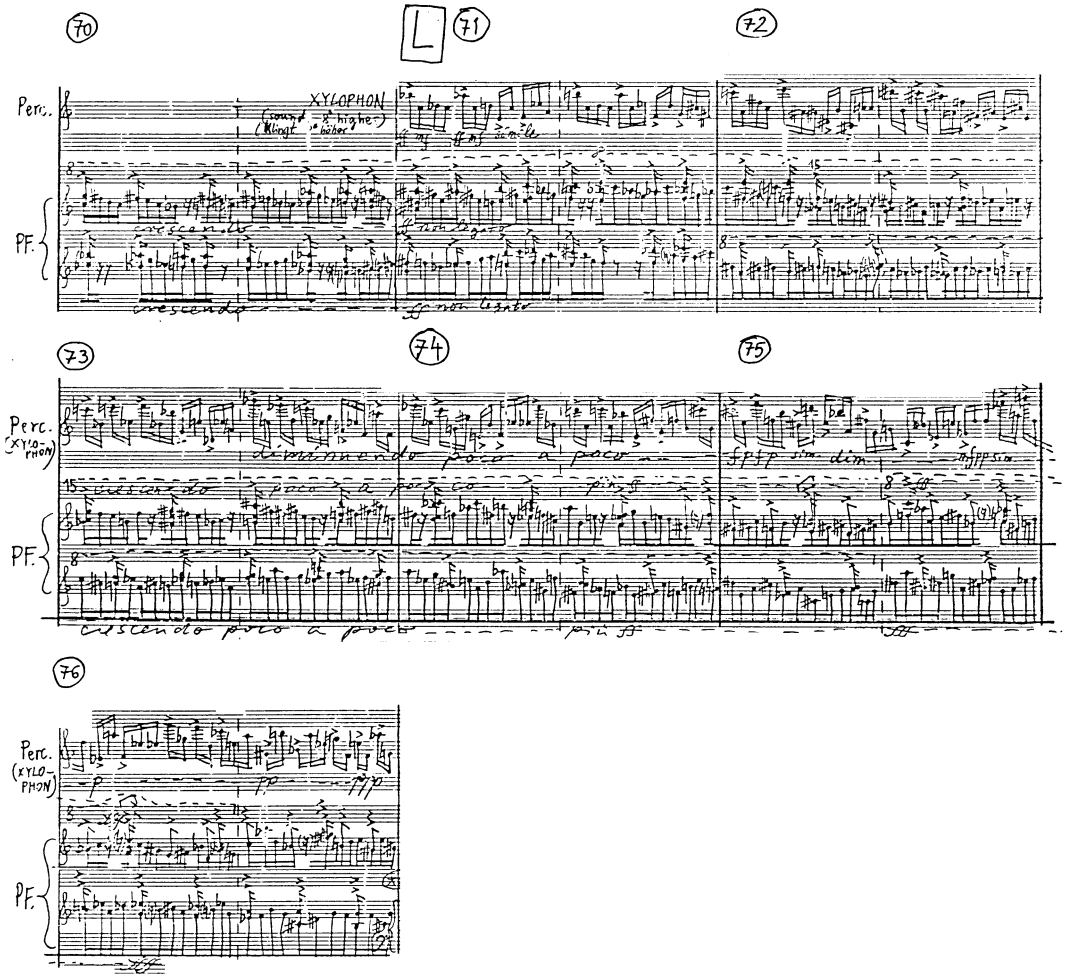
Various metric figures that can be related to a very rapid basic pulse are clearly audible in the third movement of the Piano Concerto, as shown above. All rhythmic processes here are based on a very fast basic pulse as a "common denominator": the sixteenths of the piano (at the stated rate, a sixteenth-note should be played at a tempo of 552 bpm, which corresponds to 9.2 attacks

91 Vgl. Kubik, "Einige Grundbegriffe und -konzepte der afrikanischen Musikforschung," 72–74.

92 See Nketia, *The Music of Africa*, 127–139. The problem of incoherent terminology has been noted and debated also in recent research on African rhythm, see Polak, Jacoby, and London, "Kulturelle Diversität in der empirischen Rhythmusforschung," 206, note 32.

93 Ligeti, "Foreword," xviii.

Example 5.12: György Ligeti, ***Concerto for Piano and Orchestra****, third movement, mm. 71–76, piano solo/xylophone*



per second and a pulse duration of about 10.86 ms[94]). Of course, the different periodicities that sound at the same time might also be perceived as a superimposition of *tempo* layers and less as an overlaying of different rhythms or meters – an aspect that Ligeti himself has reflected

94 Here too, one can see a reference to the African genres. Ligeti describes in detail that the basic pulse can here be even faster than ten attacks per second: "The fastest piano-tremolo that we can perform consists of 13, 14 attacks per second, that is a bit faster, but the Central Africans are building incredibly complex polyphony on such frantically fast pulses." (Ligeti and Boulaine, "Stilisierte Emotion," 53; "Das schnellste Klaviertremolo, das wir ausführen können, besteht aus 13, 14 Anschlägen pro Sekunde, das ist zwar etwas schneller, doch die Zentralafrikaner bauen eine unglaublich komplexe Polyphonie auf solch rasend schnellen Pulsen.").

Table 5.3: György Ligeti, ***Concerto for Piano and Orchestra****, third movement, mm. 71–76: pulse layers, data in sixteenth note values (* = offset), ostinato pulses marked in* ***bold***

measure	xylophone	piano (r. h.)	piano (l. h.)	piano (r. h.)
71a	4-3-2-3 (12)	3-4-2-3 (12)	{93}*	3-4-2-3 (12)
71b	4-3-2-3 (12)	3-4-2-4 (*13*)		3-4-2-4 (*13*)
72a	4-3-2-3 (12)	3-2-**6** (*11*)		3-2-**5** (*10*)
72b	2-2-3-2-3 (12)	**6-6** (12)		**5-5-5** (*15*)
73a	2-2-3-2-3 (12)	**6-6** (12)		**5-5** (*10*)
73b	2-2-3-3-2 (12)	**7-7** (*14*)		**5-5-5** (*15*)
74a	2-3-2-3-2 (12)	**7-7** (*14*)		**5-5** (*10*)
74b	2-3-2-3-2 (12)	**7-7** (*14*)	**3-**	**5-5-5** (*15*)
75a	2-3-2-3-3- (*13*)	**7** (*7*)	**3-3-3-3** (12)	**5-5** (*10*)
75b	2-2-3-2-3- (12)	**7-7** (*14*)	**3-3-3-3** (12)	**5-5-5** (*15*)
76a	2-3-2-2-3- (12)	**7-7** (*14*)	**3-3-3-3** (12)	**4-4-4** (12)
76b	2-3-2-2-2 (*11*)	**7** (*7*)	**3-3-3-3** (12)	**4-4-4** (12)

with the term "polytempo."[95] The orientation of the listener is deflected away from the basic musical framework, the sixteenth pulse, to different pulse rates or periodicities, which are at first clearly distinguishable from one another, but later increasingly blur into texture and thus produce a "destabilization" of cognitive interpretation. It remains to be noted, then, that the distinction between "polyrhythm," "polymeter" and "polytempo" is by no means trivial and requires a more detailed discussion.

The relation of such layering to the aspect of the illusionary can be discussed in reference to another passage from the same movement in which, over six measures, a xylophone part joins the solo piano and interlocks with it, no doubt following the model of *amadinda* music (Ex. 5.12; this setting and reference are taken up again at the end of the fifth movement[96]). By auditory streaming, notes in the same registers in the listener's interpretation are connected to form common patterns,[97] so that rhythmic-melodic shapes – "inherent patterns" – arise that none of

95 Ibid., 52 ("Polytempik." – The term is here suggested by Bouliane). Ligeti developed this concept of "polytempo" already in 1974, using the example of Ives's music: "Ives needed the exact tonal definition of his quoted materials in order to set them apart clearly from the context, which often described a different tonality. The polytonality is joined by polyrhythm, polymeter and – one would actually have to introduce this term – polytempo. Polymeter already existed in Mozart's *Don Giovanni*. In Ives, however, different metric processes sometimes also have different tempi." (Ligeti, "Zur Collagetechnik bei Mahler und Ives," 289; "Ives brauchte die exakte tonale Bestimmung seiner zitierten Materialien, um sie deutlich gegen den Kontext, der oft eine andere Tonalität beschrieb, absetzen zu können. Zur Polytonalität gesellen sich Polyrhythmik, Polymetrik und – man müßte eigentlich diesen Begriff einführen – Polytempik. Polymetrik gab es ja schon in Mozarts *Don Giovanni*. Bei Ives jedoch haben die metrisch verschiedenen Abläufe mitunter auch verschiedene Tempi.")

96 Ligeti, Piano Concerto, fifth movement, mm. 79–84; see Jena, "Raum und Zeit in der Neuen Musik," 52–76.

97 Phenomena of auditory streaming or stream segregation have received broad attention in music psychology, and are most prominently described in Bregman, *Auditory Scene Analysis*, 47–212.

the two soloists alone plays (Ligeti has repeatedly used formulations by Gerhard Kubik almost verbatim to describe this effect[98]).

How do the levels of rhythm, meter, tempo, and melody relate to each other in this situation? In order to answer this question, it is advisable first to consider the individual strata in isolation; one quickly sees that there are essentially four pulse layers, all of which have different characteristics, or "tempos." Ligeti notates the passage in 6/4 time, with each measure divided in the middle by dashed lines in 2x3 quarters (these half-measures are indicated by adding a and b to the measure numbers below). The 24 sixteenths of a measure can be divided into the hemiolic ratio 3:2 at four levels – 24:16 𝅘𝅥𝅯/𝅘𝅥𝅯, 12:8 𝅘𝅥𝅮/𝅘𝅥𝅮., 6:4 𝅗𝅥/𝅗𝅥., and 3:2 𝅗𝅥/𝅗𝅥.

Already in the transition from measures 71 to 72, both hands of the piano add a sixteenth note to the regular 12+12 sixteenth pattern, thus creating a friction with the regular meter of the xylophone, which retains the 4-3-2-3 division from measure 71 (Table 5.3). On sixteenth beat 72a.7, ostinato pulses begin in the piano at 6, then 7 sixteenths (right hand) as well as 5 sixteenths (left hand), which from the end of measure 74 are supplemented by another layer in the right hand (3 sixteenths). By measure 73b at the latest, one would have to speak of a continued "generalized" hemiola with the accents only realigning at the beginning of measure 77. This moment of synchronization is prepared, in particular, by the regular isochronous 3 and 4 divisions from measures 75 and 76, consolidating the given meter; this regularity, however, continues to be disturbed by an accent shift of one sixteenth in the xylophone layer.

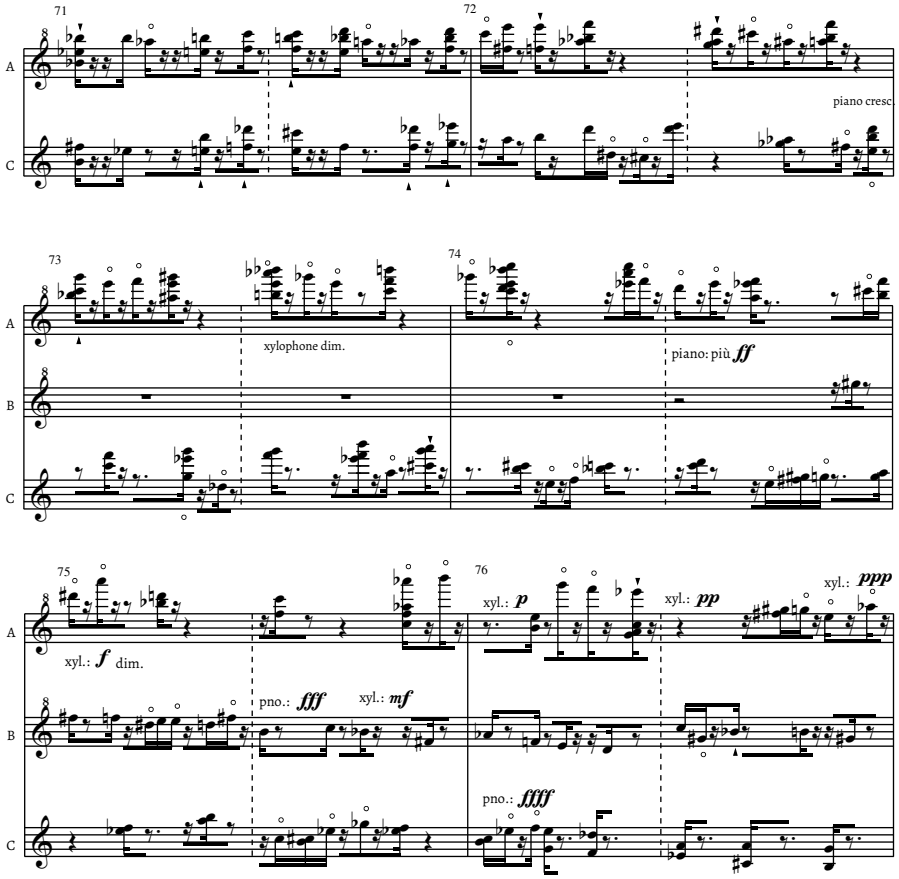
So far, I have consciously restricted the description to the terms "pulses" and "accents." The extent to which these also constitute *meter* can only be clarified by discussing whether these pulses in themselves or in their interaction have superior salient properties that give rise to metric periodicities. For this purpose, I extracted all accented notes from the musical text and wrote them on three staves (A, B, C) separated by register (Ex. 5.13). This reduction makes clear that registers A and C describe an upward movement to the highest piano key C8 in measures 73 and 74, and then a downward movement which can also be observed in registral layer B entering shortly before measure 75.

The xylophone part, marked in Example 5.13 by wedges (accents together with piano) or circles (xylophone accents without piano), jumps between all three registers, transforming the largely periodic layers of the piano into changing "inherent patterns." It can be assumed that the shared accents (wedges) are particularly emphatic markers, so that the first pulses of the measures 71a, 71b, 72b, 73a, 73b are clear indications of marking the given meter (6/4, subdivided in 2x3 fourths or 2x12 sixteenths), which is also supported by highlighted register peaks (this results in an overarching aural stream of B♭6-B6/C7-[D7-E7-]F♯7-G7-[G♯7-]B♭7 in layer A; thereafter almost no common accents occur. The alternative presentation in Table 5.4 vividly demonstrates the compression process leading to metric leveling and destabilization: whereas measures 71 to 73 contain between five and seven accents on twelve fundamental pulses in each half-measure, this number rises between measures 74 and 76 to eight and ten accents per half-measure.

The relative metric stability of measures 71 to 73 is also demonstrated by another illustration in which the resulting rhythmic figures of layers A and B+C are placed one below the other in a simplified manner (Ex. 5.14). Here it is obvious how, from measure 74 onward, the initially clear periodicity of the resulting patterns seriously disintegrates. This becomes apparent relatively late in layer A, in which the accents within the first three eighths of each half-measure are shifted only in measure 75b. Here, as well as in measure 76a, new (off-meter) periodicities are formed by the shared accents of piano and xylophone. In registers C and B, the processual shift

98 Compare, for example Ligeti, "Zum Klavierkonzert," 301, with Kubik, "Musikgestaltung in Afrika," 39.

Example 5.13: György Ligeti, ***Concerto for Piano and Orchestra****, third movement, mm. 71–76, accent layers in three registers A, B and C; wedges: common accents piano and xylophone; circles: accents xylophone (without piano)*



begins earlier, with particular emphasis on the development of the figure, which at first seems to be clearly syncopated at positions 71a.8 and 71a.10. These positions remain stable until measure 73a, thus contributing significantly to an "intact" metric periodicity, while afterward they move more and more "to the left," switching between layers C and B – a process of convergence is completed that simultaneously blends the pitch registers of these two layers (see Ex. 5.13).

While measures 71 to 73 can still be perceived as metric despite their complexity, and within this basic meter, the deviation of the piano accents' shape in measure 72a can clearly be identified as a conflicting metric layer, the following three measures, with the seven-sixteenths ostinato pulses of the upper piano register, the addition of a third register, and a shift in the resulting salient patterns, eliminate almost any sense of meter, although new stabilizing factors counteract this process (such as the 3-sixteenth and 4-sixteenth pulses). Owing to the overall compression, these pulses also tend toward a dissociation of meter – ten accents on twelve basic pulses, such as in measure 74b, hardly allow us to speak of a reference metric layer anymore. Time becomes space, structure becomes texture – a paradigmatic process in Ligeti's later works that can be equally observed in Piano Etudes 1, 6, 12, or 13, as well as in the first, fourth, and fifth movements of the Piano Concerto.

*Table 5.4: György Ligeti, **Concerto for Piano and Orchestra**, third movement, mm. 71–76, accent layers in three registers A, B and C, represented on the basis of an adapted Time-Unit Box System (TUBS), developed by Philip Harland*

	measure 71																						
A	▪			○	●			○		○			▪			○	▪			○		○		
C	○			○				▪		▪			○			○				▪		▪		
	x				x				x				*x*				x				x			

	measure 72																						
A	●	○			▪		○						▪		●		●		○					
C		○			○		○	●		●		○					○			●		▪		
	x				x				x				*x*				x				x			

	measure 73																						
A	▪		●		●		○						▪		●		●			○			●	
B																								
C			○					▪		●			○					○		●			○	
	x				x				x				*x*				x				x			

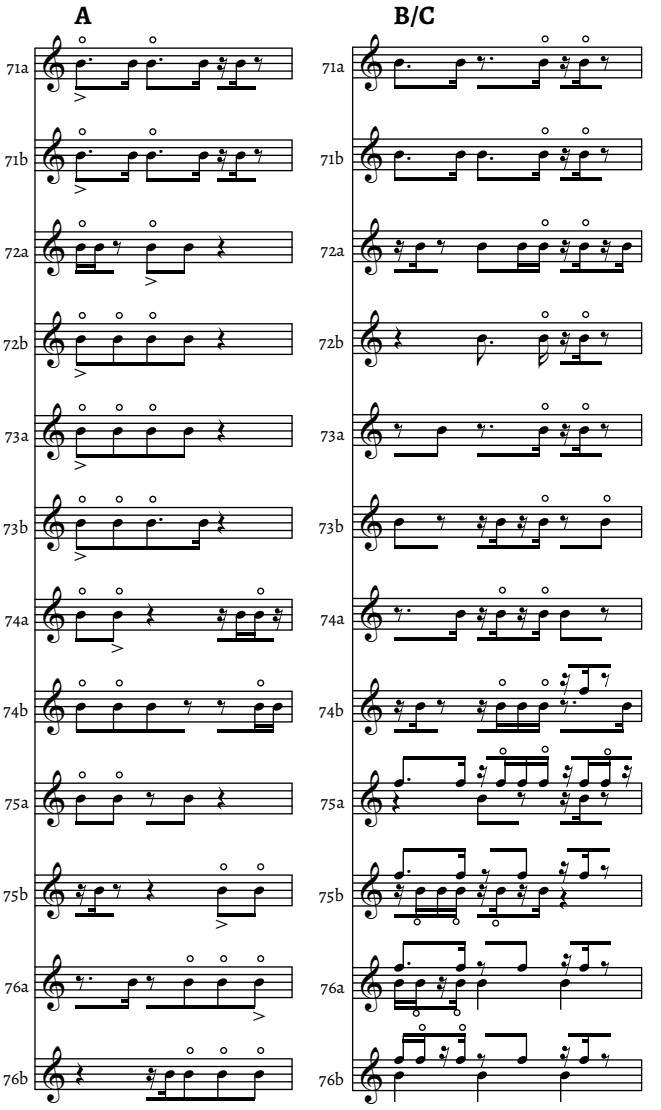
	measure 74																							
A	●		▪							○	●		●		●		○						●	○
B																						○		
C				○		●		●	○					○				●	○	●				○
	x				x				x				*x*				x				x			

	measure 75																							
A	●		●				○							○							▪		●	
B	○			○		●	○	●		○	●		○			○			○			○		
C					○					○				●	○	●		●		○				
	x				x				x				*x*				x				x			

	measure 76																							
A				○			●		●		▪							○	●		●		●	
B	○			○			○			○			○	●		▪			○			○		
C	○	●		●	○				○				○				○				○			
	x				x				x				*x*				x				x			

▪ piano + vibraphone accent ○ piano accent ● vibraphone accent

Example 5.14: György Ligeti, ***Concerto for Piano and Orchestra****, third movement, mm. 71–76, resulting rhythms of layers A (left) and C/B (right); accents: common accents piano/xylophone; circles: impulses xylophone*



Summation Meter and Metric Dissonance

Let us now try to expand this analytical approach to Ligeti's "generalized hemiola" somewhat more systematically. It seems necessary to problematize the arguably inadequate distinction between polyrhythm and polymeter in Ligeti's theoretical perspective, which corresponds to a similar lack of distinction in some approaches in music theory, music psychology, and ethnomusicology.

The phenomenon of meter can, as already shown in the above analysis, usually be explained as periodically recurring salient signals within regular pulse sequences, that is, dynamic or register-based emphases, accents, patterns, or events, which can be eliminated when the meter is established, so that meter cannot be generally defined on the basis of "accents," as has long been the norm. On the contrary, a distinction must be made between "commetric" and "contrametric" accents, a necessity which becomes very clear, for example, from measures 71 to 73 of the example discussed above.[99]

In research, there has been a tendency only to recognize those musical contexts as "metric," where meter can also be identified by an "experienced listener." Meter has thus been described as an essentially cognitive phenomenon, often in explicit contrast to rhythm.[100] In this context, the existence of polymeter was repeatedly questioned, since it was only possible to perceive different metric shapes simultaneously to a limited extent.[101] On the contrary, it has been stated that the term "rhythm" today says "much and yet almost nothing anymore."[102] One could justifiably assert that the term "polyrhythmic" is, on closer examination, tautological and therefore unusable, since countless types and forms of music are composed of different simultaneous "rhythms," while the simultaneity of different *metric* periodicities constitutes a far more specific form of superposition.[103]

At any rate, it seems problematic to make a (narrowly empirically defined) cognitive level the sole prerequisite for a definition of meter. For there are – not only in the twentieth and twenty-first centuries – musical contexts and compositional processes in which the conflicts between a metric base layer and the actual formations in musical groupings, or conflicts between such units, are crucial factors of the structure which are not aimed at a clear identification of one or more meters, but are still essential for complex and often ambiguous manners

99 Kolinsky, "A Cross-Cultural Approach to Metro-Rhythmic Patterns," 497.

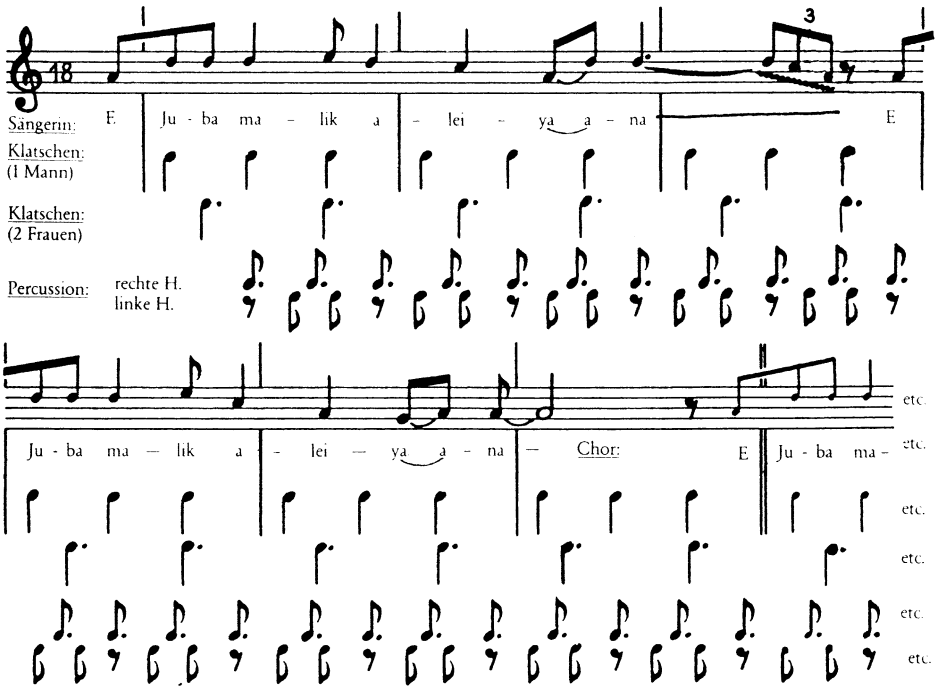
100 See London, "Rhythm," I.1. The Distinction Between Rhythm and Metre. This distinction essentially goes back to the rhythm and meter theories of Lerdahl and Jackendoff, *A Generative Theory of Tonal Music*. See also London, *Hearing in Time*, 65–76.

101 See Drake and Parncutt, "Psychology of Music," II. Perception and Cognition, 2. Rhythm; London, *Hearing in Time*, 67.

102 Seidel, "Rhythmus, Metrum, Takt," I. Zur Definition des Prinzips ("Heute bezeichnet *Rhythmus* alles, was irgendwie mit der Struktur oder dem Ablauf der musikalischen Zeit, oft auch, was mit Bild- und Raumbewegungen zu tun hat. Das Wort sagt vieles und doch fast nichts mehr.")

103 Arom tries to circumvent this problem by defining polyrhythm as "different patterns of accent […] superposed in the same work" (Arom, *African Polyphony and Polyrhythm*, 205). To associate rhythm (rather than meter) with "patterns of accent" might, of course, appear quite problematic. Arom's rejection of the concept of polymeter for African music is consequently based on a very narrow definition of "meter": "If we take 'metre' in its primary sense of *metrum* (the metre being the temporal reference unit), 'polymetric' would describe the simultaneous unfolding of several parts in a single work at different tempos *so as not to be reducible to a single metrum*. This happens in some modern music, such as some of Charles Ives's works, Elliott Carter's *Symphony*, B. A. Zimmermann's opera *Die Soldaten*, and Pierre Boulez's *Rituel*." (ibid.)

Example 5.15: ***E Juba*** *– beginning of a popular song from South Sudan (transcription: Gerhard Kubik; Kubik, "Musikgestaltung in Afrika," 36)*



of gestalt perception. Ligeti's music is a prominent example of this. Of course, the problem (or indeed the impossibility) of providing a succinct definition of "rhythm" and "meter" accommodating not only different periods of Western music history but also musical time structures on a global scale is far beyond what can be achieved here and would require a monograph on its own (as presented for the Western context, most notably, by Christopher Hasty[104]). Especially when we turn to the richly imaginative and thorough treatment that the relationships between rhythm, meter, and tempo have received in twentieth- and twenty-first-century music, it seems inevitable to conceive of a complex model in which the interrelation of these concepts or areas is maintained and highlighted.[105]

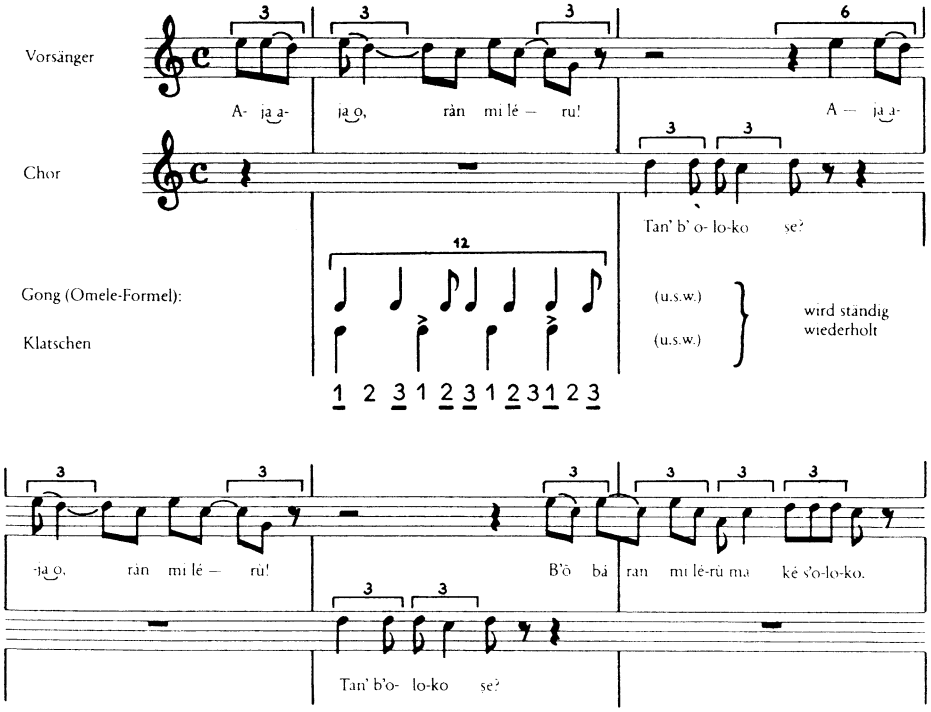
Examples 5.15 and 5.16 and Tables 5.5 to 5.8 show polymetric situations in African contexts based on the studies of Kubik, which Ligeti knew, and without taking into account the extensive more recent research on African rhythm, which has undergone much further development.[106] Although to what extent a concept such as "meter" can be appropriate for African designs of

104 Hasty, *Meter as Rhythm*. The concepts of polyrhythm or polymeter are not discussed in Hasty's book which otherwise offers an unsurpassedly nuanced discussion of the relation between rhythm and meter.

105 See Utz and Nonnenmann, "Rhythmus, Metrum, Tempo" for a comprehensive overview of definitions and compositional approaches in twentieth- and twenty-first-century music. See also Delaere, "Tempo, Metre, Rhythm."

106 Polak, Jacoby, and London, "Kulturelle Diversität in der empirischen Rhythmusforschung" provides an excellent example.

Example 5.16: ***Tan'b'oloko se?*** *– song from a fairy tale of the Yoruba, West Africa (transcription: Gerhard Kubik; Kubik, "Musikgestaltung in Afrika," 37)*



music at all remains controversial in ethnomusicology, there is broad agreement that most African musicians think in larger, frequently recurring, rhythmic-melodic formulas, and thus in periodicities whose relationship to European concepts of meter has possibly not yet been fully explored.[107] In Example 5.15, Kubik uses a popular song from southern Sudan to show how four different periodicities are superimposed.[108] They comprise 6, 9, 12, and 18 pulses per "summation meter" of 36 basic pulses read from top to bottom (schematic representations in Tables 5.5 and 5.6). The numbers 6, 12, and 18 are divisible by both 2 and 3, thus allowing constantly changing metric references. In addition, a periodically recurring vocal melody comprising 36 basic pulses, which is shifted by two basic pulses with respect to the rhythmic group generates an additional quasi-canonic metric displacement.

107 Polak, Jacoby, and London, for example, argue: "We concur with authors who support an application of the concept of meter in African music research; however, we emphasize the necessity to keep the theoretical definition of the concept of 'meter' open." (Ibid., 198; "Wir folgen Autor*innen, die eine Anwendung des Metrumsbegriffs in der afrikanistischen Musikforschung befürworten, betonen jedoch gleichzeitig die Notwendigkeit, die theoretische Bestimmung des Konzepts 'Metrum' offen zu halten.")

108 Kubik, "Musikgestaltung in Afrika," 36.

Table 5.5: Representation of Example 5.15 in the Time-Unit Box System (TUBS); metric periodicities of the patterns are marked by changing gray levels

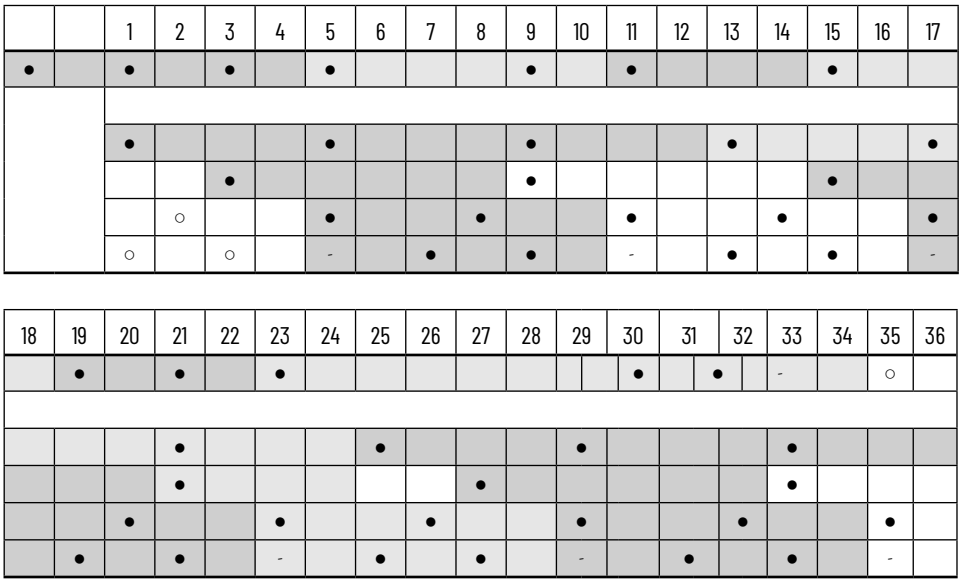


Table 5.6: Pulse speeds and metric patterns in Example 5.15

pulse speeds	
clapping (one man)	4-4-4-4-4-4-4-4-4 (9 x 4)
clapping (two women)	6-6-6-6-6-6 [4+2] (6 x 6)
percussion r. h.	3-3-3-3-3-3-3-3-3-3-3-(3) (12 x 3)
percussion l. h.	2-4 [2-2]-2-4-2-4-2-4-2-4-(2-4) (6 x 6 [2+4]; 18 x 2)
meter/pattern	
voice	-2 6-6-4-4-4-12 [12-12-12]
clapping	12-12-12 ...
percussion	4-6-6-6-6-6-6 ...

The different pulse speeds, on the one hand, and the meter within the three sound layers (voice, clapping, percussion), on the other hand, should be differentiated here. The representation in Table 5.5 shows clearly that only with the completion of a full 36-valued unit can all periodicities be synchronized again. It also becomes clear that the meter of the percussion layers follows that of the voice (with a hemiolic dissonance between the 11th and 22nd pulse), while the meter of clapping is canonically displaced by two fundamental pulses. Hemiolic overlays occur even within the metric periods in clapping and percussion layers (3:2 and 6:4 pulses).

The values transcribed as triplets by Kubik between the 29th and the 32nd pulse of Example 5.15 seem to be a rhythmically free "phrasing" provoked by a speech-oriented vocal intonation,

Table 5.7: Representation of Example 5.16 in the Time-Unit Box System (TUBS); metric periodicities of the patterns are marked by changing gray levels

							1	2	3	4	5	6	7	8	9
lead singer	●		●		●		●		●						
choir							○				○		○		○
gong							●				●				●
clapping							●						●		

	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
lead singer	●			●			●					●		-	
choir				○				●				●		●	
gong		●				●				●				●	
clapping				●						●					

Table 5.8: Pulse speeds and metric patterns in Example 5.16

pulse speeds	
lead singer	(2-2-2) 2-7-3 3-5-4
choir	4-2-2-4-4-(4-2-2) [6 x 4]
gong	4-4-2-4-4-4-2 [12 x 2]
clapping	6-6-6-6 [4 x 6]
meter/pattern	
lead singer/ choir	(2-2-2) 2-7-3 3-5-4 [12-12]
gong	10-14
clapping	12-12

while the continued triplet values in Example 5.16[109] produce additional rhythmic-metric complexity. Based on Kubik's note values, one must assume that triplet sixteenths act as a common fundamental pulse, so that a "summation meter" of 24 values is obtained (Table 5.7). Continuing in the gong, the *omele* formula is one of Africa's best-known structural elements, commonly also referred to as "time-line pattern," and has been widely deployed by Ligeti and others.[110] Due to its irregular division according to the proportion n-1/n+1 (5+7 triplet-eighths – here cor-

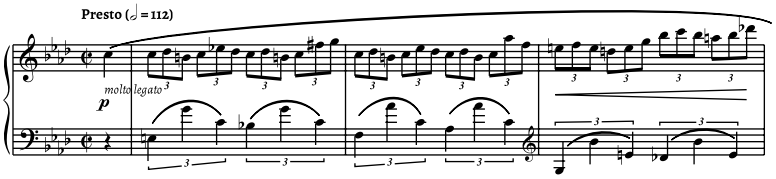
109 Ibid., 37.

110 See Scherzinger, "György Ligeti and the Aka Pygmies Project," 240–244. The *omele* formula has also been related to Steve Reich's paradigmatic works *Drumming* (1970–71) and *Clapping Music* (1972), see Klein, *Alexander Zemlinsky – Steve Reich: Alternative Moderne(n)*, 139–147 and Colannino, Gómez, and Toussaint, "Analysis of Emergent Beat-Class Sets in Steve Reich's 'Clapping Music.'"

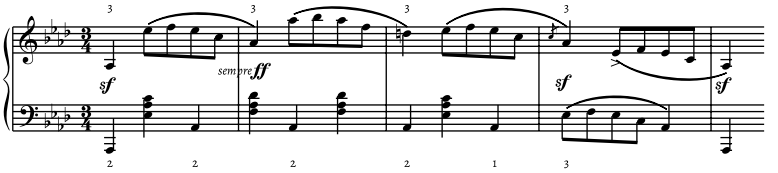
Table 5.9: Categories of metric dissonance in Classical-Romantic music

1. Metric grouping dissonance (superposition of metric groupings; simultaneous conflicting meters)

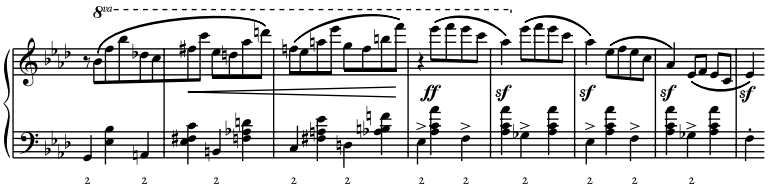
a. Superimposition of metric groupings within the measure boundaries (Chopin, *Etude* op. 25, no. 2, mm. 1–3)



b. Superimposition of periodically recurring metric groupings (Schumann, *Carnaval*, "Préambule," mm. 28–32)



c. Superposition of aperiodic metric groupings (Schumann, *Carnaval*, "Préambule," mm. 99–106)



responding to 10+14 fundamental pulses) and the additional constant change between three- and two-division in the singing voice (lead singer), metric tension is created on a simultaneous and successive dimension (Table 5.8).[111]

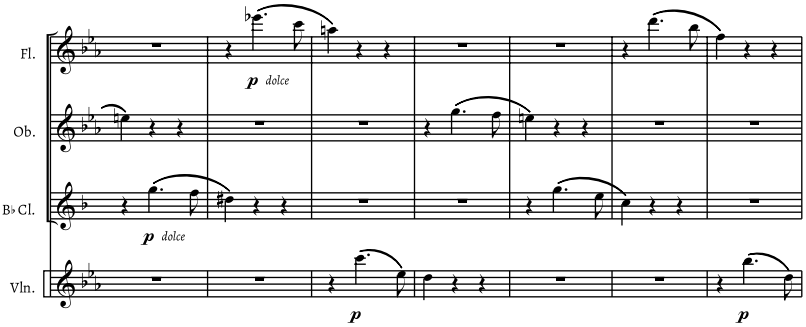
The function of such overlays in the African context varies. In some genres – as is often the case, for example, with the Aka pygmies in Central Africa – the strata are gradually built up, and the increasing "polymeter" thus serves to increase the density of sounding events and is often coupled with an intensification of dance movement. In other genres, the metric layers are established from the beginning, so that the complex mesh over time appears static and basically only the inherent patterns within a summation meter are perceived, as in the examples discussed above. In general, the superposition of different periodicities in numerous genres of African music can be understood as the basic constant.

In contrast, the simultaneity of different meters in European music, at least within the framework of the common-practice tonality of about 1600 to 1900, most often fulfills a very specific formal function, namely that of a *metric dissonance*. This dissonance deliberately distinguishes itself from the *metric consonance* of (established or imagined) rhythmic constellations supporting the prescribed meter, so that one can meaningfully speak of "conflicting meters" in

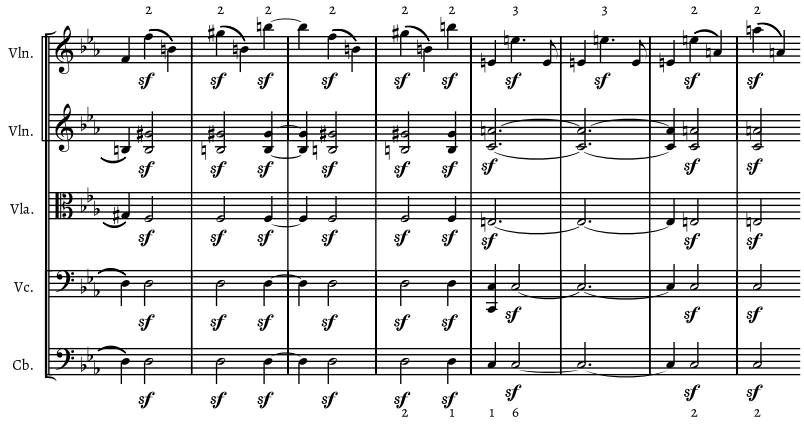
111 See also Arom, *African Polyphony and Polyrhythm*, 241–250.

2. Displacement dissonance (shift of focus by syncopation/accentuation, successive conflicting meters)

a. without changing the group length (Beethoven, Symphony no. 3, i, mm. 46–52, melody instruments)



b. with change of group length (Beethoven, Symphony no. 3, i, mm. 250–257, strings)



this context. Yet, numerous examples can be found in music history, particularly before 1600 and after 1900, in which certain affinities with the African models become visible.

Following on from Harald Krebs, one can distinguish two basic types of metric dissonance (Table 5.9).[112] In a metric *grouping dissonance* (or simultaneous conflicting meters) a continuous shift in emphasis is brought about by ongoing and possibly irregular syncopation or accentuation, while in a *displacement dissonance* (or successive conflicting meters) different metric groupings or accents are superimposed, leading to a continuous shift of metric emphasis.[113] In each case, subcategories of increasing complexity are to be differentiated, with hybrids occurring frequently. Each *displacement dissonance* is at the same time a metric *grouping dissonance* relative to the (possibly inaudible) periodicity of the prescribed meter.

112 See Yeston, *The Stratification of Musical Rhythm*, Krebs, "Rhythmische Konsonanz und Dissonanz," Krebs, "Some Extensions of the Concepts of Metrical Consonance and Dissonance" and Krebs, *Fantasy Pieces*. London, "Rhythm in Twentieth-Century Theory," 708 provides a useful summary.

113 This distinction is particularly linked to the terminology first developed by Krebs in "Rhythmische Konsonanz und Dissonanz" and further developed in *Fantasy Pieces*, 31–45. Krebs acknowledges the origin of these terms in Kaminsky, "Aspects of Harmony, Rhythm and Form in Schumann's *Papillons*, *Carnaval* and *Davidsbündlertanze*," 27.

Of the categories and examples provided in Table 5.9, the basic meter remains intact in category 1a, but is subdivided by the dissonant combination of quarter and eighth triplets, which creates a floating character that the mathematically equivalent notation of eighths and quarters in a 6/4 meter could surely not generate. This points to the important fact that metric dissonance can have profound implications for performance and is crucial for a particular aspect of virtuosity and the impression of "levitation" in Romantic piano music. In category 1b, the 2/4 grouping in the left hand faces a 3/4 grouping in the right and both groupings return periodically and therefore realign after two measures, that is, they sound together again after 2x3/3x2 pulses.[114] We find a more complex case in category 1c, where the periodic 2/4 grouping of the left hand is overlaid with an aperiodic sequence in the right hand. The grouping dissonance becomes so intense here that Schumann inserts a 4/4 measure (not indicated) in the third measure of the specified section in order to re-synchronize the layers with the prescribed meter – a moment that actually aptly exemplifies an interaction of grouping and displacement dissonance.

The second basic form of metric dissonance, *displacement dissonance*, is illustrated here by two widely cited examples from the first movement of Beethoven's *Eroica*. In category 2a, the group length of the basic meter 3/4 is retained, but shifted by one beat to create a syncopation that turns into a continuing displacement of the metric grid, while in category 2b – analogously to the right hand in 1c – the grouping lengths change constantly, which increases the metric destabilization or the degree of metric dissonance. As frequently observed, harmonic and metric dissonances here reinforce one another, marking a crucial moment in the movement's formal process.

Toward an Intercultural Theory of Musical Time and Its Historiographic Implications

I will refrain here from further exploring the history of polymeter in Western music, as I have done in earlier versions of this chapter.[115] Much of this is familiar from a variety of studies and does not need to be repeated here at length.[116] The implications of hemiolic or *sesquialtera* proportions to provoke metric ambiguities might be traced back to ancient Greek theory, where the term *hemiólion* is found in Pythagorean tuning theory and already transferred to five-beat rhythmic patterns by Aristoxenus.[117] The ambiguity is made explicit in mensural notation where especially the coloring of notes can be associated with hemiolic re-

114 See Krebs, *Fantasy Pieces*, 33.

115 Compare this part in the German edition of the present book (Utz, *Komponieren im Kontext der Globalisierung*, 300–316) which is, as the entire chapter, based on an earlier 2009 publication (→ Appendix).

116 Grove Music Online offers articles on hemiola and proportio sesquialtera (see Rushton, "Hemiola," Hiley, Stanford and Laird, "Sesquialtera"). A systematic study of hemiolysis and polymeter in European music has so far taken place mainly on the basis of isolated case studies. See among others Ham, "A Sense of Proportion: The Performance of Sesquialtera ca. 1515–ca. 1565," Willner, "Metrical Displacement and Metrically Dissonant Hemiolas," Willner, "The Two-Length Bar Revisited: Handel and the Hemiola," Lewin, "On Harmony and Meter in Brahms's Op. 76, No. 8," Cohn, "Complex Hemiolas, Ski-Hill Graphs and Metric Spaces," Cohn, "Metric and Hypermetric Dissonance in the Menuetto of Mozart's Symphony in G minor, K. 550," Cohn, "The Dramatization of Hypermetric Conflicts in the Scherzo of Beethoven's Ninth Symphony," Berktold, "Zur Satztechnik der Hemiolenbildung in Klaviersonaten Mozarts," and Plyn, *Die Hemiole in der Instrumentalmusik von Johannes Brahms*. More general studies relevant in this area include the classic Apel, *The Notation of Polyphonic Music, 900–1600* as well as Schachter, "Rhythm and Linear Analysis," Kramer, *The Time of Music*, Hasty, *Meter as Rhythm*, Maurer Zenck, *Vom Takt*, and particularly Mirka, *Metric Manipulations in Haydn and Mozart*.

117 Aristoxenos, "Elementa Rhythmica, Book II," 189.

lationships, eventually resulting in prolonged phases of polymensural structures in music by Johannes Ciconia and his contemporaries. For Baroque music Channan Willner distinguishes between "cadential hemiolas," "contraction hemiolas," "expansion hemiolas," and "overlapping hemiolas" in Handel and Bach, thus making it clear how diverse and sometimes formative hemiolic structures could be in the eighteenth century.[118] Further elaborations of hemiolas in the classical style and the nineteenth century arise from "dance" movements, particularly the courante and minuet, and eventually result in famous examples of metric dissonance in the Minuet from Mozart's Symphony G minor K. 550, the first and third movements of Beethoven's *Eroica*, Schumann's piano cycles, Chopin's Fourth Ballade, as well as Brahms's late *Klavierstücke* and the first movement of his Third Symphony.[119]

In the most complex of these examples, such as the Chopin, more than two metric layers are established, anticipating the subsequent practice of superimposing structures in differing meters in the twentieth century. More generally, one can distinguish two main tendencies in the unprecedented wealth of rhythmic-metric dimensions since 1900 that are conjoined in the late music of Ligeti. On the one hand, the metric organization might tend to increase in complexity by means of multiple superimpositions, up to the point at which they transform into a texture that we can no longer conceive of metrically in any specific sense. On the other hand, metric structures can be somewhat overemphasized, be it through clear tonal or registral structuring, that allows their friction, interaction, and internal dynamics to be perceived.[120] In works such as Charles Ives's Fourth Symphony (1910–16)[121] and *Universe Symphony* (1911–28), Karlheinz Stockhausen's *Gruppen* (1955–56), or Bernd Alois Zimmermann's *Die Soldaten* (1958–64), we can witness both tendencies in permanent interaction with the polyphony of meter and/or tempo exposed and concealed at irregular intervals. In the *Universe Symphony*, Ives conceived of a "basic unit," a macro-metric period symbolizing the "pulse of the universe," that is cyclically overlaid with ever new metric layers until a structure of twenty different layers is reached. The arrangement for percussion orchestra entitled *Life Pulse Prelude* by Larry Austin (1984) uses different *tempo* layers to realize this polymeter for practical reasons.[122] The pulses are sent to the players via click track. In his *Memos*, Ives worked intensively on questions of the feasibility and perceptibility of such stratifications:

> The listener, if he tries enough, will get the composite effect that's wanted, while each player concentrates on his particular meter, hearing the others as secondary sounds, at least while practising [*sic*] them. […] if the different meters are each played by groups of different sounding units, the effect is valuable, and I believe will be gradually found an important element in deepening and enriching all of the depths of music, including the emotional and spiritual.[123]

***

118 Willner, "The Two-Length Bar Revisited: Handel and the Hemiola."

119 See Ligeti and Boulaine, "Stilisierte Emotion," 54. The passage from Chopin's Fourth Ballad (mm. 175–178) referred to by Ligeti is also dealt with in an essay by Douglas R. Hofstadter that obviously pointed Ligeti to the respective passage: Hofstadter, *Metamagical Themas*, 179 (the article first appeared in 1982 in *Scientific American*).

120 See Utz and Nonnenmann, "Rhythmus, Metrum, Tempo" for an overview.

121 See, among others, Gail, *Charles E. Ives' Fourth Symphony*, 308–434 and Gail, "Die 4. Symphonie von Charles Ives," 73–87, and Utz, "Bernd Alois Zimmermann und Charles Ives," 126–129.

122 See Austin, "The Realization and First Complete Performances of Ives' *Universe Symphony*."

123 Ives, *Memos*, 125.

Both the systematic considerations of summation meter and metric dissonance as well as the historical examples of conflicting metric formations in Western music make it clear that a complex reflection of the simple hemiolic principle of juxtaposed or superimposed metric periodicities is found in various eras and cultural contexts. These properties thus can by no means be considered a specific aspect of recent music, although twentieth-century composers, often inspired by Stravinsky and Bartók, offer an extraordinary variety of examples. Many genres of African music seem to imply comparable types of superimposition of meter-like periodicities as a fundamental prerequisite for music making, even though both the conceptualization of the performer and the perception of the listener may be more focused on the patterns resulting in the summation meter than on the superimposition itself. At this point, it seems important to stress that, in contrast to a strong focus on "emic" approaches, that is, on the musical structures as imagined and conceived by the performing musicians (and local audiences) in ethnomusicology, an intercultural approach aiming at global historical and theoretical perspectives must go beyond these restrictive premises, as Michael Tenzer has most notably done in his essays exploring musical temporality by systematically referring to repertoire of different cultures and historical periods.[124] While it is clear that some of Tenzer's arguments risk overgeneralization, his typology of musical temporalities (though it conspicuously lacks a type that could apply to polymeter or polytempo) would surely make a good starting point for rethinking musical time in broader terms than has been done until now.

A dimension of polymeter that may be further explored in the intercultural universe is the idea of musical spatiality as it emerges particularly strongly in polymetric music of the twentieth century with Ives, Mahler, Zimmermann, or Ligeti, but which also resonates with African genres, as they are often characterized by an anti-teleological, quasi-spatial basic principle[125] with which Ligeti's "frozen turbulence" has close affinities. Even in most of the other examples discussed here, metric confusion produces a temporal delay, a congestion of energy, and sometimes a momentary stasis, which, however, is not always to be understood as a tension that requires resolution. Thus the concept of "metric dissonance" should reasonably be limited to the three or so centuries of common-practice tonal music.

In any case, one can take the history of polymeter as proof of the thesis resulting from the considerations in Chapter II.1 that music history, especially from an intercultural perspective, is not a linear progression from simple to more complex forms. On the contrary, it becomes clear from the examples discussed here that – as in many other areas of music – the different concepts and musical contexts of metric conflict and overlays describe a network of references that embody the most diverse, sometimes unexpected and surprising connections as they were drawn again and again by composers such as Ligeti in the twentieth and twenty-first centuries. It is more than a mere *bon mot* to say that polymeter constitutes a kind of "metric dissonance" in the structure of music history.

124 See Tenzer, "A Cross-Cultural Topology of Musical Time" as well as the earlier "Temporal Transformations in Cross-Cultural Perspective."

125 See Arom, *African Polyphony and Polyrhythm*, 17.