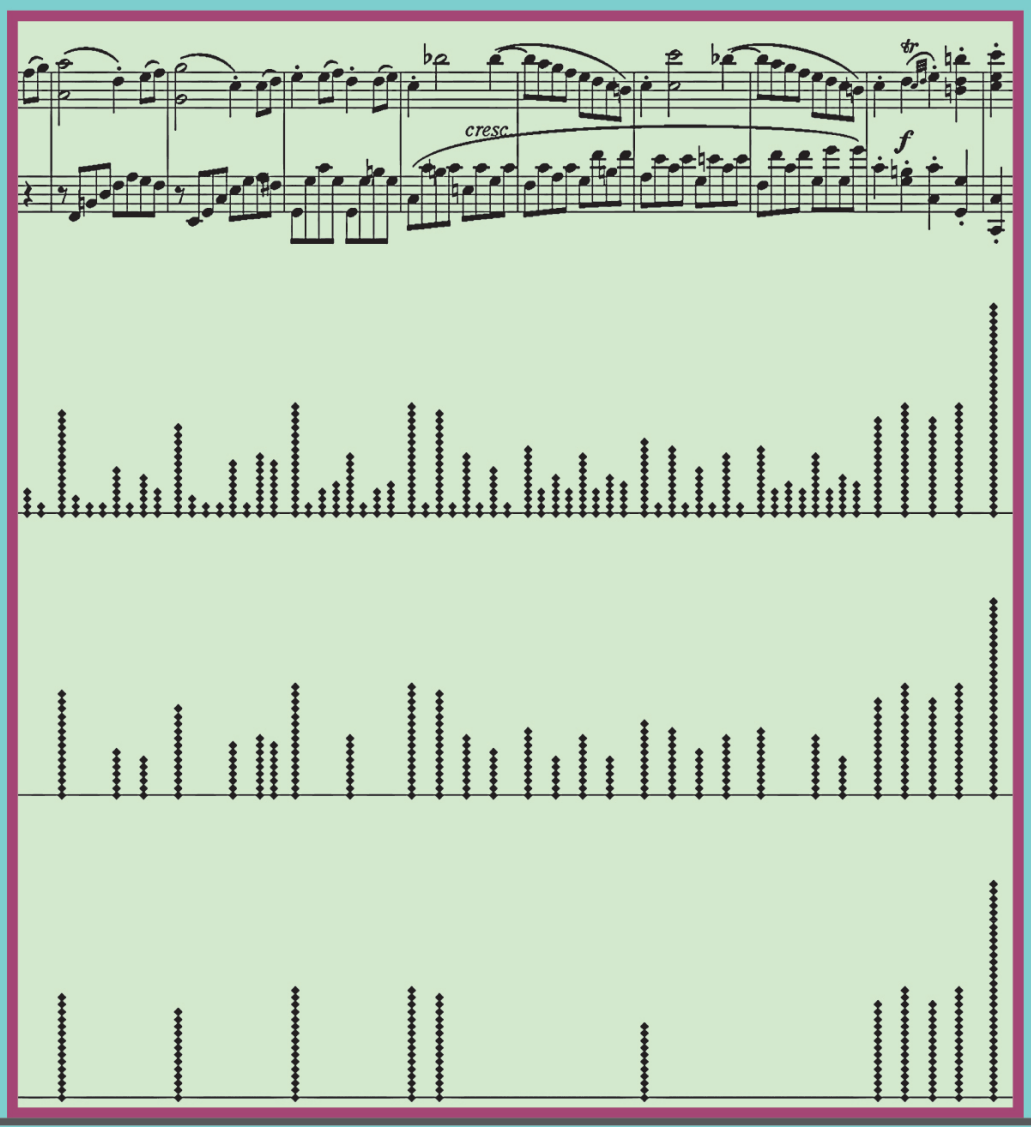
Peter Petersen

Music and Rhythm

Fundamentals – History – Analysis



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Bibliographic Information published by the Deutsche Nationalbibliothek
The Deutsche Nationalbibliothek lists this publication in the Deutsche Nationalbibliografie; detailed bibliographic data is available in the internet at http://dnb.d-nb.de.

Revised and expanded version of the original German edition
„Musik und Rhythmus. Grundlagen - Geschichte - Analyse“
published by Schott Music GmbH & Co. KG, Mainz/Mayence, 2010.

Translated by Ernest Bernhardt-Kabisch.

The cover illustration shows a section of Beethoven’s Sonata
op. 13, 3rd mov., with rhythmic profiles from Ex. 3-126 on p. 272.

Library of Congress Cataloging-in-Publication Data

Petersen, Peter.
[Musik und Rhythmus. English]
Music and rhythm : fundamentals, history, analysis / Peter Petersen. — Revised and expanded version of the original German edition.
pages cm
Includes index.
ISBN 978-3-631-64393-8
1. Musical meter and rhythm. 2. Bach, Johann Sebastian, 1685-1750—Criticism and interpretation. I. Title.
ML437.P4713 2013
781.2'24—dc23

2013024307

ISBN 978-3-631-64393-8 (Print)
E-ISBN 978-3-653-03491-2 (E-Book)
DOI 10.3726/978-3-653-03491-2

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Introduction

To think anew about the subject of »Music and Rhythm« may seem superfluous to many people. The ability to feel one's way into songs, dances, marches, or symphonies, swing along with them and, as it were, ›join in‹ on their movement, is a basic experience of every musician and every listener. Once we have ›gotten‹ the beat, we get a feeling of security enabling us to experience the varied event of a piece of music with pleasure. To sense the beat means for many to ›know‹ the rhythm.

This simplistic view of the matter has long since been controverted. Rhythm, understood as the alternation of long and short tones, was regarded as something multiform and unpredictable, unfolding over the foundation of constant metrical relations. Besides beat accents there are accordingly rhythmic accents that frequently modify the regular alternation of »heavy« and »light«. But these latter accents, which can be produced by a variety of compositional means, were regarded as accessory, whereas rhythm as such was thought to result simply from a sequence of sound durations.

I believe, however, that even this view of rhythm and accent is not altogether satisfactory, because it rests on a too narrow conception of rhythm and, by interpreting accents as extraneous events, fails to integrate them sufficiently into the temporal structure. A comprehensive theory of the temporal relations in a musical composition is overdue, one that is ready to recognize all sound signals as producing durations and consequently also rhythm. We must question the convention of regarding only tonal sequences as rhythm-building while excluding other sound signals like changes in pitch, direction of intervals, volume, or tone color (timbre).

Among the great achievements of European music history is the development of a system of signs that makes it possible to note down the gradations of different temporal distances in ever more refined form (𝅜, 𝅝, 𝅗𝅥, ♩, ♪, 𝅘𝅥𝅯, 𝅘𝅥𝅰, 𝅗𝅥., 𝅗𝅥.., 𝅗𝅥... etc.). These signs stand for individual tones that follow each other contiguously. Musical sequences, however, regularly include also other, secondary durations, e.g., 𝅗𝅥 between dynamic accents (> → >). These intervals, too, can be represented by note values. They are therefore clearly also rhythms. Primary and derivative rhythms can thus be related to each other and then analyzed as rhythmic textures.

It is high time, then, to free the concept of »duration« from its linkage to the individual tone, to expand it to include durations between other sound phenomena (»components«), and thereby to bring into our purview an entire cosmos of additional rhythms (»components rhythms«) that has until now remained occluded by accent analyses. The rhythm/accent relation is replaced by the »components theory« of a new rhythm/rhythm relation. In this way all of a composition's temporal relations are taken into account and comprehended more adequately than before. Accents and even meters are now subordinated to the central concept of »rhythm« and thus are newly evaluated.

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Hypothesis I: COMPONENTS RHYTHMS

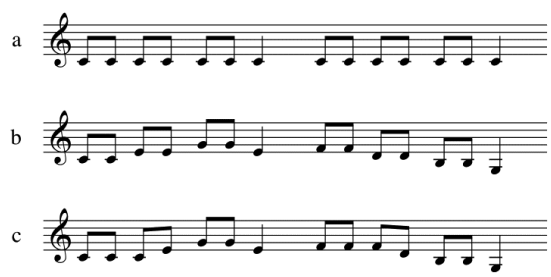
Musical rhythms are dependent on sounds or sound formations and their components (properties). The durations between beginnings and beginnings, or beginnings and ends of sounds, shapes, or components constitute rhythms. Since sounds and sound formations are generally determined by more than one component, it follows that even monophonic melodies have more than one rhythm. The rhythms derived from components are called components rhythms.

***

By means of durational values, sound sequences can be structured rhythmically and coordinated with each other, as they determine the intervals of contiguous tones or notes. There are, however, also temporal intervals between *non*-contiguous tonal phenomena, e.g., the appearance of a new pitch after note repetitions, the recurrence of a melodic phrase, the modification or retention of certain tone colors, degrees of loudness, harmonies, etc. Although temporal intervals thus defined by components are not noted separately, their measure is determinable.

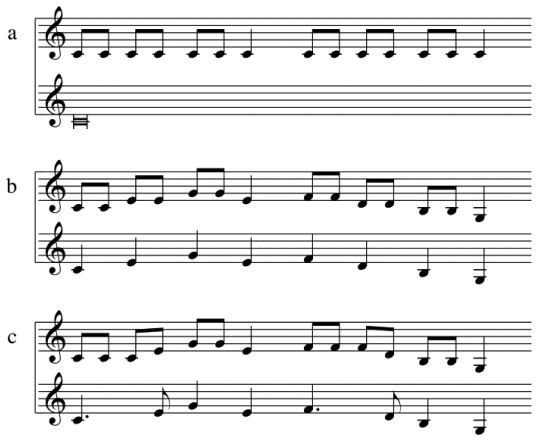
The question, now, is whether and why it makes sense to pay any attention to durations that are not actually noted down. The answer is simple: the components-derived durations are determining parts of the music's temporal structure. Such derivative durations depend quite as much on sound phenomena as noted-down durations do on contiguous tones. Both cases involve rhythms. What that means can be shown by a simple example (Ex. 0-1).

Ex. 0-1



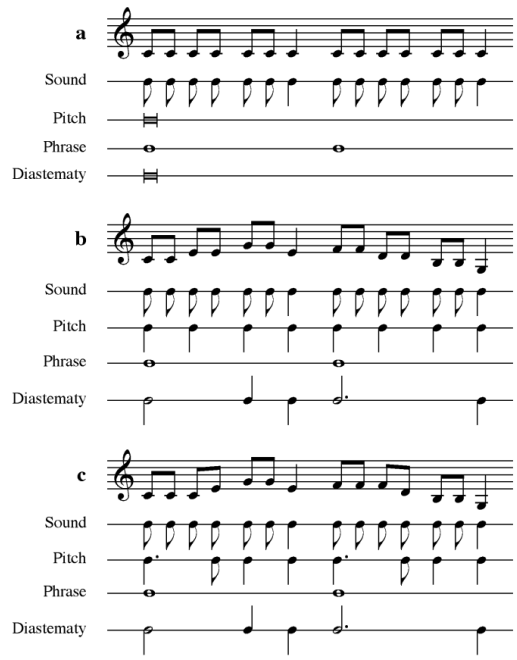
Traditionally one would say of these three variants of a single tonal configuration that a, b, and c have the same rhythm with different melodies. That is true, yet insufficient. The description fits as long as one regards only the noted durations as rhythms, that is to say, only the component »Sound« is considered. If by listening to the melodies in the variants b and c one takes the component »Pitch« into consideration as well, it becomes apparent that there are additional durations and hence additional rhythms. Though not noted down, they are intended by the composer and thus relevant to the temporal structure (Ex. 0-2).

Ex. 0-2



Since in variant a the pitch does not change, no rhythm other than the noted one obtains. In variant b, the melody-forming and repeated pitches C4 E4 G4 E4 F4 D4 B3 G3 follow contiguously in quarter note rhythms, and one hears this rhythm of the pitches (♩ ♩ ♩ ♩ etc.) simultaneously with the rhythm of the notes (♪ ♪ ♪ ♪ ♪ ♪ ♩ etc.) retained from variant a. In variant c, the sequence of pitches is slightly altered, inasmuch as the change from C4 to E4 and from F4 to D4 is delayed by one eighth. The result is a modified pitch rhythm (♩. ♪ ♩ ♩ etc.).

Ex. 0-3

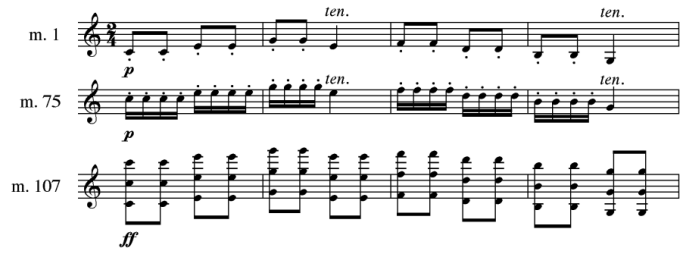


As simple as the example I have constructed is, two additional components are of rhythmic consequence in these melodies: »Phrase« and »Diastematy« (Ex. 0-3). The noted rhythm of twice six eighths plus one quarter note causes two phrases to emerge that here have the same duration (𝅗𝅥 𝅗𝅥). This rhythm of phrases, too, is heard simultaneously with the rhythms of tones and pitches, while the up and down of the melodies, i. e., their diastematy, exhibits a not entirely uniform alternation of the crest and keel tones (the top and bottom tones of directional change) that structures the time and generates its own component rhythm (𝅗𝅥 ♩ ♩ 𝅗𝅥. ♩). The three melodies are thus by no means rhythmically identical: four separate components go into the making of rhythms and produce a texture of rhythms endowing each melodic variant with an individual character of its own.

A look at the original of one of the melodic variants, the second movement of Joseph Haydn's Symphony in G No. 94, confirms that real rhythmic changes can be produced by individual components, while other components are kept constant (Ex. 0-4)

Ex. 0-4

Haydn, Sinfonia in G No. 94, 2nd mov.



In the theme of the variations movement (m. 1), the components »Articulation« and »Dynamics« are added to those already cited. The rhythm of the notes articulated explicitly (*staccato* and *tenuto*) concurs with the basis rhythm of the component »Sound«, because every note has an articulatory mark. The constant volume mark (***p***) is (here) rhythmically irrelevant (but see m. 33, not included in Ex. 0-4).

M. 75 works with the basis component »Sound«, the rhythm of the tone entries changes (♪♪♪♪ etc.), but pitch, phrasal, and diastematic rhythms remain constant, and the articulatory rhythm in turn adapts itself to the entry rhythm.

The situation is similar at m. 107 in that the component »Sound« causes all the tone entries to appear equalized (16 ♪) and the quarter note caesuras are omitted. Here, too, the rhythms of the pitches and of the crest and keel notes remain in force, while articulatory rhythm does not apply and the dynamic situation (everything is ***ff***) is rhythmically insignificant.

***

Hypothesis II: RHYTHMIC WEIGHT

Components rhythms can be isolated in analysis, but in reality they happen simultaneously and interpenetrate each other. Together they constitute the rhythm of a monophonic or a polyphonic composition. If rhythmic durations change, and if different rhythms coincide at certain points, rhythmic weighting results. The distribution of the rhythmic weights within the temporal continuum is subject to the composer's calculation.

***

Components theory and analysis serve the purpose of exploring the rich rhythmic events ›between the notes.‹ In an analysis based on components, rhythms are determined independently of the laws and limits of mensuration. In the process, differences in the weighting of specific moments

in the course of musical events present themselves. This becomes apparent when one relates different component rhythms to each other and discovers that some of these rhythms coincide at certain points. The more components occur simultaneously, the more strongly the attention of listeners and performers is focused on the moment in question.

For this phenomenon of accumulated component durations resp. rhythms I have coined the term »rhythmic weight«, analogous to the concept of »metric weight.« Rhythmic weight is owing to a) the length and shortness of durations and b) the accumulation of several component durations resp. rhythms and their relative weights. That long durations are to be accorded more weight than short ones is a generally recognized axiom in rhythm theory; hitherto ignored has been the fact that rhythmic weight is increased by the coincidence of multiple component rhythms.

Rhythmic weights must not be misconstrued as accentuation, let alone dynamic amplification. If a specific volume is called for, that constitutes an independent component, whose impulses enter into the rhythmic weight but are not identical with it. As an analogy we may use the concept of mass in physics, one of whose properties it is to attract other masses. Large rhythmic weights are therefore points of attraction for the attention of listeners and players, whether they are loud or low. As we, in listening, register the interplay of the components, the moments at which several of them are simultaneously active send forth special signals that draw our attention and make them, so to speak, ›weightier‹ than others.

In the tone entries (»Sound«), the durations are ascertained on the basis of the note values. The smallest value is the sixteenth, all larger values are weighted according to its multiple by adding notes above the basis note (columns of notes).

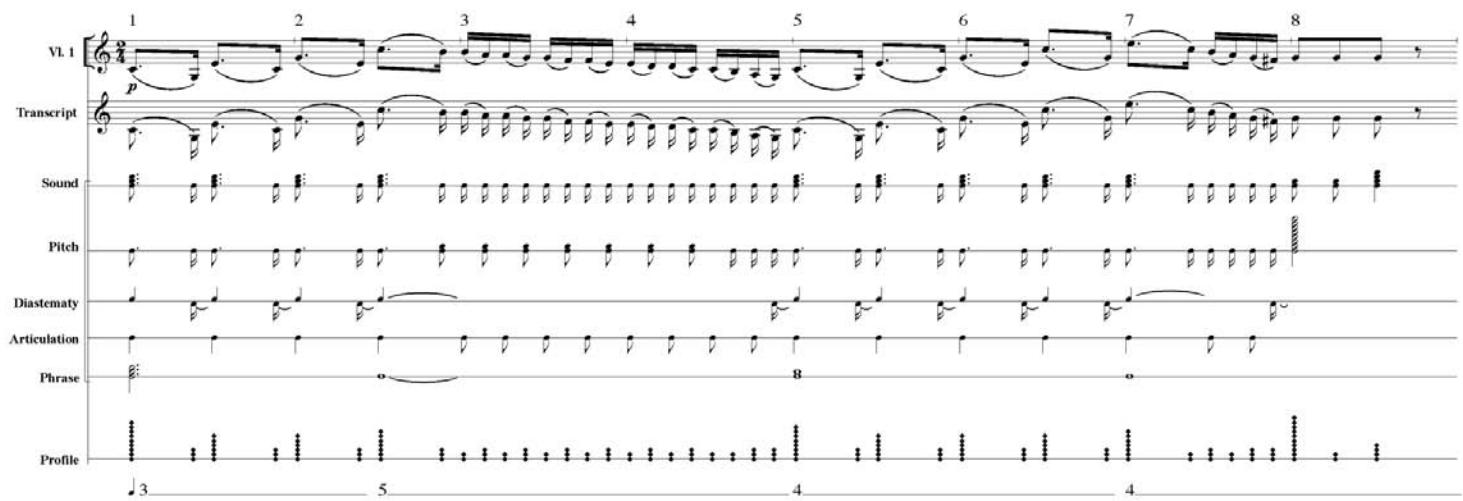
The component rhythm »Pitch« largely coincides with that of the tone entries. An exception occurs in the repeated notes. Here two notes each are combined and the values of the repeated notes are added to the pitch holder. The result in the chain of 16ths in m. 3 and 4 is a doubly weighted syncopated rhythm of the pitches. The durations of the not repeated pitches (mm. 1-2 and 5-7), on the other hand, are singly weighted.

In the component »Diastematy«, rhythms are produced by crest and keel notes. For reasons of method I include all such turning points, regardless of whether they are approached and relinquished by leaps or merely by steps, whether they are emphatic or merely incidental in nature. Crest notes (stems pointing up) lead to rhythms in quarter notes (beginning of phrases), as do the preceding keel notes (stems pointing down).

The only »Articulations« in this example are the legato slurs, resulting in very simple rhythms composed of quarter notes and eighths. The legatos support the meter, or rather, in this example, the dominating binary motion. Interestingly, the articulation eighths in m. 3 and 4 are complementary to the syncopated eighths of the pitch rhythm.

The component »Phrase« exhibits an unusual feature: the first phrase of the eight-bar repeat period is divided into 3+5 𝅗𝅥., the consequent into 4+4 𝅗𝅥.. The reason for this modification is to be sought in the differently positioned top notes (C5 in m. 2 vs. E5 in m. 7). I have differentiated the weight of the (partial) phrases according to their validity's duration (simple, double, triple).

Ex. 0-5 Haydn, Sinfonia in G No. 94, 2nd mov., mm. 115-122, Vl. 1



A further passage from the Haydn movement maybe adduced (Ex. 0-5) to exemplify the phenomenon of rhythmic weight and to consider the latter's impact on the overall compositional structure. In the fourth variation (mm. 115-122), the violins play a free variant of the theme, during which not only the note values but above all the melodic contour and therefore also the rhythm and the internal structure of the period are modified in comparison with the thematic melody. If beneath this melody and its rhythmic »transcript« one inscribes all of the component rhythms, the resulting schema will be that of a »rhythm score«.

The line »Profile« sums up all of the component durations resp. rhythms. The more components are active at any point in sequence – that is to say, contribute a rhythmic impulse – the higher will be the rhombus towers. They symbolize the rhythmic weight that obtains at these points.

The most conspicuous detail in this rhythmic profile is the new start of the melody in m. 5. By itself this does not

signify much, as one can recognize the beginning of the consequent also directly from the voice as Haydn has written it down. Even so, the comparison of the first and second phrase reveals some significant differences, the most important of which has manifested itself already under the component »Phrase«, namely the divergence in the structures of first and second phrase.

We can see from the rhythmic »Profile« that the rhythm of the tone entries (♪. 𝅘𝅥𝅯) is supported by several components so that it stands out markedly as the main rhythm, weighted six- to eightfold. The following chains of sixteenths seem as a result to be overshadowed by this power center and dwindle into (nearly) contourless downward movements, until the second phrase repeats the opening. Since the descending melody initially sets in after the fourth quarter note, i.e., in the middle of the second bar, whereas the second time round it does so only in the fifth quarter note, i.e., following upon the downbeat of m. 7, the rhythmic »Profile« illustrates the uneven length of the partial phrases, which is already predetermined by the position of the top notes. Hereby it is significant that only low weight values obtain in the beginnings of m. 3 and 4, so that the gravitational centers of the measures are obscured, wheras in the second phrase all the beginnings of the measures are strongly weighted rhythmically, so that the accentual order of the 2/4 beat is clearly manifested.

It should be recalled that the above analysis deals only with the main voice. The other voices are not taken into account, so that additional important components, such as »Harmony« (including suspension dissonances and cadence patterns), »Timbre« (including octave registers) and »Texture« (e.g., theme entries) are left aside. These components would bring the total profile more closely in line with the schema of the 2/4 time. Even then, however, the specific rhythm of the main voice would be retained and effective within the total structure.

***

Hypothesis III: RHYTHM AND METER

Composing with sounds and rhythms and the distribution of rhythmic weights can be aimed at making regular alternations of durations and weights audible and thereby approximating, or corresponding to, the notion of metrical models (modus, tempus, meter). Isometry – the crucial characteristic of metric orders – is realized by rhythmic means. Kinds of meter are thus not merely set in advance but are objects of compositional arrangement.

***

I have so far left out meter and bar lines. To get to the bottom of the rhythmic conditions of a piece of music, it is advisable to disregard the meter for the nonce. In Haydn's time, as is generally known, a concept of beat had established itself that distinguished between »duple« and »triple« times, and between »good« and »bad« beats. Hand in hand with that went a system of notation that inscribed rhythms in accordance with the measure – as in the tie across a bar line, or the drawing of beams only within the limits of the measure and the time positions. Both the idea of an evenly pulsating alternation of heavy and light beats and the notational forms dictated by the meter are apt to distract both eye and ear from the actual rhythmic conditions. To put it more succinctly: whoever reads or plays only by the meter misses the temporal structure actually composed. No good musician does that. Consciously or unconsciously, he also hears the unwritten rhythms, as well as the fine gradations between rhythmic weights, and gives expression to them.

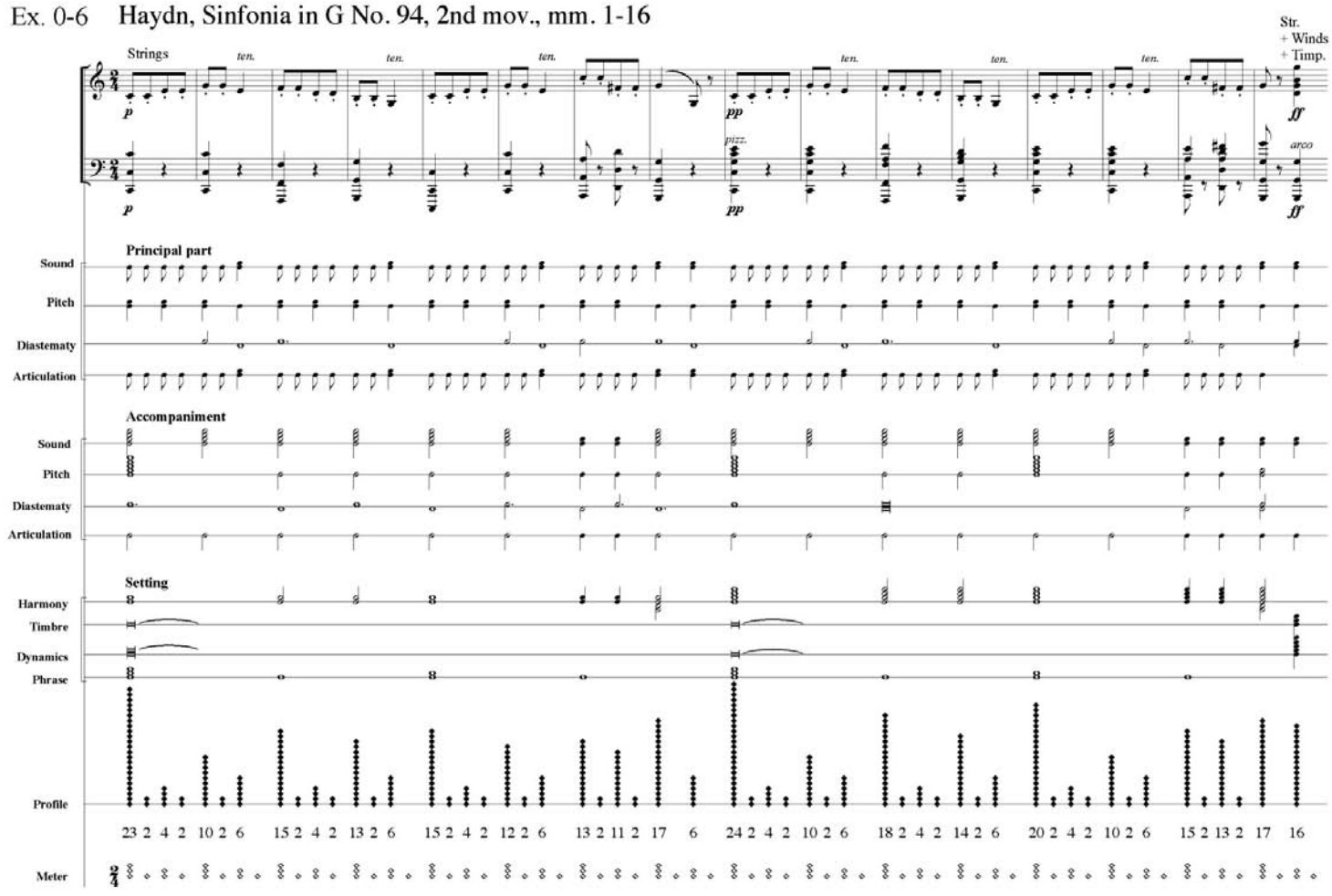
To illustrate the relation of rhythmic and metric weights, we will once more take a close look at a section of the Haydn movement cited earlier. We will thereby also be able to introduce an important additional component, which generally obtains only in compositions of more than one part: »Harmony«. The section in question is that of the first sixteen measures of the movement (Ex. 0-6). The top accolade reproduces, in compact form, the orchestral passage with every detail (analytical particello). For the rhythm analysis, I distinguish here betwen »Principal part«, »Accompaniment«, and »Setting« (second, third, and fourth accolades). The systems containing the component rhythms are found within the accolades. The bottom line depicts the rhythmic »Profile« along with the schema of the 2/4 time. Let us explicate this rhythm score.

The rhythm of the »Principal part« has already been delineated: it can be simply taken over at this point, except that the components »Dynamics« and »Phrase« are neglected here, as the respective results apply to the entire passage of the composition and are therefore entered in their place (4th accolade).

In the »Accompaniment«, which in the first eight measures is monophonic in double octave unison and only then exfoliates into full chords, only the bass part is considered with regard to the components »Sound« and »Pitch.« For the component »Diastematy«, however, the upper voice of the chorded part is also taken into account (mm. 5-8). The component »Articulation« applies to all the tones of the accompaniment, for the rests here are articulation rests in that they serve to shorten the sound of both the octaves and the chords.

In the bracket »Setting«, the components »Harmony«, »Timbre«, »Dynamics«, and »Phrase« all apply and are therefore taken into consideration. The rhythm of the »Harmony« (changing harmonic function) is identical in both phrases but should be weighted differently in the first eight measures than in the second.While there are only two parts (principal voice and bass line), a weight value of 2 can be assigned to each change in harmony, a value of 4 as soon as the full chords set in. The two authentic cadences in the dominant (mm. 8 and 16) are entered with the value 2 (a cadence in the tonic, which does not yet occur here, would have the value 3).

Ex. 0-6 Haydn, Sinfonia in G No. 94, 2nd mov., mm. 1-16



The »Timbre« changes twice, in m. 9 (*pizz.*) and in m. 16 (arco; winds and tympani); the changes are accompanied by changes in volume (»Dynamics«, ***p*** – ***pp*** – ***ff***). Depending upon their length, the »Phrases« are weighted with 1, 2, or 3 points.

As is to be expected from this theme, all of the component rhythms have very simple structures. Thus it comes as no surprise that the rhythmic »Profile«, in which these rhythms are totaled, also displays a large degree of regularity. The comprehensive rhythmic profile clearly mirrors the prescribed 2/4 time, though the rhythms of the individual components do not always do so. A comparison of the rhythmic with the metric profile (»Meter«) reveals that in the rhythmic profile the second position in the measure is always weighted more lightly than the first, and that the eighths located between the beats have even lower values – which corresponds to the 2/4 time. The rhythm thus brings the graded accent meter to the fore, and that without the weights of heavy and light beats of the meter being figured in.

The purely rhythmically generated 2/4 time, however, appears in a living, that is, variable form, as the heavy and semi-heavy positions slightly differ from each other. It is conceivable that compositions of a greater complexity than this Haydn movement exhibit the metric structure, too, may be subject to greater fluctuations than the time signature would lead us to expect. The method of components analysis enables us to describe such degrees of rhythmic-metric weights with some objectivity. By this method we can also document well-known phenomena such as hemiola and hypermeasures, as well as demonstrate latent time changes and heterometric structures in the course of a composition. Meter is recognized as part of rhythm, as an object of compositional creation and not merely a norm or convention.

***

This book will substantiate and apply the components theory I have developed. In Part One I will explain in detail what components rhythms are and what relevance they have had in the course of music history. Starting with the basis component »Sound«, the most important and most widely present components will be exemplified: »Pitch«, »Diastematy«, »Articulation« (also »Ornament«), »Dynamics«, »Timbre« (including degrees of brightness), »Harmony« (as well as cadences and dissonances), »Texture« (e.g., distances between entries of voices), »Phrase«, and »Prosody« (syllabic weight, verse meter). The second Section of Part One will elucidate the concept of »Rhythmic Weight« through an analysis of the Allegretto movement of Beethoven's Seventh Symphony. The rhythm of its three themes will be precisely differentiated, and in turn again correlated, by means of components analysis. The result will be the realization that while Beethoven wrote this processional march in 2/4 time, he in fact composed it in varying meters. Part One concludes with a third section, entitled »Rhythm Aspects«, dealing with several specific problem areas of musical rhythm, such as »Augmentation« and »Diminution«, as well as »Isometry«, »Heterometry«, and »Symmetry«. Under the rubric »Rhythmic Characters«, we will also bring up some historically established phe-

nomena such as »Upbeat«, »Syncope«, and »Hemiola«, which can be regarded as paradigmatic for the devising of rhythmic characters (e.g., in dances). This section, too, will be interspersed with (mostly brief) examples from the history of music from the Middle Ages to the present, so as to reflect the respective historical contexts conditioning the components.

In Part Two I want to present rhythm analyses of selected examples from the music of Johann Sebastian Bach for discussion. Here analysis will thus be applied to a group of works of a unified personal and period style. A side benefit will of course be yet another demonstration of the exceptional variety of Bach's music – in this case in reference to its rhythm. The juxtaposition of very simple and highly complex rhythmic processes, regardless of generic differences, in Bach's music may serve to remind us that rhythm, like every other compositional means, is at the service of a work's central idea, of a certain expressive need, of a musical dramaturgy. Complexity is not an end in itself, no matter how much, especially in Bach, it time and again evokes our wonder.

Part Three of the book, finally, presents a critical inspection of older as well as current rhythm theories. The purpose is not to present a comprehensive account of existing theories of rhythm, something for the most part already done by others. Rather, I wish to examine the respective texts solely from two aspects: whether theory and analysis are adequate to the locus of the composition in its own time, and, whether components rhythms and rhythmic weight – even if under other names – are reflected in theory construction and analysis. With respect to the first question, one can't avoid the sobering assessment that the music theory of a given era hardly ever attains the spiritual level of the contemporary masterworks. As for the second question, no simple anwer is possible. Reflections on what musical rhythm is and how to describe it have increased enormously during the last fifty years and – especially in the Anglo-American world – have frequently attained a degree of differentiation that makes once famous approaches from the 19th and early 20th centuries appear obsolete (e.g., Hugo Riemann).

What I call »component« others address under the terms »accent«, »factor«, »element«, »parameter« or similar. Examination of these writings will show, however, that accents etc., when included in rhythm analyses, have mostly ranked only as accidental to rhythm, whereas they actually have rhythm-creating import once they are recognized as musical components. Components analysis opens up an avenue that makes it possible in principle to consider each and all sound phenomena occurring in a composition under the concept of rhythm.

This discussion complex in Part Three, reserved for the end, will also disencumber the exposition of my theory in the earlier parts. There I largely dispense with any discussion of already existing analyses of the examples selected, while this is now the very subject. Concerning the examples, personal knowledge of the repertoire and – admittedly – subjective preferences dictate and restrict their choice. My sole aim was to find illustrations that will clearly document and support the facts of each case. I could readily cite numerous other examples, and readers will likewise frequently think of musical passages that could replace the ones chosen.

***

The purpose of the components theory is to refine our way of looking at rhythm and the method of its analysis beyond the level hitherto attained. There is a real dearth of nuanced musical analyses under the aspect of rhythm. It may be symptomatic that there are several accounts of the history of rhythm theories,[1] but hardly any attempts at a history of musical rhythm.

One characteristic, above all, pervades the older analyses of musical rhythm: the conception of time flow as a unilinear process. In fact, however, there are always several events taking place simultaneously during the passage of time. In music these are sound events and processes of change that can overlap and interpenetrate. They are coordinated, to be sure, but their beginnings and ends do not by any means have to coincide. In contrast to this, an inclination can be observed to this day among theoreticians of musical rhythm to make imaginary vertical cuts through a score as a way of getting at the secret of its organization. If such cuts are often already problematic in formations of medium and extended length, that is even more the case in analyses of forms of shorter extent, in other words, of rhythmic processes.

Several reasons may account for this narrow view of rhythm. To begin with, there is the tradition of classical prosody, which until the 18th century dictated the description of rhythms and meters and hampered the development of a specifically musical method of rhythmic analysis. A spoken verse is unilinear, so that it may seem adequate to divide it into stresses and unstresses and metrical feet. For the rhythmic content of single melodies, let alone compositions in many parts, however, this analytic instrumentarium is quite deficient and incommensurate. It cannot do justice to the multiplicity of rhythmic components and to the structural wealth of a developed musical art generally.

A second reason may have to do with the way European music is written. Notation became necessary for singing and playing as soon as oral tradition no longer sufficed or the composer-as-author appeared, who wished to be heard here and there in his absence. But notation is practice-oriented and not adapted for the content of a composition.

[1] Wilhelm Seidel, *Über Rhythmustheorien der Neuzeit* (Bern / München, 1975); *Geschichte der Musiktheorie*, ed. Frieder Zaminer and Thomas Ertelt [since 1992] by commission of the Institut für Musikforschung Preussischer Kulturbesitz, Berlin, 15 vols. (Darmstadt 1984 ff.). *The Cambridge History of Western Music Theory*, ed. Thomas Christensen, 3rd print. (Cambridge University Press, 2006).

To slightly oversimplify, it indicates which tones a musician is to pluck and how long to hold them. Since one can identify short and long notes directly from the various voices, such durational sequences were, and still are, regarded as *the* rhythm of melodies and polyphonic compositions. Rhythms that depend on other components than sound entries are not noted down as such and thus were overlooked by theoreticians. Yet there cannot be any doubt that they are part of the composition. I know of no theoretician of the 16th to the 19th century who asked about these *un*noted rhythms, while many have written about the notation of rhythms of tonal duration, rules of mensuration, types of measures, and stresses.

A third reason for the relative disregard of components rhythms has to do with the fact that, with the development of polyphony, rules of mensuration had to be established to coordinate the voices and to regulate their chords with exactitude. Thus the notion of a grid extending vertically through the texture of voices became paramount, which established itself early on in the *conductus* (in contrast to *motet*) notation. But this system dictated by performance practice was apt to distract from the actual, aesthetically intended processes. The motet notation, with its independent fields of voices, is really the more adequate form of representation when it comes to musical, and hence also rhythmic, meaning.

Metering brought about the practice of beating or treading time. The metronome, invented in the early 19th century, further mechanized this practice. The habits that musicians display in this connection may play a role as an additional reason for the tendency to interpret musical sequences metrically more than rhythmically. Even outside of lay performances, where the principal concern often is not to ›get out of step,‹ the oppressive influence of a conductor's beating of time on the playing and hearing of a piece of ensemble music is not to be underestimated. At the same time I want to put in a good word here for the often maligned guild of orchestra leaders. Good conductors have such a large and differentiated repertoire of movements and gestures that they can embody and express countless rhythmic events and processes contained in a composition besides the beaten time. Thus they can not only prevent the listening by meter but can effectively implement the complex rhythmic life that is in music.

***

The components theory was developed with reference to the pulse-determined, polyphonic, scripted music of the European sphere. Whether this approach can also serve the analysis of the music of other cultures or genres will have to be decided by the respective cognoscenti.

Pulse here refers to isometric sequences of smallest durations by which larger durations can be measured and brought into relation to each other. On the basis of the isometric pulse both heterometric and isometric (occasionally even symmetric) rhythms can be formed. If there is no metric pulse, the components remain effective but there is no standard to determine the durations and their relations to each other. Generally excluded are *senza misura* passages such as cadenzas or free-flowing fantasies, as well as miniphenomena like trills and tremoli – not to mention certain avant-garde compositions that are presented in spatial notation. Not that such free tone sequences have no rhythm, but such rhythms would have to be described differently.

Excluded from consideration here is also the subject of musical interpretation, which in our age of analog and digital music recordings could well be the object of analysis and actually also is. Everyone can observe that individual interpreters of one and the same piece not only choose different tempi but also shape the inner rhythmic structure of a composition more or less freely. Such deviations from the noted rhythmic values are principally measurable and determinable. But the masses of accumulating data quickly become unmanageable, since obviously not only different interpreters would produce different data, but even one and the same interpreter certain divergences would be observable from recital to recital. This diversity is part and parcel of the artistic substance of every good musical performance; it constitutes the vitality and the fascination of individual interpretations. But the expense of such an investigation would be immense, quite apart from a number of methodical issues that would first have to be clarified. I therefore dispense with interpretations of individual musicians. My hope is that the rhythmic analyses and rhythmographic procedures will prove stimulating for music performers and will further refine their playing and approximate it to the intention of the composer.

***

Taking up a casual remark of György Ligeti's, I start out from a very simple, formal concept of rhythm. Ligeti once defined musical rhythm as follows:[2]

»Rhythm« signifies any temporal sequence of tones, sounds, sound formations, whereas »meter« refers to a more or less regular structuring of the temporal process. Thus a Gregorian chant has rhythm but no meter. »Rhythm« (and generally »rhythmics«) is present in any kind of music; not just the »pulsating« rhythm (i.e., the one subordinated to, and unfolding within, meter) is rhythm.

If one were to derive a formal definition from this, one might say: the term »Musical Rhythm« refers to sequences of durations that are derived from shaped sound events. But I don't assign much importance to this or similar definitions. They simply provide an operational basis, on which rhythmic events in concrete compositions, whether simple or complex, can be described.

[2] Letter of György Ligeti from April 18, 1974, to the student Kai Jacobs, who wrote to him on the occasion of a rhythm-lecture at the Institute of Musicology at the University of Hamburg.

The methodic frame of this study is a phenomenological one. My point of departure is the music itself, not the thinking about music, let alone the musical tools-of-the-trade books, which are legion. Since music is an artifact, not a natural product, the methodical procedure is at the same time oriented towards the aesthetics of production. Although the analyst is initially a recipient, the perspective he adopts should be that of the composer.

Composing can be understood as a form of artistic work requiring continual decision-making. The choice of sounds or sound formations is one category of decisions, the consideration as to when this sound or sound formation should enter, be modified, or recur, is the other. Components are among the *what* alternatives, durations among the *when* alternatives. *What* and *when* questions thus determine every rhythm analysis, and the distincton between these two kinds of interrogation is essential.

To regard the duration of a tone or sound as one of its properties is to overlook this categorical differentiation, which already Aristoxenos conceptualized as the »rhythmicized« and the »rhythmicizing«. In the referential frame of space and time, sounds and sound shapes belong to the spatial, durations and rhythms to the temporal dimenson. If durations, therefore, can be neither components nor properties of sounds or sound formations, but, on the contrary, condition these in their succession and mutual interpenetration in the temporal continuum, they cannot be said to be tied to individual noted tones. The concept of »duration« is free vis-à-vis the entirety of the sound event, it can be used to describe any rhythm, including durations, between any components whatever, between directly contiguous tones or sounds, between crest and/or keeltones, between sharp and soft modes of attack, between shades of loudness or different volume areas, between instrumental and vocal timbres and their grades of brightness, between harmonic functions, between suspensions and other dissonances or altogether free tone clusters, between homophonic and polyphonic passages, along with any conceivable types of texture, between entries of phrases and themes, etc.

Thus construed, musical rhythm corresponds to musical form. It is no more than a convention to analyze large units, such as arias or symphonic movements, under the rubric of form, and small units like motifs and phrases under the aspect of their rhythm. Both cases involve the formation of sounding material with more or less free use of any and all components available in a given period. To accept this does not mean to posit the terms rhythm and form as synonymous. The difference in temporal dimension as regards rhythm and form remains meaningful and, not least, also psychologically relevant. But to raise rhythm analysis to the rank of formal analysis may lead to our approaching rhythmic structures from the same multiplicity of angles long since customary in the description of musical forms.

Besides, it should not be forgotten that rhythm constitutes only one aspect of music. The point of departure for any musical event is sounds and sound shapes. They have a meaning of their own, and each has a specific character. A tone, a sound, a chord, produced by the human voice or by an instrument, is an event that impresses us and which we remember and recognize. An aesthetic effect proceeds from sounds before any temporal order comes into play. Even when sounds and sound shapes are part of a rhythmic structure, they retain their own quality and efficacy. Though all components of a tone or sound composition are rhythmically relevant, the rhythm cannot by itself represent the entire composition.

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I have been occupied with matters of rhythm for more than thirty years. In a series of essays[3], I have developed

[3] »Die ›dichterisch-musikalische Periode.‹ Ein verkannter Begriff Richard Wagners« [»The ›poetic-musical period‹. A neglected concept of Richard Wagner«], in *Zur Musikgeschichte des 19. Jahrhunderts* (Hamburg, 1977), 105-123; »Brahms und Dvořák« [»Brahms and Dvořák«], in *Johannes Brahms. Symposion Brahms und seine Zeit*, Hamburg 1983 (Laaber, 1984) 125-146; »Rhythmische Komplexität in der Musik J. S. Bachs« [»Rhythmic Complexity in the Music of J. S. Bach«], in *Studien zur Systematischen Musikwissenschaft* (Laaber, 1986) 223-246; »Rhythmik und Metrik in Bartóks Sonate für zwei Klaviere und Schlagzeug und die Kritik des jungen Stockhausen an Bartók« [»Rhythm and Meter in Bartók's Sonata for Two Pianos and Percussion and the Critical Comments of the Young Stockhausen on Bartók«], in *Musiktheorie*, 9 (1994) 39-48; »Rhythmische Komplexität in der Instrumentalmusik von Brahms« [»Rhythmic Complexity in the Instrumental Music of Brahms«], in *Johannes Brahms. Quellen - Text - Rezeption - Interpretation* (München, 1999), 143-158; »Die Rhythmuspartitur. Über eine neue Methode zur rhythmisch-metrischen Analyse pulsgebundener Musik« [»The Rhythm Score. On a New Method of Rhythmic-Metric Analysis of Pulse-Determined Music«], in *50 Jahre Musikwissenschaftliches Institut in Hamburg* (Frankfurt / M., 1999), 83-110; »György Ligetis *Zehn Stücke für Bläserquintett* (1968)« [György Ligeti's Ten Pieces for Wind Quintet], together with Albrecht Schneider, in: *Musiktheorie* 18 (2003), 195-222; »Der komponierte Tanzschritt. Rhythmusanalyse gemäß der Komponententheorie und ihre Relevanz für die Körpergestik im Tanz« [»The Composed Dance Step. Rhyhmic Analysis After the Components Theory and its Relevance for Gestural Movements in Dance«], in *Die Beziehung von Musik und Choreographie im Ballett* (Berlin, 2007), 35-55; »Nochmals zum Tanz-Quodlibet im ersten Akt-Finale des *Don Giovanni*« [»The Dance Quodlibet in the First-Act Finale of *Don Giovanni* once more«], in *AfMw* 65 (2008), 1-30; »›*Jede* zeitliche Folge von Tönen, Klängen, musikalischen Gestalten‹ hat Rhythmus. Über die Rhythmik in Ligetis Cembalostück *Continuum*« [»›Rhythm Signifies Any Temporal Sequence of Tones, Sounds, Sound Formations‹. On Rhythm in Ligeti's Piece for Harpsichord *Continuum*«], published on internet page http:// www. saitenspiel. org; »Zur Rhythmik in den Messen Josquins (und Bauldeweyns). Isometrische Phrasenwiederholungen und ihr Verhältnis zur mensuralen Ordnung« [»On Rhythm in the Masses of Josquin (and Bauldeweyn). Isometric Repetitions of Phrases and their Relation to Mensural Dispositions«], in *Musikkulturgeschichte heute* (Frankfurt / M., 2009), 9-29; »Primäre und sekundäre Dauern in der Musik. Über einige Grundzüge der ›Komponententheorie‹ [»Primary and Secondary Durations in Music. On some Outlines of the ›Components The-

hypotheses and substantiated concepts that can now hopefully stand up to critical discussion. It would be desirable for such a discussion to get underway so that an as yet unduly neglected area of music theory can begin to take its proper place in scholarly discourse.

ory‹‹], in *ZGMTH* 8/3 (2011), online: http://www.gmth.de/zeitschrift/artikel/667.aspx/

Part One: Theory of Components

Rhythms and Components

Definition of Terms

Sounds are the stuff of which musical structures are made. Like other objects of perception, they are subject to the categories of space and time. Because they are experienced as fleeting and intangible, we easily overlook the fact that sounds are material objects. Yet one only needs to think of membranes or other vibrating bodies that condense and compress and rarefy air and leave their traces as sensations of pressure to realize the bodily and therefore spatial nature of sounds.

This actually banal signification of sounds as »things« is important to our inquiry concerning rhythm and music insofar as it helps distinguishing the spatial character of the phenomenon of sound from its manifestation in the temporal continuum. Leibniz's graphic saying that there was »coexistences« and »successions« in all things[4] means in our context that sounds and rhythms are subject to different modes of perception. About sounds we ask »what,« about rhythms we ask »when.«

»What« questions provide access to the entire universe of the audible in music: sound and tone as simple events; harmonies, chords, tone sequences as complex formations. Every individual sound incident and every sound event can be described in terms of its specific features. Individual tones are determined by their pitch (frequency), color (sound spectrum), degree of lightness (octave position), loudness (dynamic), form (articulation), etc. Chords are distinguished according to their pitch content, interval structure, octave level, type of inversion, function, etc. Melodic figures may be determined by pitch content and tonal systems, diastematic course, rhythm and meter, extent and tempo, semantic (thematic, figural) substance, etc. All of this is potentiated by the number of voices and/or performers. From the point of view of the composer, single tones and sound formations with all their characteristics constitute »components.« Components are the materials with which the composer works.

»When« questions address the temporal order of musical configurations. When does a sound or one of its components appear? When does it stop, or change, or is overlapped? And what durations elapse between these points of time?

Durations are dependent on sound phenomena but, owing to a categorical difference between space and time, are not really part of them. It is therefore questionable to count the duration of a tone as one of its properties.[5] The concept of duration is needed for the determination of all temporal relations, whether these are measured in regard to individual tones/sounds or to their components, or with reference to composite sound formations of whatever extent.

Like the concept of »duration« that of »rhythm« belongs to the complex of »When« questions. Rhythms in music can appear only in dependence on sound; visual rhythms observable in the bodily movements of performers or conductors are ignored, as are special instances of rhythmic visualizations on the theater.[6] A piece of music is said to »have« a rhythm, not to »be« one. Even though it is customary in common parlance to refer to a knocking signal as a rhythm, strictly speaking one should say that the series of knocking sounds »follows« a certain rhythm rather than that it »is« one.

The simplest definition of »rhythm« is »a rhythm consists of successive durations.« Since there are durations of different dimensions – in music they reach from tones of different frequencies all the way to the span of entire compositions – classes of durations have to be limited to a medium measure so as to hit the temporal window typical for rhythm between perception of pitch (micro-durations) and perception of form (macro-durations). This medium-sized measure has always been derived from the human body, e.g., from steps or breathing. The borders between the perception of pitch, rhythm and form are fluid.

By relating the concepts »component«, »duration« and »rhythm« to each other, one attains an enlarged perception of what is »rhythmic« in music. The exclusive attention to the written values of tones or sounds will have to be given up so that both eye and ear are freed for the reception of rhythmic phenomena not directly derivable from the notation. If in a sequence of eighths played by string instruments every other note is to be played pizzicato, a rhythm of quarter notes results that is no less real than the basic rhythm of eighths. Such »components rhythms« are both numerous and independent of the basic rhythm of the notes. They point to the »coexistences« in Leibniz's »space«. We hear and experience them simultaneously. Applied to the time continuum, these rhythms form a fluid

[4] Leibniz to Clarke: »As for my Own Opinion, I have said more than once, that I hold *Space* to be something *merely relative*, as *Time* is; that I hold it to be an *Order of Coexistences*, as *Time* is an *Order of Successions*.« In *A Collection of PAPERS, Which passed between the late Learned Mr. LEIBNITZ, AND Dr. CLARKE, In the Years 1715 and 1716. Relating to the PRINCIPLES OF Natural Philosophy and Religion. […] By Samuel Clarke, D. D. Rector of St. Jame's Westminster.* […] LONDON […] MDCCXVII. Internet-Edition: http://books.google.de/, p. 56.

[5] It is true that nothing exists without duration and that therefore no tone/sound can appear without duration either. But as soon as we talk about time intervals, that is, about rhythm, a concept of »duration« takes hold that means more than helping sound phenomena to come into being. Duration is what enables the succession of sound material to be ordered and shaped. Thus conceived, durations cannot themselves be »properties.«

[6] In the pub scene in Alban Berg's opera *Wozzeck*, there is a moment where the music stops but the dancers are to continue dancing »in the tempo of a landler« (II:iv, m. 599).

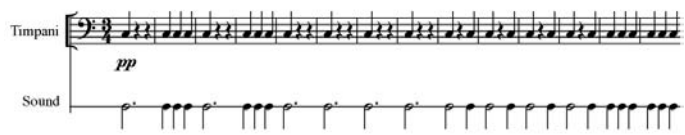
texture that is responsible for a great deal of the vividness of music. As the simple example of the Haydn theme in the introduction has shown – and the analyses of the 48 fugue themes from the *Well-tempered Clavier* will confirm again and again – even monophonic melodies have a characteristic »rhythmic texture« and not merely a »rhythm.«

Rhythm-building Components

Sound

The component »Sound« is the basic component for any music within our frame of reference. It simply means that a sound disrupts silence. In occidental music, this usually occurs through the onset of tones, often accompanied by syllables of words, but also through percussive sounds. The term »sound« is to signal that this prime phenomenon of all musical events does not yet involve distinctions between pitches, as determined by physics, or any other forms of sound. Solely the fact that a sound appears and that a sequence of such sounds generates rhythm is at issue.

Ex. 1-001 Beethoven, 5th Symphony, 3rd mov. mm. 324 ff.

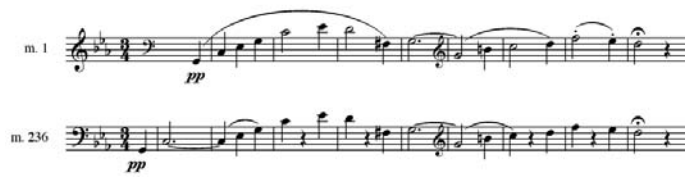


In example 1-001, the note of C sounds in constant repetition on the timpani, whereby, in the frame of a fast 3/4-time, the rhythm starts as a ternary one, which after twelve measures fades into an amorphous repetition of quarter notes.

The component rhythm »Sound« thus does not have the same notation as what appears in the timpani part. The quarter pauses are omitted and are added to the value of the note actually sounded. The durations are thus measured according to the temporal intervals between the tonal entries – what in the Anglo-American world is generally referred to as »inter-onset interval« (IOI).[7]

The measuring of durations according to temporal intervals between the onset of tones makes sense for several reasons. For one thing, the pauses here as almost always are articulation pauses that determine the form of the tone rather than its rhythmic value. Such pauses correspond to staccato and other abbreviation signs. Beethoven demonstrates this himself by making the thematic melody of the third movement of his Fifth Symphony appear in several articulatory variants (Ex. 1-002).

Ex. 1-002 Beethoven, 5th Symphony, 3rd mov.

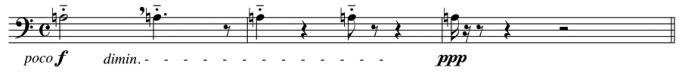


Initially he requires legato and tenuto playing for his theme, in the da capo part legato and staccato playing, the latter indicated by means of quarter pauses. The component rhythm »Sound« is identical in both variants, while their articulatory rhythm differs.

The fact that we tend to measure the rhythm of sounds/notes by their onset intervals rather than by the absolute value of each sound probably has to do with the general predominance of beginnings over ends. That something begins is generally more meaningful than that something ceases. This principle of measuring durations initially between entry and entry rather than beginning and end also applies to the treatment of other components. Thus phrases, too, are for the time being measured only by their beginning, as followed by the beginning of a new phrase. There is no danger that in this way endings of phrases or other formal parts are altogether lost in the rhythmic structure, as the endings come into play by means of other components, e.g., by cadences.

Ex. 1-003

Berg, *Wozzeck*, II/2, m. 310, Corno



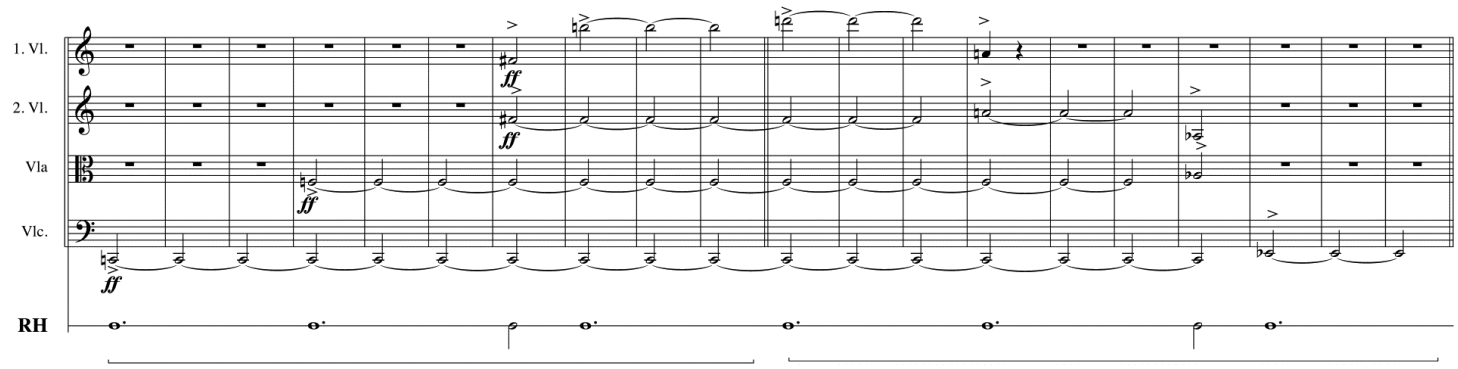
There are, however, cases where, for special effects, tones are firmly fixed also in their actual durations and not merely relative to the entry distances from subsequent tones. Alban Berg, all the way round a music-theoretically highly reflective composer, provides some pertinent examples. Thus in *Wozzeck* (Ex. 1-003) we encounter a passage where a simple rhythm (𝅗𝅥 𝅗𝅥 𝅗𝅥 𝅗𝅥 𝅝) is highly differentiated by means of durational and rest values so that a series of increasing pause durations (?, 2, 4, 6, 15 𝅘𝅥𝅯)[8] is complementary to a series of decreasing sound durations (8, 6, 4, 2, 1 𝅘𝅥𝅯). Since the notes are marked by tenuto-staccato signs so that their form of articulation is already predetermined, the rests must have yet another function besides that of shortening the tones.[9]

[7] Justin London, *Hearing in Time. Psychological Aspects of Musical Meter* (Oxford: Univ. Press, 2004), 4. See also Eytan Agmon, »Musical Durations as Mathematical Intervals: Some Implications for the Theory and Analysis of Rhythm«, in *Music Analysis*, 16:1 (1997), 45-75.

[8] The caesura mark (,) after the first tone represents as an irrational value, the expected sixteenth rest (which I have indicated by a ?).

[9] The purpose of this strange rhythmicization is to be found in the dramatic context. Captain and Doctor, who in Act II, sc. ii encounter Wozzeck in the street, have their fun with their subordinate by hinting that Marie is cheating on him with the Drum Major. The note A is the final note of the Captain theme, thus marking the attitude of the Captain in this dia-

Ex. 1-004
Berg, *Lulu* I/3, m. 833 (Strings)



Berg's operas furnish additional exemplary instances for the problem of entering and ending notes and the formation of rhythms by these means. In Act I, sc. iii of *Lulu*, whose second part is significantly headed by the formal term »Monoritmica,« one hears – at the climax, which is also the turning point of the retrograde process of acceleration (at m. 843) – the »leitrhythm« ♩. ♩. ♪♩. in multiple augmentation, at first by means of newly entering notes, which in each case are held, and then by means of stopping notes, whereby the chord just built-up is dismantled again in precise rhythmic control (Ex. 1-004).[10]

No less subtle is a passage in Berg's *Wozzeck*, famous not for its intricate rhythmic structure but rather for its dramatic effect: the brief transitional music between the murder and the following tavern scene, which is shaped as a two-fold crescendo on the note of B. The first crescendo is followed by a solo on the big drum, whose strokes are timed to the rhythm that underlies the entire following scene as its »leitrhythm«. The second crescendo is followed *attacca* by the music of the tavern scene, whose »out-of-tune pianino« presents again the »leitrhythm«, this time furnished by an accompaniment that has the character of a »Schnellpolka«.

Ex. 1-005 depicts the first crescendo plus drum solo. Berg here created a classic example and at the same time a borderline case of the matter of the entry rhythm, one prompted, of course, by the internal dramatic events. Fixated on a single absolute pitch – even bass tuba and double basses are held to the B3 – the winds enter one after the other, in the measure of the (here augmented) »leitrhythm«. The strings imitate it a mere quarter note later, in such a way that a rhythmic stretto canon results. At the same time, Berg does his best to make this small contrapuntal trick *in*audible, as each newly added instrument is supposed to begin ***pppp*** and go immediately into a crescendo, so that the following entry is covered up.

The second crescendo (***pppp*→*fff***), too, can be regarded as a borderline case of musical rhythm and meter. It demonstrates, again in five alla-breve measures, a quasi-rhythmic passage, as all the instruments hold their tone during the crescendo or else play it in tremolo. There are therefore no markers to provide any clues how to structure this stretch of time rhythmically. To be sure, the two five-bar crescendos last barely eight seconds each, so that they approximate a long-held fermata (which is actually called for at the end of each five-bar passage). The subterranean rhythm of the first crescendo remains nevertheless both spectacular and mysterious – no doubt a reflection of the internal psychic processes of the characters acting on stage.[11]

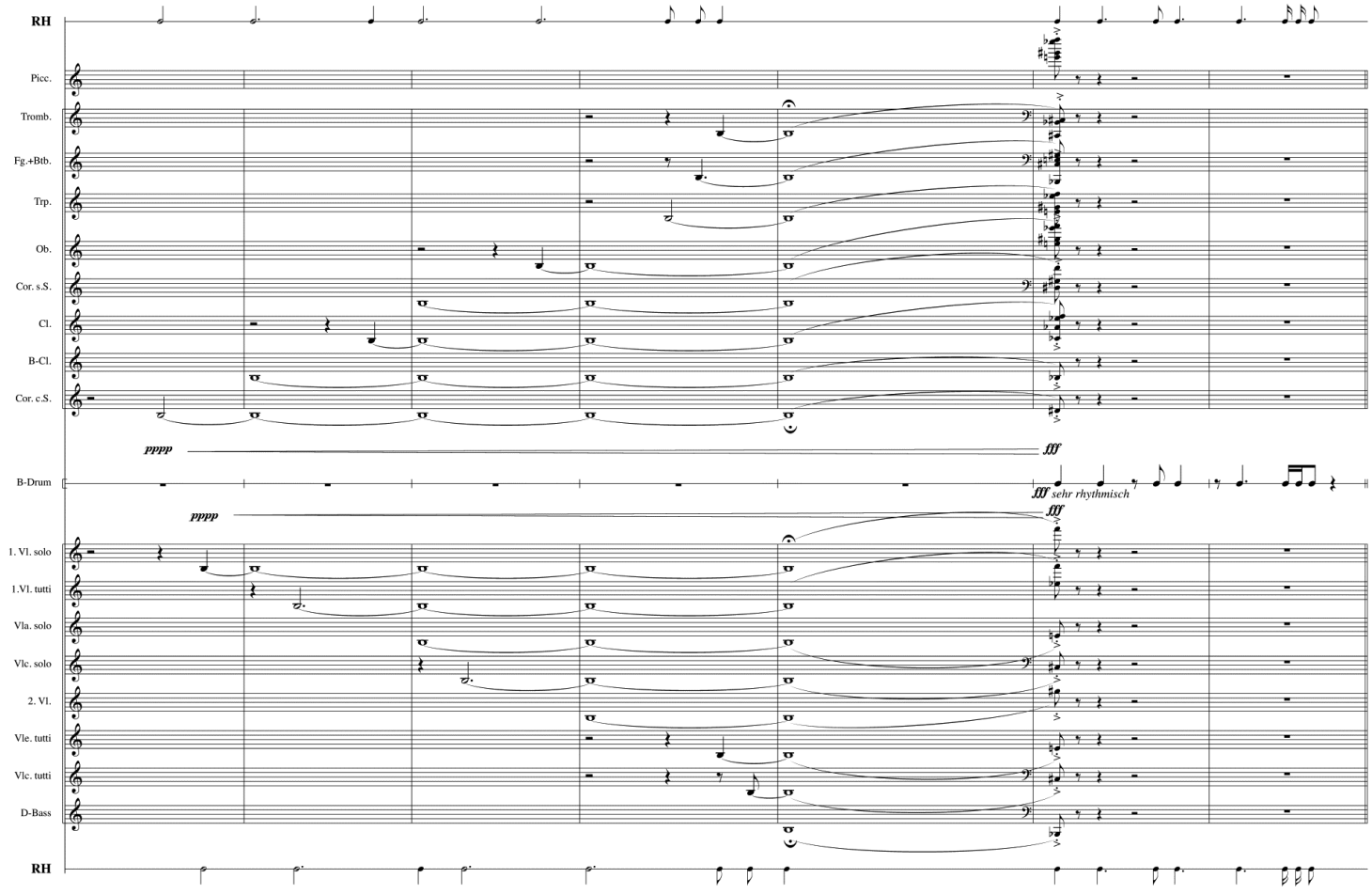
Apart from such borderline cases, the handling of the component »Sound« in a rhythmic analysis is fairly simple, as this is the only case where the durations can be taken directly from the notation – though meter-related notational forms such as slurs have to be translated into simple durations and the pauses (in the case of articulation pauses) may have to be added to the value of a note.

bolical situation. The latter has just mentioned the Drum Major in a highly suggestive manner and now withdraws into himself – virtually disappears from the sound event – waiting for the effect his words will have on Wozzeck. See my analysis of this scene in *Alban Berg: Wozzeck. Eine semantische Analyse unter Einbeziehung der Skizzen und Dokumente aus dem Nachlaß Bergs* (Munich, 1985), 218-221.

[10] The fact that in this process the four notes of the main rhythm (RH), which throughout the opera is used as a symbol of death, are combined with the four notes of the so-called »Earth Spirit fourths« signifying the »Lulu principle,« illuminates the semantic intensification in this spot. The Painter has cut his throat because of Lulu, his corpse is discovered at exactly the moment when the main rhythm enters again and Lulu's ascending fourths (C-F-F♯-B) give way to their descent (D-A-A♭-E♭). At this point the music semantically indicates Lulu as the Painter's nemesis.

[11] As I have shown elsewhere (cf. note 9, pp. 142-145), the »leitrhythm« forms a semanteme meaning »Wozzeck, the murderer,« inasmuch as it appears only after the deed, which Wozzeck is immediately afterwards charged with (in the tavern scene). At the same time it dawns on him that what he has done in a paranoid fit will mark him as a murderer in the public eye of the state. It is these processes in Wozzeck's subconscious that Berg seems to have intended to express with the implantation of the »murder rhythm« into the crescendo.

Ex. 1-005 Berg, *Wozzeck* III/2:3, m. 109

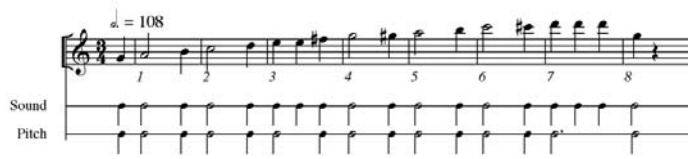


In music history, both simple, developed and highly complex rhythmic concepts have been rendered by means of the basic component »Sound«: from the *organa* to the *ars subtilior*, all the way to the serial music of the mid-20th century. The following chapters will show what role other components, which were added, or else refined, in the course of history, played in rhythmic shaping.

Pitch

That the component »Pitch« must be distinguished from the component »Sound« with regard to its rhythm-generating import can most easily be demonstrated on melodies that contain tone repetitions.

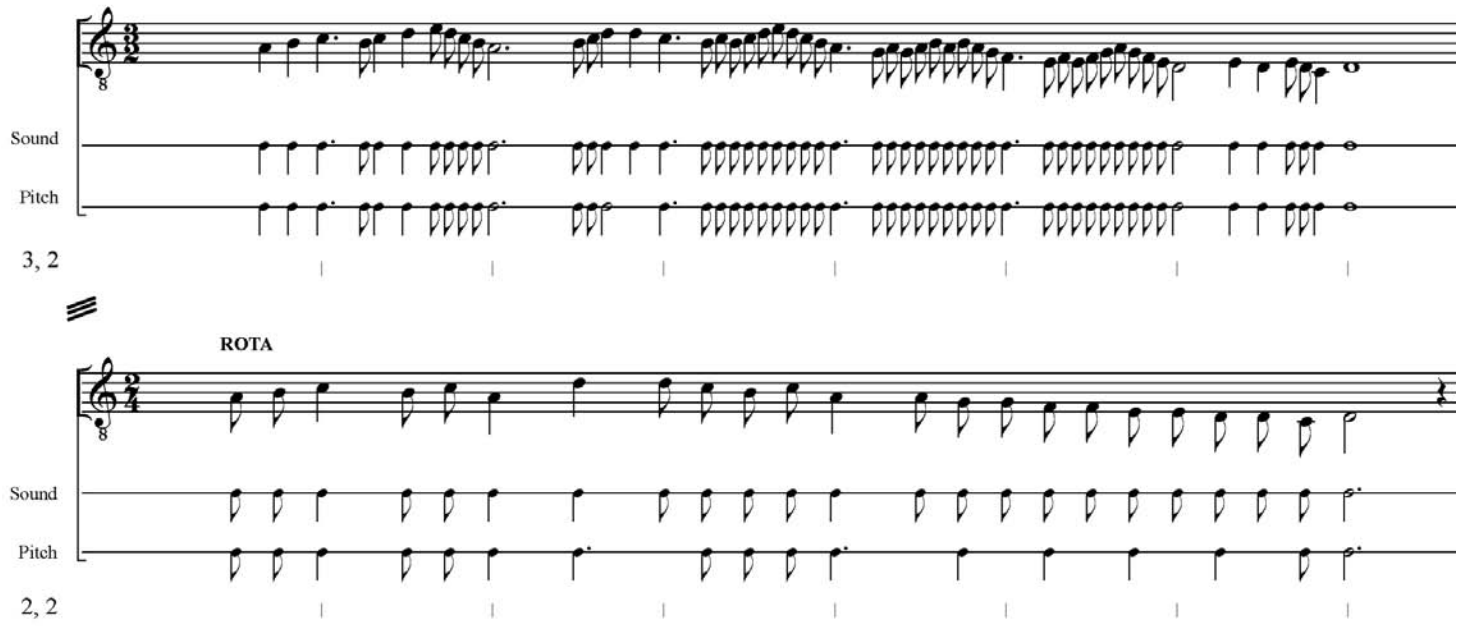
Ex. 1-006 Beethoven, 1st Symphony, 3rd mov., Beginning



The Scherzo (»Menuetto«) of Beethoven's First Symphony (Ex. 1-006) presents a case, in which the component rhythms »Sound« and »Pitch« are nearly identical. Only in the third and the seventh measure they diverge: there, because of some tone repetitions, longer values emerge at the points of pitch change. As a result, the iambic rhythm (𝅗𝅥𝅗𝅥 𝅗𝅥𝅗𝅥 𝅗𝅥𝅗𝅥) continues in one of the components in the third measure, while it changes to dactyls in the other (𝅗𝅥 𝅗𝅥 𝅗𝅥). Both rhythms are relevant: one hears them simultaneously.

This method of rhythmic enrichment is very old but has not hitherto been included systematically in rhythmic analysis. Here is an example from the Middle Ages (Ex. 1-007). This

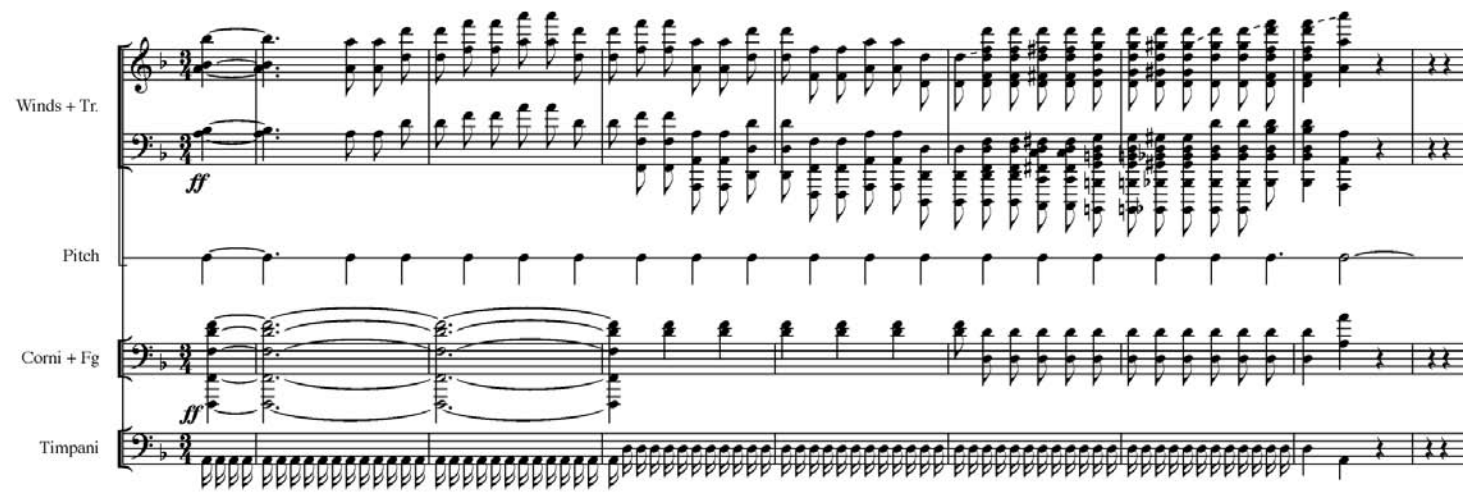
Ex. 1-007 *Lamento di Tristano* (13th century), triple and duple variants (cut-out)



dance song in Dorian mode,[12] transmitted in mensural notation, shows but one deviation between the component rhythms »Sound« and »Pitch« in the principal, ternary form, but in the even-measured after-dance (»Rota«) includes numerous tone repetitions, which in the chain of eighths notes in the second half inject a syncopated sequence of quarter notes that furnishes a rhythmic stimulation to this cadential melody.

This dramatic, almost catastrophic-seeming start, with which the first instrumental recitative, later sung to the words »O Freunde, nicht diese Töne!« begins, derives its force from the massive wind sound combined with a fourfold octave unisono of the main voice in *marcato* articulation and a harmony sharpened by dissonances. Add to that the syncopated rhythm, which is not actually notated but unfolds its effect from the tone repetitions. These repetitions, which maintain the pitch and even entire chords, lead to quarter notes within the eighths attacks. From a comparison with the voices of the horns one can tell that

Ex. 1-008 Beethoven, 9th Symphony, Finale, Beginning



Music history is full of melodies of this type, which are also known as chains of sighs or suspensions or else successive sound anticipations. How immense an expressive potential can be gained from that is shown by the beginning of the Finale of Beethoven's Ninth Symphony (Ex. 1-008).

these pitch quarter notes are complementary to the repetitions of D-F and in that sense syncopated. From m. 5 on, the horns, too, play only eighths so that the syncopations are stripped of their metric opposite. That Beethoven has applied not only tonal, dynamic, articulatory, melodic[13] and harmonic[14] but also subtle rhythmic means

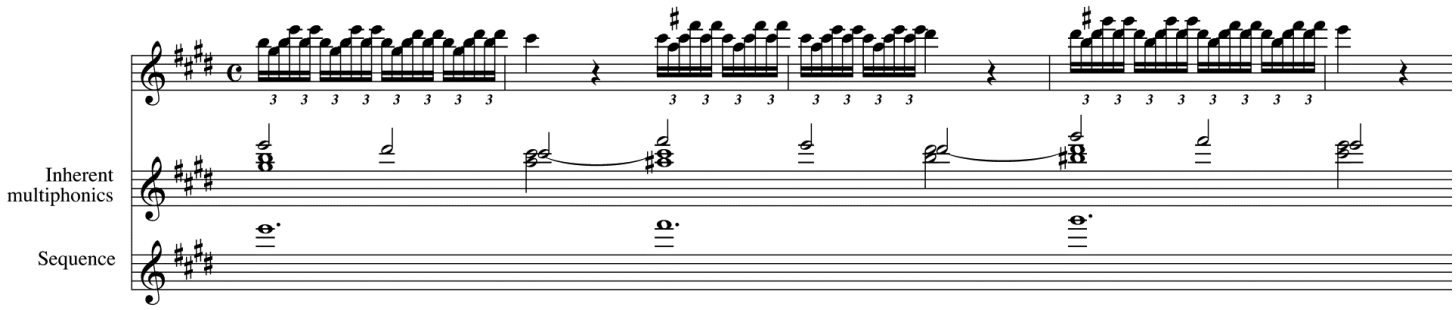
[12] See Marius Schneider, »Klagelieder des Volkes in der Kunstmusik der italienischen Ars nova,« *Aml* 33 (1961), pp. 162-168.

[13] The principal voice is built mainly from the steps of the D minor triad and describes a wave form, which at the end frays

can also be seen from the fact that the change of the timpani from A2 to D3 occurs on the second sixteenth of the 3/4 measure, that is, on the lightest possible part of the beat.

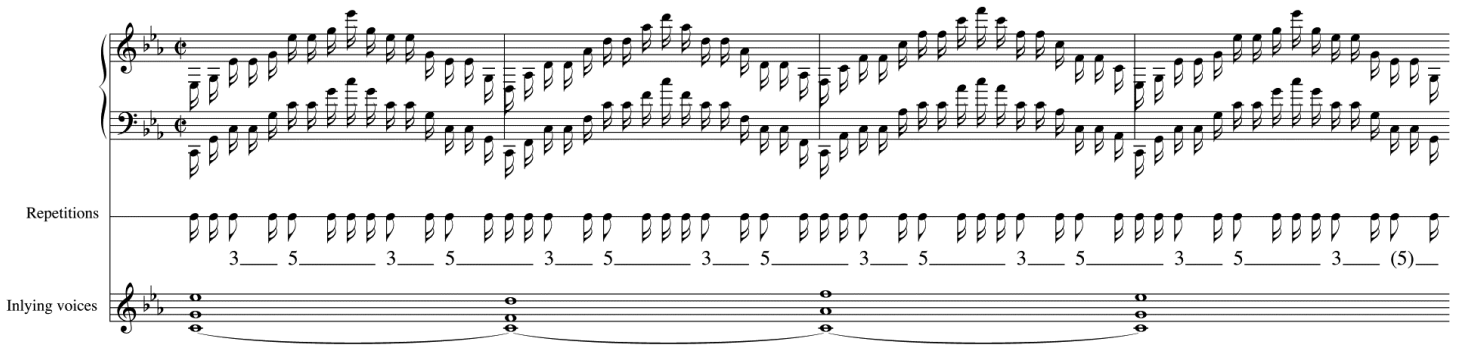
The component »Pitch« takes effect most frequently in tone repetitions. But there are also cases of an indirect melodic movement that produce a rhythm of their own. Indirect melodic trains like these are known as »core melodies« or as outer and inner voices in cases of inherent polyphony. The phenomenon is most frequently recognizable in sequences and figurations.

Ex. 1-009 Vivaldi, *La Primavera*, m. 47



In the violin part of Antonio Vivaldi's Concerto op. 8, no.1 – to cite an arbitrarily chosen example (Ex. 1-009) – figure play and sequence technique can be described conjointly. The upper part (E-D♯-C♯ etc.) of the *arpeggio*-chords forms a rhythm of 𝅗𝅥, the stepwise progression of the sequence (E—F♯—G♯) proceeds in 𝅝.

Ex. 1-010 Chopin, *Etudes* Op. 25 No. 12 (schema)

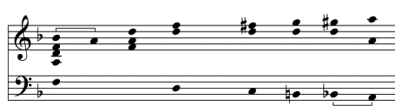


A great many examples of pitch rhythms are also found in the piano literature from Domenico Scarlatti to György Ligeti. Especially in the great etude works since Frédéric Chopin the pitch component is prominent, by whose means bizarre rhythmic worlds are constructed despite often uniformly fast basic values (e.g., pervasive 𝅘𝅥𝅯).

In Chopin's Etude op. 25, no. 12, for example, the wave-like arpeggios in both hands consist from beginning to end entirely of sixteenth and are at the same time interspersed with tone repetitions, which, since never more than two sixteenths are repeated, enrich the rhythm with eighths (Ex. 1-010). As one can see in the respective line in the example, these eighths values stand »aslant« to the beat, so that durations of three or else five sixteenths elapse between the recurring pitch eighths. At the same time, the harmonically quite simple piece is carried by inner parts that, owing to the arpeggio structure, are realized simultaneously in several octave registers. If one telescopes these inherent parts into a single octave, the result is a quiet rhythm of wholes, which unfolds over a pedal point of twelve measures (four of them are included in the example). Chopin also sets dynamic accents (>), which are placed according to an alla-breve beat, that is, at the beginning and the middle of the measure. The phrase rhythm, which, from the slurs set by Chopin, may extend over entire measures, has the same function. The half-measuredness is reinforced by the contour of the arpeggios. However, the rhythms derived from pitch (tone repetitions and inner parts) are not superseded by these additional component rhythms but are superadded and intensify the rhythmic complexity of the piece.[15]

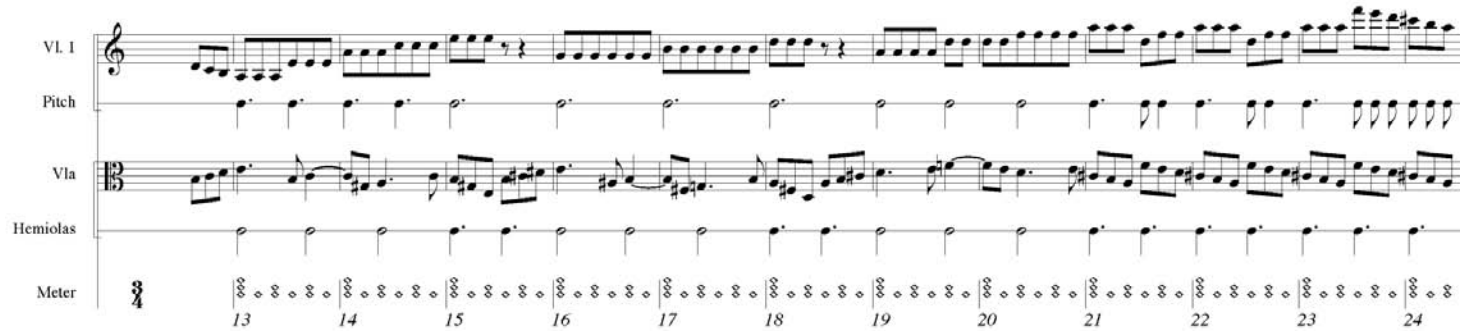
out in countermotion. It is worth noting that the initial melodic interval B♭—*a* returns at the end in the basses.

[14] The initial four-three chord of VI[7] is followed by a kind of Phrygian cadence to the dominant, in which the recitative sets in (Ex. 1-008a):



[15] I might add that in mm. 15f. (and elsewhere) partially ternary sequences occur, which are produced by a different distribution of the repetition: 𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯 𝅘𝅥𝅯𝅘𝅥𝅯 𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯 𝅘𝅥𝅯𝅘𝅥𝅯 𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯 𝅘𝅥𝅯 . Eytan Agmon (cf. footnote 7) gets the same results, though he divides not by tone repetitions but by ternary micro-phrases (66ff.).

Ex. 1-011 Brahms, String Quartet A-Minor, 4th mov., mm. 13-23 (extract)



A last example may be cited from the String Quartet in A minor by Johannes Brahms. The Finale is written in a fast 3/4 time, which is pervaded by hemiolas and time and again »attacked« by binary rhythms (frequently at points of harmonic changes). In its first repetition, in which the main voice is heard in the viola, the twelve-bar main subject of the movement, subdivided into 3+3+2+4 measures, displays an unexpected counter-rhythm in the first violins, which is brought about by the tone repetitions (Ex. 1-011). The pitch rhythm thus generated in violin I, which has to play a typical accompaniment figure composed almost entirely of strung-out triadic notes (in A minor, G major, D minor), has a fully contrapuntal quality. The duration of these pitches is determined by repeated eighths: 3+3+3+3+6+6+6+6+4+4+4+3+1+2+3+1+2+3+1+1+1+1+1+1 ♪. Initially, the three-eighths sequences in the violin stand against the 𝅗𝅥 (𝅗𝅥. ♪) of the viola, and both rhythms stand in hemiolic relation to the effective 3/4 beat (2 𝅗𝅥.: 3 𝅗𝅥, 2 𝅗𝅥.: 3 𝅗𝅥). The three-eighths units in the violin relate to the corresponding groupings in the main part, where they are underlined by the drawing of the beams, noticeable especially in the concluding measures.

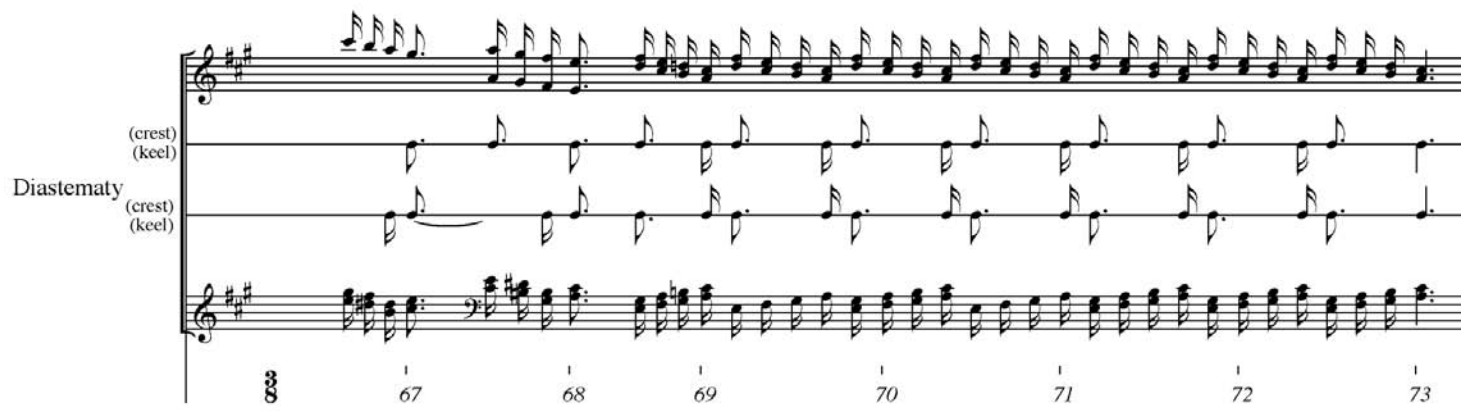
Diastematy

The component »Diastematy« refers to the up and down of melodic lines. There are no melodic lines without contours and therefore no melodies without diastematic rhythms. Whether striking or inconspicuous, they always co-determine the rhythm of a linear form. For every change in interval direction has the character of an event, and it is events that articulate the temporal continuum.

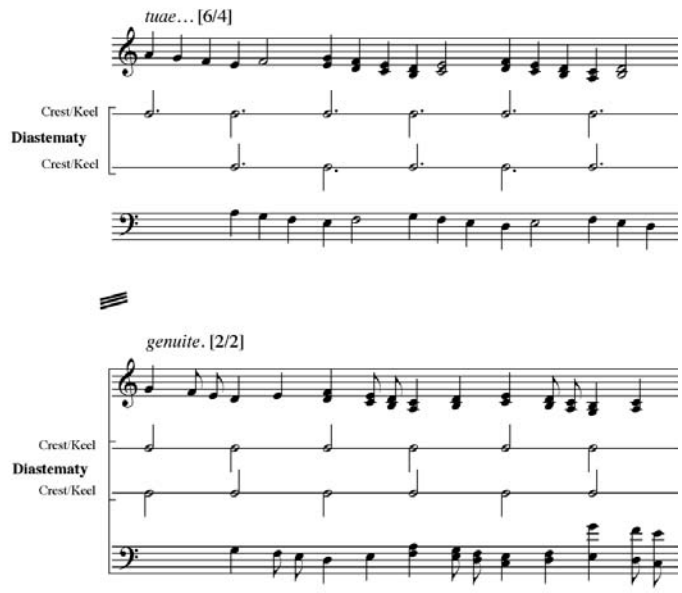
A passage from the Larghetto of Beethoven's Second Symphony furnishes a prime example (Ex. 1-012). The passage consists almost entirely of sixteenths. From the middle of m. 68, chains of thirds in contrary motion structure the time lapse and by means of crest and keel notes (upper and lower directional changes) introduce rhythms not otherwise noted. These diastematic rhythms consist of quarter notes (4 ♪ = ♪♪. = 𝅗𝅥). Clearly hemiolic in structure (three 𝅗𝅥 spread over two 3/8 measures), they keep the eight measures rhythmically ambiguous. By means of a crescendo from ***p*** to ***ff*** and further intensifications such as octave transpositions and accumulations and additional instruments (not represented in the example) Beethoven directs the hemiolically ordered chains of sixteenths toward the destination chord in the tonic of A major (m. 73), from which then the transition to the subsidiary theme takes its departure.

Numerous passages in older music work analogously. The effect of diastematic rhythms is observable especially in sequences. An example from the *Virgin's Vespers* by Claudio Monteverdi (Ex. 1-13) shows the crest and keel tones both in the ternary version (*tuae*...) and in the immediately following binary one (*genuite*) in simple isometry and, as in the Beethoven passage, in contrary motion. Thus the rhythm of the component »Sound« (𝅗𝅥𝅗𝅥𝅗𝅥𝅗𝅥𝅗𝅥 and ♩♪♪♩♩ respectively) is overlaid by that of the component »Diastematy«) (𝅗𝅥. 𝅗𝅥. and 𝅗𝅥𝅗𝅥).

Ex. 1-012 Beethoven, 2nd Symphony, 2nd mov. mm. 66-73 (schematic)

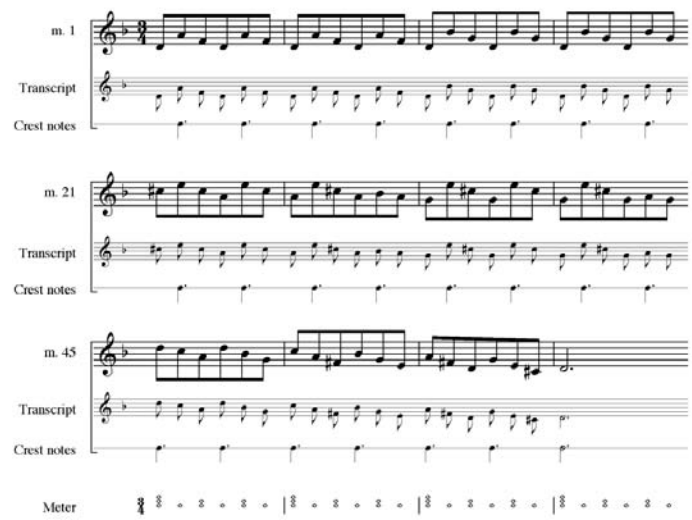


Ex. 1-013
Monteverdi, *Vesperae beatae Mariae Virginis*, Psalm 109



Diastematic rhythms are objectively given. Whether they are always intended by the composer, so that the crest and keel notes are deliberately included in the rhythmic shaping, is another matter. In the case of J. S. Bach's Little Preludium in D minor, however, cogent reasons for the setting of the crest notes can be adduced. The piece (Ex.1-014) is largely based on broken triads. The latter having both a harmonic and a melodic effect, the two functions initiate different rhythms. The harmonic rhythm is very sedate, while that of the component »Sound« is fast (mostly ♪ in the right hand). To these rhythmic results the durations of the crest and keel notes have to be added, i.e., the »diastematic« rhythms. I have confined myself to the crest notes in the analysis of these three brief segments because they make the facts of the case sufficiently clear. As one can see especially in the beamless transcription, the downward-moving triads have their highest note at first on the »off-beat«, the second or fifth eighth of the measures. In the last bars, on the other hand, they fall into the first or fourth eighth, thus marking the *One* or the middle of the measure. The intervals between the crest notes constitute

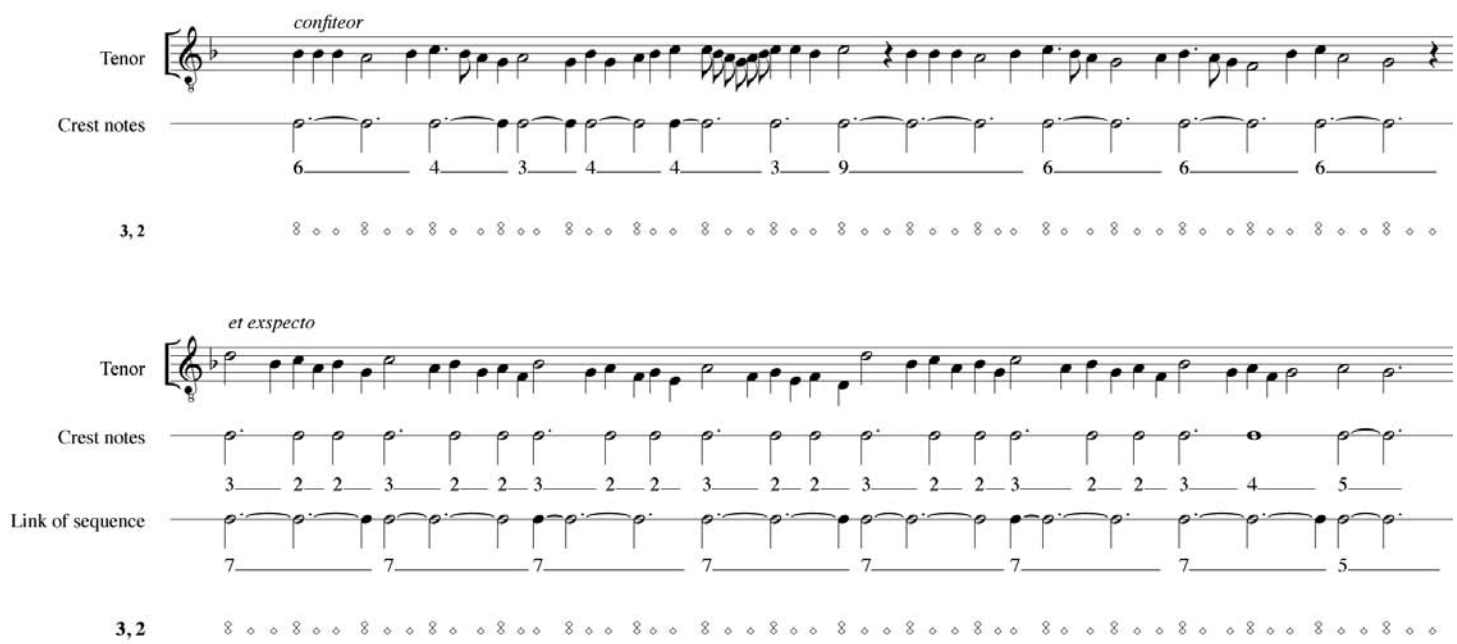
Ex. 1-014 Bach, Prelude BWV 926 (selections)



three eighths, so that the diastematic rhythm is 𝅗𝅥. 𝅗𝅥. 𝅗𝅥. 𝅗𝅥., both at the start of the piece, in the middle and also in the epilogue. I regard the fact that the composer sometimes offsets the triadic motif in the beat and sometimes makes it coincide with it as a clear indication that the component »Diastematy« was purposefully included by him for the enrichment of the rhythmics. The offset position of the crest notes in fact explains in part the appeal of this generally very modest prelude. One should also mention that the diastematic rhythm in the last four measures displays a hemiolic structure (3:2) in relation to the meter. Hemiolic conditions also have their effect at the beginning, though the sequences of 𝅗𝅥. there are offset in the 3/4 beat.

This line of argumentation can also be applied to an example from the 16th century (Ex. 1-015) – two successive passages from the four-part *Missa »Da pacem«* by Noël Bauldeweyn (formerly ascribed to Josquin de Prez). The tenor voice derives from the Credo, its first section starts with »confiteor«, its second with »et expecto«. For both sections the measure is prolatio perfecta and tempus imperfectum, which corresponds to 3/4 in the transcription.

Ex. 1-015 Bauldeweyn (ex Josquin), *Missa »Da pacem«*, Credo



The first section is relatively free in its diastematic rhythm, whereas the second constitutes a complex, strictly developed sequence. The segments of the sequence consist of three falling thirds that are offset downward by seconds. The repetition of the sequence is likewise stepped downward by seconds, so that an overriding structural voice of D-C-B♭-A results. After four segments, there follows a repetition, which, however, is abbreviated and cadenced off early.

The chains of thirds have a diastematic quality that is quite audible. The rhythm resulting from it could be a very simple one if all of the notes in the thirds had the same value, e.g., quarter notes (semibreves), which would result in the rhythm 𝅗𝅥 𝅗𝅥 𝅗𝅥 . Instead, however, Bauldeweyn starts every segment of the sequence with a half-note (brevis), resulting in a diastematic rhythm becoming top-heavy (𝅗𝅥. 𝅗𝅥 𝅗𝅥). If one observes only the crest notes (which is advisable, as the keel notes would yield only an exact copy of the crest-tone rhythm), a diastematic rhythm of 3+2+2 ♩ emerges, from which follows a rhythm of the sequence segments of 7+7+7+7 ♩, etc.

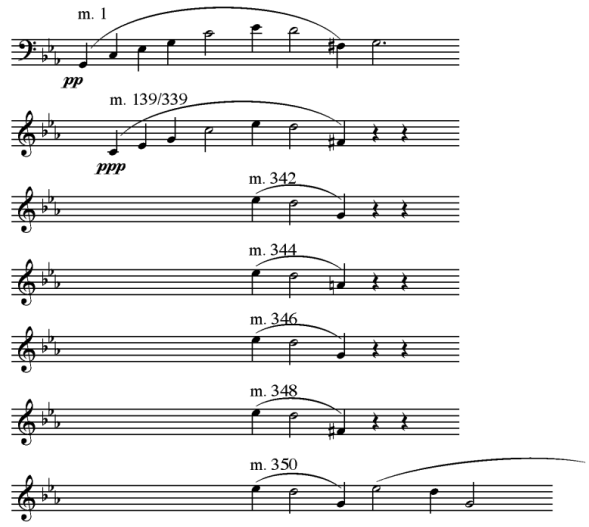
In the preceding section »Confiteor,« one looks in vain for a similarly constructive rhythm. Here, too, there are two phases, where after nine mensural units the beginning is repeated and concluded in a shortened form. The rhythm of the crest notes is at first free (6+4+3+4+4+3 ♩) but in the consequent is well adjusted to the prolatio perfecta (9+6+6+6 ♩).

It will be agreed that the melodic contour in the sequence passage is rhythmically relevant. Without the rhythmic articulation by phrases of seven, which is multiplied by the imitative four-part setting,[16] this elaborated concluding passage would lose its individual character. It follows from this that the component »Diastematy« must on principle be a regular aspect of any rhythm analysis. Its inclusion must not be restricted to striking or somehow spectacular instances.[17]

In all of the examples hitherto cited, the components involved were more or less attuned to each other, that is, they largely coincided. If the components are linked heterometrically, the result can be complicated rhythmic conditions. A passage from Beethoven's Fifth Symphony presents a good example of this: the celebrated transition from the third to the fourth movement. The basis of this most mysterious passage (apart from the timpani solo already cited) is a motif that is split off from the main theme (Ex. 1-016). It consists of three notes with a clear rhythmic-metric shape (the quarter notes are on the light, the halves on the heavy beat) and a succinct contour (a falling second followed by a likewise falling large interval). During the splitting-off process, Beethoven preserves the metrical situation in the measure by means of two quarter-note rests. At m. 350, however, he brings the three-note motif without rests in constant repetition, keeping the iambic rhythm ♩𝅗𝅥 ♩ 𝅗𝅥 ♩ ♩ etc. Some of the notes thereby acquire the value of a half-note instead of the original quarter value and vice versa. Since the diastamatics of the motif remains the same, the modified values of the motif tones impact the durations of the repetition units, resulting in durational sequences with crest notes of four or five quarter notes (ex. 1-017). The unusual rhythmic structure of the transitional melody is probably one of the reasons for the subtle tension of the entire passage, a tension which then discharges in the exulting triumphal march in C major, with which the Finale commences.[18]

Ex. 1-016

Beethoven, 5th Symphony, 3rd mov.
motivic separation



The diastematic rhythms are less striking in runs, arpeggios, coloraturas, etc. in short, virtuoso figures, which pervade the music of the centuries. Even mechanical finger exercises, which exist for all instruments, are rhythmically structured by their diastematic contour, yet without it acquiring any aesthetic function.[19]

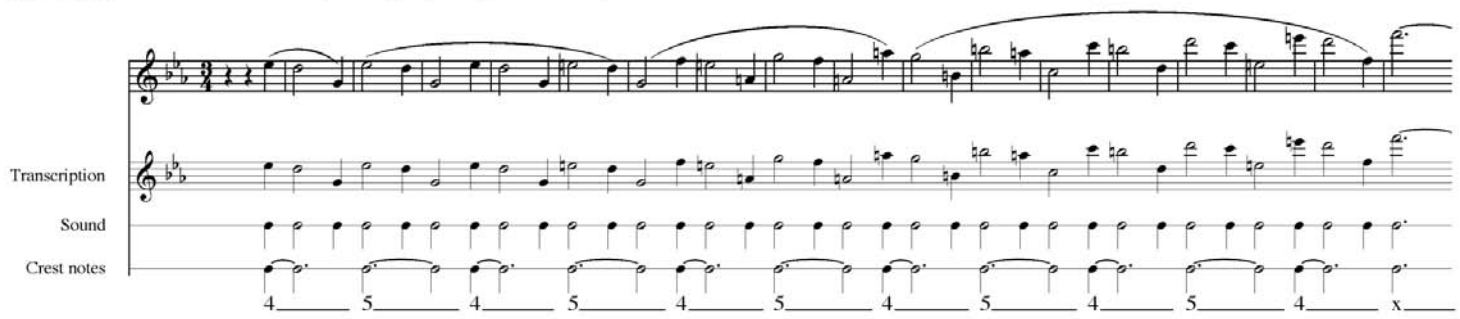
[16] In the four-part setting the tenor is followed by two voices linked by thirds 1 ♩ later, another 2 ♩ later. All of the voices share the same melody and rhythm.

[17] See my essay »Zur Rhythmik in den Messen Josquins (und Bauldeweyns). Isometrische Phrasenwiederholungen und ihr Verhältnis zur mensuralen Ordnung«, in *Musikkulturgeschichte heute. Historische Musikwissenschaft an der Universität Hamburg*, ed. F. Geiger (Hamburger Jahrbuch für Musikwissenschaft, 26) (Frankfurt/M.: Lang, 2009), 9-29.

[18] Closely analogous is the shape of a passage in the »Scherzando vivace« of Beethoven's E♭ major string quartet op. 127. The metrically fitted main motif is, from m. 36 b on, repeated in close succession, resulting in a diastematic rhythm of 5+7+5+7+5+7 ♪ etc.

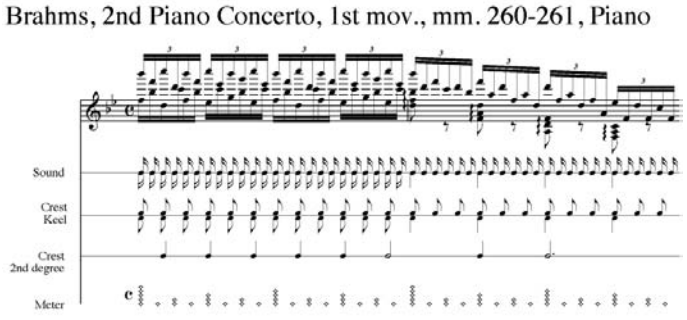
[19] In my essay »Rhythmische Komplexität in der Instrumentalmusik von Johannes Brahms« (in *Johannes Brahms. Quellen – Text – Rezeption – Interpretation*, ed. F. Krummacher / M. Struck (Munich, 1999), 143-158) I also attended to Brahms's *51 Übungen* for piano.

Ex. 1-017 Beethoven, 5th Symphony, 3rd mov., mm. 350ff.



Where such virtuoso passages are integrated into ambitious works, however, a closer look at the intricate rhythmic work by means of the component »Diastematy« is worth the effort. As an exemplary instance of many such passages, we may cite a spot in Brahms's Second Piano Concerto. In its first movement in B♭ major, which has the form of a concerto sonata movement, the large formal sections, orchestra exposition, development, recapitulation and coda, are each introduced by the same horn cantilena with which, unaccompanied, the entire work commences. Brahms has given special attention to the return of the theme at the start of the recapitulation (m. 260 with upbeat). Similarly to the first movement of Felix Mendelssohn's Violin Concerto, he has the soloist prepare for, and accompany, the main subject by means of figure work. It is this passage we want to look at.

Ex. 1-018
Brahms, 2nd Piano Concerto, 1st mov., mm. 260-261, Piano



Ex. 1-018 reproduces the passages in the piano underneath which the horn plays the theme. We hear ***pp*** and *dolce* chords in various resolutions, as the 4/4 time is resolved into sixteenth sextuplets. While the second measure of the example has the units linked by the beams into groups of six to coinciding with the beats of the meter, the first measure displays binary groupings resulting from crest and keel tones. Thus the chains of sixteenths in the right hand are structured by eighths (stems pointing up) because of their constant directional reversals. These eighths relate like triplets to the eighths of the 4/4 meter.

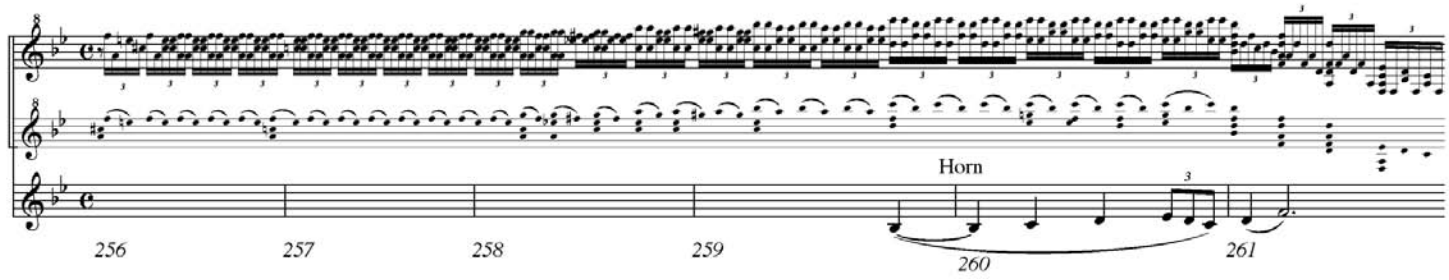
The situation is analogous in the left hand, as here the keel notes (stems pointing down) form the triplet-like eighths rhythm, which, as already in the basic component »Sound«, merges into simple quarter notes in the second measure. What is interesting here is that the upper voice formed by the crest notes in the right hand (B♭6-C7-B♭6-C7 etc.) has a, quite audible, contour of its own, whose crest notes – as it were a second-tier diastematic – each combine two triplet eighths, or else four sextuplet sixteenths, into quarter notes. These quarter notes, too, have a ratio of 3:2 to the quarter notes of the meter.

The onset of the recapitulation is preceded by four measures in which the figuration already starts. It sets in with an F6 and slowly climbs up to a C7. This ascent is accompanied by a harmonic movement that begins with a secondary dominant A major and reaches the tonic of B♭ major via the F-major seventh chord. In Ex. 1-019, this harmonic path is indicated together with the associated steps. The component »Harmony« thus included is relevant also for the results of the diastematic rhythm analysis. For if one telescopes both hands into a single octave, it becomes apparent that the seconds in the (indirect) upper voice (e.g., in m. 256 the notes F6-E6-F6-E6 etc.) always have a function as a suspension. The suspension notes are, moreover, reinforced by their character as crest notes. Besides, the harmonic rhythm creates durations of its own, which do not always coincide with the crest tone changes. For example, the darkening from A major to A minor begins, in my view, already with the last triplet eighth of m. 256, although the C5 sounds only on the *One* of the following measure.

Altogether one can say that the interaction of components – crest notes of the first and second degree, harmonic changes plus suspensions – produces a highly filigree-like rhythmic texture that seems to suspend the metric order. At work is a process of effacing the temporal markers, whose function is to make unpredictable the point at which the main subject returns. That its onset is anticipated by a quarter note (before m. 260) and this early, extended note (the B♭ in the horn) is already harmonized with the tonic is one of the exceptional subtleties of Brahms's rhythm and his compositional art generally.

In the 20th century, too, the component »Diastematy« is often used for the building of rhythms. A good example is furnished by György Ligeti in his piece *Continuum*. This virtuosic character piece for two-manual harpsichord rests on a single durational value of strokes, written in eighth notes under an endless beam. Their length depends on the tempo. Ligeti notes: »The correct tempo is attained if the piece (minus the concluding pause) lasts less than four minutes.« That amounts to more than 816 ♪ per minute.

Ex. 1-019 mm. 256-261, Piano (both hands) and entrance of Horn (Recapitulation)

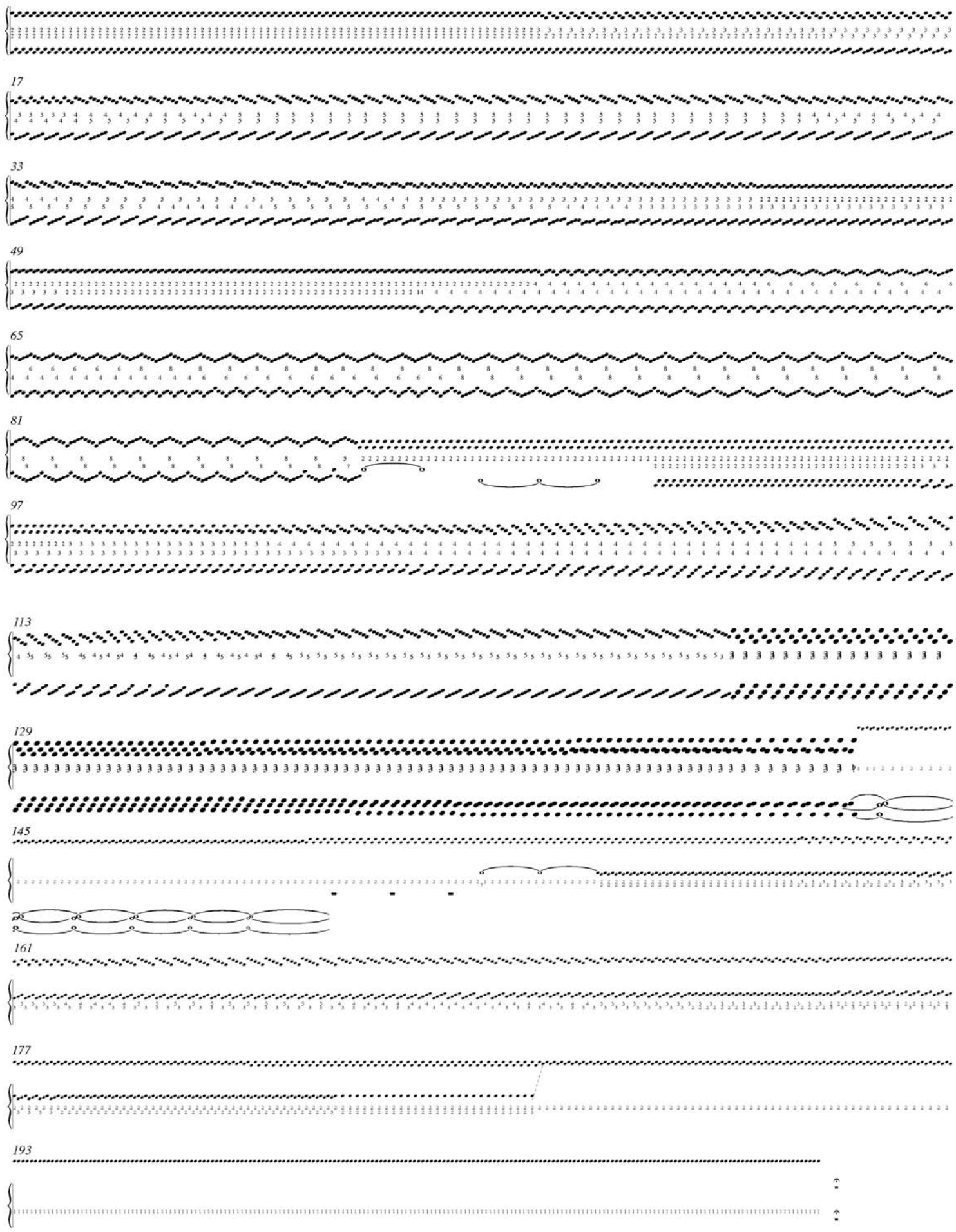


Rhythms in *Continuum* result almost entirely from the contours that are produced by the contra-rotating scale play, which makes for micro-phrases of up to five ♪ duration, which, moreover, are offset in the two hands (ex. 1-020). A notation in a simplified form, i.e., without stems and without accidentals, shows the rhythmic figure play of the two hands. Since the hands move on two different manuals, the pitches actually played can be identical without any mutual hindrance (e.g., at the beginning: r. hand: B♭4-G4, l. hand: G4-B♭4). When tone figures interact in this way, melodic contours are obscured. What is clearly visible in Ex. 1-020 is not at all audible. Only when the figurations drift apart upwards and downwards are the diastematic rhythms noticeable. Thus the 8-♪ figures, which from the fifth accolade are slightly staggered, emerge in fact as a phase with an isometric rhythm. Other formations, e.g., the proportions 4:5, 5:5, 5:4, 5:5, 4:5, 3:5, 3:4, 3:3, 2:3 and 2:2 may be registered as rhythmic iridescence or as rhythmic arrest (2:2).

The component »Diastematy« is nevertheless the most important means of temporal articulation in this otherwise monochronic piece. To the performer, the diastematic rhythms will become far more apparent in the movement of the hands and fingers than they do to the listener. One can speak downright of a haptic rhythmics here that does not fully reveal itself in the listening event. That additional rhythms, not cited here, come to the fore in the process of the superimposition of pitch levels I have shown in detail else where.[20]

[20] Peter Petersen, »›Jede zeitliche Folge von Tönen, Klängen musikalischen Gestalten‹ hat Rhythmus. Über die Rhythmik in Ligetis Cembalostück *Continuum*,« internet publication at http://www.saitenspiel.org (2009).

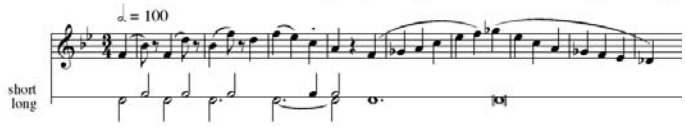
Ex. 1-020 Ligeti, *Continuum* (Diastematics)



Articulation

The component »Articulation« comprises those tone forms that are based on irrational values (save notes with articulation rests). Notes marked legato, tenuto or staccato can be classified as long, medium or short, but the notation does not signal anything more precise. However, the intervals between notes such qualified are measurable, so that, as with the component »Sound«, it is the temporal

Ex. 1-021 Beethoven, 4th Symphony, 3rd mov., Beginning

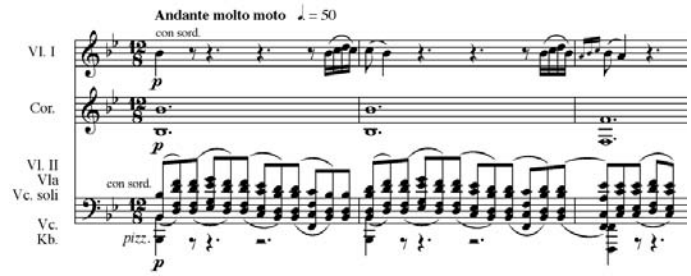


gaps that are again relevant rather than the actual durations. The beginning of the third movement of Beethoven's Fourth Symphony provides a prime example (Ex. 1-021). Here the shortened notes are followed by eighth or quarter rests or else furnished with a staccato point. The unabridged notes are linked by legato slurs, whereby the starting points of the slurs add up to a rhythm of their own. The slurs spanning two or more bars could also be regarded as phrasing slurs; in the present instance, however, they are bound to be articulation slurs owing to the fast tempo. The articulation reinforces the rhythm produced by the melodic contour, that is, a binary subdivision in the framework of a very fast 3/4 time. This dance-like beginning with its alternation of thrice two and twice three units of quarter notes reminds me of the Czech folk dance Furiant.

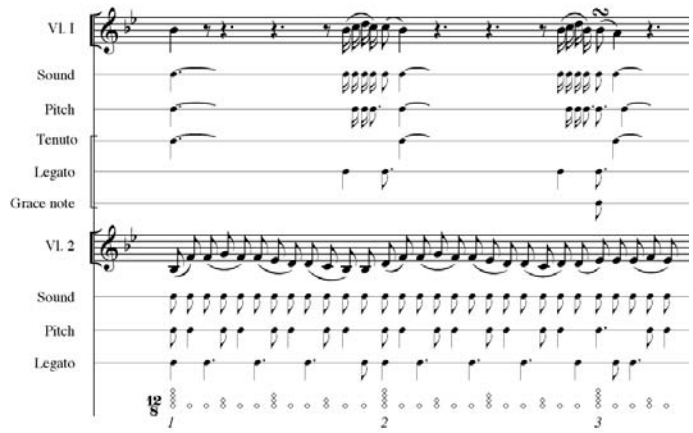
To exemplify articulation rhythms in *slow* movements we may take Beethoven's *Pastoral* Symphony (Ex. 1-022). The *Andante* makes use of legato slurs, pizzicatos, articulation rests and grace-notes. The principal feature of the melody-carrying voice in the first violins (Ex. 1-023) are the long rests between the briefly sounding notes. Brevity of sound, however, does not necessarily mean brevity of effectiveness. Since the seemingly isolated notes of the main voice certainly add up to a coherent melody – one comprising seven measures and, besides, consisting of long notes without rests from the fifth measure on (not included in the example) – the short notes can be taken only as effectively *long* up to the next note. The fact that they are to be played as relatively short (quasi tenuto) is the specific ›event‹. The durations between these ›tenuto notes‹ result in an articulation rhythm that is not identical with the component rhythm »Sound.«

The remaining component rhythms of the main voice also diverge from the rhythms of the tone entries (»Sound«). Thus the tone repetitions (»Pitch«) produce slight modifications of the basic rhythm. Another articulation rhythm, one resulting from the legato slurs (»Legato«), likewise has a certain life of its own, while the mordent-like grace-notes that have to be added to the first beat of measure 3, as a singular event reinforce other rhythms.

Ex. 1-022 Beethoven, 6th Symphony, 2nd mov., Beginning



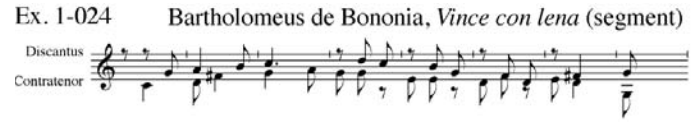
Ex. 1-023



At the beginning, the merely dabbed-in melody notes of the first violins are reinforced by the horns (see ex. 1-022), which hold the violins' B♭4 for the whole measure, though they diverge from m. 3 on. The rhythm of the horns, in turn, is matched by that of the pizzicati in the double basses, which have a durational validity of whole measures.

The accompaniment, too, is carefully articulated and thus rhythmically independent (see the extract of the 2nd violins in Ex. 1-023). The sound entries have constant ♪ (»Sound«). This uniform pulsation is matched by the persistently repeated down-beat-iambic »Pitch« rhythm (| ♪♩ ♪♩ ♪♩ ♪♩ |). Not quite as smooth in its effect is the rhythm of the »Legato« articulation (| 𝅗𝅥. 𝅗𝅥. 𝅗𝅥. ♪ |). Evidently these diverging component rhythms in the accompaniment correspond to the unpredictability of the fluid element (»Szene am Bach«).

Ex. 1-024 Bartholomeus de Bononia, *Vince con lena* (segment)



Articulation marks as compositionally relevant components emerged only in the 18th century. A special exception, however, are the pauses in hoquetus passages in the Middle Ages. They seem to have served the purpose of securing a brief execution of notes. The hoquetus (as a compositional technique) is based on the complementary alternation of short individual notes or note groups in diverse voices. Ex. 1-024 shows a hoqueting passage from a motet of Bartholomeus de Bononia, in which the eighth rests (minima) in the treble and countertenor practically take on the function of staccato points.[21]

[21] Facsimile and transcription in Willi Apel, *The Notation of Polyphonic Music. 900-1600*, (Cambridge MA, [4]1953), 143 and appendix No. 20.