Theory of Rhythm
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Throughout the history of music theory, there have been many treatises written about the structure of rhythm in music. Some of the more prominent treatises were written by Franco of Cologne and Phillipe di Vitry during the medieval period. Riemann wrote about rhythm in the early 20th century. All of these theorists and their treatises have been influential in the history of music theory. The problem was that until 1960, there was no concise language to help theorists and students say something meaningful about the rhythmic structure of music, and there was no textbook available that could be used in the classroom as part of a core theory curriculum.

In 1960, Grosvenor Cooper and Leonard Meyer wrote *The Rhythmic Structure of Music* as a textbook to help students logically analyze the rhythmic structure of music. This textbook sparked a renewed interest in the theory of rhythm. Many treatises have been written to supplement its ideas. Some of the more prominent ones were Lerdahl and Jackendoff's *A Generative Theory of Tonal Music* (1983) and Christopher Hasty's *Meter as Rhythm* (1997). This paper will compare Cooper and Meyer's *The Rhythmic Structure of Music*, Lerdahl and Jackendoff's *A Generative Theory of Tonal Music*, and Christopher Hasty's *Meter as Rhythm*. The concepts in these three treatises will be applied to excerpts from Beethoven's *Piano Sonata, Op. 2, No. 1*, and Webern's *Quartet Op. 22*. Their inherent strengths and weaknesses will be explored by applying them to these two pieces. What can these three theories of rhythm tell us about each piece?

First we will discuss the general state of rhythmic theory today then summarize each of the three treatises and look at who, what, when, where, why, and how these treatises were written. Then we will apply concepts from each treatise to excerpts from tonal and non-tonal repertoire. Then we will compare these three theories to each other to determine what their inherent strengths and weaknesses are. In other words, what can they tell us about the music that we did not already know?

The general state of rhythmic theory is weak in most theory programs. It is generally limited to a discussion of rhythmic motives in relationship to the melodic structure. This is unfortunate because most composers spend as much time thinking about the rhythmic structure in their music as they do about the harmonic structure. At the same time, the lack of rhythmic theory in the classroom is understandable. The development of Western music is unique from a harmonic perspective. The music that developed in Western European culture is more harmonically complex than any other culture in the world. Rhythmically, the ragas of India are much more complex than Western European art music, so it is natural to focus on what is unique about the music you study.

This does not mean that rhythm in Western music does not need to be studied. The rhythmic structure works with the harmonic and melodic structure in most pieces. Many times, they are inseparable. A thorough analysis of the rhythm and harmony together could yield better results that just an analysis of the harmonic structure alone. If so, why is rhythmic theory often not part of the theory curriculum in most music programs? This is because it is very difficult to discuss the rhythmic structure in most pieces. There are so many factors that determine if a note is rhythmically accented or not that, in the end, rhythmic analysis is all a

matter of what you decide to emphasize. In rhythm, the rhythmic structure becomes your interpretation of the piece. In harmony, it is much easier to definitively say that this is a tonic and that is a dominant chord. There are not as many variables to consider.

What are some of the questions that a student must answer to determine the rhythmic structure of a piece? First of all, are rhythm and meter separate entities or does rhythm create meter or vice versa? In order to answer this question, rhythmic theory needs delve into how humans perceive rhythm. Do humans have a preconceived sense of meter that rhythm fulfills or denies? Or can rhythm create any number of metric structures based on recurring accented note positions in a pulse stream? How do factors such as harmony, melodic shape, dynamic shape, timbre, rests, and accents influence the rhythmic structure? Which of these factors is preferred by most listeners? Can we generalize about perception or does it vary from listener to listener? These are difficult questions that no single theory can answer.

The Rhythmic Structure of Music by Cooper and Meyer does an excellent job of giving theorists and students some basic tools to discuss the rhythmic structure of music. These tools are based on "traditional terms associated with prosody:"[1] iamb ˘¯, anapest ˘˘¯, trochee ¯˘, dactyl ¯˘˘, and amphibrach ˘¯˘. They are similar to the rhythmic modes of the late medieval and early Renaissance. It is logical to use these terms when notating rhythmic groupings because they cover all of the basic rhythmic patterns found in most music, whether tonal or non-tonal. When you think about it, music is either duple, triple, or a combination. In duple, it can be either beginning or end accented. In triple, it can be either beginning, middle, or end accented. *The Rhythmic Structure of Music* shows how these symbols (˘¯) can be combined

[1] Cooper and Meyer, *The Rhythmic Structure of Music,* (Chicago: University of Chicago Press, 1960), 6.

with grouping brackets to show prosody groupings on a foreground and background level. *The Rhythmic Structure of Music* then goes on to give the student a lot of "if/then scenarios" to teach them how to determine the rhythmic grouping. When does harmony trump melodic position? How do you choose the most important melodic note in a phrase?

One thing *The Rhythmic Structure of Music* does not do is explain specifically why prosody terms are used and how they contribute to the large scale rhythmic structure. This treatise states, "The use of poetic feet to analyze rhythmic patterns is somewhat unusual. . . An account of the theoretical basis for the viewpoint advanced here is beyond the scope of this book. We can but ask the reader, at least provisionally, to accept this viewpoint and hope that he will find it justified by the understanding which it yields."[2]

Jackendoff and Lerdahl did not accept this explanation for the use of poetic feet. They did not believe that listeners perceive rhythmic groupings according to poetic feet, and they did not believe that poetic feet were capable of showing large scale rhythmic structure. They decided to explore the gaps left by this theory. In 1983, they did a psychological study of human perception to scientifically determine human preference regarding rhythmic grouping. They found that among listeners, there was a strong tendency to group things according to harmonic consideration. Lerdahl writes, "A well-known finding in music psychology is that listeners' judgments about the distances of pitches, chords, and regions (or keys) from a given tonic form consistent patterns. . . These results have been replicated in several ways, using different input materials, participants with varied training, and different task instructions. . ."

[2] Cooper and Meyer, *The Rhythmic Structure of Music*, 7.

In their studies, they found that listeners did not hear poetic feet when they listened to music. They found that listeners grouped music according to significant events. The most significant event in tonal music is the return to tonic. They found that the return to tonic acts as the head of a new musical event in the mind of most listeners. All of the other chords relax into the tonic. In order to notate this, Jackendoff and Lerdahl developed their own system of lines that visually represent the sense that all events relax into the tonic. In reference to example 2, the lines show the direction that each chord leans toward. The top-most lines represent the most significant events, namely the return to tonic. The 0 represents at the top represents complete relaxation of harmonic tension. Jackendoff and Lerdahl call this "time-span reduction" because tonic relaxation reduces all of the little events within the phrase to a single goal of resolution. Meter is completely separate from individual rhythmic events within the phrase. Meter independently counts time in the mind of the listener until the tonic returns.

Christopher Hasty did not agree with Lerdahl and Jackendoff that meter is separate from rhythm. He wrote *Meter as Rhythm* (1997) to show that our sense of meter is created by rhythmic events in the piece. He wanted to show that rhythm and meter are dependent upon one another. He also wanted to create a theory of rhythm that could explain our sense of rhythm and meter in non-tonal music. His treatise starts with a complex explanation of how events are perceived temporally. Then he explains why he believes that other theories of rhythm do not capture a sense of how the listener experiences the music in real time. Hasty believes that listeners are either remembering and comparing or projecting and anticipating events in real time. In his treatise, he writes that our sense of meter is created as our expectations are confirmed or denied while the piece unfolds in time. When notes sound in a

particular rhythmic position, they create a projected potential in the mind of the listener. If subsequent notes confirm this potential, the listener's sense of meter begins to take shape. In Hasty's theory of rhythm, there are different hierarchical levels of "projected potential." The hierarchical levels are note values such as whole notes, half notes, quarter notes, and eighth notes etc. Each one is on a separate hierarchical level. He uses a system of vertical and slanted lines to indicate projected potential on different hierarchical levels. I shows where a projected potential begins and \ shows that a projected potential continues. I \ \ is a projected potential of triple meter and I \ is a projected potential of duple grouping. These symbols are used to show duple and triple groupings on different hierarchical levels. He labels these hierarchical levels with letters, and he shows where each projected potential begins and ends with curved lines and arrows. The letters are logical because it is easy to find and compare different hierarchical levels throughout the piece. Example 3 is a sample of Hasty's method of representing projected potential on different hierarchical levels. His theory of rhythm is a flexible system that conforms well to changing meter in contemporary pieces. It is a challenge to work through the verbage and get to the heart of what he has to say.

Now that we have an idea of what these treatises are about, we can use them as a framework for analysis to find out what they can tell us about the rhythmic structure of particular pieces. First we will look at the rhythmic structure of the theme from *Beethoven's Sonate Op. 2 No. 1*. The motivic structure of this piece is often analyzed in common-practice theory courses to demonstrate motivic parallelism. Then we will examine the rhythmic structure of the theme from Webern's *Quartet Op. 22*. We will apply all three theories to the theme from each piece to find out what they can reveal about the rhythmic structure.

Cooper and Meyer's theory of rhythm reveals some interesting things about Beethoven's *Op. 2*. Example 1 shows their poetic feet notation applied to this piece. ˘ indicates an upbeat leading to a ¯ downbeat. These two symbols are bracketed together to show the rhythmic grouping. In this example, rhythmic groupings are primarily determined by the anacrusis at the beginning of the piece. The C on beat four of the pick-up measure jumps a fourth up to the tonic. This creates a strong five to one intervallic leap and the sense that there is an upbeat to downbeat grouping as the piece begins. In that case, the first part of this piece is in an iambic rhythmic grouping.

The iambic grouping can be found on different hierarchical levels in this theme. In measure 2 for example, there is a sixteenth note triplet on the second eighth note of beat two that resolves to note F on beat three. This is also an iambic rhythmic grouping. On a larger scale, measure 1 is an upbeat to measure 2. This is because the Ab at the beginning of measure 2 is much stronger than any notes in measure 1. Ab is the highest note of both measures, and none of the other notes in measure 1 are distinguished with a change of direction or accent marks; therefore, measure 1 is an upbeat (˘) to measure 2. The iambic grouping carries through measures 1-6 at the eighth note, quarter note, and measure level. Then there is a significant change of grouping in measure 7. This due to the way measures 7-8 play out. For example, the descending eighth note motive on beats 3-4 creates a trochee grouping. This is because the Bb is the highest note in the motive. Bb shifts the grouping so that the grouping now begins on beat 3 and beat 4 is subordinate to beat 3. This is a trochee. This new grouping temporarily negates the iambic anacrusis on beat 4 that began with the anacrusis to measure 1. The first two notes of measure 8 are grouped together dynamically, melodically, and harmonically.

Dynamically, they are delineated from the preceding measure with a piano dynamic marking. Melodically, F is the highest of the two notes, and harmonically E natural leans toward F. With this in mind, measure 8 is also a trochee group. In retrospect, the important F minor 6/4 chord is the point where this piece shifts from an iambic grouping to a trochee grouping. This can be noted with Cooper and Meyer's theory very clearly. In measure 7, there is an interlocking set of brackets that shows the moment where the shift occurs. The F minor 6/4 is the moment of arrival for this entire theme on a melodic level, a harmonic level, a dynamic level, and on a rhythmic level.

Lerdahl and Jackendoff's theory shows the larger rhythmic structure better. When Cooper and Meyer's rhythmic theory is applied to larger structures, it breaks down. It becomes difficult to determine if measures 1-2 are an upbeat to measures 3-4. The poetic feet groupings do not work very well for larger structures. Lerdahl and Jackendoff's study shows that listeners hear the resolution of harmonic tension to the tonic as the delineator for larger rhythmic structures. When this theory is applied to Beethoven's *Op. 2*, the larger rhythmic structure becomes clear. According to the lines in example 2, measures 3-4 are a dominant-seventh that leans toward the F minor chord in measure 5, and the dominant seventh chord in measure 6 leans toward the F minor chord in measure 7. The tonic chords represent downbeats in measures 1, 5, and 7. They mark the beginning of rhythmic groups and a part of the overall time-span reduction. They represent large scale downbeats. All of the tonic chords lean toward or connect to the main tonic chord of this section. The higher that they connect on this line the more important they are. Below the staff are brackets that break up the theme based on recurrences of the tonic. Lerdahl and Jackendoff's theory does not get as deep into small

scale rhythmic structure as Cooper and Meyer's theory does because, according to their psychological studies, most listeners do not hear music in the kind of detail that Cooper and Meyer's theory can provide. Most listeners hear larger rhythmic patterns, especially at faster tempos.

A combination of these two theories can offer some interesting insights into this theme. Cooper and Meyer's theory shows that this piece is iambic on all hierarchical levels in measures 1-6. Then it shifts to trochee in measure 7. Lerdahl and Jackendoff's theory shows that this piece is grouped according to recurrences of the tonic chord into 4, 2, and 1 measure accelerating units. The tonic chord is a downbeat in these units that makes them harmonically trochee. There is a conflict between a trochee harmonic grouping (Lerdahl and Jackendoff) and an iambic motivic grouping (Cooper and Meyer). This means that the iambic grouping on the smaller hierarchical level works to counter the trochee grouping on larger hierarchical level. If this were not the case, the theme would feel heavy, as if it were mired in the tonic chord. The iambic group makes this theme sound lighter than it ordinarily would. Then in measures 7-8, the two theories are in agreement. They agree that these measures are trochee when the theme lands on the tonic chord at the beginning of measure 7. This is interesting because there is a definite change of direction. The theme sounds heavier as it descends into measure 8.

Hasty's theory shows a different side of this theme. It shows that there is a strong sense of the meter in this piece. The potential for prolongation of the metric pulse is realized on several hierarchical levels. It fact, Q, R, and S are realized in every measure except measure 8 where the phrase ends. On beat three in measure 8, Q and R are denied. S (the whole note hieararchical level) is maintained. This is interesting because the denial of Q and R introduces a

little rhythmic ambiguity at the cadence in measure 8. There is stasis in the melodic and harmonic active in measure 8, but the rhythmic activity becomes syncopated to keep the piece moving forward. Additionally, Hasty's theory shows that the faster T and U hierarchical levels accelerate the rhythmic activity in measures 2, 4, and during the continuation in measures 5-6. His theory brings out these particular points well, but it does not give us much insight into pieces, like this one, that already have a great deal of rhythmic continuity. His theory is best suited for pieces with more complex rhythmic structures. His theory is capable of finding rhythmic patterns that contribute to a sense of meter where there is no obvious pattern. In this piece, his theory tells us that there is a great deal of rhythmic continuity. We already knew that.

Cooper and Meyer's theory in *The Rhythmic Structure of Music* can be applied to Webern's *Quartet Op. 22*. For example, most pieces tend to be grouped in either duple, triple, or some combination of the two. In example 5, when Cooper and Meyer's theory is applied to this theme, we see duple and triple rhythmic groupings. Measure 1 is made up of duple patterns that are trochee and iambic. Measure 1 also contains triple groupings that are dactyl $\breve{-}\breve{}$, amphibrach $\breve{}\breve{-}\breve{}$ and anapest $\breve{}\breve{}\breve{-}$. This means that this theme will have a great deal of rhythmic diversity on the surface level. Webern also combines these groupings in a polyphonic manner. This layering of patterns on top of each other creates extended patterns like measure 4, $\breve{}\breve{-}\breve{-}\breve{}$. Measure 2 is $\breve{-}\breve{}\breve{}\breve{-}\breve{}$. The next step in Cooper and Meyer's theory is to assign accented and unaccented designations to the theme at the measure level. This is not possible in this particular theme. This theme is so disjunct that it is difficult to determine which note is most important in the theme at the measure level. In pieces where there is a conjunct ascending or

descending motion then a sudden change of direction, the choice is clear. In this case, the motion is primarily disjunct. Cooper and Meyer's theory breaks down in this type of theme at the measure level. It is difficult to say much about the large scale rhythmic structure of this theme with Cooper and Meyer's theory.

Lerdahl and Jackendoff's theory is simply not suited to a piece like Webern's *Op. 22*. Their theory is based on relaxation of tension into the tonic. When there is no tonic, their entire theory falls apart. This is fine because Lerdahl and Jackendoff do not claim to be able to analyze the rhythmic structure of non-tonal music.

Hasty's theory shows the basic rhythmic structure of this theme most effectively. A word of warning; Hasty has rebarred the excerpt in example 6 to show his interpretation of the rhythmic structure of the theme more clearly. For comparison, example 7 is an unaltered version of the main theme from Webern's Op. 22. Example 6 is Hasty's own rhythmic interpretation of this passage. Hasty's theory shows that in the first measure, there is a note in the hierarchical level of the quarter on each beat of measure 1. The arrows show the projection of quarter value throughout measure 1. Measure 2 consistently projects eighth value. This measure is made up of primarily sixteenth notes, but this value is not projected because the last sixteenth note is missing. The last sixteenth in measure 2 occurs in the eighth note position. This preserves the eighth note projection into the next measure.

Hasty's interpretation of the next measure is debatable. He indicates in his reduction, below example 6, that this measure 3 is a sixteenth note projection. An alternate interpretation is that this measure projects two more eighth notes. Even though this measure

is questionable, his reduction of this theme captures the general feeling that the first measure is in 3/4 time, and the next measure is either 3/8 or 5/8 time.

This theme is an excellent example of the type of music that Hasty's theory is best suited to analyze. The surface rhythmic activity is ambiguous, but at the quarter and eighth note hierarchical levels there is a sense that this theme is in 3/4 time in the first measure which changes to 5/8 time in the second measure. This demonstrates Hasty's theory that the rhythm creates meter. He also theorizes that a sense of meter is created when the next note occurs in the expected hierarchical position. When the listener's expectation is fulfilled, the projected metrical potential continues until it is denied. We see that in this passage. There are notes in the first measure that occur consistently where the quarter should be in 3/4 time, and there are notes that occur consistently in the position of where eighth notes should be to in 5/8 time. Hasty's theory can find note values that are common to a passage and showing how they create a sense of meter. This is very helpful in meterically ambiguous passages such as our Webern example.

What we have discovered is that Cooper and Meyer's theory of rhythm can be applied to tonal and non-tonal music. It can bring out the surface rhythmic patterns in rhythmically consistent music such as Beethoven's *Op 2* example or rhythmically ambiguous examples such as Webern *Op. 22*. This is because almost all rhythmic groupings can be interpreted as either duple or triple. The main weakness in this theory is that it becomes difficult to determine which measure is dominant in a longer passage.

Lerdahl and Jackendoff's theory of rhythm shows larger rhythmic structures. It does this by focusing on the listener's preference for harmony. Their theory states that listeners hear the

rhythmic ebb and flow of a piece as it tenses and relaxes into the tonic. It further states that meter marks off time between these points. Their theory does not show the surface activity of the rhythmic structure very well. It also does not work if the piece is non-tonal.

Hasty's theory shows continuity in rhythmically ambiguous passages. It also shows that meter and rhythm are very closely linked. Rhythmic activity creates the listener's sense of rhythm by fulfilling the listener's expectation that a note value will occur in the proper position as the piece progresses. One of his goals is to capture the way listeners hear the music in real time. The strength of Hasty's theory is that it can be used to find continuity in non-tonal music. One weakness is that in Classical period music with a great deal of continuity, it does not tell us much about the piece. It basically tells us that there is a lot of continuity and the listener will hear it that way. This theory works best in contemporary music that is rhythmically ambiguous.

The best strategy to use when analyzing the rhythmic structure of a piece is to combine of these particular theories. For instance, in tonal music, it would be advantageous to use Cooper and Meyer's and Lerdahl and Jackendoff's theories to discuss the large scale and small scale rhythmic structure of a piece. Cooper and Meyer's theory can show the note to note and measure to measure structure, while Lerdahl and Jackendoff's' theory can show the rhythmic structure of the entire phrase based on tension and relaxation into the tonic. For contemporary music, it would be good to use Cooper and Meyer's and Hasty's theory to say something meaningful about the rhythmic structure. Cooper and Meyer's could show the small scale rhythmic groupings, and Hasty's theory could find the meteric continuity in rhythmically ambiguous passages.

In general, these theories build on each other. There is still a lot more to learn about rhythm. It is a complex subject. This is one reason it is not part of most music programs. At the same time, rhythmic theory needs to be a part of a music curriculum. There is a great deal of potential for greater insight into the structure of music if rhythmic structure is taken into consideration.

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