A Companion to *Mallet Quartet*: Rhythmic Voice Leading Prototypes Matt Chiu and Tyler Howie

Steve Reich's Mallet Quartet (2009) has quickly become a staple in the percussion-ensemble repertoire. Four such ensembles-the Amadinda Quartet, NEXUS, Synergy, and So Percussion-cocommissioned the piece (Reich 2009). Its popularity, however, is certainly not due to its percussive accessibility; it was, after all, commissioned by four professional ensembles and the piece poses performance challenges from the start. In the first movement, performers must navigate canons, hocket, and conflicting formal cues. We seek to provide a theoretical map of the first movement of the mallet quartet using primarily our concept of *rhythmic voice leading*—a method for describing the relationship between rhythms. By presenting the piece's rhythmic content as a series of related transformations connected through simple voice leading, this paper acts as a performer's companion to aid in the learning and rehearsal processes. We will begin our analysis by providing an overview of the movement's form before introducing the concepts of beat-classes and beat-class sets, both of which other music theorists have used to analyze Reich's music (Cohn 1992; Roeder 2003).ⁱ We then present the three main rhythmic motives played by the marimbas and describe relationships among them using beat-class sets. Following our analysis of the marimbas' music, we turn to the vibes', where we use beat-classes to help us describe formal and structural relationships between the two pairs of instruments. We then place our analysis in dialogue with the one Reich offers in the score's notes (Reich 2009). After discussing the potential performance implications of this analytical dialogue, we offer a companion practice guide based on our analyses.

Before moving on to our formal overview, we would like to take a moment to discuss some cultural context for the primary rhythmic motives of our analysis. Like other patterns Reich enjoys, these come from the dance musics of various indigenous populations in regions including West Africa, South America and the Caribbean (Locke 1987; Toussaint 2013). Other music scholars have discussed Reich's colonization of West African rhythms (Agawu 2003; Gopinath 2019), noting in particular how he "...takes specific patterns of African music (notably bell patterns), and subjects them to distinctly 'un-African' processes..." (Agawu 2020). Discussions of cultural appropriation are complicated, and we do not have the space to explore this issue in the depth it deserves. But we believe that Reich—due to many factors including gender, race, nationality, location and genre—benefitted from his use of the rhythms in ways that indigenous populations did not. We analyze Reich's use of these multicultural patterns, focusing in particular on the effects of the "distinctly un-African" processes to which he subjects them. Where possible, we give patterns culturally appropriate names, whether based on a borrowed term or their musical function, and we encourage readers and performers to engage with and discuss the complex

political power structures at play in the composition, performance and analysis of a piece like *Mallet Quartet*.

Form

The tonal structure of the first movement defies traditional key schemes. These key areas, defined by their scalar collections, progress by minor-third transposition—or T₃. Figure 1 shows that the movement starts in an area of 2 sharps and moves through all T₃ related keys: $2\# \rightarrow 1b \rightarrow 4b \rightarrow 5\#$, dividing the movement into four tonal areas. If we think of the key scheme as a T₃-related cycle, each new tonal area is a step closer toward the cycle's completion. The steps continue through the *attacca*, and the next movement continues from where the cycle began—2#s. The first movement's key scheme is therefore directional, and the T₃ cycle harmonically divides it into four sections, two of which repeat. The rhythmic motives in the marimbas, however, present a contrasting view of the first movement's form.



Figure 1. Mallet Quartet, I: Tonal form chart

The rhythmic motives suggest a symmetrical, five-part rondo. The marimbas play two, two-bar rhythmic patterns—X and Y—which alternate to create five formal sections: XYXYX. These patterns, along with formal labels, are transcribed in Figure 2.ⁱⁱ



Figure 2. Mallet Quartet, I: Rhythmic form chart

Figure 3 juxtaposes the tonal and rhythmic forms of the first movement. Altogether, there are seven tonal sections (made up of four, T₃-related key areas) and five rhythmic sections (made up of two alternating two-bar patterns—X and Y). We call this combination the *formal aggregate*. The concept of the formal aggregate can help the learning, rehearsal and performance processes. It provides multiple musical guideposts around which performers' mental maps and ensembles' rehearsals can be organized, and ensembles may choose to highlight certain formal divisions and obscure others in the service of a particular musical interpretation.

Form							
Measures	1	41	69	113	149	169	Mvt. II
Key	2#	1b	2#	1b	4b	5#	2#
Rhythm	Х		Y	Х	Y	Х	

Figure 3. Mallet Quartet, I: Formal aggregate

Having examined the form from multiple angles and created the formal aggregate, we will now turn to the rhythmic relationships used within each section. In our analysis below, we boil down the marimbas' musical material to just three prototypical rhythms from which each unique measure-long pattern can be derived. In order to describe these relationships, we will use beat-class sets, which we will now explain.

Beat-class sets

The concept of beat classes (BCs) is rhythmically analogous to that of pitch classes. In pitch-class space, each of the twelve chromatic pitches corresponds to a number from 0-11, and octave and enharmonic equivalencies are assumed (every C is 0, C#/Db is 1, D is 2, etc.). BC space operates similarly. Each subdivisional "beat" (in our case, the eighth note) in a measure corresponds to a number. Lucky for us, the first movement of the mallet quartet is in 3/2, which means our corresponding numbers will also range from 0-11.ⁱⁱⁱ

Music theorists often like to represent pitch-class space as a clockface on which 12=0=C, 1=1=C#/Db. Following this convention, we visually represent our BC space in the same way. Figure 4 shows a clockface portraying both a measure of 3/2 with six eighth notes and the six pitches of a whole-tone scale, all of which land on even-numbered units; although these patterns exist in different musical spaces (pitch and rhythm), they are represented by the same mapping on a clockface.^{iv} Note that the BC clock shows onsets, or where notes occur, rather than their durations. This means that the rhythmic pattern in Figure 4 is equivalent to a series of quarter notes.



Figure 4. Pitch-class and beat-class clock

Marimbas

As stated previously, we trace all of the marimbas' rhythmic material back to three main patterns, shown in Figure 5. Before describing these rhythmic relationships, we should examine our labeling system. Each pattern has a name—*bell*, *Tonada*, and *split*—followed by a subscript digit ("bell₀"). The subscript refers to the BC on which the pattern begins. A notable characteristic of all the three rhythms is that they each have a symmetrical property—each pattern has a unique, single axis of symmetry dividing it, and the two resulting halves can map onto each other over that axis. Because of this unique axis, each permutation of each rhythm is unique and sounds perceptually distinct from other permutations.



Figure 5. Different rhythmic patterns used in Mallet Quartet

We have used culturally relevant names when possible. The "bell" pattern is found in dance musics of many cultures; Toussaint (2017) finds the pattern practiced across regions including West Africa (*agbekor*), South America (*behavento*), and the Caribbean (*bembé*), and more. Because it has many culturally dependent titles, we call it the "bell" pattern because of its musical function; a bell pattern in West African music, much like in the mallet quartet, is a rhythmic ostinato and guide pattern. The "Tonada" pattern is a fusion of Andalucian and African rhythms that came together in Cuba. It also appears in *Bélé* music in the Carribbean. We borrow the term "Tonada" from Toussaint (2005). The split pattern is the only pattern named for its relation to another—a connection we'll explain shortly. One notable characteristic of all the rhythms in Figure 5 is that they each have a symmetrical property—each pattern has a unique, single axis of symmetry dividing it, and the two resulting halves can map onto each other over that axis. Because of this unique axis, each permutation of each rhythm is unique and sounds perceptually distinct from other permutations.

In a way, our representation of the patterns embodies the music's effect. We combine modernist music theory and its processes with culturally relevant titles paralleling how Reich takes African materials and subjects them to un-African processes. Both groups co-opt a musical culture to serve academia's whiteness; both present a postmodern juxtaposition of African, Cuban, South American, and Caribbean dance traditions and Western concert-hall (and academic) practices.

The bell pattern first appears in Marimba 1, m. 1. Here, it is labeled "bell₀" because it starts on BC0. The bell is the most prevalent of the three main patterns, and the mallet quartet has three of its permutations: bell₃, bell₇, and bell₈. Each of these permutations is the result of transposition. To get to bell₃, transpose by bell₀ by T₃. Likewise, bell₇ is T₄ of bell₃, and bell₈ T₁ of bell₇. Figure 6 shows the transpositions of the bell pattern in notation and on BC clocks.



Figure 6. Bell pattern transpositions

As stated previously, the three patterns in the marimbas are closely related. To connect them, however, requires not just transposition (/permutation), but the displacement of onsets. As shown in Figure 7, moving BC4 of bell₀ to BC3 results in Tonada₉. Displacing onsets to create new patterns is analogous to a harmonic-melodic device—voice leading. Therefore, we call this process rhythmic voice

leading. The combination of displacement (voice leading) and permutation (by T₄), maps the bell pattern neatly onto the first Tonada pattern.



Figure 7. Mapping the bell pattern to the Tonada

The Tonada first appears in Marimba 2, m. 1. Although it initially enters on BC0, it is labeled Tonada₁ because each subsequent entry starts on BC1. Only two versions of the Tonada are present in this movement: Tonada₁ and Tonada₉. Much like the bell maps onto the Tonada, the Tonada maps onto the split. Figure 8 shows how each pattern can relate to one another via rhythmic voice leading. Each pattern is represented in its most compact form.^v An onset is displaced from the bell pattern results in the Tonada, and by splitting onset 6 in two, the split pattern is made; the split pattern appears in Marimba 2, m. 2 on BC0.



Figure 8. Rhythmic voice leading for prototypes

Vibraphones

Vibe 1 enters in m. 17, playing a rhythmic pattern called the *tresillo* (in Cuba). It, like the bell pattern, is widely used and is known by many names. It is characterized by its 3+3+2 grouping and has been of great interest to music theorists in recent years (Toussaint 2013; London 2012; Biamonte 2013; Cohn 2016). Figure 9 shows the pattern as found in the vibraphone parts, where the 3+3+2 grouping is made clear by the highest pitch. Vibe 2 joins the texture in m. 29 and enters in canon a quarter note after Vibe 1. We can also describe the canon in BC terms: Vibe 2 enters in canon with Vibe 1 at T₂.



Figure 9. Vibraphones tresillo pattern in canon

During this canon, the marimbas continue playing their two, measure-long patterns (12+12). In the same span, the vibes play the tresillo pattern three times (8+8+8). The marimbas divide a 24-beat unit in half, and the vibes divide it in thirds, creating a two-against-three metric hemiola between the two pairs of instruments. This is further complicated when one takes into account that the vibes are in canon at T_2 and the marimbas are in a repeating two-bar canon (shown in Figure 10).



Figure 10. Rhythmic aggregate including marimbas and vibraphones

As we have shown, there are many ways of structurally partitioning *Mallet Quartet*. We showed that the form is simultaneously directional (tonal) and alternating (rhythmic); we showed that the rhythm in the marimbas could be united by three prototypical patterns, and related through rhythmic voice leading and permutation; and, finally, we analyzed the conflicting metrical layers which resulted in a hemiola, further complicated by the canon. Reich describes the movement as two sets of canons: one in the vibes and one in the marimbas. While we did recognize the canon in the vibes, we chose to highlight different rhythmic relationships in the marimbas that are more perceptually salient. The analysis presented here prioritizes the performers' relationship to the music rather than the larger compositional design.

Conclusion

We hope our view of the rhythmic relationships in the piece will help performers and ensembles in the learning, rehearsal, and performance processes. We also hope that our concept of rhythmic voice leading will be of use to performers, educators and scholars, and we encourage its alteration and application to other musical styles. As we have suggested over the course of this paper, neither analytical tools nor compositional processes are politically neutral. Our modernist music theory works well for analyzing the distinctly un-African processes Reich uses, but that does not make it universally appropriate. Notation, be it in BC sets, staff notation, or form charts, inherently prescribes communicative codes which require a specific knowledge to make meaningful, and as a result, can implicitly and/or explicitly reinforce a particular ideology. By extracting rhythms from Reich's piece and ascribing names to the patterns from non-Western cultures, we have similarly divorced them from their experiential and cultural origins. While we hope our theory might be of use, we encourage further critical reflection on how analytical methodologies might frame, distort, or organize music.

APPENDIX: Practice guide

Figure A1 presents a sample practice guide based on our theoretical model of the first movement of the mallet quartet. This is just one way to use our analytical method to create practice exercises.

Practice with a metronome. Play each pattern until you feel comfortable (our worksheet suggests a minimum of 4x). Do not stop between patterns.

- Start with the bell₀. Play the pattern 4 times.
- Without stopping, displace BC4 to BC5 to create Tonada₉. Play the patter 4 times.
- Without stopping, split BC5 into BC4 and BC6 to create split₃. Play the pattern 4 times.
- Without stopping, transpose split₃ by T_1 to split₄. Play the pattern 4 times.

Now, go backward through the process.

- Without stopping, fuse BC5 and Bc7 into BC6 to create Tonadat. Play the pattern 4 times.
- Without stopping, displace BC6 to BC5 to create bell₁. Play the pattern 4 times
- Without stopping, transpose bell₁ by T₁ to bell₂.

Now, go through the original process again. Repeat ...



Figure A1. Practice worksheet

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ⁱ For a summary of the methods and analyses in the above sources, see Roig-Francoli (2008), ch. 13.

ⁱⁱ Figure 2 also shows our labels for the patterns, which include a subscript number denoting the patterns permutation. We explain this labeling system after our discussion of BC sets.

ⁱⁱⁱ In fact, much of Steve Reich's music uses 3/2, perhaps because of its potential for metric ambiguity or its metric parallel to pitch space.

^{iv} In mathematical group theory, this is called an *isomorphism*.

^v In post-tonal theory, this is known as the "prime form" of its T_n/I_n class. For more information on T_n/I_n class, see Straus (1990).