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Feeling Beats and Experiencing Motion:

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Abstract

Musical meter is often described as an objective grid-like system of time-points that is created by musical sounds. I define meter instead as any pattern of felt beats an individual listener chooses to hear, a physical and cognitive interpretation of the music that is (re-) created in the moment of listening. We construe meter through embodied *metering practices*: dance gestures, patterns of counting, or epistemologies of rhythmic motion. Many metering practices have conventional *metering constructions*, specific associations between sounding features, patterns of felt beats, and paths of motion through these beats. Drawing on concepts from cognitive science and performance studies, I explore how this embodied knowledge is constituted and applied in both planning of musical phrases by a performer, and in-time perception and cognition of musical rhythms by any listener or participant.

Metering constructions and practices are often performed by and associated with certain communities and identities. I take a culturally-situated approach to meter and felt motion, studying traditions of embodied movement and bodily discipline including headbanging in heavy metal (Chapter 1), characteristic dance rhythm topics in non-dance concert music of the eighteenth century (Chapter 2), motivic manipulation and developing variation in late Romantic chamber music (Chapters 3 and 4), and prosody and speech gestures in operatic recitative (Chapter 5). Contrary to many existing theories of meter, I argue that our feelings of beat are not necessarily organized in cyclical grids, but are improvised on the spot by stitching together familiar motions. I also explore how movements often embody and perform aesthetic ideologies and cultural meanings, with these hermeneutic frameworks often shaping listeners' choice of movements, their proprioception of their own movements, and their perception of the qualities of rhythm and motion in the music they are listening to.

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Introduction

> *Simply in order to play the notes at the right time [...] I had memorized a silent click-track for the piece—a click-track against which the rhythms played out their jazzy syncopations and crossrhythms. [...] I can also remember well my surprise some months later when I listened again to the tape [...] what had seemed to me in my days of familiarity a rhythmic-metric structure of crystalline clarity had become thoroughly opaque. Seemingly erratic impulses dominated the soundscape. Did an audience, any audience, hear only this latter piece and never the one that I had striven so hard to perform?*
>
> *—Joel Lester, describing a composition by Milton Babbitt*

First you hear subdued sustained chords, slowly refracting and folding in on themselves. For some of you this frozen moment is a chance to leave behind the concerns of the day, for others it is rich with anticipation that beckons the party ahead; the quiet stillness represents both equally well. Slowly the sound swells into a thunderous echo of itself, before that magical *it* breaks the stasis into motion: the *thump thump thump thump* of the bass. We feel this thump in our bones, not just because the sound is loud, but because it represents movement, dance, beat. The beat we feel in DJ Tiësto's "Ten Seconds Before Sunrise" isn't the bass by itself—the beat is in our bodies, we make it as we jump and shout and stomp our way into the night. Hi-hats, shakers, and other small percussion circle around our beat like a pack of disco-wolves chasing down a bass-bison, weaving in and out in coordinated pursuit. Though all these auxiliary rhythms are pre-determined in the DJ's set, we experience them as a response to our own dancing, a sonic wake of our own embodied beat. The topic of this dissertation is beats and their organization into meter, such as the "*uhm-tss uhm-tss*" of Tiësto's song or the "1-2-3 1-2-3" of a waltz. But I'm not interested in identifying beats and metrical grouping for their own sake. My goal is to use these theoretical abstractions to communicate about motion, to explore the diverse ways we can move together in time, to understand why we imagine musical sounds to trace and embody the movements of others, to explain what happens when we experience music playing against the motions and felt beats we perform within our own bodies.

For centuries, it has been assumed that beats are *created by* regularity and order, a paradigm I will call "entrainment-is-periodicity." Theorists have defined meter as strict regularity, structured by evenly-spaced beats grouped into measures with the same number of beats in each measure, playing out a cyclical pattern of strong and weak beats forever. Decades of research have established that such nested periodic cycles are a productive model for much musical activity, accurately predicting many phenomena in rhythm perception. But most writings on meter also discuss *metrical irregularities*, exceptions to the well-ordered rules of meter, analyzed as surprising disruptions to the nested periodicities that define meter in these theories. But this means that existing theories of meter can only offer *adequate descriptions or explanations* for metrical irregularities if it is assumed that they are both surprising and disruptive.[1] In this project I present many examples in which I believe this is not the case.

[1] Here I am referring to Noam Chomsky's conceptions of *descriptive adequacy* and *explanatory adequacy* in theories of linguistics. Chomsky states that "A grammar can be regarded as a theory of a language; it is *descriptively adequate* to the extent that it correctly describes the intrinsic competence of the idealized native speaker" (1956, 24). Further, "To the extent that a linguistic theory succeeds in selecting a descriptively adequate grammar on the basis of primary linguistic data, we can say that it meets the condition of *explanatory adequacy*" (Ibid., 25). A theory of musical meter has *descriptive adequacy* if it can successfully describe all the organizations of felt beats that occur in musical cultures, and has *explanatory adequacy* if it offers a plausible explanation for how it is that people come to experience meter in this way.

Despite the incompatibility of these ”irregularities” with existing definitions of regular meter, we often experience and talk about irregularities in metrical terms. The problem is illustrated well by Richard Cohn's proposition at the beginning of his widely-cited article about hypermeter in Beethoven: ”Consider a single span of eight units that divides 3 + 3 + 2. For a Balkan listener, who would recognize a constant rate only at the unit level, this is not a metric complex” (Cohn 1992, 194). This 3+3+2 organization is not meter because it does not fit Cohn's definition of meter (which builds on Yeston, Schachter, and Lerdahl and Jackendoff), yet nobody would assert that Balkan music is *unmetered*—in fact, for evidence of the 3+3+2 structure Cohn cites an article titled ”The *Metrical* Structure of Macedonian Dance” (my emphasis). One approach to solving this problem has been to relax these requirements for regularity in certain cases, such as Non-Isochronous meters like the Balkan dances (London 2004, 100), or variable meters that constantly shift between duple and triple groupings like Stravinsky's work (Lerdahl and Jackendoff 1983, 97). But while loosening these rules allows those theories to describe a broader range of metric structures, they lose the explanatory power of *entrainment-as-periodicity*, a paradigm founded on the ontological principle that beats are created by periodic regularity.

Similar tensions with theory are more viscerally evident in the epigraph above, in which Joel Lester describes a non-isochronous, non-cyclical ”memorized click-track” that was only perceivable when maintained with careful practice, a phenomenon which clearly does not fit into standard definitions of cyclical meter. But Lester's experiences clearly involve feeling sounding rhythms against a particular metrical interpretation, and he describes these experiences through the language of meter theory: “click-track,” “impulses,” “jazzy syncopations and cross-rhythms,” a “rhythmic-metric structure of crystalline clarity.” As I will show throughout this dissertation, this *discourse of meter* is used by many writers to account for physical experiences of rhythm, whether or not those rhythms are “metrical” in a strict classical sense. One of the goals of my project is to reorient the basic ontology and technical definitions of meter theory, so that the regular and irregular patterns of felt beats can be analyzed in the same terms.

Another goal of mine is to place *motion* at the heart of all theories of meter, by arguing that each person creates their own felt beats with overt body movements or covert imaginations of motion. To hear music rhythmically is to join the rhythm: to both identify affordances for motion, and then perform one of those motions and create for oneself a particular embodied rhythmic interpretation. From this perspective, beats are created by the (deliberate or unintentional) action of the human body’s sensorimotor system, not by durational properties within sound. Sometimes, the interpretations we come up with are periodic; but lots of music has timing that is not so rigidly disciplined, and even when it is, we rarely all move in metronomic unison. Even in regular meter, durational invariance does not itself directly cause an experience of musical beat; the existence of periodicity does not explain why we ”feel” a beat. My argument is that in every case (including the periodic one), the experience of a musical beat comes from hearing familiar rhythms and finding a way to fit one’s body into the music. Periodicity does not create beat on its own, it only affords embodied participation in an especially direct and obvious way.

Regularity and repetition have been central tools in Western conceptions of how rhythm works, at least since Plato defined rhythm as “the order in movement” almost two and a half millennia ago. When viewed as a structure in music, this regularity has been defined as “meter,” a grid of strong and weak accents generated by the music and discovered involuntarily by the listener. The most reductive version of this tendency is Maury Yeston’s definition that “meter is an outgrowth of the interaction of two levels [of periodic pulse]—two differently-rated strata, the faster of which provides the elements and the slower of which groups them" (1976, 66). For Yeston, meter is the interaction of two differently-speeded pulses, in a hierarchical relationship that exists independently of any perceiver. These pulses are generated directly by the articulations of the music, are in some sense objective facts rather than subjective experiences. While Yeston's theory may be unique in almost entirely abstracting away from the listener, all existing theories of musical meter exhibit comparably abstract basic ontologies or initial definitions of meter, despite the fact that many defer to the experience or agency of the listener regularly in their applications of these ontologies in actual analysis.[2]

When viewed as a human behavior, this regularity is called "entrainment," an organism's capacity to synchronize with rhythms outside itself, which in the case of music is usually modeled as humans' ability to synchronize with a metronomic pulse (Repp 2005, Repp and Su 2013). While music theory scholars have traditionally defined meter separately from human perception, many recent scholars (Gjerdingen 1989, London 2004, Mirka 2009) have blended the perspectives, arguing that meter should be defined as *entrainment to* periodicities in the music, rather than the periodic durations themselves. Within the larger paradigm of periodicity, this is a local development which Mitchell Ohriner has termed "*meter-as-entrainment*" (Ohriner 2016, 2). Ohriner emphasizes that *meter-as-entrainment* theories define meter as periodic *attending* (not just periodicity in sounding durations), thus focusing on the human body as the locus of meter; and theories of attentional periodicity seem to provide a good explanation for how we sometimes fall into a groove so effortlessly it seems automatic or subconscious. But this focus on the body still remains within the larger paradigm which reduces all

[2] Many scholars including Lerdahl and Jackendoff (1983) and Krebs (1999) talk about meter as a structure that must be discovered or inferred by a listener (i.e., not a trivially obvious aural percept), but meter itself is still defined as an abstract, immanent structure generated by and latent within the sounding durations of the music.

motional participation to a periodic substrate.

Even when music does go *thump thump thump thump* in endless cycles, the model of metronomic synchronization is blindsided by the diversity of metrical interpretations people often choose to make. Theoretical studies (Attas 2015, Butler 2006, Horlacher 2000) have described shifting attention between multiple metrical possibilities in a wide range of music. Several empirical studies have highlighted participants' divergent metrical interpretations (Handel 1984, Handel and Lawson 1983, Handel and Oshinsky 1981, Martens 2012). Aside from these ambiguities which can be recognized even from traditional definitions of meter, many scholars (Benjamin 1984, Hasty 1997, Hatten 2002) have complained that the abstraction of meter into layers of periodicity flattens out crucial details, recognizing only equivalences between two pieces that are drastically different in rhythmic character, like a Bourrée by J.S. Bach (see Chapter 2) and a heavy metal song by Metallica (see Chapter 1) which are both in 4/4. This work reflects a need for a new ontology of meter that offers better explanations for these scholars' insights into how we structure our own ongoing experiences of rhythm.

Instead of defining meter through periodicity, I will take human motions as the ontological foundations of my theory. I will start by considering the motions we make in music, focusing on the irregularities, which under the current paradigm are *exceptions* to the rules of meter. My first priority in this work has been to create an alternative ontology that can explain how and why we experience beats and metrical structure in these irregularities, without appealing to periodicity. But I will also reflect the motional principles of this approach back to regular meter. The periodic phenomena theorized in existing studies of meter also can be approached from this body-first perspective, which I believe can lead to more direct and compelling explanations of our physical experiences of regular meter, not just of metrical irregularities.

I will theorize motions as “constructions,” familiar collocations of formal features associated with a particular function or interpretation. A compelling example of a linguistic construction is *"That's so last year!,"* a collocation of words in which the meaning of the phrase has been defined by usage, but cannot be recovered from dictionary definitions of the individual words (Wee and Tan 2008). My conception of a “metering construction” is a modified version of Lawrence Zbikowski’s “metrical constructions” (2008, 289–290), and like him I am inheriting concepts of constructions and usage-based grammar from the work of cognitive linguists like Adele Goldberg (1995, 2003), Ronald Langacker (2002), and Michael Tomasello (2005, 2008). Metering constructions are ways of moving associated with particular musical features, which I will define in more detail below. I will analyze music primarily as a series of motions, and extract felt beats from those motions, before finally analyzing the properties of these motions and beats as a metrical structure. By analyzing metrical structure “bottom-up” based on a particular listener’s motional interpretation and felt beats, I offer an explanation for experiences of meter which does not rely on the ontological premises of *entrainment-as-periodicity*.

A growing number of scholars over the last few decades have already been struggling with the paradigm of *entrainment-as-periodicity*. Scholars dissenting to the paradigm (just to name a few, Horlacher 1995, Ito 2004 and 2013, Butler 2006, Ijerzerman 2011, Grant 2014 chapter 3, Ohriner 2016) have produced many insights, but these advances have mostly remained at the margins of the discourse about meter, which continues to be defined *a priori* as isochronous pulse. My goal in this dissertation is to: (1) synthesize the insights of these other researchers into a general theory of rhythmic structure that accommodates diverse ways of moving together; and, (2) convince the reader that the time has come to reshape our definitions of meter to bring some of these existing insights into the mainstream; and finally, (3) that this paradigm shift will give meter theorists greater explanatory power to account for an abundance of less-regular metrical experiences which are already widely being discussed and analyzed in metrical terms.

Context: Theories of Meter

In most twentieth-century music theory, beats and meter are defined as strata of time marked off in rigidly equal durations, often seeming to exist in an abstract space without reference to a human listener. The 1983 theory of Lerdahl and Jackendoff (L&J) is the most highly-cited theory of musical structure, and is representative of several other influential orthodox approaches to meter, including Yeston 1976 and Krebs 1999. In L&J's theory, beats are duration-less time-points (18) which are separated by equal durations, and meter is a hierarchy of at least two levels of stronger and weaker beats (19). For example, in their model of 4/4 meter, a quarter note beat is considered to be the *tactus* or basic pulse, with four quarter notes in each measure, and normally every other quarter note is stronger or metrically accented. These regular accents at the quarter note level count as beats in the next largest level of hierarchy, a half note level; similarly, every other half note is accented, and these regular accents form a level of beats which are a whole note (or four quarter notes) in duration. L&J provide a set of "Metrical Well-Formedness Rules" (MWFRs) which stipulate that only levels consisting of equally spaced beats count as meter (MWFR 4; see L&J 1983, 69–73). In theories like L&J's, meter (and by proxy, all engagement with classical music by experienced listeners) is defined in terms of rigid cycles, which are determined relatively universally without much consideration for subjective differences in listening.[3]

[3] It should be noted that Lerdahl and Jackendoff only claim that their theory represents "final-state" hearings of classical music by experienced listeners, not confused or disorderly initial hearings or hear-

A central problem in the theory of meter, dating back at least three centuries, is reconciling this static, rigid cyclicity and predictability with the dynamic expressiveness often associated with musical rhythm (Hasty 1997, 46). William Benjamin critiques L&J's theory along these lines, observing that "In their view, the metric structures of tonal music are shallow (comprehending few levels), obvious from the standpoint of proportional organization, invariant over time, and hardly different from one piece to the next" (Benjamin 1984, 359). The music theorist Christopher Hasty proposed in 1997 that one solution to this problem might lie in theorizing meter as an active process, in which even deeply repetitive rhythmic structures are experienced as continually unfolding durations in an extended present. His theory came on the coattails of cognitive research in the 1980s by music psychologists including Mari Riess Jones (Jones and Boltz 1989), who theorized rhythm perception as a "dynamic attending process" involving flexible entrainment to external rhythm, and Robert Gjerdingen (1989) who describes "meter as a mode of attending." A growing collection of music theory scholars draw from these approaches, creating a "perception turn" that emphasizes meter as an active process of cognition rather than an objective structure in music (Butler 2006, Grant 2014, Hasty 1997, Horlacher 1995 and 2000, London 2004, Mirka 2009). These authors still define meter *a priori* as periodicity, so within their theories many of the less regular metrical interpretations discussed in this study would be treated either as exceptions to their definitions of meter, or dismissed entirely as non-metrical. I want to explore how such irregular structures can still offer metrical or meter-like experiences (felt beat, strong/weak accent, etc.), so their focus on meter as a perceptual experience forms the foundation for my thinking.

My work follows this recent turn to focus on active perception, which Mark But-

ings by untrained, undisciplined listeners, which I hope to account for within my approach.

ler calls "metering" in his study of electronic dance music (2006, 105). Butler describes meter as something which is subjectively *construed*, a structure created or felt-out in real time by each listener, instead of an abstract, intersubjective given (137).[4] This perspective is inspired by the work of the psychologist James J. Gibson (1966), who argued that the body is a system for perceiving, and that we move our bodies to actively create percepts instead of passively perceiving them. My argument in this dissertation will be that rhythm and meter are not perceived as abstract structures in sound, but as traces of or affordances for human movement. When we listen to music, we are investing our own body in a particular beat interpretation, and we perceive the rhythmic qualities of the musical sound in reference to the way we move alongside it.

My principal innovations over these previous theories of active rhythmic perception are (1) to redefine metrical interpretation through body motion, rather than defining it through an abstraction temporal periodicity; and, (2) to admit any motion as the basis for felt beats, whether periodic or not. In a review of Butler's book, music cognition researcher and jazz pianist Vijay Iyer clarifies that metering draws on prior musical experience.

> Any model of rhythm perception and cognition must include stages at which incoming rhythms are compared to known rhythms, matched against known meters, and situated among broader expectations about musical events. [...] In short, it must treat perception to some degree as a *practice*—an open-ended, intentional activity that is accomplished actively by the musical participants, dancers, and listeners included. (Iyer 2008, 275; my emphasis)

Iyer's terminology of "practice" and "known rhythms" evokes convention, familiar

[4] This approach is ontologically opposed to the abstract and universal metrical structures determined by Lerdahl and Jackendoff, whose Chomsky-influenced "generative theory" of music is founded on an assumption of a "homogeneous speech community," in which individual differences between listeners are flattened out so that a set of propositional rules might generate all possible "correct" statements in a particular (musical) language (Lerdahl and Jackendoff 1983, 5-6). Empirical studies by Stephen Handel (1984) and Peter Martens (2012) have shown that considerable subjective variation in perception exists in both artificially simplified research conditions, and performances of normal music.

ways of hearing and interpreting rhythms that we recognize in music. When I redefine movement as the basis for meter, one important corollary is that these "metering practices" are *movement practices*. This approach participates in a conversation going back centuries which connects musical motion to other recognizable traditions of movement and rhythm like dance, oration, poetry, and manual labor. My conceptual goal in this dissertation is to study the possibilities for cooperative movement and rhythmic interpretation, and these concepts will be made concrete through analyzing both individual familiar rhythms, which I'll define as *metering constructions*, and how we deploy those familiar rhythms in broader musical styles and movement practices.

Despite the fact that I theorize the perception of beats as "metering," one of the central claims in my study is that embodied beats (and human entrainment behavior more generally) may easily occur in patterns that are not identifiable as musical meter from traditional perspectives. Each chapter provides a case study of how these less regular, less cyclical forms of movement can still afford "metrical orientation" (Ito 2014), or a sense of orientation towards specific locations within a given metrical order. Each of these cases demonstrates that fixed metrical cycles are not required for rhythm to be comprehensible and allow for participation and engagement. Noncyclical and nonperiodic rhythmic interpretations also afford the entrainment and communicative functions that are traditionally associated with meter, and these less regular rhythmic interpretations often arise from the same kinds of embodied practices that we use to construe regular meter.

I also seek to understand the role that metering practices play in creating experiences of rhythmic feeling. I argue that the things one does with one's mind and body while taking part in music generate the motional qualities of the beats, and also shape the motion we feel between beats. By identifying and theorizing some of the things people can do with/in their bodies to feel beats and construe meter, I hope to at least begin to account for what rhythmic feelings are, where they can come from, and how they might differ from listener to listener.

Moving Together: Entrainment and Coordination

In music theory and cognition literature, entrainment has often been defined as synchronization to a periodic pulse, but a robust account of musical motion and rhythmic feeling must cast a broader net. A wider conception of "entrainment" encompasses a greater variety of rhythms, including both simple isochronous pulse and less even divisions of time. But this issue is also complicated by several factors: (1) musicians can be performing the same metering constructions and felt beats while overtly expressing different motions; (2) musicians performing together may feel different beats at times, but still be cooperating to create a single rhythmic whole; (3) listeners may hear a different set of beats or motions implied in music than the musicians felt or intended. None of these are a "failure" of musical rhythm, but require broader conceptions of entrainment and coordination.

Gary Tomlinson considers one broader sense of entrainment which he calls "social entrainment," and situates the term within a broader framework of cognition and co-action that will be useful for thinking about metering constructions. Tomlinson studies the evolutionary origins of the cognitive abilities which are most crucial in today's musical behaviors, tracing the concept of entrainment and cooperation to "Acheulean axes," a tradition of "knapping" or chipping away small pieces of stone to create a small pear-shaped hand tool. The process of "knapping" has been inferred and theorized by anthropologists and evolutionary scientists as a crucial stage in the development of human cognition, based on the widespread appearance of these axes across hundreds of thousands of years beginning circa one million years ago. Tomlinson draws on the thinking of André Leroi-Gourhan, who conceptualizes "knapping" as a *chaîne opératoire* (or "operational chain"). This concept describes how a "gestural chain created a matrix where social behavior and material conditions met; from the meeting a stone tool emerged" (Tomlinson 2015, 65). Leroi-Gourhan views these gestural sequences as "a prosthetic externalization of cognition" (64), and argues that this repetitive knapping played an important role in the development of humans' capacity to "think at a distance," to plan ahead, rehearse movements, and otherwise execute actions (like making tools) whose ultimate purposes were beyond their immediate consequences.

Tomlinson expands this way of thinking about sequences of actions through Tim Ingold's concept of a "taskscape." A taskscape is not fixed like a landscape. Instead, a taskscape is an always-evolving, emergent scene of action created by people interacting with their environment. Tomlinson elaborates, "The taskscape creates, from the rhythms of action sequences that form it, its own temporality, one based on moments of mutual attention commanded among its participants by movement and gesture" (2015, 65). The repetitive knapping used to create an Acheulean axe was a taskscape in which one early hominid could learn to create a stone tool by mimicking the repetitive movement of another. Tomlinson points out that "mimesis was a crucial ingredient in this taskscape," and argues that the capability for mimesis was related to an idea of a "rehearsal loop" that in his evolutionary narrative is the first step humans took towards thinking-at-a-distance and, eventually, rational subjectivity. The most significant aspect of this discussion for my own work is not the evolutionary origin of rhythm, but that the concept of taskscape points towards how human actions create their own temporality, with affordances for other humans to participate.

In my own work I conceive of musical rhythm as a taskscape, an emergent set of affordances for participation, which can be either sounding or silent, encompassing both overt performed movements and covert rhythmic feeling. The "point" or "purpose" of musical rhythm is then to find a way to join the rhythms of others, to participate either by contributing one's own movement and sound or by "following along," giving attention to the rhythms of others and investing in them with one's own feelings of beat.

One of the principal issues I wish to explore in this project is how different people's actions and perceptions can fit together in this taskscape of musical rhythm. Most musical theories of rhythm have a bias towards coincidence, assuming that all listeners hear and feel the same beat, and often implying that rhythms which syncopate or do not constantly coincide are "dissonant" or pulling against one another. This assumption of coincidence harmonizes with decades of cognitive research on "entrainment," which is often conceptualized as listener's ability to find and join a metronomic pulse by tapping along with it. This tapping paradigm for studying rhythm has been used in hundreds of studies (see Repp 2005, and Repp and Su 2013), showing our ability to entrain to periodic stimuli at a wide range of tempos and flexibly adjust to various kinds of rhythmic disruptions or tempo fluctuations. The term "entrainment" connects these tapping studies to a much broader field of biology research, in which "entrainment" refers to any situation in which an organism is able to synchronize with a rhythm outside itself. These rhythms are often periodic: for example, the circadian rhythms of sleep cycles, which are entrainments to the daily rising and setting of the sun.

But Tomlinson's account of stone knapping implies a looser and less synchronized sense of the word entrainment, one that is valuable for understanding more diverse musical rhythms. He emphasizes that the "synchronization of action routines in Lower Paleolithic taskscapes must have been of the loosest sort. These hominins did not join their various stone-knapping gestures, like some lithic percussion section, in the coinciding rhythms of modern field-laborers reaping or soldiers marching or rowers rowing to a shared beat" (2015, 76). However, when two hominins entered this taskscape at the same time, they were both performing the same operational sequences. This creates a "perceived regularity in the environment" that Tomlinson argues "Formed a kind of self-initated *social entrainment*" (2015, 77; my emphasis). In other words, stone-knapping is a form of entrainment because it involves joining the rhythmic activities of others, even though this activity is neither metronomically-timed, nor synchronized! This is a dramatic expansion of how entrainment has been conceptualized in music cognition research of rhythm.

Tomlinson thus slips between two very distinct senses of the word "entrainment": one in which two actors are engaged in roughly the same task but need not be in synchrony or even articulating any isochronous durations; and another in which isochronous cycles are strictly synchronized. I argue that these two senses of entrainment can be conceived of as two polar opposites along a spectrum of human behaviors w hich all involve co-presence, shared attention and intentions, and various degrees of coordinated timing. Tomlinson seems to be thinking along these lines as well. Towards the end of his chapter on Acheulean axes, he calls for the study of entrainment to be broadened beyond metronomic synchronization.

> Beat-based musical processing shows every sign of being the tip of a cognitive iceberg. It is a precise, focused instance of a much broader phenomenon of entrainment, a phenomenon that in human experience seems to underlie our general capacity to attend to and correlate sequences of events around us. (Tomlinson 2015, 81)

This spectrum of degrees of synchronization is represented in Figure 1 below. The established paradigm of entrainment-as-periodicity is a clearly delimited category at

<— social entrainment —————————————————— isochronous entrainment —>

(copresent, same motions, but not synchronized)   (completely synchronized)

Figure 1: Caption

one extreme, but human musical cultures are extraordinarily diverse, and in moving together we use the whole spectrum.

"Entrainment" still involves two individuals entering into the same rhythmic taskscape, and I will sometimes refer to an even broader category of *coordination*. Tomlinson's example of Acheulean axe-knapping is a taskscape in which each participant is performing the same motions, just not in synchrony, but a taskscape can also involve interacting participants with distinct roles and motional logics. While such looser forms of motional collaboration do not fit within the paradigm of *entrainment-as-periodicity*, it is still a type of temporal coordination that is relevant to music. In Chapter 1, I will examine a case where it appears that two musicians in the same ensemble are simultaneously performing different metering constructions. I will slip between "entrainment" and "coordination" as appropriate throughout the dissertation, but I will use the term "*moving together*" to refer to this whole complex of copresence, cooperation, and taskscape—a theorization which affords variable degrees of synchronization.

Two people moving together in opposite or contrasting rhythms can still be cooperating towards the same activity, and can even be moving in interlocking rhythms which have closely correlated timing without ever literally coinciding. Returning to the example introduced at the head of this section, in a basketball game the physical motion of passing the ball involves two players making similar arm motions which overlap in time but must not coincide because one player is throwing the ball, and the other player must catch it a fraction of a second later. This is still a feat of *moving* *together*, even if it is not "entrainment" in a strictly coinciding sense.

Music involves all kinds of temporal coordination, not just strict synchronization but also all kinds of rhythms which are only occasionally coincident, or which are entirely contra-incident. Musical taskscapes often offer us many different affordances for movement, different rhythms of participation, which may not be strictly synchronized with one another. In a rock song we can stomp on the downbeats or shake our fists on the offbeats. We can sing along with the words, or play air guitar along with a great riff. Timing can also be closely coordinated at particular downbeats even if it varies widely in between, such as certain idioms of soloistic playing in Jazz (see Huang and Huang 1994, Benadon 2009). In some cases, different elements of a musical activity may not be synchronized at all, such as the sung recitation and body movements in Jewish Orthodox liturgy (Abrahams 2017). Following Tomlinson's thinking, the social and evolutionary purpose of musical behavior is not synchrony but *moving together*, cooperating to cultivate a sense of togetherness, community, or shared emotion.

Theorizing Beats and Meter as Motions

John Paul Ito's theory of motor coordination in musical performance provides the basic terms I will use in trying to understand felt beats and musical motion. In his 2004 dissertation, Ito defines "focal impulses" as muscular impulses around which other movements are organized, citing an extensive literature of neurological studies of motor control and movement planning to support the idea that most human movement patterns have such physiological reference points. Ito argues that in the performance of music, these impulses are organized into larger "impulse structures" that correlate closely with traditional understandings of meter, although he stops short of identifying these impulses with meter itself. Throughout this dissertation project I assume that felt beats and focal impulses are one and the same thing; to feel a beat is to produce/experience a focal impulse. A felt beat is literally an action, and even if it is often not marked by an overt movement, it is still embodied by an internal neuromuscular impulse. I will use Ito's term "impulse structure" to talk about how smaller motions are linked together into larger patterns of beat and meter.

Many metering practices involve movements, and most movements seem to be organized around a focal impulse. To the extent that these two generalizations hold, metering constructions are comprised of knowledge about ways that body movement can be organized around impulse structures consisting of strong moments in time or metrical accents. This knowledge can be thought of as a motional resource that is drawn upon in feeling out rhythms. Such motional knowledge of how to navigate musical time, and how to fit the body into rhythmic patterns, is an essential component in making rhythmic notations or verbal descriptions of rhythmic structure into activatable or deployable metering interpretations.

While impulse structures are an indispensable analytical tool that I will depend on throughout this dissertation, the motional resources of metering constructions do not consist of impulse structures alone. Metering constructions are mutually dependent knowledges of how movement and impulses co-constitute each other, and of how movement can flow around or through impulse structures. If you take some of the footsteps out of a march, it becomes a different motion, not just a different set of beats. Plus the bipedal back-and-forth motion of the marching gives the beats their grouping and metrical patterning. The same point could be made about a parabola curve; there is no maximum without a whole curve leading up to and falling away from that point, and the shape of the curve itself determines that there must be a specific maximal point, so that you cannot have the curve without a maximum or a maximum without the curve.

Similarly, beats/impulses and motion are co-constitutive and should not be analyzed separately.

One of the main ways in which I connect impulse structures and metering practices to traditional theories of meter is through the concept of a *referential rhythm*. In the theories of Yeston (1976) and Krebs (1999), definitions of meter are based in an abstract sense of periodicity, but they both use language that implies that meter is an *interpretation* of musical structure. Yeston describes this as a consensus of generations of previous writing on meter, and also summarizes a consensus about the function of these interpretive layers.

> In addition, the theorists of the last three hundred years have universally understood meter to be a conceptual source of accent interpretation, a context of regularly recurring structural accents and weak beats with which, or against which, freer rhythmic designs may play. (Yeston 1976, 32-33)

Each metering construction in my theory is simultaneously both an accentual interpretation of music, and a referential rhythm against which the rest of the music is heard. I argue that impulse structures and the flows within them are also referential rhythms, with the same properties of interpretation and reference: directed networks of embodied beats act as an interpretation of the music, and a referential "background" against which the music is heard and felt, even if the music does not necessarily articulate the embodied beats. Rhythm scholarship has already identified some categories of repeating referential rhythm distinct from classical ontologies of meter because time is marked by a non-isochronous rhythm, especially timelines in West African drumming (Agawu 2006), and the clave-son in Latin-American music (Chor 2010). In this dissertation, I will extend the concept of referential rhythm to include structures of rhythmic interpretation which do *not* cyclically repeat, and I theorize this larger category as a product of metering practices.

While I describe many of the metering practices that generate these referential rhythms as incorporating physical motions, I believe the same rhythmic effects can be felt in a still body. Modern research on the neuroscience of rhythm describes a close connection between perception and production, neatly summarized by Iyer's argument that "*a perceived rhythm is literally an imagined movement* [...] the act of listening to rhythmic music involves the same mental processes that generate bodily motion" (2002, 392; my emphasis). This strand of thought in music cognition participates in a broader cognitive science trend in recent years to consider large portions of human thought in terms of *embodied simulation* rather than mental computation (Bergen 2012, Tomasello 2008). I argue that embodied knowledge of how movement can be organized around impulse structure can also be generalized beyond specific movements to shape a wider sense for rhythmic expectations and inflections. Classical musicians frequently talk about the "dancing" feeling of certain passages, and they do not need to dance themselves, or imagine specific dance moves, to evoke a dance-like feeling. The motional resources of metering practices are available to performers without their needing to physically perform the movements through which they learned to navigate time in that way.

Speaking of embodied simulation, before I conclude this introduction I should make a disclaimer about my use of the terms "body" and "embodiment." Much music theory writing either explicitly or implicitly separates conceptual ideas from the physicality of the body, often distancing itself from the latter. This follows a long tradition in Western thought in which the mind and body are considered to be ontologically separate, an idea commonly associated with Descartes but generally acknowledged to be much older. Scientific theories of embodied cognition hold that this is not true. More recently, "embodiment" has become a buzzword in humanities fields, where it frequently refers to "abstract" knowledge or power relations made manifest in bodies (such as racial ideologies manifested as restrictions on black bodies in the United States, or cosmological concepts acted out in folk ritual). I wish to distance myself from the implication that some meanings or ideas are embodied while others aren't. Every mind is in a body, and most human bodies have minds, so in using the term "embodied practice" I do not mean to imply that there are human practices which are not embodied. I use the word "embodied" merely to signal that my interest is in literal ways of using the body. Similarly, in describing uses of the body, I mean to include the mind. For example, the conditioning of rhythm sense by movement I describe in the previous paragraph also applies to counting strategies, conceptual hierarchies, and mental imagery used in training specific ways of creating rhythm. Though these practices are not commonly thought of as body movements, I believe they affect the perception of rhythm in the same way. Just like primarily movement-based practices, covert practices such as internal metrical counting produce felt beats and include motional resources that through practice can become subconsciously available in listening or performance, without the explicit counting that developed that particular motion.

Chapter Outlines

My chapters outline a continuum from metrical regularity to irregularity—from constructions which usually appear the same way over and over, to less fixed constructions which are recognizable in passages of almost complete temporal freedom. This trajectory of possibilities for hearing with metering constructions is my main contribution, and while I investigate these metering constructions in more detail than previous authors, the concept of such a metrical pattern is not my own innovation. London also recognized an important role for something like metering constructions in passing, although he uses the term “templates” and does not explore the concept in detail:

> [...] in many cases inferring a meter does not involve extracting invariant information such as component periodicities, but rather matching the musical figure against *a repertoire of well-known rhythmic/metric templates*. For example, in Western tonal music, an interval of an ascending melodic fourth at the start of a phrase, especially if the first note is shorter than the second, both signifies ”sol-do” in terms of scale and key and also marks upbeat and downbeat—it is an anacrustic cliche’. Similarly, the ”thump-thump” of the kick drum in rock music indicates beats 2 and 4 of the measure. Indeed, these thumps are called the ”back-beat” figure. Most listeners have a bevy of metrically familiar templates at their disposal, and in recognizing these commonplace gestures they are readily able to establish metric entrainment. Likewise, once a melodic or rhythmic figure has been metrically defined by its initial presentations(s), we may then use it as a metric cue in its subsequent appearances throughout the remainder of the piece. (London 2010 [2004], 67; my emphasis)

I rediscovered this passage late in the writing of my dissertation project, and was surprised to find that the examples London mentions represent much of my chapter outline: Chapter 1 covers the backbeat pattern (although I should correct London by pointing out that beats 2 and 4 are usually indicated by the snare drum, not the kick drum). Chapter 3 focuses on motives, melodic or rhythmic figures that we hear with reference to their earlier metric settings. And Chapter 5 has a whole section devoted to tonal “cliches” like the association of “sol-do” with upbeat-downbeat. I hope I have contributed to a deeper understanding of how these kinds of patterns work in musical practice and perception, and shown how they can add to our theoretical descriptions and explanations of metrical experiences in both regular and irregular contexts.

In Chapter 1, I present my definition of metering constructions and explain the reasoning behind this definition and its ramifications, through a study of headbanging in heavy metal. Headbanging is a convenient case study for the relationship between motion and meter for two reasons: (1) the motion is so vigorous that it is hard to imagine *not* feeling a beat with each swing of the head, and (2) the motion is overt and extravagantly demonstrative, so it is highly visible in video. I define two metering constructions, the *backbeat* and the *phrase-ending 3+3+2*, and explore their properties, especially the status of 3+3+2 rhythms as meters, and their "motional syncopation" (Kaminsky 2014) against a quarter note pulse. I also argue that 3+3+2 rhythms can be understood as a basic motional gestalt that can exist in disciplined subdivision space of 4/4, or in an "undisciplined," freer rhythmic space.

This first chapter demonstrates that from a metering constructions perspective, the metrical structure of a piece is better understood as a *patchwork quilt of recognized rhythms*, than as a stable cyclical system of durational periodicities; this claim also returns in later chapters. As we listen, we identify familiar rhythms with familiar affordances for movement, then perform some of those movements overtly or covertly as a metrical interpretation. As we move, we create internally felt beats, and then experience the music against those beats. These beats need not be organized into any stable or recurring pattern in order to constitute a referential rhythm that structures our understanding of music as it unfolds.

Each chapter moves further away from the regular cyclicality of traditional definitions of meter, and Chapter 2 makes an incremental step from the fixed constructions of Chapter 1 by considering "degrees of rhythmic freedom" as theorized by the 17th century theorist Wolfgang Caspar Printz. Printz theorizes music in terms of recurring patterns of rhythmic feet (like iambs and trochees), but allows these patterns to be transformed or alternated in various ways. I place Printz's theory within a broader discourse about characteristic motion in eighteenth-century music, in which the dance rhythms of the court of French monarch Louis XIV became "topics" incorporated in later concert music, activating aspects of the original dance's movement and meaning in the minds of audiences who remained seated. This provides an opportunity for me to consider how the "movement" part of a metering construction need not be actual dancing, but can instead be manifested as characteristic rhythms, covert motional interpretations and accentual flows rather than overt movement.

In Chapter 3, I move even further away from regularity by considering how manipulations of musical motives can lead us to hear whimsically mercurial plastic transformations of meter. In late-Romantic music (by which I mean composers from Brahms through Schoenberg), motives often recur with substantial transformations. I argue that a motive is essentially a category of passages heard to embody the same motion. Building on Lawrence Zbikowski's "conceptual models" of motives, I create a "*motional conceptual model*," a way to model the constitutive features of a motive through the lens of the motion we infer into them. We recognize motives by hearing how they progress through the stable order of motions in the motional conceptual model, which makes these shapes and the meter they imply still legible in spite of considerable temporal distortions or fragmentations.

Chapter 4 is an analytical interlude, in which I apply the methods developed so far to express a motional/metrical hearing of the first movement of Ravel's *Piano Trio*. This provides me an opportunity to highlight many phenomena of perceived motion and meter that have been overlooked by previous scholarship, often because they cannot be identified in terms of well-ordered hierarchies of periodicities. I also discuss how such a hearing of a piece can be developed through rehearsal, contrasting with existing theories of rhythm and meter which model either the unfolding experience of a naive first-time listener, or the "final-state" awareness of a virtually omniscient listener.

Chapter 5 takes this dissertation's trajectory away from regularity to its logical conclusion with a study of free rhythm in operatic recitative. Previous chapters mostly talked about constructions as melodic/rhythmic patterns which often recur, but recitative rarely repeats any melodic or rhythmic pattern within a single movement. This invites the consideration of other kinds of constructions: patterns with less strictly-specified form, like associations between particular harmonies and tonal stability, or characteristic galant melodic schemas, or speech gestures that express some combination of semantic and prosodic emphasis. I also give a broader discussion of the applicability and limitations of the concept of "entrainment," and suggest that a study of music within broader rubrics of cooperative action and collaborative cognition may be needed to give a full account of felt beats, perceived meter, and performed musical motion.

Chapter 1

Headbanging Beats and Metering Constructions

Bang your head against the stage like you never did before
Make it ring, make it bleed, make it really sore
In a frenzied madness with your leathers and your spikes
Heads are bobbing all around, it's hot as Hell tonight

Adrenaline starts to flow
You're thrashing all around
Acting like a maniac
—Whiplash!

—Metallica, "Whiplash" from *Kill 'Em All* (1983)

Headbanging is a frenzied performance of physical excess, which involves throwing your head back and forth over and over in time to music. This motion literally transgresses the upright comportment expected in staid, white Western society. But it's not just a form of *acting out*—though it certainly is that. In the epigraph above, Metallica says headbangers are "acting like a maniac," a phrase with implications of madness that are drawn out more explicitly by another hit song from the same year:

> Oh get your straight-jackets on tonight oh (Bang your head)
> Metal health'll drive you mad
> The bad boys are gonna set you right / rock on rock on rock on
> Metal health'll drive you mad
> Bang your head
> — Quiet Riot "Metal Health" from *Metal Health* (1983)

There's something really thought-provoking about how easily the transgression of norms for bodily behavior is equated with madness, an undoing of Western rational subjectivity and disciplines of self-control. And there also seems to be a critique of Western discipline of the body in this song—"Metal health'll drive you mad" but that will "set you right"—madness is *good for you*.

But this chapter is not about that critique. My work unfolds from the claim that headbanging is not just an outward expression of some social meaning—like bawdy celebration, transgressive opposition, teenage angst, aggression, or others. Headbanging is an *embodied practice of listening*, a way to shape felt experience of music's rhythm. And though it certainly contributes to excited energy ("Adrenaline starts to flow"), it also does something else: it creates felt beats. This chapter is a culturally-situated study of how headbanging can be used to construe beats and meter and create experiences of musical motion.

But this chapter is also one where I make a case for new ways of theorizing musical meter, based in embodied knowledge of familiar motions like headbanging, rather than abstract geometries of duration. I'll define particular rhythmic structures and movements in heavy metal music as *metering constructions*, familiar ways of moving to sound. By performing movements (overtly or covertly), we create rhythmic experiences for ourselves. Headbanging metal fans create for themselves experiences of heavy, thrashing rhythm—and these embodiments of beat may not always fit within traditional conceptions of musical meter.

HEADBANGING THROUGH THE HISTORY OF HEAVY METAL

The practice of headbanging that is the focus of this chapter shares its origins with the heavy metal genre. According to the well-rehearsed canonical history of heavy metal, the genre emerged at the end of the 1960s from a mix of primal blues rock with prog and psychedelic influences.[1] The roots of this style in African-American blues and rock are often mentioned briefly, but rarely discussed at length. As Robert Walser said in the first musicological study of heavy metal, "The debt of heavy metal to African-American music making has vanished from most accounts of the genre, just as black history has been suppressed in every other field" (Walser 1993, 8–9). Since Walser's book was published in 1993, very little scholarship or fan discourse has re-examined or critiqued the erasure of blackness from metal's history.[2] Popular legend has it that headbanging was invented by Black Sabbath or by fans at a Led Zeppelin concert.[3] But just as with the genre as a whole, I suspect that a precise moment of genesis is identifiable only in legend, that headbanging coalesced gradually within a wider field of white encounters with (and imitations of) African-American music culture.

Whatever its origins, headbanging quickly became an icon of the metal genre, and has persisted throughout the subsequent chapters of the genre's history. (In recent

[1] The basic outline of metal history I give here is told from different methodological perspectives by Weinstein 1991, Walser 1993, Christe 2003, Waksman 2009, Cope 2010, Wiederhorn and Turman 2013, and many others. This outline can be considered common knowledge so I will not provide citations for each stage of the genre's development. The most substantial disparities among these authors occur in their conceptions of the boundaries and circulationof influences between metal, punk, and hard rock styles and cultures. See Waksman 2009.

[2] Wells 1997 and Fellesz 2011 are some notable exceptions. The earliest uses of the term "heavy metal" described bands that would not be considered part of the genre today, but Brown 2015 reveals that the term seems to have replaced "white blues" as a term for describing a particular set of heavy rock bands. See Brown 2015 and Weinstein 2013 for further discussion of these origins.

[3] The Wikipedia article about headbanging, which is collaboratively written by dozens of volunteer editors, is as good a representation of popular myth as any. It states that "The origin of the term 'headbanging' is contested," but names all three bands most often named as progenitors of metal – Black Sabbath, Led Zeppelin, and Deep Purple — as possible inventors of the movement style. (Wikipedia 2017)

decades some fans have dropped the "heavy" from the label and called their genre "metal music," but as I am talking about the whole genre from the 1960s to the present I will use both terms more or less interchangeably). Headbanging is sometimes associated with rock more broadly, but metal fans stake a claim of ownership over the practice, taking headbanging to physical extremes not approached within other forms of rock music. Metal fans often refer to themselves as "headbangers," and bands often reference headbanging in songs about the genre, such as Metallica's "Whiplash" or Quiet Riot's "Metal Health." During metal's commercial heyday in the 1980s, the music industry's flagship metal production was MTV's *Headbanger's Ball*. More recently, an acclaimed non-academic history of the genre was titled *Sound of the Beast: The Complete Headbanging History of Heavy Metal*. Headbanging unifies the many sub-genres and sub-styles of metal, while many other practices have been points of contention throughout metal's history up through the present, including singing styles, dress, theatricality, blues influences, mosh pits, occult iconography, and pretentious virtuosity.

During the 1970s, the first generation of metal bands championed a culture of Arena Rock.[4] According to what is now standard history, by the end of the 1970s the market was dominated by these enormous extravaganzas, and many began to feel that these performers were obsessed with their own grandeur and losing touch with audiences. Further, younger musicians had trouble attracting the attention and support of the large record corporations that subsidized the arena tours. In the aftermath of the 1977 UK punk explosion, a metal scene sprang up in parts of Britain, a "New Wave of British Heavy Metal" that sought to make the older metal bands obsolete with a leaner, faster style. The '80s and '90s witnessed a series of fundamentalist revolutions, which doubled down on the basic distinctions between metal and regular rock

[4] See Steve Waksman's 2009 book *This Ain't the Summer of Love: Conflict and Crossover in Heavy Metal and Punk*, especially chapters 1 and 5.

by making metal progressively more extreme—louder, faster, and with heavier distortion. Each new musical style was accompanied by changing ideologies of authenticity and new trends in dress and lyrical topics. The first of these extreme metal genres was thrash metal, which was pioneered by the American band Metallica, who also led a widespread rejection of the costumes and theatrical shows that had characterized the genre throughout the 1970s and early 80s. Metallica went on to become one of the best-selling bands in the history of the genre, and from the late 1980s onwards, their music and image became a primary point of comparison for all metal. The majority of existing research on rhythm in metal music focuses on the innovations of the Swedish extreme metal band Messhugah (Pieslak 2007, Lucas 2016 and 2018, Capuzzo 2018) or the American progressive metal band Dream Theater (McCandless 2013), so in this chapter I focus on Metallica's music to provide context for those innovations. Like most metal bands, Metallica frequently headbangs while performing their music, and many of their fans join them.

Headbanging as a Dance Movement Practice

While brief references to headbanging are ubiquitous in writing about metal, few scholars describe the practice in detail. Perhaps the most concise is Robert Walser, who defines it in a footnote as "a vigorous nodding to the beat of the music" (Walser 1993, 180). But in a recent dissertation on the aesthetics of doom metal, Jonathan Piper contends that headbanging is much more than mere nodding: "the head does not simply pivot on the neck; the entire body undulates back and forth, up and down, to propel the head (and often long hair) through space in a spectacular display" (Piper 2013, 59-60). Headbangers frequently stand with their legs apart and knees bent for balance, and may lean forward for greater depth of movement, or even grab on to their knees or a nearby piece of furniture for support.

Although Piper is one of the only scholars to consider the physical motions of headbanging in detail, a number of others have commented on the meaning and purpose of the practice. Many mention that headbanging helps translate sound patterns into felt rhythm or amplify the intensity of rhythmic experience. Glenn Pillsbury argues that the sound of thrash metal "assault[s] and affect[s] the bodies of the performers and audience, usually through some sort of headbanging or moshing" (Pillsbury 2006, 11). One of the main purposes of headbanging is increase the physical intensity of rhythmic experience, but headbanging also carries social communication. Natalie Purcell notes in her study of the death metal scene that "While popular bands are playing, fans show their appreciation by 'getting into' the music" in several ways, including headbanging (Purcell 2003, 33). Headbanging communicates listeners' enthusiasm for the band performing, indicating that they choose specific moments of particular songs by a particular band to identify with and engage more physically, a kind of voting with the head. But headbanging does more than just indicate a listener's preference—it generates and transfers physical energy to the performers and to other audience members, encouraging and rewarding mutual physical investment.[5] It also seems to be a coin of authenticity: only thrashers are real fans, and only a worthy band deserves a throng of headbanging celebrants. By banging their heads, metal fans participate in creating and affirming a sense of community, a togetherness in mutual appreciation of heaviness in metal music.[6] Crucially, headbanging movements are not choreographed ahead of

[5] In a book of photos of headbanging metalheads, one fan is quoted as saying: "It's just that everything becomes a whole when the music, the audience and the band move to the same rhythm. You can't help yourself, you're just swept away by the mood, and then it's really cool to show the band that you like the shit they're playing. You can worry about the pain the following day." (Ehrbahn 2015)

[6] Arnie Cox describes how community can be created by a shared way of feeling music. "This is part of music's socializing power: It provides a medium whereby we can enact participation and community—literally, a state of sharing, where the thing shared is a state of being, by way of a shared state of doing." (2011, 63)

time. Each musician and audience member decides spontaneously when and how to move during a live performance, or while listening to a recording, based on what they feel as the beat and what they think of as the most exciting moments of a song.

As a form of spontaneous movement, headbanging can be compared to audience participation practices in black American music cultures including rock, blues, and gospel. In this context the meaning and function of movement has been given more attention by previous scholars, and in many respects their accounts match my experiences of headbanging in metal culture. Jacqui Malone emphasizes the importance of audience participation in her widely-cited book about black American music and dance culture (1996, 35). The ethnomusicologist Portia Maultsby gives an evocative description of participatory movement in black American music spaces that could just as easily apply to a rock or metal concert.

> When performers demonstrate their knowledge of the black musical aesthetic, the responses of audiences can become so audible that they momentarily drown out the performer. The verbal responses of audiences are accompanied by handclapping; foot-stomping; head, shoulder, hand, and arm movement; and spontaneous dance. (Maultsby 1990. 195)

Headbanging is also a response to especially successful metal performance. Malone emphasizes a diaspora of movement styles from Africa, and characterizes the distinct physicality of Africanist movement styles as emphasizing bent knees and hips and an angled back. This preference for involvement of the whole body, and especially head movement and swaying away from erect posture, are physical similarities with headbanging.

Given such comparability, it seems productive to think of how headbanging and other participatory movements performed by (mostly white) metal audiences might have evolved from stylized imitations of black American practices, just as the musical style of metal evolved from white appropriations of the blues. In a discussion of the origins of the musical codes of metal in the British blues scene, Cope mentions a blues club called Crawdaddy which featured a "harder" blues sound in the late 1960s as playing a pivotal role. He then mentions that

> [...] certain visual codes that have come to be associated with rock and metal were witnessed at the Crawdaddy. The description of 'shaking heads', for example, paints a clear picture of 'head banging' and this is conflated with black leather, a context that becomes synonymous with hard rock and certain factions of heavy metal. (Cope 2010, 24)

At the time, the Blues bands who performed at Crawdaddy were predominately made up of white British young men, so the genre that eventually evolved into heavy metal was referred to as "White Blues." Andy Brown reveals through an analysis of music magazines that "from 1967 to 1974 it ['White Blues'] is the dominant term in reviews and coverage" of a range of bands that would be later classified using terms like heavy metal and hard rock. This term implies a specific contrast to the music's Black American heritage, maintaining a racialized understanding of this music which seems to have disappeared in discourse about heavy metal by the end of the 1970s. The appearance of "shaking heads" at a blues club suggests that the practice of headbanging developed with racial connotations that are unacknowledged in existing scholarship about metal.

Another important function of participatory dance in black American culture which is shared by headbanging is that movement serves as a way to feel the rhythm of the music. Malone describes a tendency to "dance the song" in black American traditions, so that the rhythms of a song are expressed through physical motion, and the visible body becomes a part of the rhythm of the music (1996, 28). Many scholars have commented on the conflation of dance movement, rhythm patterns, and feeling of rhythm or groove in black American music. Jeff Pressing argues that in Black Atlantic rhythm styles, "Groove or feel forms a kinetic framework for reliable prediction of events and time pattern communication, and its power is cemented by repetition and engendered movement" (Pressing 2002, 308). As heavy metal music evolved out of black American rock and blues styles, some of these associations between body and rhythm have persisted in the form of headbanging (and other movement practices, such as the wild jumping antics and grimacing faces of metal guitarists while playing solos).

Piper's account of headbanging confirms that this practice of movement in metal culture is integrated into a sense of rhythmic feel and groove. "If the drums go into a half-time feel, so do heads. If the last 4/4 measure in a four-bar phrase is accented in a 3+3+2 feel, the banging of heads will change to match it" (2013, 60). Although simpler descriptions like Walser's risk making headbanging sound like an involuntary reaction synchronizing with a fixed periodic beat, Piper's account clarifies that "Headbanging is not simply an automatic motoric response to meter that is initiated like a metronome. It is a sensitive and reactive embodied response to musical feel" (2013, 60). Like the participatory movement traditions in earlier black American music cultures, headbanging is a flexible way of participating in rhythm that reflects subtle changes in the sounding music, not a fixed dance routine.

Audiences' headbanging is a response to sounding music, but it is a creative response that is not controlled by the performers on stage. In her book on Led Zeppelin, Susan Fast suggests that rock musicians' body movements teach an audience how to feel the music they are witnessing. "The way in which rock musicians use their bodies in performance is critically important to an understanding of the music. [...] band members model physical behavior for the fans watching. How should it look to play a guitar solo? How should a body respond to this music?" (Fast 2001, 114). Headbanging and other ways of moving to rock music are often modeled by performers, but audiences usually perform these motions spontaneously to feel the music out for themselves, rather than simply copying motions of the performer like a mirror. Audience movement is usually heterogeneous, with some people headbanging, others moshing in circle pits, and some shaking their fists.[7] Often the majority of an audience is relatively still, and the more active dancers are closest to the stage.

Even when several people are headbanging at once, they may not be doing so in unison: if one person is headbanging at a regular beat, chances are someone else is headbanging twice as often, and other members of the crowd may be headbanging only on every other beat. Occasionally when bands headbang in unison for part of their performance, their audience may respond with mostly unified movement, catching an infectious energy from the band's undivided intentionality and purpose. But even then, headbanging and other audience movement practices in rock and metal are about getting caught up in feeling the rhythm, not copying the movements of the performer. Fast implies this clearly while summarizing and unpacking interview statements by Led Zeppelin's Robert Plant: "it is the music that should always remain the central focus of attention, not the performer's body, and it is the music that determines, supposedly in an unpremeditated way, how the body should respond" (Fast 2001, 148). In rock music culture, listeners and performers alike are not moving together according to a choreography or script; each person is independently feeling out their own idiosyncratic rhythmic interpretation, creating their own embodied response to music, and nobody is required to match the movements of anyone else.[8]

[7] Moshing is a practice in which audience members (and occasionally performers) deliberately punch, elbow, and body-slam one another. This creates an ecstatically heightened experience of the music's intensity. Moshing is usually not rhythmically "in-time," so I do not discuss it at length here. Gabrielle Riches has written several excellent articles analyzing the mode of pleasure involved in the practice, and the unspoken code of mutual care and respect that keeps moshing from degenerating into out-of-control violence. See Riches 2011 and Riches et al. 2014.

[8] Admittedly, metal performers do sometimes instruct the audience to perform an action together, like clapping their hands or creating a "wall of death." But in such cases the imitation or direction is

Defining Metering Constructions

My primary goal in this chapter is to examine headbanging as a movement response to music, and suggest some implications which this focus on movement might have for theories of meter. Although the interactions between performers and audience, and the plural possibilities of movement, are framing conditions of my investigation, my primary goal is to identify how sounding musical structures can invite headbanging movement. The previous paragraphs have highlighted three dimensions of rhythm in musical activity: (1) sounds, (2) dance or other overt movements, and (3) internal feelings of beat. I will follow other rhythm scholars in describing both movements and sound as overt, surface phenomena organized by covert, subsurface felt beats. In this section I will develop a definition of *metering constructions* to model how associations between these three dimensions constitute rhythmic knowledge.

Many previous rhythm scholars have described beats as a hidden structure which lies behind a "musical surface" of sounding notes. Lerdahl and Jackendoff suggest that the metrical accent which they identify as beat "is a mental construct, inferred from but not identical to the patterns of accentuation at the musical surface" (1983, 18). They point out that while humans may *prefer* to hear beats in places that are marked by note onsets (76), we can also infer the presence of a felt beat where no note is heard.[9] David Temperley follows a similar line of thinking to create a computational model of the process of meter perception using Bayesian statistics. In this tradition, observable phenomena are assumed to be related to but distinct from underlying structures

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rarely sustained, and serves to intensify the atmosphere of the event rather than to establish a script or choreography. (A "wall of death" is when a large part of a crowd splits into two sides, creating an open space in the middle, then the two sides rush back in and slam into each other as violently as possible. This is a fun game in a small club but can become a more dangerous stampede at larger festivals.)

[9] Lerdahl and Jackendoff's Metrical Preference Rule 3 states: "Prefer a metrical structure in which beats of level L_i that coincide with the inception of pitch-events are strong beats of L_i" (1983, 76).

or causes. Bayes' Law provides a proportional equation for calculating the most probable underlying structure given some observed phenomenon.[10] In his computational model of meter, Temperley suggests that the observable surface of music is sounding rhythm, while the underlying structure is the meter or beats as they are understood by the people creating that sound.

Recovering this subsurface metrical structure from the surface of musical sounds is not a trivial perceptual task, but requires prior knowledge about what metrical structures are possible and how those metrical structures can be used to produce audible rhythms. Temperley's model casts this recovery of meter as the determination of *probable* structure from a potentially noisy image, rather than certain discovery. While I disagree with some aspects of his model (especially his assumption that all rhythmic structure is based in an underlying periodic meter), the probabilistic nature of his model is clearly a move in the right direction. No matter how carefully we attend to sounding rhythms, it is often hard to know for sure if we are feeling the beat in exactly the same way as other musical participants; but we can make a guess that is *good enough* to successfully participate in the musical event. [11]

The model of overt, observable surface and covert, underlying structure also describes the relationship between beats and visible rhythmic movements. John Paul Ito theorizes beats as "focal impulses," covert or visible muscular impulses that act

[10] Temperley provides the following concise description of Bayes' Law: "In vision, the perceptual problem is to recover information about the world—or "scene" (S)—from a noisy and ambiguous visual image (I); we wish to know the most probable scene given the image, that is, the S maximizing P(S|I) [read as "the probability of S given I"]. Using Bayesian Logic, we know that P(S|I) [is proportional to] P(I|S)P(S). What this expression tells us is that vision depends not only on knowledge about how visual scenes cause images, P(I|S), but also on the prior probability of different scenes, P(S)—that is, the probability of different events or objects in the world." (Temperley 2007, 13)
With respect to musical rhythm, S is the underlying meter, and I is the "surface" of sounding notes.

[11] A study by Peter Martens (2012) found that even when they could see the performers, only 58% of listeners to Haydn string quartet excerpts were able to correctly identify the performers' intended tactus, instead choosing a pulse half or twice as fast, or even in hemiolic proportion to the performers' embodied beat.

as reference points, helping to coordinate performed movements which flow over and through these impulses. In this project, I will assume that impulses and felt beats are the same thing. How else would we "feel" a beat except as a muscular impulse? And how could such a focal impulse which provides the reference point for performed/imagined motion *not* be experienced as a referential musical beat? "Entrainment" is an action, even if it is not always a deliberate one. To feel a beat is to create a focal impulse, and vice versa. Accordingly, I will use the terms "beat" and "focal impulse" interchangeably in the rest of this chapter.

While movements may frequently coincide with the beat in some music (such as a marching band), movements that do not occur on a single beat are still organized by beats. For example, a cello player may sustain a long note over multiple beats, using those beats as reference points to control the timing of the larger bow motion. In another passage of the same piece, this same cellist might play short notes in between each beat, using the focal impulses as reference points to keep the off-beats in phase with rhythm of the rest of the ensemble. Focal impulses or beats act as an underlying structure that organizes overt physical motions, and these focal impulses that underlie physical motion are the same beats that underlie perception of rhythm. Although there may be plenty of ways of moving that are vague enough to avoid felt beats, I will assume that most gestures are probably organized around focal impulses or felt beats. Consequently, my methodology for exploring rhythmic feeling will be centered around impulse structures.

What is the knowledge of rhythm that we use to ascertain probable beat structures that might lie behind sounding notes as in Temperley's model, and how can we theorize it in a way that connects it to performed movement and focal impulses? One way to describe this schematic knowledge is by appealing to a paradigm from cognitive linguistics called construction grammar. My use of construction grammar follows the approaches already taken by Lawrence Zbikowski (2008) and Robert Gjerdingen (2015; also Gjerdingen and Bourne 2015). A "construction" is a pairing of form and function, a particular syntactical pattern that is associated with a particular meaning. Gjerdingen (2015) gives the memorable example of "*That's so 90's*," which has a meaning of "That [thing in view] is so [characteristic and sadly reminiscent of similar things once common in] the 1990s" (see Wee and Tan 2008). The meaning of a construction is not always deducible from the definitions of the individual words; instead, the construction becomes associated with that meaning contextually through frequent use.

In my research, I'm interested in understanding how performers and listeners use musical constructions on-the-fly in what Mark Butler calls "metering" (Butler 2006, 105) a continuously unfolding process of simultaneously creating and experiencing beats to "construe the meter actively" (Ibid., 137). Butler's term "metering" refers to the perspective that rhythmic interpretation isn't passive discovery of an objective meter immanent in the music, but an active process in which listeners construct meter for themselves in real time. This concept of active perception is inspired by James Gibson's ecological theory of perception as presented in *The Senses Considered as Perceptual Systems* (1966), in which all perceptions are considered to be the products of engaging one's surrounding environment through perceiving actions. For example, visual perception involves not just passive reception of light by the retina of the eye, but also head movements to manipulate the binocular structure of eyes to help identify distinctions between objects and place them in a field of depth. These movements we make while looking literally create our understanding of space, and by making them we come to understand how we and the objects around us are positioned and can move within that space. Applying this perspective to the perception of rhythm, feeling a beat involves creating a focal impulse with one's body, but at the same time this felt beat forms the background or orientation according to which rhythmic structure is perceived.

All engaged musical participants use their bodies (including their minds) in this way to create a rhythmic interpretation of heard motion structured by beats, and simultaneously experience the music according to that interpretation. Sounding rhythms may have particular affordances that inform metering, but as Butler demonstrates with his concept of "turning the beat around" (2006, 141) every participant has agency to navigate these affordances on their own. In a review of Butler's book, Vijay Iyer summarizes the role rhythmic knowledge plays in navigating these affordances.

> Any model of rhythm perception and cognition must include stages at which incoming rhythms are compared to known rhythms, matched against known meters, and situated among broader expectations about musical events. [...] In short, it must treat perception to some degree as a practice—an open-ended, intentional activity that is accomplished actively by the musical participants, dancers, and listeners included. (Iyer 2008, 275)

Metering constructions provide a concrete model for this comparison with known rhythms and meters. In analogy with cognitive linguistics and Temperley's model, a metering construction is knowledge about "how rhythm goes" that can be used by listeners in this active process of construal.

My conception of "metering constructions" builds on Zbikowski's application of musical constructions to eighteenth-century French courtly dance. Using the Waltz as a case study, Zbikowski argues that "constructions are in each case sonic analogues for dynamic processes" (2008, 289) such as dance steps, so that the movements of individual dancers and the interaction of the group are "mirrored" by the gestural shapes of the music. In other words, the music "provide[s] the dancer with a sonic image of the various gestures required for the dance as well as a series of sonic events onto which she could map specific bodily motions" (Ibid., 288).[12] In the context of eighteenth-century dance music in European aristocratic courts (specifically the minuet), Zbikowski argues that when dance and music do not mirror each other in this way, these dimensions are in "contest" and "each threatens to go its own way" (2008, 291).

At least two scholars, Arnie Cox (2011, 2016) and Kofi Agawu (2003, 2006), have suggested that embodied feelings of movement need not be directly analogous to the shape of the sound itself. Arnie Cox proposes a "mimetic hypothesis" which asserts that "part of how we comprehend music is by way of a kind of physical empathy that involves imagining making the sounds we are listening to" (2011, 3). Under this hypothesis, the mimetic motor imagery that creates embodied feelings of movement is not necessarily directly analogous to the shape of the sound, because it is an imagination of actions that could cause those sounds rather than a visualization of the sounds themselves. In his writings on dance and meter in West African music, Agawu discusses a further remove between sounds and felt beats or danced motion, in which notes and footsteps may syncopate against one another and the beat may be marked by silence.

> For cultural insiders, identifying the gross pulse or the '*pieds de danse*' ('dance feet') occurs instinctively and spontaneously. Those not familiar with the choreographic supplement, however, sometimes have trouble locating the main beats and expressing them in movement. Hearing African music on recordings alone without prior grounding in its dance-based rhythms will not necessarily convey the choreographic supplement. Not surprisingly, many misinterpretations of African rhythm and meter stem from a failure to observe the dance. (Agawu 2003, 73)

While music and dance are inseparably linked, it appears that in some cases any analogies between the sounds and the dance gestures that always accompany them are

[12] In some kinds of dance this correlation is closer than in others, and Zbikowski argues that when there is little correlation, "any sense that [the dance and the sound] participate in a common communicative function may be lost" (Zbikowski 2008, 291).

either absent altogether, or indirect, coded, and insensible to cultural outsiders. Taken together, these scholars provide three distinct perspectives on the relation between sounding notes and embodied feelings of movement: (1) Zbikowski views shapes in baroque dance music as directly analogous to the shape of dance movements; (2) Cox suggests that felt rhythm can relate to the actions that are imagined to have produced the sound, rather than mirroring the sounds themselves; and (3) Agawu discusses examples where the felt beat syncopates against the heard notes, and is thus not clearly evident to listeners with no direct experience of the musical culture in question.

I seek to accommodate all three of these perspectives by considering a *metering construction* to be any conventional association between a specific way of moving, a specific syntactic function or rhythmic interpretation, and specific sounding musical features. By stipulating specific ways of moving in my theory of metering constructions and citing Ito's theory of performers' coordination of movement, I'm not meaning to imply that metering is only an activity of performers. It is a trivial leap to extend Ito's arguments about performers' movements to cover participatory audience movement like headbanging or the dances Agawu describes. But I would like to go further, extending Ito's conception of beat as focal impulse to cover *all* rhythmically entrained listening, whether or not it involves the coordination of overt motion. While the qualitative experience of attending a live extreme metal concert and thrashing around has many important differences from listening to a record at home, a still listener and a headbanging listener can come to hear beats in the same places and experience the rhythms of the music in similar ways.

Modern research on the neuroscience of rhythm describes a close connection between perception and production, in which the brains of physically still listeners show similar patterns to listeners who move in response to music. Repp and Su summarize a series of studies in which "covert sensorimotor synchronization" (2013, 432–435), or hearing a beat without moving or making sound, is found to activate many of the same areas of the brain as overt sensorimotor synchronization, including the Supplementary Motor Area, premotor cortex, and basal ganglia (Grahn and McAuley 2009). Iyer summarizes that from this perspective, "a perceived rhythm is literally an imagined movement [...] the act of listening to rhythmic music involves the same mental processes that generate bodily motion" (2002, 392). I argue that embodied knowledge of how movement can be organized around impulse structure can also be generalized beyond specific movements to shape a wider sense for rhythmic expectations and inflections. Thus the way a metal fan headbangs to music conditions how they hear rhythm in metal music even when they remain physically still. And a listener might imagine and experience the epic gestures of air guitar while sitting still on the subway, without busting out those moves and bothering their fellow passengers.

These arguments lead me to propose an expanded version of Cox's mimetic hypothesis: rhythmic feeling comes from mimetic motor imagery of *any form of participation*, whether a listener imagines making the sounds they hear, or imagines making participatory movements with different rhythms (or actually performs overt motions, or creates sounds). These sounds and movements are organized by the rhythmic knowledge of metering constructions. Interpreting and feeling rhythm involves hearing sound and recognizing metering constructions, that is, identifying potential ways of moving with these sounds. These constructions become a rhythmic interpretation through embodied performance of the impulse structures, and through the performance of movements that flow through the impulse structure (or by experiencing a flow analogous to these ways of moving while remaining still; I'll revisit the precise nature of the role played by overt physical movement in Chapter 2). Metering constructions can be used as anticipatory schemes for trying to understand sounds and movements witnessed for the first time, or they can provide the logic behind well-rehearsed metrical interpretations. My goal for the rest of this chapter is to describe and model two headbanging metering constructions, and talk about how they are applied in listening to and producing metal music.

Positing that a phrase can be stitched together out of multiple metering constructions is a key difference between my approach and previous theories of meter. Meter has traditionally been described as cyclical, repeating over and over the same pattern of strong and weak beats. Instead, I argue that a listener's perception of meter is a patchwork quilt of metering constructions, familiar patterns identified in listening and then performed as an embodied interpretation. In other words, the "meter" of a heavy metal song is not a fixed temporal cycle of 4/4, but the winding course in which one listener has chosen to headbang or stamp their foot along with the sounding rhythms, the series of beats that results from these motions. These patchwork quilts of recognized rhythms sometimes repeat the same motions over and over, but they need not repeat motions at all; the phrase-ending 332, for example, rarely occurs more than once at a time, but metalheads have no trouble recognizing it and joining its unique motion. I'll return to this argument throughout this chapter, and throughout the dissertation as a whole.

Metal Metering Constructions: Backbeat and Phrase-Ending 3+3+2

Note: In the rest of this chapter I will be analyzing many commercially-released popular music recordings. Except where noted, I am referring to the album version of a song. All songs can be found on Spotify, iTunes, or a similar music service.

The most common drum pattern in metal music is the backbeat, a pattern which can be traced through recordings back at least as far as African American gospel music in the 1930s (Baur 2015). The essential sonic feature of the backbeat is a strong accent on beats 2 and 4 of a 4/4 measure, and many definitions do not elaborate further, sometimes even describing beats 1 and 3 as "empty." But a crucial, defining feature of the backbeat pattern is that the snare beats on 2 and 4 are heard as implying focal impulses on beats 1 and 3. For example, an English choir director named Richard Terry in 1934 described observing a group of black singers in the Caribbean performing a backbeat which consisted of loud handclaps on beats 2 and 4, alternating with inaudible footsteps on beats 1 and 3.[13] The footsteps would surely be more important reference points than the handclaps for coordination and balance, so although beats 1 and 3 could be quieter (or even silent), they would be more important focal impulses than beats 2 and 4. This same association between sounding backbeat rhythms and felt beats has persisted through the musical style and genre transformations that turned African-American blues into metal music.

My definition of metering construction is context-specific, because it requires a specific form of movement and a specific set of sounding features. While the backbeat

[13] "In his singing the (West Indian) Negro—like the ancient Greek—beats time with his foot, giving that foot the strong accent. But he also clapped his hands on the weak beat. The hand-clap was audible to everybody; the strong beat of the bare foot made no sound; the unobservant listener might therefore be pardoned for thinking he was listening to syncopation." (Terry 1934, 11). Unfortunately, Terry makes this observation in service of a racist argument that every aspect of early jazz music (including its characteristic rhythmic style) is derivative of white European music.

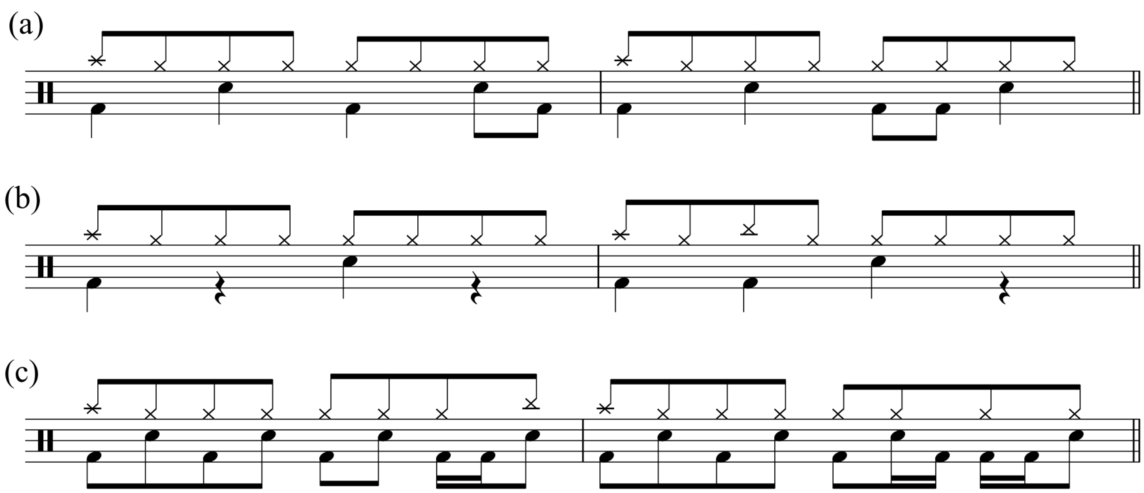

Figure 1.1: Backbeat prototype example; (a) normal, (b) half-time, (c) double-time

metering construction in metal inherits the basic logic of earlier backbeats, and is probably legible to listeners familiar with other backbeats, the metal backbeat has its own constitutive norms for sounding features, danced movement, and felt beat placement. In metal drumming, the backbeat is usually realized as strikes on beats 2 and 4 in the snare drum, juxtaposed with bass drum hits on beats 1 and 3, but this basic prototype is often elaborated.

Metal drummers frequently change between different speeds or scales of backbeats (see Figure 1.1). Rock music often uses the half-time backbeat, in which the main alternation between bass and snare occurs only once per measure, with the bass on beat 1 and the snare on beat 3. In metal, the bass drum is often left out of the half-time backbeat, and a hihat strike is added on each quarter note. Another common variant is the double-time backbeat, which has an alternation between bass and snare twice as frequently as the regular backbeat, so that each beat has a bass drum and each off-beat has a snare drum.[14] Metal sometimes uses even faster variants of the backbeat struc-

[14] See de Clercq (2016) for a more extensive exploration of double-time and half-time backbeats in a wider range of rock music, and a nuanced discussion of why these variants are not always immediately

ture, which could in some cases be thought of as quadruple-time backbeats, but often shift qualitatively into a different kind of rhythm called the "blast beat."[15]

Some metal bands favor a stripped-down prototypical backbeat, while in others the sounding drum part is just as often a variation that implies the backbeat but has a much more complicated surface rhythm. Usually the snare on beats 2 and 4 (or snare on beat 3 in the half-time version) remains constant, while the bass drum is allowed to vary more widely to highlight the guitar parts or add rhythmic intensity. Occasionally a cymbal may take the place of the snare to outline the backbeat; more often, cymbals are used either for accents or to mark every beat to fill out the texture (see Figure 1.2).

Backbeat drum patterns are usually accompanied with certain kinds of headbanging responses, but the drums do not completely determine the choice of movements and felt beats. Some available ways of moving are shown with a typical backbeat in Figure 1.3. Part (a) shows headbanging to a half note pulse, while part (b) shows headbanging to a quarter note pulse. The hook-shaped symbols above the staff represent felt beats, or focal impulses in Ito's terms; my use of this symbol follows Ito's dissertation. The choice between the two strategies of headbanging shown in Figure 1.3 affects the motional qualities of the meter, which you can see by considering the main riff from Metallica's "Master of Puppets," transcribed in Figure 1.4. Energetic listeners might shake their head vigorously forward once each quarter note pulse, which approaches 200 bpm, while less energetic listeners might do a smaller version of the same motion, or might headbang to the 100 bpm half-note pulse instead. While headbanging at the faster tempo is quite a cardiovascular workout, headbanging at the slower tempo could be relatively lethargic compared with the frenetic music and lyrics. These two strategies can be generalized to half-time and double-time backbeats:

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and obviously distinguishable.

[15] See Bogue (2004) for further discussion of blast beats, and rhythm in death metal more generally.

Figure 1.2: More elaborate backbeat drum patterns

placing focal impulses either on the beats “opposite” the snare drum accents, or on every beat in a duple or quadruple subdivision of those opposite beats.

A variety of headbanging interpretations can be observed in most videos of live metal concerts, among both performers and audiences; it is rare that all the headbangers in an audience move in unison. Glen Pillsbury describes a video Metallica’s late bassist Cliff Burton performing a slower form of headbanging.

> Unlike Hetfield and Mustaine, Burton’s headbanging [during ”Whiplash”] does not always coincide strictly with the beat: this and other footage of him illustrate that he often expressed the heaviness at the level of the half note, but also was not restricted to headbanging precisely in time. [...] Burton engaged with the changing rhythmic intensities of Metallica’s music in a very flowing manner. Rarely affecting the same direct engagement with the audience as either Hetfield or Mustaine, his body motions were generally slower than the others, but also more fluid and large-scale. (Pillbury 2006, 14)

Robin Attas highlights a similar plurality of possible levels of attending in her discussion of groove “buildups” in popular music more generally: ”In this polyphonic metric setting, any projection is a potential focus, and this is part of what makes groove-based popular music such a rich listening experience” (Attas 2015, 279). The backbeat metering construction affords this flexibility of engagement, so that listeners are free to improvise with different paces of motion while they remain anchored by the same motional logic of on-beat and off-beat.

The backbeat is not the only metering construction at play in the Metallica example. Some listeners may move their heads instead with the 3+3+3+3+4 or 3+3+2 rhythms in the guitar riff in Figure 1.4; in fact, the guitarists and bassist in Metallica can be seen moving in this way a few times in a live recording of their performance on the Howard Stern show from 2016.[16] While some theorists distinguish between 3+3+2

[16] This footage is available on youtube.com. See Metallica. 2016. Metallica “Master of Puppets” Live on the Howard Stern Show. YouTube Video. The Howard Stern Show. https://www.youtube.com/watch?v=cJOSvvdy27I

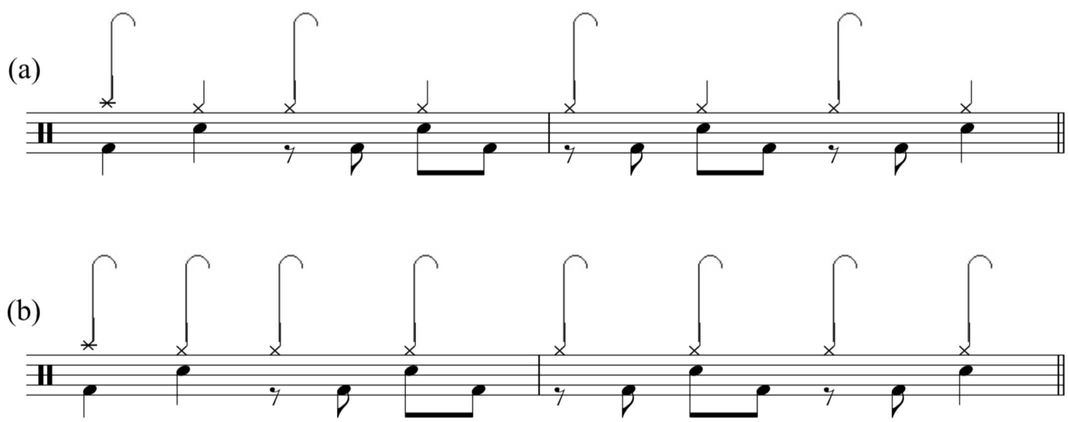

Figure 1.3: Different levels of entrainment or felt motion. (a) Headbanging to half note pulse; (b) Headbanging to quarter note pulse.

rhythms and 3+3+3+3+4 rhythms, which Biamonte (2014) refers to as "tresillo" and "double tresillo," I will consider these rhythms to be varied realizations of the same way of moving, a larger category of "3-generated pulses" (Cohn 2016, 0.4) involving a brief overlay of dotted eighth notes that ultimately are organized in phrases with durations that are powers of 2 (that is, phrases which have a length of 2, 4, 8, or 16 quarter notes). This way of moving corresponds to an impulse structure that articulates the 3-cycle of this rhythm, rather than feeling the rhythm according to the beats of 4/4. For the sake of easier reading, in what follows I will refer to this entire family of rhythms as "3+3+2 rhythms."

A weak metering construction could be described that consists of a weak association between this rhythmic interpretation (3+3+2 impulse structure / movement) and a sounding form of any 3-cycle that can be extrapolated from accents or grouping of the sounding surface.[17] This weaker construction would describe the headbanging

[17] My use of the word "weak" is not intended to be diminutive or pejorative. I'm using the word in the mathematical sense of calling a theorem "strong" means that it applies to or determines a greater range of cases, while a "weaker" version of a theorem restricts it to a smaller set of cases.

Figure 1.4: Master of Puppets 2nd intro riff, guitar and drums

by guitarists during the first part of the riff. But another listener focusing on the backbeat in the drum pattern may prefer to form an impulse structure congruent to 4/4; for example, the drummer Lars Ulrich maintains a backbeat during this riff, and his movements seem consistent with 4/4 organization. Tresillo rhythms are often described as having this plurality, a tension between 3+3+2 and a quarter note pulse, and listeners are free to choose which rhythm to entrain to.

Does this mean that Metallica is performing two metrical interpretations at once in their live rendition of Figure 1.4? How does a listener headbanging to the backbeat experience the 3+3+2, and vice versa? There are some fascinating theoretical problems about the status of 3+3+2 rhythms *as meter* that I will untangle in the following sections. But there is a version of the 3+3+2 rhythm family that forms a distinct metering construction that I must identify first, which will motivate many of my arguments.

The figure that ends the riff is an example of a much stronger *phrase-ending 3+3+2 headbanging construction* that is frequently used in thrash metal music. For brevity, when I am talking about this specific construction, I will omit the plus symbols and shorten the italicized term to “phrase-ending 332.” This stronger construction consists of a strong association between a 3+3+2 rhythmic interpretation and a more specific sounding form. Piper has described the movements and felt beats of this construction already, when he mentioned that headbanging is a sensitive response to musical feel: “If the last 4/4 measure in a four-bar phrase is accented in a 3+3+2 feel, the banging of heads will change to match it” (Piper 2013, 60). The sounding form of this construction is a particular drumkit setting, in which a 3+3+2 grouping or accent pattern in the guitar riff is matched by simultaneous strikes on the bass drum and a crash cymbal. This form is matched by a unanimous interpretation in 3+3+2 among the band members, who all headbanging to this rhythm in unison. In contrast with the weaker 3+3+2 metering construction, in which some or all band members are still performing backbeat or 4/4 metering, the stronger phrase-ending 332 presents a unified departure from 4/4.

Part of the reason the phrase-ending 332 construction is stronger than the more general 3+3+2 construction is that the former has takes a specific syntactic role of a “turnaround.” Construction-based theories of grammar propose that the syntactical function of a phrase is created by repeated usage in similar contexts, not by inherent meanings of the individual lexical units of language. In his theorization of musical construction grammar, Zbikowski argues that “Basic constructions are organized into larger structures through syntactic processes,” and he gives repetition and cadence as examples of larger syntactical processes (Zbikowski 2008, 289). The phrase-ending 332 headbanging construction occurs at the end of phrases, and acts as a “turnaround,” a conventional formal function in rock music in which a particular figure “turns” the end of a phrase or section “around” to lead into the beginning of the next section (not to be confused with Mark Butler’s “turning the beat around” in electronic dance music).

The drumkit setting of the phrase-ending 3+3+2 described above is associated through frequent usage with the syntactic function of the turnaround; other settings of 3+3+2 rhythms in metal music occur just about anywhere—in the terms of Biamonte (2014), 3+3+2 rhythms occur in Metallica's music as initiating dissonances beginning longer phrases, as cycling or repeating riffs, or also as (less strong) turnarounds.[18] The more particular usage of the phrase-ending 332 is another reason why it might elicit a more unified rhythmic interpretation in 3+3+2 while the other usages of 3+3+2 elicit a mix of rhythmic interpretations.

Motional Syncopation

After this discussion of the status of 332 rhythms as meters on their own, I can return to consider the combination of 332 and backbeat rhythms in Figure 1.4. Most previous scholarship has assumed by default that a 332 rhythm is a syncopation against an presumed 4/4 meter. But if 332 rhythms can also be felt as beats, and be a separate metrical interpretation from 4/4, then 332 rhythms are not inherently syncopations; it seems counterintuitive to describe notes felt as on-beats as a syncopation. But then what patterns would we experience as syncopated if we entrain to a 332 rhythm? And, well, what is a syncopation in the first place?

Syncopated rhythms are exciting rhythms that weave around the beat in an especially skillful or unexpected way, dazzling us with a performer's rhythmic prowess. I take this subjective experience to be the most important constitutive feature of syn-

[18] Biamonte (2014) describes two of these syntactical functions (intiating and cadencing/turnaround) as formal functions specific to small-scale rhythmic dissonances. Biamonte usually describes what I would identify as a turnaround as a "cadence." (Fast also uses the term "cadence" or "cadential pattern" for turnarounds; see Fast 2001, p. 117). I prefer to use the term "turnaround" because the use of the word cadence in traditional music theory usually implies a sense of ending, while turnarounds are always in motion and initiating a new section. There are truly ending cadences in metal and hard rock, but they usually occur only at the end of songs. Additionally, turnarounds do not always arrive at a tonic harmony.

copation. This quality is very subjective; what one person will hear as a surprising, clever rhythm may seem like a tired trope to another listener. But an "objective" analytical definition of syncopation may be impossible. Syncopation has been the subject of numerous theoretical discussions, with many existing definitions failing to account for some portion of the whole range of rhythms colloquially described as "syncopations." In the following discussion, I'll show how this existing literature presents three separate but sometimes overlapping definitions: (1) syncopation measured against an abstract metrical grid; (2) syncopation as an abnormal, surprising rhythm; and (3) "motional syncopation" measured against the body of a particular listener or participant. None of these theoretical definitions perfectly matches the subjective experience of syncopation as a particularly clever or skillful dancing around the beat, but each provides a productive route through which analysis can point towards this experience.

Traditional accounts of meter such as the theory of Lerdahl and Jackendoff describe meter as a well-ordered, rigidly grid-like hierarchy in which the downbeat of a measure is always the strongest accent, and the next strongest accent is halfway through the measure. At the scale of one or two measures, the grid they generate to model meter is essentially the same for all music, except that at each level, the strongest beats are separated consistently by either one or two weak beats. Then, "Syncopation takes place where [the music is] strongly contradictory yet not strong enough, or regular enough, to override the inferred pattern" of the meter (Lerdahl and Jackendoff 1983, 17–18). In other words, syncopation in all music is held against the same universal, normalized background. The rhythms which are sufficiently regular are "metrical" and define a meter, while the rhythms which do not coincide with that meter are "syncopations" and undermine the meter to create tension or ambiguity.

David Temperley observes one problem with this perspective, which is that in some music cultures, syncopations seem to *confirm* a sense of meter rather than undermining it. In rock music, melodic rhythms which Lerdahl and Jackendoff's definition would define as "syncopation" are actually "normative," part of the basic fabric of the music rather than "special effects" (1999, 25). These ubiquitous syncopations do not seem to "contradict" this meter; instead, "syncopated rhythms often seem to reinforce the metre of a song rather than conflicting" (1999, 26). In more motional terms, I would paraphrase this by saying: a syncopation seems to be organized around the "real" beats felt by musicians and audiences without actually coinciding with those beats, and dances around the beat in just the right way so that the beat is still obvious. Temperley proposes a theory in which syncopations are "some sort of deviation from an underlying structure," which he identifies as ultimately the same grid-like well-ordered metrical hierarchies theorized by Lerdahl and Jackendoff (1999, 26).

Mark Butler summarizes Temperley's definition of syncopation as "a dynamic tension between our perception of a note's position and our sense of where it *should* be" (2006, 87). But what structure creates this sense of "where a note should be"? Temperley uses Lerdahl and Jackendoff's well-ordered metrical hierarchies, suggesting that notes on "weak beats" like 2 and 4 would be heard as "displacements" from strong beats like 1 and 3. But Butler points out that rock music's ubiquitous backbeat is a clear counterexample.

> In rock, funk, and other traditions with roots in African-American musical practice, strong phenomenal accents on the second and fourth beats of the measure are so pervasive that this trait can be regarded as normative—hence, audiences within these traditions tend to clap on these beats rather than on 1 and 3—and there is little reason to regard the attacks on beats 2 and 4 as belonging elsewhere. (Butler 2006, 87)

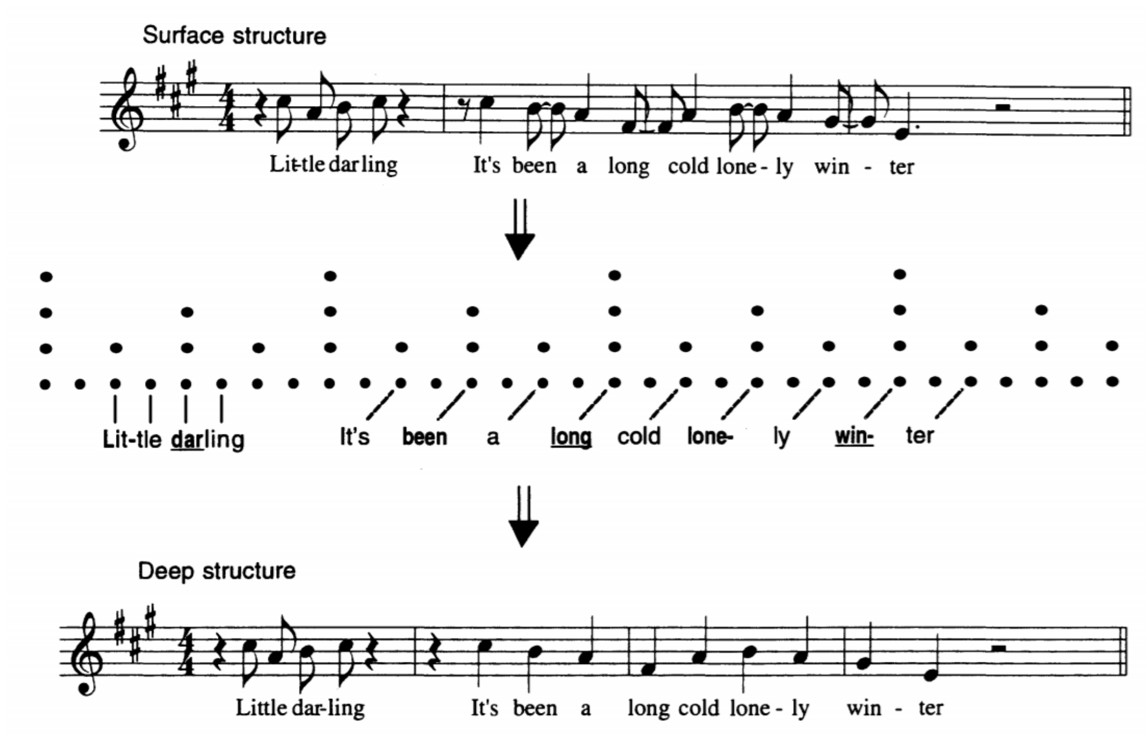

Figure 1.5: Temperley Syncopation Displacement Example

Figure 1.6: Opeth "Grand Conjuration" Chorus Riff, Guitar and Drums

This backbeat drum pattern is so normative it is impossible to hear these snare accents as "displacements."

One could extrapolate Butler's argument to suggest that any rhythm that is common enough might no longer count as a syncopation, while all uncommon rhythms are syncopes. But this excludes plenty of rhythms we still call "sycnopations" in everyday practice.

Another definition is Kaminsky's concept of "motional syncopation," experiencing rhythms against the body's motion instead of abstract beats.

> Note also that every rhythmic event of a polska tune need not be associated with a corresponding body movement in order to consider its musical rhythm to be grounded in corporeal motion, any more than we need each downbeat of a piano sonata to be accented in order to consider its musical rhythm to be grounded [in] abstract meter. Syncopation can exist in motionally based just as well as metrically based music. This 'motional syncopation' simply operates against the body instead of against the beat. (Kaminsky 2013, 47)

For a listener entraining to a backbeat, a 3+3+2 rhythm would be experienced as a motional syncopation. When a listener headbangs to a phrase-ending 332 rhythm, however, the same set of durations is no longer a motional syncopation, because it coincides with their body movement.

One corollary of this perspective may surprise some readers: a listener who invests their motion into the 3+3+2 rhythm will experience the backbeat as a motional syncopation. This completely contradicts the other perspectives of syncopation, as the backbeat rhythm is undeniably more normative and more closely aligned with the well-ordered isochronous hierarchical grid of a traditional definition of meter. However, this matches my intuition listening to songs in which a 3+3+2 rhythm dominates a backbeat, such as the Chorus to Opeth's "The Grand Conjuration." In this song, the entire band plays a (3+3+3+3)+(3+3+3+3)+4+4 rhythm (numbers represent sixteenth notes), while the backbeat is only maintained by the snare playing on the second and fourth quarter note of each measure (see Figure 1.6). In live concert videos, the guitarists clearly move to the 3+3+2 rhythm, and when I join them in my foot-tapping/nodding/headbanging, I experience the snare hits as surprising off-beats—in other words, as *motional syncopations* against the powerful unison 3+3+2 rhythm of the riff. However, if I seek out the sparse snare rhythm, it is possible to experience the guitars as the syncopated line instead.

This concept of "motional syncopation" opens up a rather wide range of rhythmic experiences of a conventional backbeat. In an SMT paper from 2014, Robin Attas presented ethnographic fieldwork showing a diversity of ways of moving to a backbeat, including moving on every beat, moving on beats 1 and 3, moving on beats 2 and 4, and other possibilities. Could each of these form a different experience of motional syncopation? Yes, because each will create different focal impulses and a different experience of how the surrounding sounding rhythms fit into the individual's body movement. But I wonder, how many of these listeners continue to experience beats 1 and 3 as starting points or "downbeats," even if their body movements emphasize beats 2 and 4? Further research is needed to disentangle "motional/felt beats" from "points of reference or departure."

But no matter how a listener navigates a backbeat with their body, it seems unlikely this rhythm will be *surprising*. For most listeners, a backbeat is too simple and mundane to create the experience of stunning rhythmic prowess, even if it moves against the body in a pleasant or stimulating way. Because not all motional syncopations are experiences of astonishment (or even disorientation), "motional syncopation" is not a complete theory of syncopation on its own.

Another area with lots of open questions is exactly how we perceive a motional syncopation. When we entrain to a gesture, we reproduce aspects of its motion within our own motor system, either as a covert simulation or an overt action. A review of body perception studies by Catherine Reed shows that humans are much better (faster) at understanding human figures when the position of the figure in the image is similar to the current body position of the viewer (Reed 2013). But when we see a gesture that differs in some respects from our own, how much or little of this gesture do we understand? When we entrain to a backbeat, we are clearly able to coordinate with 332 rhythms, at least with some practice with this combination of rhythms. But more research is needed to understand exactly what we experience of the teleology and timing of that off-beat motion, other than an awareness of motional syncopation.

Microtiming, Motional Gestalts, and Subdivision Discipline

Some may argue that the beat and subdivision structure of 4/4 are still important points of reference in a 332 rhythm, even for a performer/listener who invests their body motion in the 332 rhythm. And indeed, many 332 rhythms in popular music are undergirded by a drumkit accompaniment with a clear 4/4 pulse, and a lot of music these days is recorded alongside a fixed quarter-note metronome pulse in the studio. I argue that the isochronous subdivision framework of 4/4 is useful in disciplining accurate and even timing of a 332, but that 332 also can have a separate ontology as a motional gestalt that need not be clearly subdividable. Generalizing to other music, I argue that gestural shapes of rhythm have their own motional ontology, separate from metronome discipline. I hypothesize that we can entrain to these motions as a mode of attention distinct from isochronous periodicity, even when these gestures are disciplined to fit within 4/4 or other regular meter. We can and do freely switch between these modes of attention and motion during listening or performance.

Phrase-ending 332s in Metallica's early recordings provide a perfect case study to illustrate this argument and its ramifications. Specifically, I will be looking at their studio recording of "Hit the Lights," a song which actually predates the formation of the band in 1981. By all accounts, Metallica's rhythm guitarist James Hetfield and drummer Lars Ulrich were novice musicians; Ian Christe describes Ulrich as "barely a musician himself [in 1981], owning just a few mismatched pieces of a drum set" (60). In 1984, the producer Flemming Rasmussen began working with the band on their second album, and his account of the experience confirms the band's lack of experience.

> 'I thought [Lars Ulrich] was absolutely useless,' Flemming says now. 'I remember the very first thing I asked when he started playing was: "Does everything start on an upbeat?" and he went, "What's an upbeat?" Holy shit! The thing is that Lars is an innovative person, so his whole drumming had been based on drum fills. That was his thing. All the ones and twos in-between, he never took notice of that. He didn't really think about what was going on between the drum fills. I still think he's a great drummer in his own right 'cos I think he does some things that are absolutely amazing. But me and the guy who was his drum roadie, another guy called Flemming [Larsen] who at that time was [also] playing drums in a Danish metal band called Artillery, *we started telling him about [beats]. That they have to be an equal length of time between that hit, that hit and that hit and you have to be able to count to four before you come in again ...*' (Wall 2011, 170-171; my emphasis)

Training in the discipline of equal beats and subdivisions is a part of most Western musicians' most basic, fundamental instruction. Since Ulrich did not receive this training until Metallica's second album, tracks on the band's first album can reveal aspects of everyday rhythmic cognition that might be obscured by the careful isochronous timing discipline of most other professional musicians. Rasmussen's observations suggest that the band may not have been subdividing their 332 rhythms in a 4/4 framework.

The bridge riff of "Hit the Lights" is especially illuminating, because its arrangement juxtaposes phrase-ending 332s (where the entire band plays 332 rhythm in unison) with 332 rhythms coordinated against a backbeat. My own transcription of the riff is in Figure 1.7a. The bridge begins with the rhythm guitar playing a riff by itself,

Figure 1.7a: My transcription of the Bridge riff from "Hit the Lights," with labels a-g for the onsets of the phrase-ending 332 construction.

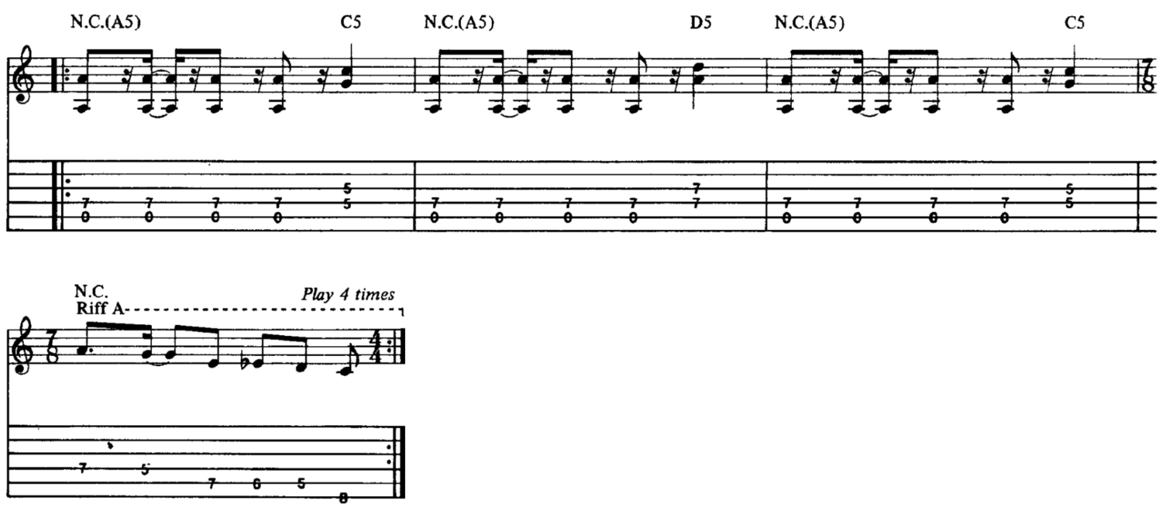

Figure 1.7b: Representative commercial transcription of Bridge riff from "Hit the Lights"

rep #	a	b	c	d	e	f	g
1	2:39.876	2:40.168	2:40.442	2:40.690	2:40.919	2:41.129	2:41.348
2	2:45.655	2:45.931	2:46.196	2.46.434	2:46.666	2:46.877	2.47.089
3	2:51.378	2:51.654	2:51.910	2:52.155	2:52.382	2:52.588	2:52.814
4	2:57.094	2:57.359	2:57.628	2:57.852	2:58.080	2:58.270	2:58.473
5	3:02.953	3:03.232	3:03.472	3:03.690	3:03.897	3:04.083	3:04.265
6	3:08.793	3:09.071	3:09.316	3:09.542	3:09.748	3:09.933	3:10.117
7	3:14.684	3:14.960	3:15.199	3:15.427	3:15.632	3:15.828	3.16.009
8	3:20.580	3:20.858	3:21.104	3:21.321	3:21.555	3:21.705	3:21.925

Figure 1.8: Table of onset times for the bridge riff in ”Hit the Lights.” Columns labelled according to Figure 1.7a. The format of these numbers is not intended to represent a scientific estimation of error or significant digits.

rep #	a-b	b-c	c-d	d-e	e-f	f-g
1	.292	.274	.248	.229	.210	.219
2	.276	.265	.238	.232	.211	.212
3	.276	.256	.245	.227	.206	.226
4	.265	.269	.224	.228	.190	.203
5	.279	.240	.218	.207	.186	.182
6	.278	.245	.226	.206	.185	.184
7	.276	.239	.228	.205	.196	.181
8	.278	.246	.217	.234	.150	.220

Figure 1.9: Table of intervals between onset times in Figure 1.8. Shaded cells indicate inter-onset intervals which are longer than the immediately preceding interval.

consisting of three instances of a dotted eighth figure (33334), followed by a fourth measure that is clearly a phrase-ending 332, with the drummer joining in to play the characteristic drumkit setting of this construction (paired bass drum and cymbal hits on the 3-pulses). After four repetitions of this four-measure riff featuring the rhythm guitarist by himself, the rest of the band joins in for the full riff, as the lead guitarist begins a guitar solo.

A curious timing pattern with a barely-controlled rushing quality occurs during these phrase-ending 332s.[19] In Figure 1.8, a table shows timing measurements of each individual rhythmic onset in the first eight instances of the phrase-ending 332 pattern (this riff continues to be repeated throughout the guitar solo, but the characteristic timing profile of this final measure sounds consistent to me, so I have only measured the first eight). The columns a-g represent the points labeled a-g in my transcription in Figure 1.7a. The table in Figure 1.9 shows the durations between the attack timings of Figure 1.8. While the exact durations vary between instances of the riff, there is a consistent pattern in which each subsequent duration is slightly shorter than the previous one. A few exceptions are highlighted in gray, mostly located in the final column, indicating that the last two durations (the 22s of the 333322) are equal. This same timing profile occurs during the 33334 rhythms of the first four statements, but the drum accompaniment of the phrase-ending 332s makes it easier to measure durations accurately.

There is no clear categorical distinction between the 3-pulses and 2-pulses in this rhythm. Each pulse is consistently about 0.015 or 0.02 seconds shorter than the previous one. The few outliers appear to be local errors in performance or measurement, because they average out between two pulses; for example, in repetition 4, while a-b and b-c are almost the same duration, c-d is 0.04 seconds shorter, so the difference between a-b and c-d is the same as if b-c had followed the consistent trend of decreasing 0.02 seconds. This problem is suggested numerically by the timing measurements, but can be confirmed by trying to count any level of subdivision or pulse in listening.

[19] I measured this timing by marking articulations of the cymbal on a spectogram. This analytical methodology has also been used by Lucas (2018) and others. The high frequencies and rapid onset of a cymbal sound enable more precise timing measurements than bass drum or guitar articulations. The phrase-ending 332s have cymbal strikes on every single ensemble onset, while the cymbal is not in unison with the guitars during the rest of the riff, so it would be more difficult or subjective to perform a similar analysis of the riff's first three measures.

But perhaps embodied participation or entrainment is a better test; I have difficulty trying to embody the quarter-note, eighth-note, nor sixteenth-note subdivisions that would be implied by conventional readings of the notation of Figure 1.7.

Tellef Kvifte expresses a similar line of thinking on a more local scale in his article about subdivision and categories of durations. Trying to resolve contradictions between Justin London's theory of meter and the non-isochronous rhythms of Norwegian *springar* folk dance music, Kvifte argues against the "common fast pulse" theory in London's 2004 book, which argues that Non-Isochronous meter depends on the stability of an isochronous smallest-common-subdivision (the second edition of London's book has been revised to accede to Kvifte's critique). Kvifte argues for a "Common Slow Pulse" theory, in which a *tactus* beat or a higher level of meter is stable, but faster subdivisions need not be equal. His position is memorably explained by the *Chocolate Argument*:

> "As my children know very well, when I divide a chocolate bar into three pieces, there is absolutely no guarantee that those three pieces will be of the same size. The reason is simple; I do not use a calculator to divide the chocolate; I use my body. In the same way, when we, as listeners or performers of music, subdivide beats, we do not use calculators, we use our bodies." (Kvifte 2006, 76)

Kvifte proposes that this division of time with the body need not be numerically accurate, in other words, that subdivision durations need not be separable into categories with clear proportional relationships.

In the table in Figure 1.9, we can see no clear categorical distinction between the durations of 3- and 2-pulses. It thus seems incorrect to think of them in terms of a nominally consistent subdivisor—that is, perhaps it is misleading to describe them as "3-pulses" and "2-pulses." I will continue to describe them in 3s and 2s because this rhythm is clearly associated with the phrase-ending 332 construction. But perhaps at some motional level, this rhythm exists as a set of gradually-accelerating pulses, rather

rep #	Span of PE332	Average Span of Three 4/4 measures	Difference Between 4/4 and PE332
1	1.472	1.400	-0.072
2	1.434	1.436	0.002
3	1.436	1.430	-0.005
4	1.379	1.427	0.048
5	1.312	1.493	0.181
6	1.324	1.509	0.185
7	1.325	1.522	0.197
8	1.345	1.524	0.179

Figure 1.10: Table of durations of 4/4 and Phrase-Ending 332 (PE332). See Figure 1.7a.

than 3- and 2- groupings of a nominal subdivision referent.

Another piece to this puzzle is that one can observe a clear difference in timing between this initial version of the riff, and a version that is disciplined in a 4/4 backbeat framework. Starting with the fifth statement of the riff in Figure 1.7a, the 33334 rhythm of the first three measures is accompanied by a backbeat pattern in the drums, while the phrase-ending 332 of the final measure continues to feature the conventional phrase-ending 332 drumkit pattern. I measured the timing of full measures, shown in the table in Figure 1.10. For the first four statements of the riff, where the rhythm guitarist plays by himself, the timing of 33334 and phrase-ending 332 is close enough that the differences might be excused as random noise. But when the rest of the band comes in, the "4/4" version of the rhythm in the first three measures is on average about 0.185 seconds longer than the phrase-ending 332 of the final measure—an entire eighth note duration from the perspective of the 4/4 timing.

This consistent difference explains why commercial transcriptions of this riff consistently notated the final measure in 7/8 (see Figure 1.7b), despite the fact that the drumkit setting clearly other phrase-ending 332s (which are notated in 4/4). But it should be noted that if this measure were truly “in 7/8,” the entire riff would be “in 7/8” for the first four repetitions, because when the rhythm guitar is playing alone, the entire riff features this accelerated timing, not just the fourth measure. I have chosen to keep the entire riff in 4/4 in my own transcription, reflecting the convention of notating 332 rhythms in 4/4 across a wide range of popular music.

Both versions of this riff’s timing are based in patterns that resonate with the 332 construction, but some are disciplined to fit into the 4/4 timing of a backbeat, while others are given a freer, more gestural timing. Since Metallica had little to no formal training before the recording of their first album, they did not know they were “supposed to” make their 332 rhythms consistent across the whole bridge, rather than only fitting them to a 4/4 pulse when that equal pulse was physically manifested in the drumkit. Whether the 332 disciplined in 4/4 and the “undisciplined” 332 count as the same metering construction is an issue I will explore in the next section. For now, I will argue that the 332 construction has a consistent motional basis, an ontological layer which is present in any instance of a 332 construction, but normally disciplined to fit metronomic 4/4 timing. In other words, the first and second components of my definition of a metering construction — the sounding features and the performed movement — are analogous in all 332 rhythms. Regardless of whether or not a 332 is disciplined in 4/4, it still represents the same *way of moving*.

Some support for this perspective comes from two recent studies of motivic entrainment in free rhythm or non-periodic meter. A study of a Swedish *polska* dance by Mats Johansson answers Kvifte’s rhetorical question ”But then, is it possible to imagine a meter where NO level has isochronous units?” (Kvifte 2006, 82). Johansson finds that while there is no consistent level of periodicity (durations of measure and beat vary widely), individual recurring motives have surprisingly consistent timing. One possible explanation of this some sort of “density referent” like what Kvifte calls a ”Common Fast Pulse” theory. But Johansson argues that instead, “the correspondence between motivic structure and timing patterns may suggest the the precise timing of the measured units is an intrinsic component of the melodic-rhythmic articulation of the motif seen as a complete rhythmic event or gestalt” (Johansson 2017, 36). My discussion here extends this argument, by examining the same motional gestalt (332 constructions) in both the presence and absence of an isochronous 4/4 beat.

Johansson’s analyses examine the timings of a fixed recording, but a comparable study from a more behavioral perspective has been carried out by Mitchell Ohriner, who arrives at some similar conclusions. Ohriner performs an experiment where he asks listeners to tap along to a piece from a free-rhythm instrumental genre called *Taqsim* (specifically, a recording by the renowned Iraqi musician Rahim AlHaj). This performance features a section where a motive recurs, but with freely varying timing and number of articulations in different parts of the motive. He finds that while some listeners seem to tap randomly, others coordinate their tapping consistently with salient features of the motive, despite the free rhythm and variations. Ohriner suggests that the motion of the motive provides a “corporeal basis” for metrical behavior (Ohriner 2016, 33).

> What I have proposed here is a further move in this direction, towards locating meter in the synchronicity between a performer and specific attending listeners rather than the degree of periodicity of the sound signal. Because the durations between salient events in the interior excerpt roughly repeat in a (highly unequal) cycle, the passage affords entrainment and might be considered metered. Rather than arguing whether or not it ”is metered,” I have demonstrated that it enables *metric behavior* for some but not all listeners. (Ohriner 2016, 33–34; original emphasis)

Ohriner’s experiment demonstrates that listeners are clearly able to attend to and join free rhythm when there is a familiar motive or motion that can form the basis for this movement. I will return to his experiment in a more extensive discussion about motive in my Chapter 3. But for now, it is enough to say that his position corroborates the perspective I've been building that a familiar motional gestalt could be the basis for rhythmic cognition and behavior, without the need for an isochronous referent of any kind.

Another researcher who seems to imply a separate motional mode of attention during regular 4/4 meter is Olivia Lucas, in her study of the Swedish extreme metal band Meshuggah (Lucas 2018). This band often imposes riff overlays with irregular odd durations over drum patterns containing elements of a 4/4 backbeat, with the large-scale structure of songs often seeming to be determined by the backbeat in duple groupings (4, 8, 16) of measures.

> Whether the music is heard as polyrhythmic, rhythmically or metrically dissonant, or simply as some kind of "weird 4/4" depends on the listener, the song, and sometimes even the segment of the song, and I am attentive to and interested in varied ways of hearing this music. To my mind there are (at least) two ways of "getting" this music. Someone who is following the 4/4 in all its weirdness is enjoying it differently, but no less fully, than a listener who parses the music polyrhythmically. (Lucas 2018, 10)

The "polyrhythmic" riffs are gestural shapes overlaid atop a stable meter, and Lucas suggests that these are distinct modes of attention, which we can easily switch between during listening. 332 rhythms in 4/4 provide a much less complex example of analogous perceptual possibilities.

Crucially, these authors all appeal to the body as the locus of these perceptions of motion, as I do in defining headbanging as a metering construction. Kvifte argues that body movements are "more likely candidates for referent level units than a fast clock pulse without any clear location in the body" (Kvifte 2006, 76), rejecting a literature on motor control and rhythm cognition that describes timing in terms of "internal clocks." Johansson makes a similar move, positing a close connection between the non-isochronous timing of *polska* and the movements of the dancers.

> Suffice it to say that there is generally an overall correspondence between the durational and accentual structuring of musical rhythm and the organization of dance movements, which indicates that the asymmetrical beat patterns are established as basic frameworks for musical performance and interaction, and that they should not be regarded as expressive deviations from some nominal referential structure (such as symmetrical or isochronous triple meter) (Johansson 2017, 32).

Experiences of felt movement are clearly integral to our cognition and perception of rhythmic gestures, but I want to clarify that this need not be overt movement. When a regular headbanger listens from an armchair, she can still experience the music as if she were on her feet in a mosh pit. In Chapters 2 and 3 I will explore this issue of covert motion further.

To summarize, I'd like to suggest that motional shape is a potentially distinct mode of attending, which can be present in the absence of periodicity, but is also often present in some of the periodic environments that have been the focus of most previous studies of rhythm and meter. Obviously, however, a large amount of music does feature some kind of isochronous pulse or subdivisor. This temporal regularity often correlates with the cognitive phenomenon of attentional periodicity that forms the basis of London's theory of meter (2004) has been demonstrated over and over by literally hundreds of periodic tapping studies (Repp 2005, Repp and Su 2014). Both motional shape and periodic pulse can form the sole basis for entrainment, and we can switch between these modes of attention easily in real time.

The Status of 3+3+2 Rhythms as Meter?

But is 332 really a "meter" in the same sense as 4/4? And is a 332 rhythm over a backbeat a more generalized version of the phrase-ending 332 construction, or a different construction entirely? In the following paragraphs I'll take Mark Butler's explorations of 332 rhythms in electronic dance music as a jumping off point to further explore the status of 332 metering constructions as meters. I'll argue that combining a 332 rhythm with a backbeat (sounding or imagined) can fundamentally change the motional properties of the 332 rhythm. But first, I'll explore the "metricality" of 332 rhythms, comparing my motional perspective with previous scholars' investigations of metricality in terms of the numerical properties of 332 rhythms.

Butler weighs several potential theoretical categories for rhythms like 332, before settling on the concept of "diatonic rhythms." The term "diatonic" is an analogy to the Western seven-note scale made up of whole- and half-steps, and like the diatonic scale, diatonic rhythms like 332 and 33334 are "maximally even" and "maximally individuated" (Rahn 1996). "Maximally even" means that a set of points is as evenly distributed as it could be; for example, 332 is the most even possible distribution of 3 rhythmic attacks in a space of 8 units, and 33334 is the most even possible distribution of 5 attacks in 16 units. "Maximally individuated" means that each note has a unique relationship to other notes in the pattern; the first "3" in 332 is preceded by a 2 and followed by a 3, while the second "3" is preceded by a 3 and followed by a 2. These properties make diatonic rhythms easy to track in listening, while they are also quasi-isochronous, making it easy to feel them as a beat.

> I do not deny that the irregularity of diatonic rhythms can become apparent when they are juxtaposed with the even rhythms generally associated with meter; in my view, however, diatonic rhythms are not heard as *subordinate* to an underlying metrical structure. Rather than being measured against an absolutely even, strictly regular norm, they create their own kind of evenness through their distinctive structural properties. (Butler 2006, 88-89; emphasis is original)

Even when a 332 rhythm is juxtaposed against an equal 4/4 pulse, it does not have to be subordinated to that pulse. A 332 rhythm can be felt as an independent beat in its own right, experienced as an embodied point of reference for the musical sounds around it.

I argue that while these specific properties of the proportions between durations (maximal evenness and maximal individuation) characterize many metrical interpretations, they are not necessary criteria for metricality; many more kinds of rhythm can be potentially be referential felt beats, as I demonstrate in subsequent chapters. Diatonic rhythms and periodic rhythms do have very obvious affordances for interaction—synchronizing with each pulse—so they are inevitably more common as participatory behaviors. Periodicity especially has been theorized as invariances to which neural oscillations can become entrained (Large and Snyder 2009). Many studies have demonstrated that this phenomenon of attentional periodicity enables humans to achieve extraordinary accuracy in rhythmic performance within periodic conditions (see literature review in London 2004). But the special properties of periodic entrainment (or quasi-periodic, in the case of diatonic rhythms) do not mean that these are the only ways of moving, the only referential rhythms we can use in performing and listening to music. In other words, *metricality* is determined by someone deciding to move in a particular way and perform that rhythm as an embodied reference for their own hearing, not by the numerical properties of the sounds' durational proportions.

In his discussion of rhythms like 332s, Richard Cohn mentions another property of pattern that supposedly distinguishes "metrical" rhythms from the others: "cyclicity." Cohn acknowledges Butler's arguments about the maximally even property of diatonic rhythms like 332, but he apparently thinks Butler has gone too far in arguing that 332 rhythms often are not subordinate to a 4/4 meter.

> The approach here occupies a middle ground, treating dotted spans primarily as rhythmic patterns with properties, such as cyclicity and quasi-isochrony, that are shared by meter. The patterns thus have the potential to blossom into meters if developed in certain ways, although in the repertoires studied here those potentials are rarely fulfilled. (Cohn 2016, 0.3)

Cyclicity is indeed an important property in many theories of rhythm. From my perspective, in which meter is a patchwork quilt of recognized rhythms, cyclicity is not a necessity of entrainment. Cyclicity certainly makes it a lot easier to join music's movement; one can just repeat the same motion over and over. It may require a fair amount of musical sophistication to put together a non-cyclical rhythmic interpretation that locks in tightly with the timing of the music around you. Thus cyclical and quasi-isochronous rhythms may have more accessible affordances for entrainment, and hearing periodic motion may may often be more likely than hearing a less regular flow. But I argue that all kinds of rhythm can be referential, can form the basis for a hearing of felt beats, which need not be cyclical or even quasi-isochronous.

But even if 332 can be heard as a meter / referential rhythm in the presence of 4/4, is this hearing different than the "undisciplined" motion of Metallica's phrase-ending 332s? This issue is complex because 332 with a backbeat and 332 alone (undisciplined by 4/4 time) have the same pattern of *overt* rhythmic motion, while something about the internal felt properties of the two rhythms is different. Mark Butler goes as far as to argue that 3+3+2 can be nearly indistinguishable from from equal triple time (3+3+3). He analyzes 3+3+2 and 3+3+3+3+4 rhythms using Christopher Hasty's theory of projection, showing how the difference between 3+3+2 and 3+3+3 involves only a slight difference between the projected final duration and its realization. I would add to this by pointing out that both 3+3+2 and equal triple time have similar *motional* profiles; three "quasi-isochronous" pulses with the third one having a strong feeling of upbeat.

But when 3+3+2 rhythms are heard simultaneously to isochronous 4/4 rhythms, they take on additional motional qualities in their relationship to the stream of regular quarter notes. Tellef Kvifte states this point by describing the rhythm from the

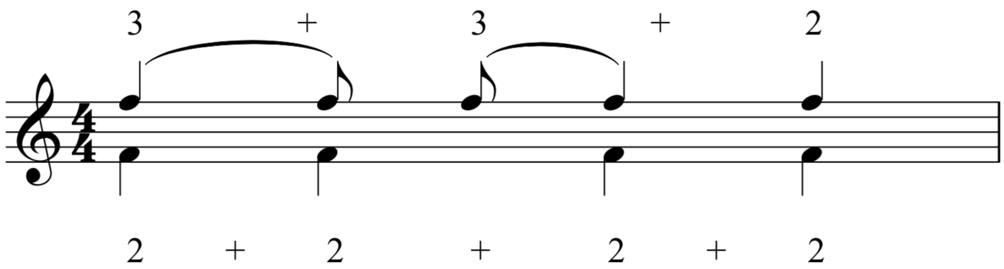

Figure 1.11: 3+3+2 against quarter note pulse. Note how the second "3" is in counterpoint between two quarter note pulses.

perspectives of "additive" meter and "divisive" meter (the latter is essentially the 4/4 isochronous subdivision discipline I've been discussing).

> But the mathematical construction of the additive and divisive meters is not the whole matter. There also seems to be consensus in the literature that the difference is a question of perception. [...] Perceived in a divisive context, [3+3+2] may be described as a syncopated pattern in a four-beat bar. But in an additive context, each of the pulses is to be perceived as the actual beat of a three-beat bar, where the beats have different duration (Kvifte 2006, 66-7)

Kvifte's description of a "three-beat bar" resonates with Butler's conception of a close similarity between 3+3+2 and 3+3+3 "equal triple time." He also hints that 3+3+2 is experienced differently in a four-beat bar. The 3+3+2 is syncopated (the second 3-pulse is an off-beat), and the "divisive" subdivision hearing gives the 3s and 2s different qualities because they group different numbers of subdivisors. These motional qualities of the attacks that form the 3+3+2 pattern are different when they are experienced in a 4/4 context.

But there are also less obvious changes to the motional quality of a 332 rhythm, because adding a quarter note pulse doesn't just change the quality of existing 332 onsets, but also creates new rhythmic relationships. If the 3+3+2 is experienced in relation to a 2+2+2+2 rhythm, so that the second 3-pulse is in rhythmic counterpoint to a 2-pulse on either side of it. In my experience this alternation-in-close-proximity seems to give the second 3-pulse more excitement or motional velocity, perhaps the same kind of experience that motivates Charles Keil's theory of "participatory discrepancies" (Keil 1966). (One important caveat is that some music such as the EDM that Butler analyzes, different instrumental layers appear to be deliberately dissociated from one another, so in some music some listeners may not integrate simultaneous 332 and 4/4 rhythms even if their timing interlocks nicely). But in my experience the presence of the 2+2+2+2 quarter-note pulse (and its assumed equal subdivision into 1+1+. . . +1) can often change the motional nature of the 332 rhythm, even if the 332 rhythm is still felt as the referential pulse.

In other words, a 332 rhythm disciplined in 4/4 time and an "undisciplined" 332 like Metallica's phrase-ending 332s are actually different ways of moving to the sounding notes—different metering constructions. The same overt gestalt of 332 rhythm can have have different motional qualities in the context of different sounding surfaces or different felt beats. In describing similarities between 332 and equal triple time, Butler seems to be referring to the "undisciplined" or free 332 gestalt. One of the sharpest critiques of Butler's book seems to have arisen from an author who interprets 332 as "asymmetrical," that is, inherently defined by certain disciplined timing relationships to a quarter note pulse.

In a review published two years after Butler's book, Vijay Iyer finds fault with Butler's analysis of a 332 rhythm in Carl Craig's "Televised Green Smoke." This rhythm begins as a 3+5, or a 3+3+2 missing the final "2"; this final note is added partway into the track to complete the 332 pattern. Butler describes this moment as a shift in perception, a realization of 3+3+2 after initially hearing the 3+5 as two beats in equal triple time—that is, as 3+6. For the record, I can easily hear the 332 interpretation if I consciously choose to, but until the final "2" comes in, I easily slip into a triple-meter hearing, as do a number of other readers I've spoken with.

Iyer, however, rejects this equal-triple-time hearing, claiming it to be an imposition of Western theory on to Afro-diasporic popular music. Iyer's reference to "afrological" understandings of rhythm may indicate that he hears this rhythm in a motional/conceptual framework other than 4/4, but he claims there can be no mistaking it for equal triple time.

> I instantly recognized it as a particular kind of asymmetry that is so common—not just in EDM, but in a broad spectrum of music of the African diaspora and its hybrids—that it could be called a cliche. Granted, I am a professional musician and not an active consumer of the strains of EDM that are considered here. [...] To me, as a listener, it seemed unlikely that this rhythm would be in a triple meter, because the vast majority of EDM I have heard is duple in construction. (Iyer 2008, 272)

Iyer criticizes some passages where Butler might seem to claim universality for his hearings (arguably a misreading, given Butler's frequent discussions of subjectivity and agency in rhythmic hearing). But while Iyer mentions his own embodied subjectivity, he does not dwell enough on how it might affect his hearing; as a professional jazz musician who has trained in 332 rhythms, he is of course trained to "instantly recognize" these patterns—and specifically, to instantly recognize (and be instantly ready to perform) the particular ways of moving along with 332 rhythms that are cultivated by jazz music's rhythmic practice or culture. While I need to do more research on the effects of expertise on rhythm perception, I tentatively suggest that practicing such rhythms in performance would not only heighten Iyer's sensitivity to small discrepancies in timing (like 3+3+2 vs. 3+3+3), but would also make these relationships between 332 and 4/4 pulse very prominent in his conceptual and embodied understandings of these rhythms.

While Iyer's review positively highlights some of Butler's most compelling points, his criticism is misplaced. Iyer misrepresents several points, conflating Butler's work with Lerdahl and Jackendoff's "generative" approach (which Butler clearly rejects), and apparently missing Butler's nuanced discussion of syncopation and normative rhythms (2006, 87) when he says Butler "could have started with other assumptions about meter, accepting cross rhythms and asymmetries as normative" (Iyer 2008, 276). A generous reading of Iyer's critique might focus on his helpful clarification of the cultural and cognitive implications of Butler's conception of metrical construal.

> Any model of rhythm perception and cognition must include stages at which incoming rhythms are compared to known rhythms [...] In short, it must treat perception to some degree as a practice—an open-ended, intentional activity that is accomplished actively by the musical participants, dancers, and listeners included (Iyer 2008, 275)

This conception of meter as an active practice in which listeners and dancers participate in construing rhythm is a perspective which Butler's book appears to wholeheartedly support (though he does not stress the "known rhythms" part as emphatically as Iyer does). However, one could also read Iyer's review as a claim that a particular hearing of 332 in electronic dance music by an expert musician in another genre (jazz) is not only more authentic than other hearings, but even is the *only valid hearing*—a problematic assertion, even if Iyer is correct in tacitly assuming that EDM *musicians* experience 332 rhythm in the same way he does; clearly at least some EDM *listeners* (Butler, myself, and others) hear it differently.

When I've discussed this passage with other readers, musicians with jazz training emphatically side with Iyer, while classically-trained musicians and fans with less training have expressed more sympathy with Butler's hearing. This difference of opinion highlights the explanatory power of describing meter as a patchwork quilt of recognized rhythms. Each listener brings their own set of culturally-situated metering constructions to the task of musical listening, and is free to use deploy those ways of moving in whatever way they want (though some people might believe some ways of moving to be more or less culturally appropriate or relevant). A rhythm one listener experiences immediately in one way can be heard by another listener as ambiguous, or even heard as an entirely different type. Our experiences of rhythm are deeply culturally conditioned—not just in our identification of familiar dance patterns or interpretations of hierarchy or large-scale structure, but in our most basic physical percepts of what the basic units of motion in a rhythm are in the first place.

Listening with the Phrase-Ending 3+3+2 Construction

So far in this chapter, I have introduced the idea of metering constructions and defined two separate ones: phrase-ending 332 and the 4/4 backbeat. In my examples so far, modeling meter as a hierarchy of isochronous periodicities could still make sense; even though 3+3+2 impulse structure differs from the beats of 4/4 time, these more typical uses of phrase-ending 332 rhythm fit within the whole-note phrase rhythm of 4/4. But the examples of phrase-ending 332 examined in the rest of the paper show that it can displace or disrupt all the periodicities of 4/4 meter. The various uses of phrase-ending 332 illustrates an important claim in this dissertation that generalizes to other music: the process of metering interpretation and the physical feelings of rhythm that result are sometimes better described as a patchwork of recognized rhythms, rather than as a unified cyclical system.

The song "Primal Concrete Sledge" by the groove metal band Pantera uses the stability and familiarity of the phrase-ending 332 construction to displace 4/4 backbeat meter. The whole song is a fascinating case study in 3-generated rhythms, including the most extended overlay rhythm of this type that I have ever heard, which serves as the verse.[20] The chorus, on the other hand, features a double-tresillo rhythm that

[20] Cohn examines a lengthy 64-unit 3-generated rhythm in his 2016 article, noting that "A protracted contra-metric series of this length taxes any performer's capacity for rhythmic cognition and control,

Figure 1.12: Pantera "Primal Concrete Sledge" Chorus 1:01–1:05, two hearings: (a) Staying in 4/4; (b) Changing to displaced phrase-ending 332 hearing

turns into a phrase-ending 332 rhythm in an unexpected way. First, the vocals in the chorus repeat a rotated double-tresillo (2+3+3+3+3+2) several times, while the drums maintain a backbeat. Then at the end of the chorus, the vocals repeat this rhythm one more time, using the title of the song as a refrain. On the second note of this rhythm, the drums begin playing in unison with the dotted eighths, using paired cymbal and bass drum hits on each dotted eighth. I interpret this rhythm, and headbang to it, as a phrase-ending 332 construction.

From the perspective of the established backbeat, this rhythm starts on the second eighth note of the measure. But hearing the rhythm as a phrase-ending 332, it feels like the first dotted eighth note is a new downbeat, not a syncopation. The pattern plays out as if this were a normal phrase-ending 332 construction; after four dotted eighths, there are two regular eighths, followed by a final staccato note that feels like a new downbeat. This all causes me to feel the rhythm as 3+3+3+3+4. This phrase-ending figure also sets the title of the song, which highlights this passage further in the mind of any listener who is attending to the lyrics. The song title is followed by a half note's worth of silence, after which the next section of the song begins. In other words, the phrase-ending 332 construction has led back into regular backbeat time, even though it began in the "wrong" place. This leads me to assume that no matter where the drum setting of the phrase-ending 332 might occur, I would immediately hear it as the downbeat of a new "measure" of 3+3+2, regardless of how the beginning of this rhythm fit into any established meter.

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and particularly a singer's breath control and endurance. [...] Unlike most of the other 3-generated passages presented in this paper, the 64-cycle examples that I am currently aware of are presented not as repeating cycles, but rather as individual instances." (2011, 7.1).

The main riff in "Primal Concrete Sledge," which serves as both the intro riff and the verse, is a 64-unit 3-generated cycle. At 0:43-0:56 in the album version of the song, the intro to the second verse and the second verse itself are elided to form a 128-unit 3-generated cycle, twice as long as any such rhythms Cohn discusses in his article.

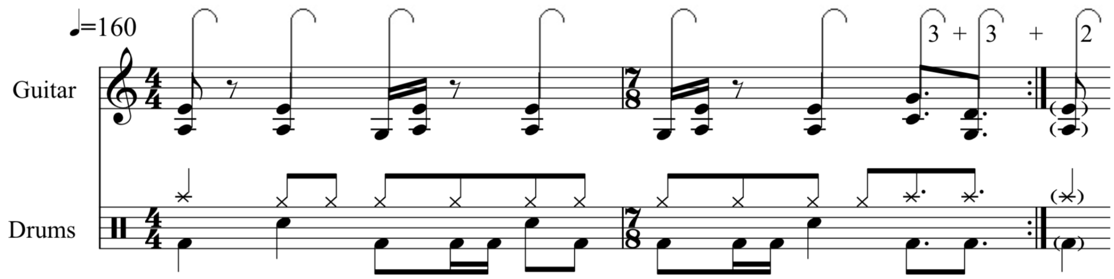

Figure 1.13: Metallica "Hit The Lights" Chorus riff, 1:09–1:19

The last example seems to me to use the same rhythmic knowledge as the phrase-ending 332 construction, but without using a complete 3+3+2 pattern. In the chorus riff to Metallica's first song "Hit The Lights," which I discussed earlier, the bulk of the guitar part consists of guitar notes on every quarter-note beat, clearly matching a backbeat in the drums. At the end of every second measure, the guitars play dotted eighth note power chords, and the drums play paired cymbal and bass drum hits in the same rhythm, as in a phrase-ending 332. The singer also sings the song's title "Hit The Lights" in the same rhythm. But then instead of following these two 3s with a 2 "durational comma" to achieve "closure" against a hypothetical expectation of background 4/4 phrase rhythm as the tresillo does (Cohn 2016, 2.7–8 and 3.4–5), the "Lights" in "Hit The Lights" is the downbeat of a new backbeat pattern. I hear this as an elision of the last beat of a phrase-ending 332 with a new downbeat. Unlike a hearing that remains in 4/4, I hear no "off-beat" notes; I headbang to each word in the phrase "Hit The Lights." The only disruption this creates is a somewhat uneven headbanging rhythm.[21] From the perspective of traditional theories of meter, the chorus riff of "Hit the Lights" terminates or displaces all quarter-note, half-note, whole-note,

[21] Another possible hearing is that the two dotted eighth notes could be "sped-up versions" of the final two quarter note beats of a 4/4 measure. But drum rhythm here is not a distorted version of a backbeat. Since this Chorus riff uses exactly the same drumkit setting as the phrase-ending 3+3+2 rhythm, I've chosen to maintain that interpretation.

and larger periodicities of the surrounding 4/4 backbeat. (This riff is an example of a ″weird join,″ a concept I discuss in Chapter 4. Essentially, because the last impulse of phrase-ending 332 pattern is elided with the first beat of the next backbeat, there is no felt interruption to headbanging. Thus this meter change is not as disruptive as it looks in notation.)

A motional quality of heaviness is strongly associated with the phrase-ending 332 construction. As I mentioned earlier, headbanging serves to amplify the intensity of rhythmic experience, which is an especially important part of an aesthetic of heaviness in sonic and corporeal affect that is central to metal culture. Pillsbury theorizes the aesthetic of thrash metal as "movement through cycles of energy working on many different levels to focus power and intensity into bodily experience" (2006, xx; my emphasis). He characterizes these cycles as "a build-up of potential energy, energy released as kinetic by another explosion" followed by another build-up of rhythmic energy (2006, 12). Phrase-ending 332 constructions occur at the local maxima of the phrase-level cycles, expressing high rhythmic intensity with their paired bass drum and snare hits and their jagged rhythms. This feeling of intensity or heaviness is partly created by this bludgeoning unison, and partly by the forward-leaning quality that 3+3+2 rhythms often naturally create. The examples above also come at points of high intensity in the largest cycles of energy within their respective songs; Figure 1.6 occurs at the climactic ends of Choruses, Figure 1.13 is one of the most prominent moments in "Hit The Lights" because it repeats the title as a refrain, and Figure 1.7 occurs during the Bridge—a section Pillsbury describes as the "mosh part," the most physically intense part of the whole song.

The words shouted in Figures 1.6 and 1.13 emphasize this heavy impact. "Hit The Lights" literally calls for an impact, one which launches the transformed reality of the ritual that is a metal concert: “We know our fans are insane / We are gonna blow this place away / With volume higher / Than anything today the only way / When we start to rock / We never want to stop again / Hit The Lights!” Pantera’s “Time For Primal Concrete Sledge” similarly summons an impact, and the title clearly evokes the heaviness and destruction such a collision might have. These two phrases are both performative statements, not mere words but dramatic transformative utterances imbued with heavy affect and threatening weighty consequences. Each syllable is shouted out as loud as possible, evening out strong and weak accents that a normal poetic scansion these words might be given in another context. That these bands chose to employ phrase-ending 332 rhythms to carry across these titular refrains indicates the heavy affect this construction has in non-texted contexts such as Figure 1.7.

The physical motion of headbanging is also conducive to this affect of heaviness. The primary articulation of headbanging is a downward motion; while there is an opposite upward motion upwards that traverses an equal distance, it is often a rebound. Headbanging creates the impression of a heavy impact of the head, as the brain pushes against the inside of the skull and the body’s central organs of aural and visual perception are thrust downwards on the beat. Other metal dance practices including mosh pits and fist-pumping involve similarly powerful moments of physical impact. Fans valorize the music for its ability to inflict such corporeal impact through their dance practices, though this power is often ascribed directly to the music itself and wildly exaggerated. The most effusively positive album reviews, such as the following review of demos by the pioneering extreme metal band Death (yes, they invented the genre of ”death metal”), describe the music literally destroying the body of the beholder. “Total Neckbreaker-Riffs shoot against me. The solo reminds me of the first Venom LP—total chaos! The sound separates your skin from your bones, and your brain begins to cook...!" (Ludwig 1985).[22] Realized through headbanging, this phrase-ending 332 construction becomes an icon of this larger aesthetic of bodily affect that pervades the entire metal genre.

These examples point to the significance of understanding meter as recognized rhythms and affordances for rhythmic interpretation, rather than a stable cyclical structure. From this theoretical perspective, meter can be created by the recognition of metering constructions and the performance of those constructions as a rhythmic interpretation. It follows that the meter of a piece is a series of metering constructions that a listener chooses to feel. As I will explore more in the following chapters, listening to rhythm and interpreting meter is a kind of improvisation based on prior knowledge, where we piece together an impulse structure which constitutes a possible way of moving with what we hear. If meter is defined as whatever series of beats that a listener experiences, in other words as a performed rhythmic interpretation, then meter is a patchwork of recognized rhythms. Some of these recognized rhythms might be periodic, cyclical systems resembling traditional time signatures, but not all felt beats and perceived motion is so regular. Most human musical activity involves shifting rhythms, and considering these shifts as recognition of different metering constructions provides a robust way to theorize the discontinuity and continuity of rhythmic change.

If meter is a structure improvised by a listener, rather than a fixed property of sounding music, then the simultaneous combination of backbeat and 332 rhythms makes sense. Even if listeners have the same rhythmic knowledge, they might apply metering constructions differently in determining beats. These differences can be

[22] This is my own translation. The original German reads: "Totale Neckbreaker-Riffs schießen mir entgegen. Das Solo erinnert mich an die erste VENOM-LP —Chaos total! Der Sound trennt dir die Haut von den Knochen, dein Gehirn fängt an zu kochen...!"

created by attending to different parts,[23] or they may result from each listeners' own idiosyncratic preferences,[24] or they may just be spur of the moment decisions to follow different paths through the many rhythmic possibilities afforded by the sound. And it is natural that two performers (even two people in the same band!) might perform different interpretations in the same moment. Even though Metallica's 4/4 interpretation and a 3+3+3+3+4 interpretation might be classified as a "metrical dissonance" according to metrical phenomena, the band members in Metallica are clearly not undermining each others' groove. These musicians using different rhythms are still *moving together*, still clearly cooperating to produce a groove and atmosphere even though their felt beats may not be constantly coinciding.

[23] Cox suggests that in listening, we usually focus on mimetic engagement with one person or part at a time. "The mimetic hypothesis holds that auditory streams are comprehended in part mimetically, and while the number of streams, or mimetic invitations, that a given listener can attend to simultaneously may vary, I suspect that most of us, most of the time, respond primarily to one at any given moment. I can attend to multiple parts roughly simultaneously (if we allow the present to extend up to a couple of seconds), but at any given instant I am focusing on the drums, or the bass, or the violins, or what have you, and this focus includes my mimetic response: I am mimetically participating with the drummer, or the bass player, or what have you." (2016, 55)

[24] A study on the perception of polyrhythms by Stephen Handel (1984) found that while adjusting the volume, pitch, and tempo of polyrhythms had an effect on which line of the polyrhythm listeners chose to attend to, listeners also showed distinct individual preferences for one interpretation or another. These preferences remained stable between trials and could be considered inherent biases by those listeners towards certain ways of hearing rhythm.

Chapter 2

Experiencing Dance Rhythms Without Dancing in 18th-Century Music

In 1957, the German musicologist and critic Hans Keller made a claim about the fundamental nature of rhythm in classical music that at first glance seems absurdly anachronistic. In describing a few bars of music by the recently deceased radical modern composer Arnold Schoenberg (1874-1951), Keller argued that not only this passage, but rhythm in all modernist art music was saturated by the influence of the highly stylized dances of the Baroque period—*many of which had hardly been danced in two hundred years or more.*

> Rhythmically, this passage could hardly be more primitive; if you displace the barlines by a half-bar, you get a perfectly square, even sequential four-bar structure, the scheme being that of a dance rhythm. Thus behaves one of the most anti-symmetrical composers in our musical history. In fact, I do not think a western composer can, at this historical juncture, honestly compose without reference, positive or negative, to the dance schemes which dominated, *inter alia*, the Austro-German tradition up to Brahms. (Keller 1995, 202)

Keller's claim is a rather extreme example of a common narrative in music criticism: that composers from Bach through Beethoven inherit many rhythmic qualities and gestures from the dances of the seventeenth century. But in extending this influence to an even more recent historical period, Keller exposes some substantial gaps in the theoretical underpinnings of this mainstream narrative. How does the nature of a dance rhythm change when it leaves the dance floor and becomes part of the "pure music" of the concert hall? How can a later composer or listener enter this rhythm with no firsthand knowledge of the dance steps? What traces of dance rhythm can be captured on the printed page or preserved in musical structure? How were these palimpsests of dance transformed through successive generations of musical practice? Is it possible for performers of the present to unearth and revive the rhythms of the past from notated compositions? To summarize, how can we better understand the way that rhythm travels in time?

To answer these questions, I will draw on writings about these dance music genres from the seventeenth century (when the dances were still in social circulation) and the eighteenth century (when many of them had become obsolete). Many of these historical treatises draw on a long-running analogy between rhythmic accent patterns in dance, music, and poetry. While we may never have access to the embodied understandings of cultures from centuries past, we can use the traces of motion these writers left in their prosodic analysis of musical rhythms to speculate how they might have experienced rhythm in this music. An ideal tool for this exploration is the metering constructions that I introduced in Chapter 1, which are defined as associations between physical movement and sounding patterns, and which I used to emphasize the culturally-situated process of inferring beats and movement into heard music. But in this chapter, I will refocus my conception of "specific movements" of a metering construction from *overt* dance movements to the *covert* inner rhythms of instrumentalists. To illustrate this line of thinking, I have chosen to explore rhythm in the music of J. S. Bach, because there is a clear consensus among today's musicians and scholars not only that Bach wrote excellent dance music, but also that his dance music was probably not used for actual dancing.

The lasting influence of baroque dance in non-dance music is a legacy of the courtly dance culture fostered in the second half of the seventeenth century by the French King Louis XIV.[1] Louis XIV was a passionate dancer and life at his court was full of luxurious social balls and extravagant theatrical ballets. Both types of dancing were structured around reinforcing the power of the monarchy and the social hierarchy of the court: the king often played lead roles in theatrical dances, and social dances were full of gestures in deference to the king; no other participants could leave before him, and many such balls lasted until dawn. Skill in dance became a necessity for anyone desiring a political career and was expected of anyone born into high social standing. Anyone who entered the court was expected to be able to instantly recognize and gracefully execute whatever dance choreographies were in fashion, often over a dozen dance types within a single night. Louis XIV reigned in France for a period of more than seventy years lasting until 1715, and long after he was too old to dance much himself, he continued to insist on a central role for dance in his court. The longevity of this refined dance culture, combined with its associations with elite status and political power and amplified by the growing cultural and political influence of France, helped spread French courtly dance throughout nearby European countries, including England and Germany. By the beginning of the eighteenth century, French dancing masters could be found in nearly every city in Western Europe, and the elegant poise and refined expression of courtly dance were considered essential components of a well-rounded upbringing, alongside Latin schooling and musical training.

[1] This brief descriptive summary of baroque dance culture is mostly common knowledge, but I am indebted in my understanding of it to some excellent scholarship by Eric McKee (2012), Rebecca Harris-Warrick (2016), and Lawrence Zbikowski (2014).

The influence of this courtly dance culture dominated ballrooms across Europe, but also left an enormous legacy of dance forms in (non-danced) art music. Many of the dance types that prospered in the French court, including the allemande, bourrée, bransle, courante, chaconne, gigue, loure, musette, menuet, passepied, rigadoun, and sarabande, became standards of instrumental music at concerts performed by and for wealthy music lovers. Suites of stylized dance types, often structured around a central core of an allemande, a courante, a sarabande, and a gigue, became one of the most important genres of art music in the late seventeenth and early eighteenth centuries. Many significant composers of that period wrote dozens of suites or *sonatas da chiesa* (similarly composed of several dance movements and intended for music lovers rather than the ballroom), including Arcangelo Corelli, Johann Jakob Froberger, François Couperin, Johann Sebastian Bach, Georg Philipp Telemann, and George Frideric Handel. During the middle decades of the eighteenth century, movements with titles that identified them as dances became progressively less and less common, a trend that correlates with the rise of genres based in sonata form, like the string quartet and symphony. But these newer genres were often full of references to and imitations of dance rhythms, and exhibited similar qualities of balance and refinement. To reiterate the opening of paragraph, how were these gesture, rhythms, and qualities motion transferred from dance into concert music, and how did they inevitably change during this transition?

Metering constructions as I defined them in Chapter 1 provide a substantial avenue into these issues. At the same time, many of the questions posed above are also theoretical obstacles that must be overcome for me to extend the concept of metering construction beyond the realm of specific, consistent, and overt dance movement practices such as headbanging in metal culture, or dancing in Louis XIV's court. In this dissertation, I am developing the concept of metering constructions to theorize experiences of musical meter and rhythmic entrainment as human movement first and foremost, in contrast to many modern theories of rhythm which define meter as recurring abstract durations measured between equally abstract durationless time-points. In my first chapter, I defined metering constructions as a three-part association between specific sounding features, specific movements, and specific beat structures. In this chapter I will refocus my conception of "specific movements" from the *overt* movements of dancers to the *covert* inner rhythms of instrumentalists. Following the lead of several seventeenth-century treatises, I will theorize these inner rhythms using prosodic accents from the study of poetic meter. I will rehabilitate a much-maligned definition of accent proposed by Grosvenor Cooper and Leonard Meyer in 1960, combining it with aspects of John Paul Ito's theory of focal impulses to show how this ancient technology of prosody can be used to represent the trace of a movement as an accentual flow.

These accentual flows are one way to understand how the characteristic baroque dance *rhythms* can be said to continue to flow throughout centuries of classical music when baroque dance *practice* does not. An accentual flow is of course not the same thing as a dance step, but provides a way for a musician who does not know the steps to grasp (however incompletely) the dance's characteristic motions and join them. Though they do not use these terms, Meredith Little and Natalie Jenne (2001 [1991]) have reconstructed the accentual flows of many baroque dance types. Other scholars writing about "musical topics" have already documented how the characteristic rhythms of many of these dance types were referenced throughout non-dance music in the Classical style of the late eighteenth and early nineteenth centuries. As I will show, several topic theory researchers make arguments which imply that aspects of the accentual flows and choreography of baroque dance remain associated with these characteristic sounding rhythm patterns as they become cited in other kinds of music. The accentual flows are not preserved by most musical notation, but various (written and unwritten) conventions of performance practice can guide a listener's interpretation, hinting at what kinds of movement the score affords.

A tradition of *rhythmopoeia* in writing on music during the seventeenth and eighteenth centuries deployed technologies of accent and poetic foot from theories of prosody to capture and express these feelings of motion hidden behind notation (Houle 1987, Chapter 3). This kind of analogy between music and language was enormously productive for music thinkers during this period (Bartel 1997, Mirka 2010, Kuester 2012). One of the most intriguing examples is an overlooked 1696 treatise by the *Capellmeister* Wolfgang Caspar von Printz, who describes the principles of freedom a composer had in manipulating these accentual flows and expressing them in notated music.[2] The central section of this chapter presents Printz's framework as a kind of algebraic syntax that can help structure the act of reading dance rhythms into a score. After a close reading of Printz's rules and examples, I will apply his concepts to several bourrées by J. S. Bach to investigate some of the ways in which the syntax and function of characteristic dance rhythms might have changed as they left the dance hall. Confronted with some of Bach's experimental rhythms, I will explore the interpretive implications of the concept of syncopation, in which the disruptive "off-beat" quality of notes is traditionally measured against the abstract divisions of notated meter. Instead, I will advocate for what David Kaminsky calls "motional syncopation,"

[2] The chapters of Printz's *Satyrischer Componist*with which I am concerned appear in the third and final volume of that work. The first two volumes were published in 1676 and 1677, respectively. According to the musicologist Nieves Pascual León, Printz finished writing the third volume and sent it to the publisher in 1679, but for some reason it took 17 years to actually appear in print (Pascual 2018). Pascual also mentions that Printz was one of the most-cited authorities on music theory in the German Baroque, "yet today perhaps only a coterie is familiar with the name and the work of this German writer" (Pascual 2018, 1.1). To my knowledge, no modern scholarship has discussed Printz's chapters about rhythm in any detail.

in which the rhythmic stability of notes is measured against danced *movement*—but I extend motional syncopation to include the inner accentual flow felt by a listener or performer. The fact that motional syncopation can exist without the overt movement of dancing to measure it against dramatizes the main theoretical contribution of this chapter, which is to show how the definition of metering constructions I developed in the first chapter can be extended beyond traditions with active live dance practices.

The chapter will end with a comparison of dance rhythms to the structures theorized by conventional definitions of meter. Many of these rhythms are more unevenly shaped than traditional meters, which always form well-ordered hierarchies of evenly-distributed accents. Treatises of the seventeenth and eighteenth centuries mandate that a performance of any dance-derived instrumental genre like allemande or menuet must be based in some form of dance motion or accentual flow characteristic of that dance type. In other words, it cannot be created from the equal measurement of basic meter, but must arise from the performance of dance rhythms as metering constructions. Despite the near-universal assumption in music theory and cognition literature that rhythmic understanding and entrainment are always based in an isochronous, well-ordered pulse, I argue that these uneven dance rhythms are the primary mode of entrainment in a historically-informed cognition of baroque dance music, the main interpretive rhythmic structure with which this music was measured and felt.

Feet First: Moving Between Dance Steps and Classical Theories of Prosody

The conceptual base of this chapter is writings about rhythm by the French scientist Marin Mersenne in his multi-volume treatise *Harmonie Universelle* (1636), which was intended to represent all existing musical knowledge. Mersenne's *Harmonie Uni-*

verselle is difficult to navigate because it lacks a coherent organization scheme. The whole work is divided into books, but neither books nor pages are given consistent numbering or title pages. Related material on rhythmic feet appears in several volumes. Even Mersenne seems to have been confused by this labyrinthine compendium; in the preface to the first book, Mersenne describes "nineteen books of the *Harmonie Universelle*," but I count 20 in his own outline and 21 or more in the actual printed copy, depending on what divisions are counted as "books." The guide below should help the reader navigate this text to find the passages I've referenced.

Part I

Preface and Livre I–III (pages 1–84)

Traité de mécanique (pages 1-36)

Traitéz de la voix et des chants (Livre I & II) (pages 1–180)

Traitéz des consonances (Livre I–IV) (pages 1-282)

Part II

Traitéz des consonances (Livre V–VII) (pages 283-442)

"*Des instruments*" through "*Des orgues*" (Livre I–VI) (pages 1–412)

"*Des Instruments de Percussion*" (Livre VII) (pages 1–79)

Livre de l'utilité de la musique (pages 1-68)

Nouvelles observations physiques & mathématiques (pages 1–28)

Mersenne provides an introduction to theories of poetic feet and meter from classical prosody, and argues that these techniques for analyzing verse can also be applied to music.

> Nevertheless from any manner in which one grasps verse, musicians can use to their advantage all the types of *mouvemens* or rhythmic feet which we have just been discussing: whereupon it must be observed that the composers of *Branles* & of Ballets, & the Dance Masters may call each rhythmic foot *un pas* [a step], & by consequence a verse which has 3, 4, 5, or 6 feet will be akin to a Dance composed of 3, 4, 5, or 6 pas [...] in such a way that each type of verse represents each type of dance, and one could make entire ballets which use the *pas* and the *mouvemens* of all the types of [poetic] meters which we have just spoken [. . .].” (Mersenne 1636, *Traitéz des consonances*, Livre VI p. 394) [3]

Mersenne equates each *pas* or step in choreography with a metrical foot in poetry—each *pas* or foot carries the same *mouvement* or motion; and a sequence of dance steps is analogous to a line of verse containing the same number of feet. “*Mouvement*” seems to be a very flexible word for Mersenne, applying to everything from the transit of objects in Galilean physics to the sense of motion in poetic prosody. While physical dancing and the internal accents of speech are certainly separate domains of corporeal action and experience, Mersenne claims that they share the same essential motions, that both contain the same system of accent patterns and affects described in classical theories of prosody.

The use of analogies to speech and poetry played a significant role in virtually every discussion of musical rhythm in the long eighteenth century. German theorists in the eighteenth century expanded this approach to include a wide range of concepts from classical rhetoric, to describe the organization of music into phrases and

[3] My own translation. The full passage in French reads:
”Or en quelque maniere que l’on prenne les verse, les Musiciens peuvent faire leure profit de toutes sortes de mouvemens ou de pieds rythmiques, dont nous avons parlé iusquesá present: surquoy il est bon de remarquer que les Compositeurs de Branles & de Balets, & les Maistres de la Dance peuuent appeller chaque pied rythmique un pas, & par consequent les vers qui ont 3. 4. 5. ou 6. pieds seront semblables aux Dances compose’es de 3. 4. 5. ou 6. pas; & lors que le vers aura 5. pieds & demy, &c. il sera composé de 5. pas & demi, &c. de sorte que chaque espece de vers representera chaque espece de dance, & que l’on pourra faire des Balets entiers en usant des pas & des mouuemens de toutes les especes de metres dont nous auons parlé, en faueur desquels ie donneray apres l’exemple des principales sortes de metres ou mouuemens Rythmiques, afin que les Compositeurs en puissent user pour rendre leurs Chants pathetiques, & qui’ils entendent la maniere dont les Grecs & les Latins se sont seruis des mouuemens, soit pour chanter ou pour dancer, & qu’ils ne leur cedent en nulle chose.” (Mersenne 1636, 394)

larger sections comparable to sentences in prose, verses in poetry, or various structuring strategies in oration (this literature is thoroughly documented and cross-referenced by Bartel 1997). In the twentieth century, this eighteenth-century edifice of rhetorical approaches to rhythmic structure has often been derided as a too-literal application of a "metaphor of music as language." In his dissertation about the role of prosody in German music theory from the eighteenth century, Martin Kuester argues that these linguistic concepts were not mere metaphors or analogies.

> As their long history shows, these words did not simply migrate from language to music; rather, they seem to have occupied a space in between or in common, occasionally shifting to either side. *Rhythmos* and *metron*, along with all feet and their names, were general concepts applied to the ancient greek dance-song or *mousike*, and thus to language, music and bodily movement simultaneously. (Kuester 2012, 16)

While consensus about specific terminology or units of analysis is rare among eighteenth-century writers, and their analytical systems are often unclear or even self-contradictory, the use of the technologies of classical prosody to equate motion in music, speech, and dance continues in theories of rhythm throughout the eighteenth century.[4]

Mersenne's *Harmonie Universelle* seems to have been an influential precedent for eighteenth-century theories of *rhythmopoeia* (Houle 1987, 63-64), and it provides a good basis for my work in this chapter. Mersenne provides a summary of the most common dances in France at the time, devoting a paragraph to each in which he outlines the dance's origin and describes the phrase structure and key features of the choreography. In each paragraph, Mersenne describes the *mouvement* of the dance by providing a

[4] In an appendix to his dissertation, Kuester documents many conflicting uses of the words *Rythmus* and *Metrum*, but argues that they follow a similar logic. "Although the writers included here all participate in the confusion and disagreement they deplore, their statements allow drawing some generalizations. First, all apply the two terms to music and language equally, sometimes grounding their definition directly on song (cf. passages 31-–32). Second, they apply one concept to a smaller, the other to a larger unit (the first being called 'meter,' the second 'rhythm' by all major theorists, except Mattheson, who swaps the labels)." (2012, 190)

Figure 2.1: Houle's analysis of Mersenne's *branle gay* (Houle 1987, 67).

pattern of poetic feet, using the classical symbols of prosodic accent: a *macron* (◡) for a weak syllable/pulse and a *breve* (–) for a strong one. For example, to define the *Gaillarde*, Mersenne offers that "its measure is ternary, & follows the mouvment of the Italian drum, with the foot Pyrrichianapeste ◡ ◡ ◡ ◡ – " (1636, 165).[5] The pattern Mersenne calls a "pyrrichianapeste" is a concatenation of the classical poetic feet pyrrus (◡ ◡) and anapest (◡ ◡ –). Mersenne uses from one to three feet to characterize the *mouvemens* of the dance types: the *Volte* consists of a quartus paeon (◡ ◡ ◡ –) followed by a diiamb (◡ – ◡ –) and then a minor ionic (◡ ◡ – –), while the motion of the *Courante* is merely "iambic" (◡ –).

A collection of melodies exemplifying each dance type follows on the next page. Without "insider" knowledge of the dance, it is often impossible to figure out how the poetic feet Mersenne describes match his musical examples, as his patterns of strong and weak have no indication of duration. George Houle (1987) suggests that Mersenne's prosodic patterns apply to the dance steps, rather than directly to the melodies.

> The short and long elements of each musical foot seem to represent the pulses on which the dancers place their feet, and therefore they mark the underlying metrical structure of the dance music. The melody is sufficiently decorated that the dance meter may not be evident without the clarification of *rhythmopoeia*. (Houle 1987, 67)

[5] My own translation. Original French: "sa mesure est ternaire, & suit le mouument du tambour Italien, ou le pied Pyrrichianapeste ◡ ◡ ◡ ◡ – . Elle a ordinariement trois pas & cinq mesures" (1636, 165).

Figure 2.2: Mersenne's Gaillard

Houle provides a figure in which he superimposes Mersenne's accent pattern representing the *mouvement* of the *branle gay* over the example of this dance type (see Figure 2.1). I will illustrate this process of matching by examining Mersenne's description of the gaillard. Mersenne describes the *mouvement* of the gaillard as a "pyrrichianapeste," a Frankenstein stitched together out of two conventional feet, which consists of five articulations (◡ ◡ ◡ ◡ –). This number five does not match the meter (triple time with phrasing that pairs measures together into lengths of six beats), and there is no recurring five-note motive in the melody. But the basic gaillard choreography has five dance steps within each six-beat notated musical phrase, according to the sixteenth-century choreographer Thoinot Arbeau in his *Orchésographie* (1589).[6] The first four musical beats of six are each marked by either a kick or a tap alternating between the left and right feet, and the last two beats are taken up by single step, the "cadenza" or cadence which involves a pause and a leap. Each of these dance steps creates a felt beat, for a total of five felt beats during the duration of six notated beats. This creates a dance rhythm of $\frac{3}{4}$ ♩ ♩ ♩ | 𝅗𝅥 ♩ |, which repeats over and over in the steps of the dancers.

[6] Arbeau's *Orchésographie* was one of the most authoritative treatises about French courtly dance, and was one of only a few historical dance treatises to include specific rhythmic timings of dance steps.

Mersenne's prosodic notations and the dance steps they refer to represent only one version of a dance, and even within the same country and time period there were often a number of popular variants of any given dance (for example, Arbeau follows his discussion of gaillard with a chapter featuring six different alternate choreographies, only one of which is location specific: a Milanese gaillard). In some cases I have had difficulty matching Mersenne's patterns to the versions of these dances that I am familiar with. This may be because these dances changed over time; for example, the *Gavote* which Mersenne describes appears to be a seventeenth-century version which begins on a downbeat, while the eighteenth-century Gavotte usually begins with a distinct anacrusis of two quarter-note beats. Some dances and dance rhythms remained more stable through this same period of time, however; Little and Jenne (2001 [1991]) report an eighteenth-century version of Sarabande rhythm which is remarkably similar to the characterization of a Sarabande as ”Hegemolien” (◡ ◡ ◡ – ◡) given by Mersenne, which in 3/4 time would be  .

The Dance Steps Fade Away, but the Topic Remains

As I mentioned at the beginning of this chapter, throughout the eighteenth century a number of dance types began to be performed with increasing distance from their danced origins. Seventeenth century composers were already writing suites of dances, but in the early eighteenth century suites became primarily a genre of concert music, and more often contained obsolete dance types that were no longer popular among dancers. In his paradigm-defining survey of the basic materials of *Classic Music* (1980), Leonard Ratner describes how many dance rhythms became "topics" for composition, "musical commonplaces" which were used over and over again throughout music of the late eighteenth century. Ratner argued that contemporary and antiquated dance types had different roles in different contexts. Familiar dance types like the minuet and sarabande could be deployed as "functional" dance music (Frymoyer 2016, 84)—music written to be danced to—but composers could also make "speculative [...] use of dance rhythms as subjects for discourse" in the church, theater, or concert hall where no actual dancing would occur (Ratner 1980, 18). Ratner and a subsequent group of theorists including Kofi Agawu and Wye J. Allanbrook argued that these topics retained some of their connotations of social class and mood even when referenced outside of the ballroom. These scholars argue that compositions from this period tend to juxtapose contrasting topics to create an interplay of different valences of signification, so that topics provided a vehicle for creating and communicating musical meaning in the eighteenth century.[7]

These kinds of reference are not limited to music of the eighteenth century, of course, and several points about them can be generalized to other kinds of dance and other bodily practices. William Echard traces a similar evolution of psychedelic style characteristics in rock, funk, and electronic dance music genres.

> [O]ne of the crucial themes in topic theory is precisely the manner in which direct experience and historical specificity drift toward standardized symbolism over time. [...] To deal with topicality is to deal with convention, with signs of experience rather than with raw experience itself (Echard 2017, 13).

Echard's argument about "raw experience" traces the attenuation of the connection between psychedelic signifiers in pop music and the psychedelic experiences of psychoactive drugs such as LSD with which they were originally associated.

Theorists studying the extended legacy of eighteenth-century topics into the late nineteenth and early twentieth centuries emphasize this same dynamic of attenuating "raw experience" and increased formalization. Johanna Frymoyer traces the develop-

[7] See especially the collection of essays *Communication in Eighteenth-Century Music* (2008) ed. Danuta Mirka and V. Kofi Agawu, and Mirka's Introduction to the Oxford Handbook of Topic Theory (2014).

ment of the Waltz from a social dance into the atonal chamber music of Arnold Schoenberg, reading ironic distance into his increasing departure from the tonal and rhythmic conventions that characterized waltz music for dancing during its peak popularity as a social dance. Focusing in on the origin of the waltz topic, Frymoyer characterizes topic formation as a historical process in which a musical sign became increasingly independent from what it once signified.

> First and foremost, a dance such as a minuet or a waltz may be a fully worked out piece with a functional purpose. That is to say, it is an instrumental composition for the purpose of dancing. These functional pieces, however, may be transported to concert venues and infused with more virtuosic or harmonically interesting elements. [. . .] In these art contexts, form and virtuosity are more complex than the functional context, yet the gestural content drawn from the functional genre may be simplified and broadened to "signal" the dance in the concert hall or salon. At this point, a topic emerges as a self-standing entity that may signal the dance without necessarily relying on title, genre, or context for that signification. (Frymoyer 2016, 84)

When Frymoyer says that gestural content may be "simplified and broadened" throughout the life of a topic, she means that its features become simplified so that it can be recognized more easily. For example, as Little and Jenne point out, there are a wide variety of rhythms associated with Sarabandes in the time before J. S. Bach, which are united by simple phrase structure and consistent emphasis of even measures over odd ones, but may or not feature strong accents on beat 2 of each measure (Little and Jenne 2001 [1991], 98). But for topic theorists studying music of the later eighteenth century, the strong beat 2 in slow triple meter becomes *the* defining characteristic of the Sarabande topic, despite the fact that many other triple-meter dances composed by Lully and other French composers have strong accents on beat 2 in every (or every other) measure. This reduction of the diverse Sarabande styles to a single characteristic rhythmic feature created an instantly-identifiable icon for a web of noble, serious, virtuosic associations. While some characteristic features become more strictly defined or even over-simplified, others become looser, so that the topic can be referenced clearly in a wider variety of contexts.[8]

It would be an oversimplification to suggest that the topics of the eighteenth century were entirely separated from the "raw experience" of the dance. Isn't one of the premises of topic theory that some motional qualities and valences of meaning of the original "raw experience" persist even in the highly conventionalized iconic state of an independent topic? If the concert-hall incarnation of a dance type still has some of the "gestural content" of the ballroom version, as Frymoyer suggests, then this is surely not entirely unrelated to the "raw experience" of dance movement. More careful discernment of what exactly constitutes these gestures and the experience of dance movement is required.

Fortunately, eighteenth-century German sources have already suggested some directions for exploration in their commentary on the *Bewegung*, *Metrum*, or movement characteristic to each dance type. In 1777, the German composer and music theorist Johann Kirnberger argued that any aspiring composer or musician needed to devote themselves to studying the rhythms of dance music. One obvious benefit of such study would be that students could learn a repertoire of dance rhythms to use as topics within their own compositions. But broadening his students' palette of styles was not the only thing on Kirnberger's mind. He is worried that aspiring musicians might not develop a sense for feelings of rhythm that lie just beneath the musical surface.

> *How will the musician give the piece he performs the appropriate expression, which the composer conceived, if he cannot determine...exactly what sort of movement and what*

[8] Additional support for this perspective comes from Zbikowski, who notices a similar simplification in Ratner's account of dance topics. "In that Ratner's focus was more on the expressive resources represented by dance types than on the patterns of movements associated with various dances, he tended to view diverse forms of dance as relatively closely related to one another. Thus the passepied was classified as a rather lively minuet and the sarabande as a slow minuet, despite important differences between the execution of the steps and the musical organization of each dance as well as the social context within which they would have been performed." (Zbikowski 2014, 159).

> *character are appropriate to each kind of measure?* In order to acquire the necessary qualities for a good performance, the musician can do nothing better than diligently play all sorts of characteristic dances. Each of these dance types has its own rhythm, its phrases of equal length, its accents at the same places in each motif; thus one identifies them easily, and through repeated practice one unconscientiously becomes accustomed to distinguishing the proper rhythm of each dance-type, defining its motifs and accents, so that finally one easily recognizes in a long piece the various intermingling rhythms, phrases, and accents.... on the other hand, if one neglects to practice the composition of characteristic dances, one will only with difficulty or not at all achieve a good melody. Above all, it is impossible to compose or perform a fugue well if one does not know every type of [dance] rhythm. (translated by McKee 2012, 3-4; emphasis is my own)

Eric McKee (2012) and Lawrence Zbikowski (2014) have taken this same passage from Kirnberger as motivation for some of the most detailed studies of the relationship between music and dance steps that are now available. This is an admirable approach and there is a clear need for more musical analyses which incorporate dance.

But Kirnberger does not actually advocate dancing—in fact, he doesn't mention the dance steps at all. Instead, Kirnberger seems to be instructing his reader to develop *musicianly knowledge* about how best to interpret the rhythmic flow and feeling of the notes printed on the page. Studying dances was not an end in itself, but a means towards learning to read the vivid movement of "various intermingling rhythms, phrases, and accents" lying behind the notated surface of any written composition. Many of the dance types featured in his 1777 book were no longer actually danced-to in social settings, though they might still be frequently heard in concerts and at the opera or ballet. And as Zbikowski points out, "that Kirnberger saw a need to publish his *Recueil* suggests that knowledge about courtly dances was fast waning" (2016, 158). Instead of promoting *dancing itself* as a remedy for reviving sustaining this knowledge, Kirnberger suggests the study of characteristic rhythms in dance music.

But also, except for some of the simpler and more popular social dances in the later eighteenth century like the minuet and the waltz, dance and music were somewhat independent in motion (though not in timing). Rebecca Harris-Warrick notes that dance steps often do not reflect many of the characteristic musical accents that distinguish the different dance types.

> There is a close relationship between a piece of music and its choreography, but this does not mean a literal kind of imitation of one medium through the other. The surface rhythms of the music may or may not be paralleled by the step rhythms, although the downbeat of most measures generally receives accentuation of some kind via the body of the dancer. (Harris-Warrick 2016, 97–98)

In fact, Harris-Warrick argues that the characteristic rhythms mentioned by Kirnberger and other eighteenth-century German writers are only characteristic of the music, and that there is very little or even nothing in the choreographies that is characteristic of specific dance types.

> The menuet and passepied are the most recognizable because they always involve at least some menuet steps, even on the stage. The bourrée and the gavotte, on the other hand, have distinguishable musical profiles, but few if any differences in the range of steps. (Harris-Warrick 2016, 90–92)

Dance and music are always loosely connected because their main downbeats usually coincide (though even this is only every other measure in the minuet; see McKee 2012, 24). But Harris-Warrick suggests that in many cases, even when the musicians were thoroughly familiar with the dance steps, the characteristic rhythms that Kirnberger is concerned with did not express the same motions as the dance steps anyways.

In other words, while Kirnberger's characteristic dance rhythms could never be a replacement for first-hand knowledge of choreography, they *did not need to*. A successful performance of dance music, *in situ* or in concert, provided a frame for dancing but did not need to match each dance movement with an equivalent musical rhythm. Zbikowski describes how the experience of actual dancing was not a part of Ratner's original conception of dance topics, but that "Wye Allanbrook took the idea of a dance topic somewhat further and proposed that the *musical materials associated with different* *dance types could activate knowledge about the movements specific to the dance* and the affectual states correlated with such movements" (Zbikowski 2016, 144; my emphasis). There is no reason why it could not be characteristic rhythms activated in this way, rather than specific dance steps. This is the form in which the "raw experience" of dance rhythm is still relevant long after the steps have been forgotten: the essential components of the dance-as-topic are a set of conventional motifs and ways of feeling rhythmic flow, and whatever qualities of (e)motion that remain as vestiges of the dance's original practice and historical context. Consequently, these rhythmic flows abstracted away from dance steps are the only way into baroque dance rhythm available to most musicians and audiences from the middle of the eighteenth century through the present.

Abstracting movement away from specific dance steps solves an important theoretical issue for my concept of metering constructions. Intuitively, both dancers and the musicians who play for them should be participating in the same metering construction. But by stipulating a specific movement, I've created two paradoxes: How could both be participating in the same specific movements when the dancer is elegantly leaping through the air while the musician stays seated? And how can students of Kirnberger's be said to be participating in this same metering construction when it is likely that neither students nor their audience were familiar with the dance steps? In dances where the dance steps do not reflect the music's characteristic rhythms and accents, these two parallel domains may be best characterized as separate metering constructions. When dance and music are in more complete synchrony, it is clear that an abstracted structure of impulses and accentual flow is no equivalent to intimate first-hand knowledge of the dance steps. But from a practical perspective, these abstractions are *good enough* to enable participation in the dance rhythm by those who are not expert dancers. The two paradoxes above were solved when I realized that an accentual flow through an impulse structure is a *specific enough* movement type that a seated musician and a leaping dancer can be using their bodies to navigate musical time together, cooperating but each moving in a different manner.

THEORIZING MOTION AS ACCENTUAL FLOW

In the previous section I explored the process by which functional dance music became abstract topics. While studies of how music serves as an analog for dance steps by Zbikowski and McKee are an important part of understanding rhythm in eighteenth century music, another theoretical approach is required to understand how characteristic sounding rhythms continue to evoke movement and serve as metering constructions once the dance steps became less familiar to composers, performers, and audiences. Conveniently, there is a historically-sourced starting point: the technology of prosodic accents used by Mersenne and others can capture traces of dance practice. Dance notation like Raoul-Auger Feuillet's *Chorégraphie* (1700) can only be understood by an expert dancer, but for musicians without dancerly expertise like Kirnberger's students, Mersenne's representations of movement using prosodic accents would have been easily accessible. In this section, I will theorize how these patterns of prosodic symbols can be felt as accentual flows and used as metering constructions.

To treat a pattern of prosodic symbols as a metering construction, I will need to show how they can be considered as motion. Except for this issue, however, Mersenne's representation of dance rhythms with prosodic accents fits neatly into the definition of a metering construction which I introduced in the first chapter.[9] As a reminder, each

[9] Not all musical applications of prosodic accents in the baroque period map easily in to my theory of metering constructions. Some theorists used strong and weak symbols to refer to long and short durations, instead of weight of accent. This ultimately stems from differences between ancient Latin, in which poetic meters were expressed by variations in long and short syllables, and some modern

metering construction consists of (1) specific sounding musical features, (2) a specific set of beats or metrical interpretation, and (3) a specific body movement.[10] The characteristic motives and phrase-structure features of a dance type, some of which are listed in Mersenne's definitions and many of which are documented by Meredith Little & Natalie Jenne (2001 [1991]), form part (1) of the metering construction. Part (2) consists of a focal impulse or felt beat at each moment marked by a prosodic accent (strong or weak).

Part (3) of my definition of a metering construction was originally framed as a performance of overt movements, so it is not initially clear how a collection of accent symbols could represent such motion. Additionally, the way Mersenne and later authors use these accents conflicts with some of the principles underlying Ito's theory of focal impulses. In this section I will introduce a conception of accent from Cooper and Meyer that will bring these disparate tools together into a functioning analytical theory. These accents represent a flow through the beats or focal impulses that constitute part (2), and in situations such as dance topics where it is desirable to abstract away from specific overt body movement while retaining some sense of covert motion, this flow can constitute part (3) of the metering construction.

To describe the sense of accentual flow I have in mind, I will rehabilitate a theory of accent by Grosvenor Cooper and Leonard Meyer that has long been unpopular in music theory. Though their book *The Rhythmic Structure of Music* (1960) inspired

languages, in which meter was a pattern of louder or more weighty syllables. In poetry and literary criticism, theoretical confusion between weight-accented versus length-accented meters seems to have been mostly resolved by the end of the sixteenth century; but in music theory, the debate over the nature and proper application of prosodic accent continued into the eighteenth century.

[10] It may often seem that parts (2) and (3) of the metering construction are not distinct or separable; this is because in baroque dance, body movements often articulate and create felt beats. In many other traditions, however, body movements and beats can appear to occur at different times; I will examine this in more detail in Chapter 4 when I consider supposed "metrical dissonances" such as overlay, metrical displacement, and polyrhythm.

a large-scale effort to study rhythm in the second half of the twentieth century, their terms and analytical methods quickly fell out of use. This is in part because their analyses did not seem motivated by consistent, systematic principles—some analytical choices seem arbitrary. However, if taken as a method of description rather than a systematic model, Cooper and Meyer's conception of accent and their symbol system are some of the most robust and musical tools available for communicating rhythmic motion in print. The following detailed look at their definitions of beat and accent will set up terms for describing the rhythmic flow that constitutes part (3) of the metering construction in this context where dance types are abstracted away from actual dancing.

Cooper and Meyer have been most frequently criticized for their conception of meter as a durational structure (Caplin 2002, 711). That is, Cooper and Meyer conceive of a "beat" as something that has duration or "length" (1960, 68) which can be "divided" or "compounded" (4). In such an architectonic model of rhythm, each rhythmic group's duration becomes the length of the beat in the next largest level of hierarchy. At higher levels of hierarchical structure, entire spans several measures long are analyzed as single strong or weak beats. For example, they refer to a passage of 8 measures in the first movement of Beethoven's "Eroica" Symphony as an "anacrusis" (1960, 139), which Justin London complains is an "inappropriate application of a phrase-level phenomenon to higher structural levels" (London 1993, note 2). Meyer has even retracted his extrapolation of "Gestalt grouping ideas which work well on levels up to the phrase and period to analyze whole sections and even movements" (Meyer 1991, 250), which has drawn the most critique. But as he believes his theories of rhythmic structure "work well on levels up to the phrase and period," it seems he continues to defend what London disparagingly calls "meter as a time-span phenomenon" (London 1993, note 4).

A slightly different form of this critique comes from the composer Jonathan Kramer, whose 1988 book The Time of Music has been influential in the analysis of modernist and experimental styles of the twentieth century. Kramer criticizes Cooper and Meyer by proxy:

> Part of the problem with Cone's method of analyzing accent, which he derives from Cooper and Meyer, is that he does not clearly state whether accents are applied to timepoints or timespans. Surely he does not mean literally that every timepoint in the first measure of Example 4.4 is accented with respect to every timepoint in the second measure. (Kramer 1988, 88)

On the contrary, I think this is exactly what Cooper and Meyer mean! The confusion comes from often-overlooked details of the *ontology of accent* which underlies their theory of meter as a time-span phenomenon.

In vernacular usage, accent usually refers to a point of strong articulation or emphasis, and with this reading Cooper and Meyer's statement is indeed confusing and problematic. But Cooper and Meyer provide their own definition of accent which refers to an entirely different phenomenon. Though their definition of accent is often cited as merely any note which is "marked for consciousness" by volume, duration, or other characteristics (1960, 4), they view this concise definition as incomplete, and refine it just a few pages later.

> But in a sense so are the unaccented beats thus distinguished. The difference between accented and unaccented beats lies in the fact that the accented beat is the focal point, the nucleus of the rhythm, around which the unaccented beats are grouped and in relation to which they are heard. (Cooper and Meyer 1960, 8).

Since the whole of a strong measure (yes, every timepoint!) is heard as a nucleus around which the weak measure is grouped, and a focus in relation to which the weak measure is heard, the accent lasts through the whole first measure. The vernacular concept of accent frequently correlates with this sense of accent as focus—imagine a swell leading to an important dramatic point in a song, or a bass drum pounding on the beat—but not always.

In the prosodic accent patterns described by Mersenne, each pattern as a whole is focused around the strong beats marked by the prosodic accent symbols, just as in Cooper and Meyer's definition of accent. For example, in Mersenne's sarabande pattern (see Figure 2.3 below), the first three quarter note beats are weak, and are grouped around the strong accent at the beginning of the second measure. I hear these first three beats collectively as an anacrusis leaning towards the first beat of the second measure. The rest of the second measure, the one remaining weak beat, is also oriented around the strong beat; it feels more like an after-beat than an anacrusis to the next two-bar dance phrase of Sarabande. These flows of dependence are the "characteristic accents" which Kirnberger describes, without which he claims a performance is incomplete and bound to be lifeless.

Cooper and Meyer's definition of accent as focus seems closely related to Ito's theory of beats as focal impulses, but they differ in that Ito recognizes strong-weak hierarchy only in very limited ways. Ito describes a distinction between two kinds of impulses: focal impulses provide the main energy of a motion, and subsidiary impulses adjust the motion as it progresses.

> We can now restate the main theory in somewhat more precise terms. Processes of motor planning and coordination are segmented by periodic focal impulses. These focal impulses are aligned with the meter, so that the segmentation consists of metrical units. Each focal impulse is responsible for structuring the motion that will occur during its consequent span, creating initial conditions that will facilitate the production of the subsidiary impulses. The initial energy introduced into the system (the body) is a key part of those initial conditions. (Ito 2004, 28)

In motor coordination, then, focal impulses must occur at the beginning of a motion, and subsidiary motions must occur after the focal impulse with which they

Figure 2.3: Mersenne's Sarabande

are associated. This would seem to preclude the sense of anacrusis that is dictated by many of Mersenne's dance rhythm definitions, such as the first measure full of weak beats that leans towards the second measure in the Sarabande I described above.

But these concepts can be reconciled by thinking of these accents as a level of *conceptual* motor organization describing a larger scale of structure than the *physiological* motor organization with which Ito's theory is concerned. In Ito's theory, a focal impulse can only be a point of reference for subsequent motions, and only for a limited amount of time, because his focus is on the physiology of motor control. If several weak beats are organized leading towards one strong beat, this anacrusis is a *conceptual relation* between more than one focal impulse, a mental routine which flows through and connects several distinct movements/impulses rather than remaining within the physical span of a single focal impulse. At levels larger than a single focal impulse I use Cooper and Meyer's rules for accentual structure, which allow an anacrusis to be grouped with the subsequent accent.[11]

Another discrepancy between Ito's theory and the structures of prosodic feet described by Mersenne (and later by Wolfgang Printz, whose work I will focus on for the remainder of this chapter) is that these rhythmic feet are often not isochronous: that is, they often denote prosodic symbols that are irregularly spaced, rather than always occurring at intervals of the same duration. Ito's theory assumes that motor coordination is based in isochronous motion, and usually aligns with the written barlines and time signature. In other words, Ito's theory is very *metrical* in a traditional, grid-like sense. But the notion that Mersenne's prosodic feet represent dance steps suggests that motor coordination can indeed arise from such uneven rhythms. Almost all study of human rhythmic entrainment has been based on the same assumption of isochrony that Ito makes, but we humans are clearly able to coordinate gestures that do not occur in strictly isochronous time, as one might notice from any observation of most sports.[12] Additionally, most professional musicians (especially baroque specialists) can tell you that pedantically tapping out meter is an unfortunate form of timing discipline which often kills any sense of rhythmic gesture or vitality.

In the rest of my work in this chapter, I will expand Ito's theory to allow for non-periodic distributions of focal impulses, to match the motions and notated accents

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[11] This move adapts Cooper and Meyer's approach to escape one of the major critiques of their work. Cooper and Meyer attracted a lot of criticism for treating all levels of rhythmic structure equally, analyzing passages as long as an entire movement as a single strong-weak accent pair. Justin London (as quoted earlier) and others have criticized this approach in the case of large-scale structure, correctly pointing out that our experiences of longer spans of time is essentially different from the periodic attentional entrainment we experience with a regular tactus. By viewing smaller scales of time in terms of physiological motor organization, and larger scales of time in terms of conceptual motor organization, I believe it is possible to accommodate Cooper and Meyer's essential insight that it *is in fact possible to experience strong-weak orientation across large spans of music*, even if this experience of large-scale accent is categorically, qualitatively separate from our experience of local metrical accent at the level of the tactus.

[12] Also, several recent studies on speech rhythm have demonstrated our capability to entrain to aperiodic rhythm. I will discuss these studies in detail in Chapter 5, which focuses on free speech-like rhythm in operatic recitative.

of baroque dances. There are aspects of Ito's definitions which resonate with the logic behind my expansion. Ito's conception of focal impulses is based in recurring motion. The first criterion in his list of seven guidelines for the identification of focal impulses is the "local consistency guideline," which states that "Impulse structure should be consistent from measure to measure within a section that has a *consistent motional character*" (2004, 39; my emphasis). As we will see, consistent motional character is a key element of the syntax of baroque dance rhythm. Since Ito views impulses as arising from motional character, his theory is compatible with my expansion to include non-periodic impulse structures which are constituted by characteristic dance motion.

My conception of motion-based rhythm based in the work of Cooper and Meyer also provides a way around a strong critique of meter by ethnomusicologist and dance scholar David Kaminsky. Kaminsky criticizes traditional conceptions of meter, arguing that in some dance music such as the Swedish *polska* "musical rhythm closely follows the motion of dancing bodies, without (as I will argue) abstract meter as an intermediary" (2013, 45). Kaminsky argues that conventional theories of meter, which extract a recurring pattern of durationless timepoints to represent metrical structure, reduce rhythm "to a skeletal frame, a simple pattern of attacks, something that can be represented entirely by clapping" (47). This "skeletal rhythm" fails to represent many subtleties of rhythm as experienced in bodily motion, and Kaminsky is right to criticize "time-point" theories of meter on these grounds. The details of Cooper and Meyer's "time-span" theory of meter, and specifically their definition of accent as focality, not only match well with Ito's concept of a "focal impulse," but they also consider accents to constitute a larger motional flow, instead of individual, disconnected points of articulation. In other words, Cooper and Meyer's definition of accent allows for a conception of motion-based metering which avoids the pitfalls in traditional theories of meter that are exposed by Kaminsky's critique.

But Kaminsky's warning about abstracting meter away from dance motion should be heeded. Something was inevitably lost as the steps of seventeenth-century courtly dance faded from memory during the eighteenth century. This loss has been theorized by the performance studies scholar Diana Taylor, who explores differences between "the archive of supposedly enduring materials [...] and the so-called repertoire of embodied practice/knowledge" (2003, 19). Taylor argues that without direct "acts of transfer" in live performance, embodied knowledge like dance rhythm disappears.

> The repertoire, whether in terms of verbal or nonverbal expression, transmits live, embodied actions. As such, traditions are stored in the body, through various mnemonic methods, and transmitted "live" in the here and now to a live audience. Forms handed down from the past are experienced as present. (Taylor 2003, 24)

The disappearance of most baroque dance types from actual dance practice by the end of the eighteenth century prevented any "acts of transfer," and embodied knowledge of the flow and character of motion in these dances was lost. The prosodic accents left by Mersenne and others, and the characteristic motions of accentual flow which I argue they represent, are traces of dance motion which can be notated on paper, but they can never convey all subtleties of motional character that the original dance music must have held. Motional character can be re-created or re-imagined by historically-informed modern baroque music and dance practitioners, but as the eminent musicologist Richard Taruskin argues, these are essentially modern creations, which can never be truly authentic to the historical originals (Taruskin 2005, 164–172).

Syntax in Functional Dance Music

Rhythm has traditionally not been considered as one of the "primary" or "syntactic" structures of music, such as pitch, harmony, and form. Leonard Meyer argues that in order for syntax to exist, "successive stimuli must be related to one another in such a way that specific criteria for mobility and closure are established" (1989, 14). In an insightful and unique comparative study of melodic peaks and gesture in the styles of Haydn, Chopin, and Berg, Zohar Eitan explains why musical gestures and other "statistical" or non-syntactic parameters lack this sense of order and closure.

> Second, "statistical" parameters of music—the principal domain of musical gesture as defined here—fall mostly in the sphere of tacit, unverbalized knowledge (to use Michael Polanyi's term). Missing are explicit rules, guidelines, and strategies, like those that have served for centuries as a basis for the instruction of musicians in tonal and modal syntax [...] the way in which musical gestures are used by composers and experienced by listeners may be inherently different from the way musical syntax and form are. (Eitan 1997, 153)

On the contrary, in the next section I will follow recent work by Zbikowski and McKee in arguing that dance gestures *constitute* musical syntax and form in baroque dance music. The overlooked 1696 theory rhythm written by Wolfgang Caspar Printz, which I will review in close detail, provides the "explicit rules, guidelines, and strategies" which Eithan suggests are missing from a theory of motion and gesture.

The *syntax* of a dance is the order of the "dance materials," which Zbikowski characterizes as correlated units of dance and music: steps of dancers and musical constructions which are "sonic analogues" for the shape of these dance steps (Zbikowski 2008, 289). Zbikowski draws this conclusion from the writings of Adolf Bernhard Marx:

> For Marx, then, the function of waltz music is to support, as thoroughly as possible, the movements of the dancers. The grammar of the waltz—that is, the way its materials are organized—has to realize this function or, implicitly, there is no waltz. (Zbikowski 2008, 288)

But these functional links between music and dance predate A.B. Marx by at least a couple of centuries. In an excerpt I quoted earlier, Mersenne not only equates the structure of dance and music, he even breaks both arts down into the same basic units of analysis: using the word "*pas*" for a dance step, he calls "each rhythmic foot *un pas*, & by consequence a verse which has 3, 4, 5, or 6 feet will be akin to a Dance composed of 3, 4, 5, or 6 *pas* " (Mersenne 1636, vol. II, p. 394).[13] Mersenne identifies each dance step with a prosodic foot in musical analysis; but he also indicates that a dance phrase consisting of several steps is analogous to a verse of several prosodic feet. He goes on to state that as in poetry, entire pieces of dance music are made up of sequences of such ordered phrases.

This way of thinking, tying dance music syntax to the social and motor functions of dance, still applies even if the music does not mirror the choreography. Though Zbikowski's writings on dance have focused on "sonic analogues" in which the dance and music mirror each other closely, the mental associations between dance movements and musical characteristic accents can still be strong even if the movements and music do not coincide at every single moment. Georg Muffat instructs his readers "to mark the movements of the dance so well that one may recognize immediately to which type each piece belongs, and may feel inspired, in spite of oneself, with a desire to dance" (Muffat 1967 [1698], 222), but in my reading "marking the movements" could involve any sounding pattern which carries a strong association with those movements, not just music which literally articulates the footwork of the dancers with tones.

Zbikowski suggests (in analogy with construction grammar theories of linguistic structure) that in dance and music, a series of dance steps (or the associated char-

[13] "Or en quelque maniere que l'on prenne les verse, les Musiciens peuvent faire leure profit de toutes sortes de mouvemens ou de pieds rythmiques, dont nous avons parlé iusquesá present: surquoy il est bon de remarquer que les Compositeurs de Barnles & de Balets, & les Maistres de la Dance peuuent appeller chaque pied rythmique un pas, & par consequent les vers qui ont 3. 4. 5. ou 6. pieds seront semblables aux Dances composées de 3. 4. 5. ou 6. Pas" (Mersenne 1636, vol. II p.394)

acteristic rhythms in music) are organized by "syntactic processes" such as repetition or cadence. In essence, these syntactic processes represent or explain the *ordering* of these dance-based rhythmic constructions. There are a couple of important historical authors who seem to have in mind a similar syntax of dance rhythm. The first is Mersenne, who provides definitions of a number of different dance types, each ruled by a certain movement which he describes in terms of prosodic feet.[14] Some of these descriptions characterize the dance using a single foot; but others use a sequence of several feet, such as the Volte which contains "le quatriesme Paeon ◡ ◡ ◡ – , le Dijambe ◡ – ◡ – , & l'Ionique mineur ◡ ◡ – – " (Mersenne 1636, Part 1, 165). As far as I can figure out, each of these dance phrases is repeated throughout the length of a dance piece. In other words, in Mersenne's syntax of dance rhythm, dance phrases may consist of several different feet in order, but each dance piece repeats the same phrase over and over.

Meyer warns in his discussion of syntax and primary parameters that "syntax usually differs from one culture and one period to another" (1989, 14). As the characteristic figures of functional baroque dance music were simplified and reified into topics, the grammaticality of these rhythms changed and they lost their strong determinative power they once held as the primary basis for syntax. This is not to say that syntactic implications of these rhythms entirely ceased to exist. As Vasili Byros argues, topicality is not incompatible with grammaticality.

> Topics and harmonic schemata are assemblies of musical style symbols that interact in both syntactic (sequentially structured) and semantic (referentially structured) dimensions to some communicative and expressive end. There exist no sharp boundaries between them, either in categorial or pragmatic terms. That is,

[14] "Quant aux danceries, il y a plusieurs especes qui appartiennent á la Musique Metrique, dautant qu'elles sont sujettes á de certaines mesures, ou pieds reglez & contez" (Mersenne 1696, Part I, 164)
"Regarding dances, there are many sorts which belong to Musique Metrique, because of the fact that they are prone to certain mesures, or ruled and counted by feet"

> in respect to both categorization and language use, syntax and semantics interface in what cognitive linguistics call a *syntax-lexicon continuum*—"a continuum of symbolic structures" (Langacker 1987 and 1991; see also Zbikowski 2002: 138). (Byros 2014, 382-383)

In other words, many topics can have syntactic affordances or implications, just as many grammatical structures are easily associated with certain semantic valences. Dance topics can "activate" embodied knowledge of characteristic rhythms, and still have some implications of dance rhythm syntax.

But when dance rhythms began to be used in non-dance contexts, the syntax of interacting movements required for the practice of dancing was no longer a determinate factor. As I will show later in this chapter, composers began to use rhythms that increasingly departed from the characteristic rhythms most closely associated with the original dances, violating the grammatical structure of the original dance music either by breaking apart the fixed shapes of the recurring dance phrase, or by citing fragments of characteristic rhythms outside of the regular syntax of dance. The following theory by Wolfgang Printz (1696) lies somewhere between these two extremes. Although Printz's rhythmic examples are all titled as dances, he rarely talks about dancing, and never discusses specific dance *steps*; yet, the regular syntactic structure of Mersenne's theory of dance rhythms is still essentially intact.

Wolfgang Caspar Printz: A Syntax of Dance Rhythm c. 1700

Wolfgang Caspar Printz's syntax of dance rhythm is far more complex than Mersenne's, and explains some degrees of variation that illustrate some of my arguments about characteristic motion and meter. After defining a range of basic types and sub-types of musical feet, Printz devotes chapter 14 of his treatise to "*der Licenz in Musica Rhythmica*," or six types of liberties a composer can take in the application of musical feet, followed by three chapters on how different feet can be chained into sequences. For the purposes of locating Printz's theory within the historical processes of topic formation, it should be noted that Printz does not describe these prosodic or rhythmic feet as dance steps. However, many of his examples are titled as dances, including some from ballets by Lully, which were actually danced to, and some menuets, a relatively new dance in Printz's time which would remain quite popular in social dance practice for a while longer. Each rhythmic foot constitutes a metering construction in the terms of impulse structure and accentual flow which I outlined earlier in this article.

Printz's theory of rhythmic feet begins by defining several classical poetic feet in musical terms using the concept of *intrinsic quantity*. This concept, also used by a number of other historical writers, does not necessarily correspond to actual duration, but to some sort of felt or implied weight or importance to a note. For example, an iamb consists of an intrinsically short note followed by an intrinsically long note, but could be rendered with equal note values. Printz distinguishes between two different types of each foot: *Vulgaris* which consists of all equal durations, and *Proportionatus* in which the notes are cast in some uneven durations so that intrinsically long notes are expressed with proportionally long durations.

In Printz's theory, each piece has a *Genus Melodia Ligatae*, a short sequence of feet that characterizes the rhythmic feel of the entire piece. A *genus* could either repeat the same rhythmic foot over and over, or be comprised of a recurring regular pattern of feet. The length of this sequence is called the *numerus sectionalis*, and Printz mentions that this number should be fixed throughout a section.[15] For example, the *genus*

[15] A possible origin of the term "*numerus*" is in prosody. Baragwanath (2014, 165–166) discusses the contrast between classical poetic meters and the Italian vernacular poetry of the Renaissance, "which was based not so much on 'measure' as on rhyme, natural speech inflections, and 'number' or syllable count."

Figure 2.4: *Menuet Dichroni Contrario-Dactylici* (Printz 1696, part III, 127)

of the piece in Figure 2.4 above is "*Menuet Dichroni Contrario-Dactylici*." This complex pseudo-Latin phrase describes a minuet in which the repeating rhythmic pattern consists of a *Contrarius* followed by a dactyl.[16] The length of this rhythmic unit is two feet, so the *numerus sectionalis* is two and the unit as a whole is called a "Binary" or "Twosome." (Sixty years later, F. W. Marpurg clarifies the definition of this term and compares it to the work of his contemporary Joseph Riepel; see Marpurg 1755, 221–223). This regularity provides two quantitative criteria for a syntax of dance rhythm: a dance should be based in a repeating sequence of feet, which should make phrase units of consistent lengths.

The six types of rhythmic liberties Printz discusses in Chapter 14 are: "1. *Dilatatio*, 2. *Contractio*, 3. *Commutatio*, 4. *Decurtatio*, 5. *Prolongatio*, and 6. *Expletio*." Printz pro-

[16] See discussion of the *Contrarius* later in this chapter. The *Contrarius* was not part of classical theories of Prosody, but was created only for musical applications, and was used by several eighteenth-century German writers. See Kuester 2012, 64–89.

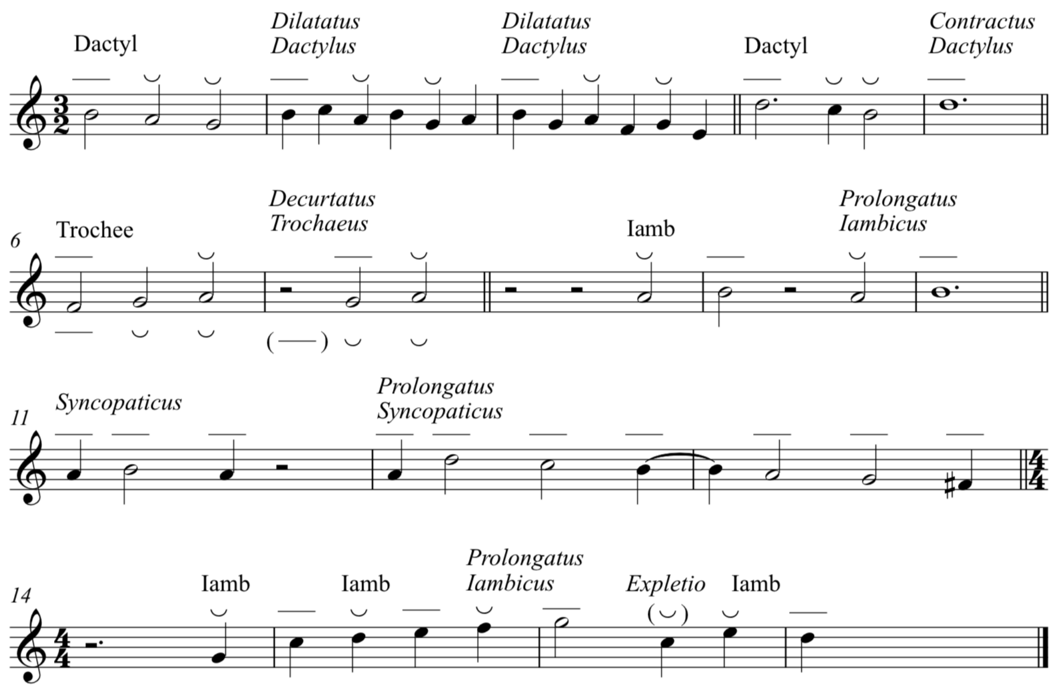

Figure 2.5: Table of Printz's principles of rhythmic freedom (1696, 108–110)

vides definitions for these principles of freedom, then lists several rules guiding how these principles may be used appropriate to particular musical styles and settings. In the following paragraphs, I will discuss Printz's initial definition and later comments on each of these principles, jumping around within his exposition in an attempt to gain a complete picture of each strategy and draw out some important implications. Printz's examples are collected in Figure 2.5 above.

Dilatatio refers to an elaboration of a foot's rhythm. Printz describes *Dilatatio* as "when the sounds diminute a rhythmic foot, and are also multiplied from it" (108).[17] In the two examples he provides, a dactyl expressed in half notes descending stepwise is elaborated into quarter notes. These quarter notes still outline the same descending scale, but in the first example they add an off-beat upper neighbor to each downwards

[17] "Dilatatio ist/ wenn die Soni eines Pedis Rhythmici dimuniret/ und also vermehret werden." (Printz 1696, 108)

step, while in the second example, they add a downward leap of a third. One page later, Printz provides a rule that in dance music, “a *Dilatatio* should be used in such a way that one can still observe the Feet hidden within” (110).[18] This implies that a foot is most basically expressed explicitly by the surface of the rhythm, but can become buried beneath this surface by elaborations. Though this foot is no longer directly expressed at the rhythmic surface, it still structures the rhythmic feeling of the music. In analogy with Kirnberger’s comments in the excerpt at the beginning of this chapter, the performer’s primary task in making a rhythmic interpretation is to exhume the rhythmic feet that lie underneath the notated surface.

Contractio is defined as “when an entire rhythmic foot is pulled together into a single note” (108).[19] Printz’ example shows a dotted-rhythm dactyl (DH Q H) which is transformed into a single dotted whole note. How is a single note legible as a three-part Dactyl? Presumably only when a dactyl is expected. Printz cautions that “Contractio should not often be used, and only at the end of a Caesur or Section” (110).[20] And indeed, in the examples he describes in subsequent chapters, a Contractus is only used when a pattern of feet has already been established, for example at the end of a section which had been comprised of a dactyl in every single bar.

Printz neglects to define *Commutatio*, likely just as an oversight, but from the Latin term we can make a guess as to what it means. In Latin, “*commutatio*” could mean change, upheaval, exchange, or reversal. This could mean that a foot has been expressed in reverse order, or one foot has been substituted for another. In some cases, such as the Iamb (◡ –) and Trochee (– ◡), the difference between a reversal of the

[18] “Reg. V. In diesem Stylo soll die Dilatario so beschaffen seyn/ dass man den darinnen versteckten Pedem mercken könne.” (110)

[19] “Contractio ist/ wenn man den ganzen Pedem in eine Note zusammen ziehet.” (108)

[20] “Reg. VI. Contractio soll nicht offt gebraucht werden/ als nur im Ende einer Caesur oder Section.” (110)

Iamb and the substitution of a Trochee would be only a terminological difference, producing the same musical result. While Printz never uses the word "*commutatio*" in the subsequent chapters, he devotes much of Chapter 17 to the substitution of one foot for another, for example, the use of a single Trochee near the end of a section using only dactyls (123).[21] In his set of rules for the use of these principles of freedom, Printz suggests that "*Commutatio* should be employed rarely indeed, in such a way that the type of *Melodiae Ligatae* is not altered" (110).[22] From this, my best guess is that *Commutatio* refers to the substitution of an expected rhythmic foot with one of a different type, whose difference is assimilated into the dominant rhythmic mode of the rest of the passage.

There are two different phenomenon encompassed by the use of a rest in *Decurtatio*. The first is "when the number of sounds in a foot is shortened" by replacing a foot with a rest; the second is when "the duration of one sound" is shortened (108).[23] Printz's example is a half rest followed by two half notes, and he explains that it could be either a "*Decurtatus Trochaeus* [. . .] in which the first sound is shortened by half," or a "*Decurtatus Dactylus* [. . .] in which the foot is shortened by a single tone" (108).[24] This highlights once again the fact that a foot is an interpretation of the sounding notes, a sub-surface structure which may not be immediately evident but sometimes must be inferred based on context.

The next principle of freedom which Printz describes is perhaps the most radical: *Prolongatio*. Printz defines this as "when the time of a sound or the number of

[21] "Zum Exempel/ in denen Dactylischen Sarabanden wird öffters auss die letzt ein Trochaeus gebraucht/ wodurch doch das pure Genus Dactylicum nicht verändert wird." (1696, 123)

[22] "Reg. VII. Commutatio soll dergestalt/ und zwar selten/ adhibiret werden/ dass dadurch das Genus Melodiae Ligatae nicht verändert werde." (110)

[23] "Decurtatio ist/ wenn ein Pes verkürzt wird an der Zahl der Sonorum, oder an der Zeit eines Soni, welches geschicht durch eine kleine Pause" (108)

[24] "[Example] ist ein Decurtatus Trochaeus, auch ein Decurtatus Dactylus, da in dem ersten die Zeit des ersten Soni umb die Helffte/ in dem andern aber der Pes um einen Ton verkürzet wird." (108)

sounds [in a foot] are multiplied without diminution" (108). His first example is an iamb in which the first note is a quarter but the second note has been greatly expanded to a dotted half. His second example is a "*prolongatus Syncopaticus*," in which a quarter note downbeat is followed by four half-note offbeats, and finally a quarter note to make a complete measure. Printz gives no prosodic analysis for this example, but based on his earlier definition of *Syncopaticus* as a type of Spondee (which consists of two strong accents; 106), we can infer that each of these syncopated notes repeats the second strong accent of the Spondee. The significance of this second example is that the structural logic of a foot can be extended (perhaps indefinitely?) by repeating one of the component tones.

Last is *Expletio*, in which "a note, which can also be diminuted, is set between two feet for the filling out of the Takt" (108).[25] *Expletio*, *Dilatatio*, and *Prolongatio* all involve adding notes or duration, but it seems to me that *Prolongatio* and *Dilatatio* add to or extend motions that are already expected, while *Expletio* allows for notes to be added outside of expected rhythmic feet. Printz's untitled example features what I recognize as a 4/4 bourrée rhythm, with a quarter note up-beat leading to a measure of four quarter notes in an ascending scale that leads to a half note downbeat on the second measure. Printz describes this half note as "*Iambicus Prolongatus*," and the quarter note which follows on the third beat of the second measure as "*Expletio*." Printz does not give prosodic accents, but I have extrapolated the iambic rhythm backwards. The *Expletio* extra beat I have assigned as a strong accent, but in parentheses because I do not feel this as really an independent accent from the downbeat. The *Expletio* is more of an after-beat or ghosted beat (this also seems to be indicated by Little and Jenne's bourrée model which I will discuss later; see Little and Jenne 2001 [1991], 37). I will

[25]"Expletio ist/ wenn eine Note/ welche doch auch diminuiret werden kan/ zwischen zween Pedes gesetzt wird zu Ausfüllung des Tactes." (108)

use this analysis as a template to analyze bourrée rhythm in the following sections of this chapter.

These six degrees of freedom are defined with reference to individual feet in isolation, but his examples make it clear that they are to be used as a means to vary motion in the context of a repeating rhythmic genus to articulate phrases and larger levels of structure. These examples of larger-scale structure are the kind of syntactic processes which organize musical constructions into larger structures of musical grammar, like Zbikowski's examples of repetition and cadence (2008, 289). But Printz cautions that these freedoms should not be used randomly: "The most graceful compositions layer different rhythmic feet, and within them balanced proportions are observed in such a way that not only in two or more sections, but also in two or more individual *Numeris Sectionalibus* the same progression and type of foot are used" (123).[26] This aesthetic of recurrence and balance in motion is a crucial element of dance-derived rhythmic syntax.

Printz next describes several methods for varying the mixture of feet without violating a piece's *genus* or the aesthetic of balance. The simplest mixture is the substitution of one foot for another (*Commutatio*), which Printz associates with cadential closure (*Clausulae Formalis*).

> It should be observed here, that the feet which will be used in the formation of the *Clausulae Formalis*, do not alter the *Genus Melodia Ligatae*, though they differ from the proper feet [of that *Genus*]. For example, in Dactylic Sarabandes, the last (foot) will often use a Trochee, but still the pure dactylic *Genus* will not be altered. (Printz 1696, 123)[27]

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[26] "Die zierlichste Compositio unterschiedlicher Pedum Rhythmicorum geschicht/ wenn Proportio Æqvalitatis dergestalt darinnen observiret wird/ dass nicht allein in zweyen oder mehr Sectionibus, sondern auch in zweyen oder mehr einzeln Numeris Sectionalibus einerley Ordnung und Arth der Pedum gehalten wird." 123

[27] "Es ist aber hier zu mercken/ dass die jenigen Pedes, so allein zu Formirung der Clausulae Formalis gebraucht werden/ das Genus Melodiae Ligatae nicht verändern/ ob sie gleich von denen gebührlichen Pedibus unterschieden seyn. Zum Exempel/ in denen Dactylischen Sarabanden wird öffters auss die

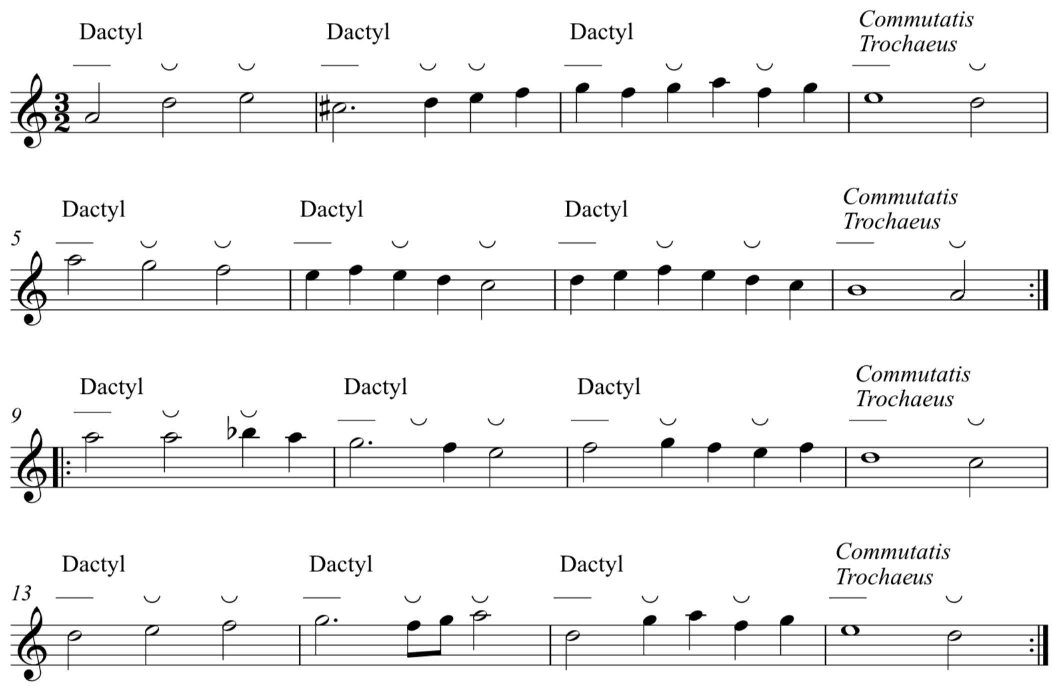


Figure 2.6: Dactylic Sarabande (Printz 1696, 124)

Figure 2.6 below contains Printz's example of a dactylic sarabande which substitutes a trochee for a dactyl to create closure. His earlier rules indicate that this kind of substitution is only to be permitted when it does not completely disrupt the established rhythmic feel. The trochee here does not upset the general established dactylic motion but is simply an elaboration or variation that creates a feeling of rhythmic closure to match the pitch *clausulae*.

Printz's next example uses *Commutatio* to describe what appears to be a hemiola, in a way which illustrates what Roger Mathew Grant calls "unequal triple meter" (2014, Chapter 3). The dactylic menuet in Figure 2.7 below contains a *Contrarius* that forms part of the final *clausulae formalis* (Printz 1696, 124–125). As Grant shows, triple meter in the eighteenth century was not conceived of as three equal beats, but as two unequal beats. Ordinarily, in 3/4 this consisted of a thesis with a half note duration

letzt ein Trochaeus gebraucht/ wodurch doch das pure Genus Dactylicum nicht verändert wird." (123)

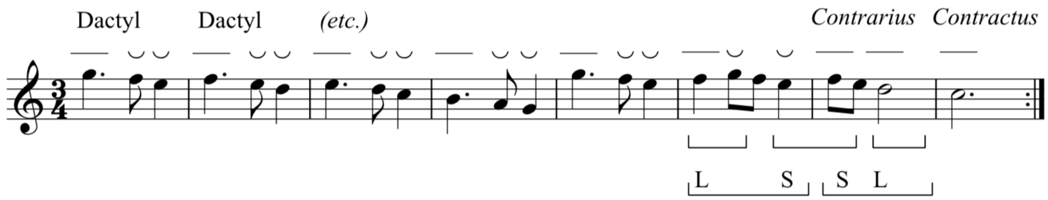


Figure 2.7: Dactylic Menuet (Printz 1696, 125)

followed by an arsis with a quarter note duration; but occasionally, this durational proportion was flipped to create what Printz calls a *Contrarius*, so that the downbeat thesis was short and the arsis was long. Grant points out an alternative theorization of the hemiola not as a metrical dissonance of three equal beats spread across two measures, but as one normal long-short measure followed by a short-long "syncopation." Printz's use of the Contrarius below illustrates this theorization perfectly, using one foot per measure.

The next most complex strategy is the consistent alternation of two kinds of feet throughout a composition. Printz especially focuses on the combination of dactyl and *Contrarius*. His first two examples of this type show how the two-measure pattern of alternation can lead with either the dactyl or *Contrarius*. For example, in Figure 5.5, every odd-numbered measure contains a dactyl and every even-numbered measure contains a *Contrarius*. This is not a *Commmutatio* or substitution, but simply the basic mode of motion in the piece.

Several of Printz's musical examples contain phrases which modern theorists would recognize as sentences and periods, and in some cases Printz explains the constitutive properties of a sentence in terms of his freedoms of rhythmic feet (for definitions of musical sentences and periods, see Caplin 1998, 9–12). This is the case with his discussion of the sentence that appears in Figure 2.8 below.

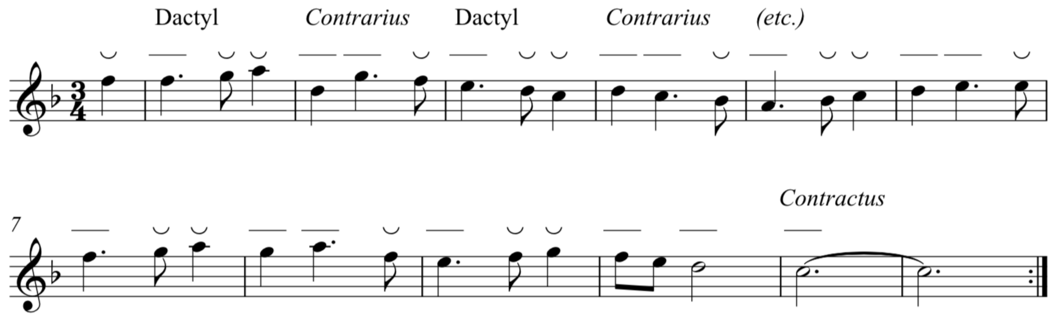


Figure 2.8: Courante *Dichronii Dactylico-Contrarii* (Printz 1696, 126)

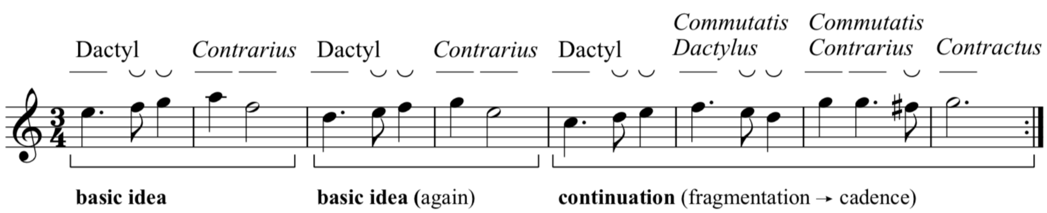


Figure 2.9: Printz Menuet p. 128, analyzed as a musical sentence

> The third type is, when in the first two *Binariis* [two-measure units] Dactyl and *Contrarius* alternate, in the third [two-measure phrase are] two Dactyls, and in the fourth there is a *Contrarius* and a *Contractus*; while in the other section [of the piece] the *Melodiae Ligatae Contrarius* and *Dactylus* are used in the reverse order. (Printz 1696, 128)[28]

Figure 2.8 is a textbook example of what twentieth-century theorists would describe as a musical sentence. There is a two-measure "basic idea" at the beginning, which is repeated once, creating what William Caplin calls a presentation function. Then in measure 5 and 6, a fragment of the basic idea (the first measure) is repeated, generating a sense of acceleration associated with the formal function of continuation. Finally, measures 7 and 8 contain a stock cadential motion, closing off the eight-measure sentence.

[28] "Die dritte Arth ist/ wenn in beyden ersten Binariis Dactylus und Contrarius wechseln/ in dem dritten zween Dactyli und in dem vierdten Contrarius und Contractus stehen/ in der andern Theil aber der Melodiae Ligatae Contrarius und Dactylus Wechsels-weise gesetzt werden." (128)

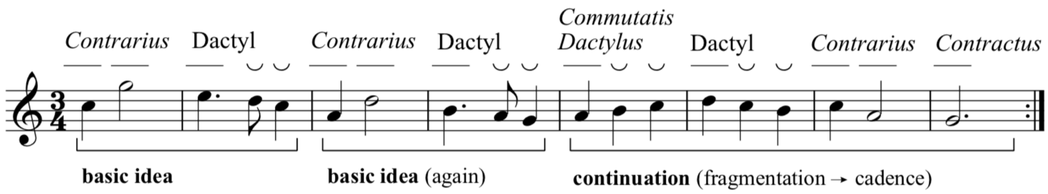


Figure 2.10: Printz Menuet p. 129, analyzed as a musical sentence

Each of these three components of an eight-measure sentence (presentation, continuation, and cadence) are distinguished by Printz according to their dance rhythms. From this perspective the presentation is simply generated by the "default" in dance syntax of repeating the 2-measure step unit. The acceleration that creates a continuation function in measures 5 and 6 arises from the use of an "extra" dactyl instead of a *Contrarius* in measure 6, not a thematic function. And the cadence is not just melodic and harmonic, but also features the rhythmic closure created by the conventional ending figure of a *Contrarius* and a *Contractus*. On the next page, Printz describes a similar sentence, here reproduced as Figure 2.10.

> The fourth type is when in the first two *Binariis*, *Contrarius* and *Dactylus* alternate, then there are two Dactyls in the third and in the fourth is a *Contrarius* and *Contractus*: but in the other section the *Melodia Ligatae Contrarius* and *Dactylus* are set in the opposite order. (Printz 1696, 129)[29]

Like the menuet in Figure 2.9, the eight measures of Figure 2.10 form a textbook example of a musical sentence, and Printz's description in terms of rhythmic feet corresponds again to the formal functions which constitute sentential structure in Caplin's definition.

To summarize, while Printz does not frame his chapters on rhythmic feet as a discussion of dance rhythm *per se*, his theory of rhythmic structure correlates closely

[29] "Die vierdte Arth ist/ wenn in beyden ersten Binariis Contrarius und Dactylus wechseln/ in dem dritten zween Dactyli und in dem vierdten Contrarius und Pes contractus stehen: in dem anderu Theil aber der Melodiae Ligatae Contrarius und Dactylus wechsels-weise gesetzt werden." (129)

with seventeenth-century dance syntax as described by Mersenne. Printz's explanation of this dance rhythm syntax is framed by the hypermetrical regularity of *numeris sectionalis*, with the expectation that each suprametrical unit will use "the same progression and type of feet." The aesthetic statement about balance and proportion which Printz gives at the beginning of the chapter indicates a preference for the kind of rhythmic parallelism and recurrence that creates these structures. Additionally, Printz indicates that the most dramatic rhythmic departures should be reserved for "*modi finiendi*" or phrase endings, which also provides a critical ingredient for sentences and periods. Sometimes these syntactic constraints result in sentences or periods, and sometimes not. From the perspective of Printz's theory of dance rhythm syntax c. 1700, it appears that the phrase structure types which form the basis of modern theories of form in the classic style (circa 1770–1820), the sentence and period, are emergent epiphenomena of the characteristic rhythms of dance music, rather than constitutive syntactic principles.

Some connections between sentence and baroque dance rhythms have already been made by Eric McKee, but McKee's arguments are in several ways contradicted by the historical trajectory I have read into Printz's theory. McKee describes a type of sentence comparable to those analyzed by Printz in Figures 2.9 and 2.10 as a "sentence within a sentence," arguing that continuation group has a form of 1 + 1 + 2 that mirrors the eight-bar form of the sentence but at a smaller scale. However, McKee does not make this observation with respect to rhythmic feet or characteristic rhythms or *numeris sectionalis*. McKee also characterizes the sentence as a "forward-looking approach to phrase construction," with the evidence that the sentence is characteristic of the later Classical period, and that J. S. Bach did not appear to use sentences in his Menuets until 1720. The sentence only appears "forward-looking" in retrospect; I have found the "sentence within a sentence" not only in Bach's works, but also in titled dances by Vivaldi and other earlier composers. Another anachronism is McKee's argument via Edward Cone that the sentence represents a shift from beat-oriented time in the Baroque to growing awareness of hypermeter in Classic music. The writings of Printz and Mersenne make it undeniable that two-measure dance step-units were a motional and theoretical priority throughout the seventeenth century. The appearance of sentential constructions in Bach's dance music do not constitute a fashionable anticipation of the *galant* phrase constructions of later generations; instead, the sentence is evidence of how Classical phrasing evolved out of the dance rhythms of earlier eras.

Metering with Dance Rhythms

In the previous section I reviewed Printz's principles of rhythmic freedom. Printz describes rhythm in dance music as based in a rhythmic genus or fixed sequence of rhythmic feet that repeats throughout. But Printz allows for variations in how these rhythms are expressed by the notated surface of the piece, as well as alterations to or substitutions for individual feet (or even several in a row) as long as they do not too much upset the ruling genus. These variations can create larger phrasing structures including the sentence and period that would play such an important role in eighteenth- and nineteenth-century music.

In this section, I will analyze movements titled "Bourrée" by J. S. Bach to show how he stretches and manipulates dance rhythms, often in ways that seem to be described well by Printz's principles. Larger phrase structures in Bach's titled dance music seem to be generated (or at least, *generatable*) by manipulating sequences of rhythmic feet. While my analyses are based in Printz's system of terms imported from classical theories of prosody, I want to clarify at the outset that I am not committed to a particular segmentation of each piece into rhythmic feet; these labels illustrate the recurrence and variation of motion and I do not view them as an end in themselves, but as a historical source for ways of thinking about rhythm and movement.

I am most interested in exploring the implications of the idea that dance music has an "inner rhythm," especially in theorizing the process of the performer as interpreter deciding on how to read rhythmic feet into the notated score. Bach often varies the notated rhythms at the surface of the score. When do these indicate changes in inner rhythm, shifts between different kinds of prosodic feet, and when should such changes in surface rhythms be assimilated within the unvarying sequence of rhythmic feet that characterizes the genus?

As a basis for interpreting inner rhythm in bourrées, I will use a metering construction synthesized from a combination of the apparent bourrée rhythm analyzed by Printz (see the final line of Figure 2.5, illustrating *Expletio*) and a model of bourrée described by Meredith Little and Natalie Jenne (2001 [1991]). Little and Jenne's book synthesizes an enormous amount of background research to create a rich, cross-domain reference for each of the dance types Bach uses. They compile standard features of choreographies with other music of each dance type by earlier composers, in addition to citing commentary on each dance from a wide variety of historical writings, in an attempt to show what the historical norms informing Bach and his audiences might have been.

For each dance type, Little and Jenne provide a three-part model for the metrical structure of the dance (see Figure 2.11 for their model of Bourrée meter). The middle part of the model provides the standard notation of the beat and the most common subdivision scheme. The lowest part (sometimes separated as another table) lists some of the most characteristic rhythmic motives in this dance type. The top section of the model describes the flow of arsis and thesis within each phrase and half phrase. As far as I know, their notation for distinguishing between degrees of arsis and thesis (a/A/t/T) has not been used by any other theorists of rhythm, so I've included their explanation.

> Actually all meters are hierarchical; that is, they operate by the cooperation of several levels. The activity one perceives at these levels—the "rhythming" of the meter, if you will—involves varying degrees of motion and repose, most importantly of the beat. Rhythmic activity on a metric level may be more or less arsic, or more or less thetic. In discussions of rhythm and meter in Baroque dances we use "A" to signify a more arsic place, and "a" for a less arsic place. Similarly, "T" refers to a more thetic place, and "t" to a less thetic one. (Little and Jenne 2001 [1991], 16)

Little and Jenne provide one symbol a/A/t/T for each beat, and then usually also indicate a larger hierarchy of multi-measure arsis or thesis across the construction of a larger phrase. These maps are essentially compatible with Cooper and Meyer's architectonic analysis method and definition of accent. Thus, each of Little and Jenne's models provides all of the components needed to define a metering construction for each dance: (1) sounding features (characteristic rhythmic motives); (2) a pattern of beats (the measures and subdivision scheme); and (3) a specific movement (the accentual flow of arsis and thesis).

Most bourrées are written in cut-time (or the equivalent "2"), with two beats per measure. Little and Jenne's model describes a four-measure or eight-beat bourrée phrase, in which the odd-numbered measures are generally arsic and the even-numbered measures are generally thetic. Further, they subdivide the entire phrase into a pair of two-bar "half-phrases." The arsic and thetic qualities require some additional explanation:

> Beat 7 and the first half of 8 constitute the primary repose, or thesis; beat 3 and the first half of 4 provide a preliminary resting point, or secondary thesis.
> A thesis in the bourrée has the value of three quarter notes, all on a single harmony (DH or Q EE Q or EEEE Q). The thetic quality is best achieved in performance by phrasing all three pulses together: QEEQ [slurred together], not QEE Q [first three

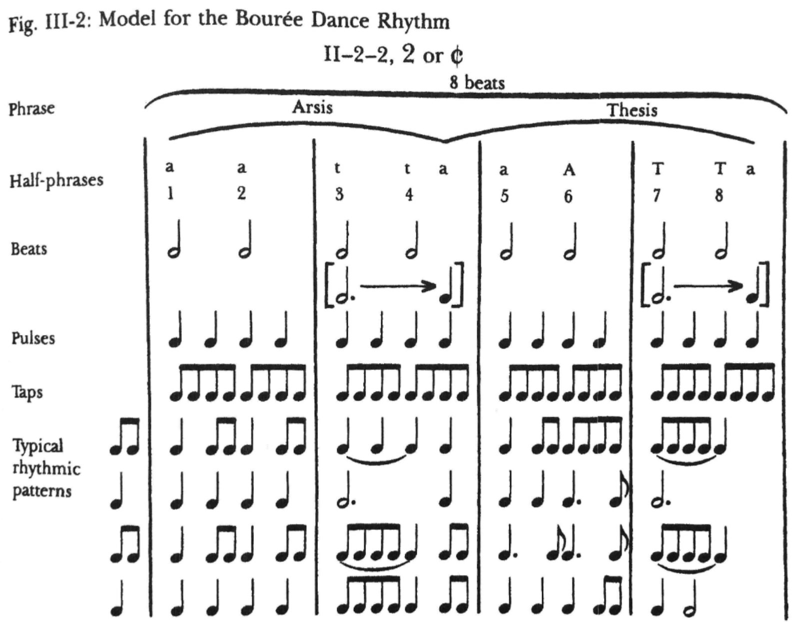


Figure 2.11: Little and Jenne's Bourrée Rhythm model (2001 [1991], 41)

> slurred, last separate] or Q E E Q [all separate, E with staccatos]. (Little and Jenne 2001 [1991], 37)

Each even-numbered measure features the characteristic thesis lasting three quarter notes (in cut time) followed by a quarter note upbeat.

Printz's analysis of a bourrée rhythm as *Expletio* adds another layer of accentual flow to Little and Jenne's model (see Figure 2.12 below). While Printz only describes the *Iambicus Prolongatus* and *Expletio* in the second measure, we can assume that the first measure would contain two conventional iambs, one serving as the opening upbeat that is characteristic of the bourrée, and the other filling out the middle of the first measure. In other words, it is not only that first upbeat that is an iamb; iambic rhythm is suffused throughout the four-bar phrases. However, Printz's analysis also confirms the sense of rest in the second measure that Little and Jenne describe, in that he describes the second measure as a prolonged strong downbeat followed by an extra beat that is not part of any iamb. I hear this extra *Expletio* beat as a sort of after-beat or extension of the *prolongatus* downbeat, sort of a continuation of the strong accent already in play rather than an independent new accent.

The conventional quality of a three-quarter-note thesis in the even-numbered measures is not shared equally by the dance. Little and Jenne feature an example of bourrée choreography from Louis-Guillaume Pecour (1653-1729), *La Bourrée d'Achille*, which uses the same step for the first and second measure of most four-measure phrases. On the other hand, though, the music clearly distinguishes the first measure as arsic and the second measure as thetic; in Cooper and Meyer's terms, the second measure is the focus of each pair, with the first measure directed towards it. Little and Jenne suggest that "Arsic measures very often consist of duple groupings of pulses, which if carefully articulated, will contrast strongly with the thetic measures. For example, the first four measures of *La Bourrée d'Achille* might be performed in this manner" (2001 [1991], 40). Even if the feet of the dancers do not literally articulate a difference between these arsic and thetic measures, the music adds a larger level of hierarchical structure to Printz's single-dimension binary of strong and weak accents.

A careful reader might object that I previously called Printz's single-measure rhythmic feet "metering constructions," and am now claiming that the larger eight-beat bourrée phrase is a metering construction. I should clarify that multiple metering constructions can be active at one moment; and a larger metering construction may be a compound constituted from smaller ones, or may be comprised of "blank spaces" in which a variety of smaller constructions could be used. Grammatical constructions in spoken and written language work the same way; one construction may operate over the span of an entire sentence, while another construction describes/defines a small adjectival phrase within the same sentence, while yet other constructions determine the

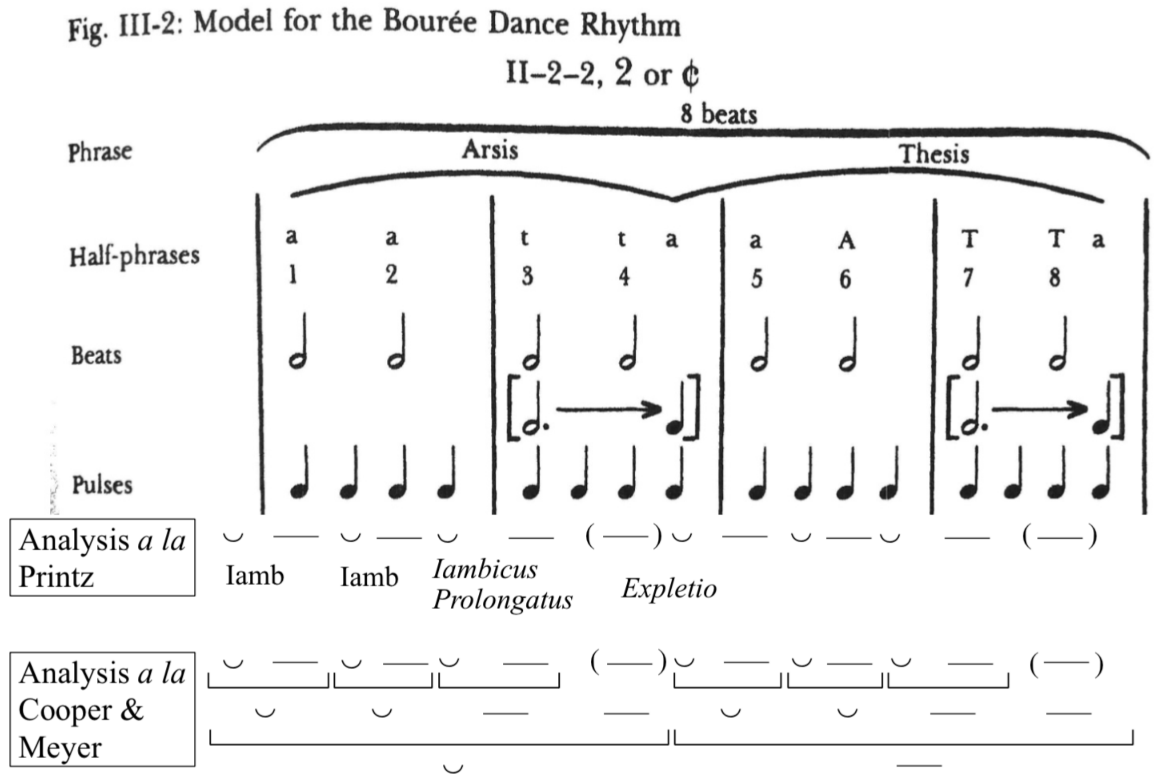


Figure 2.12: Little and Jenne's Bourrée prototype, analyzed according to the theories of Printz and Cooper and Meyer

formations of phonological units within words. As Adele Goldberg famously stated, "it's constructions all the way down" (Goldberg 2003, 223). The eight-beat bourrée construction which is specific to the bourrée dance type can be subdivided into constructions of individual rhythmic feet, each of which is also a more general conventional pattern.

Speaking of hierarchical structure, it's worth noting that Little and Jenne's archetypal dance rhythm models are compatible with Cooper and Meyer's conception of accentual hierarchy, and thus compatible with the framework of impulse structure and accentual flow that I have developed in this chapter. Cooper and Meyer analyze music as a hierarchy of strong-weak dependency. They describe this hierarchy as "architectonic" structure, meaning that a phrase grouped around a strong accent at one level becomes a single strong/weak beat in a larger level of structure. At the largest scales, accentual flows are scalloped shapes built from the compounding accumulation of the shallower curves of smaller motions. Like Cooper and Meyer, Little and Jenne also analyze rhythmic structure as a multi-level hierarchy, with their beat-by-beat markings of a/A/t/T and their larger phrasing levels.[30] Additionally, it is clear from their use of these terms in analysis that arsis and thesis are directional vectors that operate over time spans, rather than qualities of single time-points. In other words, their conception of arsis and thesis maps well onto Cooper and Meyer's theories of accent as a time-span phenomenon. Figure 2.12 shows the combination of Little and Jenne's models with Printz's bourrée analysis and Cooper and Meyer's notation.

This concept of architectonic structure is easily illustrated by an analysis of one of Bach's most prototypical bourrées, Bourrée I from the *Overture in F Major BWV 820*. Much of this piece perfectly matches the eight-beat bourrée template provided by Lit-

[30] Little and Jenne do not cite Cooper and Meyer, despite the similarity of their architectonic approaches to rhythm.

Figure 2.13: BWV 820 Bourrée I

tle and Jenne. Ten out of twelve even measures use a gesture that is a stereotype of Bach's bourrée writing: three quarter notes in one hand which arpeggiate through the root and fifth of the chord monotonically (all in the same direction), often traversing an ascending or descending octave. This gesture is highlighted by boxes in Figure 2.13 above (I have also put a box around a similarly-placed figure in measure 10, which retains the same rhythmic feeling and harmonic stasis, while using stepwise motion and more complex surface rhythms). This quarter-note gesture gives a temporary sense of rhythmic closure to the conventional bourrée two-bar phrase. A melodic repetition of mm. 1 and 2 in mm. 5 and 6 creates a larger phrase structure of a parallel period. Much of the second section follows the same iambic structure; indeed, mm. 17–24 exactly repeat the first eight bars of the movement. One could not ask for a clearer demonstration of the principle of motional consistency.

The three-quarter-note thetic figure discussed above shows up so often in Bach's bourrées that its absence often correlates with a structurally- significant shift from bourrée rhythm. An interesting deviation occurs in mm. 13–16: these measures keep repeating the same *Iambus Vulgaris* instead of moving to an *Iambus Prolongatus* in m. 14 as we might expect (in other words, in m. 14 Bach omits the characteristic three-quarter-note thetic figure described above). The highest melodic line in mm. 13-14 articulates on each half-note beat a rising scale C-D-E-F, a melodic motion which seems to emphasize an equal half-note rhythmic feeling. Measure 15 contains a *cadenza composta*, with equally spaced half-note emphases as well. It is not until m. 16 that the characteristic three-quarter-note thetic figure reoccurs. Thus mm. 9–16 are analogous to Printz's sentential examples which I analyzed earlier (Figures 2.9 and 2.10); the first half of the eight-bar phrase repeats the same two-bar *numerus sectionalibus*, but then in the second half of the phrase, one of the even-numbered measures is substituted with the odd-numbered measure so three measures of the same rhythmic feet are repeated in a row.[31] This creates a sense of fragmentation and acceleration not unlike a musical sentence, and in this case the harmonic rhythm has also accelerated. But while mm. 9–17 have the same *motional* structure as a sentence, this eight-measure phrase is not a sentence under modern definitions, because the first half does not repeat the same *melodic* basic idea.

This architectonic analysis shows how the sentence and period could be epiphenomena of the dance rhythm syntax. The basis for this entire movement is the stock two-bar bourrée phrase, which forms a rhythmic *genus melodia ligatae* that repeats over and over. Melodic recurrence and variations in rhythmic feet (like the one in m. 14) can create feelings of balance, larger phrase closure, acceleration and other formal functions; sometimes these factors add up to sentences and periods, and sometimes they do not. But in Printz's theory the dance rhythms are the generative unit of syntax and the building blocks of composition, not the large phrase-types.

But applying the same bourrée rhythm prototype to the Bourrée I of Bach's *English Suite in A major* BWV 806 presents some difficulties (Figure 2.14). The first eight measures form a prototypical musical sentence based in the bourrée rhythm that exhibits similar properties to the sentential phrases I've analyzed already. But the "fragmentation and acceleration" part of this sentence involves a tricky bit of motional relay. Bar 5 in the bass is almost exactly the same as the treble part in measure 3, and it has the same iambic feel. At the same time, the treble part in measure 5 affords a feeling

[31] This way of describing a metrical hearing using the Bourrée metering construction is inspired by Ito's "hypermetrical schemas." Ito defines a hypermetrical schema as a fixed ordering of hyperbeats, each of which has a specific degree of metrical weight and a specific grouping function within the hyper measure—Initiation, Continuation, or Conclusion (2013, 51). He argues these hypermetrical schemas can be used in dis-ordered hearings, for example, hearing a repetition of the final two measures of a four-beat hypermeasure (i.e. 1 2 3 4 3 4). Using this notation, the sentential structure I describe in mm. 9–16 of the Bourrée I from BWV 820 would be analyzed as 1 2 1 2 1 1 1 2.

Figure 2.14: Bourrée I from BWV 806

of *iambicus prolongatus* because of the dotted quarter, to which the ornament only adds extra emphasis. However, at the end of bar 5, the melody has a final eighth note which acts as an anacrusis to repeat the measure transposed in measure 6. It is as if measures 5 and 6 each have a basic rhythm of two iambs, the second of which is prolonged into a half note, but this half note is elided with an eighth-note upbeat that functions as a sort of abbreviated version of the quarter-note upbeat motional quality that consistently appears throughout the piece. While there is no overlap in notated durations, I experience the final eighth note of measure 5 as an *overlap between two motion*s, one of which is the expansive *prolongatus* ending of measure 5, and one of which is the iambic anacrusis launching into measure 6. This rhythmic construction occurs again in bar 7, this time expressed by a slightly different rhythmic/melodic surface. Finally, the half note and quarter rest at the beginning of measure 8 in the right hand place a *prolongatus* in the "right" place (on the downbeat of an even measure) and without such a motional overlap. This is a full, proper realization of the stock thetic figure, that provides enough (temporary) rhythmic closure to finish the sentential phrase, though this closure is undermined somewhat by the continuing rhythm of the left hand.

Another motional overlap just a few bars later has the potential to be much more disruptive, depending on the performer's interpretation. Measures 9–12 are almost exactly the same as measures 1–4, except that the right hand has been filled in with running eighth notes. The second half of measure 12, however, has the potential to completely disrupt the balance and pace of the bourrée rhythm, because it features the movement's main iambic motive displaced by half a bar! In the established bourrée genus, measure 12 would ordinarily begin with the long second note of an *iambicus prolongatus*, followed by an *Expletio* extra strong beat on the third quarter note of the measure. This is shown in the prosodic analysis beneath the the left hand in Figure

2.14, because the left hand alone seems to support this interpretation. But in the right hand, the beginning of the two-slurred eighth note figure feels to me as if it is already in the middle of an iambic bourrée rhythm; if this interpretation is taken we might hear the preceding two eighth notes retrospectively as an anacrusis, so below the right hand I've put a weak accent in parentheses over the second quarter note of measure 12. I've marked felt focal impulses accordingly. This new interpretation seems to be supported by the repetition of this displaced figure in both hands in measures 13 and 14, this time more clearly affording the characteristic bourrée quarter-note anacrusis. Then in measure 15, a most conventional cadential schema begins on the downbeat, affecting a metrical reset that is made especially clear by the two octaves of the dominant in the bass.

There are, of course, other interpretations. The performer could continue to feel the bourrée rhythm in alignment with the notated barlines, which would invert the primary motive to put the strongest sense of thesis at the peak of the paired eighth notes instead of at the end of their descent. That's certainly a workable interpretation but it's a shame not to take advantage of the clear change in surface rhythm as a chance to shake up the underlying motionss. Another potentially radical option might be to interpret the second half of measure twelve as a two-quarter-note anacrusis, like a gavotte rhythm inserted into the middle of an 8-bar phrase of bourrée. This gavotte-rhythm interpretation could also be used in the second half in measures 30–38. A performer would want to try out each of these interpretations, test them to see how they would affect the possibilities for shaping larger scales of architectonic phrasing; and for each interpretation, the performer might experiment with different articulations and degrees of sustain and connection to see how to best animate their internal feelings of motion and create a sense of balance and flow. They would then choose one interpretation for a performance but could easily change this choice while the piece is in their repertoire. This illustrates how a performer can develop an interpretation of a piece through experimenting with different ways of using metering constructions, a sort of embodied research into what ways of moving are possible, developing new embodied techniques of performative rhythm interpretation.[32]

Beyond Printz: Motional Syncopation and Change in Metrum

This passage from Bach's Bourrée I from BWV 806 seems to call for ways of thinking about rhythmic conflict and syncopation beyond what can be described using the terms Printz defines. Instead of using the well-ordered, normalized abstract hierarchies of Lerdahl and Jackendoff as the basis for measuring syncopation, syncopation can be measured against the motions in the body of the performer or perceiver, as in David Kaminsky's concept of "motional syncopation" (see Chapter 1 for a more extended discussion of theories of syncopation). Kaminsky clearly intends motional syncopation to apply to the overt motions of a dancing body. But the basic premise I have promoted in this chapter has been that the motions and rhythms of dance can be taken away from the dancing body and used with some abstraction, in which a covert accentual flow serves as a surrogate for the overt motion of an actual dancer. As long as some kind of accentual flows are still clearly experienced as motional gestalts by a listener, motional syncopation can be said to occur, even if the music is not accompanied by dancing or other overt movement.

[32] Ben Spatz (2015) theorizes this kind of "practice as research," using performative practices to learn embodied technique and develop new embodied techniques, new ways of moving and using the body (whether these ways of moving are "new" to the whole sphere of human knowledge, or just "new" to a single practictioner). Spatz's work could provide a useful framework for a more detailed theory of phrase/meter interpretation than what I have accomplished here.

Motional syncopation provides a conceptual description of the phenomenon in mm. 18–20 of Bourrée I from BWV 806 (Figure 2.14). A listener using Little and Jenne's eight-beat prototype as a metering construction might hear the end of m. 17 as the beginning of such a four-bar unit, and in the following four measures the right hand matches well enough to this phrase structure that the listener might continue to interpret these four bars in this way. The left hand's bass melody in m. 19 might be heard to conflict with the three-quarter-note thesis in m. 18, creating a feeling of motional syncopation by implying an accentual flow that is in a sense the inverse of the flow that constitutes the metering construction concurrently evoked by the right hand. This is not the only possible hearing; for example, one could also hop between the two hands, hearing the characteristic bourrée up-beat figure as an imitative entry in a sort of stretto structure. This metrical interpretation would repeat the same every measure, even though each voice contains contrasts between successive measures. (I would not characterize this passage as "metrical dissonance" because I do not think that it is possible for a person to simultaneously perceive multiple distinct metrical interpretations—but that's a discussion I will put off until the next stage in this project.) Each of these hearings involves choosing in each measure the implied accents of one voice as the primary accentual flow, and hearing the secondary voice as a motional syncopation measured against the (dance) motion of the voice foregrounded by attention.

This concept of motional syncopation also leads to different conclusions than traditional theories when analyzing some passages in the subsequent Bourrée II of BWV 806 (see Figure 2.15). For example, the quarter - half - quarter note rhythms in measures 2 and 4 would traditionally be considered as syncopations, since they begin on what Lerdahl and Jackendoff would define as a "weak" beat and sustain through the "strong" third quarter note. But there is no *motional syncopation* when this passage is heard against the characteristic bourrée rhythm described by Little and Jenne. The first two notes (quarter - half note) are merely a subdivision or diminution of the three-quarter-note thesis that occurs in the odd measures of many bourrées; like the backbeat in rock, this is in fact the normative rhythm of the bourrée, and to a listener entraining to this rhythm, no sense of displacement or disruption is felt. On the other hand, the suspension in the right hand in m. 15 *is* a motional syncopation even though it lies in the same position within the notated meter: beginning on the second quarter note of the measure and lasting through the half-way point of the measure that begins the third quarter note. This suspension (and the suspension in the left hand a half note's duration earlier) syncopates against the inner rhythm of two half notes that characterizes the odd-numbered measures in the bourrée scheme illustrated in Figure 1.12. If this inner rhythm is chosen by a listener as their interpretation for this measure, these suspensions will both be heard and *felt* as syncopations which push and pull against real or imagined body motion.[33]

The bourrée in Figure 2.15 is also a perfect illustration of the concept that the dance rhythms represented by prosodic feet are an inner rhythm that may not be obvious in the notated rhythms. There are constant moving eighth notes in one hand or the other throughout the entire piece, often accompanying melodies consisting mostly of straight quarter notes. Dance rhythm must be inferred if this bourrée is to sound like more than a counterpoint exercise. Recognizing the recurring two-measure bourrée template described by Figure 6.1 helps a performer identify some characteristic accentuations and groupings to bring out from these constant eighth notes. But also,

[33] I don't think these suspension-syncopations would undermine the interpreted inner rhythm I hypothesize. Suspensions are a fairly common rhythmic trick in the music of Bach's time, and any listener with even the most superficial familiarity with this style could easily hear such syncopations as confirming and pointing to the meter / dance rhythm in the same way that Temperley and Butler describe with syncopations in rock and EDM music.

Figure 2.15: Bourrée II BWV 806

a performer can highlight the substitutions and embellishments and other degrees of rhythmic freedom described by Printz which I have used in earlier analyses, which contribute to defining the arcs of larger phrase structures like the sentence and period.

But though "adding" dance rhythms creates rhythmic diversity and excitement, these prosodic feet do not exhaustively account for all rhythmic inflections. There is an interesting tension in this Bourrée II between the inter-opus stylistic construction of a three-quarter-note thesis in even-numbered measures on the one hand, and on the other the intra-opus pattern that the bass voice often begins an upward scale on the second quarter note of these even-numbered measures. This upwards scale taken by itself could indicate that the thetic quality lasts only for one quarter note, and that the rest of the measure constitutes a three-quarter-note anacrusis, as opposed to the traditional one-quarter-note Bourrée upbeat. But the rhythmic contours of the melody clearly establish (to me at least) the conventional Bourrée rhythm. In my hearing, the upwards scale in the bass in mm. 2, 4, 6, 10, and 12 is like a subtle motional syncopation, a feeling of rising motion that doesn't displace or truncate the three-quarter-note thesis, but gives it a delightful lift that creates continuing motion through what would otherwise be a point of rhythmic rest, as a kind of motional elision.

Another addition to Printz's framework is needed to account for some Bach bourrées which have longer passages that buck the motional character established at the opening of the movement. Printz's degrees of rhythmic freedom provide for short-term departures from the underlying bourrée rhythm, and motional syncopation can describe situations in which the notated rhythm might not be as characteristic but can still be heard within the conventional bourrée rhythm patterns. But the second half of Bourrée I in Bach's Cello Suite No. 3 in C Major contains longer departures from conventional bourrée rhythm. Measures 9–12 are a good match for Little and Jenne's

Figure 2.16: Bourrée I BWV 1008, second half

Figure 2.17: Bourrée I BWV 1008, second half, showing changes in hearings of characteristic motion

eight-beat bourrée template. The next phrase, mm. 13–16, could be interpreted in a couple of different ways as a use of *Commutatio* or substitution of feet similar to Printz's sentences I analyzed earlier, so that mm. 9-16 have a sentential structure. Measures 17–20 again fit Little and Jenne's four-bar bourrée template quite well, but then after that there is a long passage (mm. 21-26) which appears to have no bourrée rhythm whatsoever. This section is dominated by a dotted-quarter, eighth, dotted-quarter, eighth note underlying rhythmic/melodic gesture which repeats twice every bar.

I would analyze mm. 21–26 of the Bourrée I from BWV 1008 as a *shift in motion* rather than a motional syncopation or mere embellishment, as shown in Figure 2.17. One of the rules Printz gives constraining the use of his principles of rhythmic freedom is that in dance music, "a *Dilatatio* should be used in such a way that one can still observe the Feet hidden within" (110). In this passage, the even eighth notes must be a *Dilatatio* or elaboration of some underlying rhythm. But for six bars there is no trace of the three-quarter-note-long thesis that is so characteristic of bourrée rhythm, nor any larger patterns of arsis and thesis playing out over two- or four-bar units like Little and Jenne describe. This passage cannot be one in which the conventional bourrée rhythm "can still be observed hidden within." This departure requires an addition to Printz's dance syntax, in which dance pieces may have substantial passages in more even contrapuntal rhythms which depart from the characteristic motion of the dances. Bach uses this rhythmic technique frequently, not just in bourrées, but in many types of movements within his dance suites.

These techniques of motional syncopation and changing to a different *Bewegung* or motional character expands Printz's dance syntax, creating a more flexible mode of rhythmic thinking (analysis, interpretation, composition, and performance). But they also allow progressively greater departures from the characteristic motion of the dance.

Already in Bach's music there are sometimes long passages (most often in the second half of a binary dance form) which depart from the characteristic motion established by the piece's opening. This is a departure from the syntax of functional dance music, which usually maintained more regular and characteristic motion for benefit of the dancers, and other scholars have suggested that this trend is only exaggerated as the eighteenth century continues. Mirka observes in her analyses of examples from Koch's 1793 discussion of *Metrum* that the characteristic dance motions sometimes do not seem to form the basis for a whole section, but only the beginning of a melody.

> Yet analysis of the examples with which Koch illustrates his discussion reveals that he does not understand continuity of Metrum as the uninterrupted repetition of a foot. In these examples, feet are repeated only at the beginnings of successive melodic sections: incises (*Einschnitte*) and phrases (*Sätze*). If a given foot does not continue throughout such a section, it is complemented by Koch with free material. (Mirka 2009, 94–95)

A systematic corpus study is needed to confirm this trend and learn more about its scope. But if my hunch about this trend is right, it represents the reality that as the distance increased between a dance form like the Sarabande and the dance practice from which it originated, the syntactic functions of dancing became more flexible, until they disappeared altogether. The dance syntax recedes as generative structure and is replaced by other primary syntactic rules.

This does not just apply to dance syntax's hypermetric regularity or expectations that a motion would be repeated locally; the integrity of the characteristic rhythms themselves (and the metering constructions they activate) can also be compromised. Earlier, I said, "Even if the music is not accompanied by actual dancing, as long as these conventional accentual flows still have some cognitive reality as motional gestalts in the mind of a listener, motional syncopation can be said to occur." At what point in the progressive abstraction that characterizes the life of a dance topic does the gestalt of a characteristic motion fall apart and no longer determine aspects of rhythm, meter, and phrase structure? For example, Kofi Agawu labels the passage below (Figure 2.18) as a bourrée, but though it contains the characteristic iambic quarter-note upbeat, it has none of the two-measure polarity or eight-beat phrasing that Little and Jenne describe; the rhythm is essentially the same in every measure. In other words, is a quarter-note pickup by itself enough to trigger an expectation of Bourrée rhythm? The Sarabande topic is an even more extreme example: any indication of an emphasis on beat 2 in a slow triple meter is often taken to be an indication of Sarabande topic, even in pieces which contain none of the two-measure phrases characteristic of the dance in Bach's era. [34]

SUMMARY AND CONCLUSION: *Metrum* VS. METER

The strong/weak accent patterns of most basic dance rhythms are "ametrical" from the perspective of traditional theories of meter like that of Lerdahl and Jackendoff (1983) or London (2002). Several more striking examples are collected in Figure 2.19. Lerdahl and Jackendoff require beats at all levels to be spaced equally in time, but the bourrée dance rhythm which has occupied the largest part of this chapter is clearly not isochronous, as the even-numbered measures have a thesis that is three times as long as the one-quarter-note characteristic pickup. This prototypical bourrée rhythm is not even *maximally even*, a definition of temporal regularity which is looser than isochrony, and which has been explored by London, Butler (2006), and others as

[34] For example, John Irving (2014, 545) identifies the second movement of Mozart's Piano Trio in C Major K. 458 based on a few mfp emphases on beat 2. But this movement has none of the phrasing structure or characteristic rhythms associated with the Sarabande dance type by Little and Jenne (2001 [1991], 96–97). In contrast, the other Sarabande which Irving identifies in the same chapter (the second movement of Mozart's violin sonata K. 458) is so similar in characteristic rhythms and motives, phrasing structure, and key to Bach's Sarabande from the Cello Suite in Eb Major that one almost wonders if Mozart used this piece as a compositional model.

a possible criterion for metricality.[35] The gavotte, another commonly referenced dance topic, has a characteristic upbeat of two weak accents in a row, followed by alternating strong and weak accents spaced twice as far apart; this is not maximally even either. Many other dance rhythms are even more irregular when viewed through the lens of meter theory. Mersenne's *Gaillard* rhythm has the only strong accent on beat 6 of 6, and also has an uneven rhythm like the bourrée but also does not have a "well-formed hierarchy" (Lerdahl and Jackendoff 1983) because it places weak beats on downbeats. Mersenne's *Branle Gay* (Figure 2.1) and the eighteenth-century gavotte both break another rule mentioned by Lerdahl and Jackendoff by having two strong beats in a row, meaning that these dance meters also do not have well-formed hierarchies,[36] in addition to having uneven placement of beats/focal impulses. In other words, many of the dance rhythms break one or more constraints on meter that Lerdahl and Jackendoff and London propose, and the group of them collectively violate almost every criterion for metricality that has been proposed by previous scholars.

Additionally, while conventional theories define meter as the cyclical repetition of the same measure, dance syntax does not mandate the repetition of the same movement—indeed, as we have seen in Printz's treatise, larger-scale structure is created by the mixture of different movements or rhythmic feet. In the most extreme cases, meter is nothing but the cyclicity of the measure; for example, Yeston (1976) defines meter as simply the stratification of two periodicities in proportion, one defining the isochronous beat, one defining the ever-recurring duration of the measure. While

[35] Maximal evenness is a property of any set of points within a discrete space, in which the points are distributed as evenly as possible given the number of points and the topology of the discrete space. The bourrée rhythm is not maximally even because if the quarter-note upbeat were moved one quarter note earlier, the resulting rhythm would consist of isochronous accents spaced at durations of a half note, which would be more even. For a more extended discussion of maximal evenness, see Butler (2006, 84)

[36] "MWFR 3: At each metrical level, strong beats are spaced either two or three beats apart." (Lerdahl and Jackendoff 1983, p. 97)

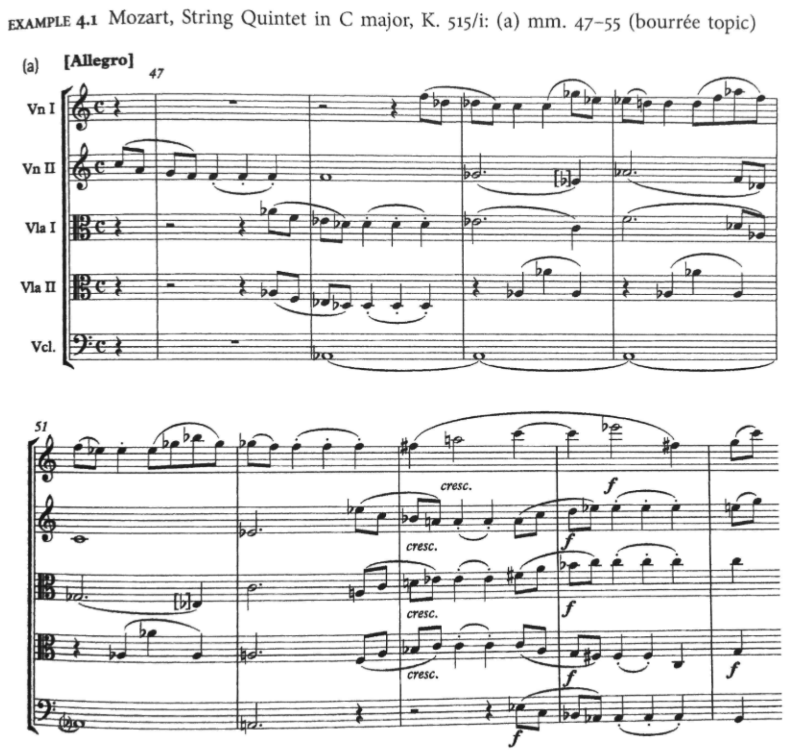


Figure 2.18: Mozart K. 515 Bourrée Topic, reproduced from Agawu 1991

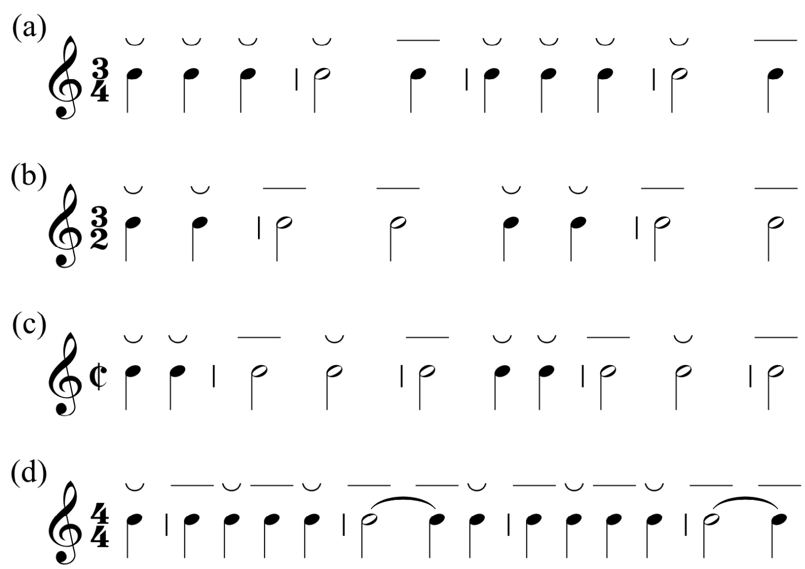


Figure 2.19: Table of dance rhythms: (a) Mersenne's Gaillard; (b) Mersenne's Bransle Gay; (c) Little and Jenne's Gavotte; (d) Printz's Bourrée

many eighteenth century writers define meter (Takt) in a similar way, they also undermine the centrality of this cyclicity by constantly referring to movement (*Bewegung* or *mouvement* or *Metrum*) as characteristic accents not represented by the Takt. Nicholas Baragwanath summarizes a similar principle from an 1850 treatise based on the teachings of the Neapolitan composer Zingarelli (1752–1837):

> While the dominant metre of a composition was determined by the principal accent of the verse and acknowledged by the choice of time signature and the placement of bar-lines, it was governed at all times (and, if necessary, annulled) by rhythm, whether drawn from the fluid natural accents of speech, the more rigid verse-feet of quantitative poetry, or the physical movements of dance. (Baragwanath 2014, 175)

Printz, Marpurg, Kirnberger, and others argue that good rhythm requiring consistent characteristic motion; but in the eighteenth century, at least, this did not mean repeating the same motion over and over. Instead, as Printz describes, this unity of motion comes from using the same motion at the beginning of phrases, hypermeasures, or sections, and there is ample room for more varied movement in between. And Kirnberger argues that musicians have to find the proper motion within *each* measure, not just identify the dance type/topic and loop the same motion throughout.

But even if these dance rhythms could be considered *ametrical* by the definitions of previous scholars, they still clearly afford the *function* of meter. These rhythms were the primary mode of entrainment for the dances, a rhythm which the musicians had to make instantly recognizable and which the audience relied on to keep their place in the dance (whether or not the dance steps "mirrored" the sounding rhythm exactly). Even after a dance was no longer performed in the ballroom, these rhythms lived on as characteristic accentual flows, which as Kirnberger attests were crucial to a musically effective performance of the given dance type. Thus the body movements of musicians performing these dance types should arise out of these characteristic rhythms, not a metronomic pulse with a well-ordered hierarchy of accents.

As the primary mode of entrainment, these dance rhythms also play an important role in listening. My earlier review of syncopation identified these dance rhythms as inner rhythms against which the sounding notes were measured in motional syncopation. Butler, in his later discussion, describes this "hearing against" as an important function of metering.

> I should note that in problematizing certain aspects of the rhythm/meter separation I do not intend to suggest that listeners never use a regular "background" to measure and evaluate a less regular "surface." Indeed, I have suggested that a strategy very much like this comes into play when listeners experience breakbeats and similar rhythms as "syncopated." However, I have tried to frame this strategy as just one possible window into what might be called "metering"; I have positioned it as a particular orientation involving "hearing against" rather than as the sole arbiter of rhythmic experience. (Butler 2006, 105)

Butler later associates the term "metering" with the use of the body to construe metric structure, rather than a passive discovery of an abstract, disembodied meter. Hearing music against the background of a particular rhythm creates rhythmic experiences of syncopation because listeners bring their own bodies into that background rhythm, which I have called the "inner rhythm" in my study of baroque dances. This inner rhythm is subjectively created or inferred by each listener, as an interpretation of the sounds they hear, guided by their knowledge of the musical style and the ways of moving through rhythm with which they are familiar.

Roger Mathew Grant, whose theory of unequal triple meter I mentioned earlier in the chapter, has made similar suggestions about how historically-informed conceptions about uneven rhythms are critical in metering and experiencing baroque music. As Grant shows, historical treatises from medieval times into the eighteenth century theorized meter in terms of *thesis* and *arsis* as motions of the hand, heart, or foot, meaning that (equal or unequal) meter was literally enacted or performed by the body. Grant even calls for the discovery of more uneven rhythms to be considered as a basis for entrainment, a means by which meter or measure can be created in both performance and in theory.

> Apart from suggesting modifications for our theories of triple meter, these pieces [. . .] invite us to envision yet other pieces under the same distorted lens: to see the inequality hiding just behind the surface of music in an otherwise familiar meter, or to be sensitive (at the very least) to the possibility of unequal division in triple settings. (Grant 2014, 78)

The baroque dance rhythms I have explored in this chapter realize Grant's description of "inequality hiding just behind the surface of music in an otherwise familiar meter"—and this mode of listening is corroborated by many eighteenth century writers including Printz and Kirnberger.

The syntax of dance rhythms I've developed based on Printz's theory also helps narrow a gap between the quantified, discrete structures theorized as meter and the messy variability of actual experience of rhythm. Hasty (1990, chs. 1–2) traces this paradox throughout the history of Western writings on rhythm, from Greek and Latin classics through the present day. The problem is well-summarized by William E. Benjamin's critique of Lerdahl and Jackendoff, in which he argues that "In their view, the metric structures of tonal music are shallow (comprehending few levels), obvious from the standpoint of proportional organization, invariant over time, and hardly different from one piece to the next" (Benjamin 1984, 359). The structures identified as meter in conventional theories are rigid, and so abstract they hardly seem to convey anything at all about the actual rhythm of a given piece. Two pieces nominally notated in the same meter can sound and feel so completely different as to be nearly incomparable—take, for example, a Mozart piano sonata in 4/4 and a 4/4 transcription of Led Zeppelin's "Rock 'n Roll."

While the 4/4 meter of these two examples can be easily notated and counted, the remaining rhythmic qualities which separate them have often been characterized as ephemeral, gestural features whose shape and feeling is impossible to even describe. Nicholas Baragwanath summarizes this disjunction neatly in describing the ideas of the late-18th-Century musician Zingarelli

> as a historical example of a 'drastic' approach to conceptualizing music, in Carolyn Abbate's terms; one that recognized the priority of unruly human performance over abstract rationalization, in contrast to the better-known 'gnostic' theories of Sulzer, Schulz, Kirnberger, and Koch, with their emphasis on notated rather than performed melodies and their subordination of rhythm (as spoken, sung, or played) to readily quantifiable metric grids. (Baragwanath 2014, 159)

The late-eighteenth-century German writers Baragwanath lists all theorize rhythm in terms of this separation between an abstracted or generalized, but quantifiable theory of meter on the one hand; and ineffable qualities of rhythm, variously referred to as *mouvement*, *Metrum*, or *Bewegung*, on the other.

Although it is ultimately impossible to capture an experience of performed motion in a fixed form like a musical analysis, my theory has sought to narrow the gap between metrical structure and rhythmic experience. As I mentioned in my analysis of the rising scale figures in the Bourrée II from BWV 806, the characteristic rhythms and accentual flows that I theorize as the Bourrée metering construction do not represent all aspects of rhythmic motion in this piece. A metering construction is still an abstraction or generalization. But it is an abstraction that is much more vivid and descriptive than traditional concepts of meter.

Chapter 3

Motivic Motion as Meter in Late-Romantic Chamber Music

Whether notated or heard, variable meter seems to be an integral component of late Romantic and early Modernist classical style and thinking. For example, Walter Frisch analyzes the song "O Tod" by Johannes Brahms (originally in 3/2 meter) by inserting new barlines to convey a constantly-shifting felt meter which he experiences hidden beneath the original notation: first in 3/2, then 4/2, 3/2, 2/2, and even 1/2 (see Figure 3.1). Frisch's analysis is part of a book extending arguments first laid out in an essay "Brahms the Progressive" by Arnold Schoenberg, perhaps the most influential musical thinker of the twentieth century. Schoenberg offers such whimsical rebarrings (representing felt meter) as counter-evidence against the 19th-century rhetoric that Brahms was a backwards-looking classicist; this rebarring shows Brahms literally "thinking outside the box," unconstrained by the square rhythmic regularities of regular notated meter.

Schoenberg projects this kind of thinking not only onto the music of his contemporaries and most recent predecessors, but reads such vivid, variable motion deep into the Classical tradition.

Figure 3.1: Frisch's rebarring of the opening measures of Brahms's "O Tod"

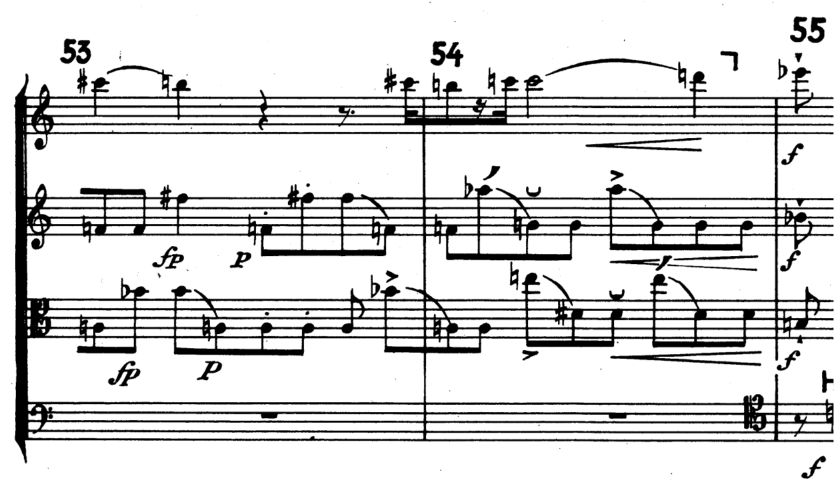


Figure 3.2: Schoenberg using prosodic symbols for strong/weak accents, in his String Quartet No. 4, mvt. I, m. 54 in the Violin II and Viola parts. Note that the two parts are supposed to play "strong beats" in different locations, but following a similar three-note descending-ninth motive.

> A wise performer, one who is indeed a 'servant to the work,' one who possesses the mental elasticity of a rank equal to that of a musical thinker—such a man will proceed like Mozart or Schubert or others. He will systematize irregularity, making it a component principle of the organization. (Schoenberg 1950, 70)

These issues of variable meter and irregularity become even more important in the twentieth century, when composers such as Schoenberg and Stravinsky often notated variable meters explicitly in their scores. And even when these composers write regular barring, they often betray this regularity with other features of notation. For example, Schoenberg sometimes imports strong and weak symbols from classical theories of prosody (see Chapter 2), and he instructs the performer to "play this as if it were a strong beat" (see Figure 3.2). Composers also use accents and beaming and other features to indicate felt beats running against the written bar lines.

Traditional theories define meter as accentual regularity, so that the only explanation they can give for why such irregularities are often experienced as variable meter is to view such interpretations as surprises, deformations pushing against an ontological assumption of metrical regularity. Gretchen Horlacher argues that while Stravinsky's music often violates the regularity of conventional theories of meter, "Most of us would be loath to accept an a-metric view of Stravinsky's music; rather, manipulating meter seems to be a major part of Stravinsky's developmental technique" (Horlacher 1995, 290). Horlacher questions the dependency of meter theory on periodicity, and clearly demonstrates the incompatibility of Stravinsky's music with such theories. She persuasively argues for "a kind of meter which is not shackled to periodicity, and which allows aperiodic material to assume a fundamental rather than derivative role" (1995, 290). But she provides neither a systematic model of this kind of meter, nor a justification of how exactly it is that the irregular barrings she suggests can *function as meter*.

In this chapter, I will use *musical motives* as a theoretical unit to resolve some of these problems—to show how variable meter can function as a metrical interpretation comparable in many ways to traditional fixed meters. (I will consider the natural accents of text and several other types of musical construction in Chapter 4). Motives are familiar melodic/rhythmic shapes used throughout a composition (like "dun-nuh-nuh" theme in the opening to the movie *Jaws*, or the "dun-dun-dun-DUN" opening to Beethoven's Fifth Symphony). I will define motives in more detail later, but the crucial move I make in this chapter is to think about motives as *motions*. As motions, motives can afford experiences of (variable or fixed) meter, which I will explain using the motion-based theory of metering constructions I've developed in previous chapters.

Ultimately, my purpose is not just to understand motives and variable meter, but to reflect an important corollary back to a general theory of meter(ing): periodicity and cyclicity are not preconditions for feelings of beat and entrainment to rhythmic motion—in short, for experiencing music as metered. This re-stages the broader argument I make in this dissertation that a listener's metrical interpretation is created through recognizing metering constructions as possibilities for moving with the music. In this chapter I will frame this broad argument in terms that will highlight motives' capacity for rhythmic development and flexibility. Experiences of meter can be created by any music which affords a clear sense of *metrical order* and *metrical orientation*, concepts which I will explain further in the course of this chapter, and which are clearly afforded by most motives.

Most of this chapter will focus on gathering and synthesizing the many insights previous scholars have made about the relationship between motive and entrainment, and to ground these insights in terms of my theory of metering constructions. Most of the key points I make about motives in this chapter have already been made by other scholars, especially Gretchen Horlacher. Horlacher's concept of "metrical identity" (1995, 288) provides the core concept through which I developed my own ideas on the topic, and her approach to motivic development and motion in her 2011 book *Building Blocks* lays the foundation for my thinking about motivic transformations. To a certain degree this chapter is an attempt to build a general theory of meter that can accommodate the ways of hearing Horlacher has already described.

The end product of this work will be a *motional cognitive model of motive*. The term "cognitive model" comes from Lawrence Zbikowski's work on motive, but as I will explain later, I have changed the construction of these models to focus on motional flow and metrical affordances. Using these motional cognitive models, we can understand how motives' essential motions may remain legible through fragmentation, augmentation, extension, and a variety of other distortions.

Focusing on motion in this way will help to overcome some of the static, universalized, abstract sameness which plagues traditional metric analysis. In describing certain West African rhythmic practices, Kofi Agawu suggested that "Whereas a metronome notionally marks time rather than carves time, a time line uses a carved rhythmic pattern to mark time" (2006, 7). Motives in late Romantic and early Modernist classical music are "carved rhythmic patterns," and by focusing on their motional flow (not just on where a beat might be felt) I will show how listeners can mark time with the carved rhythmic patterns of motives in ways that are more flexible and variable than the cyclic timelines of African drumming. Following comments by Schoenberg, and similar arguments in Chapter 2, I will argue that sensitive and stylish performances of classical music rarely resemble the metronomic regularity of past theories of meter, but are often more like sequences of changing and alternating carved pieces of time, always full of movement and development.

This chapter will also begin to broaden the conception of metering constructions in previous chapters, away from relatively fixed schemas with a predetermined duration, and moving instead towards less definite patterns. Previous chapters have focused on how metrical constructions can be reified as cultural knowledge, internalized through repeated exposure, developed and transmitted through practice, and deployed in listening and performance as (relatively) fixed motional prototypes. But this chapter will focus more on the ad-hoc improvisational flexibility of motivic hearing. The methods developed in the chapter for understanding the often especially fragmentary and mercurial use of motives in the late-Romantic and early Modernist classical music. This conceptual progression away from fixity will be taken to its logical conclusion in Chapter 4, which focuses on recitative in Baroque opera, a tradition of unmeasured recitation which nonetheless affords rhythmic entrainment in a variety of ways, and thus can be included in a theory of metering.

This flexibility and irregularity is neither a "first-time hearing" like Christopher Hasty's projective analyses, nor a "final-state hearing" like Lerdahl and Jackendoff's metrical grids, but is characteristic of any moment in a process of hearing which is essentially improvisatory. A metrical interpretation is not something fixed that is uncovered or arrived at, but is a performative hearing that always remains open to improvisatory revision. This is not to say that a metrical hearing of a motive is entirely ephemeral or arbitrary. An initially improvised metrical interpretation can be applied throughout a single piece, and enter long-term memory, from which it can continue to be rehearsed or applied in subsequent hearings of the piece, or even in other pieces if the motive is cited elsewhere.[1] A motive may also have certain affordances for meter based on universal properties of human cognition, or style-specific implications of fea-

[1] See Reynolds 2003 for an in-depth account of motivic allusion between different pieces and composers.

tures in sound such as certain pitch movements, instrumentations, and articulations, and these built-in affordances often make many hearings of a given motives similar or at least compatible (for example, see London's 2002 article about "Cognitive Constraints on Metric Systems"). But such affordances or prior hearings never *determine* a motive's metrical interpretation, instead merely serving as a starting point for what remains an essentially improvisational process of construal.

DEFINING MOTIVES AND THEIR INCOMPATIBILITY WITH PAST THEORIES OF METER

What is a musical motive? I prefer the American spelling, but there is an illuminating definition given under the British "motif" in the Oxford English Dictionary: "1. A single or recurring image forming a design" or "2. A distinctive or dominant theme in a work of art." A musical motive is often described as a short gesture that generates the character of a piece and forms the building blocks for longer melodies and themes. Lawrence Zbikowski argues that motives are the "basic level" of our perception of musical structure, the smallest recognizable units of a piece which, in succession, form a basic fabric of coherence by which we understand a piece to be more than random notes (2002, 25–30; more from Zbikowski soon). But motives are also *motions*; the origin of "motif" is the Latin *motivus*, a conjugation of the verb *movere*, or "to move." To hear a series of motives giving rise to a coherent structure is to hear a piece structured by motion.[2]

[2] My conception of motive essentially follows Schoenberg's use of the term. Zbikowski notes that Schoenberg's use of motive implies a sense of distinct rhythmic shape which differs from how the term used by Schoenberg's contemporaries. Specifically, "Both Schenker and Réti regard specific intervallic relationships as constituent of motive; rhythm and contour are regarded as secondary aspects of motivic organization. The difference between Schenker's or Réti's conception of motive and that of Schoenberg lies with Schoenberg's notion of coherence and the role it plays in making music comprehensible." (2002, 26–27)

Each motive has a "metrical identity," a set of inferred implications for felt beats and perceived meter. This term was introduced by Gretchen Horlacher in a groundbreaking 1995 article "Metric Irregularity in *Les Noces*: The Problem of Periodicity." Horlacher argues that "by repeating a melodic fragment previously associated with a stable metric identity, Stravinsky enables the listener to make a metric adjustment, to reinterpret locally a fragment in light of its earlier metrical associations" (298). In other words, a motive used throughout a piece can somehow carry metrical implications with it, referring back to its original metrical context. The motional shape of a motive can be a cue for hearing meter—a metering construction.

There is a fundamental ontological incompatibility between the idea that a motive seems to carry a motional shape and metrical identity into any context, and traditional definitions of meter based on strict periodicity. Christopher Hasty characterizes these traditional definitions of meter as "quantitative" theories.

> According to the quantitative view meter arises from the measurement of durations. Measurement is carried out through the regular grouping and consequent addition of equal durations or "time-spans." [...] For the formation of meter two things are necessary: first, a continuously recurring unit of measurement of fixed duration and second, the recurrence of an event which has as its duration a multiple of the unit of pulse. (Hasty 1981, 185)

For example, Fred Lerdahl and Ray Jackendoff suggest that the sensation of meter is produced by the regular alteration of strong and weak beats (1983, 68), and provide a list of Metrical Well-Formedness Rules which generate the set of hierarchies that can produce this kind of strict regular alternation (72). This quantitative approach also characterizes the basic definitions of meter by meter scholars including Yeston (1976), Krebs (1999), London (2004)—in short, all the canonical theories of meter written since Cooper and Meyer (1960).

Hasty contrasts this quantitative approach with a qualitative perspective, in which meter is primarily determined by shape and motion and not by periodicity or precisely measured durations.

> According to this view the essential aspect of meter arises not in the measuring of durations but before the measuring, in the internal relations of pulses. These relations are of a dynamic order and require the concept of motion to be understood. The successive pulse events are not neutral or characterless until grouped by a slower pulse. Rather there is a continuous motion from the beginning of one cycle to the beginning of another. (Hasty 1981, 187-188)

Qualitative accounts of meter have largely existed at the fringes of meter scholarship,[3] and their insights have not been integrated into the heart of any general theory of meter—except Hasty, whose 1997 book is based in the qualities of durations. But in this chapter I seek to add to Hasty's insights by exploring how physical motion or the application of knowledge of motives and other constructions could contribute to a qualitative theory of meter.

The relative paucity of qualitative meter approaches is partly due to a large cognitive science and psychology literature on rhythm perception which focuses almost entirely on the perception and production of periodicities, often outside of fully musical contexts. Most music theory writing about rhythm and meter in the last few decades has focused on integrating these empirical results with traditional music theory perspectives, or theorizing harmonic geometries of abstract, fixed periodicities. Such is the state of the field that Roger Mathew Grant, entirely without hyperbole, equates a significant portion of modern meter theory with eighteenth-century formalisms.[4] A strand of scholarship about qualitative perception of durations descend-

[3] This includes writings which explicitly focus on other topics, such as Rothstein 1989; research confined to one specific style, such as Butler 2006 or Ijzerman 2011. The small amount of research along these lines which is explicitly about meter and which claims more universal relevance has not been yet assimilated into any general theories of meter, including Horlacher 1995 and 2000, and Ito 2013.

[4] At the end of an article describing Leonhard Euler's theories about rhythm and meter, Grant de-

ing from Hasty's 1997 book would be the obvious exception. But as revolutionary as Hasty's 1997 book was, it was still primarily concerned with durational recurrence (specifically the measuredness of unfolding durations and projections of duration) not with other aspects of motion or rhythmic shape. And in spite of Hasty's followers, the quantitative approach to meter largely remains the default for discourse about rhythm across music theory and related disciplines of musicology and music perception.

Theorists have tried and failed to reconcile this fundamental ontological incompatibility between metrical identity and the predominantly quantitative theories of meter which have dominated the field. In the context of metered music, theorists have provided different accounts of how motive can conflict with or upset meter. Pieter van den Toorn argues that when a motive is "metrically displaced" in Igor Stravinsky's music (in other words, when a motive begins on a different beat from when we first heard it), it can undermine our perception of a stable "background" meter. Gretchen Horlacher goes one step further and argues that the same Stravinsky motives can force us to abandon a meter and hear a new meter determined entirely by the motive, but an "aperiodic" kind of meter in which irregularity is normative.

> ...a kind of meter which is not shackled to periodicity, and which allows aperiodic material to assume a fundamental rather than derivative role. This perspective suggests that careful listeners can make sophisticated decisions about irregular metric events if those events fall into perceptible patterns and thus provides a definition of meter that is more flexible than that afforded by the periodic model. (Horlacher 1995, 290–291)

Lerdahl and Jackendoff suggest that some of their rules might be dropped to characterize music like some pieces by Stravinsky in which "strong beats will be heard whenever there are appropriate local details" (97), but they do not consider in detail

clares: "Or, to put things in their proper chronological place, perhaps we might see our current theories through the lens of this eighteenth-century formalism and begin to see how much like Euler's theory they already are." (Grant 2013, 280) how this kind of hearing would be structured, or resolve the contradiction between this relativity and their ontological basis for meter as strictly regular alternation. William Benjamin, also analyzing Stravinsky, argues that these motive-based feelings of motion are not meter at all.

Motives can also occur in more freely-timed music, and theorists have equally mixed opinions on how these structures relate to meter. Mitchell Ohriner (2016) argues that freely timed passages featuring recurring motives in Turkish folk music are entirely unmetered, but lead to a completely different form of attending. Mats Johansson (2017), in a study of a Swedish polska tune with particularly irregular rhythm, comes to a similar conclusion, noting that while there is no consistent pulse or other level of periodicity, distinct motives tend to have a similar timing profile when they recur. On the other hand, Job Ijzerman (2011) suggests that motive-like contrapuntal structures in Louis Couperin's "unmeasured" harpsichord preludes are homologous to traditional meter.[5] I will revisit each of these writers' analyses later in the chapter, but it is clear that there is no consensus on the relationship between motive and meter.

In summary, none of the scholars who write about motive successfully resolve the inherent contradictions between motivic hearing and quantitative general theories of meter. More often than not, they suggest instead that the hearing of motive-based metrical implication has a separate ontology than "normal" metered music, whether they admit this less-periodic attending as "meter" or not.

Each of these scholars has uncovered important insights about the perception of rhythm and meter as they struggle to reconcile motivic hearing with traditional the-

[5] These structures are not motives in any conventional sense, more like conventional contrapuntal schemata than distinct melodic/rhythmic ideas. But in one sense, the way Ijzerman hears these structures is like motives as described by the other authors cited in this paragraph: these contrapuntal structures are heard to imply metrical beats through qualitative relationships regardless of duration. I will return to evaluate this difference further when I consider Ijzerman's arguments in more detail in Chapter 4.

ories of meter, and the primary goal of my work is to synthesize these insights and integrate them into a general theory of meter that can accomodate motive-based metrical interpretation. Framing motives as metering constructions allows me to generalize, analyze, and explain the hearings Horlacher and others describe, and quantify how they can feel predictable (or at least entrainable) despite their irregularity.

But the ultimate purpose of this theory of motive-based metrical interpretation is to use this conception of motives as metering constructions to integrate motivic hearing and regular meter within the same ontology of embodied rhythmic interpretation, instead of a separate "kind of meter" as Horlacher and others have suggested. This contributes to the larger project of this dissertation, which is to develop a motional theory of metering—meter as a flexible, improvisational, in-time process of embodied construal rather than a fixed structure. In this chapter, I will demonstrate that "normal" periodic attending and entrainment to motivic motion draw on the same cognitive and performative processes: hearing motional possibilities in music, inferring where performers and other participants are likely to feel beats, committing to one of those possibilities with a felt beat, and thus joining a group of fellow humans moving together.

Motive as a Motional Category

I've framed motive as motion, but what is the relationship between that felt motion and metrical identity? In her analyses, Horlacher applies the concept of metrical identity both to the meter implied by a phrase as a whole, and to the metrical accent or quality associated with individual notes of a phrase.

> Because these bars serve as a prototype for the phrase, it is worth noting the accentual characteristics of each of the four pitches. [...] That the pitch D can be heard in all three of these metric contexts will be important to us later. The other three

> pitches, however, are each assigned only one metric identity: C and E are each off the beat, while F occurs on a beat. (Horlacher 1995, 288)
>
> Should one assign a new metric identity to a motive in order to continue counting periodically, or break the periodicity in order to preserve the motive's metric identity? Alternatively, one could argue that there is very little sense of periodicity in the phrase as a whole. (Horlacher 1995, 289)

These quotations tell us that for Horlacher, metrical identity is a shape that governs an entire motive, and is generated or invoked by that motive's appearance, by the relationships between the many notes that constitute the motive. But this shape is also manifested in the metrical valence of individual notes (whether they are on- or off-beat). The metrical valence of individual notes and the larger shape of the entire motive are co-constitutive, just as the high point of a parabola and the curving lines that lead to it are mutually co-constitutive—one implies the other's existence, and these are dual perspectives on the same phenomenon. This resonates strongly with Ito's insight that most human motions are generated by and coordinated around focal impulses, peaks of energy and attention that provide the main energy for a motion; theorists of motor coordination suggest that motions are organized around these impulses, adjusting the momentum of the focal impulse while remaining within the same guiding motor program. Within my motional theory of meter, I consider musical motion to be a path that is not only anchored by beats or focal impulses, but also helps generate those beats.

Though he does not use the term "metrical identity," Charles Rosen has some insightful comments along similar lines about the rhythmic shape and gesture of motives throughout his short book *Arnold Schoenberg* (1996 [1975]). Rosen argues that Schoenberg's conception of motivic shape is inherently both rhythmic and tonal, which is to say that rhythmic motion and melodic/tonal motion are inextricably linked, or even co-constituted.

> Tonality is more than a harmonic system (although it is sometimes convenient to speak as if it were only that). It carries with it a complex set of presuppositions about melody, rhythm, and form, none of which can exist independently of the others. (Rosen 1996, 30–31)

Rosen's description of "tonality" appears remarkably rhythmic, articulated by senses of motion and closure as much as any systematic coding of specific melodic intervals or vertical harmonies. The melodic motion of a motive is thus inherently rhythmic and metrical as well.

Rosen builds towards describing the shaping of motives by describing the consonance and dissonance of individual notes as a motional quality. For Rosen, dissonance is not a static, immanent property of vertical harmonic sonorities as it is defined in many tonal harmony or counterpoint treatises. Instead, Rosen defines consonance and dissonance in terms of their motional qualities of closure.

> It is precisely this effect of ending, this cadential function, that defines a consonance. A dissonance is any musical sound that must be resolved, i.e., followed by a consonance: a consonance is a musical sound that needs not resolution, that can act as the final note, that rounds off a cadence. (Rosen 1996, 24)

A network of formal relations in many different parameters together create the "effect of ending," and it is the anticipation of cadence and motion towards this cadence that Rosen describes as dissonance. As I will explore more deeply in the next chapter, many formal relations traditionally viewed within isolated analytical parameters (pitch movements, tonal changes, melodic contours, durational ratios) not only have conventional associations with one another, but also have motional implications or affordances.

Rosen's thinking about this motion resembles Leonard Meyer's theories about expectation and emotion in music. Rosen posits that "There is, in short, no definable difference between the emotional significance of a chord and the formal relationship of the chord to the other notes in the work of music" (Rosen 1996, 18). Meyer similarly suggests that musical affect and emotional states are triggered by the activation of certain tendencies or patterns by musical structure, followed by either inhibition or resolution. He defines these tendencies as follows:

> A pattern reaction consists of a set of series of regularly coincident mental or motor responses which, once brought into play as part of the response to a given stimulus, follow a previously ordered course, unless inhibited or blocked in some way. (Meyer 1956, 24)

Like Meyer, Rosen grounds meaning in our experience of the "formal relationships" between notes, whether they resolve as expected or upset our expectations to create surprise (whether positive or negative). This perspective has become prominent in recent music theory, especially due to the popularity of the schema theory promoted by Meyer's student Robert Gjerdingen (1988, 2007). But as far as I am aware, these recent analyses of expectation have largely focused on the abstracted schematic orderings of pitch, and have not explored the motor and motional aspects of musical expectation and change, aspects which are clearly indicated in both Rosen and Meyer's writings.

In Rosen's analyses, this "formal relationship" of dissonance as motion towards consonant resolution is reiterated by his statements that within each motive, tonal and rhythmic motion are inextricable. Motives are a kind of motional gestalt which spans several notes into a single characteristic gesture.

> Neither melody nor motif is a simple linear succession. "Motif" is a succession, generally short, with a latent power of development, of variation, of creating a larger continuity. [...] The power of development and variation that lies in a motif is given by the context of tonality, above all by the function of dissonance and consonance: it is this that allows a motif to imply movement, that gives it a propulsive force. [...] Motif generates melody: that is the traditional relation between them. Nevertheless, the generative powers of a motif means that it already contains a melodic structure in miniature. In Bach and in the Viennese classics, three or four notes contain the structure of dissonance-consonance and so sound as a memorable, self-contained unit. (Rosen 1996, 99–100)

Since melody and rhythm (and meter) are inseparable, Rosen's description of a motive as a "structure of dissonance-consonance" that "sounds as a memorable, self-contained unit," with "movement" and "propulsive force," points towards a sense that metrical identity is inherent in a motive—that this melodic/rhythmic motion is constitutive of what a motive *is* and how we perceive it, and that the same pitches or rhythms with a different feeling of motion would be *another motive entirely*.

This same conclusion has been suggested several times by theorists writing about meter. A classic experiment by Sloboda (1983) reported an experiment in which six pianists were asked to sight-read two versions each of several melodies in 4/4, with the versions identical except that one had the barlines displaced by one quarter note beat. The experiment was intended to measure the means by which musicians convey meter, but a notable incidental discovery was that none of the subjects recognized that the melodies were the same, even with this relatively minimal re-barring. London amplifies this argument with a radical rebarring of "Happy Birthday," showing that many children's first melody is rendered unrecognizable with a complex variable meter (see Figure 3.3 below). A similar concept is described by Steve Larson, in the context of an argument that a rhythm is more than just a set of durations, but a feeling of flow through those durations: "Because the quality of flow has changed, the rhythm has changed—even though the durations are the same" (Larson 2012, 141). The identity of a melody or rhythm, our basic conception that a certain sequence of notes or durations "is the same," is fundamentally tied to the rhythmic/metric interpretation or motional flow we hear through those notes.

Zbikowski picks up on this theme of identity and theorizes motives as categories of similar, functionally equivalent melodies, proposing that motives form the "basic level" of musical categorization and hearing. The basic level is a concept cog-

Figure 3.3: London's rebarring of "Happy Birthday" (2006, 136)

nitive scientists have invented to describe why humans do not seem to initially identify an object from its broadest or most specific categorization, but automatically start somewhere in the middle. For example, cognitive studies have shown that when encountering a furry animal on the street, the human brain immediately thinks "cat" rather than "vertebrate" or "adult Siamese-Persian mix with its claws removed." Motives in music are the "level of maximum utility" (Zbikowski 2002, 31) as opposed to more or less specific levels of categorization, such as "any musical phrase" or "the five notes which appear in bar 51 in the violin part." Zbikowski notes that in general studies of cognitive categories (in other words, in non-musical domains of perception and cognition),

> The basic level is the highest level whose members have similar and recognizable shapes; it is also the most abstract level for which a single mental image can be formed for the category. The basic level is also the highest level at which a person uses similar motor actions for interacting with category members. (Zbikowski 2002, 33)

This description of the basic level is particularly appropriate to the inherent motion of musical motives, which have often been described as having characteristic shapes or motions. I argue that this characteristic shape or motion is what fundamentally defines a motive, and gives all examples of a motive the sense of equivalent function that binds them together as a category.

Zbikowski, however, does not define motives as motions, but instead defines them through correlated sets of notational parameters. Giving a brief introduction to category theory will help elucidate his perspective. Modern theories of cognitive and perceptual categories almost universally object to what many call "classical categories," categories which are defined by an explicit rule of inclusion or exclusion as in mathematical set theory. For example, one such rule for the category "Americans" might be citizenship status, which would distinguish all US citizens as "Americans" and all non-citizens as "not Americans." As current debates over illegal immigrants and past debates over "un-American" communist activity might suggest, such binary membership rules do not often accurately represent actual human perception and behavior.

Lawrence Barsalou explains that one of the main reasons classical categories are inadequate to describe human knowledge is that in many circumstances, humans think and talk as if there is a range of how well an object fits into a category, rather than a binary distinction between inside and outside the category (Barsalou 1992, 30). Many recent models which try to account for this concept of "graded membership" or "typicality"—which structures the internal space of a category and in some cases could mean that a category does not have a strictly defined boundary—collectively can be described as "prototype category" approaches. In these models, a human extrapolates some kind of prototype from previously encountered exemplars, and membership and typicality of a new exemplar are judged by how well it fits this prototype.

But what does a prototype consist of? Cognitive scientists have proposed competing models, but Barsalou observes some common strategies (Barsalou and Hale, 1993). One is an exemplar-based model, in which a specific known object becomes the prototype, and each new exemplar must be compared wholesale to this object. This strategy does not easily account for humans' ability to easily extrapolate categories to include exemplars with traits they have not seen before; for example, a green dog may have a color unlike any other dog you have seen, but it is still easily recognizable as a dog. Another approach describes a prototype as a list of features; if a new object matches all of the features in this list, it is deemed a typical instance of the category, and the fewer of these features it matches, the more atypical of an example it is. Barsalou criticizes this approach for failing to distinguish between attributes which play a central role in defining a category, and those which represent features which exemplars in a category share coincidentally; and also for neglecting how these attributes influence one another and function in their contexts.

Another approach to modeling prototypes which attempts to better represent the complex relations between attributes is a theory of "frames" or "conceptual models," which describes not only a list of attributes and values, but a network of correlations and causations between these attributes and values. Barsalou has advocated extensively for this approach, and it is the one Zbikowski has adopted in his study of motives as categories. For example, the following correlated elements form Zbikowski's cognitive model for the *Leidensmotiv* from the prelude to Wagner's *Tristan und Isolde*:

> -an ascending sixth, followed by three descending halfsteps
> -the rhythmic pattern 6/8 E—DQ - E—DQ -
> (Zbikowski 2002, 50; Zbikowski's score example illustrating instances of the *Leidensmotiv* is reproduced as Figure 3.4)

This simplified model does not account for orchestration or dynamics, which Zbikowski admits surely play a role in characterizing the motive. They do: the Leidensmotiv tends to have a specific dynamic hairpin which emphasizes the ultimate arrival note, which is always on a downbeat and in many cases of the Leidensmotiv also happens to be the point of departure for the rising chromatic Sehnsuchtsmotiv. But the features of melodic intervals and rhythmic durations which Zbikowski's model does account for are correlated in perceptually significant ways: the ascending sixth always occurs as the eighth-note pick-up at the beginning of the motive.

While Zbikowski's conceptual models of motive do include relations between attributes, they are still based in notatable attributes alone, and I argue that these parameters are at best indirect traces of the perceptual function of a motive: felt motion. In an article critiquing deep and widespread misunderstandings of prototype theory, George Lakoff cautions against any model of categorization based in attributes.

> As I have argued elsewhere (Lakoff 1986), the properties that are relevant for the characterization of human categories are not objectively existing properties that are "out there" in the world. Rather they are "interactional properties," what we understand as properties by virtue of our interactive functioning in our environment. [. . .] This view is in keeping with results on basic-level categorization. The determinants of basic-level categorization are all interactional in this respect: perception of overall shape, motor movements relative to objects, mental images. Each of these is a matter of interaction between people and objects. They are neither wholly objective nor wholly subjective. (Lakoff 1999 [1987], 392)

Lakoff then spends the rest of his chapter elaborating many diverse ways in which humans' interactional understandings can deviate from the statistical realities of measurable attributes. Instead, Lakoff argues over and over that humans' categorization

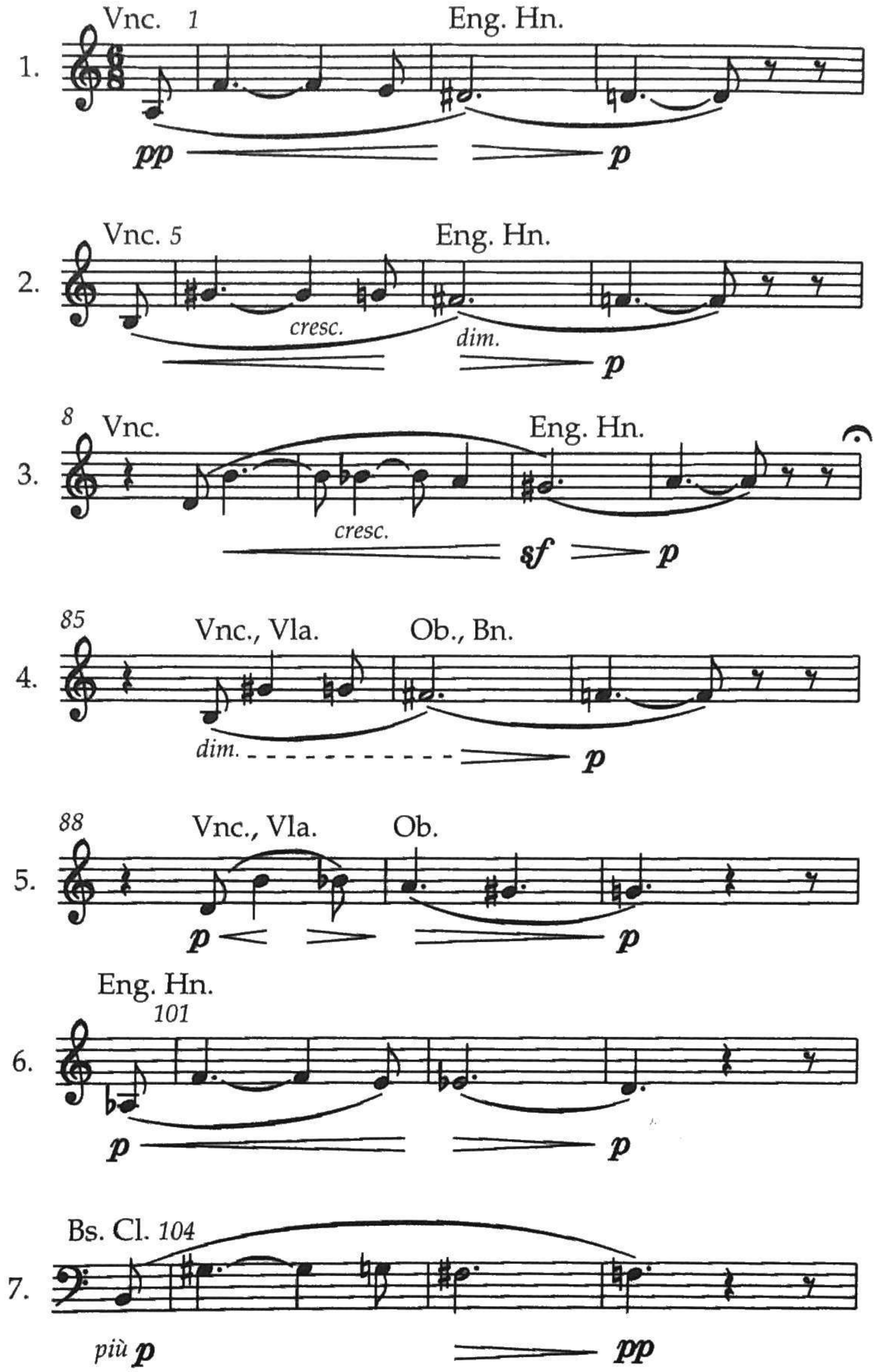


Figure 3.4: Zbikowski's *Leidensmotiv* examples (2002, 24)

can be most accurately described by overlapping combinations of "cognitive models," schemas or scripts which are simplified and idealized representations of real contexts. Accordingly, while notated parameters are easier to measure and transcribe, the judgments we make as listeners about whether two musical passages are "the same" has more to do with our motional schemas, embodied knowledge of how a motive moves and how to move with it, than with exact pitch or duration.

The perspective of the observer, their mode of interaction with an object, and their intent or purpose in categorizing that object shape not only which features are most important in deciding category membership, but also what aspects of an object are even perceived to be features in the first place.[6] In the Introduction, I suggested following Tomlinson (2016) and Tomasello (2008) that one of the principal goals of music-making is *moving together*, motivated by our human preference for cooperation and creating shared intentionality. Tomlinson and Tomasello each argue that this desire for cooperation, copresence, and shared attention is hardwired into human brains and a crucial constitutive part of what makes us human. To be human, then, is to want to move together, to desire to participate in the motional flow of music. This is evoked especially well by Zbikowski's observation that the basic level is inherently tied to "recognizable shapes" and "similar motor actions." My conclusion is that the "goal" of motivic categorization is the identification of rhythmic shapes as affordances for moving with, participating overtly through actual performed motion, or covertly through feeling along with heard music. Listeners do not separately perceive features like beat, tonal stability, and melodic contour, but experience these parameters interwoven into gestalt motional shapes. This sense of motion is the unifying force which correlates diverse features or parameters into a memorable theme.

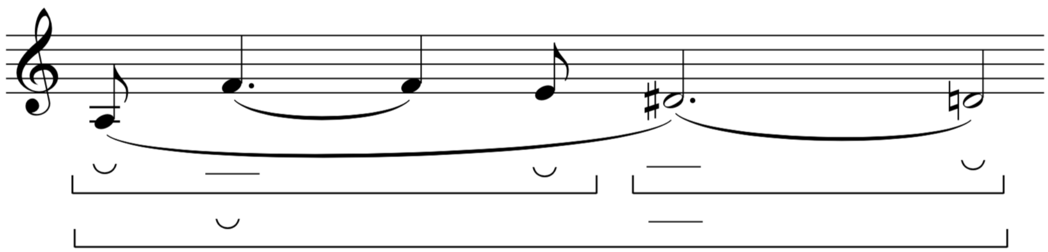
[6] This is a key insight of James J. Gibson's theory of situated and embodied cognition as presented in The Senses Considered as Perceptual Systems (1966).

Following a recent article by Mitchell Ohriner (2016—I will explain more in the next section), I will analyze the shape of a motive as a series of stages, a flow with specific focal impulses that progresses through certain motional qualities. I ground this use of the term "stages" in Robert O. Gjerdingen's definition of galant voice-leading schemata.

> For the midsize schemata that are the subject of much of this book, aspects of this form/content interrelationship are captured by the terms *event* and *stage*. Take, for example, an imaginary music schema with three events occurring in a predictable order, say A-B-C (see fig. 1.1). In a simple presentation each event may constitute its own stage, as when, for example, A, B, and C are each a single chord. But in a more involved presentation, the core events may function as points of reference or as signs of punctuation. In that case, *stage* refers to the longer utterance into which the *event* is embedded. (Gjerdingen 2007, 22)

The flow through these stages will be illustrated by strong and weak accent symbols to indicate dependency and focality rather than loudness accents, following Cooper and Meyer's work (as explained in Chapter 2). Defining a motive in such schematic and motional terms allows for and helps to identify divergently notated variations which can be recognized as the same movement, but also allows fragmentations and distortions of that motional logic to be analytically measured and compared to the original. I will call this a *motional conceptual model*, to emphasize the primacy of motion in my adaptation of Zbikowski's conceptual model approach to motive.

Figure 3.5 shows my motional conceptual model for Wagner's *Leidensmotiv*. It includes both the *Leidensmotiv* proper, and the *Sehnsuchtsmotiv*, which often rises out of the ending of the *Leidensmotive* as a kind of after-beat. While I have included a notated example of the motive and aligned the stages with it for clarity, I should re-emphasize that this notation does not form the prototype of this model. Instead, the prototype of the motional conceptual model is the characteristic motion represented by the rhythmic qualities indicated by the hierarchy of strong and weak accents, and by the descriptive



Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
Short note	Long note	Short note	Long note	Long note
Often leaps a 6th		Chromatic descent	Chromatic descent	Chromatic descent
Upbeat	Strong beat	Weak beat	Strong beat	Any beat
	Arrival	Anacrusis		Continuation, but not Anacrusis
	Crescendo	Crescendo	Dynamic peak	Decrescendo

Figure 3.5: Motional Cognitive Model of *Leidensmotiv*

terms. Stage 3 clearly represents a focal point for the motion of the entire motive, as it is the dynamic peak in most cases and it represents a downbeat.

One way to test a model is to see what it recognizes as atypical. In analyzing Beethoven's Fifth, Zbikowski suggests that the typicality of a motive can be calculated using his conceptual models by counting the number of aspects which differ from the conceptual model.

> Accordingly, versions of the motive such as those of mm. 1-2 and mm. 22-24 (which instantiate all aspects of the conceptual model) would be judged most typical of the category; motive forms such as those of mm. 6-7 and mm. 29-30 (which instantiate only two aspects of the conceptual model) would be less typical; and motive forms such as those of mm. 7-8 and mm. 35-36 (which instantiate only the rhythmic aspect of the conceptual model) would be least typical of the category. (Zbikowski 2002, 46)

In the Beethoven example, these aspects include specific rhythmic notation, a specific set of melodic intervals, a specific written dynamic, and a specific scored orchestration. In an article about motive in Schoenberg, Jack Boss provides a similar calculus for typicality measured by the number of affected aspects like melodic intervals and contour, duration, meter, etc.—all based in notatable parameters. Zbikowski similarly suggests that typicality of the *Leidensmotiv* instances can be determined from his conceptual model (2002, 50), which consists of a notated rhythm with a time signature, and a sequence of melodic intervals. Zbikowski summarizes his review of category theory research by saying that typicality effects "reflect, to a certain extent, statistical invariances among the attribute-values demonstrated by category members, they are also a function of the goals of categorization" (2002, 49). But do notatable parameters really directly reflect the goals of categorization of a listener? Does different notation really correlate inversely to functional similarity in listening?

In my model, these notatable parameters are secondary to the sense of motion recorded by the accent symbols and the descriptive terms. I would argue that given the torturous slow tempo of most performances of the Prelude to *Tristan und Isolde*, the durations of the opening statements of the motive are likely to be perceived as relatively indeterminate. How many listeners will really notice the minor rhythmic or metric differences between different versions of the motive? For instance, take the third of Zbikowski's *Leidensmotiv* examples in Figure 3.4. How many listeners will notice that the second note is one eighth note shorter than the corresponding note in the first statement of the motive? Or that the overall duration from the first up-beat to the sforzando of stage 3 is exactly half a measure longer than in the opening version? Under my model, these details have little bearing on the typicality of this instance of the motive.

Instead, from a motional perspective, typicality is better measured by how well an example fits the individual stages of the motional conceptual model and the larger

EXAMPLE 1.7 Statements of the Leidensmotiv from Richard Wagner's *Tristan und Isolde*: (a) act 1, scene 2, mm. 26–33 (*Richard Wagner: Sämtliche Werke* [*WSM*], vol. 8, part 1, mm. 313–20); (b) act 1, scene 5, mm. 439–41, 456–58, 468–72 (*WSM*; vol. 8, part 1, mm. 1754–56); (c) act 2, scene 3, mm. 260–78 (*WSM*, vol. 8, part 2, mm. 1890–1908); (d) act 3, scene 2, mm. 93–107 (*WSM*, vol. 8, part 3, mm. 1301–15; (e) act 3, scene 3, mm. 153–57 (*WSM*, vol. 8, part 3, mm. 1581–85)

Figure 3.6: Atypical *Leidensmotiv* examples (Zbikowski 2002, 53)

motional shape formed by the flow between the stages. The feature of the third line of Figure 3.4 that will most strongly imply atypical motion is not the precise durations involved, but the fact that there is an extra descending note in stage 2; but even this detail does not really disrupt the motional flow of the motive. The least typical versions of the motive in Figure 3.6 (also reproduced from Zbikowski's chapter) are not the ones in new meters like 3/4 or 4/4, but the final two lines. The second to last line is rather atypical because it has a continuous decrescendo and no sforzando to mark stage 3. This undermines the motional focus around stage 3 as the climax of the motive. Another even more atypical distortion of the motive is in the final line of Figure 3.6; again, what makes this atypical is not the notated rhythm or time signature, but the speed to which this motive has been accelerated, which reduces the drawn-out agonized motion indicated in the model. Similarly, differences in pitch would only negatively effect typicality if they were could be heard as deviating from the motion of the model; changing the size or octave or even direction of the motive's melodic intervals may hardly change the motional quality in some cases.

Compatibilities Between Motive and Meter: Entrainment and Orientation

A motional conceptual model frames motive as a path through motional states. From a perceptual standpoint, of course, thinking of a motive as motion implies a human mind following or creating or experiencing that motion. This motion is not a unified, hegemonic physical interpretation "forced" upon listeners by a performer or composer (see Maus 2004 for an excellent exploration of the implications of talking as if music controls a passive listener). The motion heard in a motive is created by each listener for themselves by drawing on their own prior motional experiences, although it can be informed by their observation of performers and others around them. As a specific category of sounding features, with specific affordances for focal impulses and metrical hierarchy, and with a specific sense of motion (however subjective), a motive can serve as a kind of metering construction—albeit a kind that may be less standardized than metering practices like headbanging or conducting patterns, which have culturally normalized practices of overt physical movement.

A number of scholars writing about motive have described a kind of entrainment to motive which involves following these motional shapes, and they have offered some key insights that will help me reconcile this motivic attending with traditional meter. Motive is one of the tools which Mitchell Ohriner uses to explore human capacities to attend to "un-measured" or "free rhythm" that has no consistent pulse or traditional metrical structure (Ohriner 2016). In analyzing a piece of improvised, untimed *Taqsim* by the Iraqi oud player Rahim Alhaj, Ohriner identifies a "repeated four-phase schema of contour and duration" that occurs throughout an interior section. This schema (see Figure 3.7 below) is essentially a motional conceptual model of a recurring motive, a series of motional states (or "phases") that has a lot of flexibility in pitch and timing, but relatively fixed affordances for focal impulses and relative metric weights.

In an empirical test, Ohriner asked individual music students to tap along while listening to this recording three times in a row. Some students consistently chose to tap in synchrony with the stages of the motive Ohriner observed, while others tapped in a way that did not seem to consistently synchronize with any particular features of the music (18–20). These results show that the music can afford "metric behavior," which Ohriner defines as "demonstrate one's attending to music's unfolding through a moving body synchronized to the music's meter" (2016, 17).

Example 4. The repeated four-phase schema of contour and duration in the interior. Measures 1 and 2 omit Phase 2; Measures 3–5 do not bisect Phase 2. Phase 4 is higher than Phase 3 in m. 18.

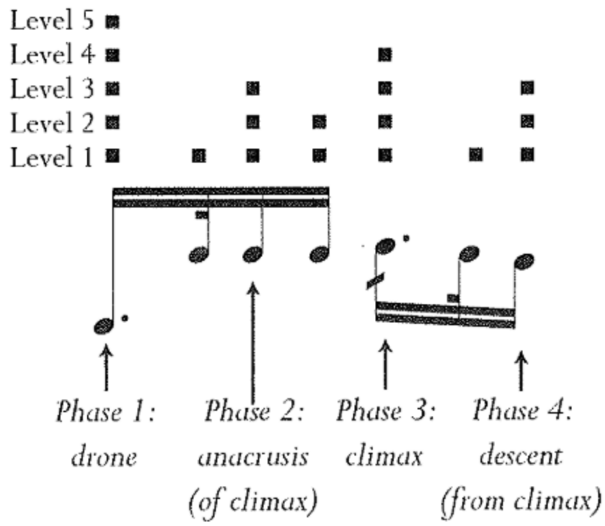


Figure 3.7: Ohriner's model of a free rhythm *Taqsim* motive (2016, 14)

> Because the durations between salient events in the interior excerpt roughly repeat in a (highly unequal) cycle, the passage affords entrainment and might be considered metered. Rather than arguing whether or not it "is metered," I have demonstrated that it enables *metric behavior* for some but not all listeners." (Ohriner 2016, 34; original emphasis)

In the terms of my theory, these listeners are hearing using this motive as a metering construction, performing this strategy of rhythmic attention as their entrainment to the heard music, and expressing this entrainment overtly through tapping. The recurrence and predictability of the (admittedly freely-timed) motive is a structure which enabled some listeners to join their own body movements into the rhythm of the music they were hearing.

Describing motive as a *metering construction* is different from arguing that motive *is meter*; exploring the similarities and differences between these two claims will reveal new aspects of motives and metering constructions. Ohriner himself recognizes that the kind of attending he reports is not equivalent to traditional accounts of meter, but questions the significance of this difference.

> If free rhythm cannot be entrained, it would seem to lack a metric hierarchy, a sense of groove through different phase relationships, and even the prosocial benefits of shared affective experience. [...] *But perhaps the distinction between meter and free rhythm has been overstated.* [...] In other words, rather than assuming that periodicity enables synchronicity and hence entrainment, we might associate synchronicity with entrainment regardless of the degree of periodicity in the sound signal. (Ohriner 2016, 5; my emphasis)

My concept of "moving together" explored in Chapter 1 extends this way of thinking beyond "synchrony" in which two participants articulate the exact same rhythm, to include any coordinated performances and experiences of motion, whether coincident or contraincident. But I would like to underline Ohriner's argument that if free rhythm affords entrainment, then perhaps conventional conceptualizations of entrainment as depending on periodicity are incorrectly limiting our understanding of human rhythmic behavior *a priori*.

Ohriner is not the first scholar to both explore how motives can provide a basis for entrainment, and also explicitly contrast this motive-based entrainment with traditional conceptions of meter. William Benjamin also describes a flexible rhythmic construction that is compatible with my motional conceptual model of motive. But unlike Ohriner's free rhythm analysis, Benjamin's example is *measured* if not *metered*, in that it features a stable subtactus eighth note pulse that neatly subdivides each heard duration. Benjamin's analysis of the opening measures of Igor Stravinsky's *Three Pieces for Clarinet Solo* is easily compatible with the kind of multi-stage, flexible motional conceptual model of motive which I developed from Zbikowski's account of motives as conceptual categories.

Figure 3.8: 2+2+1+2n construction in Stravinsky's *Three Pieces for Clarinet Solo*. Based on Benjamin's 1984 analysis, but using Stravinsky's original barring.

> At the shallowest level, however, there is no regular 'grouping' of eighths or quarters, and the length of [large-scale] time-spans is very unstable. Where there is a kind of regularity is at the middle level, the construction of which may be summarized by the formula (2 + 2 + 1) + 2n [eighth notes] (Benjamin 1984, 362)

This "construction" that Benjamin describes could easily be theorized as a metering construction, in that it consists of a particular sonic signature (an open-ended but still relatively fixed pattern of sounding durations), and a particular metrical interpretation (indicated by Benjamin's "rebarring" in Figure 3.8 below). It's worth noting that Benjamin's partitioning of this passage with this rule represents one possible hearing based on the inference of the 2+2+1+2n rule of durations. Like Ohriner's finding that only some listeners entrained to the motive he described, Benjamin's 2+2+1+2n structure is not inherent in the score, and even appears to conflict with the barring that Stravinsky himself notated.

Benjamin's discussion of how such rhythmic motives do not fit into standard quantitative theories of meter brings additional dimensions to Ohriner's comparison between meter and motive-based entrainment. Benjamin criticizes Lerdahl and Jackendoff's theory of metrical structure as "shallow (comprehending few levels), obvious from the standpoint of proportional organization, invariant over time, and hardly different from one piece to the next" (Benjamin 1984, 359). He proposes that a kind of hearing based in the motional shapes and beats indicated by motives is "a way of partitioning time that is neither metric nor based on grouping" (361). This partitioning is not meter because it neither conforms to nor is determined by regular spacing at any metric level, which is a central criterion in Lerdahl and Jackendoff's definition of meter; and while it is related to grouping when the motives can be identified as musical groups, this partitioning is distinct from melodic grouping itself because the beats and motional maxima implied by motives do not usually come at the starting or ending points of those groups. Listening to Stravinsky's music using the 2+2+1+2n rhythmic construction cannot be accounted for within Lerdahl and Jackendoff's framework that seeks to describe all rhythmic structure as consisting only of grouping and meter.

In the course of comparing his construction to meter, Benjamin introduces concepts of *order and orientation* in listening that are central to my conception of motive as a metering construction, and of metering constructions more generally. Benjamin proposes that one of the functions of meter is not just temporal regularity, but to create equivalence classes consisting of the same beat in each measure; for example, beat 3 in all 4/4 measures of a piece forms an equivalence class. Benjamin argues that part of what makes these beats equivalent to each other is not just some sense of nominal or phenomenal metric weight, but their place within the counting order of four beats to the measure.

> In strict meter, what equivalent beats on any level have in common, formally speaking, is their uniform distance from beats on the next-deeper level. [...] The psychological potential of these relationships is exploited via the grouping structure, whereby second beats can be made to sound either like close afterbeats or

> like distant upbeats; but a second beat in 4/4 time cannot sound very close to the succeeding measure downbeat, or very far from the preceding one. (Benjamin 1984, 376)

A conventional quantitative meter as defined by Lerdahl and Jackendoff has this property for each beat class; all beat 4s are the last beat in the measure, and all beat 3s are equidistant from the previous and the next downbeats. Stravinsky's 2+2+1+2n structure does not have this property, because the variable "2n" at the end means that a first-time listener could never know exactly how many beats remained before the next downbeat. Therefore, Benjamin ultimately rejects the counterargument, deciding not to call the 2+2+1+2n structure "meter" for the simple reason that a structure in which all beats have strictly consistent locations within the order of a metrical cycle is "psychologically, in a class by itself" (376).

What Benjamin's argument could have emphasized more is that the 2+2+1+2n construction still provides a lot of qualitative information about relationships between beats and motional shape that can structure entrainment, still affords a clear sense of order and orientation even if it might contain surprises for a first-time listener. The first four phases will always have the same rhythm, so (for example) the second quarter note will always be right before a single eighth and another quarter note, and the eighth note will always be felt as some kind of stutter which interrupts the succession of quarter notes. While there is some flexibility at the end of the construction in terms of exactly where the next downbeat might come, this does not prevent entrainment, but only requires some flexibility in hearing rhythmic recurrence. In other words, while exactly repeating meter might very well afford a kind of automatic, subconscious attending that is "psychologically in a class by itself," the 2+2+1+2n construction (and other more flexible motives characterizable by motional cognitive models) still affords most of the motional properties of interaction that are afforded by conventional meters.

The examples used by Benjamin and Ohriner to examine this kind of motive-based attending could be taken as indications that this form of listening only occurs in the absence of "regular" or "normal" meter. But Benjamin argues that motive-based hearing is implicated in most of our hearings of traditionally-metered works, and is thus of crucial importance throughout the classical canon.

> It seems to me, however, that even where older music is concerned, we partition time in a way that is neither metric nor derived from the music's group structures—whether harmonic or motivic—and that our perception of the music as rhythmically vital and alive depends, in large part, upon our doing so. (Benjamin 1984, 363)

This statement taken out of context *could* be taken as a symptom of a broader discourse that meter/regularity is inexpressive and lifeless while rhythm/variation is expressive and alive (for an overview of this conventional opposition of rhythm and meter, Hasty 1997, Chapter 1). But within the broader arguments of Benjamin's article, this passage serves as a claim that motive-based hearing is not merely a rhythmic opposite of the regularity of meter. We can hear metered music using the same rhythmic shapes as motives, and in the passage quoted in the paragraph above, and Benjamin even argues that we *usually do*. I propose that this is not some separate layer of motive on top of meter, but a new way of conceiving what meter is in the first place.

The concepts of order and orientation which I've drawn from Benjamin's writing show how felt beats and perceived meter can be inferred from the directed motion of motives. This brings meter and motive closer together than previous scholarship, in which motive and meter have been theorized in separate terms; the first is given extraordinary flexibility in hearing while the second is defined as measured regularity. I argue that motive and meter are much more similar; my definitions of a metering construction and of a motional conceptual model are compatible with each other, and with a broad range of scholarship on motive and with Ito's schematic approach to meter.

Defining Motives and Their Incompatibility With Past Theories of Meter

These concepts of order and orientation also form the basis for more complex and fragmentary hearings of meter than have been allowed by previous general theories of meter. I will adapt John Paul Ito's concepts of disordered hypermetrical hearings, scaling them down to show how motive can inform or afford such disordered hearings at the level of basic meter. This theorization of motive-based metering is essentially a corollary of Horlacher's metrical identity: if motives can act as metering constructions, leading to a particular metrical interpretation, then altered versions of those motives afford hearings of similarly altered metrical structure. Horlacher explores such altered recurrence extensively in her 2011 book as the "ordered succession" of a motive, but she frames the problem in terms of motion and temporality, and hardly mentions meter or beats. The connections I've made so far in this dissertation between motion and meter allow me to synthesize her work on ordered succession with her concept of metrical identity and Ito's concept of disordered hearings. The motional contour and key features of a motive can often still be heard in spite of a variety of alterations, including the addition or removal of individual notes, augmentation or diminution of durations, rhythmic elaborations or reductions, fragmentation or truncation of the motive, or even significant extension.

Such flexibility has often been accorded to motives, especially in the tradition or aesthetic of "developing variation" pioneered by Schoenberg. But this kind of motivic flexibility is radical in the context of general theories of meter, which have often been based entirely in cyclical repetition of equal durations. My goal in this work is to establish compatible theories of motive and meter, organizing language to translate between the two, and using these terms to describe flexible hearings of meter which are more radical and pliable than anything described in previous meter theories. While this chapter remains focused on building theoretical ideas through short examples, the Analytical Interlude which follows as Chapter 4 shows an extended motive-based hearing of flexible meter in the first movement of Maurice Ravel's *Piano Trio*.

John Paul Ito has explored how the concepts of order and orientation can lead to more flexible and fragmentary hearings, in his article about "hypermetrical schemas." Ito's definition of a hypermetrical schema consists of a specific sequence of strong and weak qualities paired with counting numbers and grouping functions like beginning or ending. For example, a pattern he calls the "1-2-3-4 schema" consists of a four-bar hypermeasure, with the strongest emphasis and an initiation function on the first hyperbeat, no emphasis and a continuation function on the second hyperbeat, secondary emphasis and "continuation or beginning of conclusion" on hyperbeat three, and no emphatic weight with a concluding function on the final hyperbeat (Ito 2013, 51). These schemas are essentially equivalent to the motional conceptual models I made for motives, albeit with less determined sounding surfaces and vaguer affordances for motion; they chart a specific path or cycle through an ordered series of form-functional states.

Ito provides a more thorough account of the concept of orientation I introduced earlier, and his account of "metrical orientation" can easily be translated to motivic attending. Ito proposes that listeners hear rhythmic structure using mental constructs analogous but not equivalent to notated meter, "heard measures" with "heard downbeats" that may or may not match the notated bar lines. Hearing meter is a way of orienting oneself within these metrical schemas, which Ito explains "is not a matter of counting beats but rather an awareness of position within a very familiar pattern, with the pattern organized around the moment of initiation that is the heard downbeat" (2013, 60). Using Ito's language, we could describe orientation within a motive as awareness of position within an ordered series of motional stages (i.e. a motional conceptual model).

Ito demonstrates that the concepts of metrical orientation and hypermetrical schemas allow "out-of-order" hearings of hypermeter that would not be recognizable from the perspectives of existing general theories of hypermeter. For example, in his analysis of the opening to Mozart's Menuetto K. 409, Ito proposes a hearing that begins with a relatively normal and complete statement of the 1-2-3-4 schema, but then recycles through hyperbeats 3 and 4 once or twice instead of immediately initiating a new hypermeasure (Ito 2013, 52). Ito suggests another kind of hearing in his analysis of the opening measures of Beethoven's piano sonata op. 31/3. Here Ito suggests that the piece begins with the first two bars of a 1-2-3-4, but this 1-2-3-4 is interrupted by another complete 1-2-3-4 hypermeasure that begins in bar 3. Following the completion of this interrupting hypermeasure in bar 6, bars 7 and 8 act as hyperbeats 3 and 4 to continue and complete the original hypermeasure. The interrupting hypermeasure is described as a sort of parenthesis, a kind of metrical aside inserted into the middle of the opening 4-bar phrase. These hearings traverse the ordered space of the 1-2-3-4 schema, retaining the teleological order of the schema without necessarily needing to begin at "1," progress through the stages with a consistent pace, or finish all the way through "4."

Crucially, Ito describes these out-of-order hearings in terms of felt and performed motion, not just as abstract paths through some kind of conceptual or transformational space. This adds strength to my claim that Ito's hypermetrical schemas are compatible with my motional theory of metering, which associates sounding structures with both beat interpretations and specific (overt or covert) motions.

> Awareness of orientation with respect to a hypermeasure that is not present on the musical surface can be sharpened by conducting while hearing, in this case using

> the typical pattern for a quadruple measure. This will foreground the dynamic, gestural aspects of hypermeter. Depending on the specifics of the analysis, it will sometimes be necessary to loop back and repeat beats or to skip to a different part of the pattern altogether; these loops and skips capture aspects of the hearings I describe." (Ito 2013, 50)

I will study conducting patterns more closely in the next chapter, but for now I should briefly state one point which I want to add to Ito's account: I argue that a conducting pattern is a metering practice which conditions the qualities or types of metrical/hypermetrical shapes a listener is likely to listen for in the first place, not just something which "reveals" or "sharpens" an awareness of an abstract metrical structure immanent to the music. Experiencing (even vicariously) the ubiquitous motion of the conductor's upbeat in classical music, for example, ingrains a particular kind and quality of motion which conditions how a listener might hear and feel anacrusis throughout the genre. There is no essential, abstract energetic aspect of hypermeter that is revealed by conducting; the motional qualities of conducting are baked-in to the way meter is experienced in the classical tradition, just as I argued that headbanging conditions how a listener hears rhythmic qualities of metal music even when that listener remains still.

Since I have described motives in terms of a motional conceptual model with ordered stages analogous Ito's hypermetrical schemas, a natural next step is to take these principles of flexibility in *hypermeter* and extend them to *motives*. I've already explored a mild form of this flexibility earlier, when I discussed motives from Zbikowski's analysis of the Prelude to *Tristan und Isolde*. Some examples of the *Leidensmotiv* repeat stage 2 from my motional cognitive model, in that they have multiple descending long notes before the climactic emphasis of Stage 3. In other motives from other pieces, such departures from the initial statement of the motive might by jarring rhythmic disruptions, but the transcendent langour of the opening to *Tristan und Isolde* makes it hard to hear any one particular version of the motive as any more or less typical than any other. Thinking of a motive as a flexible schema of rhythmic states rather than a fixed prototypical rhythm better reflects the scope of variations admitted by this motive.

My perspective of thinking of variations in a motive as variations of motion is heavily influenced by Horlacher's 2011 book *Building Blocks* about ostinati in Stravinsky's music. While ostinati are usually more literally repetitive than motives (motives are more often transposed or given different scale degree identities), Horlacher's discussion is often compatible with my account of motives. She makes some similar arguments to Rosen's, suggesting that despite Stravinsky's reputation for upending classical tradition with disjuncture and stasis, the individual ostinato layers of his music "still originate in, and depend upon, traditional concepts of melody, harmony, and pulsation" (Horlacher 2011, 32).[7] Like motives, Horlacher argues that ostinati are defined by distinctive pitch intervals and rhythmic configurations, using "familiar gestures" to be instantly recognizable. In a few places she seems to equate motive and ostinato, so I feel justified bringing some of her analytical methods into my discussion of motive.[8]

In her book, Horlacher focuses on what she calls *ordered succession*, a dual perspective that focuses on both stasis and motion. She juxtaposes the fixity of an ostinato's recurrence with variations in the ostinato itself and the temporal flow created by the stopping and starting of the ostinato through a piece's texture. In order to show an ostinato is often "both a static entity and a dynamic shape, especially as it may be developed over the piece" (2011, 27) Horlacher develops a new analytical display (see

[7] "After all, the building blocks of his novel textures often consist of tunes with identifiable intervallic shapes, scale-degree identities and goal pitches, and defining durational patterns, organizations that engender continuity and connection. In other words, although his basic materials are combined into new, often dissonant and usually repetitive textures, those materials still originate in, and depend upon, traditional concepts of melody, harmony, and pulsation." (Horlacher 2011, 31-32)

[8] For example, "In its simplest manifestation, ordered succession contextualizes a single ostinato or motivic figure both as a fixed whole and as an emerging shape" (Horlacher 2011, 27).

Figure 3.9 below) which places successive versions of an ostinato in parallel with corresponding notes vertically aligned, so that the differences between them become more obvious. She explains,

> This perspective allows us to experience the composer's manipulation of time—that is, our sensations of its expansion, compression, interruption, and arrival—in ways that form a central locus of expression in tonal music. (Horlacher 2011, 34)

In other words, Horlacher describes variations and development of an ostinato as manipulations of a listener's temporal experience of music—which I think usually involves felt motion. Motivic manipulations also can often be experienced as changes in motion, and these motional effects of expansion, compression, interruption, etc. can be easily seen in an ordered succession graph.

Extending Ito's concepts of hypermetrical orientation to describe motivic flexibility will also involve transferring this flexibility to smaller-scale basic meter. It's worth keeping in mind that some other scholars have rejected the idea that basic meter can be flexible in this way; for example, see Benjamin's discussion above. In presenting earlier stages of this work, I've had other scholars suggest that such flexible metrical hearings reflect *grouping*, not *meter* (using Lerdahl and Jackendoff's meaning of these terms). But I would argue that since these motivic hearings involve felt beats and metrical orientations, they are best conceptualized as meter, not grouping (or some third kind of structure as Benjamin suggests).

While suggesting that basic meter can have the same flexibility Ito describes in hypermeter is somewhat controversial, several other authors writing about meter have also described some similar mildly flexible applications of metrical ordering, such as Benjamin's "composed-in fermata." At the end of his 1984 article, Benjamin briefly considers the fermata as a halt in the heard meter in terms which are easily compatible with Ito's concept of metrical orientation.

Ordered succession at R91 from the *Rite*, "Mystic Circle of the Young Girls"

Figure 3.9: Example of ordered succession analysis by Horlacher (2011, 41)

> A fermata applied to a metric span always lengthens that span in an objective sense—often to a marked extent—but never increases the distance of its initiating beat from the next beat on the same level in a metric sense. In specific terms, the first beat of our fourth measure remains as close as possible to that of the succeeding first measure—on their level of beating—no matter how much the former measure is expanded via fermata.
> A big problem in the analysis and performance of fermati is that in situations where they are composed-in [...] It takes a sensitive performer to get beyond the notation and to make clear exactly where this count is meant to be suspended and for how long. (Benjamin 1984, 398)

In a composed-in fermata, a listener's perception of orientation within a metrical schema is frozen in a particular motional state while the measured barring of the piece continues, producing at least one "heard measure" which is longer than the notated ones. One cannot give a convincing explanation of this phenomenon from the basis of a quantitative theory of meter (where meter is defined as nested periodicity).

Besides prolonging a motional state with a notated or composed-in fermata, a piece of music can also repeat states or add extra ones to a measure. Gregory McCandless describes "additive metrical processes" in the music of the progressive rock band Dream Theater.

> ...concurrent thematic addition and metrical expansion are heard at the end of the hypermeasure, as the fourth bar of the riff changes to quintuple meter. This addition-related metrical extension is indeed surprising, but it does nothing to suggest an additive structure. Instead, it sounds like an "extra beat" at the end of a phrase—a fairly common example of metrical complexity in the progressive rock style. (McCandless 2013, 9)

McCandless describes a *metrical expansion concurrent with thematic addition*; repeating a stage of the motive produces an impression of an "extra beat." While he speaks entirely in terms of meter, his analysis clearly illustrates a motivic manipulation, not just a metrical one.

These kinds of flexible hearing can easily be afforded by both basic meter and by motives; indeed, in many cases the difference between a hearing of motive and

Figure 3.10: Opening measures of Beethoven's String Quartet in Eb Major, op. 127

a hearing of metrical schema may be purely pedantic, distinguishable by terminology only. One example is the opening to the first movement of Beethoven's string quartet in Eb Major op. 127 (see Figure 3.10 below). The opening features a motive that consists of four chords with the generalized duration structure long-short-long-short. I first fell in love with this piece through a beautifully produced recording by the Alexander String Quartet, in which these chords were deep, resonant, energizing, and fulfilling. I heard this opening in 6/8 meter, performed with a deep heartfelt rubato that made the first note of each measure disproportionately long. Imagine my surprise when I discovered the original notation in 2/4, with the first note written as a half note tied to an eighth, and the rest of the motive notated as a syncopation! Was this a "composed-in fermata" or a motivic distortion? The answer is both, of course. If either motive or meter had been established in a prior section of the piece, one could be described as conceptually prior, determining the hearing of newer details of the other parameter or creating some sort of metrical conflict. But since this passage occurs at the beginning of the piece, hearing of motive and hearing of meter are intertwined here; a distortion of one is necessarily a distortion of the other.

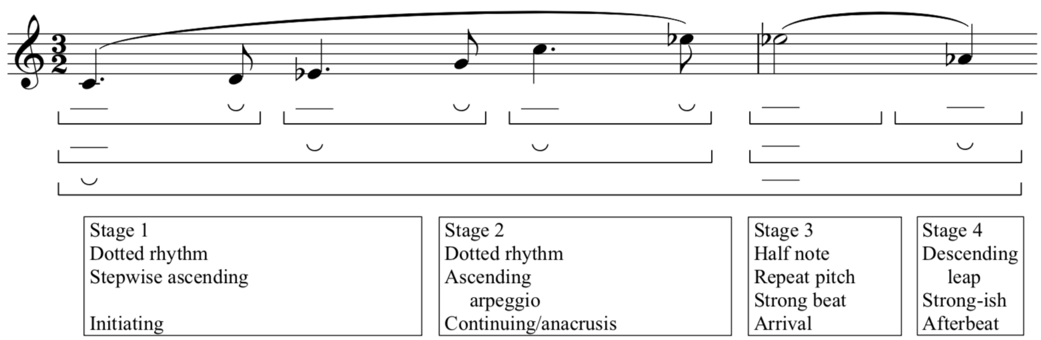


Figure 3.11: Cognitive Model of opening melody from Brahms's String Quartet, op. 51

But translating the flexibility of Ito's motivic, top-down hearings to the realm of motives and basic meter also allows for much more radically dis-ordered hearings. For example, consider the melody in the opening measures to Brahms' String Quartet in C, op. 51 no. 1. The first four half-note beats (one and one third measures in the 3/2 time signature) constitute a clear motive with four distinct motional stages, shown in the motional cognitive model in Figure 3.11. Note that in Cooper and Meyer's terminology, stage 3 is the strongest accent of the entire motive—that is, stage 3 is the focal moment around which the rest of the motion is organized.

The entirety of the opening ten measures is built from the motions displayed in this model, using a variety of transformations which maintain the sense of the original motive's order. In other words, this opening measure is the only complete version of this motive until the restatement of the opening at measure 23; but all the rhythms until measure 11 (and many portions of the rest of the movement) are completely based in the qualitative rhythmic/metric relationships of the opening motive. This gives the section a feeling of consistency of motion, a kind of physical coherence in which the motion of the opening motive seems to develop and grow and expand into a grand opening tableaux that feels entirely of one piece, like a table with hidden joins and no metal hardware. This aesthetic of "organicism" has of course been central to the whole history of critcism and scholarly research about Brahms and other nineteenth century composers. But studying the motives as motion using motional conceptual models provides a new method to analyze the qualitative rhythmic properties of this continual development and view it as a motional process.

The way the piece moves through the different stages of the motional conceptual model creates an effect of gradual fragmentation and acceleration akin to what Caplin (2008) describes in his model of a musical sentence in the Classical style. The end of measure 2 omits stage 1 but retains stages 2, 3, and 4 in order; the end of m. 3 reproduces this path through the motional conceptual model. Starting at the end of measure 4 and continuing through measure 6, the dotted ascending arpeggio of stage 2 repeats over and over, progressively reaching higher each time but failing to produce the feeling of strong downbeat required for stage 3. This deferred anacrusis finally reaches a climax to form stage 3 at the downbeat of measure 7, followed by the afterbeat of stage 4. This climactic figure is repeated in measure 9, with the viola uneasily lingering each time on the final pitch of this otherwise relatively closed concluding gesture.

In brief, the first 10 measures make the following motional path through the conceptual model of the motive: 1234; 234; 234; 2 - 2 - 2 - 2 34! 34! The drama of this motive's halting and looping traversal of the motional cognitive model is evident in the ordered succession graph in Figure 3.12. The resulting melody clearly retains the inertial logic of the original motive's order, while only stating the complete motive once. This motional path is also a metrical interpretation, in which the 3s are always the most accented beats which serves as the primary focal impulse for the subsequent measure. In the first few measures, this conforms to the notated measure; however, in

Figure 3.12: Original notation vs. Ordered succession analysis of opening melody from Brahms op. 51.

measures 5 and 6, the motivic hearing represents a metrical interpretation that is, well, rather un-metrical. Each of the ascending arpeggios creates a weak focal impulse at the highest note, which feels to me like the same basic motion as 2-3 in the motional conceptual model stated earlier.[9]

Re-turning to Re-barring and Variable Meter

Now that motive has joined the repertoire of metering constructions, I can return to the question of how the rebarrings of Schoenberg, Frisch, and Horlacher can be understood as meter. In his discussion of Brahms's "O Tod," Frisch suggests that "In my rebarring I have placed important musical and verbal stresses on downbeats" (Frisch 1984, 160). But there is a big difference between claiming that a variable meter like one of these rebarrings represents implied stresses, and treating such a variable structure as meter. "Meter" implies more than just felt beats, but a sense of measure and organization between and across those beats. More than just accents, the notated barlines in a rebarring are felt as *downbeats*, focal beats around which the rest of the music is motionally organized. Suggesting that such a variable barring like Frisch's analysis of "O Tod" *is meter* implies some sense of legible order and orientation, even if the kind of motion and order change with every measure.

Motives are one way that music can provide this order and orientation. Frisch explains that "I have rebarred the music so that analogously accented words or pitches

[9]There are some differences between this gesture and the earlier instances of 2-3 that I think contribute to this sense of a weaker focal impulse than a "true" stage 3, by creating a sense of continuing motion. The original motive repeated a note at the downbeat to form stage 3, but in mm. 5-6, the stage 2s never rest on the same note, instead continuing a never-ending loop through further arpeggiation. Additionally, there is no durational rest, as the performed rhythm keeps moving in a dotted-quarter and eighth pattern, where the original motive has a half note for the downbeat that constitutes stage 3. These parameters create a sense that the gesture has not completed, not even in a provisional way. This is why I have not labeled any of mm. 5-6 as a stage 3, even though I feel some sense of beat implied at the peak of each arpeggio.

appear on downbeats" (Frisch 1984, 153). One possible sense of "analogous" is that these newly notated downbeats occur at the same places in successive instances of the same motive. In other words, given a motive with a strong sense of downbeat at a particular stage, one could create a re-barring by placing a new bar line wherever this stage appears in the score, regardless of how many beats have passed since the last barline. If the motive itself is developed or distorted in any way, these "analogous accents" may have different numbers of notes to either side. But as long as the order of the motive is still legible, we can recognize it as the same motion.

Horlacher's rebarrings of Stravinsky in her 1997 article are strictly determined by a motive's metrical identity; but Frisch's and Schoenberg's rebarrings sometimes seem to also incorporate other kinds of metering constructions. In addition to motive, they also appeal to pre-existing metrical shapes that more closely resemble Ito's hypermetrical schemas. Schoenberg talks about a group of notes as "fitting" 4/4 or 6/4, and sometimes there is no recognizable similarity to previous material. In these instances it seems that the heard meter is determined instead by the appearance of conventional durations, patterns of accent, and melodic contours familiar from other encounters with 4/4 or 6/4 meter. These do not require a separate theory of meter from the account I've given for motives; 4/4 and 6/4 still provide order and orientation, but are just more abstract metrical constructions, whose surface rhythms and motions are less specified than motives.

Previous theorists have described periodicity as an "invariant" which enables the easy perception of meter, but while complex motivic hearings do not have large-scale periodicity, they can have another invariant: the order of motional stages in the motive. In a sense, order and orientation can serve some of the same functions as the "temporal invariant" of periodicity: they are legible, predictable patterns which afford physical coordination and entrainment. However, as shown by this chapter's exploration of motivic transformation, these familiar structures can create felt beats and highly structured motional interpretations without needing to be "invariant" in the sense of a *fixed pattern that can only appear in one way*. If meter were defined as a fixed repeating pattern, then of course any case of variable meter wouldn't count. But that's beside the point. It's not the *fixity* that creates experience of beat and meter; those experiences arise when a listener recognizes potential ways of moving with the music, often based on familiar motives or rhythmic constructions.

In other words, to a practicing chamber musician, entraining to motive is not essentially different from the coordination of so-called basic meter. Both require orientation within patterns of beats, flexible and dynamic attention to others' parts, and active imagination of phrasing and motion. Though music theorists have never quite been able to accommodate the flexibility of motive within earlier, primarily quantitative theories of meter, this flexibility has been embodied by musicians since Schoenberg's time, if not earlier. Reflecting upon one of his variable-meter rebarrings, Schoenberg remarks, "The example from Mozart (Example 51) is an enigma—not to the performer, but to the analyst who is interested in the grammar, syntax, and linguistics of the music" (Schoenberg 2010 [1975], 436). However exotic these appearings might seem in analysis, they are commonplace in late Romantic performance culture.

My schematic approach towards metering is more "radical" than many previous theories of meter; metering constructions are easy to switch between, rather than "layers" which are "activated" and have "momentum" (see Krebs 1999). This is not to say that there cannot be momentum to the motion of a piece, but that a sensitive, motive-oriented musician of the type Schoenberg describes will freely switch between different ways of feeling when constructing an interpretation. Metrical momentum is real, partly because a metrical interpretation is a way of moving, and if you continue to move in a particular way you will continue to hear music measured against that motional pattern. It may take a dramatically unexpected or jarring event for many listeners to be convinced to discontinue or modify their movement.

Consequently, it could be argued that metrical momentum is endemic to untrained, unrehearsed, or first-time listening. But Schoenberg himself leaves no doubt as to the centrality of this flexibility in truly musical performance.

> Organization based on different and differently shaped elements proves to be a vision of the future. A composer of operas, of oratorios (as Schweitzer shows in analysing Bach's music to words) or even of songs, who does not prepare for far remote necessities acts as silly and brainless as a pedantic performer who insists on playing classic music with metronomically measured equal beats–as if it were dance music. Of course, in the stiff confinement of a Procrustean bed, no modification can fit, and even those *ritardandi* and *accelerandi* (Schumann's '*immer schneller werdend*') which the composer himself demands will never turn out satisfactorily. (Schoenberg 2010 [1975], 413)

According to Schoenberg, the fixedness of metrical momentum is anathema to musicality itself, and only a "pedantic" musician would perform an interpretation in "metronomically measured equal beats." He seems to be disparaging the very notion of what meter theorists have often described as "temporal invariance" (London 2004, 5) or "the idea of equally spaced beats" (Rothstein 1989, 41), the regularity that forms the conceptual basis for existing theories of meter. But a knowledgeable musician who is not "silly and brainless" or "pedantic" is used to variable meter and flexible interpretations. Inferring flexible and variable organization during sightreading or a first listening is no magic trick, but should be the default of any sensitive musician; in my experience, many undergraduates can infer interpretations like the rebarrings examined above while sightreading.

One issue which I have not yet explored is weighing these imagined rebarrings against the more regular notated meter. Schoenberg himself argues that this regularity has an *aesthetic* importance despite the irregular felt meter: "In Brahms' notation these subcutaneous beauties [the irregular felt meters] are accommodated within eight [notated] measures; and if eight measures constitute an aesthetic principle, it is preserved here in spite of the great freedom of construction" (Schoenberg 1950, 435-436). Other theorists have mentioned a sense of unease that must be maintained when the sounding meter does not match the notated one (especially Krebs 1999). In terms of my theory, the only embodied beats or focal impulses are the irregular felt meter; any listener either experiences a beat in a given place or doesn't, and the sum of the beats they *do* choose to experience is the metrical structure. I'm not sure how to account within my terms for the aesthetic of the notated 8-bar unit, or the sense of metrical unease that Krebs describes.

This problem is merely the tip of the iceberg in a much larger question of how to interpret and explain conflicting metrical cues and rhythmic dissonances within a motional theory of meter. Previous scholars have explored this issue through concepts such as metrical dissonance (Krebs 1999) or metrical displacement (van den Toorn 2004). While a thorough investigation of this topic will have to wait for another project, I can summarize my perspective here. No human listener can simultaneously maintain distinct modes of attending, or separate physical orientations to music. Any focal impulses a listener chooses to perform become part of the single interpretation of rhythm which that listener embodies; polyrhythm and other rhythmic dissonances seem to be either experienced/produced as one entrained rhythm and one "off-beat," or as an entrainment to the composite rhythm of both rhythms put together. And as with visual perception, while we may be able to alternate between distinct interpretations or even grasp in one moment how multiple interpretations may be possible, it is impossible to physically or mentally experience two conflicting interpretations of the same stimulus at once.

Another open issue is that in some other theories, motive may not carry a clear motional or metrical identity with them. Motive has often been conceived of in terms of pitch intervals only (Especially the conceptions of motive by Heinrich Schenker and Rudolph Réti; see Zbikowski 2002, 26-27). While a series of ordered pitches could arguably still retain a sense of tonal motion, some pitch-class set analysts abstract the concept of motive to include different orderings and inversions of the same pc set. In other words, while a specific shape of motion is one of the three criteria I have established for a metering construction, what others writers call "motive" may not always be so motionally specific. But when motives do imply a specific sense of motion, it would be nonsensical to assert that this motion did not contribute to a listener's motional/metrical interpretation.

Chapter 4

Interlude: Metering Ravel's Piano Trio

In this interlude between chapters, I will analyze the first movement of Ravel's *Piano Trio* (1914) to demonstrate the radical flexibility of a constructions-based approach to entrainment. In describing some possible metrical interpretations of this movement, I will demonstrate a variety of metrical phenomena, some of which have not been previously described by meter theorists, or at least not in the sense I understand them. These include *ambiguous or multistable meter, metrical momentum, metrical alteration through developing variation, weird joins, metrical transmutation through displaced beats, metrical expansions, metrical stretto, composed-in ritardandos, motives heard as metrical templates,* and *dissolution of meter*. In some moments I will suggest interpretations based on motivic attending, often including some distortions of the motional conceptual models created by initial versions of a motive. I will also appeal to a metering construction that more closely resembles Ito's hypermetrical schemas, instead of being based in motivic recognition.

I will also consider in more detail how a listener may choose to navigate between these different constructions. Most of the analyses in the previous chapters are theoretically-driven, and only a handful span more than a few measures at a time. Here I provide a full analysis of a long movement, which emphasizes my previous idea that meter is a patchwork quilt of metering constructions (see Chapter 1), a series of recognized rhythms and ways of moving with the music. The patchwork quilt of metering constructions I present in this analysis is not recognizable as meter according to most existing theories, but better represents a competent/sophisticated musical interpretation of this piece than conducting or counting in 4/4.

The metrical interpretations I present here are not a *post-hoc analysis*, but started with listening from the mindset of a performer. In other words, this section is not an analysis of ”metrical structure in the music,” but an analytic explanation of a metrical interpretation I experience/imagine as a listener. The recording I return to the most is one made in 1960 by Yehudi Menuhin (violin), Louis Kentner (piano), and Gaspar Cassadó (cello), which surpasses other renditions I have heard in both moments of vaporous impressionism, and passages of vigorous rhythmic intensity. While I do cite some videos of folk dance to support a metrical interpretation, this is not intended to represent any authoritative or systematically-gathered knowledge of that dance or its culture. The purpose of this chapter is not to convince anyone that my hearing of the piece is especially “authentic” or represents any particular community of listeners. Rather, my goal is to bring together the main new concepts of my work, and apply them to a full-length analysis of my own experiences listening to this piece.

Ravel's *Zortziko*

The movement as a whole could be described as a funny kind of sonata form (see Caplin 1998, Hepokoski and Darcy 2006) Many editions of this piece lack printed measure numbers, so I've included a full score as an Appendix to this dissertation. A primary theme opens the movement, whose mode is arguably either A Dorian (based on an apparent tonic harmony of A minor) or E Aeolian (based on the melodic pitch-center of E in all parts). A long transition begins at measure 13, including what could be viewed as a medial caesura in measure 31. A clear secondary theme enters at measure 35, in an A Aeolian mode—not a particularly strong or conventional tonal contrast with the primary theme, but clearly a departure in rhythmic quality (as I will discuss below). A development begins at measure 46 or possibly measure 52, including large-scale sequences which Caplin calls developmental "cores" (Caplin 1998, 141). The final ten measures of the movement could be described as an odd gesture towards the tradition of recapitulation; though it is extraordinarily brief, there is a melodic return of the first phrase of the primary theme, albeit with different harmonies.

The opening melody of the piece, which Ravel described as having a "Basque flavor," appears to be derived from a Basque dance/song genre called the *zortziko*, and can be considered a dance-derived metering construction along similar lines as my discussions in Chapter 2.[1] In a dissertation about Ravel's chamber music, Sigrun B. Heinzelmann describes the *zortziko* as a tradition of 8-line song form or poetic meter in addition to a characteristic dance rhythm (see Figure 4.1a below). The rhythm is defined by a dotted eighth figure in 5/8, which can form the repeating meter of a *zortziko* song, such as the Figure 4.1b below, or the basis for a dance. This genre is still sometimes actually danced today in folk festivals, but many *zortzikos* in the twentieth century were written for the concert hall, such as several instrumental *zortziko* pieces by Isaac Albeniz or Camille Saint-Saens (Heinzelmann 2007, 165–167 and 346). The 5/8 zortziko rhythm can be extended to the length of a 4/4 measure (or 8/8) by alternating it with a second measure of 3/8 (Figure 4.1c). Lastly, some titled "*zortziko*" songs are

[1] Ravel was born in the Basque town of Ciboure, France, and though his family moved to Paris three months later, his mother often sang him Basque songs and he apparently had a close emotional connection to his Basque heritage. It's also worth noting that Ravel composed this piano trio while living for the summer in the French Basque commune Saint-Jean-de-Luz across the bay from his birthplace, and during the same months was also composing a piano concerto with a Basque title.

in even 2/4 meter, without the characteristic dotted rhythm. Heinzelmann provides a table of more than half a dozen examples of each of these metric types, drawn from a database of Basque traditional songs (Ibid., 344). Ravel's piece is notated in 8/8, an uncommon time signature for a piece that could visually fit just as well in 4/4; this decision could be taken as encouragement for hearing the opening rhythm in 5/8 + 3/8.

The characteristic *zortziko* rhythm can be considered as a dance-derived metering construction, like the characteristic baroque dance rhythms I examined in chapter 2. However, the genre as a whole is perhaps better represented by a family of metering constructions related by dotted-eighth sounding rhythms, given the different possible meters illustrated in Example 4.1 above. A search on *youtube.com* for dances titled "*Zortziko*" (or the alternate spelling, "*Zortzikoa*") pulled up several videos of Basque folk dancers which confirm that both the 5/8 and 2/4 (or 4/4) metrical types/interpretations are manifested in traditional dances performed by various troupes in the present day, although the more professional-looking ensembles tend to favor the 5/8 (or an expanded 7/8 version based in similar characteristic dotted rhythms). A guide to some of these videos appears in the box below.

Using Agawu's terms, each of the danced interpretations in these videos is a valid "choreographic supplement"—"valid" because it represents the felt motion of a cultural insider (Agawu 2003, 73). There are thus several distinct sets of form and function that are all associated with the *zortziko*, making a somewhat diverse basis for hearing *zortziko* rhythm in Ravel's piece.

J.A. Santesteban,
Aires Vascongad, 75
(1870)

Aita Donostia,
Cancionero Vasco, vol. VI, 119,
(Gipuzkoa, 19th C)

Aita Donostia,
Cancionero Vasco, vol. VII, 548,
(Gipuzkoa, 19th C)

Source: www.bertsozale.com

Figure 4.1: Zortziko rhythms from Heinzelmann (2008, 344)

Videos of *zortziko* dances by Basque dancers in various formal and informal festival settings. I am no expert on Basque dance or culture, so I am trusting the uploaders who have chosen the titles. One of the 4/4 examples is a school event where the students seem to be walking around without any specific rhythm or choreography, leading me to wonder if this and other 4/4 examples are meant to connect to a specific "*zortziko*" tradition, or if the title is being used as a general synonym for "folk dance."Links were accessed March 6, 2019; I cannot guarantee they will remain available.

5/8 Zortziko:
https://www.youtube.com/watch?v=etrH43o9f3E
https://www.youtube.com/watch?v=Nqz2MTFd8TI
https://www.youtube.com/watch?v=qveX8AQur4k
https://www.youtube.com/watch?v=SEpSs8O356Y

7/8 Zortziko
https://www.youtube.com/watch?v=OBXvR6WTgPM — starts at 4:30
https://www.youtube.com/watch?v=eoFMo6mLt0Q — with 4/4 dancing (?!)

4/4 Zortziko
https://www.youtube.com/watch?v=CPbJTEyK9wY — perhaps 12/8
https://www.youtube.com/watch?v=SS5dRN2oZUM
https://www.youtube.com/watch?v=jdADbmNJwEk
https://www.youtube.com/watch?v=eLhg_yd1PXw

Choosing Between Motional Conceptual Models

Starting at the very beginning of Ravel's piano trio, then, there is some ambiguity about how to hear meter (see Figure 4.2). Following Justin London, I am using the term "metrical ambiguity" in the sense that a passage affords more than one metrical interpretation, not the dictionary's secondary definition of inexactness or vagueness (London 2012, 103). The theme in the opening measures, which is heard many times throughout the movement, can be heard in the 3+2+3 rhythm represented by the 5/8 + 3/8 time signature in Figure 4.1c, or the emphasis could be placed on a subdivision

Figure 4.2: Different metrical interpretations, mm. 1-4

of the 3+2+3 as 1+2+2+1+2; or the melody could be heard against an even quarter-note beat represented by a traditional 4/4 interpretation. The beaming of the melody in the pianist's right hand (and throughout the movement) suggests the 3+2+3 hearing, while the articulations (especially the staccatos on the downbeat and second-to-last note of the measure) suggest to me the 1+2+2+1+2 hearing; and then there is also a steady quarter note pulse in the left hand that quietly suggests the 4/4 hearing. It's also worth noting that each of the 5/8 videos cited in the previous paragraph appears to divide the 3-groups into 1+2, corroborating my preference for the 1+2+2+1+2 hearing.

A more extensive theoretical discussion of metrically ambiguous or "multistable" rhythms will follow in a later version of this project, but for now it will suffice to say that I agree with Justin London and most empirical studies of polyrhythm perception and performance: it is not possible to experience two separate interpretations simultaneously. The closest a human being can get to experiencing true "metrical dissonance" is to combine the attacks of both patterns into a resultant rhythm, forming a third metering construction from the combination, or to experience one rhythm syncopated against the other.[2]

But how does one choose between two possible metrical interpretations of a multistable sounding pattern? Justin London describes this situation of "conflicting cues" for meter, but since my metering constructions approach is more construction-oriented than his quantitative theory of meter, I will appeal to an account by Robert O. Gjerdingen of how schemas are perceived from such cues. (Note that while Gjerdingen's most famous contribution are counterpoint schemas in galant music, his general discussions usually apply to a much more general sense of the term "schema" that can easily encompass metering constructions and other constructions; see Gjerdingen and Bourne 2015).

> "When a feature [...] is presented to us, we attempt to find a context for it, or, more technically speaking, we take it to be the partial instantiation of one of several possible schemata. As more features are perceived, rival schemata can be eliminated and the most likely schema selected. This process is often called data-driven or bottom-up processing because low-level features select a higher-level schema. [...] Schema theory asserts [...] that once distinctive features of a schema are instantiated, we actively seek out the remaining features. Such a procedure is often called concept-driven or top-down processing, because a higher-level schema directs a search or lower-level features." (Gjerdingen 1988, 6-7)

[2] This perspective seems to be increasingly common in studies of rhythm and meter, but enough researchers have talked about "metrical dissonance" as if it involved simultaneous perception of distinct meters (or are just vague enough in their statements that they could be read in support of simultaneous perception) that several writers have felt a need to clarify this point. An excellent, detailed discussion of this issue can be found in Robert Hatten's review of Krebs' book (Hatten 2002).

In my terms, the identification of some qualitative relationships that resemble a known metering construction causes the listener's mental and physical perceptual systems to actively seek out remaining features of this construction. One of our perceptual tools along these lines is to invest our body in that construction, to perform the construction's rhythm and see if it fits the music.

With rhythm, I'm not sure if it is ever so clearly cut that one schema or construction is an exclusive correct interpretation, that others are all wrong. In other words, one *can* always move or feel rhythm in pretty much any way one wants—though culturally-situated observers are likely to judge movements as more or less appropriate or sensible in comparison with their own interpretations. Rhythmic interpretation is thus really quite subjective. This is especially true from the perspective of a performer, who can make innumerable subtle motor decisions that affect the piece's momentum, gestural shapes, and patterns of emphasis. In contrast with Gjerdingen's account of schema perception, rival schemas are not often easily "eliminated" in the sense of suddenly being rendered impossible by the perception of a new feature. Instead, there is often a feeling that while many interpretations are workable or performable, one feels more natural or inherent to the music (at least, given one's understanding of how that kind of musical rhythm is supposed to feel). We may have to try out a few metering constructions to know which one will work best.

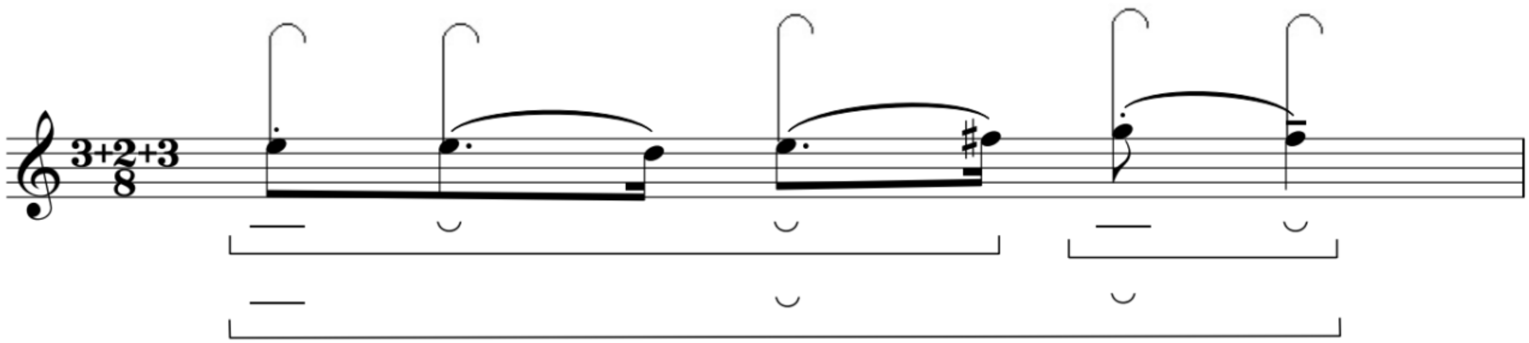
Choosing between these hearings has radical implications for the feeling of motion of this primary theme, creating completely different feelings of motional syncopation. The 4/4 hearing makes the dotted figures in the middle of the motive into motional syncopations. When the final quarter note of the measure subsequently becomes the first on-beat after the downbeat, it gives this note a persistent emphasis that I find is too stocky and pedantic, sitting on the beat too hard and arresting any sense of anacrusis towards the next measure. I prefer the 3+2+3 or 1+2+2+1+2 interpretations shown in Figure 4.2, which place the strongest metrical accent in the second half of the measure on the second-to-last note, leaving the last note less weighty and more open to a buoyant anacrusis. This interpretation also places beats on the dotted-eighth figures, giving them a graceful lilt that I feel is preferable to the propulsive and rigid hocketing motion of the syncopated quality determined by the 4/4 interpretation. In the following, I will assume a 1+2+2+1+2 interpretation except where noted.

Retrospective Hearing and Developing an Interpretation

Unlike metrical momentum (see Chapter 3), developing an interpretation is not a linear, directional process. A performer need not decide how to play measure 1, then move on to measure 2, then 3, and so on, never revising an earlier decision or returning to an earlier part. In developing an interpretation, performers usually jump around, making connections between disparate parts of a piece in order to create consistencies and progressions and contrasts throughout. A metrical interpretation may be based in discrete motives and schemas, but the rehearsed end product may be better characterized by Christopher Doll's description of a "hearing" from his theory of harmonic in rock music.

> "Hearings are highly complex; residue of earlier ones seems to stick to newer ones, creating multilayered, subtly colored patchworks that might contain outright contradictions [. . .]. When we try to verbalize a "hearing," we are probably describing a kind of Frankenstein-like composite of pieces of distinct experiences from different moments in our lives." (Doll 2017, 82)

The exact motional interpretation of the opening measures may be chosen to make something much later in the piece work better, and it will draw not only on a particular metering construction, but also on a performer's life experience of musical gestures and cultivated subtle nuances, ways the performer has learned to nudge the timing



1	2	3	4	5
Staccato 8th	Dotted 8th - 16th Repeat pitch of Stage 1	Dotted 8th - 16th Repeat pitch of Stage 2	Staccato 8th Often a dynamic peak	Tenuto Qtr
Initiating	Continuing (Afterbeat)	Continuing (Anacrusis)	Arrival	Afterbeat

Figure 4.3: Motional Conceptual Model of Primary Theme Motive

and articulation and pitch just slightly to make the interpretation "work better." In this analysis I will proceed in linear order through the piece, but I will also try to recover some of this nonlinearity by pointing out places where a later passage confirms or casts new light on the interpretation of an earlier one.

This kind of retrospective connection can be brought up with regard to the first time the music departs from the *zortziko* rhythm in the melody, in measure 14 (see Figure 4.4). Here the cello repeats four times a figure of a dotted eighth note and sixteenth note, which to me clearly implies a 4/4 interpretation, especially if one considers the bowing motions necessary to produce this passage as it is slurred in the score. (Though Ravel's consistent beaming in 3+2+3 makes the simplicity of this rhythm hard to see in the score). Applying Gjerdingen's description of schema perception quoted above, one could observe that some features of the piano part are more consistent with a 3+2+3 interpretation, specifically the rhythmic placement of bass notes in the piano and the rising contours created above these local minima. However, in the recordings I have listened to, this piano line is performed as a relatively indistinct background color, and whatever 3+2+3 grouping might be suggested by the piano's registral contours takes a backseat to the clear and simple rhythm of the cello.

In my mind, this interpretation of measure 14 has an influence over the earlier statements of the *zortziko* melody, reinforcing the association between the dotted-eighth figures and on-beats. This confirmation is only amplified by other passages which repeat a dotted-eighth figure several times in a row, including the violin in measure 16, the piano mm. 24-27, and the violin and cello in mm. 28-31. In a nonlinear model, these passages all strengthen one another, and I take them as a confirmation of my earlier preference for the 1+2+2+1+2 interpretation which places a focal impulse on each dotted-eighth figure of the primary theme.

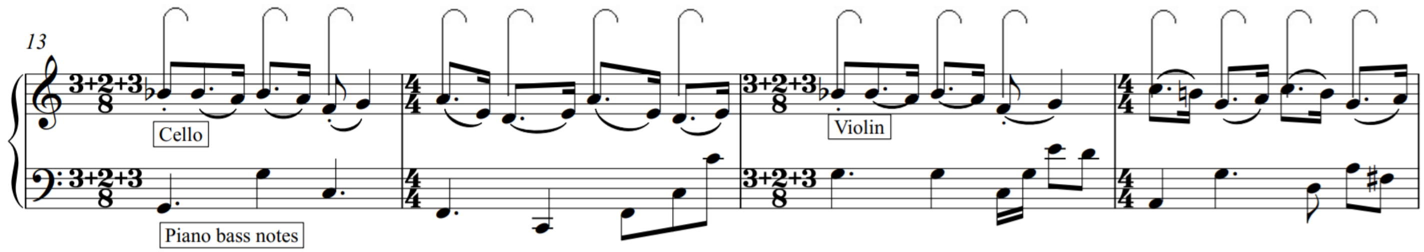


Figure 4.4: Reduction showing a metrical interpretation of mm. 13-16. Beat placement is reinforced by dotted-eighth rhythm.

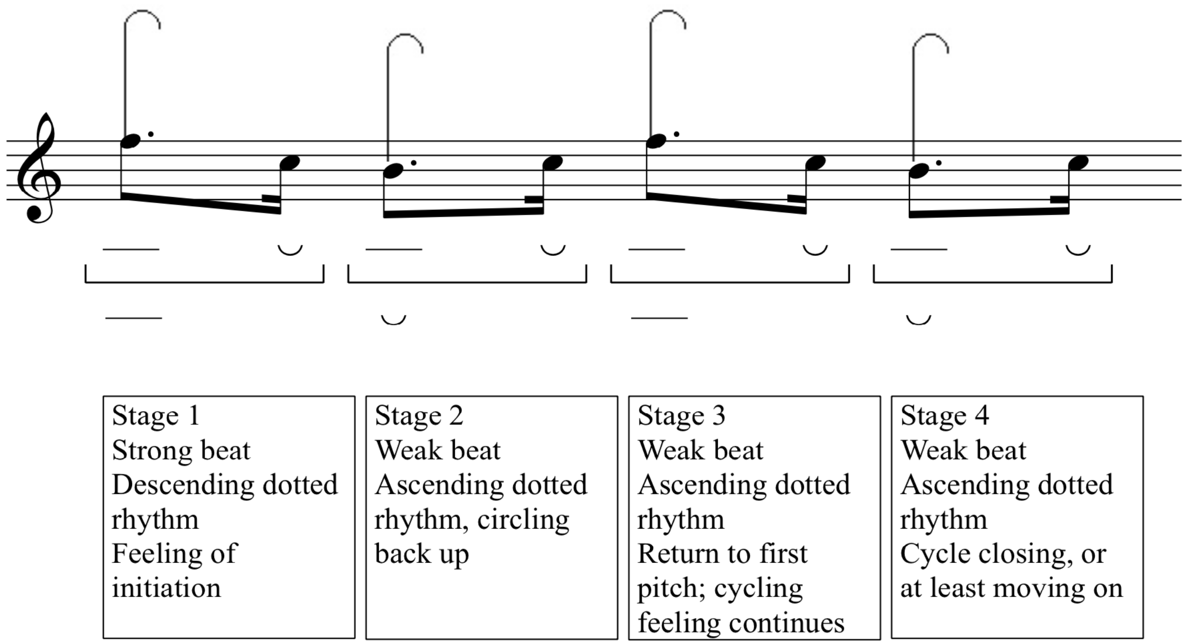


Figure 4.5: Motional conceptual model of mm. 14 and 16 (Developing Variation of Primary Theme motive)

MERGING COMPATIBLE MOTIONS: WEIRD JOINS AND METRICAL TRANSMUTATION

Measures 13 and 14 can be given separate but related motional conceptual models. The first, measure 13, is a clear instance of the *zortziko* construction, and fits in the motional conceptual model shown in Figure 4.3. But measure 14's even quarter-note pulse doesn't match the 3+2+3 loping rhythm of this construction. Instead, measure 14 is a variation that evolves out of the movement of m. 13, but takes on different motional qualities (see Figure 4.5). Measure 14 can be considered as a developing variation based on stage 2 and/or 3 of the primary theme motive in Figure 4.3, looping this dotted rhythm into a lilting, circular turn (see Frisch 1984 for a discussion of Schoenberg's concept of "developing variation").

For a few measures this piece alternates between these two dotted-rhythm motives; we might expect m. 17 to be another copy of measure 13, but after the first note, the melody does not resemble stages 2 and 3 of the primary theme motive as much as it does a repetition of m. 16 (albeit transposed up a whole step). This leads to a feeling of downbeat on the fortissimo climax near the end of m. 17 (see Figure 4.6).

Although this felt downbeat is considerably earlier than it "should" be from a qualitative meter perspective, it feels perfectly natural because of how it uses familiar motives without violating any stage-to-stage transitions. In other words, in the *zortziko* rhythm, there would normally be a staccato-emphasized eighth note in the location where measure 17 has a low C#, so it "feels" on-beat even though it occurs after an odd number of eighth-notes and would be counted as an off-beat under traditional definitions of meter. Another important factor is that the pitch contour of the dotted-eighth figures more closely resembles the circular turn in the motional conceptual model of Figure 4.5, than the repeating pitches of stages 2 and 3 in Figure 4.3's conceptual model. The music began measure 17 in the zortziko rhythm of Figure 4.3, but then slips into

Figure 4.6a: (a) Original score, mm. 17-21

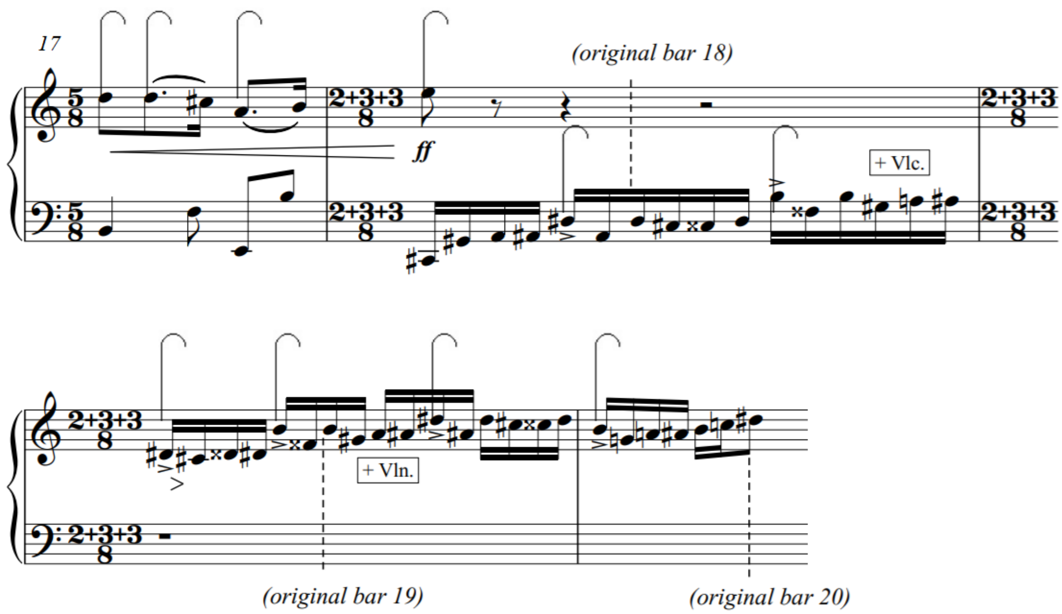


Figure 4.6b: (b) Reduction showing a metrical interpretation of mm. 17-19

the quarter-note pulse of Figure 4.5 and creates a felt downbeat displaced from the notated barlines, but this displacement is effected so smoothly that one doesn't notice without looking at the score. Because familiar rhythms are weirdly joined, this metrical adjustment feels smooth and not disruptive.

This "weird join" takes advantage of the similar dotted rhythm in stages 2 and 3 of of the primary theme motive and the motional conceptual model in Figure 4.5, so that my expectation of where the next felt downbeat will occur is altered without altering any of the intervening durations. I'm reminded of a memorable principle from Gjerdingen's schema theory:

> "The schemata of galant phrases were not immutable objects of the real world that could be bolted together in only a certain way. They coalesced, evanesced, and mutated in response to a variety of cues that could easily lead down divergent paths." (Gjerdingen 2007, 131)

Figure 4.7: Metrical displacement and transmutation, rebarring of mm. 19-21

Like galant schemas, motives and metering constructions can be bolted together in unexpected ways, but these Frankenstein combinations do not have to be monsters. Instead, if such joins merge compatible motional features, even the purplest notated complexities can sound perfectly smooth, like finger joints on fine carpentry.

A new kind of metrical displacement occurs next. Starting at this felt C# downbeat in measure 17, there is a consistent accent pattern every 4+6+6 sixteenth notes, an interpretation which is shown in the rebarring of this passage in Figure 4.6b. At the end of measure 19 there is another C# in octaves in the piano's left hand which would be the first 6 in the third iteration of the pattern, except that two sixteenths later, the downbeat of measure 20 contains a rhythm which as notated closely resembles the primary theme motive. For me this strong bass accent on the final eighth note of measure 19 makes it impossible to hear the first note of measure 20 as a downbeat, and instead of hearing the metrical implications of the *zortziko* rhythm, I hear it more as a 4/4 (see Figure 4.7a). However, other listeners may find it easier to continue to hear the *zortziko* rhythm and meter implied by the original barlines.

This moment displaces the heard downbeat from the notated downbeat, but it is a different phenomenon from previously identified displacements of meter. Previous theories of meter such as Krebs have theorized "metrical displacement" as a phenomenon in which a familiar metrical pattern is shifted over with respect to the barline. But here the sounding rhythm of the *zortziko* metering construction is still there, and notated in the original metrical position. Instead the motional character of the downbeat has been altered by the strong bass accent one eighth note before it. The notated downbeat no longer carries the motional quality of downbeat, which effects a metrical transmutation of the entire motive, whose motion has changed from a solemn and commanding opening theme in asymmetrical rhythm, to an evenly beated figure of diminishing energy that feels like a play-out.

The repetition of this C# bass note in the same metrical location at the end of measures 20 and 21 makes it easy to continue this displaced 4/4 hearing. In measure 21 I usually feel the ingrained associations of primary theme's zortziko hearing start to surface (see Figure 4.7 b). But in my hearing, they never completely banish the displaced 4/4 due to the continuing C# bass octaves, and I end the phrase hearing the 4/4 interpretation, as shown in Figure 4.7a.

Variable Meter: Metrical Expansion, Deletion, and Overlap

As the piece winds towards the end of the primary theme area, the opening theme exhibits a metrical expansion in which it repeats the middle stages of the conceptual model in Figure 4.3. Measures 22-27 consist of three two-measure phrases (see Figure 4.8), which each contain all of the stages of the motional conceptual model but loop through stages 2 and/or 3 extra times, extending the quarter-note pulse of the middle of this motive so that the entire motive fills two notated measures instead of one. The repetition of stage 3 is not just a similarity in notation, but draws out and extends the basic motion of stage 3 – a feeling of playing out with an anacrusis towards stages 4 and 5.

But in this case, the extent of the repetition causes the feeling of anacrusis to attenuate, creating a somewhat wandering quality. Each of these 2-measure phrases begins with the dotted rhythms that characterized the motive in the opening, but in repeating stage 3 the motive moves to other rhythms which still maintain the quarter-note pulse, before ending with the slurred-together eighth note and quarter note which mark stages 4 and 5. In the middle of measure 23, it is easy to think one has left the motional space of the motive when the familiar dotted-eighth rhythm disappears. Also, the number of repetitions of this stage makes it easy to question whether one is really still within the same ordering of stages 1 through 5, and easy to lose track of when the end of the motive will come. It is easy to lose one's orientation within the larger metrical pattern, even though the regular pulse is easy to follow. This is one type

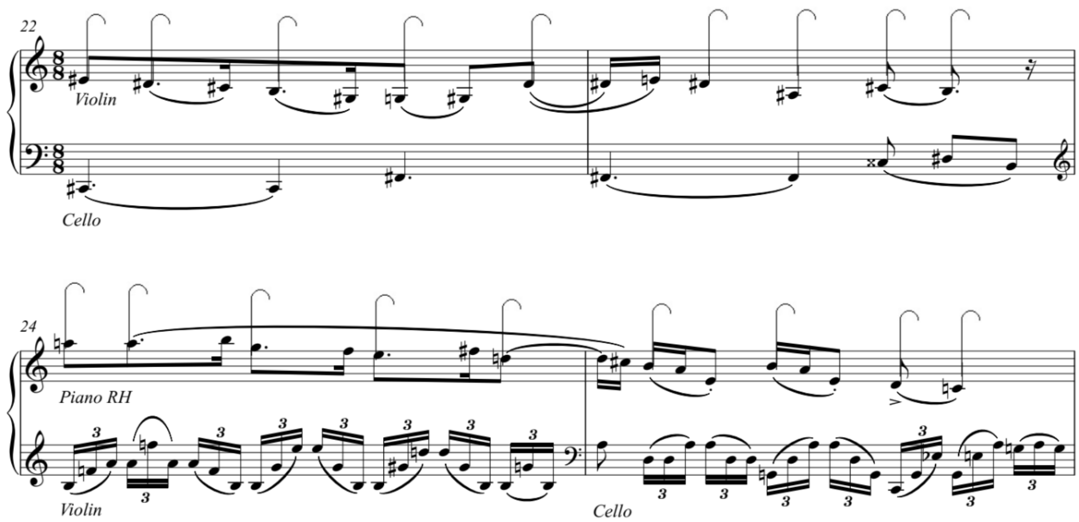


Figure 4.8: Metrical expansion, metrical interpretation of 22-27

of dissolution of metrical orientation; another type, featuring dissolving of a pulse, will be discussed below.[3]

The next passage, starting in measure 28, introduces a further developing variation of the dotted figures from the primary theme motive. This passage creates a new motive that I hear in 3/4 time, which consists of three stages: the first two have an ascending dotted-eighth rhythm, while the third has a descending dotted-eighth rhythm. Although the basic motional interpretation of the dotted-eighth rhythm is derived from the motional conceptual models in Examples 6.3 and 6.5, this new 3/4 grouping creates a distinct motive/metering construction because of its distinctive contour, shown in Figure 4.9. But after two complete statements of this new motive, the third statement skips stage 2. This motional deletion still maintains the essential motion of the 3/4 motive, but with only two motional stages.[4] Motional deletion is more than just an

[3]Horlacher (2000) discusses this first kind of metrical dissolution, the emergence and dissolution of metrical groupings of a stable pulse, in Steve Reich's music.

[4]It's worth observing that the right hand of the piano part also articulates these 3/4 and 2/4 group-

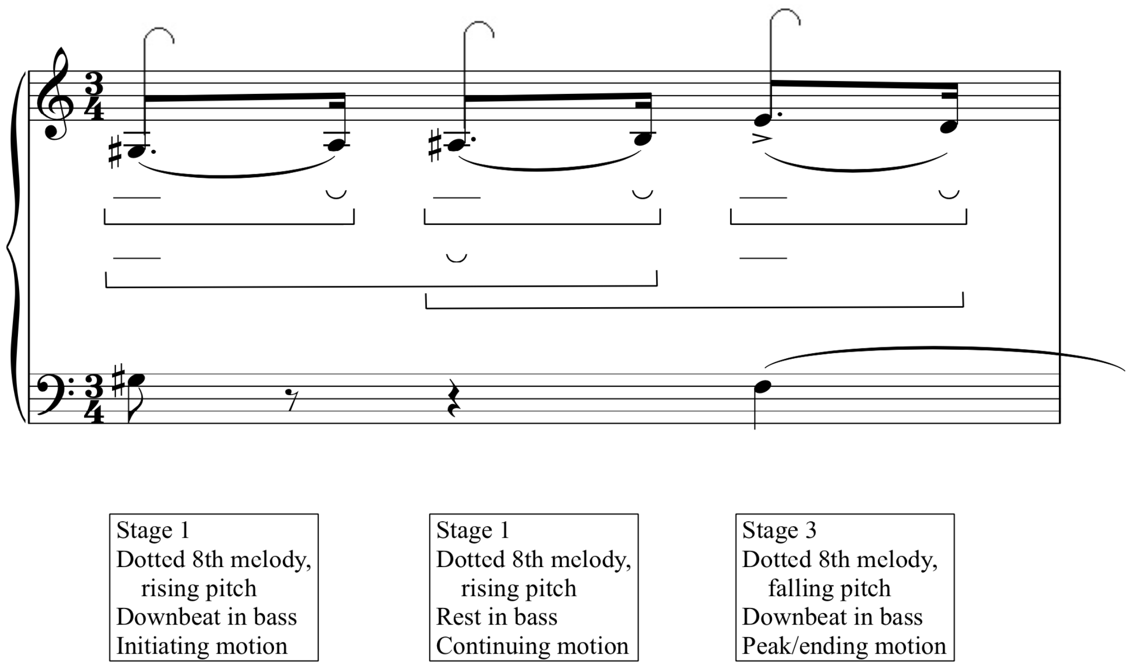


Figure 4.9: Motional conceptual model of 3/4 motive (first seen in m.28)

unexpectedly short measure; it is a sense that the basic motion of the music has been short-circuited. A rebarring based on this motive-based metrical hearing is shown in Figure 4.10b, while Figure 4.10a shows the original barring of this passage.

A similar figure occurs next in the cello part of measures 30-31, but the way it is combined with the violin part makes a novel effect that I call motional overlap. If a listener is applying the motional conceptual model in Figure 4.9 above, the violin part can be heard as two statements of the 3/4 motive, one short-circuited as before. But simultaneous to the cello's final stage 3 of the motional conceptual model, the violin part plays what is clearly stage 1 of a new instance of the 3/4 motive. The result is that the motion of the cello part overlaps with the motion of the violin part, creating a curious ambiguity for a listener. Theorizing how listeners navigate such conflicting

ings, but the left hand of the piano part continues a 3+2+3 grouping that aligns with the notated barlines.

motional cues will have to wait for a later incarnation of this project, but for now I will suggest that listeners either choose one of the metering constructions to entrain to, or experience some kind of confusion or disorientation.

This final 3/4 construction in the violin part leads to a natural felt downbeat in the last quarter note of measure 31. Because this does not perturb or interrupt the motion of the 3/4 motive, it does not *sound* like a displacement of beat or meter. But unlike the metrical transmutation I observed in measure 20-21 (see Figure 4.7), this displacement is in fact a complete metrical displacement of the conventional 4/4 meter schema. The E major chord in the left-hand piano part at the end of measure 31 is a repeating motive of four descending quarter notes, which clearly evokes a 4/4 interpretation displaced from the notated barline (although the 3+2+3 figuration in the piano's left hand does align with the notated barlines). This motive is repeated, which in my hearing clearly establishes this motive and the displaced 4/4 it implies. In contrast with the "subliminal dissonance" of Krebs' theory (Krebs 1999, 46), in which some sense of unease or displacement is present, I do not experience this as any kind of displacement or dissonance at all—there is a discrepancy between heard meter and notated meter, but this does not necessarily have to be experienced as a metrical irregularity.

The final appearance of this descending scalar motive creates a composed-in ritardando, a metrical phenomenon that I believe has not been previously described.[5] This is the second type of metrical dissolution, in which the sense of pulse dissipates along with any perceived motion and definiteness of duration. Beginning with the last quarter note of measure 33, the right hand of the piano part moves through the same descending notes as the previous two instances of this motive, but the second and fourth notes have been lengthened in the notation to dotted quarter notes. Although

[5] The term "composed-in ritardando" is analogous to Benjamin's concept of a "composed-in fermata" (1984, 398).

Figure 4.10a: Original score, mm. 28-34

Figure 4.10b: Reduction showing a metrical interpretation of mm. 28-34, showing developing variation of 3/4 motive, motional overlap, and metrical displacement.

the left hand of the piano part subdivides these uneven durations into eighth notes, the rhythm is confused even further by a written "*rallentissez*" instruction that makes the differences between notated quarter and dotted-quarter unnoticeable in most performances. The effect to my ear is not one of a motional extension or distortion of the motive, but one in which the motional and rhythmic relationships which hold together the sense of pulse and meter are undone, and for a brief moment there is no definite sense of time's passing. As the motive's motion seems to dissolve, so does my sense of entrainment, my ability to participate in the rhythm.

Motional Blur and Dissolution of Meter

This lower neighbor occurs again at the end of measure 54 in octaves between the violin and cello, evoking or activating a listener's memory of the motive at m. 46. But this forms a metrical overlap with stages 4 and 5 of the *zortziko* primary theme motive in the bass register of the piano! Further, though a listener could confidently interpret the downbeat of measure 55 as the beginning of stage 2 in the motional conceptual model in Figure 4.11, from there the melody degenerates into something unrecognizable. Because it continues "too long" for the motional conceptual model in Figure 4.11, and seems to have no clear equivalent to stage 3 of that model, I as a listener (and imagined performer) often find myself confused and unable to commit to a metrical hearing of measure 55.

A reduction of this passage appears in Figure 4.12. I've added horizontal squiggly lines to indicate places where I lose a sense of durational determinacy in the violin and cello melody. I've also placed parentheses around a few felt beat symbols which are not directly attached to noteheads. These felt beats in parentheses I fill in retrospectively; once the violin/cello melody starts to move in the odd measures, I often feel that the motivic content of those measures implies a preceding beat, but never actually heard a definite location for one marked by any onsets, because the violin/cello have been sustaining a note the whole previous measure.

Another dimension which makes this section more ambiguous is the extensive ornaments before the downbeats of measures 52, 54, and 56. In most performances this makes the final notes of the preceding measures seem to have a longer duration than notated, throwing off the meter even further. For example, the clear metrical determinacy felt by a listener who recognizes the *zortziko* motive in measure 52 may evaporate in measure 53; I personally find myself unable to decide whether the notes in measure 53 are on- or off-beats, an uncertainty which is exacerbated because the grace notes at the end of the measure blur time and reduce the determinacy of the final quarter note duration of this measure even further. At the end of measure 55 I experience a similar effect, which compounds the uncertainty described in the previous paragraph. I often find myself hearing the last three notes of the violin and cello parts in measure 55 as three equal quarter notes, rather than the notated quarter-quarter-eighth rhythm, and have a similar experience listening to measure 59.

Many of these phenomena occur again in the next 50 measures of the piece, but the ending features a motional phenomenon that has not yet been discussed, which I will call "metrical dissolution." In measure 112, the piano plays the *zortziko* rhythm all on a single pitch (a very low C), but the final quarter note of the rhythm is tied over into empty space; it does not lead to a downbeat, and its function as an anacrusis dissipates. The right hand of the piano plays chords at irregular intervals, just shorter than the length of the notated bar, but close enough so that it sounds like each tenuto eighth-note chord is on the beat. This gives the impression that the *zortziko* motive, which in fact remains aligned with the notated barlines, is the part which has moved out of phase. In my hearing, this dephasing, combined with the extraordinarily soft *Perdendosi* dynamics, slowly begin to denature the motional orientation of the *zortziko* rhythm. The final stroke comes in the penultimate measure, where the *zortziko* rhythm halters and stalls in stage 3—or does it just skip stage 3 and move to stages 4 and 5? All sense of measured duration or orientation within motive are now lost, the motional structure of meter has completely dissolved, and the final chords in the cello and the right hand of the piano feel like totally untimed events.

This heard metrical dissolution is shown in Figure 12. As before, I've added a squiggly horizontal line to indicate metrical vagueness—durational indeterminacy, which can also sometimes create some uncertainty as to whether notes feel like on-beats or off-beats. In this case, parentheses indicate rhythms which are difficult to hear with any clarity in most recordings because of the extreme range and quiet volume. This adds to the motional indeterminacy.

Figure 4.11: Metrical overlap and vagueness, mm. 52–59

Figure 4.12: Metrical dissolution in mm. 112–end: Original notation vs. Listening experience

CHAPTER 5

Entrainment Without Recurrence in Operatic Recitative

The Oxford English Dictionary defines "entrainment" as synchrony: "(of a rhythm or something which varies rhythmically) cause (another) gradually to fall into synchrony with it." The dominant paradigm for studying musical entrainment has been synchronized periodicity, including both music theory writings which define beats and meter exclusively in terms of equal repeating durations (such as Yeston 1976, Lerdahl and Jackendoff 1983, Krebs 1999, and to a certain degree Hasty 1997), and hundreds of music cognition studies which model and measure entrainment by asking listeners to tap periodically in synchrony with aural stimuli such as music or metronomic beeps (see Repp 2005, Repp and Su 2013).

But a number of recent scholars have argued that entrainment is not limited to synchronized, periodic motion. Entrainment can also encompass more diverse forms of being with others. Jessica Phillips-Silver describes a type of "affective entrainment" in which two individuals "share a mutual affective state," a phenomenon which is often present in experiences of synchronized motion but which clearly encompasses non-synchronized motion as well (such as the emotional attunements between an infant and a caregiver; Phillips-Silver 2014). In a discussion of the evolution for human cognitive capacities for music, Gary Tomlinson uses the term “social entrainment” to refer to individual hominids inhabiting the same taskscape of chipping rock into axes, without actually synchronizing their movements.

> The synchronizing of action routines in Lower Paleolithic taskscapes must have been of the loosest sort. These hominins did not join their various stone-knapping gestures, like some lithic percussion section, in the coinciding rhythms of modern field-laborers reaping or soldiers marching or rowers rowing to a shared beat. (Tomlinson 2015, 76)

I’m not sure what evidence there is for this lack of coincidence in stone-knapping, other than scholars’ inferences that humans did not have the capacity for this coordination at this time in our evolutionary history; but the historical accuracy of this claim is irrelevant to my consideration of different senses of ”entrainment.” Despite this ostensible lack of coinciding rhythms, Tomlinson uses the term “social entrainment” to describe the shared temporality of the taskscape of stone-knapping: repetitive strikes alternating different sides of a piece of stone, paring away stone to work towards the end goal of a sharp, pointed implement. Surely this sense of coordination and co-action without coincidence can also encompass many other types of cooperative human motor action with varying degrees of synchrony, from syncopated dancing in which footsteps often coincide, to the coordination of a basketball team whose individuals rarely perform the same action in synchrony. My primary argument in this dissertation, and in this chapter especially, is that *motional collaboration* is a model with greater power to explain and describe felt beats, meter, and syncopation, than the model of metronomic resonance that forms the basis of current paradigms for thinking about human musical rhythm.

One important implication of this broader definition of entrainment is that music without a periodic pulse can still afford certain senses of entrainment, such as operatic recitative. In Chapter 3 I reviewed research by Mitchell Ohriner and Mats Johansson suggesting that motive could afford entrainment in the absence of periodicity, but their sense of entrainment is still defined by the production of close synchrony (tapping along to perceived beats) and by the (almost-) exact repetition of a familiar motive. But the concept of entrainment does not necessarily involve synchronous production such as tapping. In this chapter, I seek to map broader senses of "moving together" that are involved in the perception and performance of freely-timed eighteenth-century operatic recitatives. The concept of a "metering construction"—a conventional association between sounding features, performed motion, and beat interpretation—provides many avenues into analyzing how listeners might experience motion in freely-timed recitative, despite the traditionally *unmetered* nature of that music. Here I seek neither a historically-informed model of recitative cognition and composition, nor a corpus-based survey of the style. Instead, the primary goal of this chapter is a proof of concept, to demonstrate possibilities in how a theory of metering can apply to an entirely non-isochronous and non-repeating genre of music, a style which is fundamentally incompatible with the concepts of durational recurrence or attentional periodicity which form the ontological basis of existing paradigms for academic discourse about musical meter and entrainment.

Recitative is a subsidiary component of eighteenth-century operas, but one which plays an important role. The primary components of a baroque opera or oratorio are either arias—set-pieces that showcase the virtuosic expressive singing of one or more soloists—or choruses—pieces sung by a large group of singers. Both of these types often seem to portray a single moment in time, a single emotion or idea stretched over several minutes. In the most famous Chorus from Handel's *Messiah* (1742), masses of singers shout "Hallelujah!" over and over, punctuated only by additional exclamations expressing the same rejoicing, "And He shall reign for ever and ever," "King of Kings, and Lord of Lords," etc. But if arias and choruses are tableaus, *recitative* sets these scenes and serves to transition between these moments of suspended action. Unlike the fairly rigid and conventional *da capo* structure and elaborate melismatic acrobatics of most arias, a recitative movement or section usually features no repetition at all and consists of a text that is sung straight through, set with a spartan melody and minimal accompaniment. In more modern genres of musical theater, such scene-setting would be accomplished through spoken dialogue, but recitative is a legacy of the earliest opera composers' ambitions to revive the ancient Greek concept of an entirely sung drama.

The musical contrasts between recitative and aria involve much more than the orchestration. Historical writers stress that recitative requires a speech-like mode of performance free of the regular beat of conventional meter. For example, Francesco Gasparini wrote in 1708 that the singer should be free "to take the lead, singing at his discretion and in accord with the expression of the words" (quoted in Cyr 2003, 112). Johann David Heinichen in 1711 clarified the distinctions between this speech-like rhythm and normal music: recitative is a "quite special style which, because it is played mostly without instruments, is in all aspects extralegal in the sense that it obeys neither the normal [harmonic] resolutions ... the meter, nor the other usual rules" (quoted in Dreyfus 1987, 76). While recitative may have been given the mundane function of moving the plot forwards between arias, the recitative's speech-like rhythm and mercurial twists of harmony represented an expressive beauty distinct from the surrounding music, a unique mode of expression that when well-executed is anything but mundane.

Analyzing the flexible speech-like timing of recitative will require more flexible versions of the analytical tools I've developed to study felt beats and musical motion in previous chapters. In the introduction of this dissertation I've organized the entire project along a continuum between temporal regularity and unmeasured freedom. I've relied throughout on the concept of a "metering construction" to quantify these increasingly irregular interpretations of rhythm. In the first two chapters I theorized meter as a "patchwork quilt" of metering constructions, each of which was still relatively *fixed* in that every time it was heard, it had the same number of beats in the same order and roughly the same durational proportions. In recitative, however, the constructions I analyze will not only be more flexible, but will also often have fewer strict specifications for form or content.

Following Mark Butler's conception of "metering," I argue that a listener's perception of metrical structure is not a passive discovery of an objective meter inherent in notation or sound, but an active construal of one's own metrical interpretation, in which each listener simultaneously both identifies possible ways of moving (metering constructions), and performs those interpretations by experiencing those beats and motions within their own body. Building on the work of John Paul Ito, I theorize some essential components of this process of metering: "beat" is any place where a listener is able to feel an embodied impulse (Ito 2004), and "metrical orientation" is a sense of where one lies within a motional pattern or schema (Ito 2014), a feeling that one is coming from or headed towards a particular kind of beat or impulse, regardless of precise anticipation of exactly when that beat or impulse will occur.

The previous chapters show how metrical orientation and embodied impulses can be maintained in interpretations increasingly distant from traditional theories of meter. In Chapter 3, I departed from the fixity of previous chapters' metering constructions by showing how fragments and distortions of motives could still provide metrical orientation and afford entrainment. This chapter takes that trajectory to its logical conclusion, at the far end of the continuum between temporal regularity and unmeasured freedom. The genre of recitative not only contains no consistent periodic beats or subdivisions, but generally features no motivic or rhythmic repetition either. I show that metrical interpretation of recitative is both *possible* in first-time hearing of recitative, and *necessary* for rehearsed performance. I will argue that this unmeasured rhythm actually shares more with experiences of metered music than has been previously assumed; many of the cognitive models which allow for entrainment in recitative are the same ones which shape feelings of motion and gesture in ordinary metered music.

In the more general forms of entrainment, the question of rhythmic entrainment then becomes a much broader enterprise. A narrow definition of entrainment asks, "How can the body internalize this or that sequence of periodic impulses?" In considering a broader sense of entrainment, I hope to ask instead, "What kind of rhythmic/temporal information and understanding is already in use in each domain of human cognition? And how can this rhythmic information play a role in the collaborative motional performance and cognition of music?" Each section of this chapter considers a different type of temporal structure in recitative, exploring what kinds of motional affordances and implications these structures have—in other words, studying how these types of structure can be analyzed as metering constructions.

The first part of this chapter will be devoted to considering tonal schemas as metering constructions, insofar as they provide a framework by which listeners can entrain to such freely-timed music. Specifically, I will interpret some recent studies of schemas and other voice-leading patterns by Job Ijzermann (2011) and Paul Sherrill and Matthew Boyle (2015) through Carl Schachter's concept of "tonal rhythm." These involve associations between certain pitch events and metrical accent. I will review different types of pitch structures, some of which are defined as fixed schemas and others of which are more open. All afford perceived motions oriented towards felt or implied beats, and can be understood as metering constructions.

The second part of the chapter will study the role of speech structure in recitative, drawing on cognitive linguistic theories and studies of pragmatics (or the physical rhythms and sounds of speech). One of the defining features of the recitative genre is that these pieces are supposed to be sung with free, speech-like rhythm. The linguistic structure of speech itself affords several kinds of orientation within time. The structure of syntax and pragmatics helps us to anticipate key words when listening, and in this sense what we describe as "following a conversation" is a form of entrainment that can become part of our musical attending. Some recent research has focused on the role of gesture and motion in the cognition and perception of speech, and in the third section I will discuss how this type of motion can be compared to the musical motion discussed in previous chapters. In other words, speech by itself affords a lively and rich experience of and entrainment to physical rhythms, even without being framed in musical recitative.

The fourth and fifth sections of this chapter will focus on the special problem of coordination between performers. It is easy to see how the constructions discussed in the first half of the chapter can afford a rough sense of metrical orientation that is enough for listeners to experience beats and motional contours. But today's audiences expect *all* performances of Western classical music, whether metered or not, to have highly synchronized motion. The fourth section will be devoted to a study of how modern conducting patterns have been adapted to coordinate metrical orientation between performers and help performers anticipate events more precisely. In the fifth section, I will review some recent linguistics research on "synchronous speech," which show that under the conditions similar to recitative performance, synchronicity in speech production is still possible without any underlying periodicity. In other words, with the proper preparation, a musician is better served by entraining to the recitation of the singer than trying to follow the conductor—a strategy which has been confirmed discretely by some of my period performance mentors.

To illustrate these concepts of entrainment, I'm choosing a very specific and restricted repertoire: the recitatives from Handel's Messiah and Haydn's The Creation. Recitative from the eighteenth century can be broadly divided into *secco recitative*, in which the singer is backed only by harpsichord and possibly a single bowed bass instrument ("secco" means "dry"), and *accompagnato recitative*, in which there is a larger ensemble of accompanying instruments. In addition to this difference in orchestration, *accompagnato* recitatives can sometimes have distinct, rhythmically-defined motives in the accompaniment parts, while *secco* recitative often features only sustained chords. Thus, *accompagnato* is often performed with some sense of regular beat, albeit one that is more flexible than the meter of a traditional aria. While I have included some passages of *accompagnato*, I've chosen to avoid any with defined figures that afford a sense of regular pulse, as my focus is to explore entrainment to the relatively unmeasured rhythms of speech.

I have chosen Handel's *Messiah* and Haydn's *The Creation* primarily for reasons of accessibility. These oratorios are the most widely-performed compositions today which contain recitative, so the examples may be familiar to my readers—in fact, there is a possibility that for some readers, this may be the *only* recitative which they have heard outside of a Western Music History survey course. Additionally, these are the most well-known works containing recitative originally composed to English texts; Italian was much more common. Anyone reading this dissertation will thus not only understand the texts, but can easily imagine what kinds of phrasing and declamatory rhythms might naturally fit such a text, which will simplify my discussion enormously. One last added bonus is that the recitatives from Handel's *Messiah* and Haydn's *The Creation* are widely praised as paragons of the genre, when given a sensitive and historically-appropriate performance. However, Haydn was not much of an English speaker, and while his recitatives are wonderful in German, I will argue that the setting of the English translations leaves something to be desired.

Natural Tonal Rhythm: Pitch Schemas as Metering Constructions

The core idea that harmony and melodic motion have implications for meter has already been introduced in my discussion of motives as metering constructions in Chapter 3. Especially relevant here is Rosen's assertion that "Tonality is more than a harmonic system (although it is sometimes convenient to speak as if it were only that). It carries with it a complex set of presuppositions about melody, rhythm, and form, none of which can exist independently of the others" (Rosen 1996, 30–31). This statement itself is a later entry in a much longer theoretical debate that includes Carl Schachter, who also asserts that "the tonal system itself has rhythmic properties" (Schachter 1976, 313).[1] Schachter cites Rosen's earlier writings in a long-winded discussion about the nature of tonality and meter, arguing against Rosen's conception of tonality and meter as inseparable, and positing instead that there are distinct parameters of "tonal rhythm" and "durational rhythm" which interact but are not co-constitutive. I tend to side with Rosen, believing that durational rhythm and tonal rhythm are not separable phenomena. But given the absence of durational recurrence

[1] I am indebted to William Rothstein for suggesting in an email after SMT 2018 that I revisit Schachter's articles and certain details of Lerdahl and Jackendoff's theory in pursuing the associations between tonality and meter.

CDCBCDEDCBABCDEFEDCBAGABC . . .

Figure 5.1: Busoni's *Scales in Spirals*

in baroque opera recitative, Schachter's separation of tonal and durational rhythm is an important precedent, and in the following discussion I will use his conception of tonal rhythm to highlight the metrical implications of voice-leading schemas.

Schachter's text provides many examples of how tonal structures can have metrical implications or associations, which can be productively included in my theory of "metering constructions." In the first chapter I defined a metering construction as any association between a specific sounding structure, a specific beat interpretation, and specific movements. Each of these components is illustrated in several examples Schachter provides to support his argument that tonal rhythm and durational rhythm are independent. The first of these is an exercise invented by Ferruccio Busoni called "Scales in Spirals," which involves playing the tonic note, then playing an upper neighbor followed by a lower neighbor, then continuing scales up and down each time ascending or descending one note further to create a kind of "spiral." Figure 1.1 shows the pattern in C major.

Schachter argues that each time the scale returns to the tonic note, this note carries a special weight that cannot be accounted for in terms of durational rhythm.

> The contrast between the stable referential tones and the transitional ones produces an impression of patterned movement, in other words, an impression of rhythm. [...] This impression does not depend upon accentuation; it arises even if the exercise is played without any stresses (though the rhythmic effect would be heightened by appropriate accentuation). Nor does it come from pulse or meter. The tonal rhythm persists through almost any conceivable pacing [. . .] (Schachter 1976, 313–314)

This description of "patterned movement" provides all the components of my definition of the metering construction. The definitive sounding feature is a stepwise return to the tonic, followed by a continuation of the scale in the same direction. The beat interpretation is clearly a felt beat on the tonic note. The movement is the linear motion of the scale, curved into an ever-expanding spiral by the progressively longer scalar arc and anchored by eventual return to the tonic. In this metering construction, the tonal identification of the tonic pitch as a starting and ending point is associated with a perceived beat, no matter how much duration has passed since the last perceived beat.

Schachter's next example also translates easily into my definition of a metering construction, but is also closer to normal musical practice than Busoni's "Scales in Spirals." The movement still involves scalar departure and return, but instead of a single tonic pitch, three pitch classes are heard to have special rhythmic weight.

> If we play our major scale with the right hand and hold the tonic triad with the left, we become aware of still another rhythmic consequence of tonal association. The members of the tonic chord function as stable elements in contrast to the other, "dissonant" tones; we hear the latter as transitional elements, as passing tones. The alternation of chordal and passing tones adds another layer of patterning to the melodic flow; again neither meter nor a steady pulse is required to produce the rhythmic effect. (Schachter 1976, 315)

It should be noted that this metrical construction does not completely determine metrical interpretation. The tonic pitches may have strong associations with metrical accent in a rising major scale, but this does not force a listener to feel those pitches as beats. Every type of Accented Non-chord Tone would be a counterexample to this proposition. Also, this construction gives no guide for distinguishing the relative strength of different chord tones. It simply states a tendency or association that a listener can choose to apply in hearing.

This triad-chord-tone metering construction is thus quite different from my earlier metering constructions because it is not constituted by a schema with a fixed order.

The characteristic Bourrée rhythm I examined in Chapter 2 has a fixed 2-bar pattern of felt beats and accentual flow. And motives like Wagner's *Leidensmotiv* are comprised of mental models with a fixed order of stages—even if in sounding music those stages may be repeated or distorted in duration, and individual appearances of the motive do not always present every stage. However, in the triad-chord-tone construction, the harmonic object of the triad is the only thing that is fixed, and scales can weave in and out through this field in any order or direction. The members of the tonic chord will always be accented in Cooper and Meyer's sense, meaning that the other notes will be oriented towards the chord tones as unstable tones requiring resolution. In this construction, no specific order or schema is necessary to activate a sense of metrical orientation or to select which note receives a focal impulse.

Lerdahl and Jackendoff (1983) allow for a similar flexibility by codifying associations between tonality and meter as Metrical Preference Rules, rather than Metrical Well-Formedness Rules.[2] This move implies that the associations between tonality and beat can be easily overridden by other factors, such as a pre-established metrical structure that suggests by momentum that a tonic pitch is off-beat, or a familiar motive which contains a tonic note at an unaccented stage. Schachter expresses a negative image of this same idea, saying that ”[t]onal rhythm is most easily perceived where there is little or no durational patterning” (315). The most important conceptual implication for my work is that metering constructions can still afford entrainment (metrical orientation and perceptions of beat and motion) even without any levels of periodicity. More specifically, the implications of tonal rhythm will be especially powerful in recitative, where there are by definition no repeating durational patterns.

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[2] Thanks again to William Rothstein for pointing out this line of thinking.

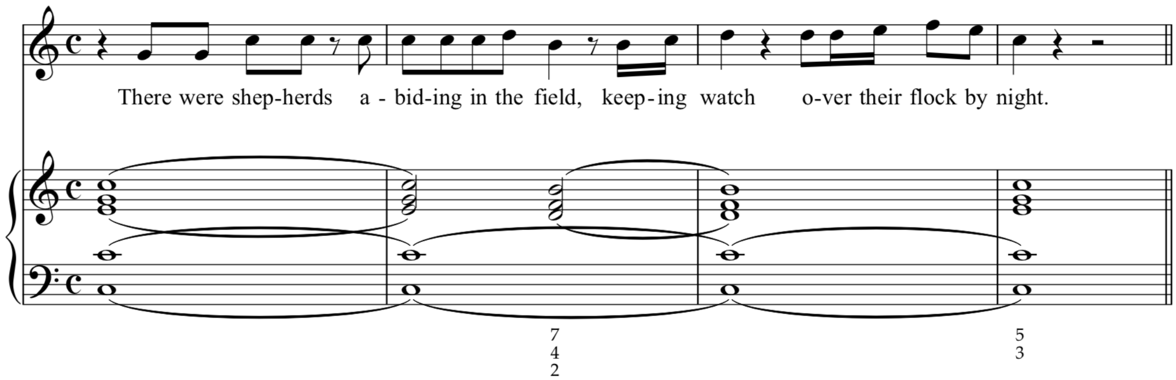

Figure 5.2: Handel's *Messiah* No. 14a, "Recitative. There Were Shepherds Abiding In The Field"

For example, consider the recitative "No. 14a. There Were Shepherds Abiding In The Field" from Handel's *Messiah*, reproduced below in Figure 5.2. Like most recitative, this short movement is notated with conventional meter symbols, but because of the freely-timed nature of recitative performance practice, it is unlikely that a listener would be able to "hear" the 1-2-3-4 count implied by the notation. However, the triad-chord-tone metering construction provides some clear metrical implications that most listeners probably would hear. In the melody, the first few notes (G and C) are within the opening 5/3 tonic chord, but the first D ("the" of "abiding in the field") lies outside this chord and by the triad-chord-tone construction is associated with weaker metrical positioning. In the middle of the second measure the harmony shifts, so B and D become chord tones while the C that is the second syllable of "keeping watch" is now a passing tone. At a larger level of scale, however, the 7/4/2 harmony itself is a passing harmony which conflicts with the C in the bass. Thus, if one were to listen only with the triad-chord-tone metering construction, the strongest metrical accent might be heard at the final note, when the 7/4/2 harmony resolves to a stable 5/3 harmony once more.

Schachter briefly gestures towards a much larger world of constructions, associations between particular tonal patterns and metrical interpretations. Schachter's examples are naturally very Schenkerian, all rooted in scales or the foreground composing-out of a middle-ground triad.

> The designs of tonal rhythm often maintain a high degree of independence from any metrical scheme. Very frequently, however, aspects of tonal rhythm underscore the meter. The avoidance, in many styles, of bass repetitions from a weak to a strong beat, the related tendency to "change chord over the bar line," the normal practice of beginning the bar with the lowest tone in Alberti or dance accompaniments—all of these show how tonal movement can help to express the meter. From a broader perspective, the appearance of an important goal of tonal motion at a metrically accented place can be an important compositional resource. (Schachter 1976, 318)

Several recent scholars have added to Schachter's insights, documenting other kinds of tonal patterns that have close associations with meter, and thus can serve as metering constructions: Robert Gjerdingen's theory of galant schemas; Job Ijzermann's analysis of contrapuntal structure in Louis Couperin's unmeasured preludes; and finally, most relevant to this chapter is Paul Sherrill and Matthew Boyle's theory of recitative schemas.

Robert Gjerdingen's influential 2007 book *Music in the Galant Style* does not expound on meter at length, but many of the schemas Gjerdingen identifies are indicated as having specific metrical implications. One schema, the "Do-Re-Mi," overlaps with Schachter's triad-chord-tone construction: Gjerdingen identifies the melody 1-2-3 as having strong-weak-strong metrical implications (with a bass line 1-7-1). But some others correlate less clearly, or even displace emphasis from the tonic triad. The Prinner schema has a bass of 4-3-2-1, but the 4 and 2 have strong metrical emphasis, while the 3 and 1 are associated with weaker beats (see Figure 5.3). A very few schemas have no metrical implications: "A Fenaroli could be initiated on either event one or event

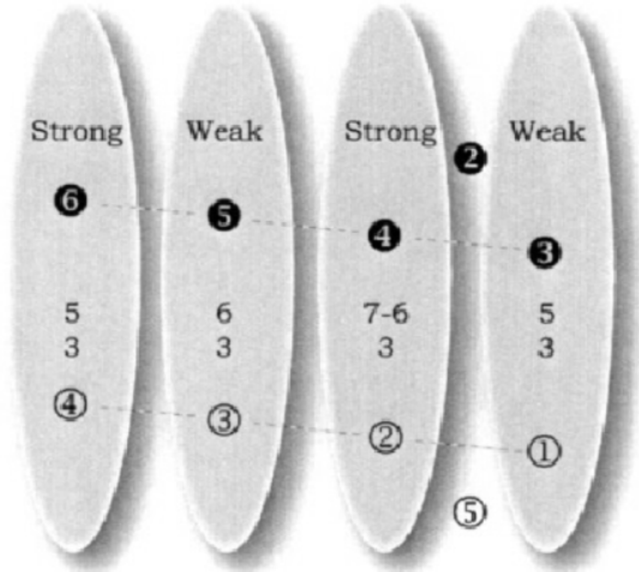

Figure 5.3: Gjerdingen's Prinner prototype (2007, 530).

two, so a given event could be metrically weak or strong depending on the choice of starting point" (2006, Appendix). But most of Gjerdingen's schemas associate specific stages with metrical accent, so they could contribute to meter and be used as metering constructions.

But while Gjerdingen's schema theory primarily deals with music notated in conventional meter, an article by Job Ijzermann about Louis Couperin's Preludes non measures or "unmeasured preludes" applies similar thinking in a repertoire closer in kind to the freely-timed recitative. Couperin's unmeasured preludes are notated exclusively in whole notes without barlines, with curved lines indicating important structural tones and arcing over ornaments and passing tones. But while the notation gives no indication of meter, and the number of notes between structural tones seems arbitrary, Ijzermann argues that these Preludes are not, in fact, unmetered. He shows how reductions can reveal conventional four-part counterpoint schemas behind the undifferentiated note values of the score.

> A deeper structural understanding [than mere harmonic analysis] can be obtained by regarding the structural tones as participants of a basically four-part contrapuntal texture. Obviously, some tones are member of a chord or, terminologically better, consonances, but others can be explained better as part of a voice leading pattern, like passing tones or suspensions. (Ijzerman 2011, 112)

The "consonances" Ijzermann describes are also explainable through Schachter's triad-chord-tone construction, but the "voice-leading patterns" he describes at the end of this passage go further. Ijzermann gestures towards even more constructions when he recognizes that "The comprehension of metre-based counterpoint as a background of the preludes can be the starting point for discoveries about stereotype formulas like (half) cadences and opening phrases" (112). These contrapuntal schemas — passing tones, suspensions, and cadences — provide a scaffold for rhythm perception because of their strong associations with specific metrical situations. These associations can lead to the perception of a "regular order of strong and weak times, regardless of their durations, and based on the relationship between consonances and dissonances" (116) which Ijzermann defines as a new type of meter suitable to this particular set of unmeasured pieces.

An important corollary of Ijzermann's theory of meter is that the construction of the suspension creates an impression of syncopation without periodicity. In other words, the schematic sequence of interval relations between notes in soprano and bass registers creates an impression that the bass is on-beat, while the soprano is a syncopated off-beat. Ijzermann's analysis of suspensions follows the opposite logic of Mark Butler's description of the experience of syncopation as occurring when listeners "use a regular "background" to measure and evaluate a less regular "surface"" (2006, 105). Here there is no regular "background," and the presence of a beat is inferred only based on the voice-leading patterns of the "surface." But this logic still makes sense within Kaminsky's definition of "motional syncopation," because the quality of suspension or syncopation is inseparable from the inference of a motional impulse with the bass rather than the soprano. Here, the syncopation of the soprano *creates* an impression of a beat, rather than being *heard* against an existing beat.

But I would like to challenge Ijzermann's assertion that this is a *new* type of meter specific to Couperin's unmeasured preludes. After all, the same metering constructions of passing tones, suspensions, and cadences would surely have the same metrical associations and implications in conventionally-metered music. Instead, I would argue that Ijzermann's understandings of how voice-leading patterns can contribute to meter reveal a side of conventionally-metered music that is undervalued in existing ontologies of meter, which are based primarily in durational recurrence or periodicity.

Finally, there is also a theory of tonal patterns in recitative itself which carries metrical implications. The "Galant Recitative Schemas" of Paul Sherrill and Matthew Boyle (2015) are a set of schemas for melodic motion and figured bass, and Sherrill and Boyle often associate these voice-leading schemas with specific metrical implications, as well as specific melodic figurations and feelings of motion. These schemas often already have been given all three components to be considered as metering constructions in my theory.

For example, the very first schema which Sherrill and Boyle introduce in their article, "O cielo," has all the makings of a metering construction. They clearly identify a specific sounding structure, metrical interpretation, and feeling of motion:

> In a prototypical schema 1, the fifth of a major triad is an anacrusis that falls to the triad's third on a metrically strong beat, setting a text that is an exclamation or a vocative. As was common in recitative, this falling third was often embellished by including a stepwise appoggiatura on the downbeat, so that the gesture concludes with a plaintive half-step sigh. (Sherrill and Boyle 2015, 6)

They note several ways in which this basic prototype can be varied. As Gjerdingen describes in his book, some kinds of musical patterns have loosely defined form and strictly defined content, others have loosely defined content and strictly defined form, while most fall somewhere in between. In other words, in most schemas (like the motives I examined in Chapter 3), some aspects of form and content are relatively fixed while others can vary without rendering the figure in question unrecognizable as an exemplar of the schema. In "O cielo," the number of syllables may change, and there may be a passing tone in the falling third, but the falling third itself is an essential feature.[3]

These galant recitative schemas are often end-directed. Sherrill and Boyle mark the typical metrical alignment in their schema prototypes with a dashed vertical line, as can be seen in their definition of "O cielo" in Example 1.3 below. This dashed line most often lies right before the final melodic pitch — and in schemas where there is a change of harmony, this final melodic note usually coincides with the arrival of the new harmony.

> Since harmonies do not change without activity in the vocal line, the overall effect is the sense that the schemas themselves are the agents of harmonic change: the schema's beginning precedes the change in harmony, as cause precedes effect, and the schema ends shortly after the harmony changes, as action ceases once it reaches its goal. (Sherill and Boyle 2015, 10)

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[3] One variation of "O cielo" which is important to mention here is that the schema's metric alignment is somewhat flexible, as the falling third does not always land on the beat. Sherill and Boyle explain:

> Significantly, however, not all forms of metric variety are well attested: when the anacrusis is present, the lower pitch of the schema almost always arrives exactly on the downbeat, so the shapes of Example 3, c and d, are rare. Likewise, while the schema's anacrusis can be repeated multiple times, as in Example 4, the lower tone of the schema is infrequently repeated more than once. (Sherill and Boyle 2015, 6)

This highlights the importance of defining a metering construction as an association between a sounding structure and a movement interpretation—an association which need not be considered a fixed rule. However, as long as the association remains, it can act as a metering construction, even if there are many exceptions.

Schema 1: “O cielo”

Figure 5.4: Sherrill and Boyle’s prototype of ”O cielo”

Schemas are often characterized by melodic anacrusis, a sense that the melody is leading towards these accented final notes. Sherrill and Boyle describe how this anticipation can be prolonged through “reciting tones,” stages in the schema which can be repeated indefinitely to accommodate additional syllables in the text. However, these recitation tones usually happen before the final tone (and change of harmony if there is one). For example, in “O cielo” there is no change in harmony, but the reciting tone (marked by an asterisk) is the first of the two stages in the schema. Sherrill and Boyle note that other tones in the schema are usually not doubled more than once. This doubling is especially common in the Italian-language recitative which Sherrill and Boyle study, in which most lines end in a trochee or strong-weak poetic foot (9). But in English-language poetry, iambic emphasis is more common, and such after-beats following the final tone of the schema are less common in Handel’s recitatives from *Messiah*. Most schemas in this repertoire end with the tone that carries the most emphasis, without any after-beat or extra syllable.

There are two strata in which these galant recitative schemas can be heard to express “tonal rhythm” in Schachter’s sense of the word. Since the schemas are often characterized by anacrusis, the melody usually leads towards accented notes in a way that is independent of any sense of durational rhythm. Many schemas also have implications for harmonic closure, especially the cadences. Because of the harmonic instability of recitative, there is usually not a tonal center that creates metrical associations through return like the tonic pitch in Busoni's "Scales in Spirals." But many figured bass chords, especially those containing dissonant intervals like 4/2 or 6/5 chords, have inherent tension, creating some sense of tonal closure for root-position and first-inversion triads (5/3 and 6/3 harmonies). This sense of harmonic motion often informs hearings of metrical weight in the recitative's nebulous, freely-timed rhythmic space.

The first Recitative from Handel shows how these melodic and harmonic strata of tonal rhythm interact. Like No. 14a, Recitative No. 8 "Behold, A Virgin Shall Conceive" begins with a tonic pedal (5/3 - 7/4/2 - 5/3). Then in the fourth bar, the recitative modulates from D major to A major. At a medium scale, the 6/3 chord at the end of bar 4 is weakly accented, in Cooper and Meyer's sense of being oriented towards the strongly accented 5/3 resolution on the downbeat of bar 5. Similarly, the cadential formula at the end of the recitative also is harmonically oriented towards the final chord. At the larger levels of scale, I hear the whole second line to be harmonically oriented towards the final cadence, while in the first line I feel the strongest metrical accent on the opening "Behold!"; however, this highest level of interpretation involves a lot of subjectivity, and I would expect many listeners to hear it differently. This subjectivity does not change the fact, however, that I (and presumably at least some other listeners) invest the music with motion at this level of scale. Thus a complete picture of entrainment to tonal rhythm must include consideration of these larger shapes, although some debate might be had as to exactly how "metrical" these larger levels of entrainment are.

These larger scales of tonal rhythm are architectonically shaped through the smaller-scale motions of melodic tonal rhythm in the singer's part. I've analyzed this movement in terms of Sherrill and Boyle's recitative schemas, and I've added red bars in the example below to indicate the normative metrical alignments they report. As has been discussed, most of these schemas have a strong association with end-accented phrasing. Schachter's triad-chord-tone schema could add additional detail to these broader motions; for example, in the Schema number 10 ("Colon") in bar 2, the E is a passing tone between the chord tones of F# and D. While the G halfway through bar 2 is locally a chord tone, at a larger scale it is a dissonance, a tritone against C# which must resolve downwards to the F# at the end of bar 3. These smaller motions trace out the larger harmonic movements, but also sometimes seem to contradict them; for example, the leap down to a D in bar 4 seems a very strong move to mark a 6/3 harmony that is oriented towards the A major cadential resolution.

I should emphasize here that I do not intend to suggest that these schemas and tonal rhythms are not intended to represent "objective" features of "the music itself," but one way of *hearing through* the music using familiar tonal patterns like the galant recitative schemas and conventional ideas of harmony. Different listeners will prefer to emphasize different patterns in their own hearing and these may make different interpretations.

Rhythm in Prosody and Construction Grammar

Tonal rhythm is not the only force at work in "Behold, A Virgin Shall Conceive"—all human language contains many linguistic patterns which are associated with certain motions and accent schemes, and these can be deployed as metering constructions alongside melodic and harmonic patterns. A long tradition of prosody has

Figure 5.5: Handel *Messiah* No. 8 "Recitative: Behold, A Virgin Shall Conceive" harmonic accent analysis

investigated how accents are matched to syllables and grouped together in both poetry and prose, and this can be applied to the text alone before considering the interaction between text and tones. I should briefly disclaim that there are innumerable theories and methodologies for prosodic analysis and I do not subscribe to any one in particular. In my intuitive and unsystematic interpretation, shown in Figure 5.6, I hear this text mostly containing *Iambs* (weak-strong) with a single *Anapest* (weak-weak-strong, "and shall call") and a single *Molossus* (strong-strong-strong, "GOD WITH US"; another interpretation I consider equally convincing is strong-weak-strong). It should be noted that the Anapest could also be considered an Iamb with an "extra" beat; some prosodists might theorize this as an "interpolation" of an "extra" accent into what is ultimately an Iamb at a deeper level of structure, while others would consider it an "irregularity" or "disruption" of Iambic flow. The text's general trend towards Iambic rhythm fits neatly with the tendency of harmonic schemas to be end-accented.

The rest of the recitatives in Handel's *Messiah* are more variable in their rhythms of prosodic accents, in other words, do not seem to consistently express the same prosodic foot over and over the way we saw in "Behold, A Virgin Shall Conceive." But in all the recitative, prosodic accents often correlate with the tonal rhythms in important ways. The normative metrical alignment of each galant recitative schema always emphasizes a strong prosodic accent—for example, note how every vertical red line is immediately followed by a strong syllable in "Behold, A Virgin Shall Conceive." Prosodic accents also match the musical notation, so that strong accents are always notated as on-beats, and further are often on conventionally "strong" beats 1 or 3. While the notated meter is likely not perceived as such by the listeners, the alignment of strong syllables with notated beats is important for the coordination of the musical accompaniment, as I will explore in the next section. And prosodic accents,

Figure 5.6: Handel *Messiah* No. 8 "Recitative: Behold, A Virgin Shall Conceive," prosodic accent analysis.

which often represent our everyday intuitions about the rhythm of language, provide one way to quantify how language might offer structures for entrainment—listeners might entrain to familiar patterns of strong and weak syllables, just as they entrain to patterns of accent in text-less music.

Prosodic accent patterns might be the dimension of speech which most literally compares to conventional ideas about rhythmic entrainment in music, but I'd like to open up consideration of broader senses of entrainment and cognitive synchrony. In recent decades, a number of scholars from diverse areas of cognitive sciences including music cognition have suggested that a crucial part of all human interaction is an internal modelling or simulation of the thoughts, intentions, and physical actions of others (Tomasello 2008, Tomlinson 2015, Cox 2011 and 2016). I would argue that this internal simulation can be thought of as a kind of rhythmic entrainment, inasmuch as it involves a specific sequence of simulated actions or imagined trajectory of future action. Part of what it means to understand a sentence like "Then shall the eyes of the blind be opened" is to vicariously experience what saying this proclamation oneself might be like, and to imagine what it might feel like if such a thing actually did happen. And in the moment of communication, as we hear each word, we are trying to understand what intentions a person has in saying such words; understanding intentions is an active part of trying to understand what these words are in the first place. Linguistic communication is not a decoding of spoken words, but a triangulation between the "signal" of speech; the physical context of the speaker's gestures, comportment, and visual attention; and the listener's internal simulation of the situation and continual attempts to infer the intentions and motivations of the speaker. Such internal modeling belongs in the broader senses of "rhythmic entrainment" described at the beginning of this chapter, in which the term refers to any type of temporal structures that can be brought into the body from outside the organism, rather than being restricted to the synchronization of periodic pulses.

The field of Construction Grammar assesses one type of temporal structure in language that affords some sense of entrainment in this broader sense of internal simulation of the actions and goals of others. Proponents of Construction Grammar in cognitive linguistics have argued that the structure of language is comprised not of separate domains of syntax, semantics, and pragmatics; but of a single domain of "constructions," each of which is a pairing of form and function (Goldberg 1995, Givon 1995, Langacker 2002). Another way to put this is that constructions underlie the verbal structures traditionally analyzed through abstract syntactical rules, but they also provide these syntactical patterns with built-in valences of meaning. It is theorized that as listeners, we understand meaning by recognizing these constructions as general semantic/syntactic prototypes, and then we "fill in the blanks" by recognizing individual words. Such a Construction Grammar approach contrasts with a traditional "dictionary plus grammar book model" (Taylor 2012, 8) in which linguistic meaning is supposedly constructed by recognizing individual words one at a time and then synthesizing them into a kind of subconscious sentence diagram.

In the Construction Grammar paradigm, listeners construct semantic meaning based on these recognized form-content pairings, not by a bottom-up process starting with individual words. Matt Johnson and Adele E. Goldberg (2012) demonstrate this in their study of "Jabberwocky Sentences," utterances which contain nonsense words and have traditionally been described as devoid of meaning, such as "He daxed her the norp." They report on previous studies showing that argument structure constructions ultimately play a significant role in a listener's interpretation of sentences, and on a phenomenon called "syntactic bootstrapping" in which constructional meaning is shown to play an important role in the learning of words. Jabberwocky sentences were mixed together with regular sentences, all constructed using one of four "abstract phrasal constructions" like "S/he Verb-ed him/her the Noun" or "S/he Verb-ed it Adjective." What they found was that when experiment participants were listening to a series of sentences, they recognized whether a highlighted word was "real" or not much more quickly if the previous sentence had used the same abstract phrasal construction, than when the same words were placed in another of the 4 abstract phrasal constructions which had not been primed. In other words, part of our automatic everyday perception of language is to recognize phrasal constructions and use them to piece together sentences. These phrase patterns, like the motives and characteristic rhythms theorized in chapters 2 and 3, carry with them implications for temporality, directionality, and motion, which we can share with others and use to structure our cognition of what we are hearing—in language or in music.

We can use the temporality and order of these linguistic constructions in our construal of beats and accentual flow in recitative. For example, the text of Recitative no. 19 "Then Shall The Eyes of the Blind" is entirely comprised of two repetitions of a "Then shall [X]" construction, each time extended to a second phrase by an "and" (see Figure 5.7). In the context of Messiah and other Christian texts, this construction often refers to the actions of God, or even invokes a kind of predeterminism in which the entire world unfolds according to God's plan set in motion at the moment of the world's creation. In attending to this text, each time we hear the words "Then Shall…" we recognize that the following words will identify God's action or an element of God's plan for the world, and we are already oriented towards an active verb of what it is that "shall" occur. I've added weak and strong accents to indicate this directed orientation towards the verb. In three of the four phrases of "Then Shall

The Eyes of the Blind," this key verb is the final word of the phrase, in each case the culmination of a schema associated with weak or strong phrase-ending schema: number 9 ("Comma"), number 10 ("Colon"), or number 7 ("Falling Fourth" cadence; this schema is the most "decisive" phrase ending, and conventionally appears at the end of every recitative movement; see Sherrill and Boyle 2015, 46-49). It is no coincidence that these schemata are named after grammatical punctuation; each often appears setting punctuation in the text of recitative, and similar patterns in instrumental music were theorized as "musical punctuation" by eighteenth-century theorists. The semantic orientation of the spoken phrase towards the active verb at the end aligns with the end-oriented tonal rhythm both of the individual schemas, and of the musical phrases as wholes.

Another example that illustrates how linguistic constructions can shape the temporality of musical attending is Recitative no. 3 from Haydn's *The Creation*, shown in Figure 5.8. Most of the text of this recitative is taken up by an instance of the "DIVIDED THE 1 FROM THE 2" linguistic construction: "and divided the waters, which were under the firmament, from the waters, which were above the firmament." As soon as we hear "divided the waters, which. . . " we will be looking for the second half of this construction. It's worth noting that the English version of this passage seems to be a poor fit for the music. In the original German, the key words "ober" and "unter" that indicate the contrast between these two halves are highlighted with pitch changes; and each half of the statement ends with the active verb "waren" (past tense of to be), whose prosodic emphasis is aligned with a barline and highlighted by a descending leap from a local peak to the root of the chord. In English, however, "over" and "under" are buried in repeated pitches, and the phrase-ending accents are in both cases given to the normally unaccented third syllable of "firmament."

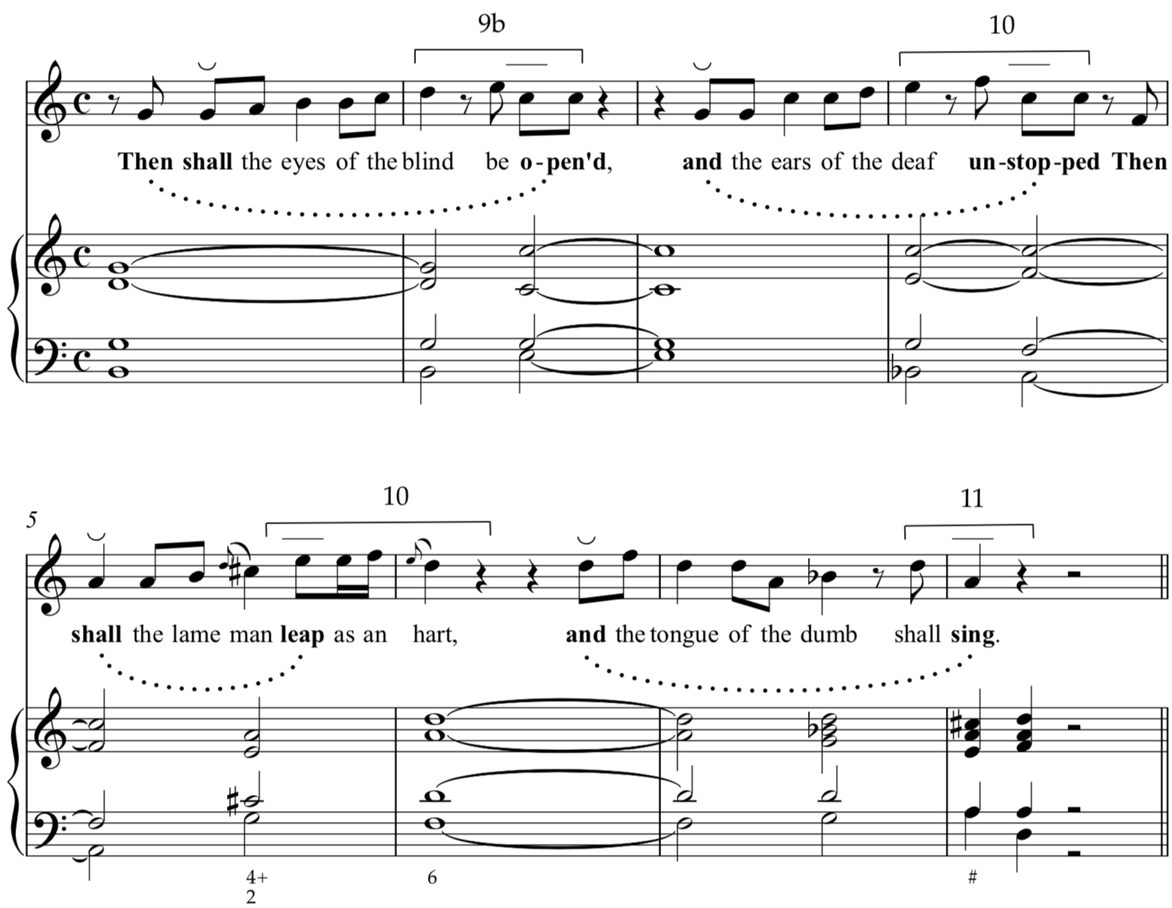

Figure 5.7: Handel *Messiah* No. 19, "Then Shall the Eyes of the Blind," recurring "Then shall..." linguistic construction

Figure 5.8: Haydn *The Creation* No. 3 "Recitative"

OVERT AND COVERT ENTRAINMENT TO CO-SPEECH GESTURES

Another sense of entrainment to speech is highlighted by a growing literature which argues that physical gestures are integral, inseparable parts of speech and thought. One of the most influential exponents of this idea is David McNeill (1992), who shows that most speech relies on physical gestures (”co-speech gestures”) of a number of types. “Iconic gestures” depict how things act or are shaped in space, representing the physical nature or action of the subjects or objects referenced in spoken words. “Metaphorical gestures” are physical analogues to a more abstract concept referenced in speech, such as pointing upwards while referring to a new band exploding in popularity, or waving outstretched hands to indicate that a revolutionary new technology is going to have an enormous impact. This metaphorical pointing contrasts with “Deictic gestures,” which involve pointing to actual objects referred to in speech to clarify referents or intentions. Last but not least, “beat gestures” carry no semantic meaning, but are sharp gestures used for emphasis, like shaking a fist in the air or pounding a podium.[4] These gestures pervade daily speech, and are often necessary to disambiguate between many different potential meanings of spoken words, but the gestures still form a meaningful part of the communication process even when the speaker’s meaning is recoverable from the words alone. Entrainment to the gestures and bodily comportment of the speaker are crucial to “being with” others and signaling cooperation.

A natural analogy can be made between beat gestures and musical beats. Brock McElheran appeals to this analogy in conceptualizing musical beats in his conducting textbook: “The traditional strong beat is thus shown by the natural gesture of empha-

[4] What I will call “beat gestures” are often just called “beats” in literature on gesture and speech. To avoid confusion with the musical concept of “beat,” I will continue to use the more verbose term “beat gesture” when I am talking about a physical movement made during speech.

sis—downward motion. When we pound a table or stamp a foot to emphasize a point in an argument we strike downwards" (McElheran 17; I'll return to McElheran when I explore conducting in the next section). As in music, beat gestures in speech are not equivalent to just any emphasis or accent, but carry specific communicative intention. Henning Holle et al. (2012) showed that beat gestures could influence the structure listeners inferred in ambiguous German sentences, in which the words alone did not clarify who was the subject of the verb and who was being acted upon. The authors found that other visual emphases (such as a bouncing disc tracing exactly the same vertical path as a beat gesture) did not have the same effect, and from this surmised that specific gestures can influence syntax—gesture is integrated into the way we convey grammatical structure, instead of just influencing semantic interpretation, as had been demonstrated by previous research. Holle et al. (2012) thus conclude that gesture is an integrated part of language, not just an "extra" embodied dimension of emphasis. Similarly, the gestures of conducting are not just random accents, but specific embodied pointers that instruct with communicative intention: "feel the beat *here*."

The concept that beat gestures are an integrated part of language has been explored by other researchers, whose work suggests that beat gestures are just one overt manifestation of a multi-modal cognitive phenomenon that is fundamental to speech rhythm. Holle et al. (2012) also found that speakers use beat gestures to package together related information. Further, beat gestures are precisely aligned with pitch accents in spoken words (Leonard and Cummins 2011). Biau et al. (2016) argue that beat gestures are integrated into our cognitive processing of prosody (strong and weak accents and rhythmic phrasing in speech). Notably, these ways of organizing speech are not unique to overtly-gesturing speakers. This reveals an important corrollary of the argument that beat gestures are not a secondary level of emphasis superimposed on regular speech: beat gestures are built into speech's natural prosody, an overt expression or manifestation of a way of moving that is "always already there." The overt physical beat gesture could be described as reinforcing a rhythm already in speech, but I argue that it could just as easily be said that something equivalent to the motional profile and organizing force of a beat gesture is always already present in the speech, whether or not it is given overt expression in a hand gesture.

In addition to beat gestures, there is growing evidence that iconic gestures also are not simply tools to clarify ambiguous speech, but are deeply integrated into our learning and comprehension of speech in the first place. Kelly et al. (2009) suggest that gestures ground the inherent arbitrary relationships between words and their referents, showing how language learners (both adults and infants) benefit from using gestures to learn new vocabulary, and arguing that those gestures become deeply associated with the words. Significantly, a number of studies have shown that congenitally blind speakers still use iconic gestures, suggesting that these iconic gestures are an integral part of human cognition of language, not merely a visual aid to communication. Iverson et al. (2000) compared the use of gestures by blind and sighted toddlers learning language, and found that while blind toddlers used gestures less often and slightly differently than sighted toddlers, "gesture is a robust phenomenon of early communicative development, emerging even in the absence of experience with a visual model" (106). Another study which suggests that gestures are inherent to cognitive structuring of language even in blind speakers is a cross-linguistic comparison of blind and sighted speakers in both Turkish and English by Özçalışkan et al. (2016). These authors found that blind speakers use iconic gestures to describe motion just like sighted speakers, and their speech gestures reflect differences in language structure, specifically a linguistic separation between direction and quality of motion in Turkish that does not exist in English. Gesture is not just a means of visually identifying things, but somehow is part of how the human brain conceives of speech in the first place.

Some important research on mimicry suggests that to "follow" someone's line of conversation is literally to move like them.[5] Experiments show that we are sensitive to gestural mimicry, and that we often remember and re-perform a speaker's gestures when we are recalling what they said, often without realizing that they were gesturing in the first place (Parrill and Kimbara 2006). Other researchers including Catherine L. Reed describe a broader sense of entrainment or rapport between speakers that goes beyond speech gestures and language structure, and involves synchrony in basic ways of being-in-the-body like breathing, posture, sway of the body.

> We use this embodied system to gain information about another person. Mirroring and mimicry are rapid, automatic processes that lead to matching the facial expressions, vocal tones, postures, and movements of others (Hatfield, Cacioppo, & Rapson, 1994; Moody & McIntosh, 2006). [...] Not only does the mimetic assumption of another's emotional facial expression or vocal tone initiate or modify emotional feelings, but also the bodily expression induces the observer to literally feel what the viewed person is feeling. (Reed 2013, 46)

Reed's research explores how humans perceive and experience the bodies of others, hypothesizing that we recognize the body states of others in relation to our own body's shape and position, and arguing that mimicry is a fundamental human behavior that enables us to connect with the emotional lives of others. This resonates with a broader literature exploring the "common ground" which forms a basis for interaction (Clark and Brennan 1991), and more specifically with the perspective of evolutionary theorists

[5]Some scholars have argued that this "mirror mechanism" has a basis in specialized cells called "mirror neurons," which fire in the brain of an individual when that individual performs particular actions—or when that individual sees another person perform the same actions (Rizolatti et al. 1996). The primary research on mirror neurons has been in macaque monkeys, and there has been some dispute over whether these cells exist in the human brain, and what exactly their role is in the first place (see Rizolatti and Sinigaglia 2010). For a detailed introduction to mirror neuron research, I can recommend an article posted to Harvard University's *Science in the News* blog, "Mirror Neurons After a Quarter Century: New light, new cracks" (Taylor 2016).

of cognition like Michael Tomasello (2008) and Gary Tomlinson (2015), who have argued that gestures and shared attention are a framework for shared intentionality that precedes language, that forms the basis for linguistic communication and continue to "fill in" for language's inherent deficiencies (because it is so hard to uniquely identify things with words). Reed specifically highlights the internal simulation of another's physical and emotional states in communication, which Tomasello and Tomlinson argue is a universal pre-requisite for human communication and cooperation.

Speech gestures are an important part of our cognitive machinery for comprehending the text of recitative, even if the singer does not make any overt hand motions. Whether or not the singer of the recitative is gesturing with their hands, the motor-control systems in our brain that produce hand gestures and relate them to speech will be activated as we listen, just as they will be activated in the mind of the singer (even as they remain relatively motionless). In a sense, this is a kind of entrainment. And of course, if the singer does move their hands, this gives us a concrete manifestation of the same feelings of movement we might have also experienced from the audio of the speech alone, and our vicarious experience of these gestures gives these feelings of movement and prosody an even more important role in our experience of the recitative.

To illustrate the role speech gestures can play in the perception and cognition of recitative, I'll return to the first secco recitative in Handel's *Messiah*, "Behold, a Virgin Shall Conceive" (Example 1.5). The very first word seems to inherently capture the schema and sense of a beat gesture as described by Holle et al (2012) and Leonard and Cummins (2011): the word "Behold!" has a pitch accent on the second syllable which aligns with the initial metrical accent I've described earlier. This exclamation also initiates a grouping of related content, showing that this moment matches with elements of both form and function associated with the beat gesture. A likely hand gesture here might be a dramatic extension of an open hand in front of the singer, a metaphorical gesture miming a reveal of what it is that is to be beheld. I argue that a listener who is attending to the speech will probably experience something equivalent to a beat gesture at this moment, whether or not the singer actually makes a hand motion.

Another moment which seems ripe for a speech gesture is the phrase "and bear a son." To me the word "bear" is strongly associated with a metaphorical gesture of hands held palm-up in front of the body, miming a carrying pose. This is a metaphorical gesture, not an iconic gesture, because it illustrates an abstract sense of "carrying," rather than the physical reality of gestation, in which the weight of the baby is borne inside a woman's body, rather than being held in the arms in front of the body. Like "Behold," I would argue that a speaker of English is likely to experience something like this motion, even if nobody present performs this motion overtly. A physical sense of carrying is an integral part of how we comprehend this sense of the verb "to bear."

A third gesture that seems to me to be inherently embedded in this text is in the final phrase "God With Us." Here I experience a motion of bringing the hands in to the body, perhaps towards the stomach or chest, as both a metaphorical and iconic gesture showing togetherness or co-presence. This gesture might be considered metaphorical because God in the Christian tradition is not normally thought of as physically present in the sense of the corporeal embrace that the gesture seems to act out. However, this particular declaration is, in fact, performatively declaring that God will physically appear on earth in the form of his son Jesus, making a radically iconic interpretation of this gesture fruitful and appropriate. Again, this gesture or motion of togetherness seems to be so strongly associated with the sense of the word "with" that I believe something like it is implicated by the text even if nobody on stage or in the audience performs any gesture overtly. To understand the text "God With Us" is to experience this With-ness at a physical level. This corporeal cognition of With-ness can be considered as an important component of common ground or entrainment between all who are reciting or attending to this text, alongside and integrated with other rhythmic information like beat gestures, strong and weak syllables, and tonal rhythm and other musical affordances for metrical accent.

CONDUCTING PATTERNS AND NOTATED METER IN SPEECH-LIKE RHYTHM

Today's audiences expect close synchrony between performers in all styles of Western classical music. In the two preceding sections I have explored many kinds of constructions which can help a listener or performer maintain orientation within each moment of time, to know where they are and what comes next. But I have not accounted for the problem of synchrony: how is it that musicians coordinate together while performing recitative? In this section I will examine two performer-specific resources for coordinating recitative: the metrical notation that is used to make unmeasured rhythm more navigable, and the conducting patterns which are used in modern performances to unify performance free rhythm. I will examine some of the ways in which these two technologies of meter afford greater accuracy, even in the absence of a periodic pulse. These arguments are supported with passages from conducting literature and with my own experiences playing continuo for two years of Prof. Stephen Alltop's recitative conducting course. Ultimately, I argue that conducting is not enough to coordinate optimal synchrony, and that successful performance of recitative also depends on the musicians' abilities to anticipate the singer.

There are two traditions of metrical notation in recitative. Most recitative in the eighteenth century is written entirely in 4/4; however, there is also a French tradition developed by Lully in which the time signature is changed to match the rhythms of the text (Cyr 2003, 114). I will focus on the 4/4 recitative because this notation is the one used by eighteenth-century German composers like Handel and Haydn. In this common-time style, Sherrill and Boyle note that "Accented syllables of the libretto reliably fall on the first and third quarter-note beats in the measure" (2015, 9), but this does not necessarily mean that the recitative conforms to standard modern assumptions about the first beat being the strongest beat, followed by the third beat, then followed by two and four. For example, in Handel's Recitative No. 8 "Behold, a Virgin Shall Conceive," the downbeat is either empty or has a weak syllable for the majority of the movement, and it is only in the final two measures that strong text accents and harmony changes are placed on downbeats (see Ex. 1.5 above). Thus notated meter does not serve as a "key" to metrical structure; a notated downbeat is not always an important accent or arrival.

Notated rhythms also provide some important information, but like the time signatures they cannot be taken as a "key" to entrainment. Notated rhythms in the singer's part usually correspond to the prosodic weight or importance of syllables, but if taken literally they do not represent a natural speech rhythm. In Recitative No. 29 from Handle's *Messiah*, "Thy Rebuke Hath Broken His Heart" (Figure 5.9), there is an eighth note rest in the first measure after "Rebuke," and then two quarter note rests at the end of measure 2 and beginning of measure 3, at the end of the phrase "hath broken his heart." This does not mean that the break following "Rebuke" should be exactly, or even approximately, a quarter of the length of the break following "hath broken his heart." Instead, it indicates that the pause following "hath broken his heart" is a more significant phrase boundary. Similarly, the first two syllables of "Thy rebuke" are notated as equal eighths, but in many performances the "re-" of "rebuke" is much shorter than the duration given to "Thy."[6] Another example is the phrase "but there was no man," which is notated in straight sixteenth notes in measure 10, but then in measure 16 the same words are written in eighth notes. This does not mean that the singer should recite measure 16 at half the speed of measure 10. It could just be that Handel needed to fit in the whole phrase after a chord change halfway through the bar in measure 10, while in measure 16 he had more space between barlines.

Notated rhythms in the bass line also often do not correspond precisely to performance practice. There are several prevailing strategies towards realizing continuo in recitative, but many of them allow for (or even dictate) bowed continuo players to not sustain some or all notes of the bass line, to help shape the phrasing. Lawrence Dreyfus observes that "Only in the so-called *accompagnato* recitatives (those with an orchestral complement in addition to the continuo) were the long notes supposed to be played as written" (1987, 73). Further, keyboard players may or may not rearticulate notes on downbeats or during vocal rests. Quantz even directs the harpsichordist to rapidly play the intervals of each vocal phrase before the singer begins (Cyr 2003, 113), to prime the correct notes! In summary, notated durations (an important aspect of meter) should not be considered to correspond in any literal or proportional way to the durations of the performance.

The usefulness of notated meter technologies primarily comes not in anticipating durations, but in their correlation with conducting patterns. The conducting pattern provides a visual map of the space within a measure, so that the musicians know

[6] It should also be noted that Recitative No. 29 is an *accompagnato* recitative, with more instruments than just continuo, so in many performances the pacing of the speech is not quite as free as in *secco* recitative.

Figure 5.9: Handel *Messiah* No. 29, "Recitative: Thy Rebuke Hath Broken His Heart"

where they are, regardless of what freely-timed durations have passed—and even if beats have been skipped during particularly fast recitation. In her book *The Modern Conductor* (1987), Elizabeth A. H. Green provides a compact set of guidelines for conducting recitative that is worth quoting at length, but I will examine it in reverse order. The last two items on Green's list articulate how the conductor should maintain metrical orientation even when "live" cues to musicians are not needed because the accompaniment is sustaining a long note or resting.

> 4) The first beat of each measure must be clearly indicated by the baton as the measure passes. This is of utmost importance, since the takt within the measure may vary rhythmically. A simple dead gesture, from the wrist (down and immediately up) is all that is necessary. In the case of several measures of tutti rest, the conductor may make a series of several quick downbeats, each beat signifying one measure, and then just wait for the singer to finish those measures. 5) After the indication of the first beat of the measure, the baton may do one of several things in handling the rest of the measure. It may show nothing except this first beat, which is often done when the entire measure is a tutti rest for the accompanying instruments. Or it may design the beats within the measure according to a rhythmic takt. This is done when the singer, for the moment, is executing a phrase which lends itself to rhythmic speaking on pitch. Or the baton may design quickly all beats of the tutti rests and stop in a position of readiness for the beat which is to be played by the musicians. (Green 1987, 196-197)

This process is easier to understand in the context of a specific piece. In Recitative No. 19 from Handel's *Messiah*"Then Shall the Eyes of the Blind," shown earlier in Figure 5.7, the conductor might give the downbeat of the first measure and then nothing else for the rest of the measure, leaving the timing of the rest of the measure up to the singer. Similarly, since the continuo players do not strike any new harmonies during measure 3, the conductor might give a "dead beat" any time after the singer's text in measure two "be open'd," and then give no further beats until it comes time to move to measure 4. These movements keep a sense of metrical orientation even when the continuo musicians have nothing to play, as it is often impossible to "count" the nominally notated beats alongside a singer's freely-timed recitation.

Green provides instructions for coordinating metrical orientation within measures when the musicians must be more tightly synchronized. As always, the singer is free to recite in whatever rhythm they feel most naturally reflects the text, but even if the conductor is not “controlling” the temporal progression of the music, the conductor can use *preparatory beats* to show musicians where they are in the measure.

> 1) If a chord is to be articulated on a beat, it should be preceded by a secure and well-timed preparatory gesture which says clearly, ”Here it comes.” 2) If a chord is to be played *after* a beat, the gesture of syncopation will be used, preceded by a staccato preparatory beat. (Green 1987, 196-197)

When such entrances are on downbeats, this can look a lot like the preparatory gesture at the beginning of a normal piece (described in Green 1987, 13). But when the entrance or chord change is in the middle of the measure, the conductor should spatially place the preparatory beat where it would be in a conventionally-conducted piece where all beats had been given.

For example, consider Recitative No. 31, “He Was Cut Off Out Of The Land Of The Living,” and the conventional 4/4 conducting pattern, respectively Figures 5.10 and 5.11. A conductor here might give the first three beats relatively normally, moving the hand first down, then to their left side, and then to their right for beat 3 (assuming they are conducting with their right hand). They might then give the downbeat of measure 2 as a “dead beat,” and the next *active* beat would be a preparatory beat for the chord change halfway through measure 2. This preparatory beat would be in the place of beat 2, but might not be strictly in time with the singer’s notated beat 2. The importance of this preparatory gesture is to give a starting point so that musicians can more clearly coordinate the arrival of beat 3, which occurs when the conductor’s hand reaches to the right. The next preparatory beat would be an upbeat to the downbeat of measure 3. The conductor’s spatial placement of these preparatory beats helps

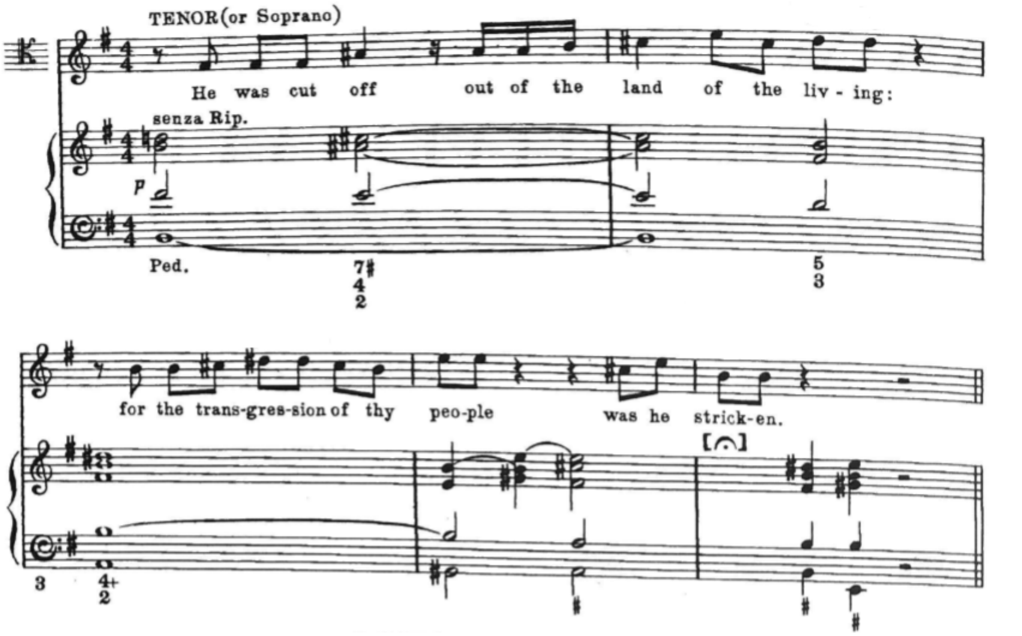

Figure 5.10: Handel *Messiah* No. 31: "Recitative: He was cut off out of the land of the living"

musicians maintain metrical orientation despite the free rhythm of the recitation.

However, the issue of exact temporal synchrony is fraught with compromise and contradiction. In her initial exposition of the technique for giving preparatory beats, Green emphasizes rhythmic accuracy.

> To start the sound, the conductor has to signal his forthcoming intentions regarding speed, dynamic, and style. This he does in a special motion, called the *preparatory beat*, which precedes the first playing beat. The speed with which this beat is executed shows the coming tempo. It must, therefore, be absolutely accurate rhythmically. When the baton *starts to move* (in the preparatory gesture), the rhythm of the piece begins. This means, then, that *the preparatory beat must take the time of exactly one beat of the time-beating gestures to follow*. (Green 1987, 13; emphasis is original)

In other words, the preparatory beat must give a *definite duration* (Hasty 1997) in order for the musicians to accurately project a definite duration for the first beat of the piece. In recitative, though, it is impossible for a conductor to know in advance exactly

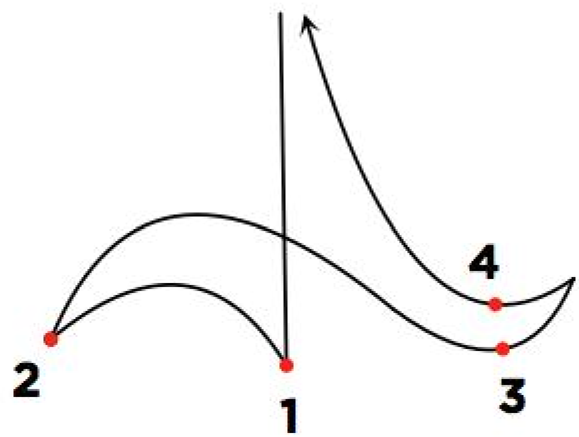

Figure 5.11: Standard 4/4 conducting pattern

how long each beat will be in the singer's recitation. This is especially a problem for entrances in the middle of a measure. How long should the preparatory beat be for beat 3 of measure 2 in Example 3.2 (Recit. No 31)? To apply Green's description of this technique, a conductor would have to know a full beat in advance exactly when the singer would reach the word "living." Is this even possible, or does the conductor simply have to accept the probability that their arrival won't quite match the singer's?

The issue is clouded even further by consideration of another influential conducting textbook by Brock McElheran (1989). He argues that performers "cannot really "follow"; they anticipate and perform with the conductor. The term "follow" is theoretically incorrect, as it implies being late" (McElheran 1989, 19). Later in the book, McElheran devote an entire chapter to "Cues," where he argues this point again in all caps:

> CUES SHOULD NEVER BE USED TO SHOW A PERFORMER WHEN TO COME IN. This point raises eyebrows whenever it is stated. Apparently many conductors allow their players to wait for cues. This courts disaster. [...] Cueing a player who does not know the place usually produces a late and poor entrance. They player should be secure and ready to come in with or without a cue." (McElheran 1989, 47; emphasis is original)

What is the purpose of the conductor if not to show a performer when to come in? McElheran suggests that in terms of timing, the conductor's primary job is one of reinforcement and reassurance. But cues also "help make a performer who is coming in anyway feel the moment of entrance a shade more precisely," by coordinating the expectations of all performers around a visible single ictus (Ibid.). In other words, although a musician should already be anticipating where to come in, having a conductor give a visual beat can help performers adjust their own expectation slightly to be more accurate within their section—an adjustment which is invaluable in trying to have a continuo group articulate together during the chaotic and groove-less indefinite durations of the recitative.

Thus while metrical notation and conducting patterns in recitative clearly act as metering constructions enabling additional spatial and visual dimensions of metrical orientation, they do not solve the problem of synchronization. Conductors must have some way of following the singer in the first place, and continuo players must not be waiting for the beats from the conductor, but must already be anticipating where their entrances will lie in order to be in time. This perspective has also been expressed to me by early music professionals whom I have studied with. The principal cellist for one of the premiere American baroque orchestras told me that he follows the singer instead of the conductor in recitative, because otherwise he would be late. But how can musicians and conductors synchronize with the free rhythms of speech?

Entrainment to Speech Rhythms

Studies on "synchronous speech" show that humans are easily able to entrain to and synchronize with spoken text, under comparable conditions to conductors and continuo attending to the speech of a singer in a baroque opera recitative. Although more research is needed to present a more detailed and systematic picture of exactly what structures in speech can afford such entrainment, several studies by Fred Cummins (2002, 2009) have established some important outlines of these conditions. But before this more enlightened approach, the study of speech rhythm suffered from assumptions about isochrony similar to theories of musical rhythm—but much worse, because periodic timing is much rarer in spoken language.

Until recently, the field of speech rhythms was hampered by an assumption that human speech had some element of isochrony, which may have precluded investigations along the lines of Cummins' work. The idea that speech was based in some kind of equal timing is expressed at least as early as a 1775 treatise by Joshua Steele, which adapts musical notation to transcribe prosodic performances by the author (as well as memorable phrases by famous actors of the day, such as David Garrick's rendition of the soliloquy from Hamlet (Steele 1775, 47). The most influential formulation of this concept has been Kenneth L. Pike's distinction in 1945 between syllable-timed and stress-timed languages, which suggested that in some cases speech rhythm was organized around syllables occurring at equal intervals in time but with a diverse distribution of accents, while in other cases accents were equally spaced and the exact timing of syllables could vary around them. Much of the twentieth-century was consumed with attempts to determine which languages were stress-timed (English, Thai, and Russian) and which were syllable-timed (French, Italian, Cantonese), and the addition of a new category of mora-timed languages (Japanese, Ancient Greek).

But researchers in the twenty-first century now widely consider this theory to be discredited (Patel 2008, 121; Dalla Bella et al. 2013, 2), to the point where Cummins claims in passing without citation or evidence that "Spontaneous speech, on the other hand, rarely presents any significant degree of recurrent, periodic, temporal structure" (2009, 18). In the second half of the twentieth century, digital sound recording and processing technologies developed to the point that phonetics researchers were able to easily measure precise timings of acoustical features with some degree of objectivity. But study after study has failed to replicate the theory of equal timing in observable features like amplitude peak, formant, onset. In the final decade of the twentieth century, a number of scholars sought to locate this isochrony in "p-centers" or perceived beats, which do not consistently correlate with any particular acoustical features across any wide variety of syllables. What's more, different listeners tend to hear p-centers slightly differently given the same sound stimuli, creating additional levels of subjectivity and variance. But even these theoretical and analytic gymnastics failed to find consistently reproducible measures of isochrony.

The idea of isochronicity in language has thus had a strange persistence, even in the face of contradicting evidence. For example, in an exhaustively detailed analysis of a recording of a short natural English conversation, Elizabeth Couper-Kuhlen finds that "spontaneous English speech is not uniformly isochronous over extended periods of time. But just as significantly, the passage is not wholly anisochronous either." She explains, "allowing for discontinuities, a large portion of it is isochronous in one way or another" (1993, 39). In other words, even in a recording where the theory of isochrony is demonstrably untenable at a large scale, it is still tempting to fit short passages of speech rhythm to isochronous intervals, creating a kind of patchwork of short sections of approximate isochrony. Annirudh Patel confronts this persistent appeal to isochrony with speculation that our subjective intuitions about rhythm may exceed our analytical tools for measuring.

> [...] why do the labels of stress-timing, syllable-timing, and mora-timing persist? One reason may be that it matches subjective intuitions about rhythm. [...] Another reason is suggested by Beckman (1992), who argues that this tripartite scheme persists because it correctly groups together languages that are perceived as rhythmically similar, even if the physical basis for this grouping is not clearly understood (and is not isochrony of any kind). (Patel 2008, 121)

In other words, while the notion of isochronicity in regular speech is today demonstrably false, it is a convenient emblem for some subjective experiences we have as humans. First of these is our subjective sense that speech is predictable, however anisochronous it might be when examined closely. Second is our sense that some languages are more similar than others in their rhythmic construction and cadence, and however difficult it may be to quantify these similarities, we intuitively grasp them in listening and speaking. Patel investigates the second of these hypotheses at length in a number of studies comparing music and language, especially of different nationalities (Patel et al. 2006), and has come up with some fascinating statistical measures that correlate with these categories of syllable-timed and stress-timed languages, even if the nominal origin for these categories has been disproven. However, these subjective experiences are not explained by theories of isochronous timing.

The first of these phenomena, our subjective sense that speech is predictable despite its lack of isochrony, has been explored by Fred Cummins in several fascinating studies of "synchronous speech," or two speakers reciting a text in unison. The most significant for my study of recitative is his 2009 study "Rhythm as Entrainment," which extends the results of previous research and projects a number of fascinating ideas about rhythm in general, and his work is an important precedent for my theory of metering constructions. In his introduction, Cummins makes an argument against the widespread appeal to isochrony in linguistics by comparing speech to music, arguing that the widespread occurrence of periodic beats in music "does not license the inference that the synchronization of movement with sound is based only on temporal intervals of equal length." Instead, rhythm "is not necessarily about isochrony, but may more accurately describe the relationship between a sound and the movement of a listener" (Cummins 2009, 17). Cummins finds in a series of experiments described below that despite the lack of isochrony in speech, entraining to one another's speech and speaking a text out loud in synchrony is a task which "appears to be a relatively easy and natural task for subjects, they are very good at it, and they can do it without practice" (Cummins 2009, 18). And as I will show, the conditions of his experiments are very similar to the conditions under which performers must coordinate timing in baroque opera recitative.

In a 2002 study, Cummins executed a pair of experiments using a set of audio recordings of experiment participants reading a text out loud in an empty room. In the first experiment, half of trials asked participants to read the same text in synchrony with the recording ("recording condition"), and the other half of the trials asked participants to read the text together live and in-person ("synchronous condition"). Cummins found, perhaps unsurprisingly, that speakers were better at synchronizing with one another in person than when one was recorded. But in the second experiment, Cummins tested whether this effect was truly dependent on physical co-presence, or whether it could be reproduced with recordings of synchronous speech. To test this, Cummins took recordings of the synchronous condition in Experiment I, in which each speaker of the pair reading together had been recorded on a different channel of audio. These channels were separated into separate files, producing a set of recordings of individuals that had been made in synchronous conditions, as opposed to the original batch of recordings which had been made in solo conditions. The combined solo and synchronous recordings were then used for another round of trials, in which Cummins found that for some subjects, “synchrony is substantially improved when the recording is a recording of synchronous speech” according to multiple different metrics for measuring asynchrony. Another experiment published the next year confirmed these results and demonstrated that practicing a specific text improved synchrony even further, while practicing the skill with a new text for each reading produced no improvements. In other words, preparing a specific text improved performance substantially, but the skill of synchronous speaking in general seems to be something which is “easy and natural” for humans to do without training. Further, “synchronous speaking” is a distinct mode of speech rhythm—in other words, when we know someone else is trying to synchronize with our speech, we use rhythms that are more predictable (but still not isochronous!).

The conditions of synchronous speech in Cummins’ experiments are analogous in many ways to the circumstances of continuo players and conductors seeking to synchronize with a singer during recitative. These non-singer musicians are usually reading off of a score containing the vocal part, including text, and thus like the synchronous speakers they have the singer’s text in front of them and know what will be said next. Further, unlike the solo speakers in the first stage of Cummins’ experiment, the singer is reciting a text with the knowledge that others are trying to synchronize with them, and thus is presumably drawing on this more deliberate and predictable mode of speaking. Continuo players and conductors also often prepare the text, learning the words and contours of the recitative so they can adapt to the singer’s timing more quickly; further, recitative is rarely sight-read, but usually rehearsed before a performance. This preparation is analogous to the post-practice condition in Cummins’ experiment, in which speakers not only read the text for familiarity beforehand, but also practiced speaking the same text together 6 times before the final trial. Under these conditions, Cummins found that median synchrony for the middles and ends of phrases was improved to 27ms.[7] This median is almost as low as the 20ms inter-onset interval which is reported by Hirsch 1959 as the minimum time separation between onsets of two sounds for the order of the sounds to be distinguished. The narrowness of this asynchrony is impressive, especially when compared to findings by Krause, Pollok, and Schnitzer (2010) that non-musicians have a mean asynchrony of 40ms when tapping alongside a metronomic pulse with both visible and audible components. In other words, synchronous speakers can achieve closer entrainment to each other than average non-musicians can achieve to an isochronous pulse under comparable conditions.[8] It seems reasonable to assume that professional musicians performing recitative would be able to achieve at least this level of accuracy, especially given the extra levels of musical structure available for entrainment in recitative (as compared with a straight spoken text).

Based on Cummins' synchronous speech experiments, some recommendations can be made to performers. In recitative, singers should time their recitation as if speaking with a crowd, like saying the pledge of allegiance or reciting communal liturgies in a religious ceremony. This mode of speech rhythm affords entrainment by our intuitive/innate capacity for accurate synchronous speech, and will make it much eas-

[7] Cummins' 2003 experiment establishes that in all conditions, synchrony was worse at the beginning of phrases but would rapidly increase by the middle of each phrase. For the default synchronous speaking condition, where the speakers were co-present and could see each other, the asynchrony improved within each phrase from an initial median lag of 60-65ms at the beginning of each phrase, to median lags of 40-45ms in the middle and ends of the phrase.

[8] It should be noted that Krause, Pollok, and Schnitzer's 2010 study found that all categories of professional musicians were able to achieve mean asychronies below 20ms when entraining to a periodic pulse in the audio + visual conducting, all of which are markedly more accurate than the median asychrony of 27ms for phrase-middles and -ends in synchronous speech after rehearsal of the same text.

ier for the conductor and instrumentalists to follow and synchronize accurately. Instrumentalists should entrain primarily to the text of the singer, using the conductor's cues mostly to sharpen their coordination with other instrumentalists rather than following or waiting for the conductor. Accordingly, to capitalize on the inherent human capacities for speech entrainment, accompanying musicians should listen to the singer's recitation as speech, rather than trying to follow using disciplines of durational projection instilled by their Classical training. And for maximum accuracy, instrumentalists should carefully study the text ahead of time to memorize its prosodic rhythms and phrase arcs.

A close look at the words to the first recitative in Haydn's *The Creation* shows what a musician might be listening for to synchronize their entrances with the singer. The original German reads, "Im Anfange schuf Gott Himmel und Erde; und die Erde war ohne Form und leer; und Finsternis war auf der Fläche der Tiefe." In two places, instrumental entrances coincide with recited syllables, and must be closely synchronized: on "Gott" and "leer." Each of these words is preceded by a word in a way that it would be quite unnatural-sounding to leave much of a gap before these arrivals. In the first phrase, "Im Anfange schuf Gott," the penultimate word "schuf" is the active verb, and a gap of any kind would leave the listener hanging as to what exactly it was that was doing the schuf-ing. In the second case, "und die Erde war ohne Form und leer," the words "und leer" mean "and empty," and it would be quite odd to have the word "und/and" followed by a pause. In each case the singer's pronunciation would likely be at least as predictable at these points than at any other point in the recitative's text. This facilitates the instrumentalists' coordination around these entrances, after which they can maintain synchrony by communicating visually with each other and the conductor. It should be noted that in the English version, the first instrumental entrance

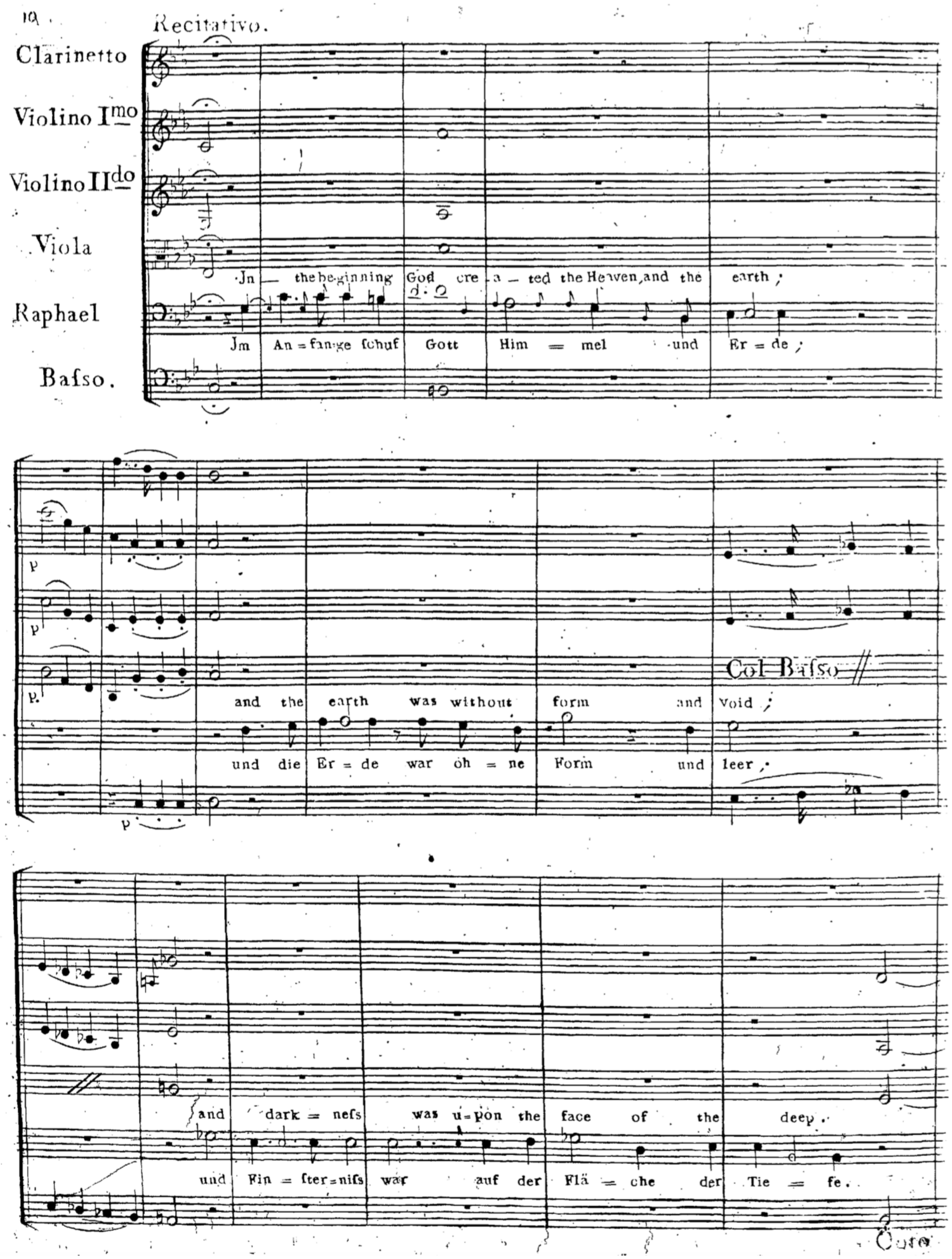

Figure 5.12: Haydn *The Creation*, No. 1 (recitative at end of movement)

on "God" has no such preparatory previous syllable—which makes another argument that the English text in *The Creation* is poorly set.

Unfortunately, while Cummins has clearly demonstrated humans' capability for accurate entrainment to speech in the absence of clear periodicity, there is currently no complete picture of exactly how language affords this entrainment, no systematic account of the structures we use to follow speech timing. Several important trends have been noted, such as the tendency of phrases to slow down as they progress. And grammatical constructions of different kinds surely play a role, allowing us to make informed guesses about what kind of word will occur where. For example, Elizabeth Couper-Kuhlen finds in her study of speech timing that lists and other parallel elements are often given some kind of equally-spaced timing.

> It will be noticed that some of the isochronous chains identified [in Couper-Kuhlen's central analytic example] accompany parallel structures. This is the case, for instance, with the lists *care, love and attention* (lines 108-111) and *the doctors, the sisters and the nurses* (lines 113-117). Parallelism can also be detected underlying the isochronous chain *he said to use his words, to quote his words* (lines 38-40) [...]. (Couper-Kuhlen 1993, 52)

To me this intuitively matches a finding by Mats Johansson that in non-isochronous Swedish *polska* dances, recognizable motives have consistent timing across different appearances—though he also notes that modeling this timing seems to be an intractable problem. In other words, two semantically comparable and syntactically parallel objects are given timing structure that is also equivalent; this makes obvious sense in a paradigm where constructions are presumed to be at the core of language cognition. But the lists Couper-Kuhlen mentions are just one of innumerable constructions and structures we use in everyday conversation, and musical timing and accent may be just as complex (. Unlike the easily-calculated model of periodic pulse, coming up with an explicit computational model which can predict non-isochronous timing in speech or music (or generate a computational explanation for why our feeling that the timing is predictable) may currently be out of reach, because of the overwhelming number of factors which seem to affect such timing.[9]

Conclusion: Reconsidering Periodicity

I'd like to end this chapter by bringing what I've shown about speech-like rhythm in recitative to bear on our understandings of conventional meter. In the first chapter I described metrical structure as a "patchwork quilt of metering constructions," in which metrical structure is conceived as a series of recognized rhythms, rather than a periodic system generated by the sound itself. In this chapter I've shown how this approach makes it possible to identify and analyze felt beats in recitative, by appealing to many constructions other than periodic pulse: voice-leading schemas, associations between cadence and beat, prosodic emphasis in words, temporalities of expectation suggested by conventional linguistic constructions, etc. But what are the commonalities and differences between this fragmentary metering in recitative, and the periodic meters that have conventionally been the focus of meter theory?

A useful analogy for the relationship between individual rhythmic constructions and repeating meter comes from a rather obscure theory of poetic verse, Gerard Manley Hopkins's concept of an "inscape." R. J. C. Watt explains that the term "inscape" takes after an artist's use of the words "landscape" or "seascape":

> Those are words which suggest not just a visible scene but the way in which a visible scene can fall into a satisfying artistic composition, with a proper relation between the parts and the whole. 'Inscape' adapts this to refer to the inner order or form of any object. (Watt 1987, 18)

[9] For an illustration of how difficult it can be to model natural-sounding musical timing, see Desain and Honing 1993.

Hopkins, in various letters and writings, uses the word inscape in a general sense to refer to design or pattern in the motion and structure of all parts of the natural world. But he also uses the word especially in discussions of rhythm in poetry, to refer to some richer sense of words' essential shapes than the abstracted strong and weak accents of classical theories of prosody. This sense of an "inner order" behind a poem's sounding words has a clear resonance with much writing on musical meter, especially the approach I've presented in this dissertation.

Hopkins argues that all spoken language has inscape, in the sense of some kind of internal motions and structure, however random and non-repeating those structures may be. But poetry, Hopkins suggests, prioritizes this shape and motion above language's ostensible purpose of communicating semantic meaning.

> Poetry is in fact speech only employed to carry the inscape of speech for the inscape's sake—and therefore the inscape must be dwelt on ... *repetition, oftening, over-and-overing, aftering of the inscape must take place in order to detach it to the mind* and in this light poetry is speech which alters and oftens its inscape. (Hopkins, quoted in Watt 1987, 20; my emphasis)

While Hopkins' claim that poetry always involves recurring inscapes is one which later free-verse poets might dispute, his explanation makes an invaluable connection between "regular" unmetered speech and the structure of strict verse. The mesmerizing rhythmic qualities of verse are not created by some abstract framework of accents, but by repeating words with similar rhythmic shapes so that the rhythmic shape becomes the dominant effect of the poem.

One important corollary of applying the concept of "inscape" to musical metering is that we can consider our experiences of meter to be derived from the same motional shapes as the isolated constructions, rather than defining meter via a separate ontology of infinitessimal time-points separated by equal durations. From this perspective, conventional meters are like looping "metrical motives," continual repeating the same accentual flow and beat structure. When a repeating motive becomes regular meter, it does not suddenly lose its motional shape and take on a completely different ontological status as an abstract cycle of beats. The motive gains a slightly adjusted motional quality of autotelic repetition (Butler 2014, 10), but retains the same recognizable pattern of movement. But while repetition may add a certain special quality to a metering construction, the inner shape of that construction is always there, even in non-repeating contexts.

A second corollary of the "inscapes" analogy, and one which is more often recognized in different terms by orthodox theories of meter, is that a motional/metering construction can become "detached" through repetition. I assume that by "detached," Hopkins means that the shape becomes somewhat independent of the sound that created it, so that we continue to listen for it even if the sounding surface does not articulate it as explicitly. When a metrical motive repeats, a particular pattern of felt beats can seem to run "on it's own"; though maybe a better way to say this is that a listener can begin to infer from repetition that a particular metering construction will continue to repeat, and generate this construction themselves with their own body movement, without needing continual reinforcement from the music.

The kinds of metering constructions I've discussed in Chapter 5 are like inscapes, shapes that seem inherent to particular sung words or melodic contours. The recurring phrase "And God Said," which opens many of the recitatives in Haydn's *The Creation*, has affordances for weight and accent and timing which seem to be inherent, in that they don't depend on an established metrical context. But these motional affordances are not incompatible or ontologically disjoint with periodic meter. These words are set to a variety of melodic contours which are compatible with the prosodic emphasis of the words. These same words, same melodies, similar rhythmic proportions, same interactions of tension and relaxation, on-beat and off-beat, can all occur in a conventionally metered piece.

The way of analyzing motion and felt beats that I've demonstrated in this chapter also presents a general solution to a long-standing problem, how to talk about unmeasured free rhythm. "Ideally, transcription should reveal the essential background structure of the temporal experience—at least this is how Western notation has been and is still essentially understood" (Frigyesi 1993, 62). Traditionally, it has been understood that the notation of time signatures and bar lines represent periodic pulse as such an "essential background structure," with particular groupings and subdivisions indicated by the time signature. But with respect to transcribing free rhythm, "our difficulty lies not only in the limitations of our notation system but in the fact that we have little understanding of the underlying structure of free rhythm, if indeed such a structure can be said to exist" (Clayton 1996, 326). The "underlying structure" of free-rhythm music is motion, and metering constructions are one way to identify and analyze these motional affordances.

But such gestural shapes can also provide the "underlying structure" for conventionally metered music, as well as a whole spectrum of "semi-metered" musics that Frigyesi and Clayton explore, which are experienced with some felt beats but not in a periodic metrical hierarchy. Non-repeating, free rhythm music like recitative can draw on many of the same cognitive and motional capabilities that are used in the perception of conventionally metered music. Our perception of both is guided by recognizing familiar ways of moving, performing those movements as a motional interpretation as the music unfolds, and experiencing the music with reference to those motions.

From a metering constructions perspective, the well-ordered hierarchies of beat and subdivisions proposed by traditional theories are not necessarily inherent in rhythmically measured music. Christopher Hasty highlights this in his 1981 article about rhythm in post-tonal music.

> To the extent the cycle is considered a continuously directed impulse, the importance of division by equal pulses or beats wanes. A tone of greater duration than the pulse (at whatever level) is not felt to be subdivided by the pulse which might have occurred, but rather takes on the continuous change of quality of that portion of the cycle which it occupies. Likewise, rests, pauses, syncopation, change of tempo and the significant liberties often taken with notationally equal durations in genuinely rhythmic performances can in fact intensify the motive quality of the cycle. (Hasty 1981,188)

Periodic pulse is a way of moving that a listener can *choose* to perform, an embodied practices applied to music to discipline our cognition, to order and control our perception and production of rhythm. But that listener can also choose to prioritize other shapes.

A theory of rhythm based in metering constructions constructions does not obviate periodicity or render established quantitative theories of meter and the harmonic geometry of rhythmic periodicities obsolete. It merely places motion as ontologically prior to periodicity, describing meter as a looping of the same kinds of motional constructions that constitute motives. Ohriner expresses a similar argument towards the end of his article analyzing motives in freely-timed *Taqsim*.

> It is increasingly evident that cognition is corporeal, that music cognition arises from bodies in motion or imagined motion, and that perception and production are inextricably linked. The shift in focus from cognitive representations of beats and hierarchies towards entrainment in theories of musical meter elevates the corporeal in this area of research, but a continued insistence on periodicity hinders the full recognition of meter's corporeal basis. What I have proposed here is a further move in this direction, towards locating meter in the synchronicity between a performer and specific attending listeners rather than the degree of periodicity of the sound signal. (Ohriner 2016, 33-34)

I go even further than Ohriner, by seeking to include other types of rhythmic coordination than strict synchronicity. Even when we move periodically, if our phases are not aligned we are often still cooperating, reinforcing rather than undermining one another's motional structure. And expanding beyond periodic pulse, as Ohriner suggests, widens the field of ways in which we can move together even further.

My approach takes "moving together" as the ontological and neurophysical basis of musical meter and rhythm more generally. The past paradigm of musical meter and rhythm grounds rhythmic structure in periodic features found in "the music itself" or abstract objective or trans-subjective "pulse layers" (Krebs 1999) or "energetic waves" (Zuckerkandl 1956 [1969]). Instead I have theorized rhythmic production and perception using metering constructions which are fundamentally constituted by corporeal knowledge of ways of moving. This ontological framework of metering identifies the "corporeal basis" of meter as a music-theoretical object (metering constructions) which can be used as the backbone of rhythmic analysis. A construction-based theory of meter can describe a more diverse range of metrical interpretations than theories based in periodicity, but also offer better explanations for *why* we experience beats. In other words, metering constructions can explain what happens when we are *feeling beats and experiencing motion*.

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Below are the printed sources referenced in the preceding chapters. I have chosen not to create a separate discography; instead I include reference information for audio and video in the text. All audio and video is available on Spotify or Youtube.

I have also chosen not to include URLs in this bibliography, except where an exact link may be necessary to access an obscure source. Most academic publications can easily be located with a web search, while the URL may not be stable over the long term.

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https://sendbackmystamps.org/2016/02/08/blitzkrieg-3-germany-1985-auf-deutsch/

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CHAPTER *A*

Ravel's Piano Trio, with measure numbers

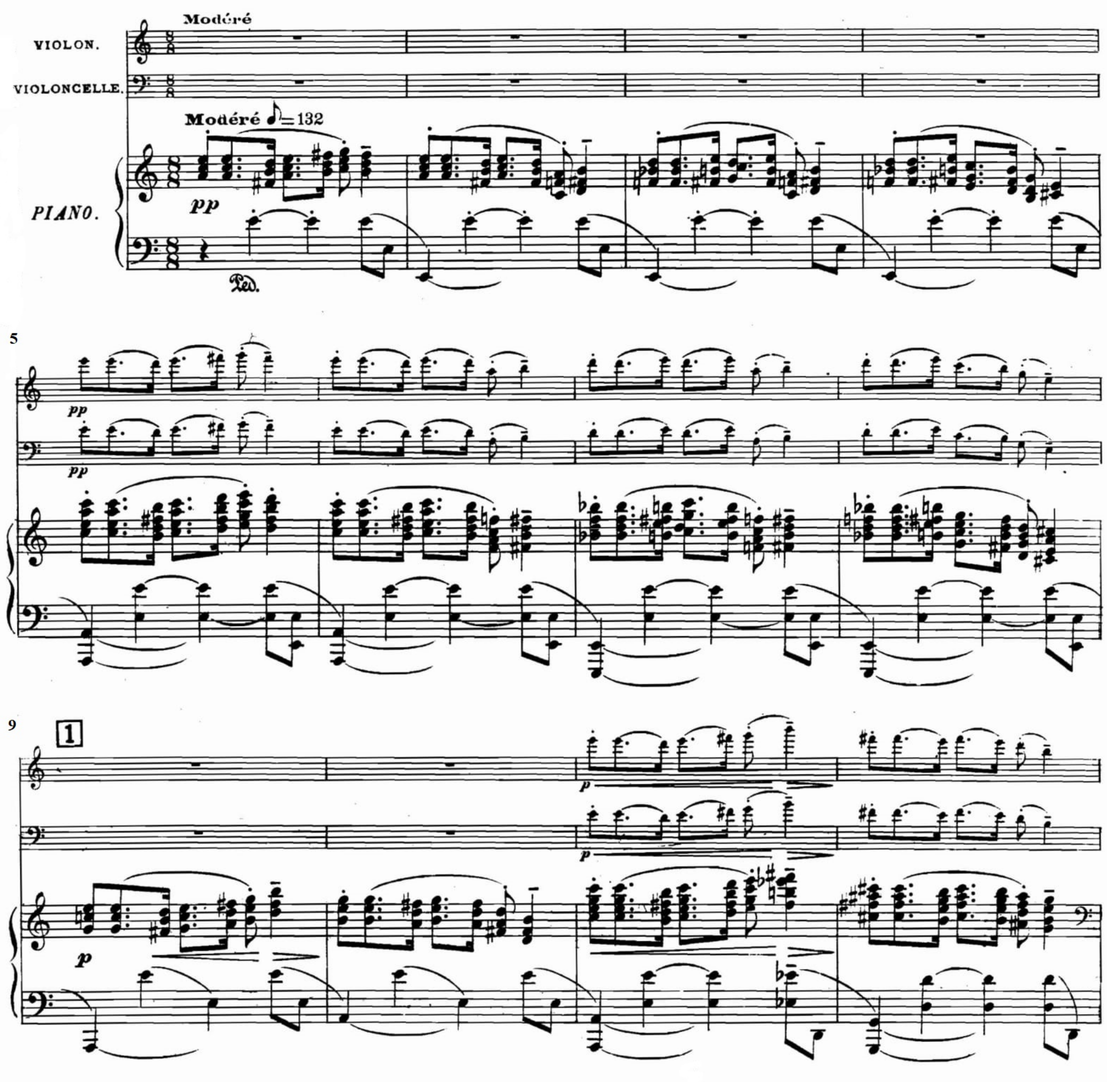
a André GEDALGE

Trio

pour Piano, Violon et Violoncelle

MAURICE RAVEL

I.



D. & F. 9346

Paris, 4, Place de la Madeleine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D. & F. 9346


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63
D. & F. 9346


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67
(en retenant)
En dehors
8 au Mouvt en animant & en augmentant peu à peu
au Mouvt en animant & en augmentant peu à peu
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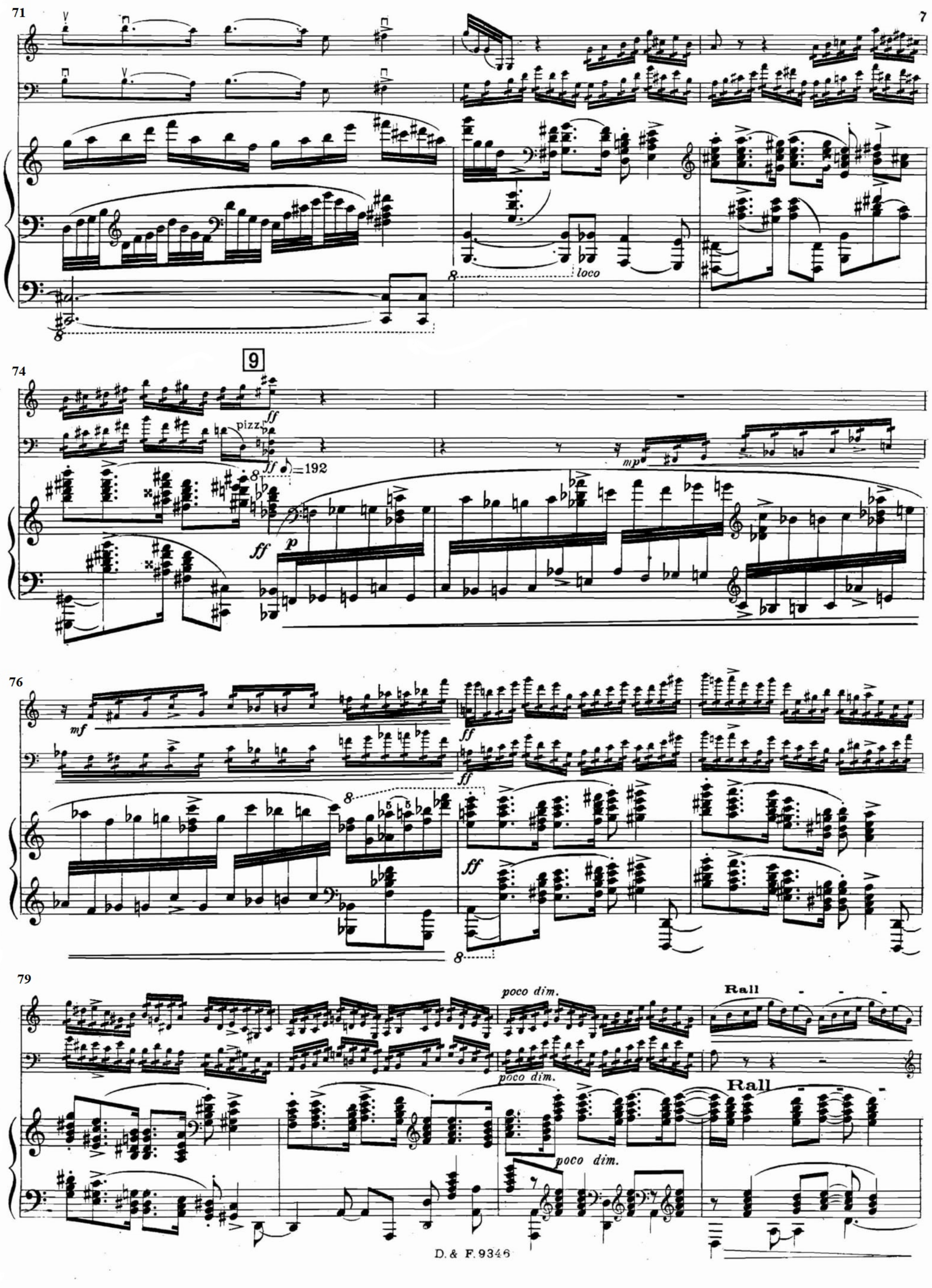
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