HEARING IN TIME

Psychological Aspects of Musical Meter

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Introduction

What Is Meter and What Is It For?

If you ask a musician "what is musical meter?" you are likely to get a demonstration of various ways of counting time such as "one-la-lee, two-la-lee" or "one and two and three and . . . " The musician is also apt to mention time signatures, the number of beats in a measure, which note carries the beat, and so forth. Some also might talk about how meter is part of the rhythmic "feel" or "groove" that underlies a particular melody or accompaniment.

This characterization of meter usually presumes, especially in styles in which one has written notation, that meter is part of the music itself. A contemporary composer might acknowledge this by saying that meter is a parameter subject to precompositional manipulation (e.g., meter can be serialized in a 12-tone composition as readily as pitch). Likewise, a music theorist might say that meter is a necessary part of the structural representation of a piece of music.

A slightly different but perhaps more useful question would be to ask a musician "what is meter *for*?" For this question you are likely to get an answer along the lines of "to help you play the rhythms properly." For, in counting correctly, a musician is able to play the rhythmic figures at the right tempo and with the correct durational proportion(s). To put it another way, the performer's sense of meter guides the motor behaviors used in the production of musical sounds. Although beginners typically need to count out the meter when they learn and practice a piece of music, more experienced musicians usually do not (although, when confronted with complicated patterns, they may also count them out). Even when not actually playing or singing (e.g., when a musician reads through a score and imagines the sounds in his or her head), metric counting helps the musician hear how the music is supposed to go.

So our hypothetical musicians would recognize that meter is both "for something" as well as part of the music's feel or groove. This is somewhat correct. In counting according to one meter and not another, a musician gives a series of tones a particular rhythmic shape and nuance: their sense of the meter leaves a kind of residue in performance, such that the "same" series of notes played under different counting frameworks will have distinctive differences in its expressive timing and dynamics.

From the outset, it is important to grasp the distinction between *rhythm* and *meter*. Rhythm involves patterns of duration that are phenomenally present in the music, and these patterns often are referred to as *rhythmic groups*. It is important to note that these "patterns of duration" are not based on the actual duration of each musical event—as a rhythmic pattern can be played legato or staccato, for example—but on the *interonset interval* ("IOI") between the attack-points of successive events. By contrast, meter involves our initial perception as well as subsequent anticipation of a series of beats that we abstract from the rhythmic surface of the music as it unfolds in time. In psychological terms, rhythm involves the structure of the temporal stimulus, while meter involves our perception and cognition of such stimuli. To paraphrase Gjerdingen (1989), if "meter [is] a mode of attending," then rhythm is that to which we attend.[1]

Meter is a perceptually emergent property of a musical sound, that is, an aspect of our engagement with the production and perception of tones in time. To be sure, there are important differences in the function of meter for listeners versus performers, but here I will focus on those aspects of meter that hold for both (and, of course, performers are also listeners). The guiding hypothesis of this book is that meter is a particular kind of a more general behavior. The same processes by which we attend to the ticking of a clock, the footfalls of a colleague passing in the hallway, the gallop of a horse, or the drip of a faucet also are used when we listen to a Bach adagio, tap our toes to a Mozart overture, or dance to Duke Ellington. As such, meter is not fundamentally musical in its origin. Rather, meter is a musically particular form of *entrainment* or *attunement*, a synchronization of some aspect of our biological activity with regularly recurring events in the environment. Meter is more, however, than just a bottom-up, stimulus driven form of attending. Metric behaviors are also learned—they are rehearsed and practiced. For musical rhythms are often stereotypical, stylistically regular, and hence familiar. So we fit, so to speak, patterns of events in the world to patterns of time we have in our minds (and, as we will see, our bodies).

At the beginning of his book on *Auditory Scene Analysis*, Albert Bregman poses the rhetorical question "what is perception for?" He answers by saying that "the job of perception . . . is to take [our] sensory input and to derive a useful representation of reality from it" (1990, p. 3). In following the implications of this seemingly obvious answer, Bregman is led to the question of how it is we are able to determine which sounds in our environment go together, that is, what sounds can be thought of as belonging to a common source. To answer this second ques-

tion Bregman developed his concept of auditory streams and the auditory scene and thus launched a thriving line of research. Here I propose a slightly different answer for meter. For meter is not just a part of the "representation of reality," a means of temporally indexing musical events. Rather, meter is one of the ways in which our senses are guided in order to form representations of musical reality. Meter provides a way of capturing the changing aspects of our musical environment as patterns of *temporal invariance*. Bregman's characterization of what perception is for can thus be amended: perception is not only for deriving representations of reality; perception also serves to guide our behavior, and this includes perceptual behavior (tracking a moving stimulus, such as another person), motor behavior (running toward or away from them), social behavior (talking to them), and so forth.

So, to return to the question "what is meter for?" we can say that metric entrainment allows listeners to synchronize their perception and cognition with musical rhythms as they occur in time. When we are entrained our attention literally "moves with the music," and this engenders and encourages our bodily movements as well—from tapping toes and swinging arms to dancing and marching. When performers perform (and presumably when composers compose) they use the same perceptual and cognitive mechanisms in directing their attention and hence their musically specific motor behavior(s).[2] Jeffrey L. Pressing takes an evolutionary point of view for this process, and he proposes the following hypothesis of "rhythmogenesis": "*Musical rhythm arises from the evolved cognitive capacity to form and use predictive models of events* [ital. in original]—specifically, predictions of the timing of anticipated future events" (2002, p. 295). He goes on to note "the time-scale of the elements [of a meter—N.B., Pressing's term in this article is "feel" or "groove"] must be those relevant for human action and predictions. This is in accordance with experimental findings, which show a correspondingly limited time-scale range in which temporal patterns engage human rhythmic responses" (2002, p. 296).

It seems clear, then, that hearing the temporal regularities in a series of tones, and attributing to them a particular coherence as an object in the auditory scene (to use Bregman's terms), is a musically peculiar instance of a more general perceptual and cognitive ability. "Peculiar" is the right adjective for this instance, for it must be acknowledged that when listening to music (whether in a concert hall, our automobile, or our living room) we are *not* attending to such sounds in terms of their normal ecological significance. As Roger Scruton (1997) has pointed out, musical sounds are not part of our normal sound world, hence he makes a distinction between sound in the physical world and musical tones in "acousmatic space." Musical tones are produced for their own aesthetic contemplation as sounds—they are ends in themselves, and not further markers of location, action, size, and so on. When we attend to the sound of the oboe in an orchestral work we are not trying to discern the location of the oboist, nor do we understand a decrescendo in the oboe part as an indication that the oboist is

moving away from us. Rhythm, too, is distilled from its everyday ecological significance in the concert hall. As I have noted, rhythm signifies movement, but musical tones do not move. Rather, we hear a kind of virtual motion in a virtual, asousmatic space (Langer 1953; Gjerdingen 1994). Nonetheless, it is precisely because our musical perception is parasitic on other modes of auditory perception that we hear movement in rhythmic pattern, or a sense of distance and remoteness when a melody gets softer and softer. Music derives much of its expressive power from the residues of the normal ecological significance of patterned sounds when we hear them in aestheticized contexts.

Some Other Premises of This Book

The major premise of *Hearing in Time* is that meter is a form of entrainment behavior. A number of other significant premises stem from it. The first is that these entrainment behaviors are highly practiced: from early childhood we are steeped in a musical environment, and have many opportunities to develop and hone our attentional habits relative to particular musical styles. Moreover, as metric entrainment is intimately related to motor behaviors, it is worth noting that those behaviors are also highly practiced. While there significant differences from person to person in their rhythmic sensitivities and abilities, most of us are very good at walking, running, and, of course, listening to and performing music—for almost everyone can sing a simple tune. Therefore, when we attend to a piece of music, we are rarely starting from metric first principles. Indeed, our highly practiced habits allow us to be sensitive to subtle nuances of a performer's interpretation (whether in the context of Rubinstein's Chopin or Tony Williams's be-bop drumming).

A second premise is that as a kind of attentional behavior, meter is subject to a number of fundamental perceptual and cognitive constraints, and these constraints need to be taken into account in discussions of meter, especially music-theoretic descriptions of possible (i.e., "well-formed") versus impossible meters. These constraints in turn have implications for how musical gestures can create particular expressive effects. By casting a pattern of alternating long and short notes in a particular meter and at a particular tempo, for example, a composer may exploit the perceptual differences between them, so that one may talk about a perceptual or cognitive basis for rhythmic affect.

Organizational Overview

Hearing in Time considers meter in both Western and non-Western musical traditions and examines our rhythmic perception and performance in both the laboratory and the concert hall. In so doing, we find a rich range of rhythmic prac-

tices and metric abilities. At the same time, I also argue that in these different cultures and contexts meters are nonetheless subject to the same basic formal and cognitive constraints. As our capacity for entrainment is universal, the same sorts of rhythmically regular patterns will tend to give rise to similar metrical structures and similar musical effects.

The first two chapters survey the theoretical background and empirical research in the psychology of perception and motor behavior relevant to musical meter. Chapters 3, 4, and 5 then relate this research to specifically musical contexts. Chapters 3 and 5 examine the ways that our metrical attention interacts with rhythmic surfaces, while chapter 4 presents *Hearing in Time*'s core conceptions of metric well-formedness, along with a new form of metric representation. The metric taxonomy becomes more fine-grained as the book progresses, as I note only differences among *metrical types* (different "flavors of $\frac{3}{4}$," for example, based on different varieties of subdivision) but also distinguish each type according to tempo, what I call *tempo-metrical types*. For our perceived sense of a given meter will change with tempo, even if its formal architecture remains constant.

Chapter 6 is an analytical interlude, a tour of the rhythmic landscape in the first movement of Beethoven's Fifth Symphony. This analysis shows how our metrical attending can change—often dramatically—over the course of a piece. It is an antidote, in some sense, to the other parts of the book, both because those other parts are more theoretical and because they tend to focus on steady states of metrical entrainment, rather than its flux.

Chapters 7 and 8 take us to other musical traditions and cultures, where we find meters with non-isochronous beat patterns. These meters are related to the principles of well-formedness laid out in the previous chapters. A single set of well-formedness constraints for both Western and non-Western musics is proposed. One of those constraints, *maximal evenness* (a concept taken from tonal theory, specifically, that of well-formed musical scales), is shown to be a global constraint on metric hierarchies, a constraint with perceptual as well as formal motivations.

Chapter 9 concludes the book by presenting the *many meters hypothesis*. This hypothesis moves beyond tempo-metrical types to highly context-specific patterns of temporal expectation that govern our attention to as well as performance of rhythmic sequences. The many meters hypothesis gives an ecologically valid approach to our metric perception and cognition by recognizing that we acquire our metrical listening habits by listening to real-world, human performances of music. And whereas these performances rarely (at least until recently) involve mechanically perfect timing patterns, their timing patterns are stable, involving expressive nuances that are typical of certain styles and genres. It is these nuanced timing patterns that we internalize and come to expect. These patterns may be highly individuated—not just among substyles of a music (e.g., different senses of swing in different styles of jazz) but also in the idiosyncratic rhythmic behaviors of particular musicians (e.g., Glenn Gould's Bach). Highly

skilled listeners may have hundreds of specific timing patterns at their command and can reflexively invoke the appropriate meter as the music demands.

The many-meters hypothesis is in sharp contrast to the standard music-theoretic view of meter as comprising a few archetypal patterns. It also differs from Christopher Hasty's recent and more radical rejection of the categorical separation between rhythm and meter. Hasty focuses on the uniqueness of each rhythmic experience, which he refers to as its durational and metrical "particularity." Hasty notes that "it is customary to view rhythm as a rich and fully sensuous embodiment of music's temporal progress and meter as rhythm's shadowy, schematic counterpart—abstract, mechanical, and devoid of any intrinsic expression. . . . What is lost in this simplification is the specifically temporal character of repetition and therefore the claim of meter to be regarded as fully sensible and expressive" (1997, p. viii). I heartily agree with Hasty regarding the sensible, embodied aspects of our metric experience; I hope to show how meter itself can be expressive and how it can embody (both figuratively and literally) expressive movement. At the same time, in considering meter as, most essentially, a kind of behavior, I also claim that these behaviors are stable, replicable, and learnable. Listening metrically involves our musical habits, and not just a few generic habits but a rich repertoire of metric responses to rhythmic patterns and processes.