

# Rhythm in Language and Music

## Parallels and Differences

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**ABSTRACT:** Rhythm is widely acknowledged to be an important feature of both speech and music, yet there is little empirical work comparing rhythmic organization in the two domains. One approach to the empirical comparison of rhythm in language and music is to break rhythm down into subcomponents and compare each component across domains. This approach reveals empirical evidence that rhythmic grouping is an area of overlap between language and music, but no empirical support for the long-held notion that language has periodic structure comparable to that of music. Focusing on the statistical patterning of event duration, new evidence suggests that the linguistic rhythm of a culture leaves an imprint on its musical rhythm. The latter finding suggests that one effective strategy for comparing rhythm in language and music is to determine if differences in linguistic rhythm between cultures are reflected in differences in musical rhythm.

**KEYWORDS:** rhythm; language; music

### INTRODUCTION

Widespread consensus exists among linguists that rhythm is an important aspect of spoken language. That is, just as languages can differ in terms of their inventory of phonemes and the lexicon they make from these sounds, they can also differ in rhythmic organization. Furthermore, the degree of rhythmic similarity is not simply a reflection of the historical relationship of languages. American English and Arabic, for example, are considered to be rhythmically similar, whereas American versus Jamaican English are considered rhythmically different.

What is linguistic rhythm? It is a composite of several aspects of a language that influence how it is organized in time. One component is the pattern of grouping/phrasing of words within utterances and pausing between utterances. A second component is the durational patterning of syllables. A third component is the “configurational” patterning of stressed versus unstressed syllables. For example, English has a roughly alternating pattern of stressed and unstressed syllables and has mechanisms to avoid too many stressed syllables in close adjacency (stress clashes) or long sequences of unstressed syllables (stress lapses).<sup>1</sup> Greek, in contrast, has a greater tolerance for stress lapses, so that stressed syllables do not recur as regularly as they do in English.<sup>2</sup>

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What is musical rhythm? As with language, it is not simply one thing but a number of things that influence the way music is organized in time. These include the grouping of tones into phrases, a stable underlying beat (if present), and, if a beat is present, the organization of periodicity on multiple time scales to create musical meter. Just as linguists agree that rhythm is an important component of language, musicologists agree that rhythm is a fundamental aspect of music. This naturally raises the question of how rhythmic organization compares in the two domains in terms of both structure and cognitive processing. Although some cross-fertilization in terms of theoretical descriptions of rhythm has occurred in the two domains (especially regarding metric structure), little empirical work has been done on the similarities and differences of linguistic and musical rhythm.

### **EMPIRICAL SIMILARITY BETWEEN RHYTHM IN SPEECH AND MUSIC: GROUPING STRUCTURE**

In speech perception, the words of a sentence are not perceived as being equally separated from one another. Rather, the boundaries between words vary in the amount of perceived “junction,” so that some words group together to form larger rhythmic chunks or phrases.<sup>3</sup> A similar situation obtains in music, where the tones of a melodic line are usually perceived as being organized into phrases even if there is no physical discontinuity between tones. Some of the acoustic cues to phrase boundaries in language and music, such as pitch drop and durational lengthening, are similar.<sup>4</sup> These cues are so salient that even young infants are sensitive to them.<sup>5</sup> It would be quite interesting to know if any relationship exists between the length of phrases in language and music. For example, do cultures with long linguistic phrases also have long phrases in their music? To my knowledge, no comparative data exist on this issue.

### **EMPIRICAL DIFFERENCE BETWEEN RHYTHM IN SPEECH AND MUSIC: PERIODICITY**

An early and influential theory of speech rhythm posited that languages fell into one of two rhythmic classes. In “stress-timed” languages such as English and German, stressed syllables were claimed to occur at regular temporal intervals, whereas in “syllable-timed” languages such as Italian and French, syllable onsets were claimed to be evenly timed.<sup>6</sup> The underlying claim was that speech is produced in an isochronous way, the only difference being the units that occurred periodically. Subsequent empirical research has failed to confirm this hypothesis,<sup>7</sup> and the search for periodicity in speech has not produced any compelling quantitative data. This stands in sharp contrast to music, where there is abundant evidence for tightly regulated periodic patterns. Indeed, persons often synchronize their movements to a stable perceived beat in music, whereas normal speech does not induce a beat in this sense.

Despite the lack of evidence for isochrony in speech, linguists have maintained the terminology of “stress-timed” and “syllable-timed” languages to capture a perceived difference between the rhythms of different languages. Considerable debate

exists, however, over whether two categories are really enough for classifying linguistic rhythms or even whether the categories are simply ends of a continuum.<sup>8</sup>

### A NEW APPROACH TO THE EMPIRICAL COMPARISON OF RHYTHM IN LANGUAGE AND MUSIC

The foregoing two sections demonstrate that an effective approach to the empirical comparison of rhythm in language and music is to break rhythm down into sub-components and compare each in turn. In addition to grouping and periodicity, another component of rhythm is the statistical patterning of event duration, particularly the variability of event duration. This has been the theme of recent research on speech rhythm, which has examined the variability of vowel duration in sentences of stress- versus syllable-timed languages.<sup>9,10</sup> The motivation for this research is the observation that stress-timed languages tend to allow a greater degree of vowel reduction than do syllable-timed languages (i.e., the shortening of vowels in unstressed syllables). A quantitative measure of vowel duration variability, called the “normalized pairwise variability index,” or nPVI, was applied to sentences in stress- and syllable-timed languages and was shown to have a greater value in the former languages. This work provided the background for a comparative study of rhythm in language and music that was recently completed in our laboratory. Full details of this study can be found in Ref. 11; here, the main points of the study are described.

We wanted to test the idea that the linguistic rhythm of a culture might leave an imprint on its musical rhythm. This is a popular idea in musicology, but to our knowledge no convincing empirical evidence had been produced to support it. Our approach was to focus on cultures with strong linguistic rhythmic differences and to compare the musical rhythms of these cultures using the same measures that had been applied to speech rhythm. The nPVI allowed us to do this, as it measures the relative variability in a set of durations and can be applied to event durations in language (e.g., vowels) and in music (e.g., musical tones). We chose to focus on the speech and music of England and France, because English and French are canonical examples of languages with different rhythms and because we had access to a large number of English and French classical musical themes from the musicological literature.<sup>12</sup> We examined turn-of-the century composers (such as Elgar and Debussy), as this is considered a time of “musical nationalism” during which the music of different countries took on characteristic styles.

Research on English and French speech using the nPVI had demonstrated that English had a significantly higher value (i.e., a greater variability of vowel duration).<sup>10</sup> We applied the nPVI to the musical themes of 16 composers (6 English, 10 French) and found that, on average, English and French musical themes had significantly different nPVI values. Furthermore, this difference was in the same direction as the difference observed in language, with English having a greater nPVI value than French, meaning that tone durations were more variable in English than in French music.

In conducting this study, we focused exclusively on instrumental music (versus vocal music) in order to examine the “rhythmic thinking” of composers when they were free of a linguistic context. Our data suggest that even when thinking instru-

mentally, composers can be influenced by the rhythms of their native language. We do not believe that this influence is obligatory. Rather, it is likely to surface at times of musical nationalism, when composers seek to produce music that is particularly representative of their country.

### CONCLUSION

Rhythm is a fundamental aspect of language and music, and empirical comparisons between rhythm in speech and music can benefit from careful dissection of rhythm into subcomponents for comparison across domains. This strategy shows that certain aspects of rhythm do show cross-domain similarities, that is, rhythmic grouping and the statistical patterning of event duration. These findings can help guide neural studies of rhythm, which will need to consider the different subcomponents of rhythm and the extent to which the components engage domain-general versus domain-specific processes.

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