

Exploring Musical Time at the Phrase, Metre and Motif Level

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Prior studies have established that musical time in Western classical music arises as the product of score-based timing and performance timing. Furthermore, research has shown that musical time is structured componentially across multiple levels. Following this line, we approach musical time through a hierarchical analysis, considering three levels: the global segment level, the mid-level metrical structure, and the local motif level. At the global level, we examine larger structural elements, such as sections and segments that serve as functional units defining the overarching organization of a piece. These elements are often shaped by the underlying musical structure and harmonic progression, as performers tend to align them with formal and stylistic conventions. At the mid-level, we focus on metrical organization, including measures and beats, which connects the broader formal structure to the finer details of rhythmic articulation. This level appears to be influenced by the constraints of human perception, with metrical regularity playing a central role in supporting listener understanding and temporal expectations. Finally, at the local level, we consider individual notes within melodies or motifs, as well as subtle rhythmic variations, where performers have the most freedom to express nuanced interpretations. To investigate these levels, we employ probabilistic models on 11 professional performances of selected Beethoven Piano Sonata movements, for which we have note-level alignments between the score, performance and musicological motif, structure and harmony annotations. Through this analysis, we aim to explore how temporal structures might be disentangled across levels, offering a perspective on the interplay between musical structure, perceptual constraints, and artistic choice. By examining these relationships, we seek to better understand how performers balance structural fidelity with interpretative freedom, providing a step toward a deeper understanding of the componential organization of musical time.