Towards a Formalization of Musical Rhythm

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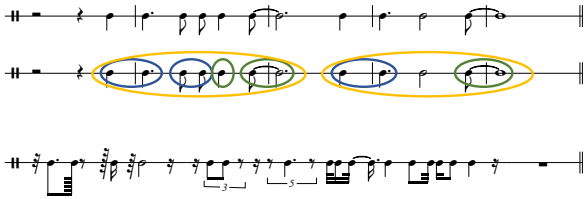
Abstract

Temporality lies at the very heart of music, and the play with rhythmic and metrical structures constitutes a major device across musical styles and genres. Rhythmic and metrical structure are closely intertwined, particularly in the tonal idiom. While there have been many approaches for modeling musical tempo, beat and meter and their inference, musical rhythm and its complexity have been comparably less explored and formally modeled. The model formulates a generative grammar of symbolic rhythmic musical structure and its internal recursive substructure. The approach characterizes rhythmic groups in alignment with meter in terms of the recursive subdivision of temporal units, as well as dependencies established by re- cursive operations such as preparation and different kinds of shifting (such as anticipation and delay). The model is formulated in terms of an abstract context-free gram- mar and applies for monophonic rhythms and harmonic rhythm.

Motivation

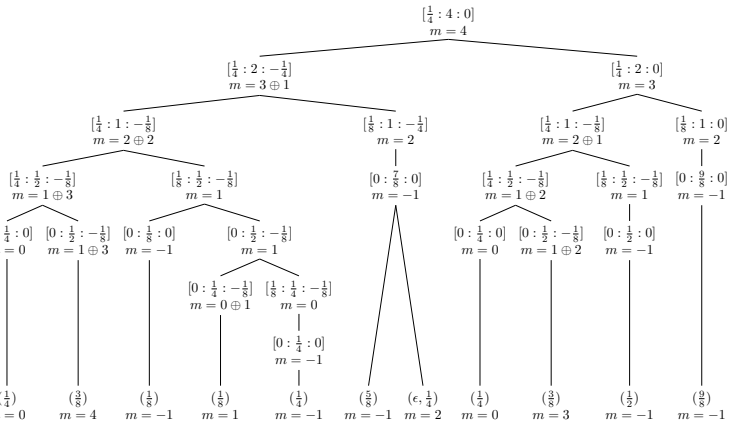
- Tonal rhythm has an interpretation:

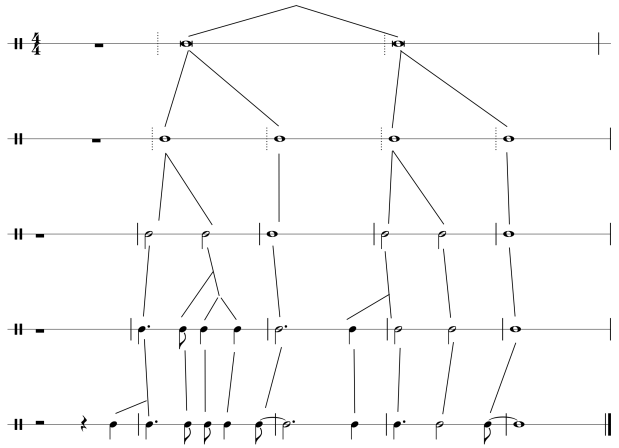


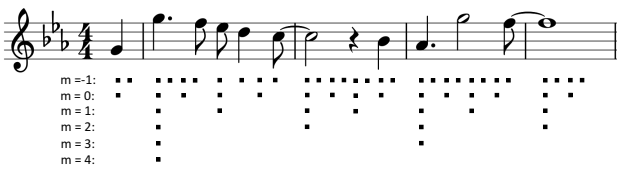
- The purpose of this paper is to model rhythm using a syntactic formalism (abstract context-free grammars) that makes it possible to express a link between structure and its (underlying) interpretation.

- Three types of abstract context-free rules are assumed, which can be recursively combined:
  - Split
  - Prepare
  - Shift (delay / anticipate)

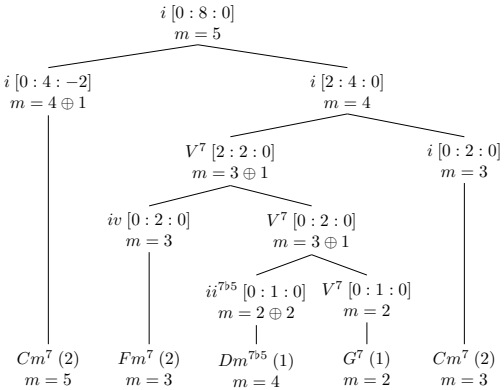
  - Modeling effects of "time-stealing"
  (events being shortened cause of this overlap with other events.)

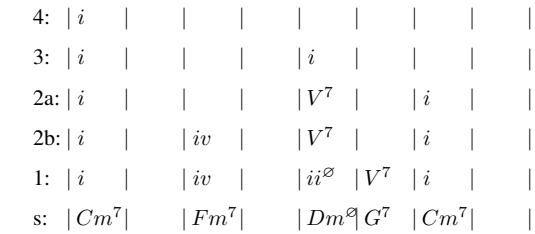






Example 2: Harmonic rhythm





References

D. Harasim, T. J. O'Donnell, and M. A. Rohrmeier, "Harmonic syntax in time: Rhythm improves grammatical models of harmony," in *Proceedings of the 20th International Society for Music Information Retrieval Conference (ISMIR)*. ISMIR, 2019, pp. 335–342.

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