Bridging Computational Rhythm Analysis and Learner Progression in Pattern Replication Tasks

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Many computational metrics have been proposed that quantify and characterize a group of monotonic rhythmic patterns' complexity (Thul, 2008) and similarity (Toussaint et al., 2011). In this work, we employ Cao et al.'s Family Theory of rhythms as a metric for rhythmic similarity (Cao et al., 2012) and an entropy-based coded-element metric of rhythmic complexity (Vitz and Todd, 1969, Thul, 2008). Both metrics have demonstrated strong correlations with human judgments of rhythmic similarity and complexity. We aim to study whether a rhythmic syllabus structured using these metrics to guide the order in which patterns are introduced will influence the rate at which learners memorize and accurately replicate looping rhythmic patterns. We test this through a rhythm reproduction study hosted on a custom-designed web-based experimental interface. We also examine how visual aids and pitched onsets paired with the looping rhythmic patterns influence learning and memorization.

Our experiment consists of six blocks, each of which a participant listened to six unique rhythmic patterns and then reproduced them by clapping into their computer's microphone. Each pattern is two measures long on an eighth-note grid, presented at 105 BPM, and looped four times. The order and content of patterns within each block are determined using our complexity and similarity metrics. A block is completed when all patterns are reproduced within performance constraints defined by the automatic assessment in the interface. Each block represents key interactions: computational metric-based ordering of stimuli, melodic contour introduced with the stimuli, and a visual representation of the pattern. We also include control blocks where patterns are selected randomly.

Dependent variables include the number of attempts per pattern, the number and type of error in replication, and total attempts per block. Participant reproductions are stored for future analysis. The experiment lasted 30–45 minutes, with data collected from 28 U.S.-based participants. Preliminary analysis indicates that the complexity metric effectively predicts difficulty in comprehension and replication. However, grouping patterns based on the similarity metric does not appear to improve reproduction performance.

References

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