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Modeling the implicit learning of metrical and non-metrical rhythms

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ABSTRACT

Background

The information dynamics of music (IDyOM; Pearce & Wiggins, 2006) model, originally applied to melodic expectation, indicates learning via entropy (reflecting uncertainty) and information content (reflecting unexpectedness). The IDyOM model has two components: a short term model (STM) where the model learns based on exposure in a single instance (i.e. a block) and a long term model (LTM) where the model is exposed to a corpus of 907 folk songs, to account for previous exposure to music. There are five configurations: STM only, LTM only, LTM and STM together (BOTH) where LTM is fixed, and LTM+ and BOTH+ where the LTM is exposed to the corpus and learns over blocks. The IDyOM model can also be applied to rhythmic expectation.

Schultz, Stevens, Keller, and Tillmann (submitted) found implicit learning (IL) of metrical and non-metrical rhythms using the serial reaction-time task (SRT). In the SRT, learning is characterized by RT decreases over blocks containing a repeating rhythm, RT increases when novel rhythms are introduced, and RT recovery when the original rhythm is reintroduced. Metrical rhythms contained events that occurred on the beat and downbeat. Non-metrical rhythms contained events that deviated from the beat and downbeat. In the metrical condition, larger RT increases occurred for the introduction of novel weakly metrical rhythms compared to novel strongly metrical rhythms. No differences were evident between the introductions of novel non-metrical rhythms.

Aims

We used the IDyOM model to test the hypothesis that IL of metrical and non-metrical rhythms is related to developing expectations (i.e. RT data) based on the probabilistic structure of temporal sequences. We hypothesized that previous exposure to the corpus results in larger positive correlations for metrical rhythms than non-metrical rhythms.

Main Contribution

Correlational analyses between RT data (from Schultz *et al.*, *submitted*) and the IDyOM model were performed. The IDyOM model correlated with RT. Entropy demonstrated moderate positive correlations for the LTM+ and BOTH+ models. Information content demonstrated moderate to strong positive correlations for the LTM, BOTH, LTM+, and BOTH+ models. As hypothesized, models exposed to the corpus demonstrated larger correlations for metrical rhythms compared to non-metrical rhythms.

Implications

Results suggest that the IDyOM model is sensitive to probabilistic aspects of temporal learning, and previous exposure to metrical rhythms. The probabilistic structure of temporal sequences predicts the development of temporal expectations as reflected in RT. Results indicate that the usefulness of the IDyOM model extends beyond predicting melodic expectancies to predicting the development of temporal expectancies.

Keywords

Rhythm, Meter, Implicit Learning, Information Dynamics of Music Model

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