Information Dynamics in Music Cognition

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Research on music perception is often inspired by psychological theories developed in other domains. This practice may simply reflect a simplifying methodological approach or it may imply that the two domains make shared use of common cognitive components and processes. For example, the Gestalt principles of similarity and proximity, originally developed to describe phenomena in visual perception, have been adapted and incorporated into theories of the perception of melodic groups (Lerdahl & Jackendoff, 1983) and the cognitive processes involved in melodic expectation (Narmour, 1990).

Here we examine the use of information theoretic methods for modelling the cognitive processing of music. In particular, we focus on the statistical induction of sequential regularities in music and the use of these regularities in prediction. There is evidence that statistical learning and prediction are involved in the segmentation of tone sequences (Saffran et al., 1999) and generation of melodic expectations (Pearce & Wiggins, 2006). We extend these approaches in studies of Gradus and Two Pages, minimalist compositions by Philip Glass, which are strictly monodic, isochronous and monotimbral, allowing for a tightly controlled study without compromising ecological validity. The investigation is conducted using a statistical model (Pearce & Wiggins, 2006) of melodic structure that operates on a symbolic musical surface consisting of sequences of note-like events. It is capable of representing and processing regularities in a number of different representations present in or derived from this surface. The model derives its knowledge of sequential melodic structure entirely from a corpus of existing music but is also capable of dynamically learning the structure of the composition it is currently predicting.

The results demonstrate that the formal structure of the piece (York, 1981) is indicated by characteristic changes in information content, while information-theoretic measures successfully predict the judgements of an expert musicologist. We argue that while Gestalt theories merely describe the perceptual behaviour of listeners, the information dynamic approach yields functional models of the cognitive processes underlying that behaviour.

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