University of Southern California

DANIEL J. EPSTEIN DEPARTMENT OF
INDUSTRIAL AND SYSTEMS ENGINEERING

EPSTEIN INSTITUTE SEMINAR • ISE 651 SEMINAR

Using Large Datasets to Understand the Perception of Structure in Music

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ABSTRACT

The perception of grouping structure in music is one of the most fundamental and yet poorly understood aspects of listening. Grouping structure refers to how a listener divides a sequence of sounds into segments, and groups these segments together recursively. This process is somewhat automatic at the shortest timescales, but modelling how the mind forms larger groups is a formidable challenge. I will present two projects that seek to improve our understanding of what musical attributes listeners are most likely to focus on.

The first is a study of the correlation between acoustic changes and the perception of boundaries, and is based on an analysis of SALAMI, a large collection of structural annotations. While datasets like this are generally used for evaluating analysis algorithms, we have repurposed SALAMI to study the inverse problem: deducing how listeners interpret acoustic signals as structured events. We computed smoothed differential functions of a number of musical features and observed how often moments of change coincided with boundaries and non-boundaries. Reinforcing and extending results from psychological experiments, we found that a change in some musical feature is a necessary but not sufficient condition for a point in time to be considered a boundary, and that the number of simultaneous changes in different musical features correlates with the salience of the boundary.

In the second project, we developed a tool that seeks to identify the acoustic parameters a listener was plausibly focusing on when they analyzed the piece. Our approach uses multiple self-similarity matrices, which are often used to detect repeated patterns for music structure analysis. Using Quadratic Programming, we find the optimal piece-wise combination of matrices to reproduce the listener's analysis, resulting in a time-series estimate of the listener's attentional focus. Examples illustrate many aspects of listener disagreements, such as the origin and independent plausibility of conflicting interpretations.

TUESDAY, MARCH 25, 2014
VON KLEINSMID CENTER (VKC) ROOM 100
3:30 – 4:50 PM

SPEAKER BIO

Jordan B. L. Smith is a Ph.D. candidate at the Centre for Digital Music at Queen Mary University of London, studying with Prof. Elaine Chew. He received his M.Sc. in operations research engineering in 2012 at University of Southern California (Los Angeles, CA, USA), his M.A. in music technology in 2010 at McGill University (Montreal, QC, Canada), and in 2006 his A.B. in music and physics at Harvard College (Cambridge, MA, USA).

As a research assistant at McGill, he planned and implemented the collection of ground truth for the Structural Analysis of Large Amounts of Music Information (SALAMI) project. His current research, which focuses on differences among listeners in the perception of musical structure, has been published in IEEE Transactions on Multimedia and at the ACM Conference on Multimedia, and he has delivered talks on the subject at the Society for Music Perception and Cognition and at the Digital Music Research Network.

In 2012, Smith was awarded doctoral fellowships from both the Social Sciences and Humanities Research Council of Canada and the Fonds de recherche du Québec; both agencies also awarded him a master's fellowship in 2009. He was awarded a Provost's Ph.D. fellowship from the University of Southern California in 2010.