USC Viterbi School of Engineering

Integrated Media Systems Center Seminar Series

Carol Krumhansl, Professor
Cornell University Department of Psychology

Statistics and Geometries of Music

Friday, November 18, 2005, 2:30-3:30PM @ EEB 248

Tonality is the term that refers to the basic principles governing musical pitch. It includes descriptions of scale structure, harmony, and the relationship between musical keys. In addition to being a central topic developed in music theory, it has provided a rich source for cognitive and computational investigations. The talk will begin with a brief summary of this background, followed by a description of two recent research projects.

Carol Krumhansl is Professor of Psychology at Cornell University, author of the seminal text *Cognitive Foundations of Musical Pitch*, and past President of the Society of Music Perception and Cognition. Her research in music cognition, spanning 25 years, began with her Ph.D. thesis at Stanford University, and focused initially on musical pitch, specifically tonality and melody. Over the years it has expanded to include studies of musical rhythm and timbre, dance, emotion, contemporary proposals in music theory, and the neuroscience of music, applied to music ranging from Mozart and Beethoven to twelve-tone serialism and atonal songs, from Javanese musical scales and Indian raga to Finnish spiritual folk hymns and Sami yoiks. The research has used a wide variety of approaches, including standard cognitive tasks such as memory and scaling, development, cross-cultural studies, psychophysiology, and most recently brain imaging. She has held visiting positions at IRCAM in Paris, the Center for Advanced Study in the Behavioral Sciences at Stanford, the University of Jyväskylä, Finland, and the Montreal Neurological Institute.

The first project is an application of a statistical learning model of language learning (Automatic Distillation of Structure - ADIOS, Zach Solan et al.) to music. There are two main motivations for extending the model to music. First, the extension tests whether a statistical learning model of this kind can extract musically interpretable structures from a musical corpus. Second, the applications address a question that has received mixed evidence in the music cognition literature, namely, whether rhythm and pitch are independent aspects of musical structure.

The second project considers a geometric approach to describing tonality, the Fourier balances proposed in Ian Quinn's (2004) dissertation. The Fourier balances are derived from Lewin's Fourier properties that were proposed to characterize chord structure. In their geometric form, they provide an intuitively accessible way to represent scale structure and key relations. It will be shown that the can also be used to account for tonal hierarchies. Finally, an application to an octatonic selection from Messian will be presented that demonstrates how the Fourier balances might account for musical tension.

Host: Elaine Chew, IMSC & Epstein Dep of ISE.