Musical Acoustics and Psychological and Physiological Acoustics: Musical Timbre:
Perception and Analysis/Synthesis I

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Invited Papers

9:20
4aMU1. Real-time segmentation of the temporal evolution of musical sounds. John Glover, Victor Lazzarini, and Joseph Timoney (National University of Ireland, Maynooth, john.c.glover@nuim.ie)

Since the studies of Helmholtz, it has been known that the temporal evolution of musical sounds plays an important role in our perception of timbre. The accurate temporal segmentation of musical sounds into regions with distinct characteristics is therefore of interest to the study of timbre perception as well as to different forms of sound modelling and manipulation. Following on from recent work by Peeters and Caetano et al, this paper presents a new method for the automatic segmentation of the temporal evolution of isolated musical sounds in real-time. We define attack, sustain and release segments using cues from a combination of the amplitude envelope, the spectro-temporal evolution and a measurement of the stability of the sound that is derived from the onset detection function. We conclude with an evaluation and discussion of some potential applications of the method.

9:40
4aMU2. Impact of MP3-compression on timbre space of sustained musical instrument tones. Chung Lee, Andrew Horner (Hong Kong University of Science and Technology, im.lee.chung@gmail.com), and James Beauchamp (University of Illinois at Urbana-Champaign)

MP3 compression is widely used in music sharing and storage. A number of studies have investigated the discrimination of instrument tones after MP3 compression. Additionally, a number of previous studies have evaluated other data reduction methods including frequency modulation (FM) synthesis, wavetable synthesis, and principal component analysis (PCA). However, these studies have not considered the impact on timbre space after data reduction. In this study, listening test subjects were asked to rate the dissimilarity of all pairs of original instrument tones. The same process was done on MP3-compressed tones with various bit-rates. Correlation analysis was done on the dissimilarity data of the original and compressed tones to see if MP3 compression caused a significant impact on the perceptual distance between instrument pairs. The multidimensional scaling (MDS) solutions of the original and compressed tones were also compared to see if the timbre space was significantly altered after MP3 compression (e.g., would a clarinet sound more or less similar to an oboe after MP3 compression?) [This work was supported by RGC grants 613510 and 613111.]

10:00
4aMU3. Investigation of timbre saliency, the attention-capturing quality of timbre. Song Hui Chon and Stephen McAdams (CIRMMT, Schulich School of Music, McGill University, 555 Sherbrooke Street West, Montreal QC, Canada H3A 1E3, songhui.chon@mail.mcgill.ca)

Timbre saliency is defined as the attention-capturing quality of timbre. Saliency differences between timbres were measured using a tapping technique in which the stronger beat in ABAB isochronous sequences was reproduced by the listener, the idea being that the more salient timbre would capture listeners’ attention and be chosen more often as the strong beat. A timbre saliency space was defined in which the distance between a pair of timbres corresponded to the difference in timbre saliency. Stimuli were generated with 15 orchestral instruments, equalized in pitch, loudness and duration. Data from 40 participants yielded a one-dimensional CLASCAL solution with two latent classes and specificities. Latent class structure shows no relation with gender, musicianship or age. Testing audio descriptors from the Timbre Toolbox [Peeters et al., 2011, J. Acoust. Soc. Am., 130, 2902-2916], the odd-even harmonic energy ratio explains 51% of the variance along this dimension. A combination of tristimulus (band 3) and odd-even ratio explains 73% of the variance in the mean saliencies of individual sounds across all other comparison sounds. Mean saliency thus seems to depend on the high-frequency harmonic energy and spectral envelope jaggedness, whereas saliency comparisons between timbres depend more on spectral envelope jaggedness.

10:20
4aMU4. Toward an effective use of timbre in data sonification. Hiroko Terasawa (University of Tsukuba/JST-PRESTO, terasawa@tara.tsukuba.ac.jp)

The spectro-temporal structure of a sound determines its timbre, and carries musically interesting information such as instrument type and performance expressions. Using timbre in data sonification can be viewed as an inverse transform of this process: Expressing data with timbre is equivalent to designing the spectro-temporal structure of a sound. Taking that into account, timbre is most effectively used in sonification by projecting time-series data onto the spectro-temporal structure of a sound. The temporal structure of the data