Preface to the Special Issue on Sonification

Paul Vickers1, David Worrall2 and Richard So3

1Northumbria University, United Kingdom, the co-Guest Editor of the Special Issue

2Columbia College, United States, the co-Guest Editor of the Special Issue

3The Hong Kong University of Science and Technology, Hong Kong, the Receiving Editor of the Special Issue

The journal *Displays* promotes dissemination of knowledge in “display technology and its effective presentation and perception of information”. For obvious reasons it has been publishing research dealing with visual display technology. However, the last two-and-a-half decades have witnessed the growth of auditory displays and their applications exposing a knowledge gap inhow data and information may be communicated sonically rather than visually. Sonification, is a branch of auditory displays concerned with the representation of data and information using non-speech audio. Sonification research lies at the intersections of a number of disciplines including computer science and engineering, perceptual psychology, physics, acoustics, music, and aesthetics.

Sonification is increasingly being used to transform data into sound in situations and environments in which the use of more traditional visual display technology would be unwieldy, impractical, or even impossible. Examples might include bio-mechanical data in elite sports training, vehicular navigation tasks, or maintaining situation awareness in complex computer network administration tasks. What these scenarios have in common is that they take place in real time and the data being transformed into sound is generated in real time.

This special issue presents five pieces of research dealing with different aspects of the sonification of real-time data.

In past studies, most researchers assumed the availability of noise-free processed data sets. This may not be true in most applications. David Poirier-Quinot, Gaetan Parseihian, and Brian Katz address some of the issues associated with real-time interactive sonification of noisy data streams. This poses interesting design challenges for sonification in which data are mapped to the parameters of an audio signal. Here noise becomes a confounding problem and Porier-Quinot *et al.* report several experiments that measure the effectiveness of a system for sonifying noisy data.

Paul Vickers, Chris Laing, and Tom Fairfax look at the problem of maintaining effective situational awareness of computer networks. By bringing together sonification techniques with measures of the underlying *self-organized criticality* of computer network traffic, Vickers *et al*. present a system that allows a network operator to monitor the behavior of a computer network in real time without needing to watch a visual display.

The use of surface electromyography (sEMG) is widespread in biomechanics in which sEMG sensors are used to measure the electrical activity of muscles. Sonification offers the potential to monitor muscle activity in real-time without having to look at a screen. This means that researchers or therapists can watch a participant or patient move while listening to what their muscles are doing. Camille Peres, Daniel Verona, Tariq Nisar, and Paul Ritchey report experiments which reveal factors that affect the design of effective sonifications for sEMG data. The success of an sEMG sonification is very sensitive to the task being carried out by the person being monitored and different use-cases require different approaches to sonification design.

The muscles of the face can be measured using EMG sensors. Focusing on a particular cultural phenomenon in Japan, Yuki Nakayama, Yuji Takano, Masaki Matsubara, Kenji Suzuki, and Hiroko Terasawa describe an interesting and novel approach that allows a person to sonifiy their facial muscles via EMG sensors in order to learn about the act of smiling.

Increasingly consumers are concerned with the expenses involved in driving a car. Learning to drive a car in a fuel-efficient manner is a challenge for many drivers, especially as there is no immediate feedback to signal that one is driving in a fuel-efficient manner or not. Jan Hammerschmidt and Thomas Hermann present the results of an experiment in which a novel system for monitoring fuel consumption in real time was tested for its ability to provide useful feedback on a person’s driving and to do so in a way that was viewed positively by participants.

We hope these articles provide a useful glimpse into the world of auditory display and will encourage readers to look deeper into this fascinating field of study.