Session 2pED

Education in Acoustics: Take 5's

Jack Dostal, Chair
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For a Take-Five session no abstract is required. We invite you to bring your favorite acoustics teaching ideas. Choose from the following: short demonstrations, teaching devices, or videos. The intent is to share teaching ideas with your colleagues. If possible, bring a brief, descriptive handout with enough copies for distribution. Spontaneous inspirations are also welcome. You sign up at the door for a five-minute slot before the session starts. If you have more than one demo, sign-up for two consecutive slots.

TUESDAY AFTERNOON, 3 DECEMBER 2013 CONTINENTAL 1, 1:00 P.M. TO 3:50 P.M.

Session 2pMU

Musical Acoustics and Signal Processing in Acoustics: Digital Musical Instruments

Edgar J. Berdahl, Chair
Music, Louisiana State Univ., 102 New Music Bldg., Baton Rouge, LA 70803

Invited Papers

1:00

2pMU1. Interaction design and the active experience of music. David Wessel (Music CNMAT, Univ. of California Berkeley, 1750 Arch St., Berkeley, CA 94709, davidwessel@me.com)

Music search engines, play list generators, streaming audio, and portable players have taken much of the focus of music technology. The emphasis is on delivery and experiencing music is by playback, playback while jogging or while working about the house, and sadly even while studying. In this talk in the hope of providing an antidote I will examine the role of bodily action in the experience of music and the importance of human computer interaction design in the development of computationally based musical instruments. Central are gestural interfaces and their mapping to musical material. Special emphasis will be given to designing for expression, for exploration and discovery, and to a musical practice that involves a coordinated balance of software development and daily bodily engagement with one's instrument.

1:20

2pMU2. LinnStrument and other new expressive musical controllers. Roger Linn (Roger Linn Design, 1147 Keith Ave., Berkeley, CA 94708, rl@rogerlinndesign.com)

Roger Linn will demonstrate his LinnStrument, a controller for musical performance that captures three dimensions of movement for each touch, polyphonically, in order to provide more expressive control of software music synthesis. In addition, he will show videos of other similar new instruments and compare the unique approaches taken by each designer.

1:40

2pMU3. Sound synthesis for a brain stethoscope. Chris Chafe, Juan-Pablo Caceres, and Michael Iorga (Stanford Univ., CCRMA/Music, Stanford, CA 94305, cc@ccrma.stanford.edu)

Exploratory ascultation of brain signals has been prototyped in a project involving neurologists, real-time EEG and techniques for computer-based sound synthesis. In a manner similar to using a stethoscope, the listener can manipulate the location being listened to. Sounds which are heard are sonifications of electrode signals. We present a method for exploring sounds from arrays of sensors as sounds which are useful for distinguishing brain states. The approach maps brain wave signals to modulations characteristic of human voice. Computer-synthesized voices "sing" the dynamics of wakefulness, sleep, seizures, and other states. The goal of the project is to create a recognizable inventory of such vocal "performances" and allow the user to probe source locations in the sensor array in real time.

2:00

2pMU4. Grafting acoustic instruments and signal processing: Creative control and augmented expressivity. Dan Overholt (Media Technol., Aalborg Univ. Copenhagen, A.C. Meyers Vaenge 15, Copenhagen SV. 2450, Denmark, dano@create.aau.dk)

In this study, work is presented on a hybrid acoustic/electric violin. The instrument has embedded processing that provides real-time simulation of acoustic body models using DSP techniques able to gradually transform a given body model into another, including extrapolations beyond the models to explore interesting new timbres. Models can include everything from various violin bodies to guitars, sitars with their sympathetic strings, and even physically impossible acoustic bodies. The development also presents several practical approaches to sensor augmentation and gestural playing techniques that can be applied to bowed-string and other acoustic instruments, in order to provide immediate creative control over the possibilities offered by DSP. The study has focused on augmenting the expressivity of the violin toward finding novel timbral possibilities, rather than a goal of simulating prior acoustic violins with high fidelity. The opportunity to control a virtually malleable body while playing, i.e., a model that changes reverberant resonances in response to player input, results in interesting audio effects. Other common audio effects can also be employed and simultaneously controlled via the musician's movements. For example, gestural tilting of the instrument is tracked via an embedded Inertial Measurement Unit (IMU), which can be assigned to alter parameters such as the wet/dry mix of an octave-doubler or other effect, further augmenting the expressivity of the player.

2:20

2pMU5. Saxophone fingering identification. Tamara Smyth (Music, Univ. of California San Diego, 9500 Gilman Dr., MC 0099, La Jolla, CA 92093-0099, trsmyth@ucsd.edu) and Marjan Rouhipour (Computing Sci., Simon Fraser Univ., Surrey, BC, Canada)

The focus of this work is to identify the tonehole configuration or "fingering'' applied by a player during performance, using only the signal recorded at the bell. Because of a player can use alternate fingerings/overblowing to produce a given frequency, detecting the sounding pitch only reduces the possible candidates—it does not produce a unique result. Several recordings of a professional saxophonist playing notes using all fingerings are considered, and several higher level features are explored for distinguishing between a fundamental and an overblown note. In the latter case, it is observed that during the attack portion of the note, the spectral centroid is usually lower, there is greater inharmonicity and increased pitch instability. Combining these heuristics with the detection of subharmonics has yielded excellent results in detecting overblown notes. With the possible fingerings being greatly reduced by this preprocessing, more computationally expensive statistical methods may be employed for a more accurate estimation of the actual fingering applied. To this end, the recorded sound is calibrated to that produced by a reed model coupled to a waveguide that is informed by an acoustic measurement of the player's saxophone configured with each usable fingering.

2:40

2pMU6. The Faust Synthesis Toolkit: A set of linear and nonlinear physical models for the Faust programming language. Romain Michon (Dept. of Music, Ctr. for Comput. Res. in Music and Acoust., 660 Lomita Court, Stanford, CA 94305-8180, rmichon@ccrma.stanford.edu)

The Faust Synthesis ToolKit is a set of virtual musical instruments written in the Faust programming language and based on waveguide algorithms and on modal synthesis. Most of them were inspired by instruments implemented in the Synthesis ToolKit (STK) and the program SynthBuilder. Our attention has partly been focused on the pedagogical aspect of the implemented objects. Indeed, we tried to make the Faust code of each object as optimized and as expressive as possible. Some of the instruments in the Faust-STK use nonlinear allpass filters to create interesting and new behaviors. Also, a few of them were modified in order to use gesture data to control the performance. A demonstration of this kind of use is done in the Pure Data program. Finally, the results of some performance tests of the generated C++ code are presented.

3:00

2pMU7. Drawn to sound: An audio visual musical instrument using custom electronics and magnetometer. John Granzow and Hongchan Choi (CCRMA, Stanford Univ., 660 Lomita Dr., Stanford, CA 94305, johknee5@gmail.com)

Drawings are amplified through a resonant surface and transmitted via microphone to custom software hosted on an embedded linux computer. An HMC-5883L magnetometer is used to modulate the signal according to the position of the pencil (equipped with magnetic sleeve). 3D vectors are derived from the magnetometer using a custom Arduino library. We project this vector into a 2D plane to get magnitude or distance between the sensor and the magnetized pencil as well as the heading angle. This implementation gives us 2D polar coordinates such that the position of the pencil can be used to vary the audio output. The transformation of the raw drawing sound is excited with proximity to the magnetometer due to the sensors exponentially increasing sensitivity to the magnetic field. Resulting drawings often contain both visually motivated marks as well as gestures that are made for sound such as dark scribbled regions where a desired timbre or pitch shift is repeated throughout a performance. This presentation will discuss hardware design, the implementation of our custom software and circuitry, how these components combine for a compelling performance platform as well as areas where we seek improvement.