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COURSE NOTES 81

An Introduction to Data Sonification

ORGANIZER
Brian Evans
Vanderbilt University

LECTURERS
Robin Bargar
National Center for Supercomputing Applications
Carla Scaletti
University of Illinois



An Introduction to Data Sonification

Presenters:

Robin Bargar
National Center for Supercomputing Applications

Brian Evans
Vanderbilt University

Carla Scaletti
CERL Sound Group-University of Illinois/Symbolic Sound Corporation

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Abstract

This course will introduce and illustrate the use of sound to extract meaning from complex data. It will begin by covering the basics of acoustics and sound perception, sound synthesis, MIDI (Musical Instrument Digital Interface) and fundamental music principles. From this basis several techniques of data sonification will be discussed. Specific tools will be shown and successful techniques will be illustrated. There will be a focus on how sonification can be integrated into scientific visualization, and how sound can be used as an effective support of visual presentation.

Course Schedule

Introduction to Sound and Digital Audio (Brian Evans, 1 1/4 hours)

Sound Synthesis Techniques (Carla Scaletti, 1 1/2 hours)

Intro to MIDI (Robin Bargar, 1/2 hour)

Simple event mapping w/MIDI (Brian Evans, 1/2 hour)

NCSA Audible Image—a MIDI application (Robin Bargar, 1/2 hour)

Sonification applications (Carla Scaletti, 1 1/2 hour)

Paradigms and problems of multimodal representation (Robin Bargar, 1 1/2 hours)

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*Preprints from *Auditory Display: The Proceedings of ICAD '92, the First International Conference on Auditory Display*, edited by Gregory Kramer, SFI Studies in the Sciences of Complexity, Proceedings Volume XVIII, Addison-Wesley Publishing Company, Reading, MA, U.S.A. 1993.

Coures Presenters

Robin Bargar

Robin Bargar is a composer working in acoustic and visual media, including electro-acoustic and computer music, instrumental ensemble, video, and computer graphics. He has performed real-time multi-image works with the Cleveland Orchestra, National Symphony, Cincinnati Symphony and others. Recent performances and presentations include the 1992 International Computer Music Conference; the Second International Symposium on Electronic Arts; the SIGGRAPH 1991 Electronic Theater; Computer Animation '91, Geneva, Switzerland; and the 1991 Asian Contemporary Music Festival, Seoul, Korea. Mr. Bargar was a finalist in the 1991 International Electro-Acoustic Music Competition in Bourges, France. In Tokyo, Japan his computer graphic collaborations received the NICOGRAPH 1990 and 1991 Arts and Entertainment Award and the 1991 Special Multimedia Prize. This work is currently syndicated on MTV's Liquid Television.

At the University of Illinois at Urbana-Champaign Mr. Bargar is currently Visiting Lecturer in composition for the School of Music, Research Programmer for the Software Development Group and Producer/Director for Scientific Communications and Media Systems in the National Center for Supercomputing Applications.

Brian Evans

Brian Evans is a research artist at Vanderbilt University, exploring the use of computers in music, the visual arts and in the visualization and sonification of scientific data. He is also on faculty at the Blair School of Music at Vanderbilt where he coordinates their efforts in integrating technology into the music curriculum.

His music/animation pieces and computer graphics have been seen internationally in art exhibits, film festivals and music festivals and concerts, and have won several awards. He has published various articles discussing the aesthetics and techniques of his work. Recent contributions include "Number as Form and Content (A Composer's Path of Inquiry)," in the special "Visual Mathematics" issue of the journal LEONARDO.

Evans received a D.M.A. in Music Composition from the University of Illinois (1988) with a minor in Computer Science. He received his M.F.A. from the California Institute of the Arts (1984) and a Bachelor of Music degree from the North Carolina School of the Arts (1976).

Carla Scaletti

Carla Scaletti is president of the Symbolic Sound Corporation and an adjunct assistant professor at the University of Illinois @ Urbana-Champaign. "Using Sound to Extract Meaning from Complex Data," a video summarizing the sonification research that she did with Alan Craig at NCSA won the Nicograph Multimedia prize in 1991, and she was one of the researchers invited to the first International Conference on Auditory Display in 1992 at the Santa Fe Institute.

She has over 15 years experience in electro-acoustic music and computer-generated sound and is the designer of Kyma, a visual language for specifying digital audio signals. In addition to her research activities with the CERL Sound Group, she is also the organizer and primary instructor for the Intensive Workshop in Sound Computation that takes place each summer at the University of Illinois.

Introduction to Audio
Brian Evans

Acoustics of sound

- The ear, motion and vibration
- Periodicity and frequency
- Amplitude
- Harmonics and partials
- Spectra, simple and complex

Psychoacoustics of sound

- Pitch
- Dynamics
- Timbre
- Interaction of dimensions
- The non-linearity of perception
- Tuning systems

The electrical analog of sound

- Transducers (microphones and speakers)
- Amplifiers
- Waveform generators
- Envelope generators
- Filters

The digital representation of sound

- Sound to numbers
 - analog-to-digital, continuous to discrete
- Sampling
- Quantization
- Numbers to sound
 - digital-to-analog, discrete to continuous