Sound Thinking: Conceptualizing the Art and Science of Digital Audio for an Interdisciplinary General Education Course

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Introduction

What is sound? How do we capture, manipulate, and harness it in the digital world? Thus began our journey into the creation of a general education course focused on the intersection of art and technology; exploring how sound is integrated into computer applications. Our goal seemed simple enough. We were going to have students explore the art and science of digital audio, from the basic end-user applications that promote creative expression and exploration, to the underlying code that allows these programs to function. Once we began to examine what this means from the perspective of a total novice, and began to think about the software applications we would work with, as well as the projects we would assign, we began to reevaluate and question our own assumptions about the purpose of general education courses and the challenges posed by teaching students outside of our respective disciplines.

Rationale

Since there are few technology and multimedia offerings available to students on our campus, our course would fill a void. It would allow students to see the practical applications of computers while introducing them to the basic fundamentals of music, such as notation, simple musical forms, and timbre. It would also expand their understanding of audio issues, such as dynamic range, compression, and end-user preferences involved in multimedia software development. We believed that the multiple perspectives inherent in an interdisciplinary course would be of value to students. We planned to achieve this by hands-on explorations of the basic principles that underlie today's technology and exposure to some of the multimedia development software currently on the market.

Sound Thinking grew out of a pilot project developed within the scope of NSF/CPATH Award No. CNS-0722161. That award was designed to integrate computer science courses with the arts in a program called *Performamatics*. Our stated goal was to create an interdisciplinary course for all students interested in music technology and how to manipulate it. We therefore based our strategies and projects on the interdisciplinary module we created for computer science and music majors. At the outset of our course development, we made several assumptions regarding the software platforms we would be working with. Since there was plenty of money in our grant for software purchases, we didn't consider the cost implications for student access to this software outside of class. In addition, we made assumptions about the students we would be teaching. We didn't necessarily take into consideration the fact that this course would be open to any student regardless of major.

As we began the paperwork and approval process, the reality of who the students were that would be signing up for this course began to set in. While we would encourage students within our respective disciplines to register for this course, there would inevitably be students from all disciplines, which would need to be a major factor in how we designed the curriculum. Within one's own discipline, certain habits of mind and logic streams are often taken for granted. But as our students learned when working collaboratively, what one person takes for granted could be another person's conundrum. Once these realities set in and we began exploring software platforms and their related costs, we found ourselves questioning everything from our goals and objectives to the underlying purpose of this course. We began anew to brainstorm about platforms and explore a variety of software applications. In the process we discovered how much ground and conceptual understanding can be covered through simple ideas and technology.

About Sound Thinking

The course we designed introduces students to simple digital audio technologies such as audio editing and looping software. We explore the various sound file formats currently in use, how to create them, their various properties, sound compression, and different recording and capturing devices. Students explore notation systems through projects that require students to think about sound production and the learning of new symbol systems from the perspective of a total novice (i.e., their own perspective). Graphic notation systems are explored as well as the various computer applications that introduce students to basic music notation.

In the same vein, by looking at the various computer applications, from the intuitive Morton Subotnick's *Making Music* to the more complex programs such as *Sibelius* and *Finale,* as well as newly developing online freeware technologies such as *NoteFlight,* students gain an understanding of the basic decisions and coding underlying an application's structure. We examine digital audio manipulation using basic freeware programs such as *Audacity* as well as simple looping programs, comparing them to more complex programs such as *ProTools* and *SoundForge*. We explore simple ways to create dynamic interactive web experiences using basic tools and manipulating sound through JavaScript.

Our presentation will demonstrate some of the tools we are using and student projects that can easily be replicated. We will also present the rationale for much of our decision-making.

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Gena R. Greher is Coordinator of Music Education at the University of Massachusetts Lowell. She teaches undergraduate and graduate level music classes in music methods; world music for the classroom; popular culture; and technology applications in music education. Her research interests focus on examining the influence of integrating multimedia technology in urban music classrooms, as well as in the music teacher education curriculum. Recent projects include: a test preparation website for music teacher licensure; a music technology mentor/partnership with UML music education students and a local K 8 school as well as the local High School; and *Soundscapes*, a technology-infused music intervention program for teenagers with autism spectrum disorders. Gena received her Ed.D. from Teachers College Columbia University, where she was the Project Associate for the Creative Arts Laboratory (CAL), a professional development program in arts integration.

Jesse M. Heines is a Professor of Computer Science at the University of Massachusetts Lowell. He specializes in the implementation and evaluation of interactive, user-centered programs with rich graphical user interfaces (GUIs), particularly those employing Dynamic HTML, JavaScript, Java, and XML and XSL and their related technologies. Jesse has developed numerous computer-based instruction (CBI) programs and course websites as well as traditional human-computer interfaces. Prior to joining the UMass Lowell faculty, Jesse spent ten years with Digital Equipment Corporation, where he founded the Computer-Based Course Development Group and developed a large variety of CBI courseware. He holds a B.S. in Earth Sciences from the Massachusetts Institute of Technology, an M.S. in Science Education from the University of Maine, and an Ed.D. in Educational Media and Technology from Boston University. He has done post-doctoral work at The Open University in Great Britain, Brown University in Rhode Island, and the Massachusetts Institute of Technology.