ATMI/CMS Fifty-Second National Conference
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Portland, Oregon

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

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Sound Thinking: The Art & Science of Digital Audio

- Background
  - Interdisciplinary course connecting Computer Science to Art, Music, & Theatre highlighting computational thinking
  - Expansion of synchronized course model in CS & Music as a result of NSF CPATH grant
  - Originally conceived to attract and retain CS majors by connecting theory to practice
  - Exposes non-CS majors to computing at a higher level than typically seen in General Education (GenEd) computer literacy courses

Sound Thinking: The Art & Science of Digital Audio

- Issues with GenEd Committee
  - All assignments needed to be completed by all students
  - Professors needed to re-orient their thinking toward total novices with regard to each of their fields
    - The level of Music and CS content had to be geared to any student from any major

Sound Thinking: The Art & Science of Digital Audio

- Course Content Issues
  - What is appropriate level of music & CS content?
  - What software platforms were available that all students could have access to that could teach basic digital audio and computational concepts?
  - What projects would work for everyone?
  - How should the material be sequenced?
    - How much digital audio vs. how much CS?

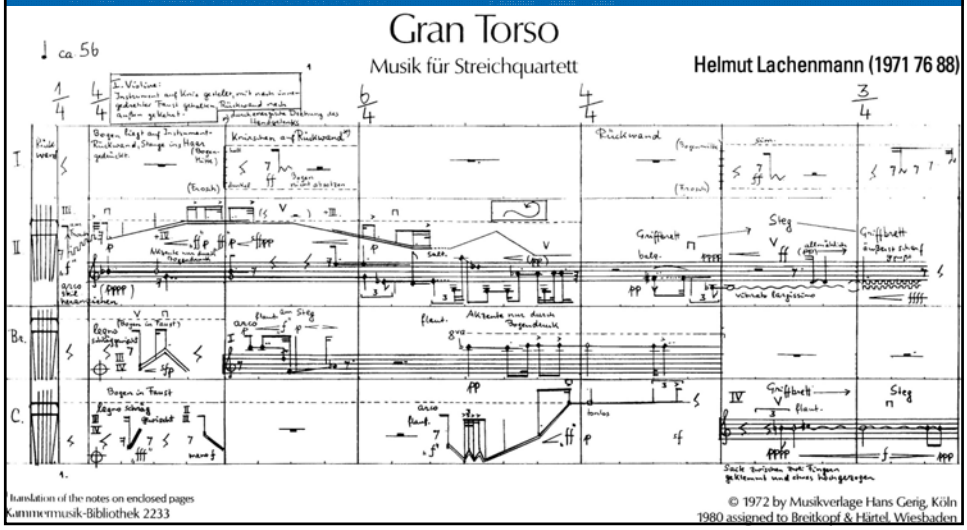
Sound Thinking: The Art & Science of Digital Audio

- Class Webs
- Jesse created a course website to house the syllabus, assignments, grades, and class notes
  - http://teaching.cs.uml.edu/~heines/91.212
- Gena put up the Ning site so students could post their work and reflect on it, post videos, music, pictures, and reflections
  - http://soundthinking09.ning.com/

Sound Thinking: Course Projects

- Found Instruments
  - Manipulating with Audacity
- SoundScapes
  - Audio Art: a soundtrack of an image
  - Audio Ethnography: a soundtrack of your life
- Computer Manipulation
  - Static webpages that incorporate sound
  - Dynamic webpages that manipulate sounds
- Final Project
  - Integrating sound & video or complex webpages

Sound Thinking: … and Expanded Thinking

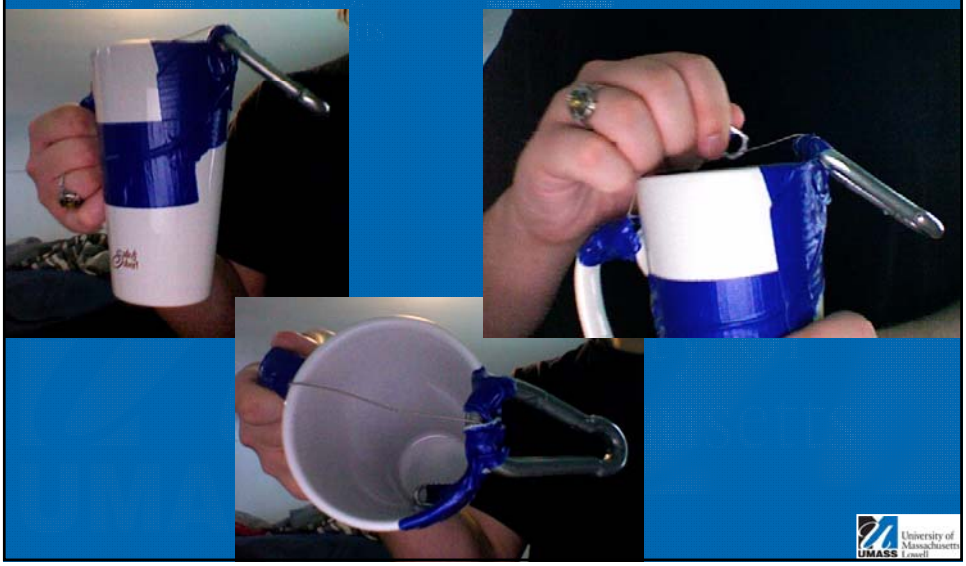


Sound Thinking: … and Expanded Thinking

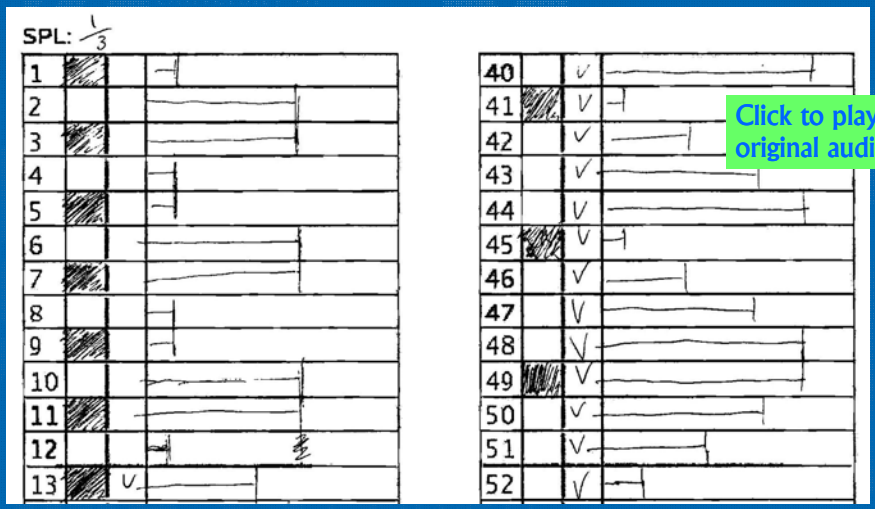
- Bach to Lachenmann to Sciarrino
- Demonstration by violinist Ari Streisfeld

QuickTime™ and a
H.264 decompressor
are needed to see this picture.

Eric (a CS Student) and His "Lever Drumitar" ❶



Eric (a CS Student) and His "Lever Drumitar" ❷



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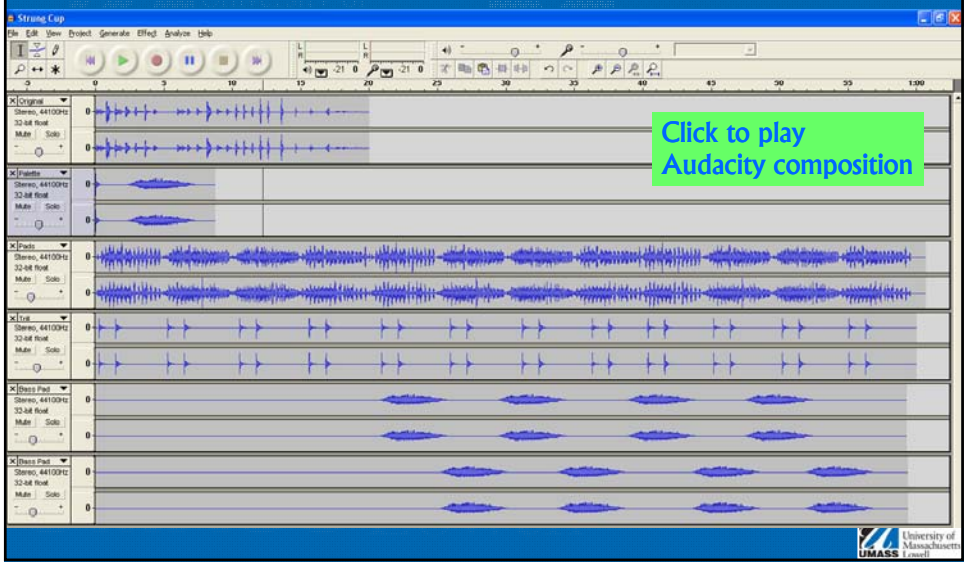
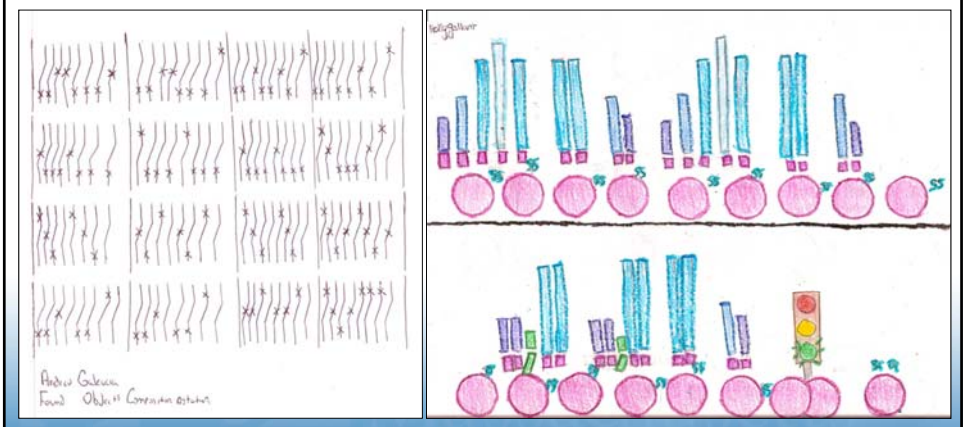


Eric (a CS Student) and His "Lever Drumitar" ❹

"A spectrogram of my remix. I thought it was rather interesting to look at. See if you can figure out what bits are where.

Click to play
Audacity remix

Sound Thinking: The Art & Science of Digital Audio



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Sound Thinking: The Art & Science of Digital Audio

- SoundScapes - Audio Art

UMASS Lowell

Sound Thinking: The Art & Science of Digital Audio

- AudioEthnography
  - You will be creating an audio narrative of who you are. Your materials will be a collection of music that can describe you, reflect your interests, be representative of the type of music you enjoy, or anything else that will give us an idea of who you are and what makes you tick. You will need to work with at least ½ dozen musical sources that you will edit, process and layer into a cohesive musical narrative of exactly 300 seconds…not a second more or a second less

Sound Thinking: The Art & Science of Digital Audio

- CS Perspective Problem
  - It's nice for one's abilities to be seen as "magical" out of respect, but the purpose of the course was to demystify CS and computational thinking

Renowned late CMU CS Prof. Randy Pausch

Sound Thinking: Computer Projects

- **Goal:** Get students to do things they didn't think they could do
- Projects in the Second Half of the Course
  1. Creating a First Webpage on a Linux Server
  2. Creating a Webpage with Embedded Sounds
  3. Creating a Web Game or Lesson that Incorporates Sound

Sound Thinking: Implementation Tools and Issues

- Adobe Dreamweaver
  - Provides an intuitive WYSIWYG environment
  - Allows viewing resultant code simultaneously
  - Includes a reasonable editor for JavaScript
  - Shows website file structure
- Issues faced and problems encountered
  - Too expensive for students to buy themselves
  - PC vs. Mac and version incompatibilities
  - Non-persistence on "frozen" drives

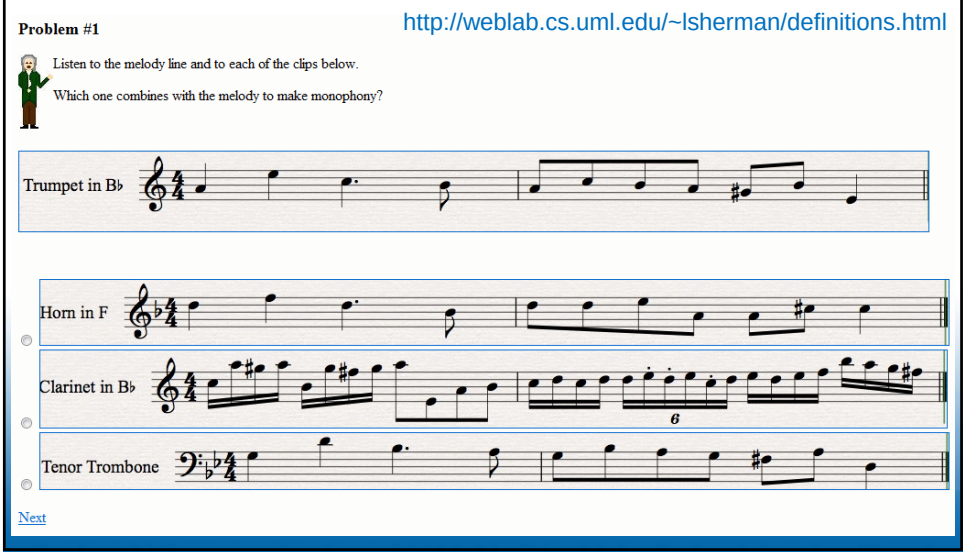
Sound Thinking: Conceptual Approach

- A CS colleague felt that raw code would freak out non-CS majors, but we felt that part of our goal was to teach students not to be afraid of code
- We therefore created a JavaScript API to play sounds and taught students to use it
  - function PlaySound(URL, ElementID)
  - function StopSound(ElementID)
  - functions to keep score

UMASS Lowell

Sound Thinking: Sample Project #1

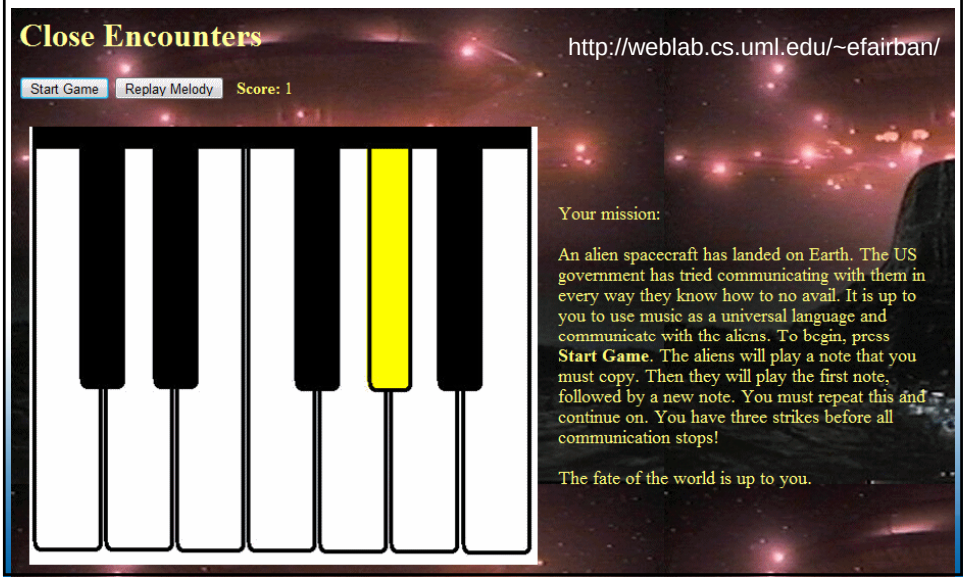
http://weblab.cs.uml.edu/~lsherman/definitions.html



Sound Thinking: Sample Project #2

http://weblab.cs.uml.edu/~agaleuci/simon-poison.html

Sound Thinking: Sample Project #3



Sound Thinking: Student Journal Excerpt

April 9th, 2009, 11:37 AM, Holly and Brittany are sitting at the cubicle trying to figure out how to predict the future through this project.

11:39 AM, nothing is **working**!!

11:49 AM, found a way to add a background song and found a theme song, perfect.

11:49 AM, uh oh... now our stop playing background link doesn't work... **Dr. Greher is going to save the day**!

12:00 PM, **Maybe not**. But she put in a good fight.

http://weblab.cs.uml.edu/~bcosta/page2.html

Sound Thinking: Student Journal Excerpt

12:05 PM, Dr. Heines worked his magic, even though he convinced us it wasn't magic. We managed to delete the head and body of our html. Who knew websites had body parts that could be deleted?

12:09 PM, Charles and Lindsay are **so complex and they're going above and beyond**.

12:11 PM, Realizing we don't have enough time, is this really due on Tuesday??? It's Easter weekend!?!?! We won't have time to be here and work on this together!

12:15 PM, OK, a little bit calmer now... we will present on Tuesday, hopefully we will have enough done by then ::bites nails::

Sound Thinking: Student Journal Excerpt

8:32 PM, found a couple sounds... don't know how much help they'll be. I hope they're in the right format.

8:34 PM, **nope... they weren't**... trying to figure out a way to download the sounds off the Internet...

8:39 PM, tried converting to MP3 format... fingers crossed!

8:43 PM, **nope**... I'm not sure how to get the sounds online anymore... and I felt so sure!! It brings me to a site with the message: "The requested URL /~bcosta/audio/sounds/scream.mp3 was not found on this server."

8:45 PM, well, I did what I DO know how to do... I changed the background color and added the picture... I'm so technologically challenged.

Sound Thinking: Student Journal Excerpt

8:49 PM, I left the mistake up, just so we can remember what i did wrong. You win this time technology! But we will meet again!! Holly signs off, over and out.

April 14th, 2009, 11:09 AM, **We begin our journey again**, more lab time...

11:13 AM, why are our sounds going to a separate player?!?!?!

11:15 AM, Dr. Heines saves the day once again: we forgot the JavaScript code... he called it "**the wrapper**"

11:34 AM, **off to find more sounds**...

Sound Thinking: Student Journal Excerpt

11:58 AM, we found a handful of movie clips and are now adding them to the site... what a blast!!!! **haha ughhhh**.

April 15th, 2009, 8:14 PM We're back in the lab to put the icing on **the cake**.

8:20 PM, We added another picture, now we're trying to find a sound that fits with it.

8:25 PM, This simple little web page takes a lot more than it shows... who knew all these codes were behind it.

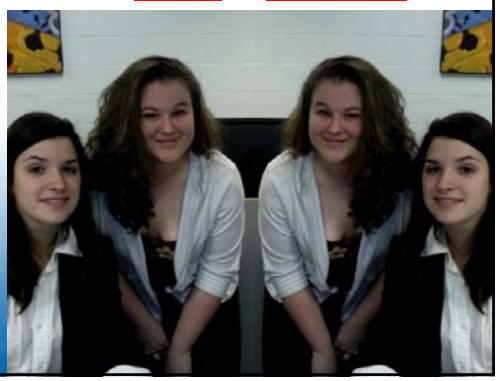
8:32 PM, We have discovered that after a while this gets extremely repetitive, and one small mistake in one code could leave us searching for a long time.

Sound Thinking: Student Journal Excerpt

8:42 PM, A few more sounds, some fun colors, and the light at the end of the tunnel is coming into view!

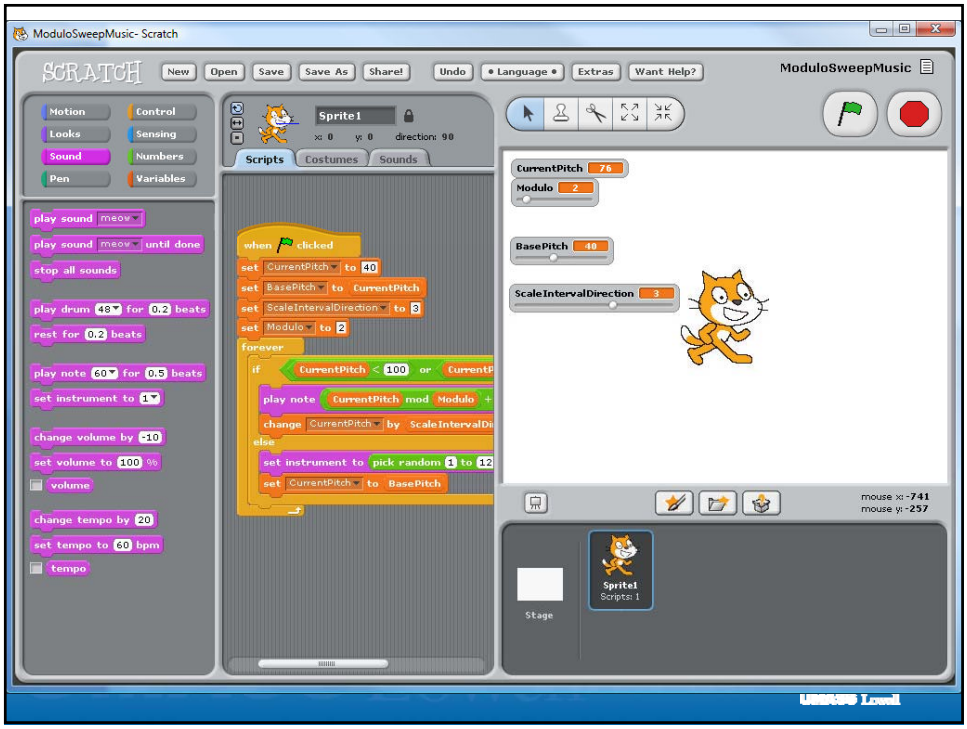
8:55 PM, Wow, we are actually getting **the hang of this**!

9:04 PM, We're finished!! Time to find **a way** to **celebrate**!



Sound Thinking: The Future

- To the amazements of both instructors, non-CS majors expressed a desire to know **more** about the underlying coding



Sound Thinking: Future Plans: Scratch

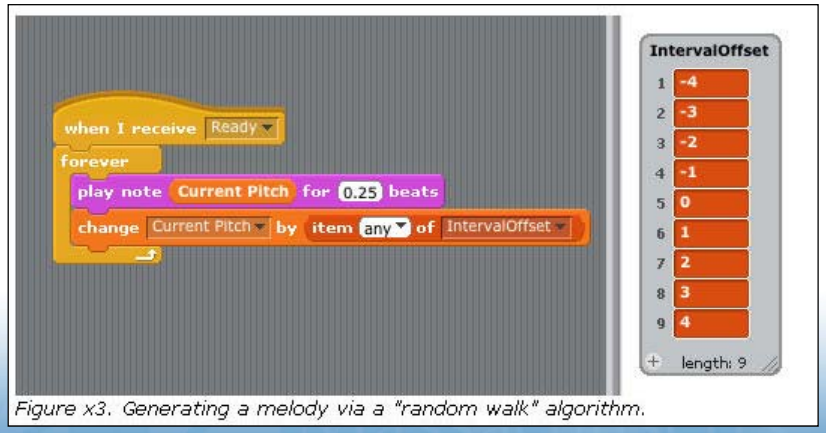
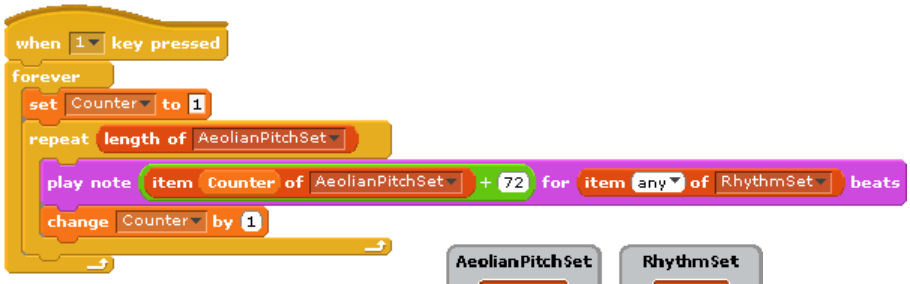
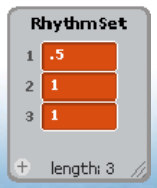


Figure x3. Generating a melody via a "random walk" algorithm.

Sound Thinking: Future Plans : Scratch





Prof. S. Alex Ruthmann
Tomorrow, Friday, 10/23
8:00 AM - Collaborative Learning Session
Mt. Bachelor Room

Performamatics: Acknowledgments

- Additional Co-PIs
  - Jim Jeffers, Art
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  - Fred Martin, Computer Science
  - Karen Roehr, Art
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thank you

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PERFORMAMATICS