

PERFORMATICs


Teaching Artsy Types to Think Like Geeks and Vice Versa

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GVU Brown Bag Lecture
Georgia Tech, Atlanta, GA

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Ramblin' Wreck - Piano Score

Frank Roman
*Piano arrangement
by Jerry Ulrich*

Marcato ♩ = 136

Piano

Piano introduction

I'm a ramblin' wreck from
Georg - ia Tech and a hell of an en - gin - eer. - - - a
hel - lu - va hel - u - va hel - lu - va hel - lu - va hel - luv an en - gin -


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Scratch Time!

Does this sound right?

The image shows two columns of Scratch code blocks. The left column is a single block of code, and the right column is a block of code enclosed in a 'when I receive' trigger. Both columns start with 'hide', 'set tempo to 400 bpm', and 'set instrument to 12'. The left column then plays a sequence of notes: 67 (2 beats), 65 (1), 64 (2), 64 (1), 64 (2), 65 (1), 67 (2), 67 (1), 67 (1), 65 (1), 64 (1), 65 (1), 65 (1), 65 (1), 64 (2), 62 (1), and 64 (5). The right column, triggered by 'Phrase 1', uses instrument 31 and plays: 67 (2), 65 (1), 63 (2), 63 (1), 63 (2), 63 (1), 65 (1), 67 (2), 67 (1), 67 (1), 65 (1), 63 (1), 65 (1), 65 (1), 65 (1), 63 (2), 62 (1), and 63 (5). The text 'Ah, that's better.' is written in yellow on the right. A UMass Lowell logo is in the bottom right.



The image shows two columns of Scratch code blocks. The left column is a single block of code, and the right column is a block of code enclosed in a 'when I receive' trigger. Both columns start with 'hide' and 'set instrument to 58'. The left column plays notes: 62 (1), 67 (1), 67 (1), 67 (1), 67 (2), 68 (1), 70 (1), 70 (1), 70 (1), 70 (2), 70 (1), 70 (1), 70 (2), 70 (1), 70 (1), 65 (1), 65 (1), a 1-beat rest, 67 (1), and 65 (6). The right column, triggered by 'Phrase 2', plays: 62 (1), a 'repeat 3' loop of 67 (1), 67 (2), and 68 (1), 'set counter to 0', a 'repeat 7' loop with an 'if not counter = 3' condition (playing 70 (1) or 70 (2)), 'change counter by 1', 65 (1), 65 (1), a 1-beat rest, 67 (1), and 65 (6). The text 'Adding loops' is written in yellow on the right. A UMass Lowell logo is in the bottom right.



when clicked
hide
broadcast Phrase 1 and wait
broadcast Phrase 2 and wait

Conductor


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when I receive Phrase 3
hide
set instrument to 41
set Key Note to 63
play note Key Note + 7 for 1 beats
play note Key Note + 9 for 2 beats
play note Key Note + 9 for 1 beats
play note Key Note + 9 for 2 beats
play note Key Note + 9 for 1 beats
play note Key Note + 9 for 1 beats
play note Key Note + 12 for 4 beats
play note Key Note + 9 for 1 beats
play note Key Note + 7 for 2 beats
play note Key Note + 9 for 1 beats
play note Key Note + 7 for 2 beats
play note Key Note + 4 for 1 beats
play note Key Note + 7 for 1 beats
rest for 2 beats

Adding a variable

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when I receive Phrase 4 ▾
hide

Do we need Phrase 4?


11




when clicked
hide
broadcast Phrase 1 ▾ and wait
broadcast Phrase 2 ▾ and wait
broadcast Phrase 3 ▾ and wait
broadcast Phrase 1 ▾ and wait

No, we don't!

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The image shows a sequence of Scratch code blocks on a blue background. The blocks are: a 'broadcast Phrase 1 and wait' block, a 'broadcast Phrase 1' block, a 'rest for 2 beats' block, a 'broadcast Phrase 2 and wait' block, a 'broadcast Phrase 3 and wait' block, and a final 'broadcast Phrase 1 and wait' block. The text 'UMASS Lowell' is faintly visible in the background.

Playing two parts

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Computational Thinking Jeannette Wing, 2006

- CT is a fundamental skill for everyone ...
- CT involves solving problems, designing systems ... by drawing on the concepts fundamental to computer science
- CT includes a range of mental tools ...
 - using abstraction and decomposition when attacking a large complex task
 - judging a program not just for correctness and efficiency but for aesthetics, and a system's design for simplicity and elegance


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PERFORMATICS


- **Connecting Computer Science to Music and Art through interdisciplinary courses**
 - synchronized vs. hybrid courses
- **Originally conceived to attract and retain CS majors by connecting theory to practice**
 - evolved into exposing non-CS majors to higher levels of computing than typically seen in “GenEd” courses
- **Supported by NSF CISE CPATH (2007) and NSF DUES TUES (2011)**



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Sound Thinking: Course Goals

- **Teach CT by dealing approximately equally with both computing and music**
 - GenEd Committee was adamant that Science majors must learn about music while Arts majors must learn about computing
- **Not just sound ... music**
 - aesthetics as well as mechanics
 - encouraging creativity
 - providing context: allowing students to work with — and create — their own music



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Sound Thinking: Where Work Like This Fits





17 **Audio 1** **Audio 2** **Stop Sound** 

Sound Thinking: What Do Students Do?

73.212 / 91.212 Sound Thinking
Course Home Page
Spring 2011, Section 201

Assignments

No.	Due Date	Assignment Title
1	Thu Feb 3	Creating a Composition for a Found Objects Instrument 
2	Thu Feb 17	Creating a Composition from Digitized Found Sounds
3	Thu Feb 24	Creating a Song Flowchart
4	Tue Mar 8	Sequencing Sounds with Scratch
5	Tue Mar 29	Creating a Composition Based on Major Seconds and Perfect Fifths
6	Tue Apr 12	Transposing with Scratch
7	Thu Apr 21	Using IchiBoards and Sensors
8	Tue May 3	Final Sound Thinking Project and Performance

18 <http://soundthinking.uml.edu> 

Notation for Mike's "Eine Kleine Jacket Musik"

Eine Kleine Jacket Musik Michael McKendry 2-12-08


The notation is organized into three systems, each with two rows. The top row of each system contains rhythmic symbols (up/down arrows), and the bottom row contains hand gestures. The first system shows a sequence of four measures. The second system shows four measures with more complex rhythmic patterns. The third system shows four measures with hand gestures that include pointing to the left.

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Performances of Mike's "Eine Kleine Jacket Musik"

A photograph showing a person's hands holding a piece of paper with the handwritten notation from the previous slide. The person's fingers are pointing to specific parts of the notation, demonstrating its use in a performance context.

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Eric's Found Instrument: Lever Drumitar



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Eric's Notation for His Lever Drumitar

SPL: $\frac{1}{3}$

1	✓	
2		
3	✓	
4		
5	✓	
6		
7	✓	
8		
9	✓	
10		
11	✓	
12		
13	✓	
40	✓	
41	✓	
42	✓	
43	✓	
44	✓	
45	✓	
46	✓	
47	✓	
48	✓	
49	✓	
50	✓	
51	✓	
52	✓	

[Click to play original audio](#)

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[Stop Sound](#)



Contemporary Music Example

Gran Torso

Musik für Streichquartett Helmut Lachenmann (1971 76 88)

ca. 56

Translation of the notes on enclosed pages
Kammermusik-Bibliothek 2233

© 1972 by Musikverlage Hans Gerig, Köln
1980 assigned to Breitkopf & Härtel, Wiesbaden



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<http://www.jackquartet.com>



Sound Thinking: What Do Students Do?

73.212 / 91.212 Sound Thinking
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<http://soundthinking.uml.edu>



Eric's Audacity Mashup #1 Lever Drumitar

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Eric's Audacity Mashup #2 Lever Drumitar

“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](#)



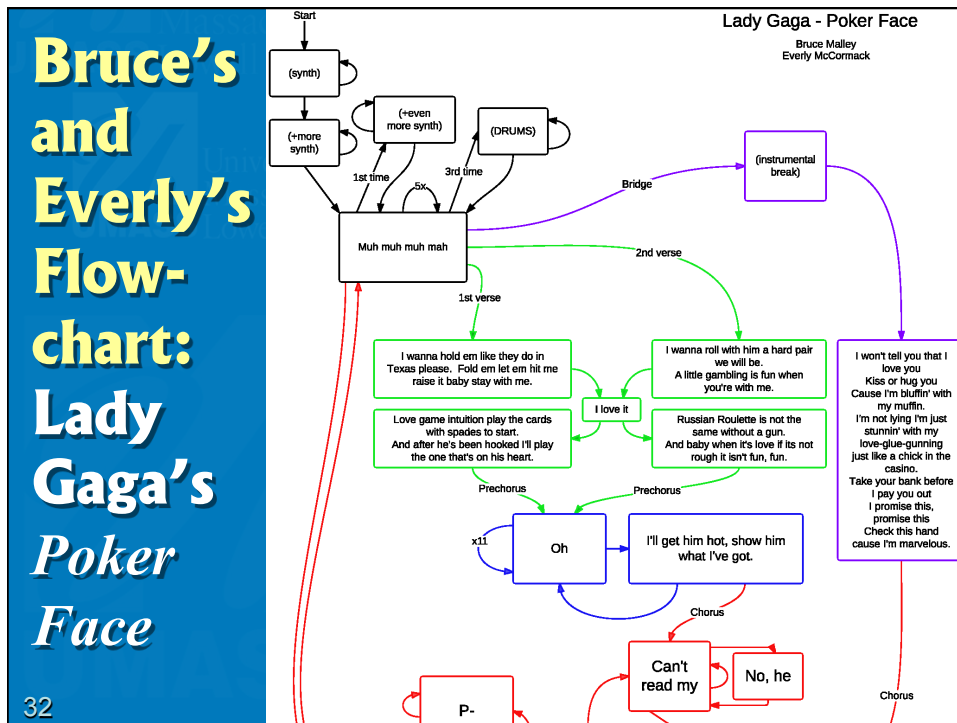
27 [Stop Sound](#) 

Nicole's Audacity Mashup: Satan Lives Inside Your Radio



[Click picture to play audio](#)


[Stop Sound](#)



Sound Thinking: From Editing to Coding

73.212 / 91.212 Sound Thinking
Course Home Page
Spring 2011, Section 201

Assignments

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<http://soundthinking.uml.edu>



Choosing Appropriate Language

SuperCollider

```
(
  SynthDef( "kashmir", {
    arg sound, freq ;
    var sin, env_gen, env, freq_env ;
    env = Env.triangle( 0.2, 0.2 ) ;
    env_gen = EnvGen.kr( env, doneAction: 2 ) ;
    sound = SinOsc.ar( freq, 0, env_gen ) + Saw.ar( freq, env_gen ) ;
    Out.ar( [0,1], sound )
  }).load(s);
)
(
  var x = 45, a = 6 ;
  p = Pseq([ 45, 46, 47, 48 ], inf).asStream ;
  q = Pseq([ 0.2, 0.2, 0.8 ], inf).asStream ;
  t = Task( {
    loop( {
      if( a < 6, { a = a + 1 }, { a = 1 ; x = p.value } ) ;
      y = Synth( "kashmir", [ freq: x.midicps ] ) ;
      q.value.wait ;
    } ) ;
  } ) ;
  t.start ;
)
t.stop ;
```



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GA Tech Laptop Orchestra



```
jason: jc1 : cat(svar5, yyp4, js3, yyp1)
yoyo: loop amplify(yyp3, 3) @m
snag: loop svar5 @m
sid<3: loop merge(eye1,partay[u,u,u,u,u,u,u,u])@m
great scott!/: loop yyp4 @m
jason: 80 more mm. let's make them count!
```

Ken's Mashup



```
when clicked
repeat 4
  broadcast Beatbox
  play sound HumanBeatbox2
  wait 2.7 secs
repeat 4
  broadcast whoop
  play sound HumanBeatbox2
  wait 2.7 secs
repeat 4
  broadcast space ripple
  play sound HumanBeatbox2
  wait 2.7 secs
repeat 4
  broadcast baloon
  change volume by 20
  play sound HumanBeatbox2
  change volume by -20
  wait 2.7 secs
  play sound HumanBeatbox2 until done
  play sound Ya

when I receive Beatbox
  play sound Ya
  wait 2.7 secs

when I receive whoop
  play sound Whoop
  play sound Ya
  wait 2.7 secs

when I receive space ripple
  play sound Whoop
  play sound Ya
  play sound SpaceRipple
  wait 2.7 secs

when I receive baloon
  play sound Whoop
  play sound Ya
  play sound SpaceRipple
  play sound BalloonScratch
  wait 2.7 secs
```

Click picture to play audio

Stop Sound

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In-Class Scratch Development

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Click picture to play audio

Stop Sound

Sound Thinking: From Editing to Coding

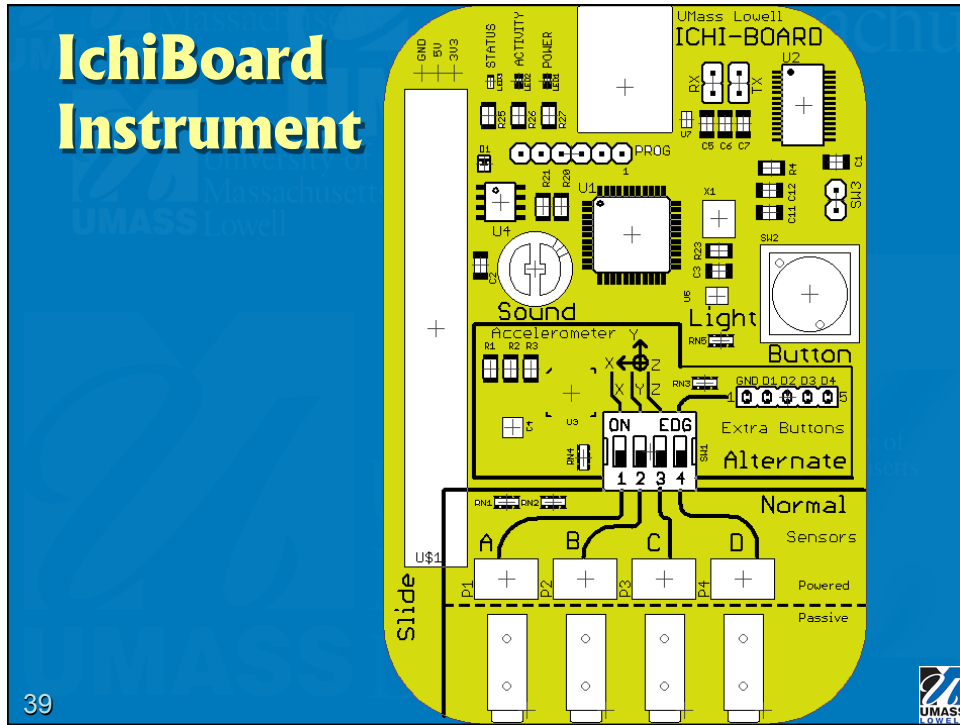
73.212 / 91.212 Sound Thinking
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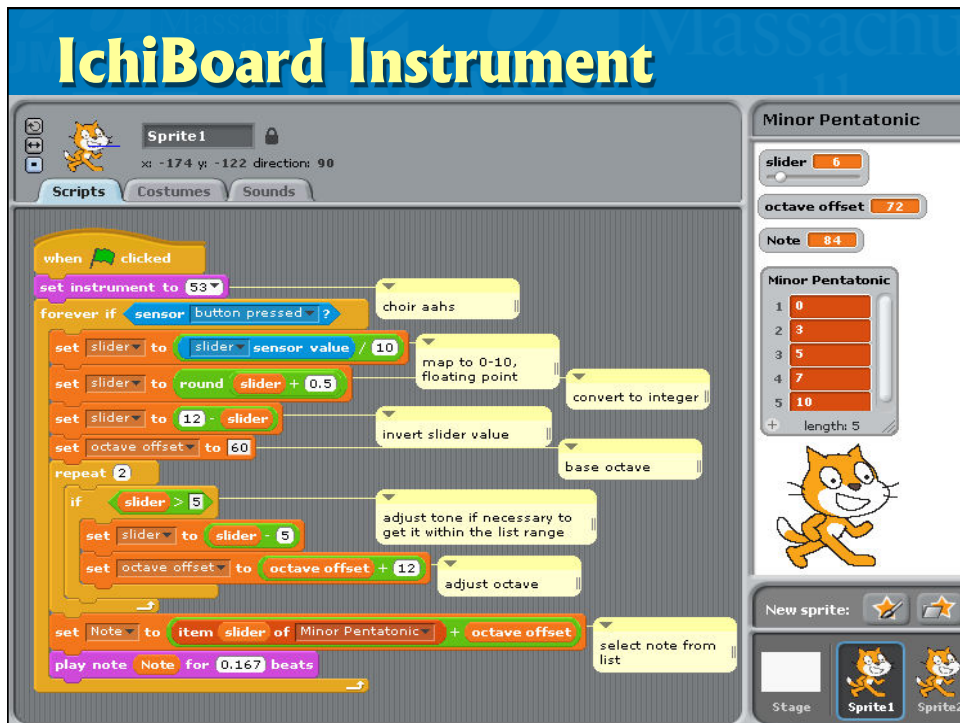
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Live Coding with Scratch

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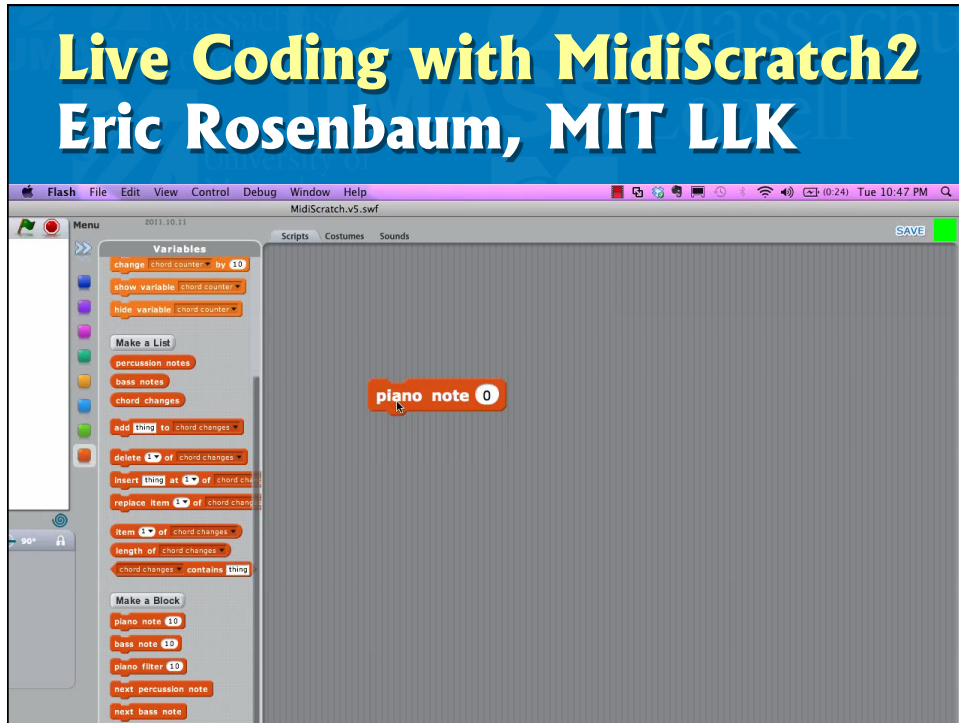
IchiBoard Tympani Duet

Jeremy
and
Nicole

SOUND THINKING
2010

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University of Massachusetts Lowell
Depts. of Music and Computer Science

PERFORMAMATICS

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Computational Thinking through Computing and Music
an interdisciplinary NSF TUES project

[Home](#) [Workshop](#) [About Our Project](#) [About Us](#) [Resources](#) [Publications](#)

Our first NSF-sponsored **interdisciplinary workshop** will take place on:
Thursday and Friday, June 21-22, 2012, at UMass Lowell
To apply for attendance, please fill out the [workshop application](#) form.

Our goal is to develop and disseminate ways to enhance students' grasp of computational thinking by engaging them in fundamental concepts that unite computing and music. Our approach leverages students' near universal interest in music as a context and springboard for engaging in rich computational thinking experiences. Prior work in an NSF CPATH project showed this approach to be effective at creating value in both discipline-specific courses for Computer Science and Music majors, as well as General Education courses for all majors. This project will develop additional activities to deepen students' experiences in both computing and music and techniques for evaluating learning through those activities. The project will also disseminate our work through workshops for pairs of interdisciplinary faculty at 4- and 2-year colleges.

www.performamatics.org

NSF-Sponsored Workshop on Interdisciplinary Teaching
June 21-22, 2012, at UMass Lowell

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Performamatics: Acknowledgments



- **Additional Senior Personnel**

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Mitchel Resnick – LEGO Papert Prof. of Learning Research

Eric Rosenbaum – Doctoral Student

- **NSF Awards CNS-0722161
and DUE-1118435**



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Computing

- **Jason Freeman**

– School of Music

- **Brian Magerko**

– School of Literature,
Communication and Culture

- **Many Students and Staff**

– GVU and CMT (Center for Music Technology)



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PERFORMAMATICS

thank you

Jesse M. Heines
S. Alex Ruthmann
Gena R. Greher



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GVU Brown Bag Lecture
Georgia Tech, Atlanta, GA

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