

## **MUSIC 1240F — Topics in New Media Theory and Production: Circuit Bending and Hardware Hacking as Musical and Artistic Expression**

MEME @ Brown University Music Department | Fall 2013

Dr John Robert Ferguson (Visiting Assistant Professor)

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Office Hours: Orwig 313, by appointment or drop in (I'll be around, come talk to me!)

Class times: T/Th 1:00pm – 2:20pm

Location: Steinert 101

### **Essential reading:**

Collins, Nicolas (2009). *Handmade Electronic Music* (New York: Routledge)

Available digitally in the library: <http://library.brown.edu/find/Record/b4937750>

2004 version: <http://www.nicolascollins.com/texts/originalhackingmanual.pdf>

Online tutorials: <http://www.nicolascollins.com/hackingtutorials.htm>

### **Aims and objectives:**

This course will introduce hardware hacking, circuit bending, and explore the creative applications of simple electronic circuits and simple audio systems. The overall goal is musical and artistic expression. During the first third of the course all participants will craft and explore the following in order to ensure that important principles have been understood and practical competencies gained:

- Six simple oscillators on a single CMOS Hex Schmitt Trigger chip. You will assemble this circuit on a breadboard and experiment with a variety of approaches to performing with and mixing the outputs of this single chip.
- Contact microphones/pressure piezometers. You will explore the possibilities of piezo music and build a simple pre-amp that will amplify six piezo contacts with just one 4049 Hex Inverter chip.
- Mini amplifier on a LM386 chip. You will build a small portable amplifier that will be useful for a variety of applications (this could incorporate the 4049 circuit above, either as a pre-amp or reconfigured as a distortion circuit).
- Sequencer. You will use your Hex Schmitt Trigger to control a variable-step sequencer on a 4017 chip. You will experiment with light emitting diodes (LEDs) and light dependent resistors to configure this circuit as a rhythmic device for chopping up audio signals. You might also pair this with a 4046 chip in order to build a simple sequencer and Voltage Controlled Synthesiser.

As everyone becomes comfortable with and has success with the above, we will start to consider how these ideas can be applied to preexisting battery-powered electronic circuits such as electronic toys, greetings cards, and instruments, i.e. circuit bending. Then, preparations for the mid-term concert will begin in earnest and the emphasis of the course will shift towards musical and compositional strategy. For the mid-term concert all forms of computer processing and most forms of professional audio

processing are completely banned. You may utilize analogue mixing desks, loudspeakers, and microphones to extend the creative possibility of your hand-built/modified creations, but that's it, nothing else is allowed!

In the second half of the course you will develop individual instruments and/or performance environments and engage in a number of solo and collaborative projects. Tuesday sessions will focus on the pragmatics of packaging and finishing an instrument, strategies for combining and mixing your instruments, alternative power supplies, and show-and-tell/feedback/help with work in progress. The Thursday sessions will be dedicated to ensemble rehearsal and development, leading up to a final end-of-semester concert (which may include computer-based extensions to your instruments).

### **Practicalities/costs:**

All participants will need to purchase a kit of components in order to realize the initial projects, these will be available as a part number from <https://www.jameco.com/> and will cost around \$100 + tax and delivery. There is likely to be some further expenditure during the circuit-bending element of the course (trips to Salvation Army and Savers stores), and also in the realization of your final projects, so please be prepared for this. Basic hand tools/soldering irons and a bench drill will be available.

### **Course outline:**

10 <sup>th</sup> / 12 <sup>th</sup> Sept.	Introductory session/Hex Schmitt Trigger (breadboard)
17 <sup>th</sup> / 19 <sup>th</sup> Sept.	Hex Schmitt Trigger (soldering/packaging/performing)
24 <sup>th</sup> / 26 <sup>th</sup> Sept.	Contact microphones
1 <sup>st</sup> / 3 <sup>rd</sup> Oct.	Mini amps, matrices, and feedback
8 <sup>th</sup> / 10 <sup>th</sup> Oct.	A simple sequencer and various applications
15 <sup>th</sup> / 17 <sup>th</sup> Oct.	Circuit bending 1(outing to Savers/Salvation Army stores)
22 <sup>nd</sup> / 24 <sup>th</sup> Oct.	Circuit bending 2
<b>29<sup>th</sup> / 30<sup>th</sup> / 31<sup>st</sup> Oct.</b>	<b>Rehearsal / mid-term concert / concert debrief</b>
5 <sup>th</sup> / 7 <sup>th</sup> Nov.	Alternative power supplies/advanced switching
12 <sup>th</sup> / 14 <sup>th</sup> Nov.	Packaging/performance ecology (Thursday = rehearsal)
19 <sup>th</sup> / 21 <sup>st</sup> Nov.	Incorporating multimedia (Thursday = rehearsal)
26 <sup>th</sup> Nov. (28 <sup>th</sup> = no class)	Digitally extending your electronic/analogue creations
3 <sup>rd</sup> / 5 <sup>th</sup> Dec.	Finalizing your projects (Thursday = rehearsal)
10 <sup>th</sup> / 12 <sup>th</sup> Dec.	Reading period
<b>16<sup>th</sup> December</b>	<b>Final concert</b>