

Fall 2008

# MUCP 5690 - Topics in Computer Music

## PHYSICAL COMPUTING: Input and Output Systems for Experimental Music and Intermedia



## Course Syllabus

### Course Description

Our world includes physical objects. As artists we like to control these physical objects to reveal alternate structural realities. This course will use a hands on approach to extend our knowledge of computer music beyond keyboard, mouse, CPU, and loudspeaker and into the world of sensor and actuator systems. While music and sound is still at the core of what we will do, the use of tangible media quickly connects our work with other contemporaneous explorations in the fields of visual arts, dance, theater, etc. Students are encouraged to consider and explore the intermedia potential of these tools and techniques.

### Basic Information

Instructor: David Bithell

Office: Music 108

Office Phone: 1(940) 565-3763

Email: [david.bithell@unt.edu](mailto:david.bithell@unt.edu)

Seminar Meeting Times: T/TH 2-3:20pm

Location: MUSIC 2009 and MEIT Storeroom

Office Hours: M 2-3pm (or by appointment)

### Course Materials

**Library Reading Carrel:** 414 (scores and books)

**Course Blog:** <http://groups.google.com/group/mucp-5690-physical-computing>

(online resource to share information, ideas, weblinks, questions, project results)

#### Recommended Books:

- Collins, Nicolas. *Handmade Electronic Music: The Art of Hardware Hacking*. New York: Routledge, 2006.
- Igoe, Tom. *Physical Computing*. Course Technology PTR, 2004.
- Mims, Forrest. *Electronic Sensor Circuits & Projects*. Master Publishing, Inc., 2004.

All books are available online via Amazon, AbeBooks, Powell's etc

**Labs:** Small electronics prototyping labs are set up in Room 2008 and the MEIT Storeroom. For access to 2008 please go through the regular CEMI studio access process. Use of the MEIT Storeroom will be restricted to regular CEMI Office Hours. You will need to check in with the on-duty CEMI Staff person, who will let you into the space. Check out before you leave. Please leave these spaces as clean and organized (or more so!) than when you arrived.

**Equipment:** Some interfaces and electronic parts are available for general use. For any consumable items (resistors, etc.) please contact me if we are running low. You will likely need to invest some money in items for your own projects. In lieu of required textbooks, consider setting aside approximately \$150 for expenses throughout the semester.

## Projects and Assignments

This is a hands-on learning course. As such, coursework is centered around a series of projects that build to a larger final project.

- Project A: Implement a “Hardware-Hack”
- Project B: Build a sensor
- Project C: Build a sensor instrument
- Project D: Build an actuator instrument
- Project E: Collaborative group project
- Project F: Final project

For each project you will be expected to turn in a short video demonstration showing the various parts of the project explaining how they work. We will learn how to make this as a part of the class. As time permits, we will review completed projects as a class. See the end of this syllabus for guidelines for each project.

## Grading

- Seminar Participation - 30%
- Projects A - D - 40% (10% each)
- Project E Participation - 10%
- Project F - 20%

## Weekly Schedule

Dates	Tuesday	Thursday
1 - August 26, 28	Intro / Safety / Basic Electronics / Soldering / Breadboards	Hardware Hacking (Collins Ch. 3 and 5) / Documentation
2 - September 2, 4	Tudor “Rainforest” Intro + Replication	Lab
3 - September 9, 11	<b>Project A Due</b> / Sensors / Sensor Instruments	Interfaces / Arduino
4 - September 16, 18	Max/MSP + Arduino + Mapping	Lab
5 - September 23, 25	Project C Planning / Lab	<b>Project B Due</b> / “Whistle” Demonstrations
6 - Sept. 30, Oct. 2	Project E (Group Project) Planning	Project E (Group Project) Planning
7 - October 7, 9	Lab	Project D Planning / Lab
8 - October 14, 16	Individual Lab Work (Bithell out of town)	Individual Lab Work (Bithell out of town)
9 - October 21, 23	<b>Project C Due</b> / Paul DeMarinis Demos	Actuators + Interfaces / Protection / Power
10 - October 28, 30	Project E Work Day	Project E Work Day
11 - November 4, 6	Project E Work Day	<b>Finish Project E</b>
12 - November 11, 13	Individual Lab Work (Bithell out of town)	Individual Lab Work (Bithell out of town)
13 - November 18, 20	<b>Project D Due</b>	Lab
14 - November 25, 27	Lab	Thanksgiving - No Class
15 - December 2, 4	Lab	Lab
Final - Tues. Dec. 9	<b>Project F Due / Final Demonstrations</b> - 1:30 - 3:30 pm	

# Project A - Implement a Hardware Hack

## Assignment

Using some form of existing electronics, implement a hardware hack that results in audio, visual, physical, or other output. You may replicate ideas presented in Nicolas Collins' book if you wish, or invent your own.

## Documentation

Once you have successfully created your hack, make a short (>5min) video documenting your tools, techniques, and outcomes. Upload your video to google video, youtube, yousendit, or other online resource and send me the link before class time on the due date listed in the syllabus.

## References

Collins, Nicolas. *Handmade Electronic Music: The Art of Hardware Hacking*.

# Project B - Build a Sensor

## Assignment

There are two options with this project.

- Option 1: Find an interesting sensor and implement it such that you can get data from it into a computer. You may use the Arduino interfaces, or another if you like. Make sure to research your sensor first to know if any support circuitry must be built around it to make it functional and to protect the interface.
- Option 2: Build a sensor from scratch. You may recreate any of the sensors described in the Forrest Mims book or create another. The sensor should produce some variation measurable by a multimeter (i.e. voltage, resistance, etc.).

For an extra pat on the back, get data from Option 2 into a computer.

## Documentation

Once you have successfully implemented your sensor, make a short (>5min) video documenting your tools, techniques, and outcomes. On a Mac, you may wish to use the application iShowU to collate video of your demonstration with video screen shots of the resultant data, etc. Upload your video to google video, youtube, or other online resource and send me the link before class time on the due date listed in the syllabus.

## References

Mims, Forrest. *Electronic Sensor Circuits & Projects*.

# Project C - Build a Sensor Instrument

## Assignment

Using some form of sensing technology (it could be a more elaborate version of the sensors you used in Project B) build a versatile sensor instrument. This instrument should include at least one sensing mechanism, a hardware interface to the computer, and software mapping/processing of the sensor data.

Aim for interesting relationships between sensed states and resultant outcomes.

Aim for subtlety.

Aim for control.

## Documentation

Once you have successfully created your sensor instrument, make a short (>5min) video documenting your tools, techniques, and outcomes. On a Mac, you may wish to use the application iShowU to collate video of your demonstration with video screen shots of the resultant data, etc. Upload your video to google video, youtube, or other online resource and send me the link before class time on the due date listed in the syllabus.

## Project D - Build an Actuator Instrument

### Assignment

Using an interface and proper power/protection boards, construct an instrument that acts on the physical world based on computer generated commands. Actuators include motors, stepper motors, solenoids, electromagnets, muscle wire, etc. You may, but need not, incorporate sensors to control the function of the actuators.

### Documentation

Once you have successfully created your actuator instrument, make a short (>5min) video documenting your tools, techniques, and outcomes. On a Mac, you may wish to use the application iShowU to collate video of your demonstration with video screen shots of the controlling software, etc. Upload your video to google video, youtube, or other online resource and send me the link before class time on the due date listed in the syllabus.

## Project E - Collaborative Group Project

### Assignment

The class will collectively realize a larger scale project to be determined. The project will be designed in accordance with the interest of the students and the goals of the course.

### Documentation

As progress is made on this project, you will be responsible for posting updates on what has been accomplished on the project's blog. This will be essential to track progress, monitor participation, and debug issues as they arise.

## Project F - Final Project

### Assignment

In consultation with the instructor, develop a final project that shows significant mastery of course topic. The project may be of any kind (a sensor instrument, an actuator instrument, a combination, a hardware hack, etc.) so long as it is sufficiently advanced. You may expand on a previous project so long as there is significant expansion in scope.

### Documentation

Upon completion of your project, make a detailed "how to" document, post it to instructables.com, and forward a link to me by the final exam time. This should include step by step directions, commentary on what worked and what had to be changed, and documentation of the final product in action.