

MAT 240C - Winter 2011

Physical Computing and Musical Interaction Design

TuTh 10-12, 4 Units

Elings 2003 (MAT Conference Room)

Instructor: Dr. Matthew Wright (matt@create.ucsb.edu)

Instructor office hours: TBA

TA: Karl Yerkes (yerkes@mat.ucsb.edu)

TA Office Hours: Fridays 10-12 and by appointment

Course Website: <http://mat.ucsb.edu/240/240C>

Description

In the tradition of MAT 594O, the goal of this course is the application of sensor technology to areas such as new audiovisual interfaces, music/sound manipulation and spatialization systems, interactive installations/virtual environments, 2D/3D video and graphics interfaces and other innovative devices for interacting with and manipulating computer systems. It is expected that the course will lead to a completed prototype of some sort as a final project. A student who successfully completes this course will have experienced taking an original interface through a full cycle of design, prototype, evaluation and testing. The system demonstrated at the end of the term should explore the relation between a physical interaction and some kind of media, and is to be accompanied with a written report / web site describing the intent and an evaluation of the interface. Lectures and examples will feature state-of-the-art environments used at UCSB, particularly in the AlloSphere Research Group.

This course will feature a top-down approach, starting students off with hands-on, high-level examples, then introducing the concepts and tools required for the design of more complex systems.

Hardware and Software

Expect lessons and examples involving Max/MSP, C/C++, PureData, Processing, Arduino, teensy, LuaAV, AlloCore, Device Server, and the new PhaseSpace motion-capture system in the AlloSphere.

Suggested references (free online at UCSB)

[Making Things Talk](#) (Tom Igoe)

[Programming Interactivity](#) (Joshua Noble)

[Designing Embedded Hardware](#) (John Catsoulis)

[Make: Electronics](#) (Charles Platt)

Philosophy

Digital audio programming, like most interesting topics, has deep aspects and superficial aspects. The goal of the course is to teach the deep aspects: principles, concepts, techniques, and theory. But to do a hands-on project and actually implement something you must also master many superficial aspects: specific programming languages, syntax, alternate names of things, where you need to put your files, etc. I learned digital audio programming 20 years ago with a substantially different set of tools than what I use today, and so inevitably much of my hard-won superficial knowledge is now obsolete. But the deep knowledge is still relevant, useful, and essential to my work. If you understand the deep aspects then you can always easily learn new superficial aspects just by looking them up. But without the deep knowledge you might not even be able to understand the documentation you find.

I see a large part of my role as instructor of this course to be a sort of guide that points out what is deep and what is superficial. I will make every effort to teach the former and I will encourage you to learn the latter on your own, from each other, and from the TA. If you try to learn something superficial and it's really hard then there's probably something deep we need to talk about; please don't be shy with questions.

Readings, Homework, and Labs

We will assign required readings each week, generally 1-2 short academic articles. Each will be due for a particular class and for each you will email Matt and Karl the following reading summary assignment before 10pm on the night before the class:

1. One to four sentence summary, in your own words, of the article.
2. Something you like about the article (interesting, useful...) and why.
3. Something you either don't understand about the article (confusing, incomplete, knowledge you lack...) or don't like about the article (something you think could have been done better) and why.

We will also recommend additional optional readings if you need additional background information or depth.

Deliverables and Assessment

Individual students will choose a final project that addresses one or more challenges in musical interaction design and/or physical computing. Final projects should include both software and hardware components as well as documentation and a demonstration or performance.

10% Participation (contributing to class discussions, etc.)

15% Lab Assignments

15% Homework

10% Reading Responses

50% Final Project

Tentative Schedule

Week 1: Mar 29, Mar 31

Survey of previous work

Reading 1 (due 10pm Wednesday, March 30)

Interaction Design Sketchbook (Bill Verplank)

Problems and Prospects for Intimate Musical Control of Computers (David Wessel and Matthew Wright)

Using Contemporary Technology in Live Performance - The Dilemma of the Performer (W. Andrew Schloss)

Homework 1 (due 10pm Monday, April 4)

Find 2 projects using sensors that interest you. These 2 projects could be something you want to copy, improve, emulate, update, or just understand better. Look in the proceedings of a conference (NIME++ 2010 or another) or follow some of the links on the 240C site. To the best of your ability, figure out how each project works. What sensors are used? What sort of computer(s) or micro-controller(s) are used? Try to determine part numbers or names. Sketch an interaction diagram for each project. Be prepared to report about the project to the class.

Tuesday - Syllabus. Purpose of this class. NIME. Survey of work in previous and similar classes (SLAB, disky, Randy Jones Multitouch Prototype 2).
Introductions. Survey of student background. Start figuring out what to order.
Thursday - Lab 1 "Introduction to musical interactivity with Pd"

Thursday, March 31, 8pm, College of Creative Studies Gallery: Gravitational Forces (Marco Pinter interactive dance work)

Week 2: Apr 5, Apr 7

Introduction to simple sensors and Arduino + Pd, MaxMSP, and Processing

Reading 2 (due 10pm Wednesday, April 6)

disky - a DIY Rotational Interface with Inherent Dynamics
A Force Sensitive Multi-touch Array Supporting Multiple 2-D Musical Control Structures
Managing Complexity with Explicit Mapping of Gestures to Sound Control with OSC

Homework 2 (due 10pm Monday, April 11)

Find 2 sensors that interest you. Using the skills you learned in Lab 2, connect them to the instrument you built in Lab 1.
What are the cheapest and most expensive accelerometers available through SparkFun? What are the differences between them?
(More short-answer questions TBA.)

Tuesday - Introduction to simple sensors and Arduino with Firmata + Pd, MaxMSP, and Processing
Thursday - Lab 2 "Microcontrollers and Sensors"

Thursday April 7, 8pm, Lotte Lehmann Concert Hall (Music Dept.): CREATE Concert featuring interactive works by Kaffe Matthews
(Saturday April 9, 12:30pm, Anisq'Oyo Park, Isla Vista: UCSB Afro-Brazilian Ensemble free performance)

Week 3: Apr 12, Apr 14

Looking at signals, gestures, and filters

Measuring and estimating latency, jitter, and bandwidth

Reading 3 (due 10pm Wednesday, April 13)

Audio and Gesture Latency Measurements on Linux and OSX (Matthew Wright, Ryan J. Cassidy, Michael F. Zbyszynski)

Homework 3 (due 10pm Monday, April 18): TBA

Tuesday - Lab: Measuring and estimating latency, jitter, and bandwidth (music 250 lab 5)
Thursday - Lab: Firmware programming. (music 250 lab 3)

Wednesday April 13, 7pm, Geiringer Hall (Music Dept.): Pianomatic springs (computer-controlled piano and Fluid Piano concert)

Week 4: Apr 19, Apr 21

Survey of embedded device technologies (Arduino, teensy, mbed, etc)

Introduction to firmware programming (avr-gcc, Arduino, LUFA, v-usb)

Reading 4 (due 10pm Wednesday, April 20): TBA

Homework 4 (due 10pm Monday, April 25)

(make your own sensor work in an interesting way)

Tuesday -
Thursday -

Week 5: Apr 26, Apr 28

Introduction to the Device Server and the PhaseSpace tracker

Networking embedded systems, making things talk

Reading 5 (due 10pm Wednesday, April 27)

Dynamic Interactivity Inside the AlloSphere
Using IR Optical Marker Based Motion Capture for Exploring Musical Interaction

Homework 5 (due 10pm Monday, May 2)

Write a brief (1-2 pages of English) proposal for your final project for this class. Include sketches of interactions and diagrams of the technologies involved. Be prepared to present your proposal to the class.

Tuesday - Introduction to the Device Server. Configuring the Device Server to work with your projects. Revisit signals, gestures and filters.
Thursday - Connecting to the PhaseSpace tracker in the AlloSphere. Position, orientation, and gestures in 3d.

Tuesday April 26, 5:30pm, Engineering Science Building, room 2001, Matt Wright @ MAT Seminar (topic TBA)

Week 6: May 3, May 5

Students pitch final project idea

Reading 6

Intuitive Real-Time Control of Spectral Model Synthesis

No Homework

Tuesday - Project proposals and discussion
Thursday - Individual student meetings to give feedback and direction on projects

Week 7: May 10, May 12

Discussion of special topics and student projects

Individual meetings and progress reports

Homework TBD

Reading TBD

Tuesday/Thursday - Special topics and project discussions

(Wednesday May 11, 12 noon, Music Bowl (Music Dept): UCSB Afro-Brazilian Ensemble free performance)

Friday May 13, 8pm, Lotte Lehmann Concert Hall (Music Dept.): California Electronic Music Exchange Concert

Week 8: May 17, May 19

Discussion of special topics and student projects

Individual meetings and progress reports

Homework TBD

Reading TBD

Tuesday/Thursday - Special topics and project discussions

Thursday May 19, 8pm, Lotte Lehmann Concert Hall (Music Dept.): CREATE Concert featuring works by Maggi Payne, Curtis Roads, and student composers
(Saturday May 21, 8pm, Lotte Lehmann Concert Hall (Music Dept.): UCSB Middle Eastern Ensemble)

Week 9: May 24, May 26

Discussion of special topics and student projects

Individual meetings and progress reports

Homework TBD

Reading TBD

Tuesday/Thursday - Special topics and project discussions

Week 10 ("Dead" week): May 31, June 2

Discussion of special topics and student projects

Individual meetings and progress reports

Homework TBD

Reading TBD

Tuesday/Thursday - Special topics and project discussions

Monday May 30 to Wednesday June 1, Oslo, Norway: New Interfaces For Musical Expression conference <http://www.nime2011.org>

Week 11 (Finals Week): Meeting time TBD

No Homework

No Reading

Last Day - **Final Project Presentations**