ASTU 3450.502
Creative Software Programming and Physical Computing
Martin Back
Office: Curry 310
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Tues and Thurs
5:00-7:50pm
Curry 316 and 312

Course Description
This class is a laboratory for practical, hands-on exploration of physically interactive electronics and basic creative software programming within the context of the arts. Students will learn how to construct novel aesthetic machines, which might interface with a viewer’s body or ambient stimuli such as motion, light, sound, or intangible data. Students will experiment with programming environments such as Processing and PureData, and will learn the fundamentals of using the Arduino and analog electronics to produce artworks such as kinetic sculpture, robotic art, sound installations, light art, and performance environments. Engagement with art historical and theoretical context will be encouraged. Despite the very rigorous technical focus and instructions, artistic voice will be emphasized over technical skills. Midpoint Review into New Media will be conducted during this course.

In addition to artworld-related conceptual foundations of aesthetic machines, interactivity, circuitry and programming we will necessarily delve into concepts from experimental music and extra-artworld notions such as Cybernetics, Biological Autopoiesis, Robotics, and the history and ramifications of the development of digital computing.

“To speak of a history, any history, as though there was but one somehow canonical history...is misleading...any entity, culture or civilization...carries innumerable, in some ways differing, histories.”

Course Objectives
- Acquire intermediate knowledge of creative programming in either Processing, or PureData.
- Acquire intermediate knowledge of working with electronics. This includes hacking, soldering, basic reading of schematics, using a breadboard, multimeter, etc.
- Complete 4 original artworks or artefacts.
- Acquire a general facility for the history and conceptual concerns of Machine Art, Cybernetics, Generative Art

Course Requirements
This course will include lectures, in-class demonstrations and exercises, quizzes, and readings. Plan on a minimum of 2-3 hours of work and research outside of class for every hour of class. Projects and assignments will not be accepted after the due date. If the student is going to be absent on a due date she should make arrangements to turn in the assignment early. Lectures will not be repeated, therefore it is the student's responsibility to make up any work or retrieve class notes due to an absence.

Reading Materials
All required texts will be provided in either electronic format via Blackboard or will be placed on reserve in the Library.

Required Materials and Sundry Items
- Journal or Sketchbook for jotting down ideas and notes from class.
Throughout the semester you may need to purchase, depending on your projects and your soldering skills, items such as proto-boards and electronic components. With that said, we have a well maintained and well-stocked physical computing lab.

-External hard drive. Processing and Pure Data (even exceedingly complex Pd files can be emailed, for example) files are rather small, so a 6-10 GB drive will be sufficient.

-Internal participation
-Internal willingness to experiment
-Expectation of the very real possibility that you will fry or blow up at least one project. But this is part of the fun.
-External Breadboard
-External Arduino. An Arduino Uno is acceptable.

Optional: You may want to purchase a plastic box—the kind of which one would store traditional art supplies, such as paintbrushes, paints or pastels—to keep and organize electronic parts and any tools you might wish to purchase. *You are not required to purchase tools. We have plenty.

Resources
UNT now has a campus-wide subscription to Lynda.com. Use these tutorials! They are invaluable. I personally have books that may be of use to you as does the New Media Department. They can be accessed during class time. Please treat them with care or I will personally extract monetary restitution from you for their replacement.

Electronic Parts: www.digikey.com
www.jameco.com
www.sparkfun.com
www.mouser.com
www.roboshop.com
Tanner Electronics
1100 Valwood Pkwy
Carrollton, TX 75006
Radio Shack (only good for certain items)

Grading
Students will be graded upon completed projects (50%), attendance and participation (20%), presentations (15%), and readings (15%). Projects will be evaluated by their originality and conceptual clarity, evidence of technical development, adherence to deadline, and attention paid to detail and execution. Each project has a point value of 12.5. (I.E. 12.5 x 4 = 50).

A=100-90 B=89-80 C=79-70 D=69-60 F= <60

Attendance Policy
It is your responsibility to attend class on time. Lateness by more than 10 minutes will result in an absence. You are allowed no more than THREE absences. More than three absences will result in a WF or an F for the class. Any necessary absences known of in advance should be approved by the Professor within the first 3 weeks of class. These absences will, however, count against the 3 absence limit. An excused absence will only be granted in the case of an illness with a written doctor's note (presented to me as a physical copy) or a family emergency with provided documentation.

PLAGIARISM
Plagiarism is the unauthorized use or close imitation of someone else's original work and will not be tolerated. Effort should be made to change images made by others so that they will not be construed as "borrowed" or "stolen." Work that is plagiarized will not be accepted and may result in a failing course grade and/or expulsion from the University.

AMERICAN DISABILITIES ACT
"The College of Visual Arts and Design is committed to full academic access for all qualified students, including those with disabilities. In keeping with this commitment and in order to facilitate
equality of educational access, faculty members in the College will make reasonable accommodations for qualified students with a disability, such as appropriate adjustments to the classroom environment and the teaching, testing, or learning methodologies when doing so does not fundamentally alter the course. If you have a disability, it is your responsibility to obtain verifying information from the Office of Disability Accommodation (ODA) and to inform me of your need for an accommodation. Requests for accommodation must be given to me no later than the first week of classes for students registered with the ODA as of the beginning of the current semester. If you register with the ODA after the first week of classes, your accommodation requests will be considered after this deadline. Grades assigned before an accommodation is provided will not be changed. Information about how to obtain academic accommodations can be found in UNT Policy 18.1.14, at www.unt.edu/oda, and by visiting the ODA in Room 321 of the University Union. You also may call the ODA at 940.565.4323.

Blackboard
Make sure that you can access Blackboard Learn System and that you are enrolled correctly in your course! Email your instructor immediately if you are not correctly enrolled. Your UNT email address will be the ONLY ONE used for communication with the instructor. Make sure that is working fine and check it often for announcements.

Rules of the Classroom and Expected Behavior
1. Safety First! Use Your common sense. If you think something is dangerous it probably is. If you have a question do not hesitate to ask me.
2. Absolutely no phone use during class.
3. Please do not turn on computers until I ask you to do so.
4. Shut down computers after class is concluded.
5. Participate in class discussions and exercises.
6. Respect your fellow students.
7. As the semester progresses we will make larger and larger messes during class. I expect that you will help me clean the labs right before our class session ends.

Expectations of your Professor’s Behavior
You will expect of me that I will be a respectful and dedicated participant in your education. I am not an ultimate authority. I do, however, know a great deal about the subject matter at hand. I cannot teach how to be a great artist and I will do my best to refrain from telling you how to make your art. My role as your professor could be better described as one who opens your eyes toward paths for you to tread, rather than which one to choose or how to walk upon it.
“Would you rather live in a small reality of one idea or a big reality of many ideas?”
—Harry Partch

Course Structure and Calendar
Week 1
Aug. 26 T
- Review of Syllabus
- Introductions: Who are you? Who am I?
- Introduction to our laboratory and tools.
- Overview of Physical Computing
- Analog vs. Digital
- Reading 1 Assigned: Machines and Art, Jasia Reichardt, 1987

Aug. 28 Th
- Discussion of Reading 1
- What is a circuit?
- Detailed Discussion of Analog Electronics
  1. Power
2. Resistors
3. Capacitors
4. Diode
5. LED
6. Transistors
7. Photocells
8. Motor
9. Sonic Transducer
10. Breadboard
11. IC
12. Relays
13. Switch

- Using a Multimeter

Week 2
Sept. 2 T
- Review of Analog Electronics
- Review of Use of Multimeter
- How to Solder
- A simple circuit with and without a breadboard
- Reading 2 Assigned: *Foundation and Development of Robotic Art*, Eduardo Kac, 1997

Sept. 4 Th
- Quiz re: Analog Electronics
- Discussion of Reading 2
- Soldering Exercise
- Reading Schematics

Week 3
Sept. 9 T
- Soldering Cont. (if necessary)
- Overview of Power and Power Supplies
- Hacking/Building Sound Circuits (for next class, bring in some kind of scavenged, sound making electronic device): simple light theremin with the 74c14

- Project 1 Assigned: Noizillator (document your progress/process in your sketchbook)

Sept. 11 Th
- Brief History of Composers Working Inside Electronics and Sound Synthesizers
- Hacking/Building Sound Circuits continued: volume, simple filters, body contacts
- Introduction to programming in PureData

Week 4
Sept. 16 T
- Introduction to programming in Processing
- Lynda.com tutorials
- Time allowing: work on Noizillator

Sept. 18 Th
- Noizillator due/Noizillator mini concert conducted by your Professor
- Discussion of process of completing Noizillator
- More creative programming with PureData and Processing
- Introducing the Arduino

Week 5
Sept. 23 T
Integrating PureData/Processing, Arduino and Other Hardware
-Programming + Arduino In Class exercise
-Reading 3 Assigned: Cybernetics and the Mangle, Andrew Pickering, 2002

Sept. 25 Th
-Discussion of Reading 3
-Introduction to BEAM Robotics
  1. Mark Tilden Youtube video
-Project 2 Assigned: Bicore Headbot (in class group project)
-Overview of Project as detailed in Junkbots, BugBots, and Bots on Wheels

Week 6
Sept. 30 T
-Continuing with Programming and Arduino: data storage, time, loops
-Project 2: Headbot planning and preliminary building
-Note: Tomorrow evening in the art building there is a symposium being given by several South and Latin American New Media Artists. It is mandatory for you to attend. I will be taking role.

Oct. 2 Th
-Guest Artist Workshop Hybrid Ecology/Wire Wrapping *mandatory to attend

Week 7
Oct. 7 T
-Sound Synthesis Basics in Pure Data and how to control PD with Arduino
-Continue building our Headbots

Oct. 9 Th
-Martin Away
-Guest Presentation

Week 8
Oct. 14 T
-Martin Away
-Guest Presentation

Oct. 16 Th
-Finishing our Headbots
-DC Motors, StepMotors, Solenoids, and Actuators: Working with these elements with and without the computer.
-Project 3 Assigned: Transcoding and Feedback: Toward Extreme Functioning (document your process/progress in your journal)
-Reading 4 assigned: Beyond Design: Cybernetics, Biological Computers and Hylozoism, Andrew Pickering, 2009

Week 9
Oct. 21 T
-Discussion of Reading 4
-What is Feedback, really?
-Implementing Transcoding and Feedback in the Analog Domain
-Implementing Transcoding and Feedback in the Digital Domain
-Implementing Transcoding and Feedback in a Hybrid Domain

Oct. 23 Th
Implementing Transcoding and Feedback Continued
-Laboratory

Week 10
Oct. 28 T
-Laboratory

Oct. 30 Th
-Project 3 Due
-Critique

Week 11
Nov. 4 T
-Discussion of Final Projects
-Assigned: Proposal of Final Project
-More advanced programming in Processing

Nov. 6 Th
-More advanced programming in PureData: Sound Synthesis and Image

Week 12
Nov. 11 T
-Discussion of Final Projects and Proposal Due
-Machine Art

Nov. 13 Th
-Kinetic Art

Week 13
Nov. 18 T
-Laboratory

Nov. 20 Th
-Laboratory

Week 14
Nov. 25
-Laboratory

Nov. 27
-No Class: Thanksgiving Break

Week 15
Dec. 2
-Martin’s Lecture on Cybernetics and Art
-Recap of the Semester
-Journal review
-Laboratory Time

Dec. 4
-Final Projects Due