62-362 FALL 2019 | CARNEGIE MELLON UNIVERSITY

Activating the Body: Physical Computing & Technology in Performance

INSTRUCTOR | Heidi Wiren Bartlett
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UNITS | 10.0
TIME | 2:30–4:20 pm, Tues/Thurs
LOCATION | Hunt Library A10
LAB HOURS | 4:20-5:20 pm, Tues/Thurs

Activating the Body: Physical Computing and Technology in Performance investigates the fundamentals of electronic computation through performative dialogue with human embodiment. In this course, students explore the body and technology as sculptural elements to be manipulated. The course examines the basis of analog and digital computation alongside contemporary, avant-garde, and traditional sculpture, installation, performance, dance, and theater. Students learn the fundamentals of electrical flow and construct functional embodied digital gates, as well as higher-level manipulations of sensors and actuators using the Arduino platform. Major themes in contemporary creative practice are addressed through readings, viewings, field trips, and the creation of original work. Students broaden and deepen conceptual skills and increase the scale, ambition, and finish of creative output. Throughout the semester students complete a series of quick thematic exercises and larger-scale projects; these works are reviewed through individual meetings, group critique, and documentation. The course includes exhibits of site-specific work on and off campus with the option to participate in an end of semester interdisciplinary collaborative event.

COURSE REQUIREMENTS

+ Attendance required and absolutely necessary. Participation in workshops, field trips, discussions and critiques are a valuable part of the learning experience.

+ Completion of projects demonstrating skill and inventive problem-solving is expected.

+ Readings will be assigned, handouts will be distributed in class, or online to serve as background for assignments and discussions. Readings will be available as PDFs on our course website and on Canvas.

+ You are required to participate in homework exercises and investigations, meant to expand your skill-set, however those need not always result in finished works.

+ Participation in class activities and discussions is required. You must work in the designated classroom or adjacent workspaces during class, with exceptions granted by instructors. Guest lecturers and field trips are an important aspect of this course, therefore trips will be timed to take place during our regular meeting sessions and attendance will be taken. Please notify us ahead of time if you know you have scheduling conflicts.

+ Conduct yourself professionally in time management and in communication with us, visiting critics, and peers.

INTENDED LEARNING OUTCOMES

By the end of this semester...

+ **Build a body of work** that expands on technical and conceptual skills.

- Effectively draw upon a range of fabrication skills, and seek training and resources where needed in order to successfully bring concepts into three-dimensional form.
- Produce projects in which ideas, actions, and

materials are effectively synthesized, and contribute to an evolving body of work that advances your practice and personal vision.

- Intentionally install your work to effectively emphasize its function, interactivity, appearance, and/or conceptual meaning, utilizing the properties of space, site, and context.
- Build interactive projects which respond to or are driven by basic ideas in computer science, electrical engineering, and digital logic.
- Design work for interaction with members of the public, attending to the needs and understandings of varied audiences.

+ Situate this body of work in the appropriate historical and contemporary context, especially pertaining to the history of technology.

+ Further develop a vocabulary for discussing contemporary art and its relationship to digital logic and other technical paradigms.

+ Effectively document work to communicate its physical presence and experiential qualities to an audience who may not have the benefit of experiencing it firsthand.

You will be encouraged to voice your ideas and thoughts and to contribute to group discussions. Respect for others' feelings, beliefs and values are essential to the success of the class, so please be considerate of your classmates' different backgrounds and experiences as you perform and discuss various points of view. This course should be a safe space in which various perspectives are considered and discussed. Uncomfortable is okay when taking risks. We aim to create spaces of trust and respect to allow for risk. It is important for each student to set limits verbally and at any point during the process, please bring concerns to the group and/or professors. You are expected to be accountable for yourself and each other.

MAJOR PROJECTS

The *three major units of the course* are **Gates, Flow,** and **Arrows.** Each unit is animated by a major underlying concepts drawn from electrical or computer engineering, and there are technical homeworks and smaller orienting assignments designed to help you learn the relevant underlying theory and practice.

The major assignments ask students to respond with an originally fabricated interactive piece to a prompt. To briefly explicate each of the themes:

- **Gates** refers to the digital logic "gates" that are ubiquitous in computers, microcontrollers, and programmable electronics. Taken individually, a gate is an electronic implementation of a Boolean (mathematical) rule that describes a precisely defined relationship between inputs and outputs. The projects in this section explicitly employ logic gates in the service of decisionmaking machines, computing devices, or other devices with multiple inputs from the world.
- **Flow** refers to the many ways in which impulses, waves, information, and signals "flow" through physical and electronic systems. Not moving instantaneously (although sometimes very quickly), impulses can take many different forms. Projects in this unit focus on creating a transduction (form-changing) flow in which a signal travels through multiple different media.
- **Arrows** refers to the many stacked layers of indirection used in the programming and operation of a modern computer or microcontroller system. Projects in this unit work off of the idea of arrows pointing to other arrows to simplify, complexify, or otherwise change meaning across layers of abstractions.

SKETCHBOOKS

Please bring a sketchbook to class – it can be any shape/color of your choice. We would recommend something that is easy to carry around. Sketchbook pages often make for strong documentation of the genesis or development of a thought pertaining to a project (and are a welcome addition to your process documentation).

GRADING

Grades are determined by the completion of projects in class, as well as research and work completed outside of class. *The evaluation of*

creative work—especially emerging forms—is notoriously difficult and necessarily holistic, making specific grading rubrics difficult to develop. Nevertheless, the following questions will guide the instructors in assigning grades.

- How well can the student articulate the cultural precedents and theoretical/ engineering foundations of the unit's theme, as evidenced by the presentation, creative work, and project statement?
- Do the ideas presented at the beginning of the unit contain the germ of the eventual project?
- Does the project represent a clear evolution in thinking and making over the course of the unit?
- How well do the project's media and execution reinforce its content?
- Does the level of finish or craft reflect intentionality and reinforce the form and content?
- How clear and well written is the project statement?
- Does the project represent the development of the student's artistic vision and contribute to a body of work?

A – Excellent / outstanding effort above and beyond the requirements

≥90

B – Good / above average achievement

<90 and ≥80

C – Satisfactory / average work

<80 and ≥70

D – Passing / below average performance

<70 and ≥60

R – Failing to meet the lowest passing standard

<60

Grades will be awarded on an A to R scale. Each project will receive a letter grade in addition to verbal critique in class. Students are encouraged to contact the instructors at any time to learn how they are doing. Grades are recorded and communicated primarily through the course Canvas site.

GRADING SCHEME

You will work on multiple activities in this class.

+ Participation **(10%)**
+ Homework and technical exercises **(10%)**
+ Project No. 1 **(25%)**
+ Project No. 2 **(25%)**
+ Project No. 3 **(30%)**

Practical homeworks (i.e. the type that involve a tech demo) are graded in class when they are due.

Projects generally have two grade components: the project itself and documentation of the project/process. Projects are graded based on their state at the time they are due, i.e. the day of the in-class or out-of-class exhibition and/or critique. **Documentation is generally due one week later than the project.**

Documentation grades include detailed feedback, and you may choose to make improvements to the documentation based on this feedback. Improved documentation is due one week after you receive the instructors' feedback on the project, and the regrade will replace the original grade.

PRESENCE & ATTENDANCE

```
while ( in_class ) {
  phoneNotifications = false;
  if ( phoneUse ) {
    phone = phone_in_basket;
  }
  if ( social_media ) {
    if ( time < 1 ) {
      goto: warning;
    } else {
      attendance_today = treated_as_absence;
    }
  }
}
warning:
   4. a. Deterrent counsel; cautionary advice
against imprudent or vicious action, or
neglect of duty.
```

Class time is precious—we've got only 4 hours a week, about 60 hours over the course of the semester. Because of this, we have some clear expectations for ourselves and for you:

- **We will get to class early and ready to go**. During class time, we'll focus exclusively on our course.
- **We'll use class time as wisely as we can:** if the whole group does not need to be involved in a discussion, we'll try to bring only the needed group together.
- **You'll also use class time carefully;** you will come on time and ready to learn. If you're late, please enter quietly and speak with us after class.
- **You'll use classtime to focus on the class,** and not the fun things happening inside your phone or out on the internet.

The course is light on lecture and heavy on hands-on learning; especially since this is the case, when there is a lecture, please pay good attention.

Attendance is expected at all sessions. Any unexcused absences beyond your 2nd will result in a third of a letter grade (3 point) deduction from your final course grade. An unexcused tardy, which is defined as being more than 3 minutes late to class, is computed as one third of an unexcused absence (1 point off of your final grade).

Excused absences, latenesses, and emergencies are excepted, of course, and don't carry any penalty. **Speak with and email the instructors at your earliest convenience in the case of these events.** If you're sick in bed, please stay in bed: get healthy so you can come back and join us (and please keep your new microbial friends at home with you).

Each of the homeworks and projects have their own grade breakdowns; see `courses.ideate.cmu.edu/62-362` for more details.

COMMUNICATION

We are happy to answer your questions, discuss your work, or respond to your concerns. Please come to lab hours, make an appointment, or ask questions via email. Email is the easiest way to reach us. We will try to respond to you within 12 hours during weekdays, and 24 hours over weekends.

ACADEMIC INTEGRITY

This is not a class, and IDeATe's Phys Comp Lab is not an environment, where you are expected to write every line of your own code or come up with all of your own electronics ideas. We gratefully stand on the shoulders of giants and also regular-sized heroes who share interesting projects and possibilities on Instructables, or Github, or their blogs. You are expected to incorporate ideas, hardware/electronics designs, and even verbatim software fragments from other sources. This isn't considered plaigirism in this class if: 1) you properly cite sources, and 2) you don't simply make a wholesale reproduction of somebody else's project but instead use their work as a jumping-off point. If you do plaigiarize, however, you can expect a serious response, including a major grade penalty and referral to the University disciplinary structure.

If you're not sure if you're borrowing too much from somebody else, or you don't know how to credit the work you're borrowing from, please discuss it with the instructors.

INCLUSIVITY

CMU recognizes the diversity of racial identities, religious backgrounds, sexual orientations, and gender identities that are a foundation of our strengths as a culture. All classes are safe spaces for self-identification, self-expression, and inclusivity. Students are expected to treat everyone with respect in our classroom and critique activities, which includes debate and the free exchange of ideas. If you experience or witness lack of respect or harassment in our classroom environment, or have any other concerns, please contact us to discuss.

ACCOMMODATION

In the spirit of encouraging everyone to be able to be maximally present in class together, it's important that students feel comfortable and supported. If there is anything physically in the environment that can be reasonably adjusted to make your learning experience better, you should feel generally empowered to make that adjustment. If the lights are too bright at your table, please ask your neighbors if it's ok to dim them, and if yes, go ahead and do so. If we're playing music at a work session and it's too loud, please say so. If you have any other concerns, please contact us to discuss.

If you have a disability and are registered with the Office of Disability Resources, we encourage you to use their online system to notify us of your accommodations and discuss your needs with us as early in the semester as possible. If you suspect that you may have a disability and would benefit from accommodations but are not yet registered with the Office of Disability Resources, we encourage you to contact them at **access@andrew.cmu.edu.**

YOUR HEALTH AND WELLBEING

Take care of yourself. Do your best to maintain a healthy lifestyle this semester by eating well, exercising, avoiding drugs and alcohol, getting enough sleep, and taking some time to relax. This will help you achieve your goals and cope with stress.

If you or anyone you know experiences any academic stress, difficult life events, or feelings like anxiety or depression, we strongly encourage you to seek support. Couseling and Psychological Services (CaPS) is here to help: call 412-268-2922 or visit **cmu.edu/counseling.** Consider reaching out to a friend, faculty, or family member you trust for help getting connected to the support that can help.

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Course Schedule

This schedule is only an outline. Dates and activities are subject to change with advance notice. The updated syllabus can be found on our course website: **courses.ideate.cmu.edu/62-362** Students are invited to self-identify important observances of faith that pose conflicts with meeting times, assigned coursework, or critiques.

T 8.27	Course Introduction | **Homework NO. 1** Introduction
	PROJECT NO. 1: GATES Introduced + Assigned
Th 8.29	**Homework NO. 1: Presentations of Portfolios DUE**
	Homework NO. 2 Introduction | Digital Logic: Switches
T 9.3	**Homework NO. 2 DUE** | Digital Logic: Schematics & Math
	Homework NO. 3 Introduction
Th 9.5	**Homework NO. 3 DUE** | Digital Logic: ICs
F 9.6	**5:00 - 6:00 p.m.** *Meet & Greet with Potential Collaborators*
T 9.10	**GATES IDEAS DUE +** Individual Meetings – Sharing *Gates* project ideas
	Instruction | Work Day
Th 9.12	Instruction | Work Day
T 9.17	**In Progress Critique**
Th 9.19	Work Day
T 9.24	Work Day
Th 9.26	**\\\ PROJECT NO. 1: DUE ///**
F 9.27	**Install PROJECT NO. 1 for exhibit opening**
T 10.1	**\\\ PROJECT NO. 1: Class Critique ///**
Th 10.3	**Documentation DUE for PROJECT NO. 1 at the beginning of class**
	PROJECT NO. 2: FLOW Introduced + Assigned | Arduino & Electronics I
	Homework NO. 4 Introduction
T 10.8	Arduino & Electronics II | **Homework NO. 4 DUE** | **Homework NO. 5** Introduction
Th 10.10	Arduino & Electronics III | **Homework NO. 5 DUE**
T 10.15	**FLOW IDEAS DUE +** Individual Meetings - sharing *Flow* project ideas | Work Day
Th 10.17	Instruction | Work Day

T 10.22	Instruction | Work Day
Th 10.24	Work Day
T 10.29	Work Day
Th 10.31	**\\\ PROJECT NO. 2: DUE /// \\\ Class Critique ///**
T 11.5	**PROJECT NO. 3: ARROWS** Introduced + Assigned | Instruction
Th 11.7	**Documentation DUE for PROJECT NO. 2 at the beginning of class**
	Homework NO. 6 Introduced | Instruction
T 11.12	**Homework NO. 6** DUE | Individual Meetings - sharing *Arrows* project ideas
Th 11.14	Instruction | Work Day
T 11.19	Instruction | Work Day
Th 11.21	Work Day
T 11.26	Work Day
Th 11.28	No Class / Thanksgiving Break
T 12.3	Work Day
Th 12.5	**\\\ PROJECT NO. 3: DUE ///**
F 12.6 or S 12.7	**Install PROJECT NO. 3 for Public Collaborative Exhibit**
T 12.10	**\\\ FINAL CRITIQUE & REDD UP 2:30 - 5:00 p.m. ///**
F 12.13	**Documentation DUE for PROJECT NO. 3 at 5:00 PM**