4.043 / 4.044 Design Studio: Interaction Intelligence
Instructor: Marcelo Coelho
W 3-5, F 2-5

# 4.043 / 4.044: Design Studio: Interaction Intelligence

## Studio Overview

Overview of core principles and techniques for the design of interaction, behavior and intelligence across objects and spaces. In a studio environment, students develop low and high-fidelity interactive prototypes that can be deployed and experienced by real users. Lectures cover the history and principles of human-computer interaction, behavior prototyping, physical and graphical user interfaces, machine intelligence, neural networks, and large language models. Provides a foundation in technical skills, such as physical prototyping, coding, and electronics, as well as how to collect data, train and deploy your own neural network models. Students complete a small interaction exercise and a portfolio-level final project. Graduate students are expected to complete additional assignments.

*Project 1: 1D Interface*
We will start the course by creating a 1D game and a custom joystick for controlling it. We will learn techniques for in-hardware sketching and prototyping, creating state diagrams, building electronic circuits, designing a graphical user interface, coding, as well as techniques for evaluating and critiquing interaction and interface design. We will explore the use of large language models for coding and design generation.

*Project 2: Large Language Objects (LLO)*
Large Language Models (LLM) have shown an unprecedented ability to generate text, images, and code, surpassing in many ways our own human capabilities and promising to have a profound impact on design and creativity. However, while powerful, these new forms of intelligence still remain largely ignorant of the world outside of natural language, lacking knowledge of our objects, bodies and physical environments. In Project 2, we will design physical interfaces for large language models, extending their capabilities and augmenting human experience.

## Learning Objectives

The course is divided into two projects that explore the fundamental skills required in interaction design today.  Content is particularly adapted to provide a foundation and help students situate themselves within a large and rapidly expanding discipline, without the need for an understanding of the complex mathematical ideas behind deep learning. Instead, the focus is placed on developing a practical, hands-on knowledge and intuition for the behavior and capabilities of neural networks, and how they can aid and augment a creative practice.

Upon completion of this course, students should have a firm understanding of:

- The structure and flow of a design project;

- Digital and physical design and prototyping skills (coding, electronics, CAD and digital fabrication);
- Design communication and language;
- Work-like and look-like prototyping strategies;
- Interaction design critique and the role of user feedback in design development;
- Historical context and precedents in human-computer interaction and artificial intelligence;
- Overview of different neural network architectures, what problems they can solve, and their limitations;
- How to augment a design and creative practice with machine intelligence, working in tandem with other computational and traditional modes of creative production.

### Where to Find Things and Communication

General class materials, assignments, resources and grades will be posted on **Canvas**:

https://canvas.mit.edu/courses/31076

General class communication will take place through **Slack**. We will share invitations in the first week of class.

Important communication will take place directly through **email**. Please make sure you include both your instructor and TAs.

Your final project deliverables will be submitted on Google Drive. *(Link to be provided after first class).*

For any remote meetings or office hours, we will use **Zoom**:
https://mit.zoom.us/my/marcelocoelho

*If you post course images to Instagram, tag them with @marcelosco or @designatmit so we can repost.*

### Completion Requirements

Completion of each of the assignments, rigor in process and clarity in presentation, as well as the overall progress of the semester (including attendance) will be fundamental to completing the course.

### Evaluation Criteria and Grading

The following criteria will be used for the evaluation of students' work, both in terms of helping their progress and in final grading.

1. **Thesis:** How clearly is the student articulating the conceptual intentions?
2. **Translation of Thesis:** How well is the student using their thesis to develop a design response to given problems, interests, or ideas?
3. **Appropriateness:** How well matched is their choice of representation and prototyping strategy to convey their intentions?
4. **Quality:** How accomplished are they with drawing, modeling, digital representation, fabrication, etc? To what degree does their product convey what they ought to?
5. **Oral Presentation Skills:** How clearly are they presenting their ideas orally, whether at their desk, in class discussions, or to a more formal jury?
6. **Participation in Discussions:** How actively and how constructively are they involved in class discussions, both formally and informally?
7. **Response to Criticism:** How do they effectively take advantage of criticism from instructors, classmates and outside jurors?
8. **Auto-Critical Skills:** To what extent are they able to critique their own work regularly and effectively?
9. **Attendance:** – see below.

**A: Excellent -** Project surpasses expectations in terms of inventiveness, appropriateness, verbal and visual ability, conceptual rigor, craft, and personal development. Student pursues concepts and techniques above and beyond what is discussed in class.

**B: Above Average -** Project is thorough, well researched, diligently pursued, and successfully completed. Student pursues ideas and suggestions presented in class and puts in effort to resolve required projects. Project is complete on all levels and demonstrates potential for excellence.

**C: Average -** Project meets the minimum requirements. Suggestions made in class are not pursued with dedication or rigor. Project is incomplete in one or more areas.

**D: Poor -** Project is incomplete. Basic skills including graphic skills, model-making skills, verbal clarity or logic of presentation are not level-appropriate. Student does not demonstrate the required design skill and knowledge base.

**F: Failure -** Project is unresolved. Minimum objectives are not met. Performance is not acceptable. This grade will be assigned when you have excessive unexcused absences.

## Grade Distribution

Each of the two projects and class participation will count towards your grade:

| | |
|---|---|
| Project 1: | 30% |
| Project 2: | 50% |
| Participation | 20% |

## Studio Culture

Work in the studio will build sequentially. Therefore, your commitment to incremental development on a daily basis is of paramount importance. The demanding nature and pace of studio courses necessitates your regular attendance and requires that deadlines be consistently met. In addition to lowering your grade, late work will prevent you from following the overall structure of the course.

It is important that you take advantage of the studio environment. Magnification of your development as a designer is made possible by the collective nature of the studio. Group reviews are collective for a reason. Each of you has something to gain from your peers.

Since the studio is a place for all, it necessitates careful attention to the needs of everyone in it. Please see your instructors or TAs if there are any problems that you are unable to resolve on your own.

## Attendance

Attendance for the full duration of each studio is mandatory. **You are allowed 3 excused absences for the semester.** (An excused absence is defined as one that was discussed with and approved by the professor at least 24 hours prior to the date of absence, or a family or medical emergency that is confirmed by your physician or a dean in Student Support Services).

Absences beyond the three allotted will result in a decrease in your final grade. If you miss six or more studio classes, you will be asked to drop the subject or receive a failing grade.

Due to the nature of our current times, we will be accommodating to unforeseen circumstances and will work with you to make sure you can successfully complete the course. Please reach out early and often if you believe you might have trouble completing the course.

## Academic Integrity + Honesty

MIT's expectations and policies regarding academic integrity should be read carefully and adhered to diligently: http://integrity.mit.edu

## Documentation

Students are expected to visually document and post their assignments, research, prototypes, and any pertinent material to the class website. Strategies for visually documenting students'

design work will be presented throughout the semester. You should dedicate a sketchbook exclusively for the class. (Always be ready to sketch and show previous sketches you've made).

### Final Studio Deliverables

Grades will not be posted for students to view on their grade report until their work has been archived. The projects need to be properly prepared and formatted, and delivered to the Archiving TA. Studio TA's will collect project archives from each student following the review. Detailed requirements and instructions for formatting will be communicated with each assignment.

## Contact Information


**Instructor:**
Marcelo Coelho
marceloc@mit.edu

**Teaching Assistant:**
Chenyue Xdd Dai
xdd44@mit.edu

Sergio Mutis
smutis@mit.edu

**MAD Shop and Fabrication:**
Chris Haynes
haynesc@mit.edu

Bill McKenna
wdmc@mit.edu


## Materials/Software List

Please have these materials in studio for every class session so you can sketch and make physical prototypes and mockups:

- Sketchbook, pen, and mechanical pencil
- Ruler with mm and in
- Olfa knife or exacto blade, scissors, and cutting mat
- Masking tape

## Schedule

****** tentative schedule, some things may change***

| Week 1 | Introduction to the Course + Project 1 |
|---|---|
| 02/05 | Introduction to the Course |
| 02/07 | Introduction to Project 1<br>Programming for Interaction |

| | |
|---|---|
| **Week 2** | **Graphical User Interface (GUI)** |
| 02/12 | Individual concept reviews + software prototypes |
| 02/14 | Electronics for Interaction Prototyping<br>Due: Group review of concepts and prototypes (1-slide + prototype) |
| **Week 3** | **Human Interface Device (HID)** |
| 02/19 | Cardboard Prototyping |
| 02/21 | Paper prototypes<br>Due: Group review of GUI + HID device prototype |
| **Week 4** | **Form and User Experience** |
| 02/26 | Human-Computer Interaction and Artificial Intelligence |
| 02/28 | 3D Printing and Laser Cutting<br>Due: Group review of physical mockups and user experience |
| **Week 5** | **Iteration** |
| 03/05 | Documentation How-To<br>Presentation Template |
| 03/07 | Work and Hands-On Documentation Session<br>Due: Project 1 finalized and ready for documentation |
| **Week 6** | **Documentation + Final Presentation Project 1** |
| 03/12 | Individual critique dry run |
| 03/14 | Due: Critique Project 1 + Deliverables |
| **Week 7** | **Introduction Project 2 + Large Language Models** |
| 03/19 | Introduction Project 2<br>Introduction to Large Language Models |
| 03/21 | Individual review of LLM exploration and project concepts |
| **Week 8** | **Spring Break** |
| 03/26 | *No Class* |
| 03/28 | *No Class* |
| **Week 9** | **Concepts + Rapid Prototyping with Machine Learning** |
| 04/02 | Individual review of chosen concept |

| | |
|---|---|
| | Introduction to neural networks and CNN |
| 04/04 | Due: Group critique of final concepts |
| **Week 10** | **Software Prototype** |
| 04/09 | Work Session |
| 04/11 | Work Session<br>Due: Software Prototype |
| **Week 11** | **Hardware Prototype** |
| 04/16 | Work Session |
| 04/18 | Work Session<br>Due: Electronics Prototype |
| **Week 12** | **Form Factor and UX Prototype** |
| 04/23 | Work Session |
| 04/25 | Work Session<br>Due: Form Factor Prototype |
| **Week 13** | **Iteration** |
| 04/30 | Work Session |
| 05/02 | Work Session |
| **Week 14** | **Critique Dry Run and Documentation** |
| 05/07 | Review documentation plans<br>Publishing your work |
| 05/09 | Due: Draft of slides and documentation |
| **Week 16** | **Exam Week** |
| TBD | Final critique for project 2 and documentation collection |