

4.043 / 4.044 Design Studio: Interaction Intelligence
Instructor: Marcelo Coelho
T 7-9, F 2-5

4.043 / 4.044: Design Studio: Interaction Intelligence Spring 2023

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 their own electronics, 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 such as GitHub Copilot, DALL-E, and Midjourney for coding and design generation.

Project 2: Large Language Objects (LLO)

Large Language Models (LLM), such as GPT-4, 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. By exploring how these models work, we will also examine their shortcomings, such as bias, lack of interpretability, computational cost, privacy, and inability to generalize.

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.

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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/25201>

General class communication will take place through **Slack**:

<http://mit-interaction-ai.slack.com>

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

Marcelo Coelho marceloc@mit.edu

Charles Perot Janson cjanson@mit.edu

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.

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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.

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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 done).

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

MAD Shop and Fabrication:

Chris Haynes
haynesc@mit.edu

Teaching Assistant:

Charles Perot Janson
cjanson@mit.edu

Bill McKenna
wcmc@mit.edu

Materials 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
02/06	Introduction to the Course
02/09	Introduction to Project 1 Programming for Interaction
Week 2	Graphical User Interface (GUI)
02/13	Individual concept reviews + software prototypes
02/16	Electronics for Interaction Prototyping Due: Group review of concepts and prototypes (1-slide + prototype)
Week 3	Human Interface Device (HID)
02/20	No Class
02/23	Paper prototypes Due: Group review of GUI + HID device prototype
Week 4	Form and User Experience
02/27	Human-Computer Interaction and Artificial Intelligence
03/01	3D Printing and Laser Cutting Due: Group review of physical mockups and user experience
Week 5	Iteration
03/05	Documentation How-To Presentation Template
03/08	Work and Hands-On Documentation Session Due: Project 1 finalized and ready for documentation
Week 6	Documentation + Final Presentation Project 1
03/12	Individual critique dry run
03/15	Due: Critique Project 1 + Deliverables

Week 7	Introduction Project 2 + Large Language Models
03/19	Introduction Project 2 Introduction to Large Language Models
03/22	Individual review of LLM exploration and project concepts
Week 8	Spring Break
03/26	<i>No Class</i>
03/29	<i>No Class</i>
Week 9	Concepts + Rapid Prototyping with Machine Learning
04/02	Individual review of final concept Introduction to neural networks and CNN
04/05	Due: Group critique of final concepts
Week 10	Software Prototype
04/09	Work Session
04/12	Work Session Due: Software Prototype
Week 11	Hardware Prototype
04/16	Work Session
04/19	Work Session Due: Electronics Prototype
Week 12	Form Factor and UX Prototype
04/23	Work Session
04/26	Work Session Due: Form Factor Prototype
Week 13	Iteration
04/30	Work Session
05/03	Work Session
Week 14	Final Fabrication and Documentation
05/07	Review documentation plans

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05/10 Review footage and early edits

Week 15 Critique Dry Run and Documentation

05/14 Due: Draft of slides and documentation

Week 16 Exam Week

TBD **Final critique for project 2 and documentation collection**