DESIGN ACROSS SCALES & DISCIPLINES

Instructors
Prof. Meejin Yoon  meejin@mit.edu
Prof. Neri Oxman  neri@mit.edu

CLASS TAs  das_tas@mit.edu

LAB TAs
Alexis Sablone  asablone@mit.edu
Alexandros Charidis  charidis@mit.edu
Jessica Jorge  jjorge@mit.edu
Nicolo Guida  nvguida@mit.edu
Markus Kayser
Steve Keating
Jorge Duro-Royo
Laia Mogas-Soldevila
John Klein
Chikara Inamura
Will Patrick
Sunanda Sharma

Schedule
Lectures  Tuesday 10:00 AM – 12:00 PM  E14-633*
Labs  Wednesday 7:00 – 9:00 PM  7-429

*Class and lab locations are subject to change

Website  design-across-scales-and-disciplines
Description

Inspired by Charles and Ray Eames’ canonical Powers of Ten, the course explores the relationship between science and engineering through the lens of Design. It examines how transformations in science and technology have influenced design thinking and vice versa. It offers interdisciplinary tools and methods to represent, model, design and fabricate objects, machines, and systems. Structured as core lectures and lab sessions, the course is organized by “systems”: Design of Data, Design of Matter, Design of Life and Design of Perception. World-renowned designers, scientists and engineers will contribute with guest lectures. We will design things – material and immaterial; we will learn new computational and fabrication tools along the way; we will develop methodologies for design research of interdisciplinary problems; we will practice what it means to think, live, and breathe Design.

The course creates a new pedagogical paradigm for education, which cuts across various disciplines and scales to demonstrate that design is not a discipline but a way of looking at the world that promotes the synthesis of interdisciplinary knowledge across scales in order to create objects and systems for the greater good. This is partly due to the fact that such challenges – such as the race to cure cancer, the mars landing mission and the challenge to design sustainable cities and buildings – require, perhaps more than ever, an interdisciplinary skill set and an ability to operate across multiple scales with creativity.

The history of design innovation provides endless examples of cross-disciplinary individuals and innovations. Buckminster Fuller, for instance, was a designer, a futurist, an inventor, an author and a systems theorist. His designs based on the geodesic dome has inspired not only generations of designers, architects, engineers and urban planners but also chemists, material scientists and physicists who were inspired by his representation of the physical world. Charles and Ray Eames were mid-century American designers working at a range of scales and in a variety of media, from furniture and military aircraft parts to films and exhibitions. Their experiments in design fabrication, and cultural media are a useful reference for design education today. An example of the value of learning across disciplines today is found in Siddhartha Mukherjee’s book, Emperor of All Maladies: a Biography of Cancer, which tells the story of how the process of inventing cell dyes to trace the growth of cancerous tissues was actually inspired by textile design.

Design has expanded to include a broad range of scales and disciplines, shifting from the production of objects to the design of experiences, data, networks, territories, and social frameworks. Designers are no longer exclusively committed to design autonomous objects (buildings, cars, furniture and household products), but rather are conceiving and testing whole ecologies of design experiences (robotic construction systems, transportation systems, health care experiences, water distribution, and clean energy). This has prompted Tim Brown, CEO of the design consultancy firm IDEO to state, “Design is too important to be left to designers.” The scope of design ecologies is so broad and so integrated with other disciplines that traditionally trained designers are ill equipped to tackle the new breadth of design tasks at hand. Interdisciplinary teams must work together to design the systems, experiences, environments and futures for our increasingly complex world.

Design Across Scales, Disciplines and Problem Contexts responds to this challenge by creating a course that is not a traditional design course for designers, but a design course about culture, science and technology to serve as a foundation for all students regardless of major.

Requirements

In addition to the one lecture per week by instructors and guest speakers, one lab session per week will be given. This lab session is mandatory for those who are not familiar with the tools per session, and are optional for those who are familiar with the tools being taught. The readings are highly recommended, particularly for Graduate Students, but not required. Each student is expected to attend all lectures, be fully prepared for lab sessions, and spend 4-6 hours per week on assignment tutorials and projects.
Assignments

For Undergraduates, the final grade is distributed as follows: Assignment 1: 25%, Assignment 2: 25%, and Class participation: 50%. For Graduate students, the final grade is distributed as follows: Assignment 1: 25%, Assignment 2: 25%, Assignment 3: 25%, and Class participation: 25%. Attendance will be taken at lectures only.

Schedule

____________________________________________________________________________________

DESIGNING ACROSS SCALES

____________________________________________________________________________________

February 3 Tues LECTURE 1: DESIGN ACROSS SCALES INTRODUCTION
Prof. Meejin Yoon and Prof. Neri Oxman

Recommended Readings:

February 4 Wed NO LAB. TAs to discuss course admission.

February 10 Tues LECTURE 2: DESIGN ACROSS SCALES IN PRACTICE
Prof. Meejin Yoon and Prof. Neri Oxman

Issue Assignment 1: Design a Representational System

February 11 Wed LAB 1: DOCUMENTATION
Video and Image Capture, Video Editing, Image Processing and Illustration
Lab Gurus: Steve, Markus, John
Location: Long lounge (7-429)
Tools: Final Cut X - Video Editing; Adobe Photoshop - Image Processing; Adobe Illustrator - Vector Drawing.

___________________________________________________________________________

DESIGNING DATA

____________________________________________________________________________________

February 17 Tues NO CLASS (MIT Monday schedule of classes)

February 18 Wed LAB 2: CAD TOOLS
Lab Gurus: John, Chikara, Will
February 24  Tues  LECTURE 3: DESIGN OF REPRESENTATION  
Notation, Information and Communication  
Prof. Meejin Yoon and Prof. Neri Oxman  
Prof. Cesar Hidalgo, Macro Connections Group at Media Lab  

Recommended Readings:  

February 25  Wed  LAB 3: Data Processing and Visualization  
Lab Gurus: Jorge, Laia, Alex  
Location: Long lounge (7-429)  
Tools for Processing: Data Stream, Sound Input/Outputs, and Visualization  

March 3  Tues  LECTURE 4: DESIGN OF DATA  
Computation, Visualization, and Big Data  
Proposed guest lecturer: Jer Thorp  
Ben Fry, Fathom (co-developer of Processing)  

Recommended Readings:  

March 4  Wed  LAB 4: Design Development Crit for Assignment #1  
Location: Long lounge (7-429)  

DESIGNING INNOVATION  

March 10  Tues  CLASS PRESENTATIONS: ASSIGNMENT 1 DUE  

March 11  Wed  LAB 5: Fabrication Workshop 1  
Lab Gurus: John, Chikara, Will  
Location: Long lounge (7-429)  
Subtractive Fabrication Tools: Laser Cutting, 3D Printing, File Set-Up & Exchange, Demo  

March 17  Tues  LECTURE 5: DESIGN OF INNOVATION  
Concept to Commerce  
Proposed guest lecturer: Lee Moreau, Principal of Continuum
Recommended Readings:

Issue Assignment 2: “Re-Design the Wheel”

March 18 Wed LAB 6: Fabrication Workshop 2
Lab Gurus: Will, Steve
Location: Long lounge (7-429)
Additive Fabrication Tools: Additive Manufacturing, Molding, Casting

March 24 Tues Spring Break (no class)

March 25 Wed Spring Break (no lab)

DESIGNING LIFE

March 31 Tues LECTURE 6: Designing with DNA
Neri Oxman with Steven Keating and Will Patrick
Introduction to the Synbiota team
With David Sun Kong, Ph.D., Technical Staff, MIT Lincoln Laboratory

April 1 Wed LAB 7 - SYNBIOTA SESSION 1: Programmable Bacteria
Lab Gurus: David Kong, Sunanda
Location: 68-074
DNA Design: Concepts, Methods, Tools and Example Applications
*This lab session will be 7-10 pm

April 7 Tues LECTURE 7: Designing with DNA
Proposed Guest Lecture:
David Sun Kong, Ph.D., Technical Staff, MIT Lincoln Laboratory
Tal Danino, Postdoctoral Fellow, Bhatia Lab, MIT

April 8 Wed LAB 8 - SYNBIOTA SESSION 2: Programmable Bacteria
Lab Gurus: David Kong, Sunanda & Chem TAs
Location: 68-074
DNA Design: Concepts, Methods, Tools and Example Applications
*This lab session will be 7-10 pm

April 14 Tues LECTURE 8: MEMBERS WEEK
Proposed guest lecturer:
John Snavely
April 15  Wed  **Brainstorming Session for Assignment 2 – work in groups**  
(Non-obligatory for ML students during sponsor week)  
*Lab Gurus: Architecture TAs*  
*Location: Long Lounge (7-429)*

April 21  Tues  **Patriots Day Holiday – No Class**

April 22  Wed  **Lab 9: Arduino Kits**  
*Lab Gurus: Will, Steve*  
*Location: Long lounge (7-429)*

____________________________________________________________________________________

**Designing Across Disciplines**

____________________________________________________________________________________

April 28  Tues  **Lecture 9: Designing Across Disciplines**  
Proposed guest lecturer:  
David Edwards, Director, Le Laboratoire  
Skylar Tibbitts  

*Grad Assignment Due (Designing Life with David Kong)*

April 29  Wed  **Lab 10: Design Development Crit for Assignment #2**  
*Location: Long lounge (7-429)*

May 5  Tues  **Lecture 10: Design as Research**  
Prof. Meejin Yoon and Prof. Neri Oxman  

Recommended Readings:  
TBD

May 6  Wed  **Lab 11: Design Development Crit for Assignment #2**  
*Location: Long lounge (7-429)*

*May 12  Tues  **Assignment 2 Due** - Class Presentations  
Redesign the Wheel*

*Changes to the schedule, if necessary, will be announced via email.*  
*Supplemental graduate student assignment due date will be determined in advance of the due date.*