Design Across Scales and Disciplines
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4.110 | 4.111 | MAS.S66

Spring 2026

2 2 8 Units

Instructors
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Schedule
Lecture: T 3-5
Recitation: W 7-9

Location
N52-337

COURSE DESCRIPTION

From nano materials to bodies, cities and outer space, this course explores design as a practice that moves across systems and disciplines to address present-day challenges. Inspired by Charles and Ray Eames' *Powers of Ten*, students investigate how matter, information, and intelligence behave at different scales—and how design, enhanced by computational tools, fabrication, and critical inquiry, serves as common ground between them.

Students will investigate how matter, information, energy, and form behave differently across scales, and how these differences demand new ways of seeing, modeling, fabricating, and intervening. Through hands-on experimentation and interdisciplinary

methods, the course introduces computational tools, fabrication techniques, and conceptual frameworks that connect materials, machines, bodies, and environments.

Rather than treating design as a fixed discipline, the course positions it as a translational practice, one that bridges engineering, science, art, and the humanities to address complex, multi-scalar problems. The course aims to develop design research methodologies for working across disciplines and scales, equipping students to navigate and design within interconnected systems, from micro-material behaviors to spatial, social, and urban dynamics.

COURSE OUTCOME

The course is structured as a weekly lecture and a lab session. An exciting lineup of guest speakers, artists, and practitioners will expose students to a wide range of ideas, practices, and methodologies across design, art, and technology.

Through three short projects, the course will expose students to different aspects and takes on design process. The course is supplemented by a series of hands-on tutorials led by TAs, covering computational design, material computation, and digital fabrication techniques.

Mini project 1:

Design–Where do we begin? This first project prompts an introduction to the main ideas of the course. Accompanied by lectures and guest presentations, it sets us off to think about the world around us and to wonder *what makes good design?* Students will observe, document, and analyze a design feature, object or system found in their surroundings. This chosen *Object of Design* will be the starting point for fast-paced research, analysis, speculation and invention. The project will ask students to conceptualize, abstract, represent and communicate ideas to an audience, while exploring synergies across scales and fields of expertise.

Mini Project 2:

This mini project unfolds alongside lectures on material intelligence, material computation, material expressivity, and design methodologies, inviting students to explore how matter, forces, and form interact to produce emergent behaviors across scales. Drawing from bio-inspired design, computational design, and material computation, students will experiment with material systems that move, adapt, or self-organize, whether through physical forces, biological processes, or computational logic. Students are encouraged to approach material research as an ecological and bioregional practice, exploring material intelligence embedded in place and rethinking

waste as a resource. The project frames materials not as passive substrates, but as active participants in design, culminating in a material-driven experiment or prototype.

Students are encouraged to work with locally sourced materials and phenomena, including:

- Biological systems: swarms, collective behavior (eg. slime mold problem-solving, collective intelligence (ants, bees))
- Oceanic systems: fluid dynamics, turbulence
- Non-biological systems: elastic or compliant materials (tensile structures), rocks, sand, granular matter

Mini Project 3:
If the first project asked us to investigate the legacy of human-made objects, and the second project focused on the material intelligence of the natural world, the third and final project turns our attention to the social aspects of design and its potential for impact.

This mini project invites students to use design as a critical and speculative tool to interrogate collective, cultural, and technological systems. Drawing from design fiction, critical design, and interrogative design, students will explore how design can provoke reflection, reveal hidden assumptions, and imagine alternative futures. Rather than solving a problem, the project asks students to frame a question—about power, technology, identity, AI, or social systems—and materialize it through a speculative design. The outcome should prompt dialogue about the implications of design in shaping collective life.

LEARNING OBJECTIVES

- Gain knowledge about the state-of-the art of design and its applications across different fields
- Understand the notions, challenges and opportunities of designing across scales: from material and bodily systems to spatial and environmental contexts.
- Gain inspiration from a host of expert designers, and experiment firsthand with interdisciplinary design techniques, such as collaboration, speculation, critique, and interrogation.
- Translate abstract concepts, such as emergence, swarm behavior, and AI-driven systems, into tangible prototypes and material experiments.
- Gain understanding about thedesign process, and develop design research skills, including documentation, reflection, and critical analysis of process and outcome.

- Collaborate with peers from across MIT departments, integrating perspectives from design, engineering, science, and the humanities.
- Communicate design ideas effectively through visual, physical, and narrative forms.

GRADING BREAKDOWN

Mini Project 1	15%
Mini Project 2	15%
Final Project	40%
Crit Sessions	10%
Attendance & Participation	20%

ATTENDANCE POLICY

Attendance and participation in both lectures and lab sessions is a fundamental part of this course. Incurring in more than three total absences without prior notice to instructors may affect the final grade.

METHODS OF PRESENTATION

Lectures, demos and tutorials, in-class collaboration, group discussion, presentations and crit sessions.

METHODS OF COMMUNICATION

Course syllabus, emails, assignments and messages will be available on 'Canvas'. For additional consultation, contact instructors via email to make an appointment.

ACCESSIBILITY, ACCOMMODATIONS, BASIC NEEDS

In line with the values and principles explored in this course, the instructor is committed to creating an inclusive, respectful, and accessible learning environment for all students.

If there are aspects of the instruction, classroom environment, or course design that result in barriers to your inclusion, assessment, or achievement, please notify the instructor as soon as possible. We will work together—and with the appropriate MIT offices as needed—to ensure that your needs are supported.

DISABILITY AND ACCESS SERVICES (DAS)

Students who require accommodations are encouraged to connect with MIT Disability and Access Services (DAS):

- Building 5, Room 104
- Phone: 617-253-1674
- Website: https://studentlife.mit.edu/das

Ombuds Office

Students experiencing conflict that affects their educational environment may contact

the MIT Ombuds Office, a neutral and confidential resource for all members of the MIT community:

- Building 10, Room 213
- Phone: 617-253-5921
- Website: https://ombudsoffice.mit.edu

Institute Discrimination and Harassment Response Office (IDHR)
For concerns related to discrimination or harassment on the basis of age, sex, race, religion, national origin, disability, sexual orientation, or other protected categories, students may contact:

- IDHR, Building W31
- Phone: 617-715-4080
- Website: https://idhr.mit.edu
- Email: IDHR@mit.edu

IDHR ensures a learning and working environment free from all forms of discrimination, harassment (including sexual harassment and violence), and offers prevention resources, reporting support, and investigations of formal complaints.

Student Support Services
For students facing challenges related to food, housing, or other basic needs, or those seeking general guidance in navigating MIT:

- **Undergraduate students**: Contact Student Support Services (S3)
  - Building 5, Room 104
  - Phone: 617-253-4861
  - Website: https://studentlife.mit.edu/s3
- **Graduate students**: Contact the Office of Graduate Education (OGE)
  - Website: https://oge.mit.edu

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Reading List:

- **Mini project 1:**
  - **"13 Ways of Looking: Jenny Odell | Broadcast."** *13 Ways of* Looking: Jenny Odell | Broadcast, Accessed 2 Feb. 2025.
  - **Powers of TenTM (1977).** Directed by Eames Office, 2010. YouTube.
  - **Waldman, Katy. "**When the World Isn't Designed for Our Bodies." The New Yorker, 3 Sept. 2020. Page Turner. www.newyorker.com.
  - **"When Did Design Stop Being 'Multidisciplinary?'"** Eye on Design, 19 Oct. 2020.
  - "Chapter 20-21." *Spacesuit: Fashioning Apollo*, by Nicholas De Monchaux, MIT Press, 2011.

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- **Mini project 2:**
  - **DeLanda, Manuel.** *A New Philosophy of Society: Assemblage Theory and Social Complexity.* Continuum, 2006.
  - **DeLanda, Manuel.** *Material Expressivity.*
  - **Bratton, Benjamin H.** *Outing Artificial Intelligence: Reckoning with Turing.* MIT Press, 2021.
  - **Jane Bennett,** Vibrant Matter: A Political Ecology of Things (Durham: Duke University Press, 2010).
- **Mini project 3:**
  - **Dunne, Anthony.** *Hertzian Tales: Electronic Products, Aesthetic Experience, and Critical Design.* MIT Press, 2005.
  - **Bronner, Stephen Eric.** *Critical Theory: A Very Short Introduction.* Oxford University Press, 2011.
  - **Kellner, Douglas.** "New Technologies and Alienation: Some Critical Reflections." 1999.
  - **McLuhan, Marshall.** *The Medium Is the Message.* Penguin, 1967.
  - **Wodiczko, Krzysztof.** *The Inner Public: Art and the Crisis of the Common Good.* Sternberg Press, 2020.
  - **Wodiczko, Krzysztof.** *Cultural Prosthetics.* University of Minnesota Press, 2020.
  - **Jones, Amelia.** *Identification and the Visual Arts.* Routledge, 2012.