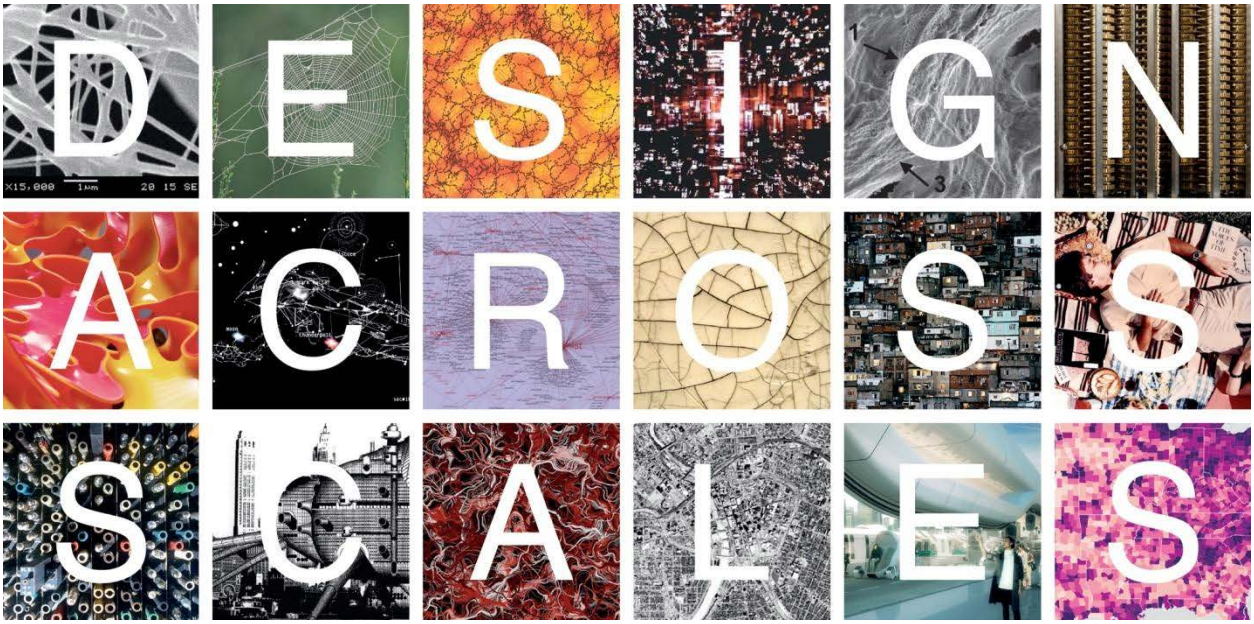
DESIGN ACROSS SCALES & DISCIPLINES

Graduate number: **MAS.650**
Undergraduate (joint subject) number**: 4.110**
Prereq: None
U (Spring)
2-2-8HASS-A (12 units)



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Schedule	Lectures	Tuesday 10:00 AM – 12:00 PM	Room E14-633
	Crit A, B, and C	Wednesday 7:00 PM – 8:00 PM	Room 9-217, 9-450,
	Crit D, E, and F	Wednesday 8:00 PM – 9:00 PM	and 9-450a

*Class locations are subject to change. Announcements will be made via email.

TA Office Hours Sunday 12:00 PM – 2:00 PM
Monday 7:00 PM – 9:00 PM

Website http://stellar.mit.edu/S/course/MAS/sp18/MAS.650-4.110/

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 thematically with topics such as information design, user interaction, digital fabrication, and design ethics.

The course creates a new pedagogical paradigm for learning and education, which cuts across various disciplines and scales to demonstrate that design is not a discipline, but a way of looking at the world; one 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 big, real-world 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 skillset combined with an ability to operate across multiple scales with creativity.

The history of design innovation provides endless examples of cross-disciplinary innovations and individuals. Buckminster Fuller, for instance, was a designer, a futurist, an inventor, an author and a systems theorist. His designs based on the geodesic dome have 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 provide significant references 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 all disciplines benefit from design inquiry and methods to tackle the new breadth of design problems at hand. Interdisciplinary teams must work together to design the systems, experiences, environments and futures for our increasingly complex world. *Design Across Scales* 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 serving as a foundation course for all students regardless of their major.

Requirements

In addition to the one lecture per week by the instructor and guest lecturers, one lab session (a.k.a. crit) per week will be given. This crit session is required and will be used for seminar-style discussions on lecture topics, design critiques, and an offering of optional design skill tutorials. The readings are highly recommended, for all students and required for graduate students. Each student is expected to attend all lectures, be fully prepared for the crit sessions, and spend 2-3 hours per week on assignment tutorials and projects.

Assignments

For Undergraduates, the final grade is distributed as follows: (1) Weekly Assignments completed for each Crit: 20%; (2) class attendance: 20%, (3) Crit participation: 20%, (4) Project Assignment (Total- 40%- broken down into Concept Design (10%), Design Development (10%) and Final Presentation: 20%.
For Graduate students, the final grade is distributed as follows: (1) Weekly Assignments completed for each Crit: 15%; (2) class attendance: 15%, (3) Crit participation: 15%, (4) Project Assignment (Total- 40%- broken down into Concept Design (10%), Design Development (10%) and Final Presentation: 20%. (5) Additional Graduate Assignment 15%.
Attendance will be taken at lectures and at crit sessions.

February 6	Tues	**LECTURE 1: DESIGN ACROSS SCALES - INTRODUCTION** **Prof. Meejin Yoon** **Prof. Neri Oxman** Recommended Readings: *Morrison, Philip, and Phyllis Morrison. Powers of Ten: A Book About the Relative Size of Things in the Universe and the Effect of Adding Another Zero. Redding, Conn: Scientific American Library, 1982.* *Brown, Tim. "Chapter One: Getting Under Your Skin." Change by Design. New York: Harper Business, 2009.*
February 7	Weds	**NO CLASS** Course enrollment application due by 5:00 PM.
February 13	Tues	**LECTURE 2: DESIGN AND RESEARCH** **Prof. Neri Oxman** Recommended Readings: *Paola Antonelli, et. al., Design and the Elastic Mind. New York: Museum of Modern Art; London: Thames & Hudson, 2008.* *Neri Oxman. "Age of Entanglement." 2016.*
February 14	Weds	Crit Session
February 19	Mons	*No TA office hours (President's Day)*
February 20	Tues	**NO CLASS** (MIT Monday schedule due to President's Day). **Concept Design 5:00 PM submission due.**
February 21	Weds	**Assignement 1 Concept Design critique, Group 1**
February 27	Tues	**LECTURE 3: DESIGN AND PRACTICE** **Prof. Meejin Yoon** Recommended Readings: *Neuhart, John and Marilyn. Eames Design. New York: H.N. Abrams, 1989.* *Mau, Bruce, and Jennifer Leonard. Massive Change. London: Phaidon, 2004.* *McDonough, William, and Michael Braungart. Cradle to Cradle: Remaking the Way We Make Things. New York: North Point Press, 2002.*

February 28 Weds **Assignment 1 Concept Design critique, Group 2**

March 6 Tues **LECTURE 4: DESIGN THROUGH AGENCY**
Increasing the Power of Design through Agency
Prof. Allan Chochinov
SVA MFA in Products of Design Program
Chair and Co-Founder, Core 77
Recommended Readings:
Choose from some of the following:
https://medium.com/@chochinov/top-reads-of-2017-8a7691f73586

March 7 Weds Crit Session

March 13 Tues **LECTURE 5: DESIGN OF INTERFACES**
Notation, Information and Communication
John Snavely
Principal Design Manager, XBox
Recommended Readings:
Ackermann, Edith. Experiences of Artifacts, in Key Works on Radical Constructivism. Sense Publishers, 2007.
Chiang, Ted. The Lifecycle of Software Objects, 2010.
Lackoff, George and Mark Johnson, Chapter 4: Orientational Metaphors of Metaphors We Live By, 1980.
Moggridge, Bill. Designing Interactions. MIT Press, 2007.
Norman, Donald. Natural User Interfaces are Not Natural, in ACM Computer Human Interaction; 17(3), 2010.

March 14 Weds Crit Session

March 20 Tues **LECTURE 6: DESIGN OF REPRESENTATION**
Prof. Meejin Yoon
Prof. Neri Oxman
Recommended Readings
Steele, Julie and Iliinsky, Noah P. N. Chapters 2 and 12. Beautiful Visualization: Looking at Data Through the Eyes of Experts. Sepastopol, CA: O'Reilly, 2010.
Tufte, Edward. "Introduction." Envisioning Information. Cheshire, Conn.: Graphic Press, 1990.
McLuhan, Marshall. "The Medium is the Message". Understanding Media: The Extensions of Man. New York: Signet, 1964.

March 21 Weds Mid-review with Prof. Meejin Yoon and Prof. Neri Oxman, 7-10 PM

March 27 Tues **Spring Break (no class)**

April 3 Tues **LECTURE 7: DESIGN OF DISCOVERY**
3D Fabrication of Biologically Inspired Structures

James Weaver
Senior Research Scientist
Hansjorg Wyss Institute for Biologically Inspired Engineering, Harvard University
Recommended Readings
James Weaver et al. "Hierarchical assembly of the siliceous skeletal lattice of the hexactinellid sponge Euplectella aspergillum." Journal of Structural Biology 158 (2007) 93–106.
Ali Miserez et al. "Effects of Laminate Architecture on Fracture Resistance of Sponge Biosilica: Lessons from Nature." Advanced Functional Materials 2008, 18, 1–8.
Li Wen et al. "Biomimetic shark skin: design, fabrication and hydrodynamic function." The Journal of Experimental Biology (2014) 217.
Nicholas W. Bartlett et al. "A 3D-printed, functionally graded soft robot powered by combustion." SCIENCE 10 JULY 2015 • VOL 349 ISSUE 6244.

April 4 Weds Crit Session

April 10 Tues **LECTURE 8: DESIGN OF LIFE**
David Sun Kong
Technical Staff, MIT Lincoln Laboratory
Recommended Readings:
Gaymon Bennett, "Nature Natured and Nature Denatured," Synthetic Future: Can We Create What We Want Out of Synthetic Biology?, special report, Hastings Center Report 44, no. 6 (2014): S38-S39
Endy, Drew. "Foundations for engineering biology." Nature 438, 449-453.
Ginsberg, DA, et al. "Synthetic Aesthetics." MIT Press, 2014.

April 11 Weds **Assignment 2 Design Development critique, Group 1**

April 17 Tues **PATRIOTS DAY HOLIDAY – NO CLASS**

April 18 Weds Assignment 2 Design Development critique, Group 2

April 24 Tues **LECTURE 9: DESIGN OF SYSTEMS**
SENSEable Cities
Carlo Ratti
Professor of Urban Technologies and Planning
Director, SENSEable City Lab, MIT
Recommended Readings:
Ratti, Carlo and Claudel, Matthew. Open Source Architecture. London: Thames & Hudson, 2015.
Offenhuber, Dietmar and Ratti, Carlo. Decoding the City: Urbanism in the Age of Big Data. Basel: Birkhauser Verlag, 2014.
Ratti, Carlo and Claudel, Matthew. The City of Tomorrow: Sensors, Networks, Hackers, and the Future of Urban Life. New Haven, London: Yale University Press, 2016.

April 25 Weds Crit Session

May 1 Tues **LECTURE 10: DESIGN OF EXPERIENCE**

Lee Moreau
Principal, Continuum
Recommended Readings:
Weinschenk, Susan. 100 Things Every Designer Needs to Know About People. Berkley: New Readers, 2011
Dubberly, Hugh. "Dubberly Design Process." Dubberly Design Office, 2005. http://www.dubberly.com/articles/how-do-you-design.html
Schneider, Jakobs and Stickdorn Marc. This is Service Design, http://thisisservicedesignthinking.com/
Rock, Michael, "F#k Content." 2x4, 2009. http://2x4.org/ideas/2/fuck-content/*

May 2	Weds	Crit Session
May 8	Tues	**LECTURE 11: DESIGN FOR HUMANITY** **Connectivity as a Human Right** **Nicholas Negroponte** Co-Founder, MIT Media Lab Recommended Readings: *Nicholas Negroponte. Nicholas Negroponte. Boston Review v35 no6, 2010.* *Aaron Watson. "Future Perfect." Acuity, 2016.* *Cooper-Hewitt. "Design for the other 90%." Washington, DC: Smithsonian Organization, 2007.*
May 9	Weds	Crit session
May 15	Tues	**Powers of Ten Final Review**
May 16	Weds	**NO CLASS**

* 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.