4.021 How to Design Spring 2024

Level: U.G.

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Schedule: MW 2:00 p.m. – 5:00 p.m.

Location: 7-434

Units: 3-3-6 HASS-A

Pre-Requisite: None

Class Overview: 4.021 How to Design introduces fundamental design principles as a way of demystifying design and providing a basic introduction to all aspects of the design process. Through lectures and exercises, students will develop skills of creativity, abstract thinking, representation, iteration, and design development. 4.021 is an introductory class intended for students without a design background, geared towards enabling more effective collaboration with designers, and the ability to apply foundational principles of design to any discipline. Limited to 26; preference to Course 4 and 4B majors/minors, first- and second-year students.

The Design Process: Each week the class will explore aspects of the design process from concepts to drawing, making, iterating, building a narrative, and finally presenting. This path exemplifies a traditional design process where a designer starts with an idea and works through testing, expanding, refining, and eventually realizing their idea for review and evaluation. Through weekly topics and assignments, students will develop a variety of design skills relating to each stage of the design path.

Learning Objectives: The course consists of three projects exploring various topics through concepts, drawings, and physical fabrication. Students should be able to engage with an increasing level of design research through iterative studies and move fluidly between different modes and scales of operation. Conventions of design representation and communication through drawing and modeling will be explored. Students will need to demonstrate the basic application of design skills, an understanding of conventions, and an ability to sustain an increasing level of research in the projects over the semester.

Exercise 1: Drawing

In conceptual art, the idea or the concept is the most important aspect of the work. When an artist uses a conceptual form of art, it means that all of the planning and decisions are made beforehand, and the execution is a perfunctory affair. The idea becomes a machine that makes the art...It is usually free from the dependence on the skill of the artist as a craftsman.” Sol LeWitt, *Paragraphs on Conceptual Art*, Artforum, V/10, Summer 1967,

The first assignment is to develop a drawing that features a concept, rules, and iteration, three elements that are essential to design, and that we will explore in various ways throughout the semester. You will invent a drawing method by developing a series of rules that govern the making of your drawing.

Starting with a geometric primitive, module, or mark on the page (i.e. point, line, plane, curve, etc.), develop rules for transforming or repeating this initial primitive, module, or mark (e.g. move, rotation, reflection, scale, deformation, etc.).

Expand from a starting point to the rest of the drawing area. Apply your rules to a drawing consisting of at least 100 geometric primitives or marks on a page.

Drawing Requirements:
• A clear concept/intention/thesis about a geometric primitive, module, or mark, rules for transforming or repeating your primitive, module, or mark, to divide or develop the space of the paper/page.
• Temporal components of the drawing/making mechanics (human or other) must be evident both in the drawing and in the collection of supporting documentation.

Possible Drawing Strategies:
• A secondary tool, template(s), drawing machine, masking
• A surface to place under the drawing paper or texture
• Color as both a concept and an implementation of theory
• A method of physical manipulation: crease, fold, erase, score, etc.
• A system of measurement and/or a custom measurement tool
• Modules and a modular support/deployment system

Schedule: Process & Iteration (2 weeks or 4 class periods)

02.05.24 (m)
Presentation: Class Introduction + Exercise 1: Precedents & References
Assignment: Develop rules/procedures for your drawing and make the first drawing that executes your rules. Bring your drawing to studio.

02.07.24 (w)
Presentation: Introduction to 2D Rhino
Assignment: Make a second drawing based on the feedback you received in class from faculty and TAs. You can either modify your rules or keep the same rules and modify your implementation of the rules. Type up your rules. Take a time-lapse video on your phone of you working on/completing your drawing. Bring your drawing, rules, and time-lapse video to studio.

02.12.24 (m)
Assignment: Make a final drawing based on feedback you received in class from faculty and TAs. You can either modify your rules or keep the same rules and modify your implementation of the rules. Take a time-lapse video of you working on/completing your final drawing with your phone. Upload images of your precedents, drawings, rules, and time-lapse videos to the provided Google Slides.

02.14.24 (w)
Presentation: Using your prepared Google Slides, present to your classmates, faculty & TAs images of your precedents, drawings, rules, and time-lapse videos of you working on/completing your rule-based drawing.

Exercise 2: Physics Fabricator

1. Select a physics/science phenomenon or engineering principle you're interested in exploring. Explain your selected phenomena or engineering principle to faculty, TAs, and your classmates' using photographs, videos, sketches, and/or text (Examples of phenomena or principals include pendulums, waves, hysteresis, Maxwell's demons, gravity, magnetism, etc.)

2. Describe using sketches, models, and text how you might fabricate, using paper-based media, a device to measure your proposed/selected phenomena or principle.

3. Fabricate using paper-based media a device to measure your proposed/selected phenomena or principle.

Schedule: Process & Iteration (5 weeks or 10 class periods)
(Note: Progress in studio is a process. Work in the classroom and between classes is cumulative. Instructors and Teaching Assistants will review your work during studio providing you with feedback which you will incorporate into a revised or final version of your project for the next class. Iteration is a key condition of effective design. Make, critique, and repeat, as many times as possible for best results.)

02.20.24 (t)
Assignment: Discuss with faculty and/or TAs, using photographs, video, text, and/or diagrams, initial thoughts about your selected phenomenon or principle.

02.21.24 (w)
Assignment: Present to faculty and/or TAs photographs, video, text, and diagrams that describe your selected phenomenon or principle. Present your initial concepts (sketches & text) for making a paper-based phenomenon/phenomenon measurement device including a proposed fabrication process.

02.26.24 (m)
Presentation: Introduction to Rhino 3d
Assignment: Further refine your concept & draw your concept diagram in Rhino. Continue working with paper, experiment with paper, and start to understand how you can manipulate different paper-based products to produce certain effects, textures, and performances, and how that can inform your fabrication process & concept.

02.28.24 (w)
Presentation: Introduction to Adobe Illustrator
Assignment: Present a digital drawing of your concept diagram (Rhino). Start to use your proposed fabrication process and experiment with various paper products to understand their formal possibilities. Update your concept based on what you learn.

03.04.24 (m)
Assignment: Use your new fabrication process and experiments with paper products to understand the paper product's formal possibilities. Update your concept and fabrication technique(s) based on what you learn about your paper/paper products. Prepare a presentation using the provided Google Slide template including precedent images, concept diagram(s), vector drawing(s) of your proposed measurement device, small-scale physical model(s) of your measurement device, and a time-lapse video of your process.

03.06.24 (w)
Presentation: Student Presentations/Mid-Project Review

03.11.24 (m)
Assignment: Update the diagrams/drawings/concepts based on Mid-Project Review feedback. Prepare a sketch/diagram of what you will do for your final measurement device. Begin the process of fabricating your full-scale paper model of your measurement device.

03.13.24 (w)
Presentation: Project Photography
Assignment: Continue the fabrication process of your full-scale paper measurement device. Begin preparing a final presentation using the provided Google Slide template including precedent images, concept diagram(s), vector drawing(s) of your measurement device, full-scale physical/operable model of your measurement device, and a time-lapse video of your process.

03.18.24 (m)
Assignment: Complete the fabrication of your full-scale paper model of your measurement device. Finalize your presentation using the provided Google Slide template including precedent images, concept diagram(s), vector drawing(s) of your measurement device, full-scale physical/operable model of your measurement device, and a time-lapse video of your process.

03.20.24 (w)
Presentation: Final Project Presentation.

03.25.24 (m)
Spring Break

03.27.24 (w)
Spring Break

Exercise 3: Occupying, Dialoguing with, and/or Modifying our Experience of Vertical Space (Note: Details of This Assignment Subject to Change)

The Tower of Babel, Pyramids, Frank Lloyd Wright's Mile High Skyscraper, Watt's Towers, Airplanes, Space Stations, Space Ships…for thousands of years humans have been devising ways to get vertical, rise above the Earth's surface, defy gravity, and/or maximize the density of limited surface area using a minimum of materials (think high-rise office/residential towers and/or monuments).

ISRU (*In-Situ Resource Utilization*) is the idea that we must harness the local natural resources, instead of importing all needed supplies. It is NASA's preferred method to enhance the capabilities of human exploration into space. Earth, however, is changing. It is no longer a place where resources should be viewed as unlimited. In a waning era of mass production and planned obsolescence, we must now position the objects we make as more than single-use or single-purpose.

The processes and pathways of design are not hard and fast but are instead slippery, branching, and circuitous. Design methodologies must remain loose and adaptable to circumstances, subject matter, and contexts. To illustrate this, we are going to take head on the concept of adaptation.

Repurpose-Reuse-Reconfiguration

We'll start by analyzing an object, building, and/or method of occupying, navigating, altering, sharing, or experiencing vertical space. In the spirit of ISRU (*In-Situ Resource Utilization*) you'll be asked to harvest, parts, pieces, or methods from mechanical, structural, and/or aeronautical devices to produce a maximally vertical and materially minimal structure or device. Ideally, your vertical structure or device will be unsupported, self-supporting, or minimally supported. You are encouraged to work in small teams of 2 or 3, but individual projects are also possible

Schedule: Process & Iteration (7 weeks or 13 class periods)
(Note: Progress in studio is a process. Work in the classroom and between classes is cumulative. Instructors and Teaching Assistants will review your work during studio providing you with feedback which you will incorporate into a revised or final version of your project for the next class. Iteration is a key condition of effective design. Make, critique, and repeat, as many times as possible for best results.)

04.01.24 (m)
Presentation: Introduction to Exercise 3
Assignment: Research and document the history of methods and devices that have been used to get vertical, rise above the Earth's surface, defy gravity, and/or maximize the density of limited surface area using a minimum of materials.

04.03.24 (w)
Assignment: Desk critiques of research and precedent studies

04.08.24 (m)
Assignment: Presentation & Narrative: Concept & context desk critiques

04.10.24 (w)
Assignment: Presentation & Narrative: Concept, material, and fabrication method desk critiques

04.15.24 (m)
No Class Patriots Day

04.17.24 (w)
Assignment: Iterate: Concept, material, and fabrication method desk critiques

04.22.24 (m)
Assignment: Iterate: Concept, material, and fabrication method desk critiques

04.24.24 (w)
Assignment: Make: Mockup and scale model evaluations and desk critiques

04.29.24 (m)
Assignment: Exercise 3 Interim Review. Prepare your presentation using the provided Google Slide template including precedent images, concept diagram(s), vector drawing(s) of your project, scale physical/operable model, and a time-lapse video of your proposed fabrication and assembly process

05.01.24 (w)
Assignment: Proposed modifications and/or changes to your project based on Interim Project Review desk critiques

05.06.24 (m)
Assignment: Concept & Context: Preparation of final full-scale project desk critiques

05.08.24 (w)
Assignment: Concept & Context: Preparation of final full-scale project desk critiques

05.13.24 (m)
Assignment: Final presentation material preparation desk critiques. Finalize your presentation using the provided Google Slide template including precedent images, concept diagram(s), vector drawing(s) of your project, full-scale physical/operable project, and a time-lapse video of your fabrication, assembly, and deployment process.

TBD (?)
Presentation: Final project presentation. Prepare a presentation using the provided Google template including: Concept diagram, vector drawing of your light modulator, precedent studies, context, full-scale physical prototype, photographs, and time-lapse video(s).

Absence Policy
Attendance for the full duration of each class is mandatory. The studio is an exceptional learning environment that requires your physical presence as well as your intellectual presence. You are allowed 3 excused absences for the semester. An excused absence is defined as one that was discussed with & approved by the instructor at least 24 hours prior to the 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.

Evaluation Criteria, Completion Requirements & Grading
Evaluation Criteria and Grading: The following criteria will be used for the evaluation of student's work, both in terms of helping their progress and in final grading. (01) Concept: How clearly is the student articulating their conceptual intentions? (02) Translation of Concept: How well is the student using their concept to develop a design response to given problems? (03) Representation Appropriateness: How well matched is the student's choice of representational means to their intentions? (04) Representation Quality: How accomplished are students with drawing, modeling, and/or digital representation? To what degree do student's representations convey what they ought to? (05) Oral Presentation Skills: How clearly are students presenting their ideas orally, whether at their desk, in class discussions, or to a more formal jury? (06) Participation in Discussions: How actively and how constructively are students involved in class discussions, both formally and informally? (07) Response to Criticism: How do students effectively take advantage of criticism from instructors, classmates and outside jurors? (08) Auto-Critical Skills: To what extent are students able to critique their own work regularly and effectively? (09) 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.

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

Studio Culture
Work in the studio will build sequentially. Therefore, your commitment to continual development is of paramount importance. It is important that you take advantage of the studio environment. Your development as a designer is made possible by the collective nature of the class. Group reviews are collective for a reason. Each of you has something to gain from your peers. Since studio is a place for all, it necessitates careful attention to the needs of everyone. Please see your instructors if there are any problems that you are unable to resolve on your own. All spraying of fixative, spray paint or any other substance should be done inside the shop spray booth.

Academic Integrity/Honesty
Massachusetts Institute of Technology students are here because of their demonstrated intellectual ability and because of their potential to make a significant contribution to human thought and knowledge. At MIT, students will be given unusual opportunities to do research and undertake scholarship that will advance knowledge in different fields of study. Students will also face many challenges. MIT students need to become familiar with the Institute's policies regarding academic integrity, which is available at Academic Integrity at MIT: A Handbook for Students

Medical
If you have a medical condition, please contact your instructors so we can make sure you have access to course materials and we can discuss how we address any missed work or class time. You can also contact Student Support Services for additional Assistance https://studentlife.mit.edu/s3