MIT Department of Architecture
4.021 How to Design (Almost) Anything: Fall 2022
Instructors: Skylar Tibbits, Laura Maria Gonzalez
Teaching Assistants: Daisy Zhang (daisyz@mit.edu), Geoffrey Mosoti Nyakiongora (gfmosoti@mit.edu)

4.021: How to Design (Almost) Anything

Class Overview: Introduces fundamental design principles as a way to demystify design and provide a basic introduction to all aspects of the design process. Through lectures and weekly exercises, students will develop their skills and enable creativity, abstract thinking, representation, iteration and design development. An introductory class intended for students without a design background geared towards enabling more effective collaboration with designers and the ability to apply the foundations of design to any discipline. Limited to 25; preference to Course 4 and 4B majors and Design and Architecture minors, and first and second-year students.

Structure of the Course - Weekly:

- Monday: Intro presentation on the topic then student presentations/group desk crits
- Wednesday: Individual desk crits and discuss next week's assignment

Exercise 1: The Design Process

The first project explores the design process. Each week the class will dive into one aspect of the design process from *context* to *concepts*, *drawing*, *making*, *iterating*, building a *narrative* and finally *presenting* a design idea and its implementation. This path exemplifies a traditional design process where a designer starts with an idea and works through testing, expanding, refining and eventually realizing it. Through weekly topics and assignments, students will develop a variety of design skills relating to each stage of this path. The project will start with an exercise on analog drawing, where students will develop a series of rules to generate a 2-dimensional drawing. Then, students will use paper as a material medium with various fabrication methods (folding, layering, crumpling, cutting, weaving, shredding, etc.) to test, expand and refine the initial rules, transforming them from rules for drawing into rules for making. In this stage of the project students will be asked to develop a concept for a functional light enclosure made from paper. Concepts should be focused on the performance of the enclosure – i.e. with regards to transparency, translucency, views, optics, movement etc. – and its relation to the method of making.

Context || *Concept* || *Draw* || *Make* || *Iterate* || *Narrative* || *Present*

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Exercise 1 - Assignment 1

The first week's assignment is to develop a drawing that features *iteration*, a process essential to design that we will explore in various ways throughout the rest of the semester. You will invent a drawing method by developing a series of rules that govern its use.

- Starting with a geometric **primitive** (i.e. point, line, plane, curve, etc.) placed at a location of your choice within a piece of drawing paper, develop **rules for transforming** this initial primitive (e.g. move, rotation, reflection, scale, deformation, etc.).

- Expanding from the starting point to the rest of the drawing area, **apply these rules** in a drawing consisting of at least **100 iterations**.

Exercise 1 - Assignment 1: Deliverables

1. Set of rules. (An interesting goal is to produce maximum variation with the minimum number of rules.)
2. A first drawing that applies your rules
3. A time lapse video demonstrating your drawing process
4. Two more drawings, based on the studio feedback

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Exercise 1 - Assignment 2

This assignment explores the steps of (a) building a design *concept* and (b) framing a *context* within a design process. Through this assignment, you will develop the conceptual basis on which you will later design and make your functional light enclosure. In the following weeks, the rules for 2D transformations that you invented in Assignment 1 will be further discovered, refined and translated into principles for 3D transformations. The system of rules that you will create is going to lead to the production of a light enclosure fabricated from paper.

For this week, we will ask you to think of a *concept* for your light enclosure, and frame a *context* around it.

Your **concept** should be focused on:

- The **performance** of the enclosure with regards to functionality and user experience – i.e. with regards to transparency, translucency, views, optics, movement or something else.
- The **fabrication** technique and rules with which you'll achieve the design and performance of the light enclosure.

Your **context** can be built upon inspiration from outside:

- Existing art, product design and architecture, objects, fabrication processes or natural phenomena across various scales etc.

In the following weeks, you will be asked to translate your concept and its associated performance into volumetric explorations, and the assignments will focus on implementation and iteration of your initial concept. Thus, having a strong concept, supported by an interesting and relevant context, is very important. With this goal in mind, start by exploring a number of concepts before selecting a final one.

Exercise 1 - Assignment 2: Deliverables

1. Concept Drawings/Diagrams
2. Rules/Procedures
3. Physical Study Models
4. Final Light Enclosure
5. Concept/Context/Narrative statement
6. Final Presentation

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Exercise 2: Discovering a Concept - Vessel for Growing

The second project explores the development of a concept through ***growth***. In the first project, you started with a concept and developed a folding process using a given material (paper) and functionality (light enclosure). In this project, you will work around a given process (growth) and be asked to discover a concept of what and how you are growing.

You will begin by selecting a growing process. We will consider all forms of growth: biological, chemical, and the unconventional! Using your chosen method, grow three samples. For each sample, change a parameter and document the effects. Allow your observations/interactions to guide the development of a concept and project narrative. We will then develop a design for a vessel that can continuously grow living or nonliving matter using your selected method, narrative, and concept. Growing can occur within the vessel or on its surface. The vessel should also influence the process by enabling, affecting, or guiding the growth.

As devices for observation and consumption, vessels for growing have shaped the ways we engage with nature. It is up to you to determine how the vessel supports growth and how it mediates our interaction with what is growing. At the end of this project, you will have developed a concept for your vessel and grown matter that demonstrates an attitude or position about the phenomena of growth in nature.

~~Make~~ Grow! || *Context* || *Narrative* || *Concept* || *Draw* || *Iterate* || *Present*

Deliverables for Exercise 2:

1. Vessel for Growing
2. Final Matter/Object(s) Grown with the Vessel
3. Process Models
4. Narrative/Concept Statement
5. Final Video of the Growth Vessel
6. Final Presentation

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4.021 Schedule
Exercise 1: The Design Process (8 Weeks)

Week 1 (Sept.7) ***Introduction***

9/7 Class Introduction / Exercise 1 Intro
Assignment:
Watch Abstract Series
Develop a series of rules/procedures for your drawing and make the first drawing that executes your rules. Bring your drawing to studio.

Week 2 (Sept.12) ***Draw & Iterate***

9/12 Studio / Intro to 2D Rhino
Due: Drawing from week 1

Assignment:
Make 2 more drawings based on your own rules and our feedback. Either modifying your rules each time, or keeping the same rules and modifying your implementation of the rules.
Write your rules down and add them to your google slides presentation.
Take a timelapse video with your phone – creating 1 of the drawings and add it to the presentation. Bring your drawings and presentation to studio.

9/14 Studio / Drawing Presentations / Exercise 1 Assignment 2 Introduction
Due:
Two additional drawing iterations
Timelapse video
Presentation

Assignment:
Watch *Between the Folds* Documentary
Come up with 3 concept sketches for a light enclosure that relate to the performance and fabrication process for making the enclosure from paper. How does it work and how is it made? This can relate to your drawings or depart from it – but it should be similarly systematic and rule-based.

Week 3 (Sept. 19) ***Context & Concept***

9/19 Studio / Context & Concept Intro / Concept Sketch Desk Crits
Due:
Three concept sketches for a light enclosure

Assignment:
Refine your concepts – narrow down to 1 concept and draw it clearly (by hand/sketch)
Concepts should be about: 1. The performance of the light enclosure in relationship to people/views/light etc. and 2. Fabrication process – how it's made from paper, how it works

9/21 Studio / Desk crits
Due:
Drawing of selected concept

Assignment:
Refine your concepts and start working with paper

Week 4 (Sept. 26) ***Make***

9/26 Studio / Representation & Fabrication Intro / Intro to Rhino 3D
Due:
Refined concept drawings
Initial paper studies

Assignment:
Further refine your concept & draw your concept diagram in Rhino
Continue working with paper – fold/shred/weave/etc. – experiment with the paper and start to understand how you can manipulate it to produce certain effects, textures, and performances, and how that can inform your fabrication process & concept

9/28 Studio / Desk Crits
Due:
Digital drawing of concept diagram (Rhino)
Paper studies

Assignment:
Start to use your new fabrication process and experiment with the paper - understand its formal possibilities. Update your concept based on what you learn.

Week 5 (Oct. 3) ***Make***

10/3 Studio / Student Presentations / Intro to Adobe
Due:
Paper models using fabrication process

Assignment:
Continue to use your new fabrication process and experiment with paper
Update your concept diagram & revise in Adobe with line weights

10/5 Studio / Desk Crits / Independent Work
Due:
Paper models
Concept diagram with line weights

Assignment:
Record your procedure as a series of rules/steps/systems
Prepare the presentation for the Interim review (from the template) including concept diagram, vector drawing of the enclosure, precedents/concept/context and small-scale physical models.

Week 6 (Oct. 10) ***Interim Review Week***

10/10 Indigenous Peoples' Day – No Class

10/12 **Exercise 1 Interim Critique**
Student Presentations

Due:
Presentation that includes a recording of your procedure, concept diagram, vector drawing, precedents, concepts, context and small-scale physical models.

Assignment:
Make the first full-scale experiment with paper.
Update the diagrams/drawings/concept based on feedback.

Week 7 (Oct. 17) ***Narrative & Presentation***

10/17 Studio / Narrative & Presentation Intro / Desk Crits
Due:
Full scale paper experiment
Updated diagrams, drawings, concept

Assignment:
Prepare a sketch/diagram of what you will do for your final paper enclosure. Make the second pass at the full-scale paper model. Start fabrication. Work on the diagrams/presentation and think about what the final documentation will be (photos/videos/timelapse) to convey your narrative

10/19 Studio / Documentation Tutorial / Desk Crits
Due:
Sketch or diagram of final paper enclosure
Second full-scale paper model

Assignment:
Make the FINAL light enclosure fabrication.
Update drawings/presentation/narrative based on feedback. Start final documentation – images/videos/timelapse of the project

Week 8 (Oct. 24) ***Review***

10/24 Studio / Desk Crits
Due:
Draft of exercise 1 final presentation
Light enclosure in progress

Assignment:
Finalize presentation, do final documentation of the enclosure (photos/videos/timelapse), update diagrams, vector drawings and presentation.

10/26 **Exercise 1 Final Critique**
Student Presentations
Due:
Concept/Context/Narrative Statement
Concept Drawings/Diagrams
Rules/Procedures
Physical Study Models
Final Light Enclosure
Presentation

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Exercise 2: Designing a Process (8 Weeks)

Week 9 (Oct. 31) **Introduction**

10/31 Studio / Introduction to Exercise 2

Assignment:

Research growing processes and select 3 to explore.

Create a diagram for each describing the inputs and outputs of the growing process and the initial setup you will use for growing.

11/2 Studio / Desk Crits

Due:

Diagram of selected growing processes that describe inputs/outputs and initial setup

Assignment:

Grow matter using your selected methods

Document the growth with a timelapse video

Week 10 (Nov. 7) ***Grow! & Context***

11/7 Studio / Grow! - Student Presentations

Due:

Grown samples

Timelapse video of growth

Assignment:

Diagram the factors that affected your growing process, any patterns observed during the first week of growing, and the material qualities of the resulting living or non-living matter (e.g. brittleness, softness, roughness)

11/9 Studio / Grow! - Desk Crits

Due:

Diagram of influencing factors, patterns, and material qualities observed through growing

Assignment:

Choose one growing process to move forward with based on your initial studies.

Grow 3 more samples changing at least one parameter each time.

Create a visual matrix that incorporates changes in parameters, time, and the resulting sample

Week 11 (Nov. 14) ***Concept & Narrative***

11/14 Studio / Concept & Narrative - Student Presentations

Due:

Grown samples

Visual matrix diagram

Assignment:

Based on your observations, define 3 concepts for a vessel that can interact with the growing process.

Create a vector drawing for each concept.

Diagram how each vessel would enable, affect, or guide the growing process.

11/16 Studio / Concept & Narrative - Desk Crits

Due:
Vector drawing of three vessel concepts
Diagram of vessel interaction with growing process

Assignment:
Continue developing your vessel concepts.
Use drawing as a way to communicate a narrative by depicting how the vessel is used to influence growing over a week, a month, and a year in your vessel.
Diagram the types of interactions people can have with the vessels at these time scales.

Week 12 (Nov. 21) ***Draw***

11/21 Studio / Draw Desk Crits

Due:
Updated vessel concepts
Narrative diagrams

Assignment:
Prepare a presentation for the interim review including documentation of your growing process (grown samples, photos, videos, timelapse), vector drawings of the vessel concepts, and concept/narrative diagrams

11/23 **Exercise 2 Interim Review**

Due:
Presentation documenting your growing process
Vector drawings of vessel concepts
Concept/narrative diagrams
Grown samples

Week 13 (Nov. 28) ***Make***

11/28 Studio / Student Presentations

Assignment:
Update the diagrams/drawings/concept based on feedback
Choose 1 vessel concept to move forward with
Prepare a sketch of your final vessel

11/30 Studio / Desk Crits

Due:
Updated diagrams/drawings/concept
Sketch of final vessel

Assignment:
Make a full-scale model of your vessel and begin growing.
Document the growth in the vessel with a timelapse video.

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Week 14 (Dec. 5) ***Iterate***

12/5 Studio / Student Presentations

Due:

Full-scale model of vessel and timelapse video of growing process

Assignment:

Update the diagrams/drawings/concept based on feedback

12/7 Studio / Desk Crits

Due:

Updated diagrams/drawings/concept

Assignment:

Fabricate the FINAL vessel for growing and begin recording the growing process

Week 15 (Dec.12) ***Iterate***

12/12 Studio / Student Presentations

Due:

Fabricated vessel and in progress video of growing process

Assignment:

Update drawings/presentation/narrative based on feedback
Start final documentation including images and videos of your project

12/14 (Last Day of Classes) Studio / Desk Crits

Due:

Updated drawings/presentation/narrative
In-progress final documentation

Assignment:

Finalize presentation - complete documentation of the vessel (photos/video/timelapse) update diagrams, vector drawings and presentation

Week 16 (Dec. 19) ***Presentation***

TBD **Exercise 2 Final Critique**

Student Presentations

Due:

Presentation that communicates the concept/narrative of your vessel for growing
Vector drawings and diagrams of your vessel
Process models/iterations
Fabricated vessel
Final matter/object(s) grown with the vessel

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Learning Objectives:
The course consists of two 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 basic application of design skills, understanding of conventions, and an ability to sustain an increasing level of research in the projects over the semester.

Statement of Required Work:
There are two main exercises that divide the semester in half. Each exercise is made up of shorter weekly themed assignments that build off one another. There are four formal reviews scheduled throughout the semester that are milestones in the sequence of the exercises.

Exercise 1 Interim Review
Exercise 1 Final Review
Exercise 2 Interim Review
Exercise 2 Final Review

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.

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. (01) Concept: How clearly is the student articulating the 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 their choice of representational means to their intentions? (04) Representation Quality: How accomplished are they with regards to drawing, modeling, digital representation, etc? To what degree does their representations convey what they ought to? (05) Oral Presentation Skills: How clearly are they 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 they involved in class discussions, both formally and informally? (07) Response to Criticism: How do they effectively take advantage of criticism from instructors, classmates and outside jurors? (08) Auto-Critical Skills: To what extent are they 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.

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Studio Culture: Work in the design studio will build sequentially. Therefore, your commitment to continual development on a daily basis is of paramount importance. We want to emphasize the importance of your peers as a source of support, inspiration, and feedback. Magnification of your development as a designer is made possible by the collective nature of the class. Group reviews are collective for a reason, as each of you has something to gain from your peers. Our studio is a place for all, and it necessitates careful attention to the needs of everyone in it.

Instructors and TAs will hold office hours outside of the listed class time. We will also use software for sketching and drawing during desk crits. Incremental assignment presentations will be uploaded to a shared google slides document so you can refer back to your peers' work throughout the semester.

Attendance: Attendance for the full duration of each class is mandatory. The design studio is an exceptional learning environment that requires your presence as well as your input. You are allowed one excused absence 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.

Student Support Services: If you are dealing with a personal or medical issue that is impacting your ability to attend class or complete work, students should contact a dean in Student Support Services (S3). These offices are here to help you. The deans will verify your situation, provide you with support, and help you work with your professor to determine next steps. In most circumstances, students will not be excused from coursework without verification from a dean. Please visit the S3 website for contact information and more ways that they can provide support.