

MIT Department of Architecture

**4.041 Design Studio: Advanced Product Design**

Spring 2023

Tues / Thurs 2-5

Room: N52-342C

Units: 3-3-6 U

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TA: Il Hwan Kim: [kimih@mit.edu](mailto:kimih@mit.edu)



Img. Lucy Orta

**Important links:**

- Class Website: TBD
- Xavi Zoom: <https://mit.zoom.us/my/aguirrecla>
- Google Drive: <https://drive.google.com/drive/u/0/folders/11oWPvvyHUf3cs3oyBrTuthB5TtDiyk6V>
- Miro Board: <https://miro.com/app/board/uXjVPv5umHE=/>
- Tutorials Miro Board: <https://miro.com/app/board/uXjVPv5umcg=/>

**Tools for making:**

- Architecture shops guide: <https://archshops.mit.edu/software.php>

**Brief:**

An advanced product design studio focused on creating a series of products that will help us get a bit more outdoorsy. In an era of both ecological loss and excessive screen time, this studio will develop products using material strategies that are both friendlier to our ecology and will bring us closer to it.

Students will invent their own experimental outdoor kit of parts that will help us do an activity outside. We will do so through circular design methods including: designing for disassembly, modularity, futureproofing and flexibility of use. To do this each student will develop a set of carefully sourced and designed parts.

This course prepares students for careers in design, product technology and other industries, developing advanced skills in design critique, hands-on making and professional- level documentation. This semester students will be experimenting with photogrammetry and Augmented Reality as novel strategies for design communication.

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**Design prompt:**

*Design a futureproof kit of parts that will help us get more outdoorsy. The kit's material approach will consider circular material practices.*

**Course organization:**

This studio considers our built environment as an assemblage of parts. As such, the structure of this course has also been conceived as an assemblage of parts. Namely, the course is divided into 4 parts:

- 1. X1A- X1C: Research & Concept parts:** In this phase, we will be gathering information and materials as well as begin to develop some early concepts for your product. In the first round, students will be asked to choose an outdoor activity to design for. They will then research this activity by looking at the objects, materiality and aesthetics associated with it by extensively researching the design needs associated with their chosen activity. They will look into the history of that activity, analyze the evolution of the typologies associated with it, research materials, look into its production processes, study its place in culture and we will visit sporting goods facilities to do this in person. Students are free to select any outdoor activity but due to the nature of the studio, we will inevitably be pulling in a lot of our references from outdoor sports as well as camping and mountaineering. Next, we will research innovations in product life-cycles, researching how design intersects with circular material strategies. Students will then enter a collection phase in which they will gather material samples, specs and resources that aid in the production of certain material qualities. Some of these materials will be found, some store bought or ordered for the course. Lastly, students will be developing an initial product concept. At the end of the first exercise students will be asked to present their design precedents, material research and initial product concept to their peers. **Deliverables** for this phase will include a dynamic presentation of visual research, an initial set of materials and samples as well as diagrams and quick models to communicate your design concept.
- 2. X2A-B: Design & Fabrication parts:** The second exercise explores processes of fabrication and production through the making and testing of the proposed product. Students will be asked to further materialize their idea by producing iterations of their final concept from the first exercise. In this phase students will begin to engage the tools and techniques for material fabrication and production through a series of workshops and tutorials. Students will be asked to create a design concept whose material, fabrication method and function are based on the research gathered in X1. The overall theme of the studio is focused on creating futureproof designs so in line with that, it is up to the student to select a material approach that considers circularity. Students will be selecting a material strategy that thinks about the design's last day as much as it thinks about its first. For this phase, students will iterate and experiment with novel material methods and techniques. The goal is to address various aspects of the product ranging from the perceptual properties, materials, joints, structural elements, production processes and user oriented function. At the end of the third exercise students will be asked to present their iterations and final concept for an innovative kit of parts.  
**Physical making:** Through fabrication, students can make use of various machines and tools: 3D printing, laser cutting, CNC, woodworking, metal working, lamination, thermoforming and sewing. Students are encouraged to invent their own experimental processes based on their research.  
**Deliverables:** At the end of this phase students will present physical prototypes of a designed kit or parts, documentation of iterations and a position on how well the prototypes answer to lifecycle practices.
- 3. X3: Communication parts:** The way your product presents itself can be as important as the design itself. In this phase students will learn to document and communicate their work at a high level of quality. For this, we will experiment with 3D capture and Augmented Reality tools. Students will make a pass at their final presentation which will include a verbal, visual and material presentation.  
**Visualization tools:** Students will attend workshops in photogrammetry capture and augmented reality techniques.
- 4. X4: Presentation parts:** Students will bring all their prior exercises together to try to communicate their ideas to critics and users. Students will have to refine their spoken narrative as well as visual design communications.  
**Final deliverables will include:** a verbal presentation, research, a carefully fabricated kit of parts, relevant prototypes, documentation as well as Augmented reality visualizations.

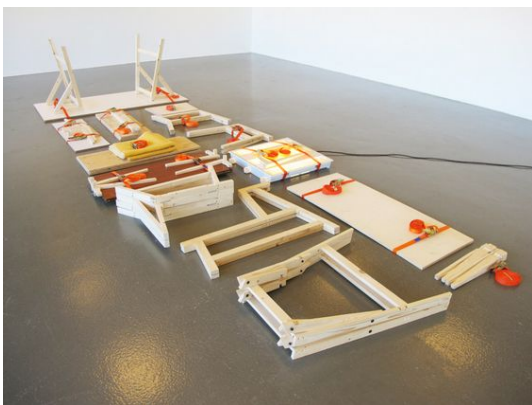
**Kit of parts deliverables:** Must include the following: A spanning element, a structural element, a surface, something that provides coverage, a 2 way and 3 way connection, an element that meets the ground, an element that is specific to the activity you are designing for, hardware and an aesthetic cohesion.



**Calendar:**

DATE	WEEK	DAY	IN CLASS	EXERCISE	ASSIGNMENT	DUE
Last Updated: 2/7/2023	Intro					
2/7	1	Tuesday	Course presentation		Research_Visual	
2/9		Thursday	Introduce X1 / <b>Visual research exercise / Activity presentation / Setup software</b>	X1A	Research_Visual	
2/14	2	Tuesday	Fieldtrip	X1A	Research_Visual	2:20PM: Meet at REI: 401 Park Dr Ste 103, Boston, MA 02215
2/16		Thursday	Desk crit / Work day / <b>Making a GIF / Gather materials</b>	X1B	Research_Material	
2/21	3	Tuesday	Group desk crit	X1B	Research_Material	X1A & X1B
2/23		Thursday	<b>Make a website</b>	X1C	Concept	X1C
2/28	4	Tuesday	Fieldtrip	X1D	Concept	

3/2		Thursday	<b>Group Review</b>	X1D	Concept	X1D
3/7	6	Tuesday	Introduce X2	X2A	Design_Fabricate	
3/9		Thursday	Shop Orientation 2	X2A	Design_Fabricate	
3/14	7	Tuesday	Guest Lecture	X2A	Design_Fabricate	
3/16		Thursday	Workshop	X2A	Design_Fabricate	
3/21	8	Tuesday	Guest Lecture	X2A	Design_Fabricate	
3/23		Thursday	Midterm	X2A	Design_Fabricate	X2A
3/27	9	Monday	Spring Break begins			
3/31		Friday	Spring Break ends			
4/4	10	Tuesday		X2B	Design update	
4/6		Thursday		X2B	Design update	
4/11	11	Tuesday		X2B	Design update	
4/13		Thursday	Group Review	X2B	Design update	X2B
4/18	12	Tuesday	Introduce X3	X3	Communication	
4/20		Thursday	Workshop	X3	Communication	
4/25	13	Tuesday		X3	Communication	
4/27		Thursday	Workshop	X3	Communication	
5/2	14	Tuesday	Group Review	X3	Communication	
5/4		Thursday		X3	Communication	X3
5/9	15	Tuesday	Introduce X4	X4	Presentation	
5/11		<b>Thursday</b>	<b>Final review!</b>	X4	Presentation	X4
5/16	16	Tuesday	No class			



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**Fabrication:**

- You will primarily be using the Arch Fablab and N52 shop.

- Bill McKenna <wdmc@mit.edu> is the point person but each shop has a different lead person.
- You will have access to 3 fabrication shops: Arch Shop, N51 and N52. Orientation required.
- Any Architecture shop and N51 shop questions can be directed to Jennifer O'brien dekinai@mit.edu and Chris Dewart cbdewart@mit.edu
- Any N52/MAD shop questions can be directed to Chris Haynes haynesc@mit.edu

#### **Gear:**

- **Camera:** You will have access to N52's photo/video room that has a white & black backdrop as well as LED light panels, tripods etc.
- **3D Printers:** At N52 there is a Connex350, a number of formlabs machines, 2 larger FDMs, a bunch of desktop FDMs and 2 Markforge machines. Arch shops/studios have a number of desktop FDM machines, a Dimension + Zcorp.
- **Lasercutters:**
- N52 has 2 smaller desktop laser cutters + 2 larger laser cutters and a metal laser cutter. Arch shop has 4 larger laser cutters.
- **Materials:**
- Generally students are responsible for getting their own materials for assignment. However there will be a few materials that we can collectively decide to purchase through the studio.
- Lasercutter/milling or general project materials need to be purchased.
- But usually 3D or 2D printer materials are typically covered by the dept.
- **Ipads:**
- We have 2 Ipad Pros + apple pencils and we have a 3D scanner attachment for the ipad if anyone wants to use those. Coordinate with Bill for access.
- **Other equipment:**
- N51 has a variety of wood/metal working + an Onsrud 3-axis router and a bridgeport milling machine. Arch Shop has a small shopbot, a robot arm, woodworking equipment, an Omax waterjet + electronics workbench, vacuum former etc.
- N52 has a 4x4 CNC, a bunch of metal/woodworking equipment, a lathe, milling machine, metal break, shear and an electronics workbench.

#### **Learning objectives:**

4.041 is an advanced product design studio in which we will reimagine how we design, make, use and reuse products for living.

- In this studio, you will push the boundaries of what's possible in product design and propose new approaches to how we create products that consider material circularity.
- Students are invited to experiment.
- By engaging research at MIT and beyond in material intelligence, fabrication technology and recycling innovations, you will reimagine today's concepts of "sustainability", for a more ecologically-responsible and digitally enabled future.
- Students will learn about circular material practices in design and manufacturing.

#### **Evaluation Criteria:**

Below are the criteria used to evaluate student work. Please note that students are graded based on all work done throughout the semester, not just the final presentation.

1. **Thesis:** How clearly is the student articulating the conceptual intentions?
2. **Translation of Thesis:** How well is the student using their thesis to develop a design response to given problems?
3. **Representation Appropriateness:** How well-matched is their choice of representational means to their intentions?
4. **Representation Quality:** How accomplished are they with drawing, modeling, digital representation, craft, etc.? To what degree do their representations convey what they are intended to?
5. **Oral Presentation Skills:** How clearly are they presenting their ideas orally, whether at their desk, in class discussions, or to a more formal jury?

6. **Participation in Critique and Discussions:** How actively and how constructively are they involved in class discussions, both formally and informally?
7. **Response to Criticism:** How do they effectively take advantage of criticism from instructors, classmates and outside jurors?
8. **Auto-Critical Skills:** To what extent are they able to critique their own work regularly and effectively?
9. **Attendance:** See below.

### Grading Criteria:

**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.

### Attendance:

- 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 three excused absences 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
- 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:

If anything is getting in the way of your academics, please know that S3 is happy to help. You can request an [appointment](#) or come to a [virtual walk-in](#). The walk-in queue is open from 10-12 and 2-4 on weekdays. Appointments can be virtual or in-person, depending on your comfort and convenience.

### Accessibility:

Students who need disability accommodations are encouraged to speak with the faculty member/department administrator early in the semester so that accommodations can be implemented in a timely fashion.

### Diversity, Inclusion and Equity:

MIT values an inclusive environment. I hope to foster a sense of community in this classroom and consider this classroom to be a place where you will be treated with respect. I welcome individuals of all backgrounds, beliefs, ethnicities, national origins, gender identities, sexual orientations, religious and political affiliations – and other visible and nonvisible differences. All members of this class are expected to contribute to a respectful, welcoming, and inclusive environment for every other member of the class. If this standard is not being upheld, please feel free to speak with me.



Parasite 2.0

### **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. You have been given a studio space; please use it. Your development as a designer is made possible by the collective nature of the studio; working in studio, instead of at home, allows you to participate in the dialogue. Group reviews are collective to give every student the opportunity to engage with others, practice speaking about design, and give feedback. **This is a critical component of every studio course.**

### **Academic Integrity:**

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 scholarships that will advance knowledge in different fields of study. Students will also face many challenges. It is important for MIT students to become familiar with the Institute's policies regarding academic integrity, available at [Academic Integrity at MIT: A Handbook for Students](#).

### **Safety:**

Fabrication can be dangerous. You will have the opportunity to use machines, tools and other methods of fabrication in MIT shops, but only once you have completed required safety trainings. If you would like to experiment with a new fabrication process, please reach out to your instructor about getting necessary trainings. All safety protocols must be adhered to when using shop and fabrication spaces at MIT. If you don't know how to do something safely, just ask a supervisor or instructor. This is your opportunity to learn new methods, so you are not expected to know how to fabricate everything. All spraying of fixative, spray paint or any other aerosol substance should be done in the shop and with proper ventilation. Adhesives and chemicals must be on the approved list provided in most shop spaces. If you can't find the list, ask a supervisor or instructor. Security is a necessary component for a studio that is accessible to you and your colleagues 24 hours a day, 7 days a week. Storage spaces may be provided in studio and doors will be accessible using MIT card access. All protocols and requirements related to COVID-19 safety must be followed in the studio and shop spaces. Please refer to MIT's website for full details as they are continually updated.