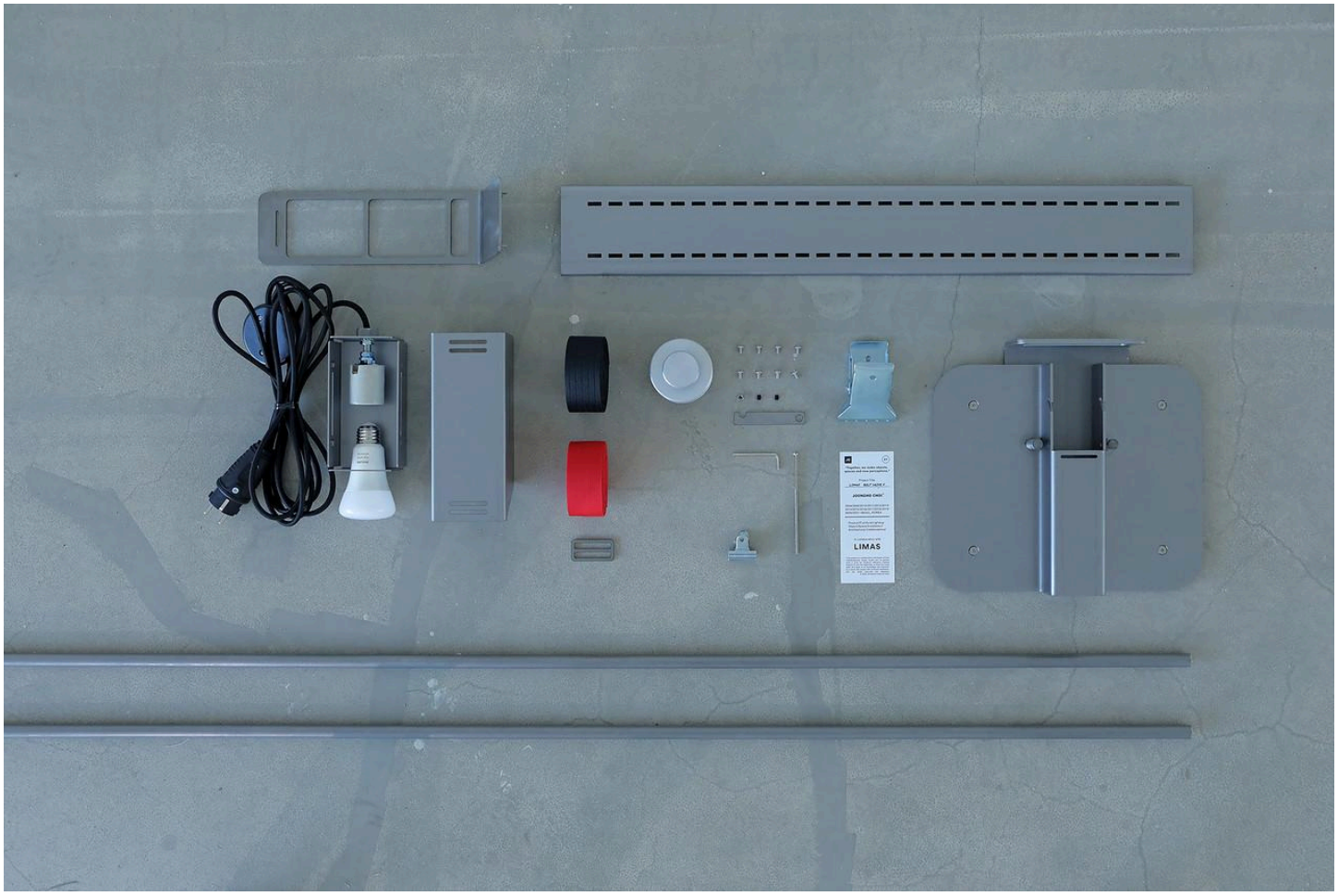
MIT Department of Architecture
4.041 Design Studio: Advanced Product Design:
‘ OUTDOORSY KIT’: an outside influence, inside.
Spring 2024
Tues / Thurs 2-5
Room: N52-342C
Units: 3-3-6 U
Instructor: Xavi L. Aguirre: xaguirre@mit.edu
Teaching Assistant: Niklas Henrik Hagermann: hagemann@mit.edu



‘A kit to see’

Important links:

- Xavi Zoom
- Calendar / Bulletin board
- Google Drive
- Miro Board
- Precedents

Tools for making:

- Architecture shops guide

Brief:

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

The studio will respond to a design prompt:
Design a kit of parts to get more outdoorsy, bringing in an outside influence… inside.

This studio argues that there is a lot of material intelligence in the design of outdoor experiences that could bring joy and flexibility to our indoor lifes. Easy move, easy clean, easy set up, easy pack, easy disassemble, easy attitude… these are characteristics associated with our relationship to outdoor design and this studio seeks to adapt the same disposition of nimbleness and robust temporality to our indoor lives.

In this studio, you will push the boundaries of what's presumed in architectural product design, you will borrow the material intelligence, fabrication technology and material reuse innovations from one world and apply it to another in order to create new hybrids. We will be reimagining some of today's concepts as future-ready designs in order to come to a more ecologically-responsible and digitally enabled future. More specifically, the studio will focus on designing for disassembly. A design approach that considers not just the current use but the future reuse of products by making them adaptable and transformable to life's changes. A nimbleness that can make objects change-ready imbuing them with a responsible longevity, a design trait that is indispensable in times where fast furniture is quickly becoming a main contributor to our global waste disaster.

The kit's material approach will consider circular material practices. You will re-interpret, imagine, and create new concepts of what 'sustainable design' is, looking not only at how objects are manufactured but what our relationship to their future use is.

This studio will begin by selecting existing built elements from your everyday life and reinventing them through the tectonics and material logics of outdoor equipment. From there you will be designing your own re-assembleable and reconfigurable architectural kit of parts. Each student will develop a set of carefully sourced and designed parts.

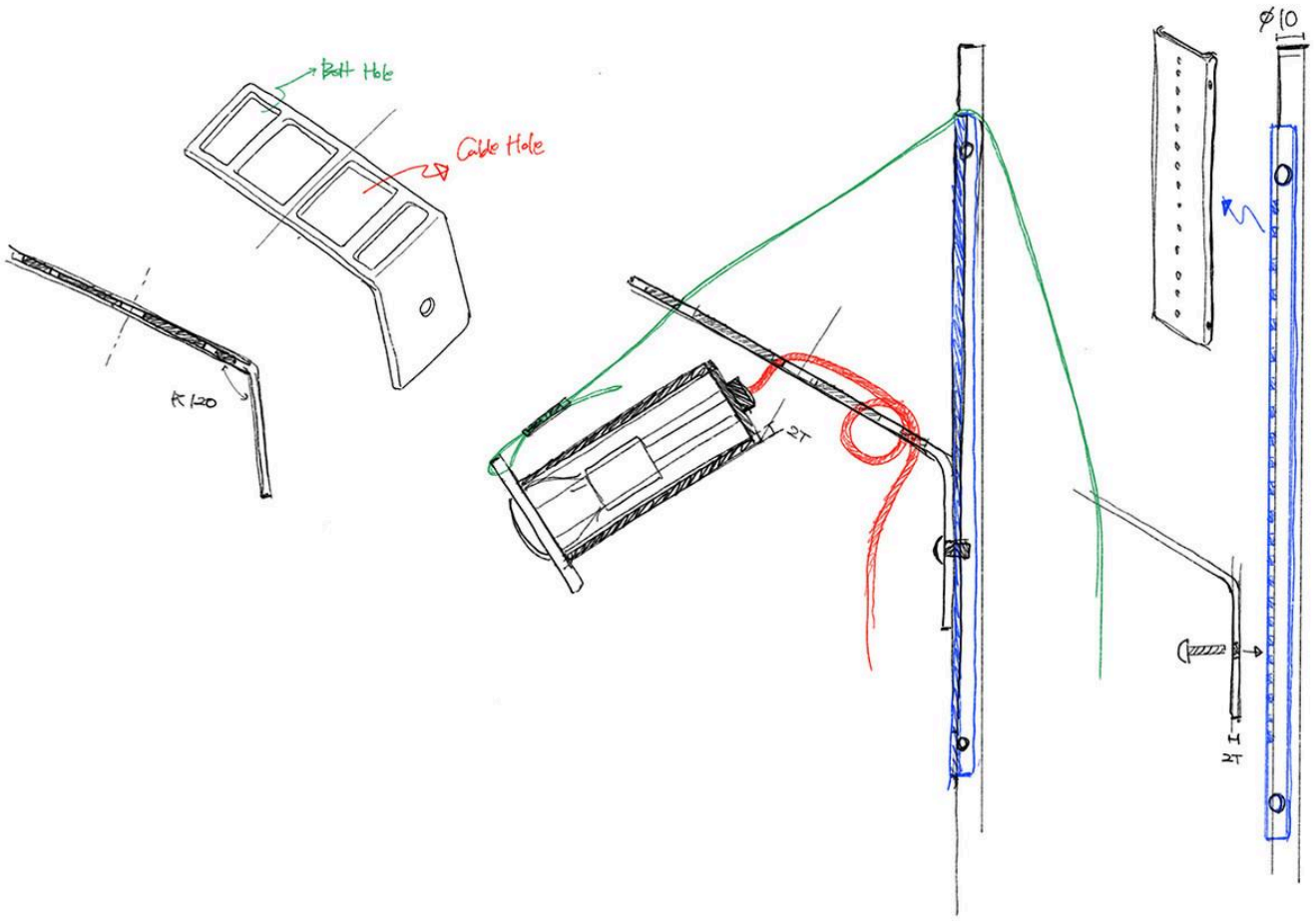
To achieve this, you will be learning the following skills: advanced material spec-ing, CNCing both metal and wood, powder coating, advanced 3d printing, tube bending, metal bending, vinyl printing and cutting and sewing. This semester you will also be experimenting with Augmented Reality and instructional diagrams as strategies for design communication.

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. Students will iteratively prototype their novel design concepts through hands-on making, document their work at a professional level, and ultimately present their products to peers, faculty and invited critics from industry leaders.

Course organization:
The structure of this course has been divided into 4 parts. 1. Concept development 2. Design & Fabrication 3. Communication 4. Packaging

1. **X1A- X1C: GATHER: Concept development + Research + Material scouting:** 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 everyday activity. 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 as well as the outdoor version of it. We will look into the history of that activity, analyze the evolution of the typologies associated with it, research materials, look into its production processes and study its place in culture. Students can select this activity based on their interests. Next, students will research innovations in product life-cycles, by becoming familiar with the logics of designing for disassembly through readings, material experiments and fieldtrips to outdoor equipment and material stores. These lessons will then be used to recreate their chosen activity through the logics of disassembly. 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 collected samples and initial product concept to their peers. **Deliverables** for this phase will

include a dynamic presentation of visual research, analytic diagrams, an initial set of materials and samples as well as sketches of your initial design concept.

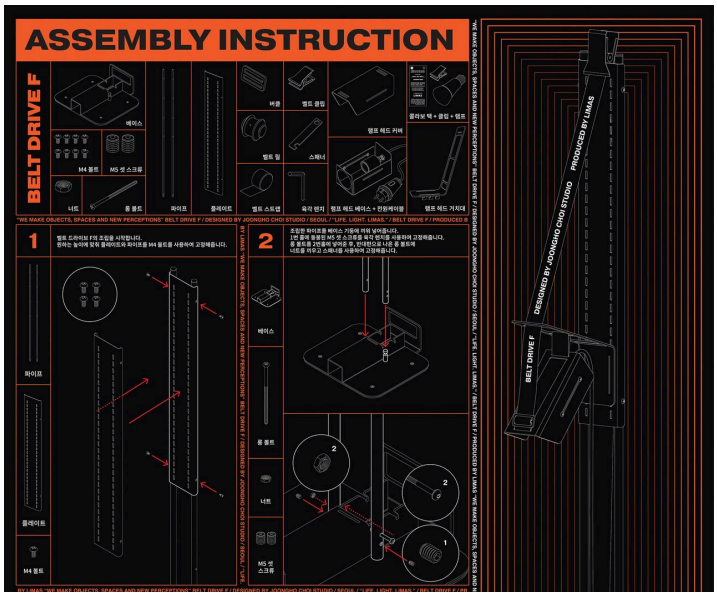


‘A kit to see’ Concept

2. **X2A-B: MAKE: Prototype & Fabrication:** The second exercise explores processes of fabrication and production through the prototyping, iterating and fabricating 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 and adaptability. For this phase, students will iterate and experiment with novel material methods and techniques. The goal is to address various aspects of the kit of parts product ranging from the perceptual properties, materials, joints, structural elements, production processes and user oriented function.
Physical making: Through fabrication, students can make use of various machines and tools: Advanced material spec-ing, CNCing both metal and wood, powder coating, advanced 3d printing, tube bending, metal bending, vinyl printing and cutting and sewing.
Deliverables: At the end of this phase students will present physical prototypes of a designed kit or parts and careful documentation of the process and results.

‘A kit to see’ Product

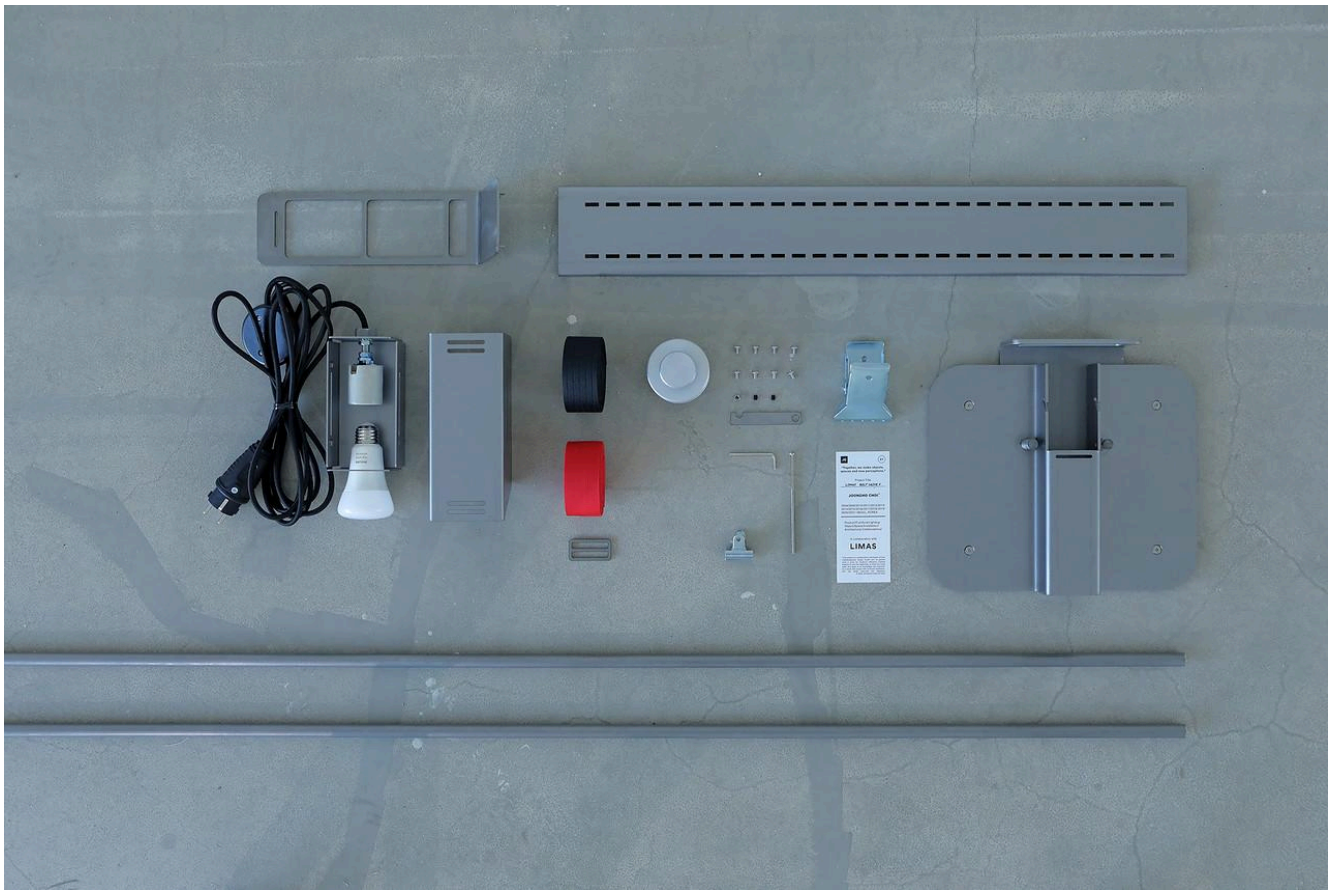
3. **X3: COMMUNICATE:** The way your product presents itself can be as important as the design itself. In this phase students will learn to document and communicate their work at a high level of quality. For this, we will experiment with Augmented Reality tools and diagrans. Students will make a pass at their final presentation which will include a verbal, visual and material presentation.
   Visualization tools: Students will attend a workshop in augmented reality and produce instructional diagrams.



‘A kit to see’ Diagram

4. **X4: PACKAGE: Wrap it all up!** 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.

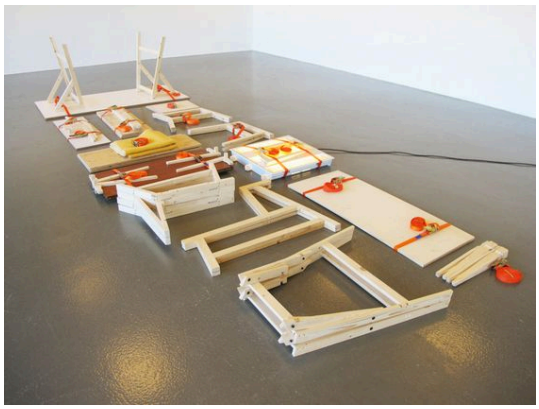


'A kit to see' final product

Calendar:

IMPORTANT LINKS	DATE	WEEK	DAY		EXERCISE	ASSIGNMENT
This Calendar will be updated as the semester evolves	**Last Updated: 2/1/2023**					
CONTACT:	2/6	1	Tuesday	LECTURE	**X1A**	GATHER_Information
Instructor:	2/8		Thursday	X1 PRESENTATIO N	**X1A**	GATHER_Information
Xavi L. Aguirre	2/13	2	Tuesday	FIELDTRIP	**X1B**	GATHER_Information
Contact:	2/15		Thursday	TA SUB + WORK DAY	**X1B**	GATHER_Material
xaguirre@mit.edu	2/20	3	Tuesday	NO CLASS	**X1C**	
Zoom link:	2/22		Thursday	LECTURE: DESIGN FOR DISASSEMBLY	**X1D**	GATHER_Material
LINK	2/27	4	Tuesday	TUTORIAL: LASER CUT METAL	**X1D**	GATHER_Concept

Teaching Assistant:	2/29		Thursday	TUTORIAL: POWDER COATING	**X2A**	GATHER_Concept
Niklas Henrik Hagemann	3/5	5	Tuesday	REVIEW 1	**X2A**	DESIGN_Prototype
hagemann@mit.edu	3/7		Thursday	FIELDTRIP	**X2A**	DESIGN_Prototype
	3/12	6	Tuesday	TUTORIAL: CNC	**X2A**	DESIGN_Prototype
LINKS:	3/14		Thursday		**X2A**	DESIGN_Prototype
GOOGLE DRIVE	3/19	7	Tuesday	TA SUB + TUTORIAL: 3D PRINTING	**X2A**	DESIGN_Prototype
MIRO BOARD	3/21		Thursday	TA SUB		DESIGN_Fabricate
PRECEDENTS / REFERENCES	3/26	8	Tuesday	SPRING BREAK - NO CLASS		
ARCHITECTURE SHOPS GUIDE	3/28		Thursday	SPRING BREAK - NO CLASS		
	4/2	9	Tuesday	TUTORIAL: VINYL CUTTING	**X2B**	DESIGN_Fabricate
	4/4		Thursday	TA SUB	**X2B**	DESIGN_Fabricate
	4/9	10	Tuesday	REVIEW 2 - MIDTERM W/ GUESTS	**X2B**	DESIGN_Update
	4/11		Thursday	TUTORIAL: TPU	**X2B**	DESIGN_Update
	4/16	11	Tuesday		**X2B**	DESIGN_Update
	4/18		Thursday		**X2B**	DESIGN_Update
	4/23	12	Tuesday		**X3**	DESIGN_Update
	4/25		Thursday	REVIEW 3	**X3**	COMMUNICATE
	4/30	13	Tuesday	TUTORIAL: AR	**X3**	COMMUNICATE
	5/2		Thursday		**X3**	COMMUNICATE
	5/7	14	Tuesday		**X3**	COMMUNICATE
	5/9		Thursday		**X3**	PACKAGE
	5/14	15	Tuesday	TA SUB	**X3**	PACKAGE
	5/16		Thursday	TA SUB	**X3**	PACKAGE
	5/21	16	Tuesday	**FINAL PRESENTATION W/ GUESTS**	**X1-X3**	PACKAGE



Parasite 2.0 / stock-a-studio / Studiomake

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:**
  - Students will purchase the materials for their own designs and they will be reimbursed up to $250 (keep your receipts). However, there will be a few materials that will be available to everybody in 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.
- **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 designing for disassembly.

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 studio session 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.