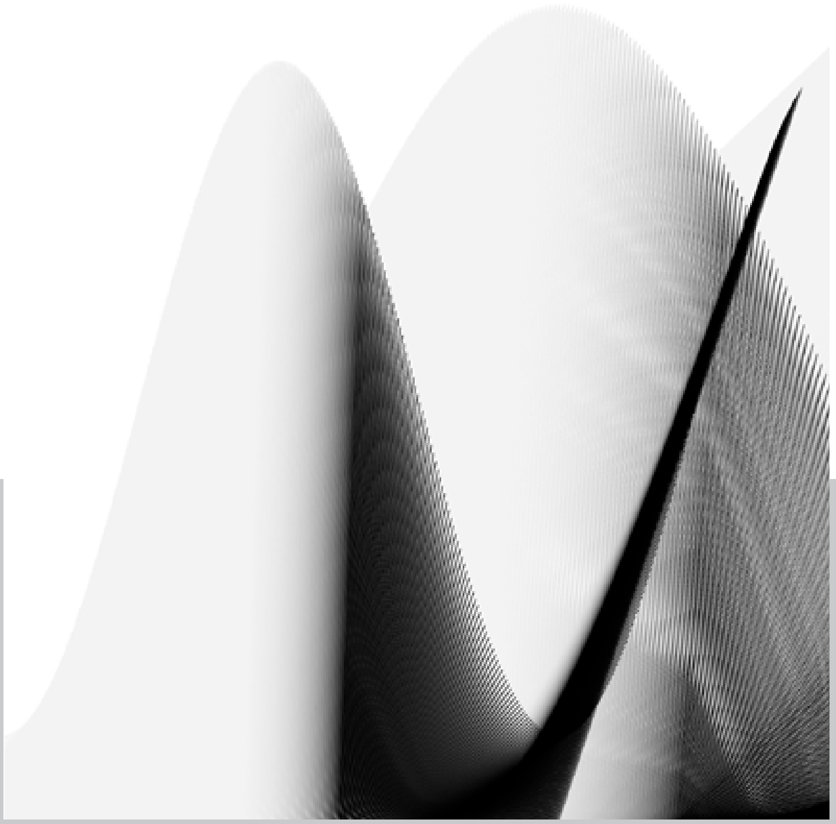
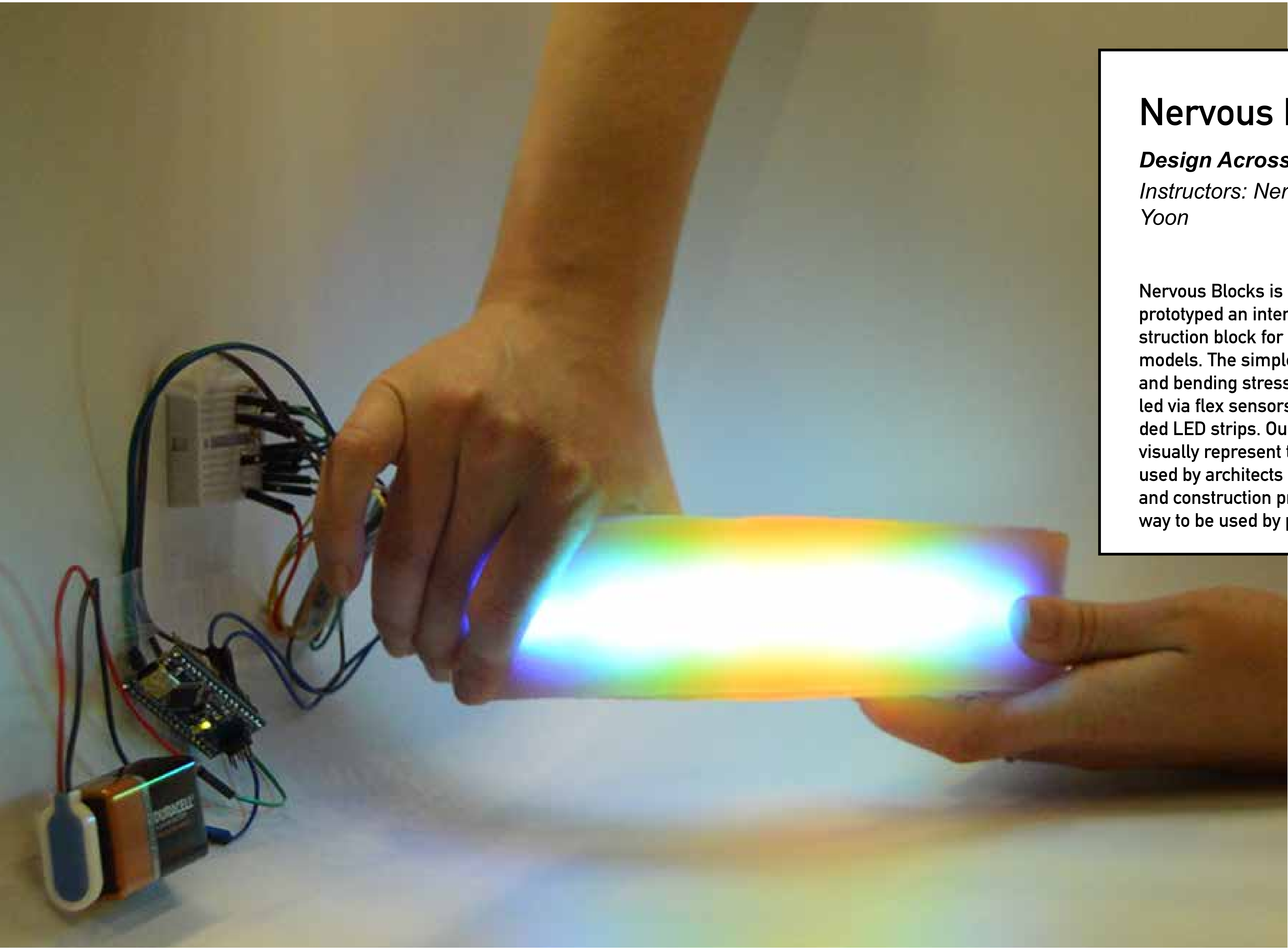
# Design and Engineering Portfolio

## Emma Pearl Willmer-Shiles, MIT 2018



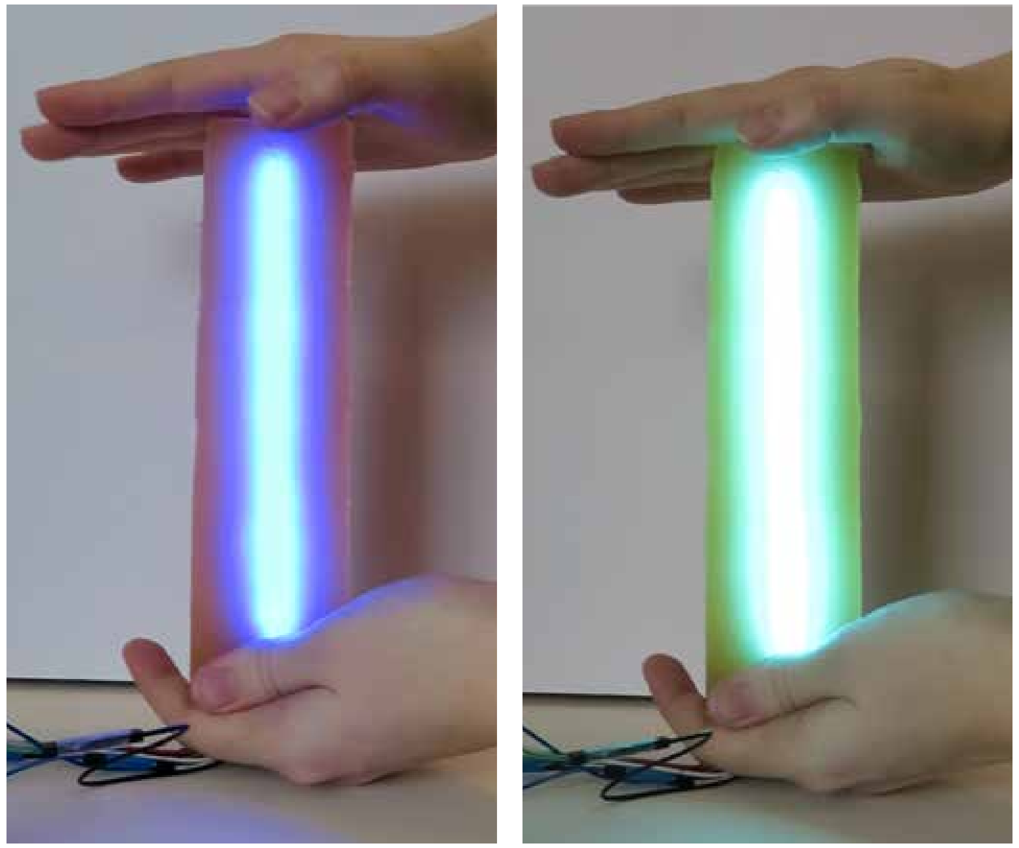


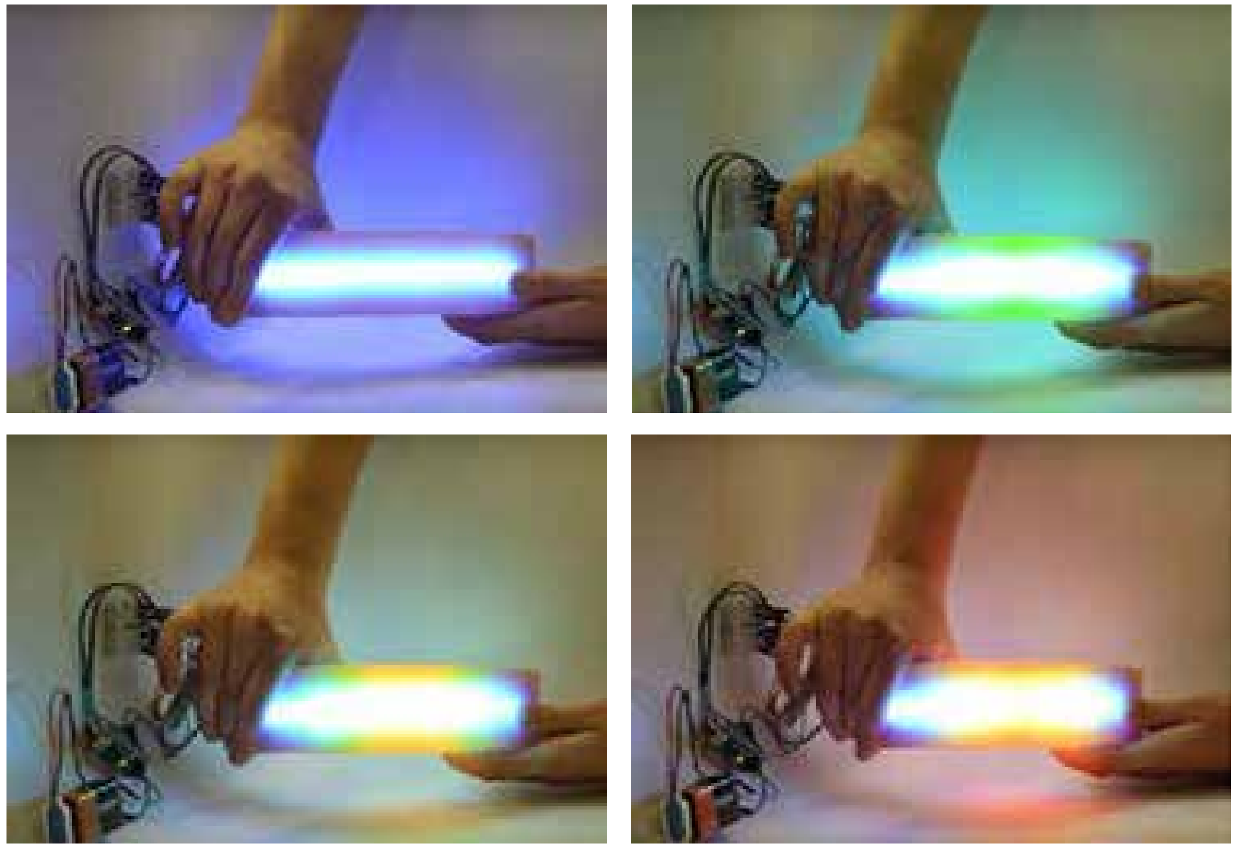
# Nervous Blocks

***Design Across Scales, Spring 2015***

*Instructors: Neri Oxman and Meejin Yoon*

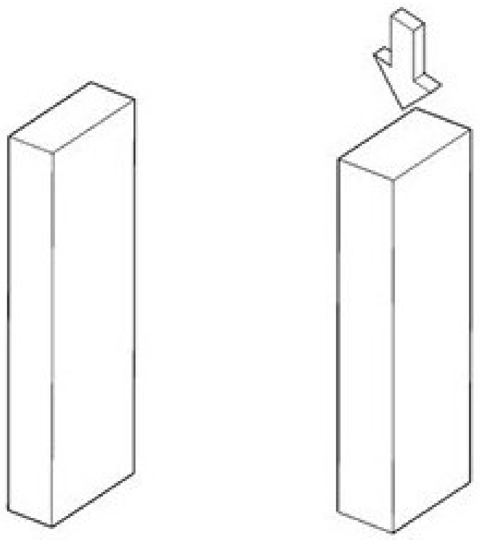
Nervous Blocks is a group project in which we prototyped an interactive, force-sensitive construction block for architectural and engineering models. The simple beam demonsrtates axial and bending stress as external forces are appliled via flex sensors, force sensors and embedded LED strips. Our goal is to interactively and visually represent the structural analysis tools used by architects and engineers in the deisgn and construction process in a more accessible way to be used by professinals and in education.

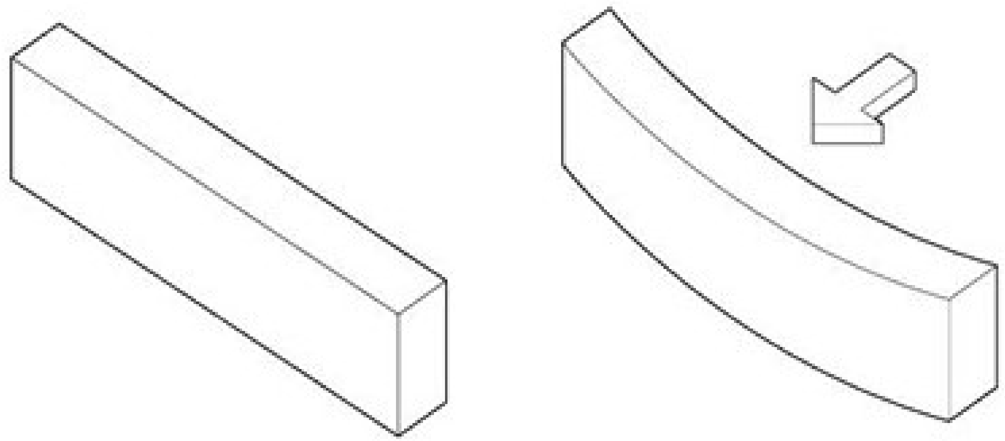




Colormapping stress in a beam during axial loading.

Colormapping stress in a beam during bending.





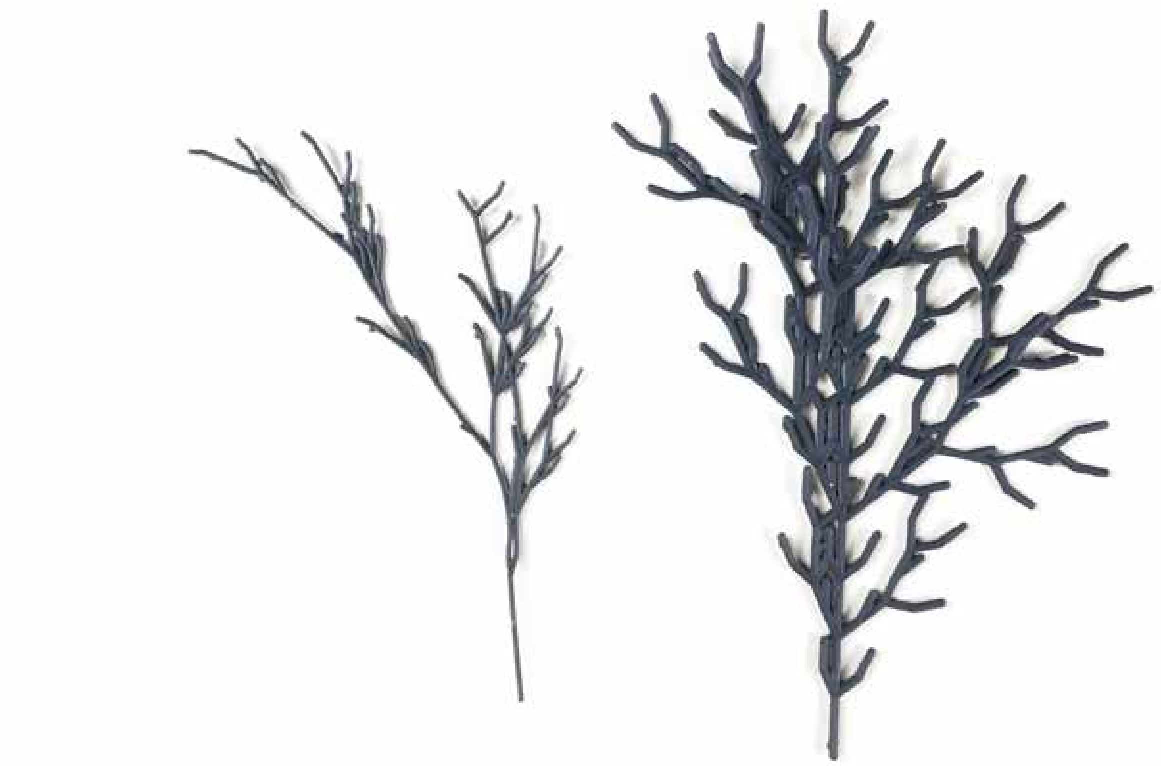

WESTIN
WELLS STREET

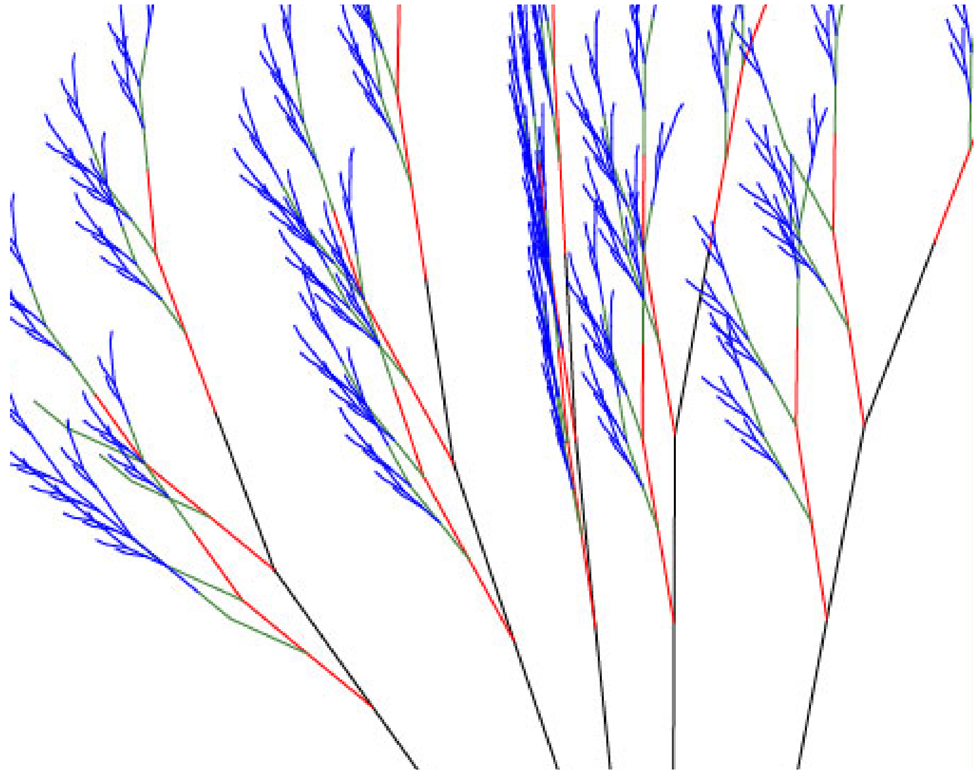
## 3D Printed Textile

***Design: Object and Interaction, Fall 2016***

*Instructors: Marcelo Coelho and Jessica Rosenkrantz*

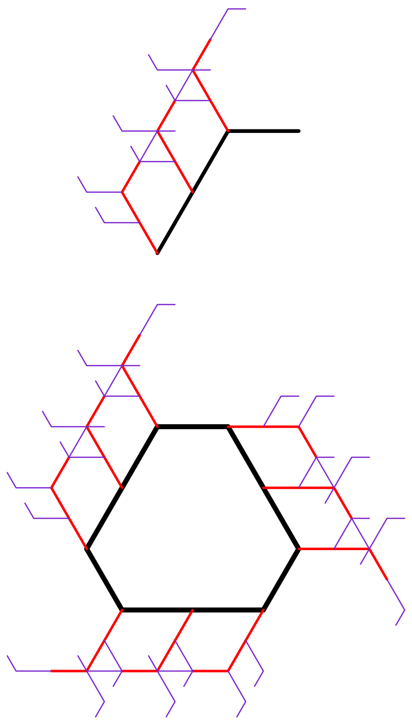
Formlabs 3D printers were used to prototype and print swatches of a textile. The process began by designing and printing single modules that could be repeated to create a larger swatch. The geometric base and texture of the modules are designed using fractal elements, taking advantage of their repetetive nature.

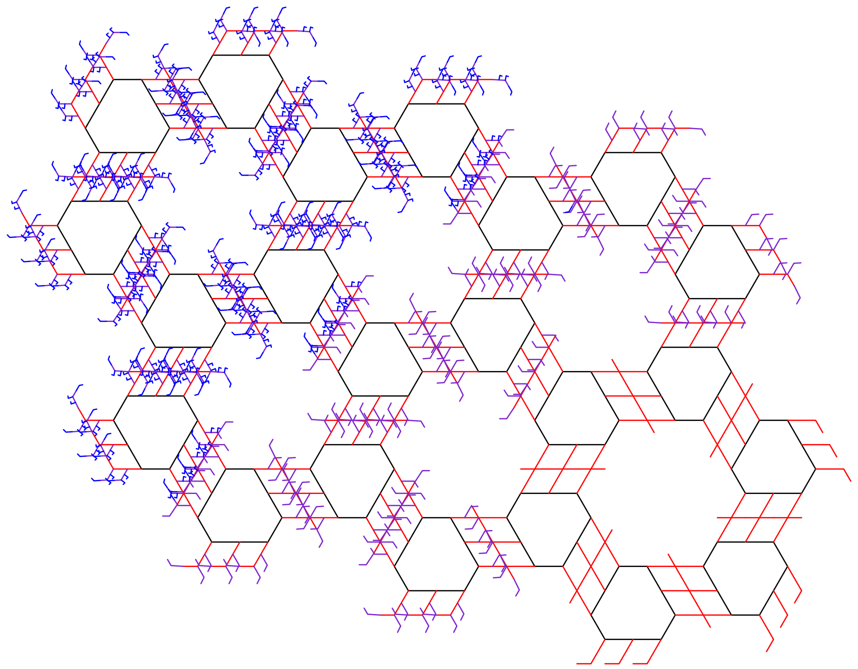




# Fractals and Repeating Modular Elements

The repetetive nature of fractals is used to design a variable and repeatable 3D printed textile. The base unit of an l-system was configured into the geometric base unit of the textile with the following generations growing upwards at an angle to develop texture. Across the textile, texture is varied by adding more generations and increasing the number of branches attatched to the original base unit.



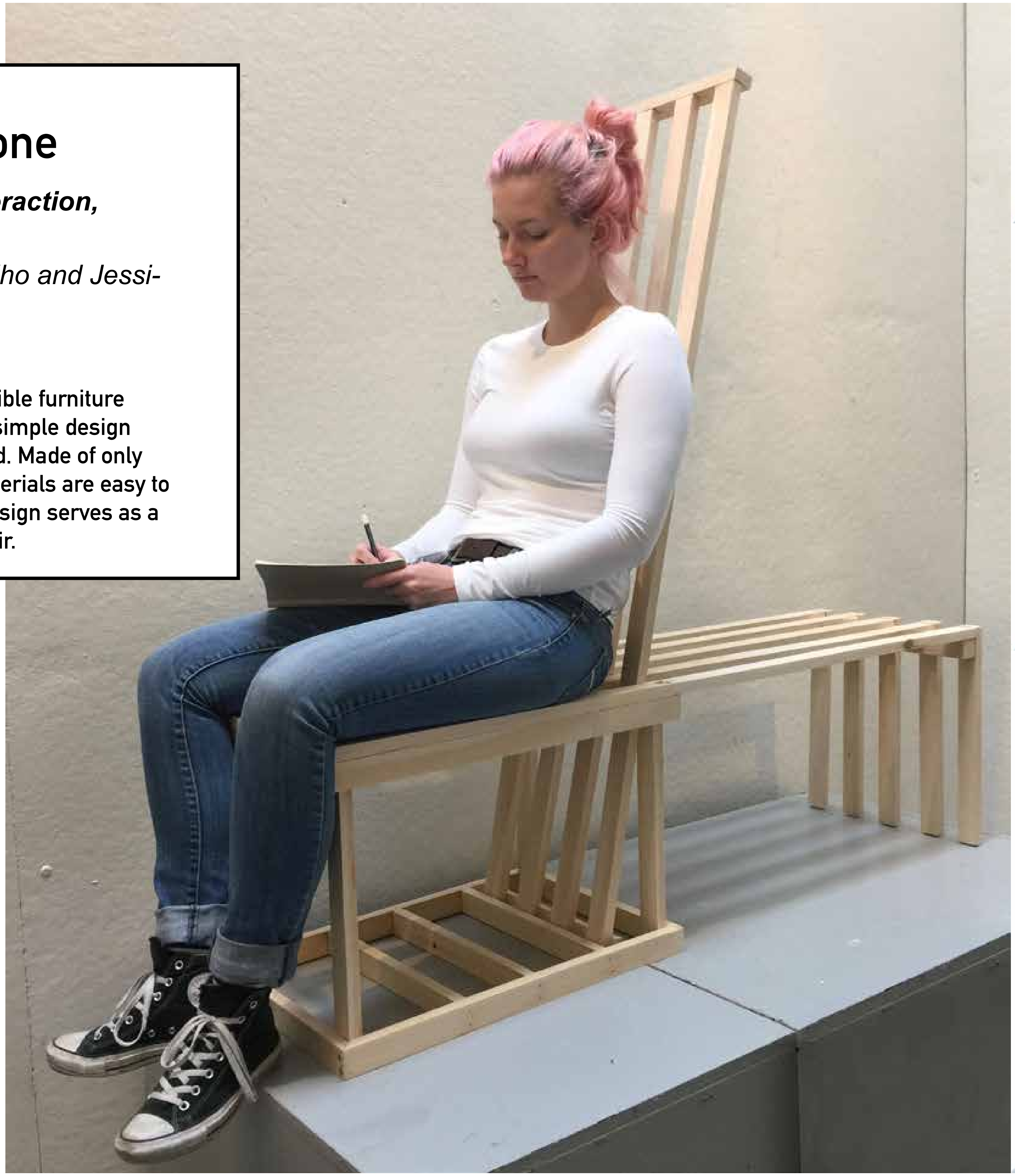


# Autoprogettazione

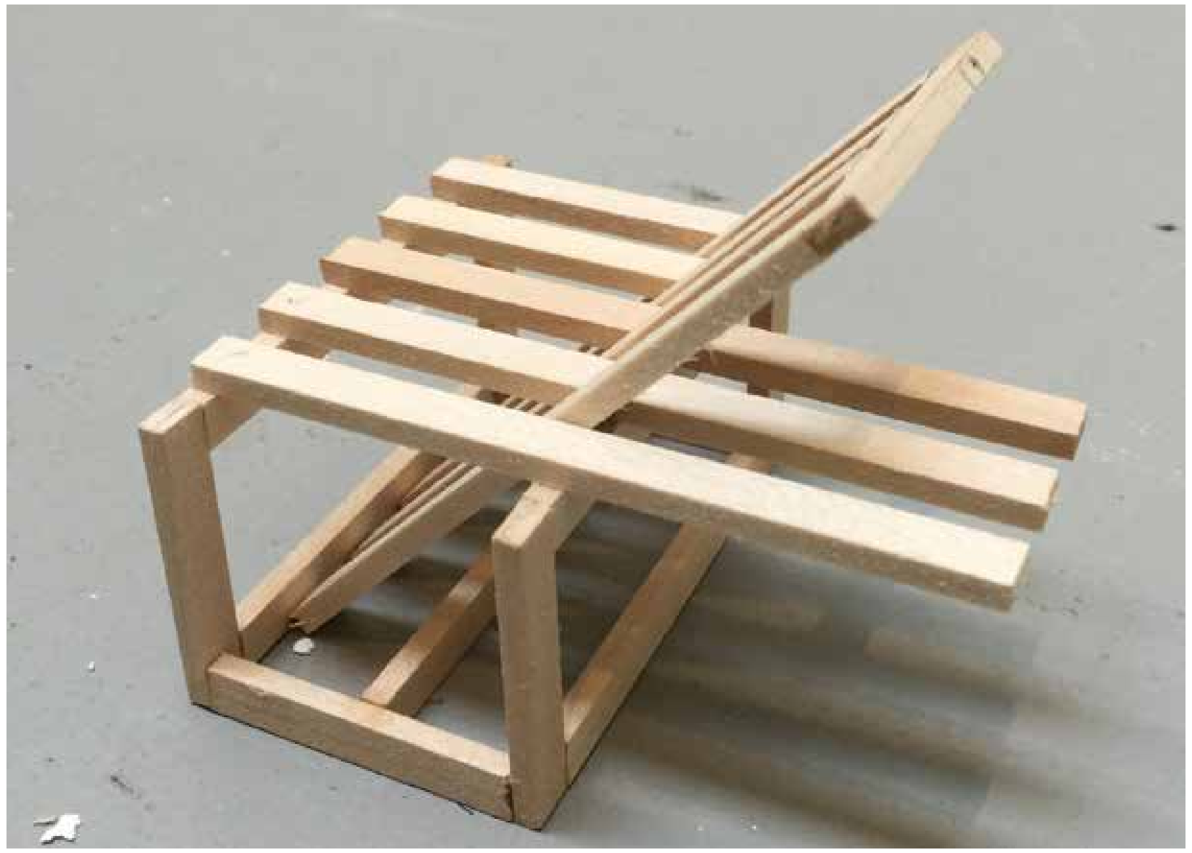
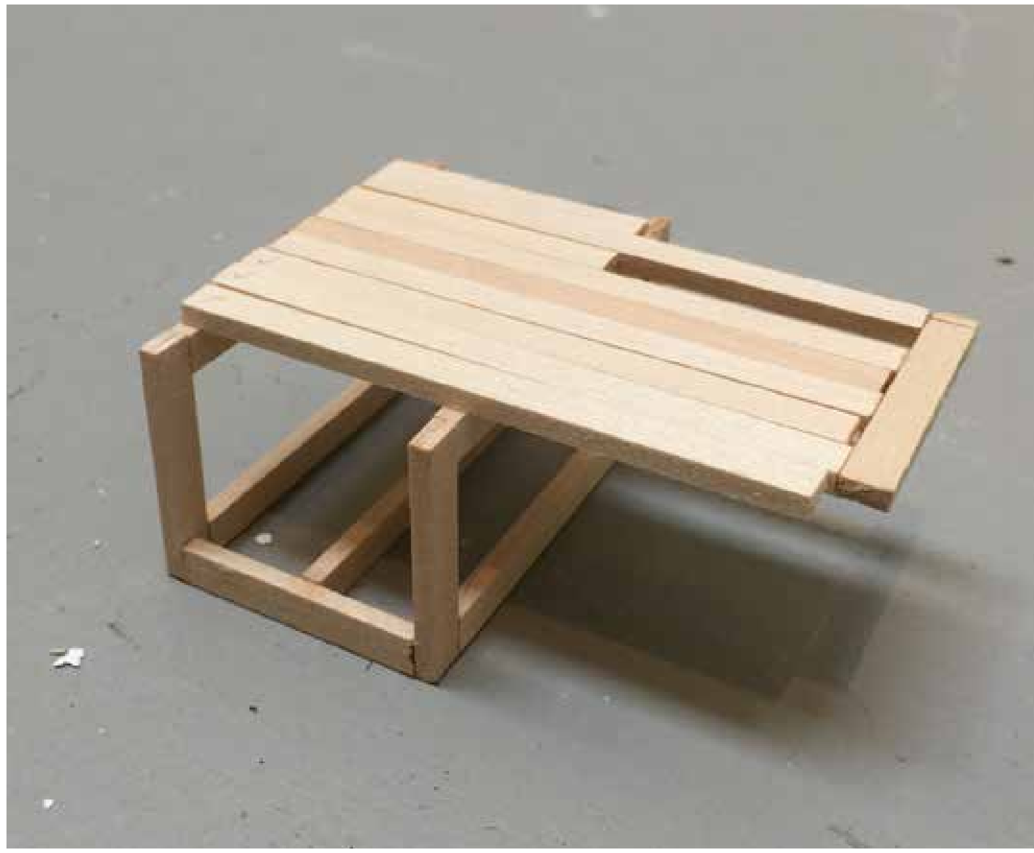
***Design: Object and Interaction, Fall 2016***

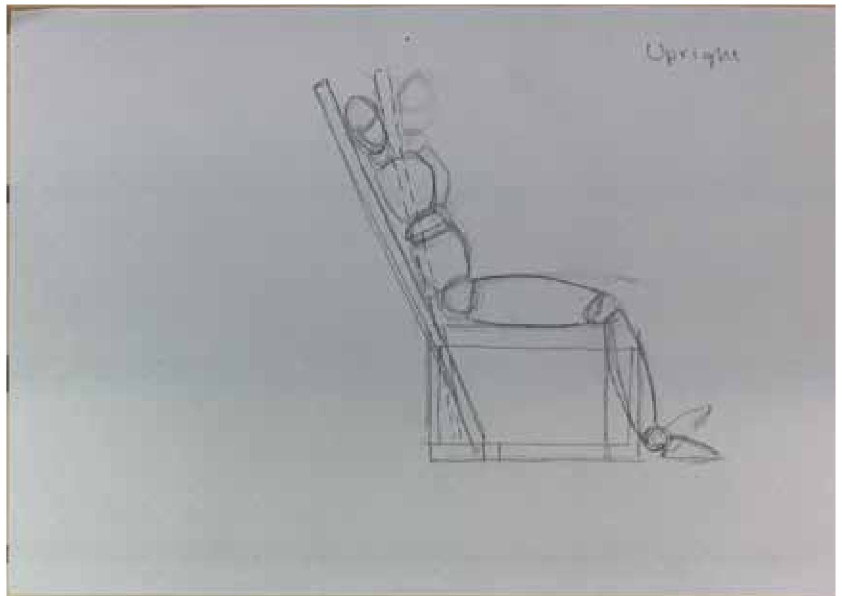
*Instructors: Marcelo Coelho and Jessica Rosenkrantz*

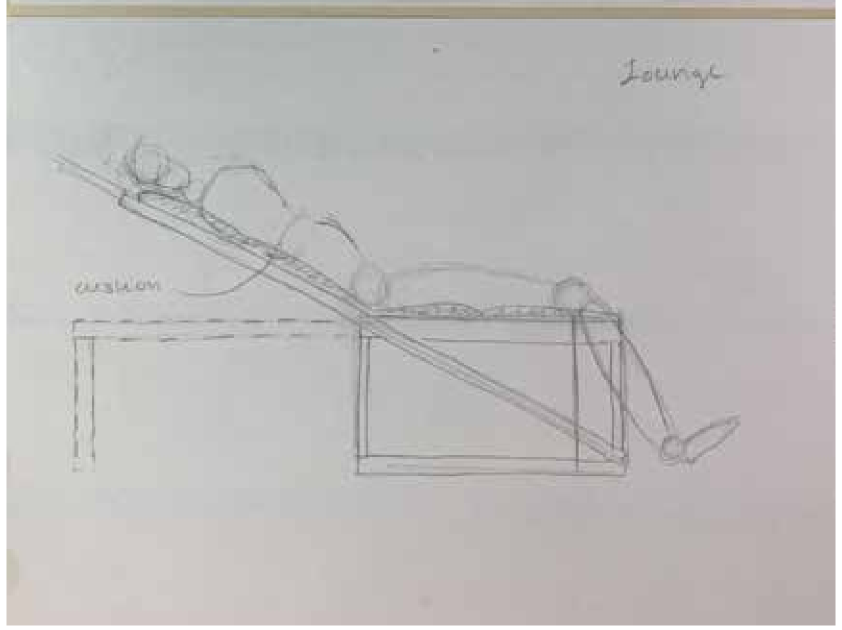
Inspired by Enzo Maris accessible furniture designs, this chair has a very simple design making it fast and easy to build. Made of only 1x2 pine slats the building materials are easy to find and the multifunctional design serves as a bench, lounge and upright chair.

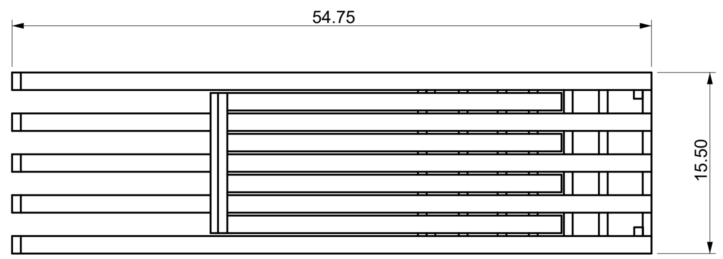


## Study Models

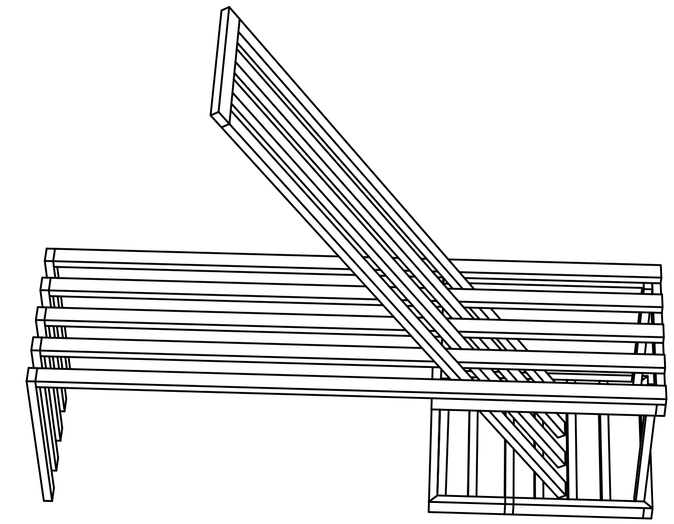






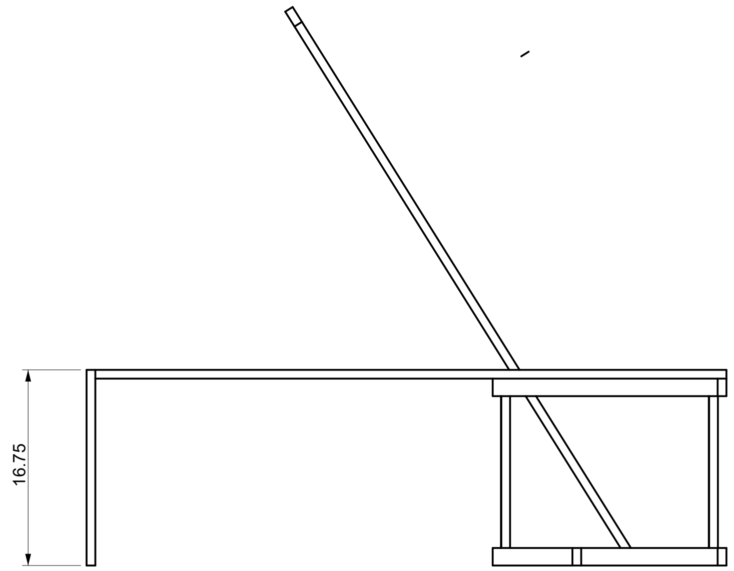



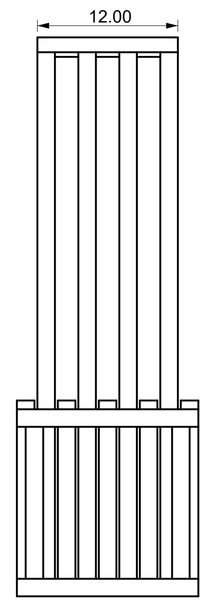

**TOP VIEW**



**ISOMETRIC VIEW**




**SIDE VIEW**




**FRONT VIEW**

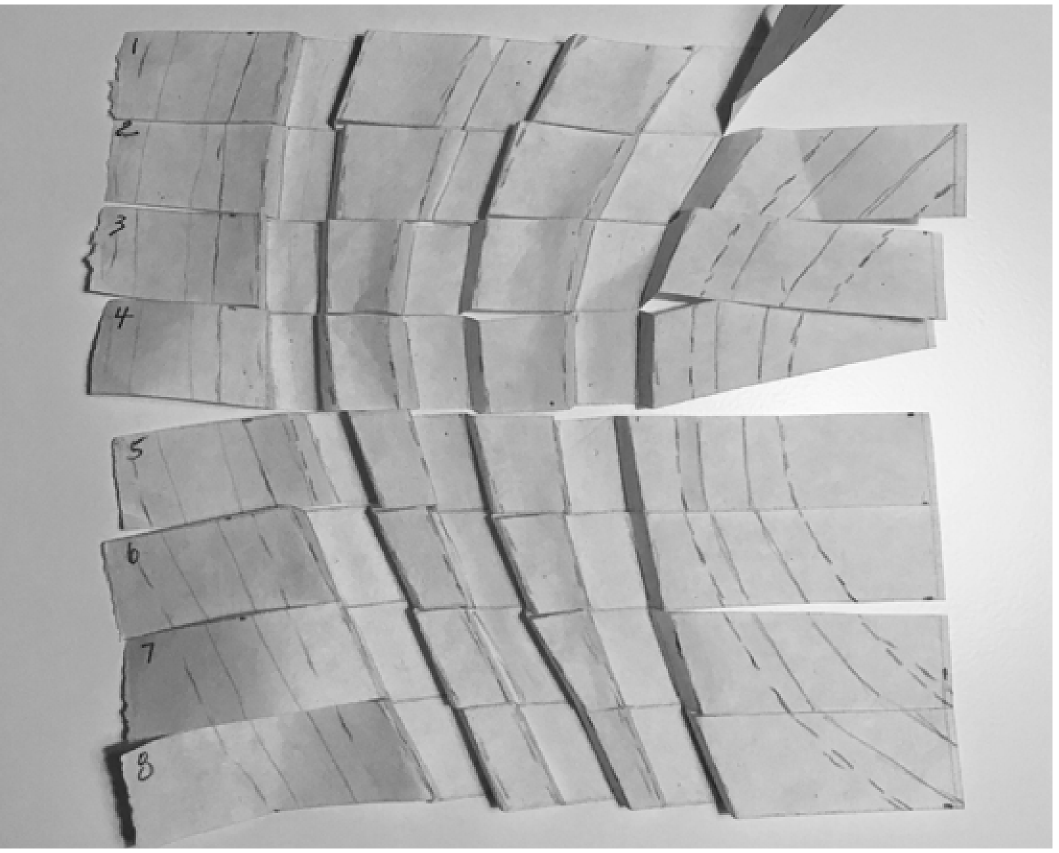
# Second Skin

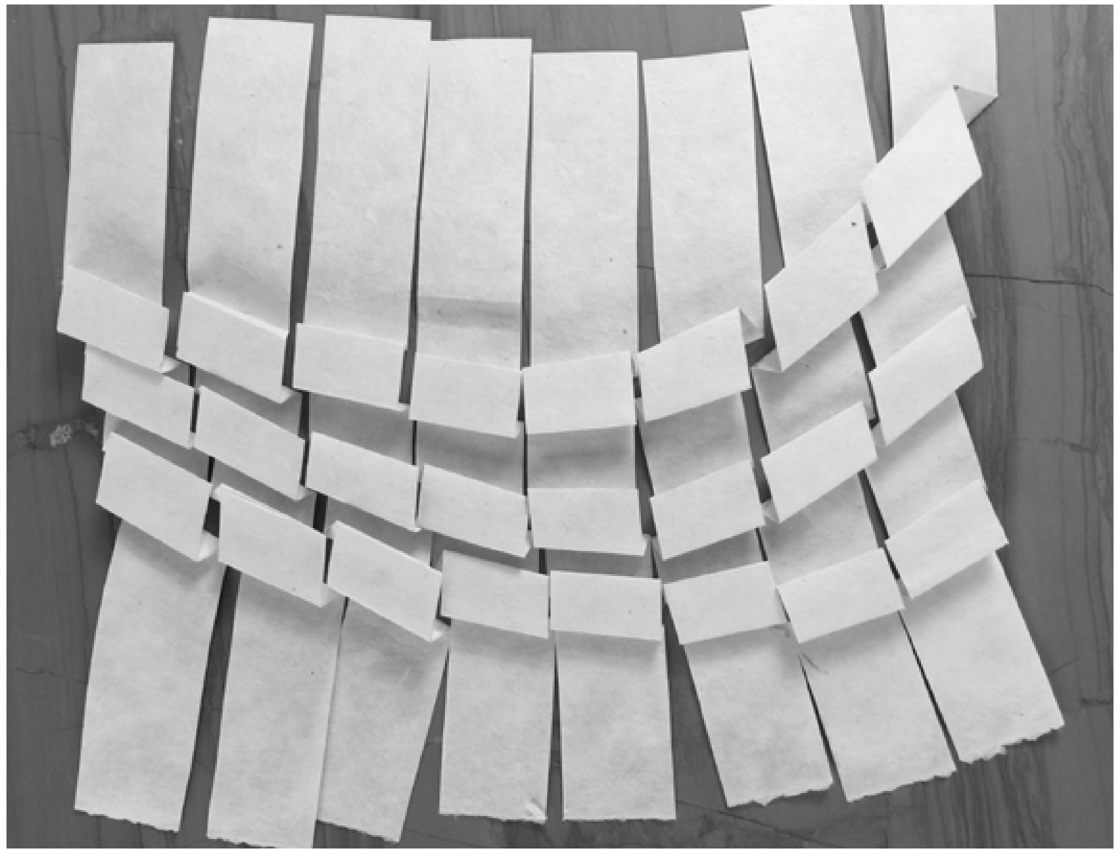
***Design: Object and Interaction, Fall 2016***

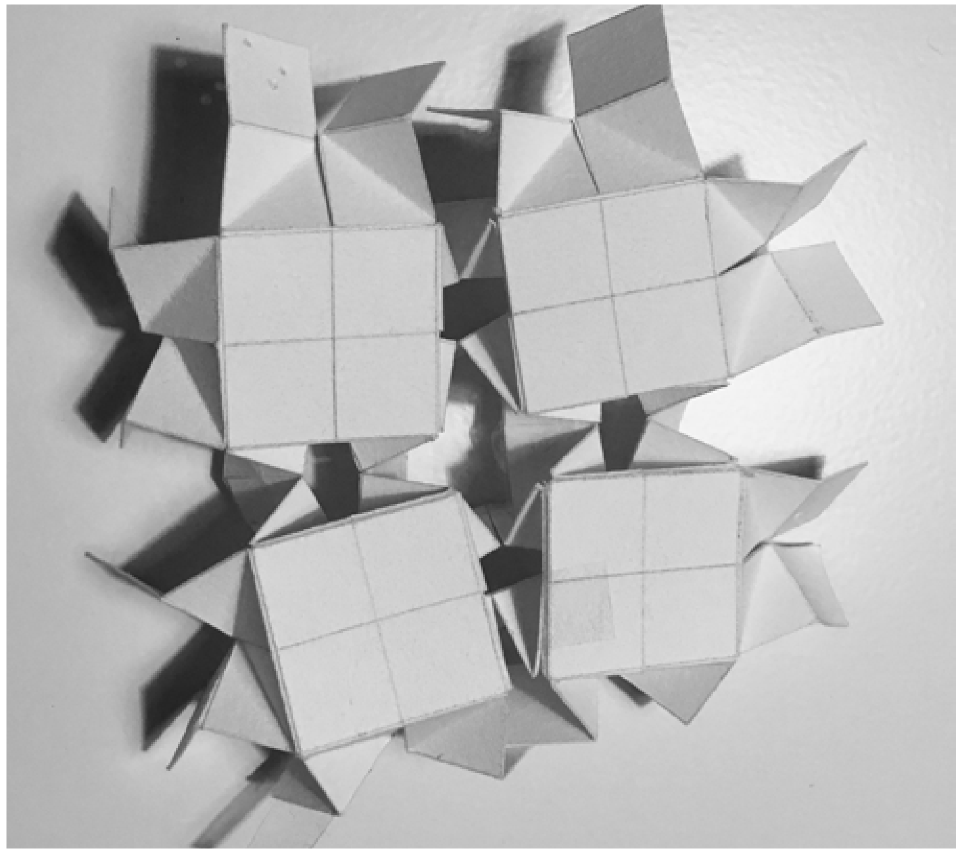
*Instructors: Marcelo Coelho and Jessica Rosenkrantz*

**This wearable explores the relationship between the appearance of the garment and movement or the shape of the person wearing it. As different contours in the body bend or relax, the expansion and compression of the garment reveals a new color, texture and pattern.**

# Study Models



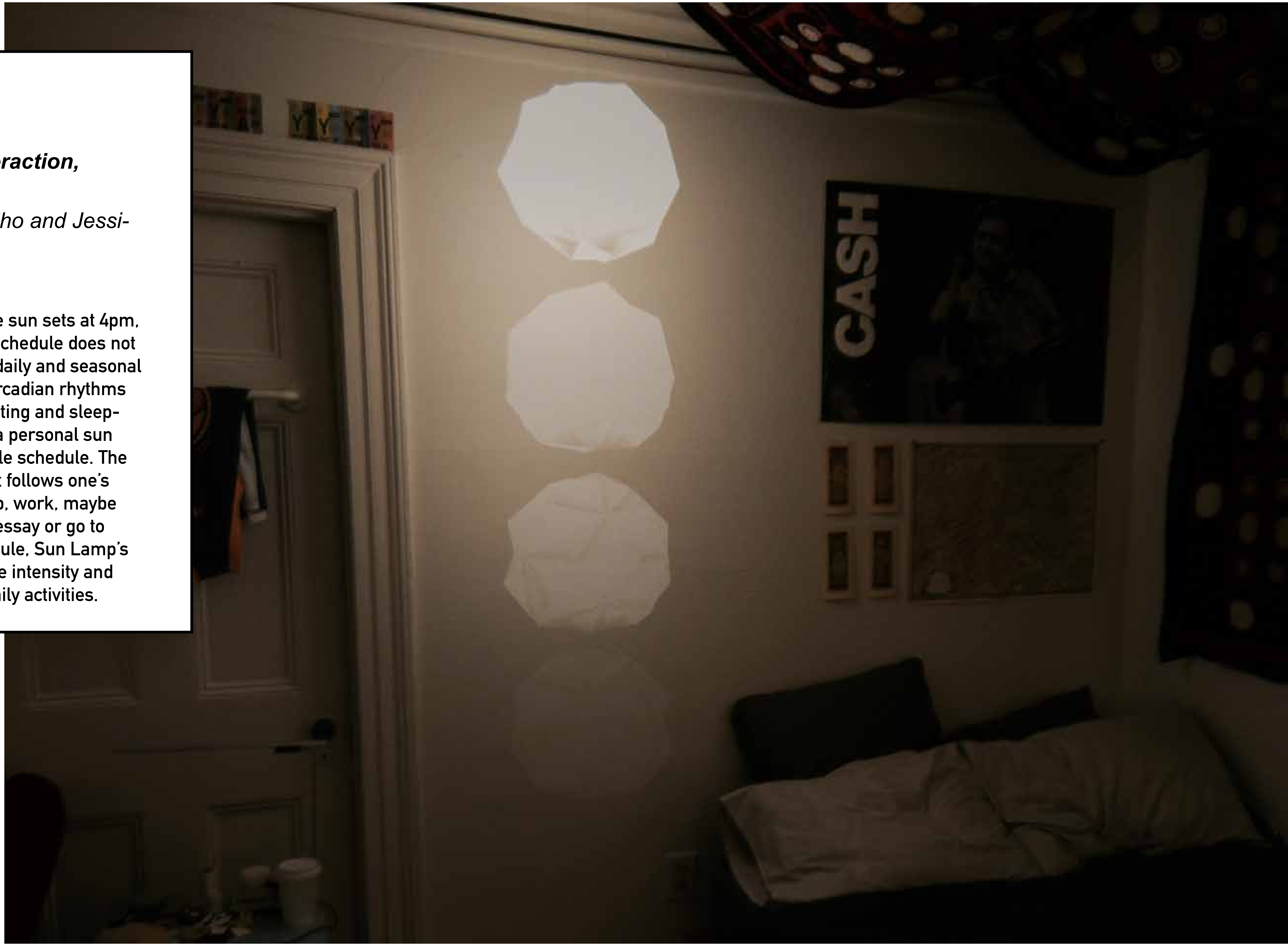


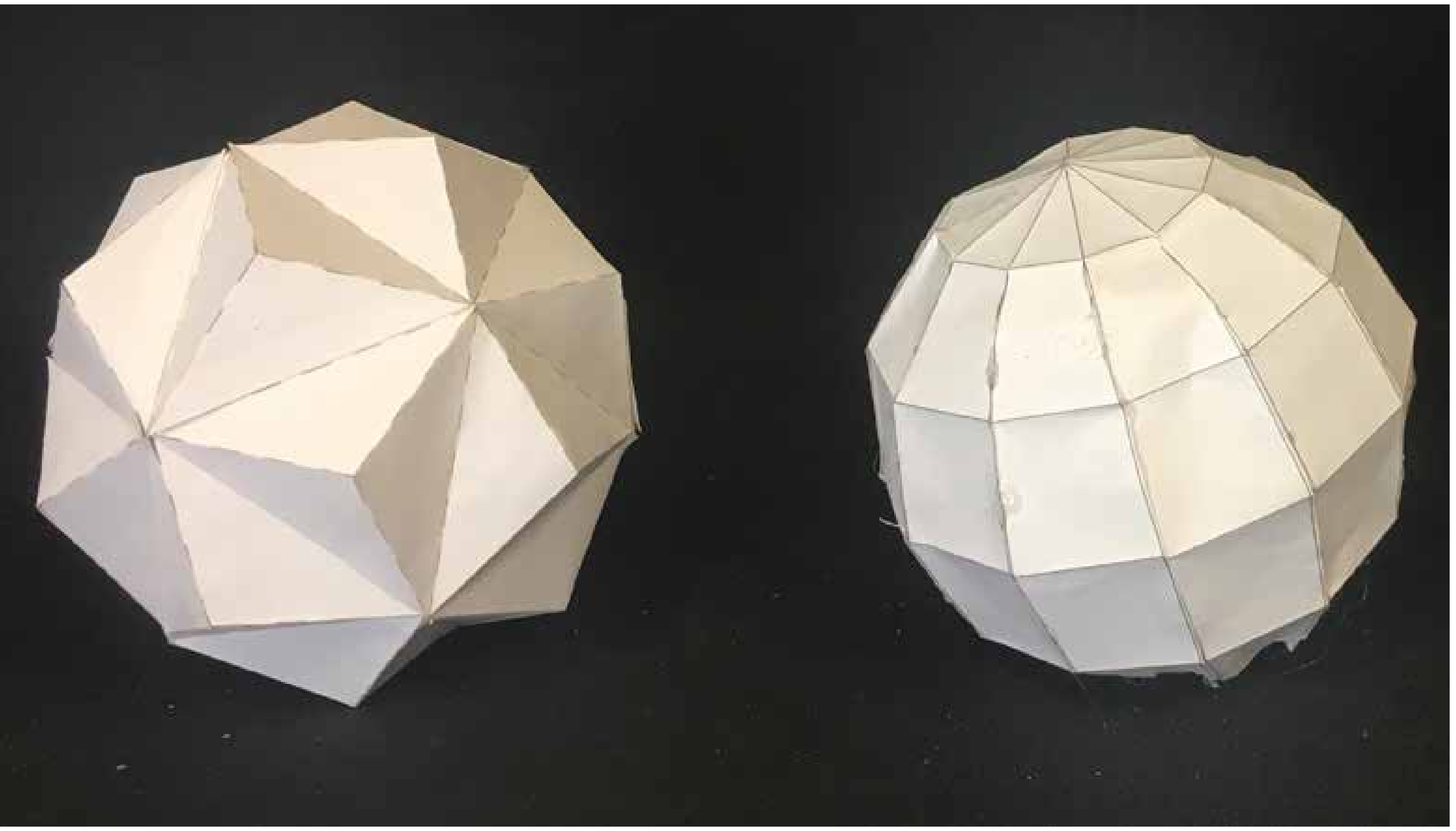
# Sun Lamp

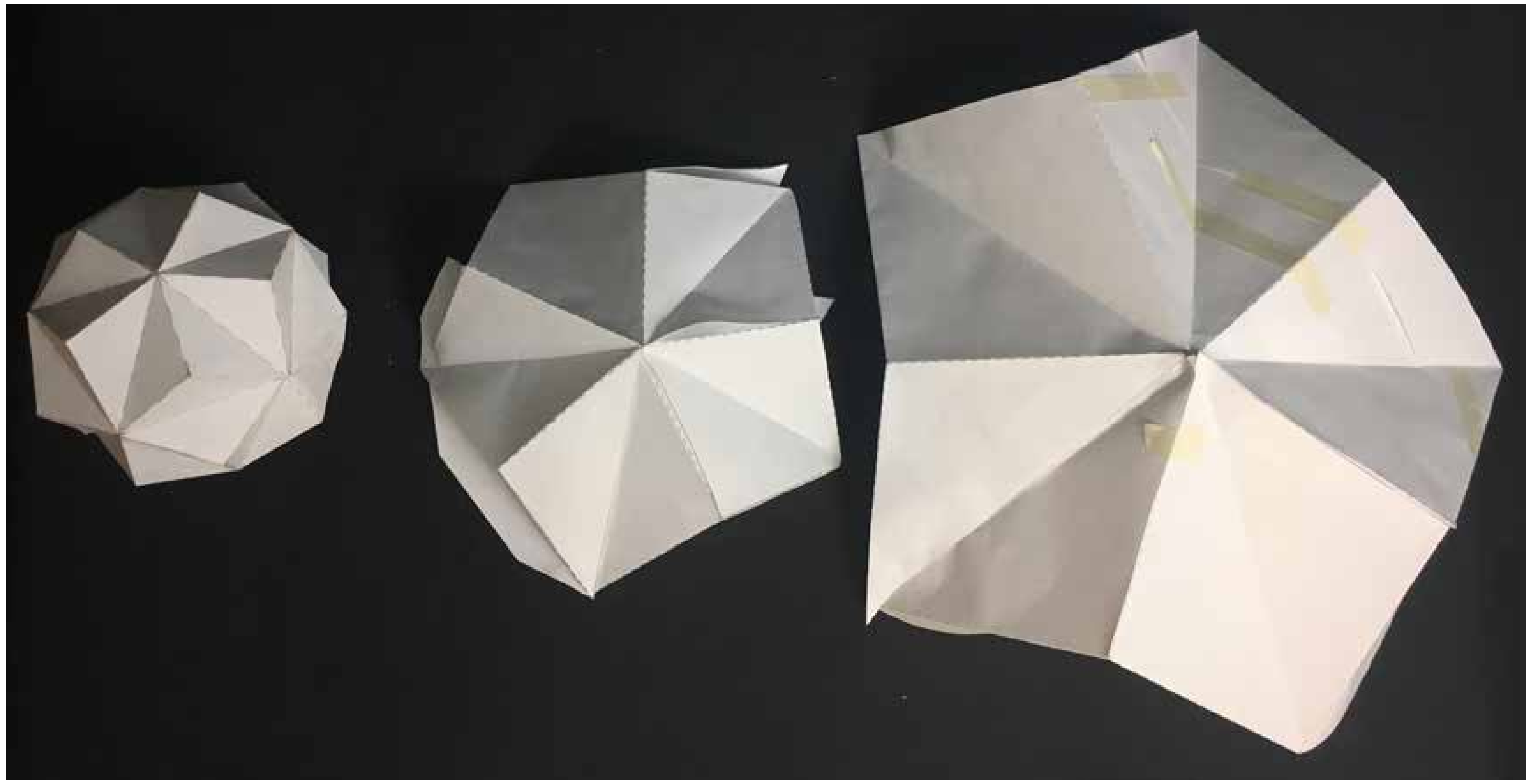
***Design: Object and Interaction, Fall 2016***

*Instructors: Marcelo Coelho and Jessica Rosenkrantz*

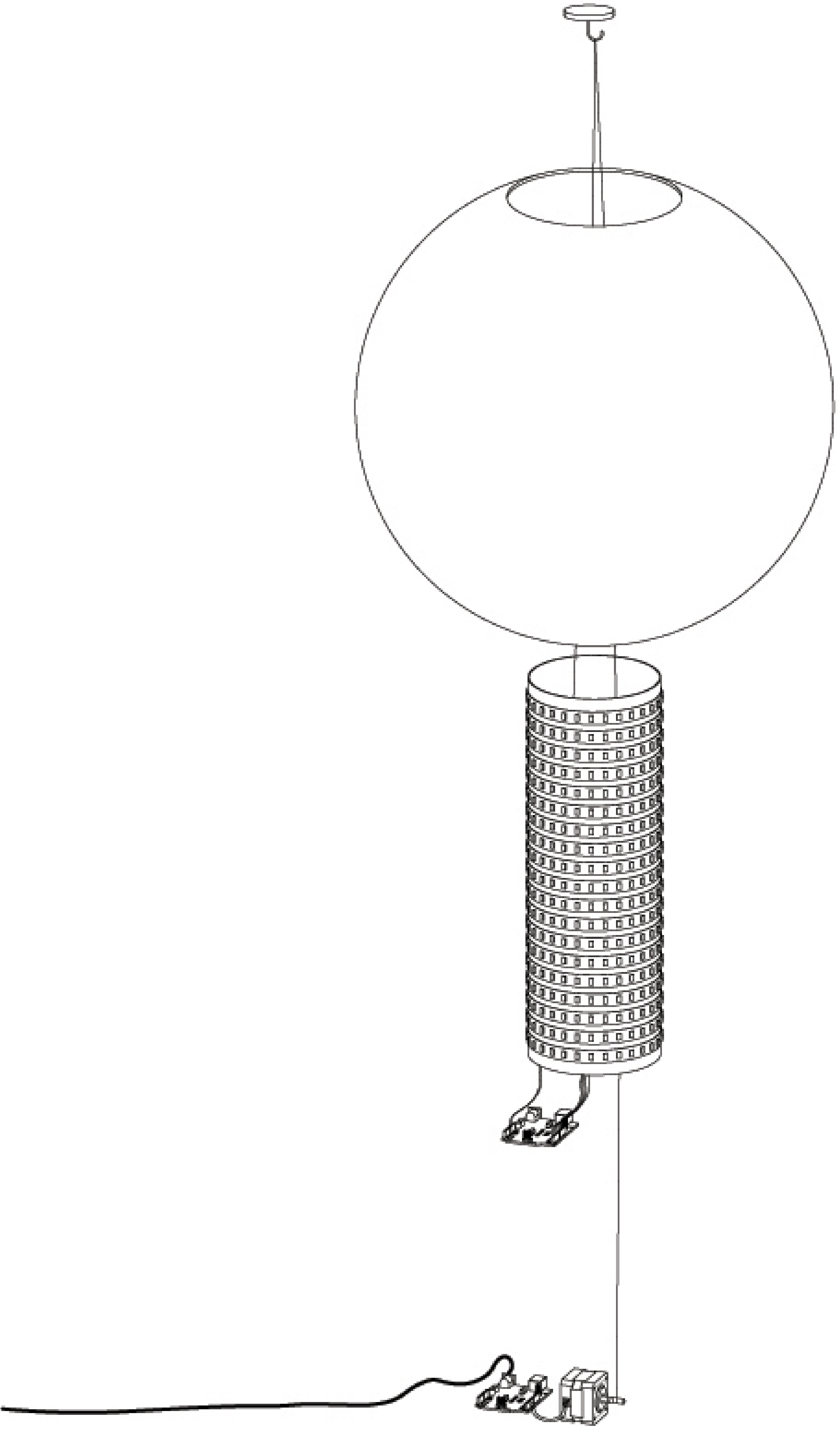
As the winter moves in and the sun sets at 4pm, we start to find that the sun's schedule does not align with our own. The sun's daily and seasonal cycles directly affect human circadian rhythms and our health, productivity, eating and sleeping habits. Sun Lamp creates a personal sun that can track a daily, modifiable schedule. The height and intensity of the light follows one's daily schedule as they wake up, work, maybe pull an all nighter to finish an essay or go to bed early. No matter the schedule, Sun Lamp's height and vibrancy parallel the intensity and productivity required for the daily activities.








CASH



# Using Arduinos to Program Schedule

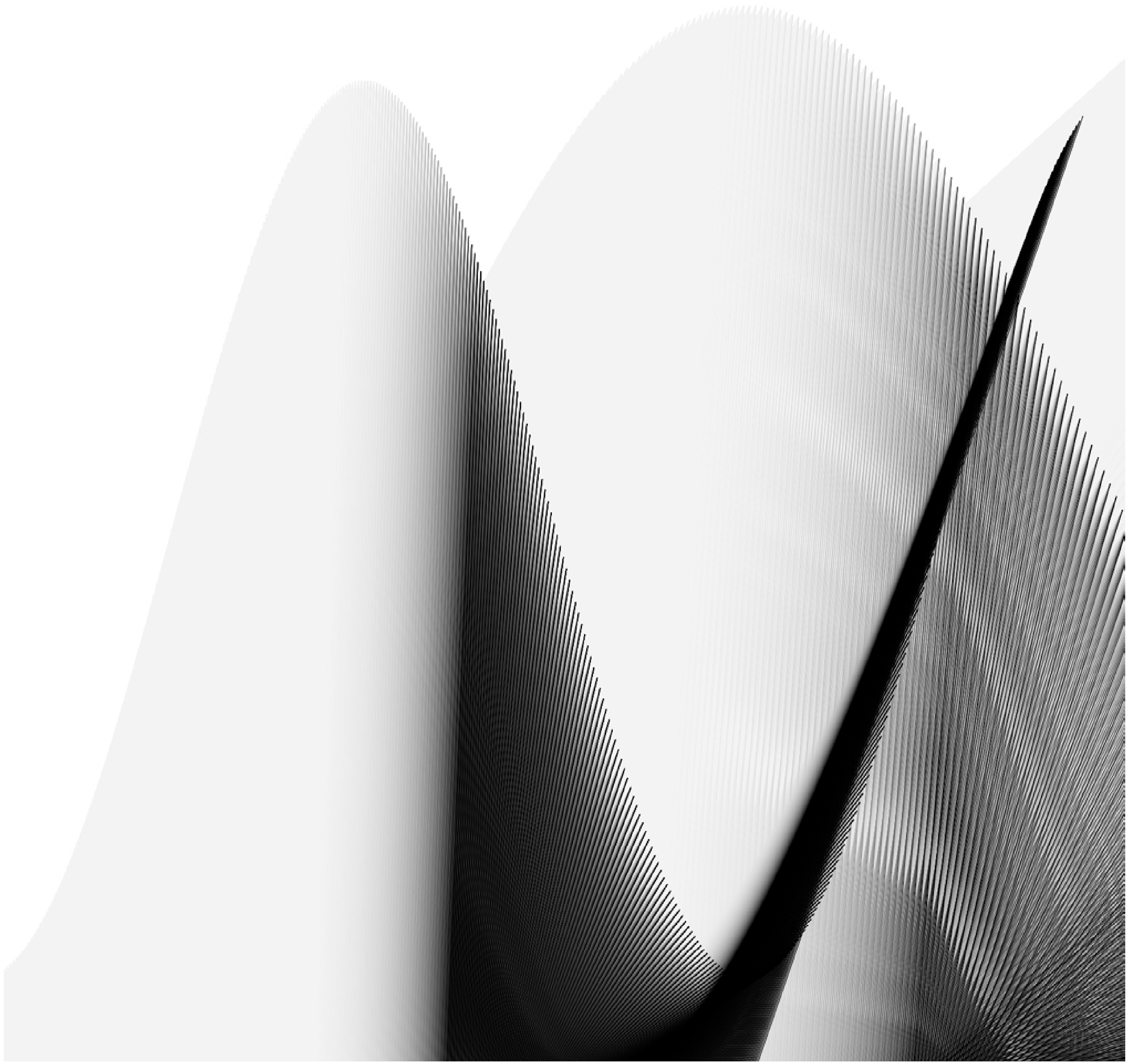
The schedule governing the height and intensity of light was controlled using Arduinos in the LED core and at the base, which were connected to a stepper motor that lifted and lowered the lamp through-out the day.

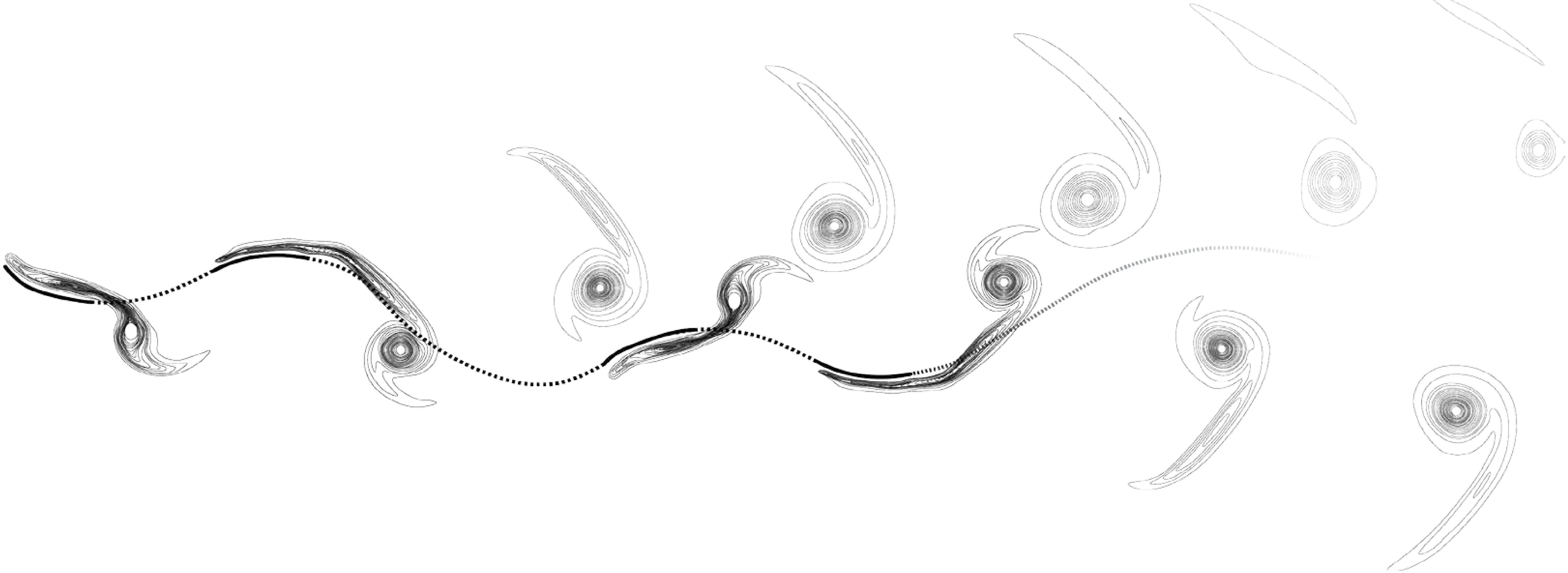
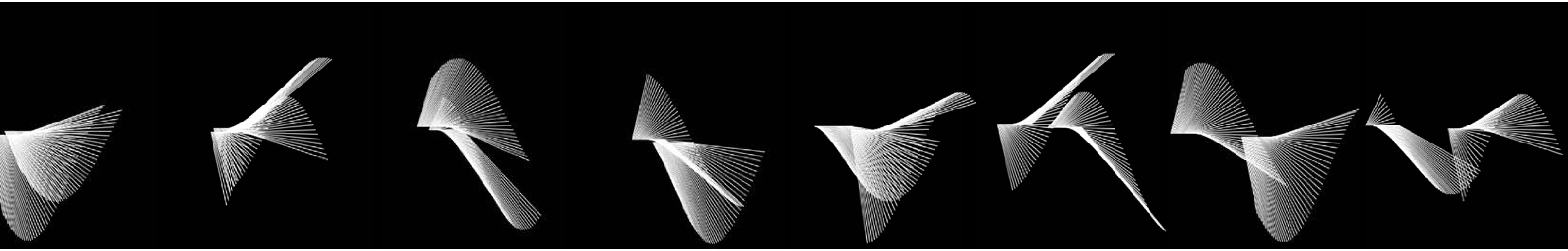
# Bio-Inspired Drawings

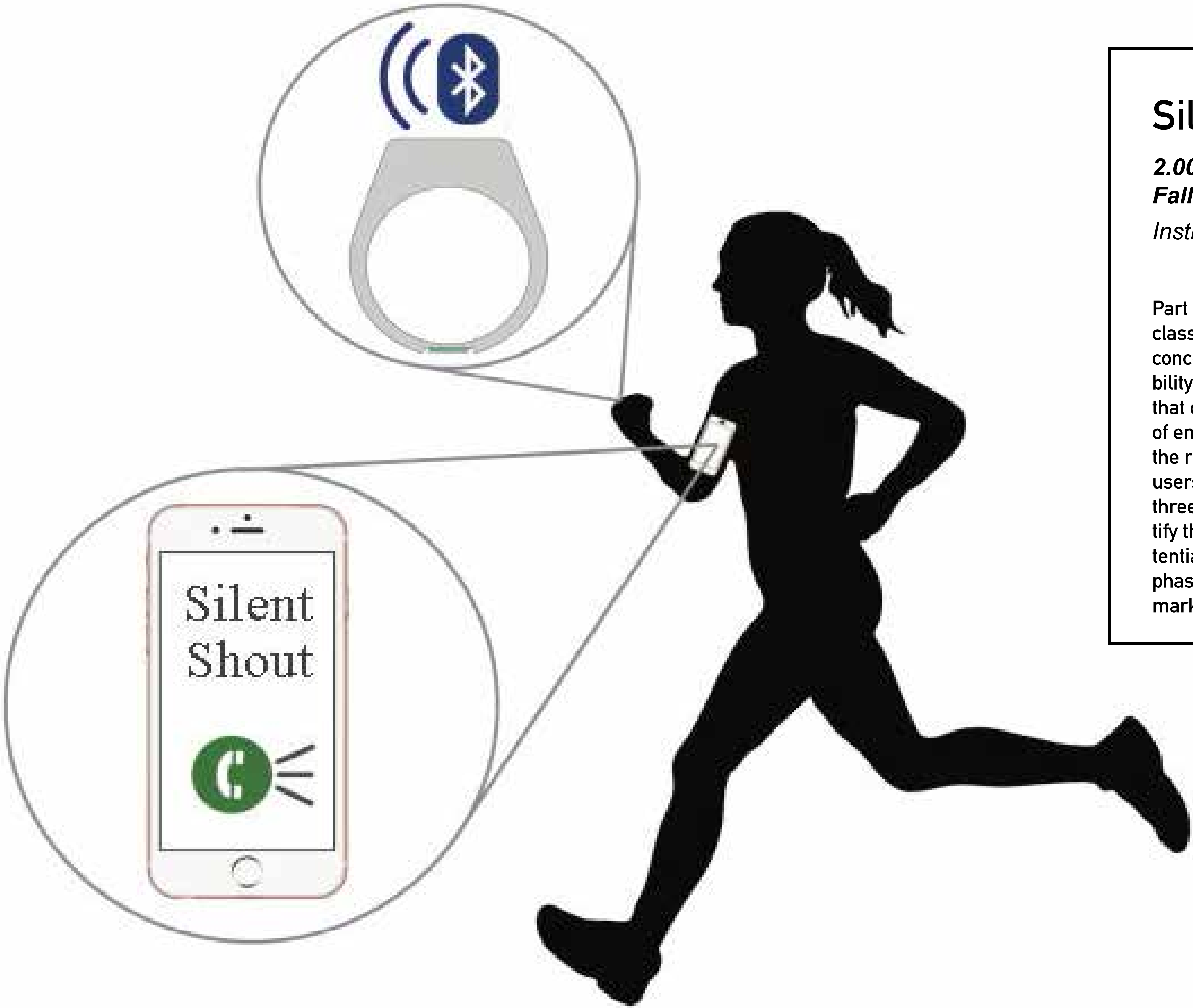
***Design: Technique and Technology, Spring 2017***

*Instructors: Jeremy Jih and Skylar Tibbits*

This project began with research and exploration of a physical precedent; fish fins and their movement through water. By modeling the fin undulations as sine waves, various parameters affecting fin and water movement were explored by creating kinetic drawings with the Processing language and environment. Stills of these drawings looking at fins with different parameters and the water eddies created by a fin are presented here.






## Silent Shout

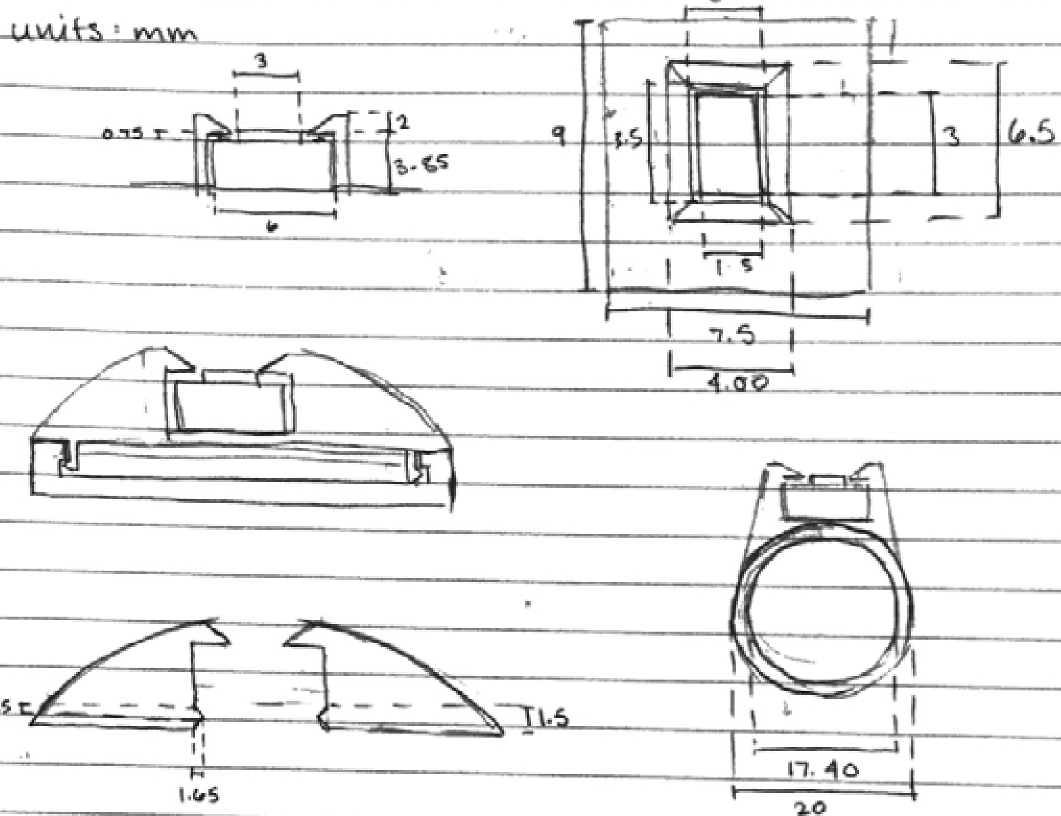
***2.009: Product Engineering Process, Fall 2017***

*Instructor: David Wallace*

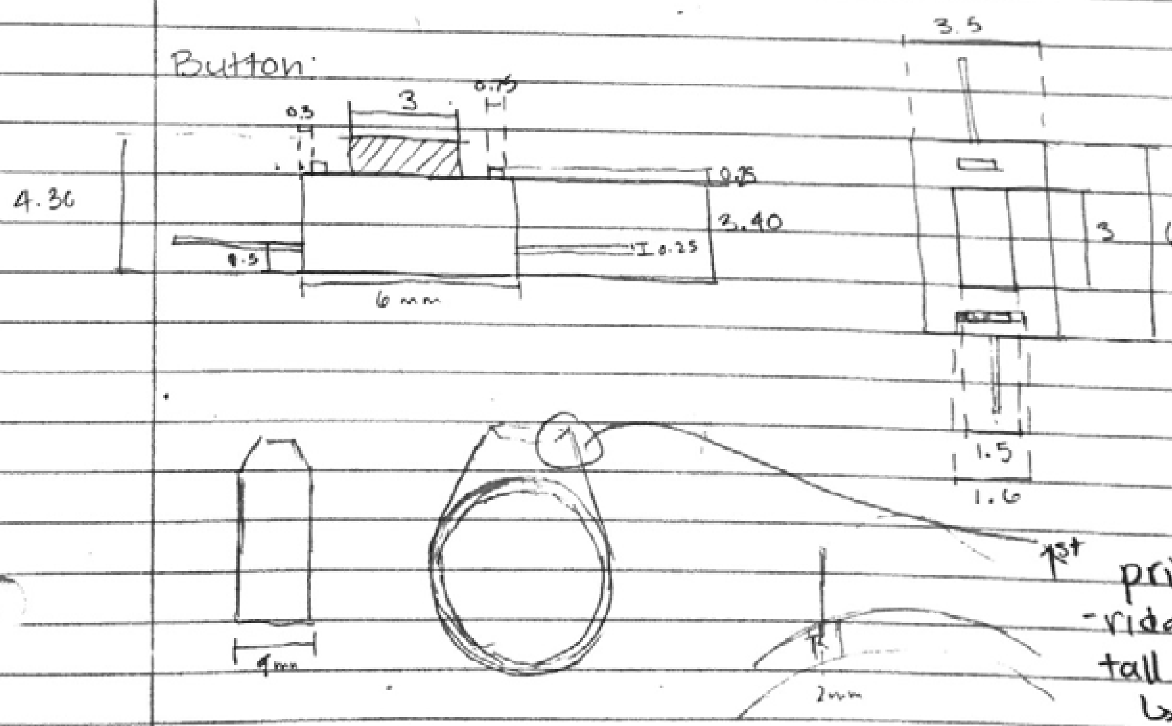
Part of MIT's mechanical engineering cap stone class, Silent Shout was an early stage product concept. This group project explored the possibility of an active wearable in the form of a ring that could serve as an alert system in the case of emergency. Mostly targeted towards runners, the ring would be connected via bluetooth to the users phone and when activated would contact three designated contacts with a message to notify them of the emergency. Interviews with potential customers, police deparments and early phase protypes were used to explore physical, market and system feasibility.

Silent Shout 10/15

units: mm



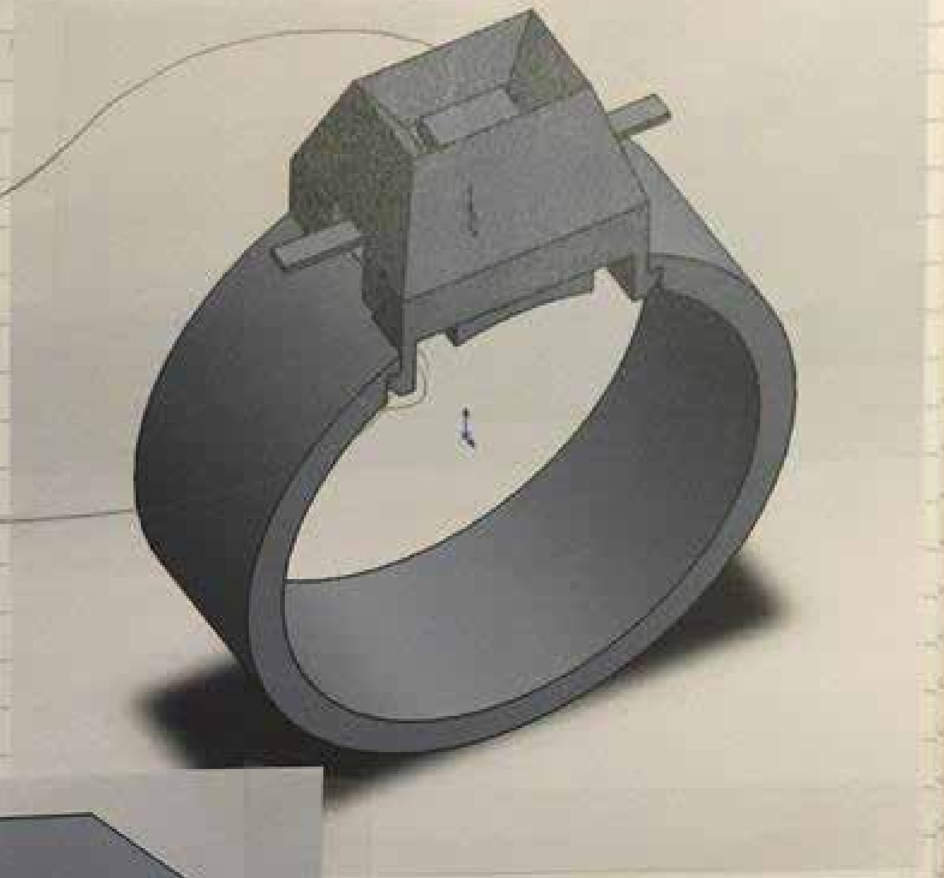

Button:




1st print
- ridges too tall and steep
↳ finger cannot reach button

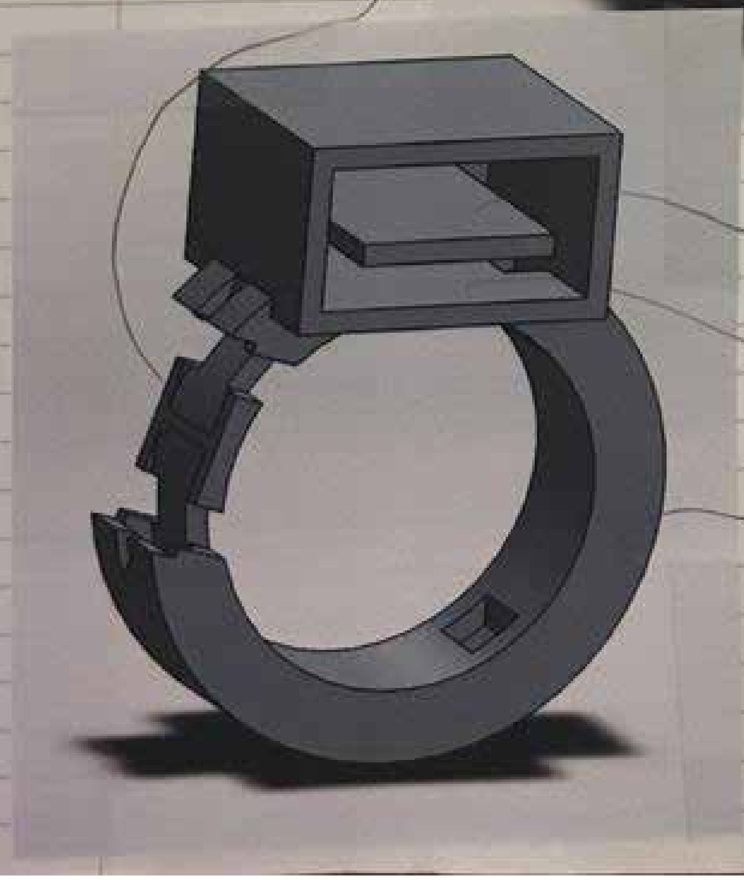
Silent Shout - CAD iterations 10/18

had to lower height of wall to make button access easier



too small to print

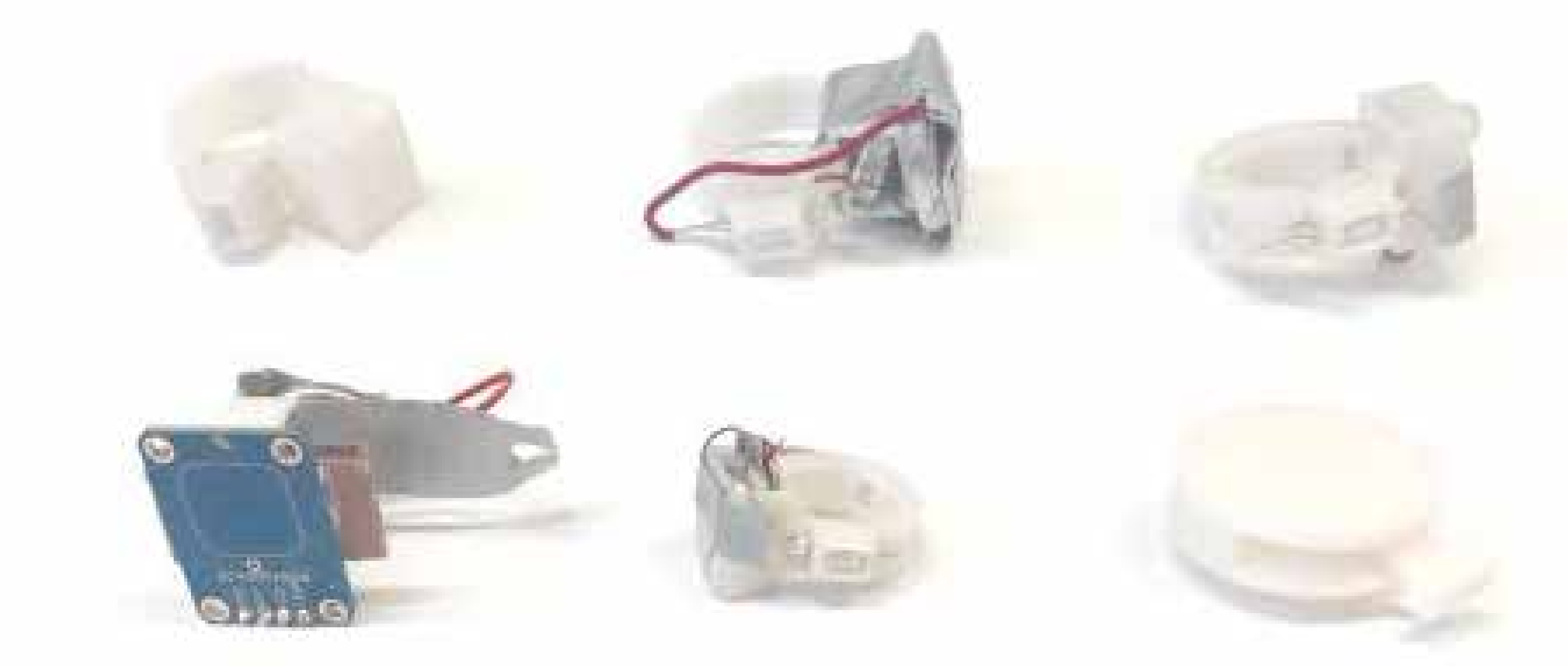
slot for button + clip



motor on top

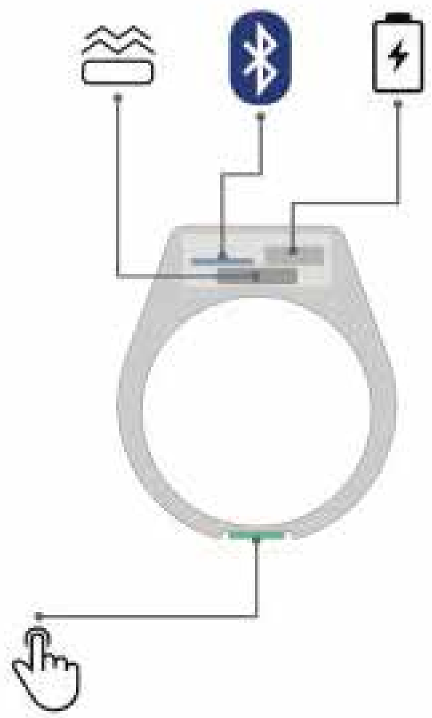
"clip" for battery to keep wires in place

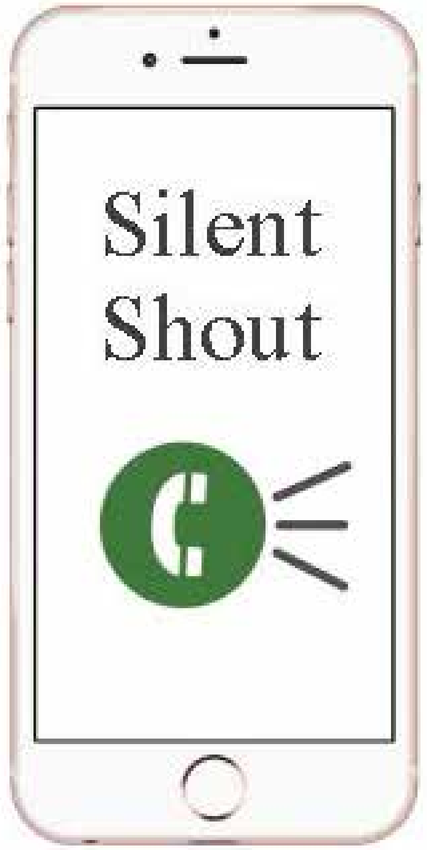
hollow casing for wires



## Exploring Form Factor

Early prototypes focused on how the user would activate the emergeny system. Various prototypes used single push-buttons, switches and capacative touch sensors and examined how difficult it was to activate each one as well as how prone they were to accidental false activation.



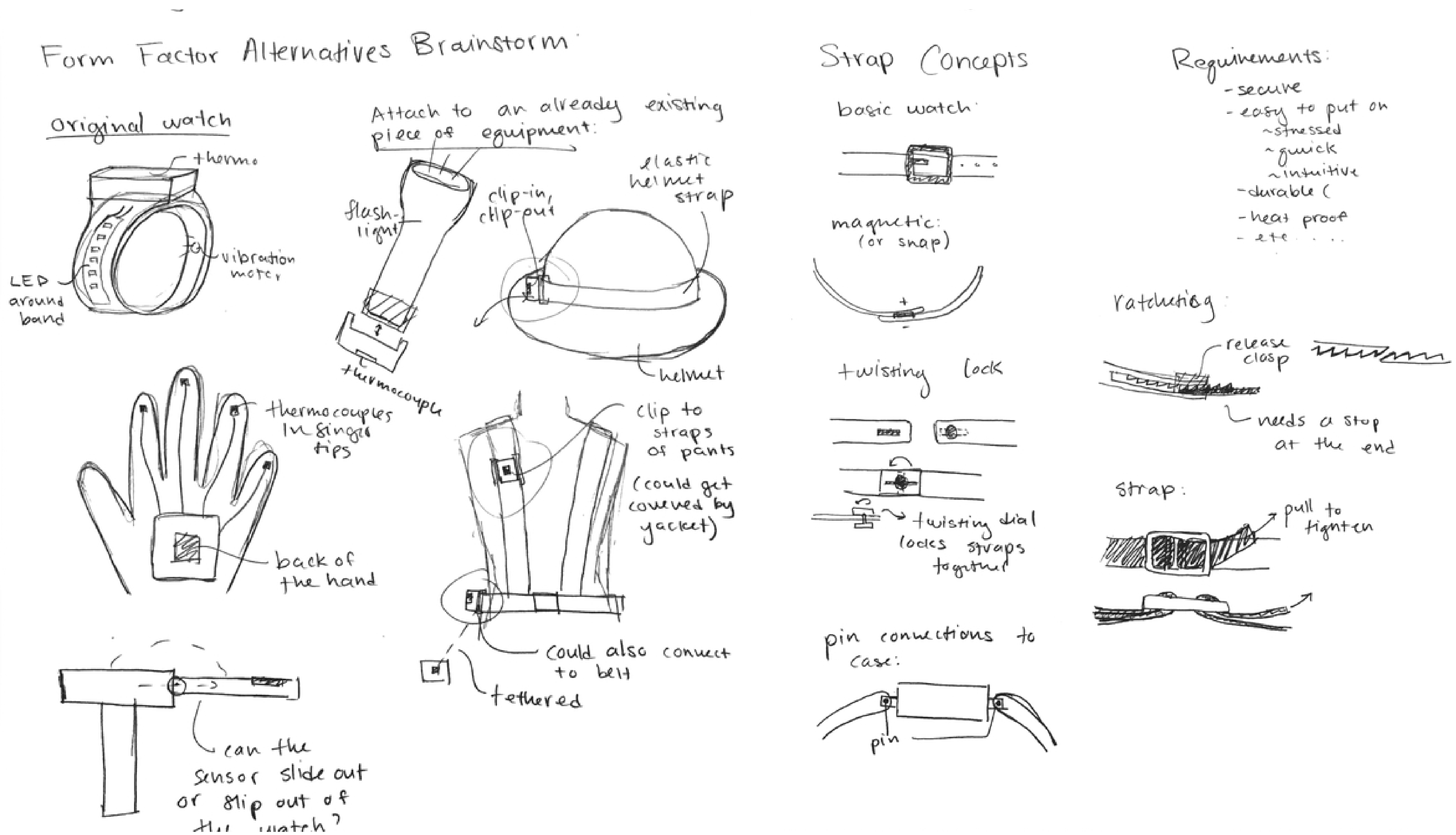


# FireSense

***2.009: Product Engineering Process, Fall 2017***

*Instructor: David Wallace*

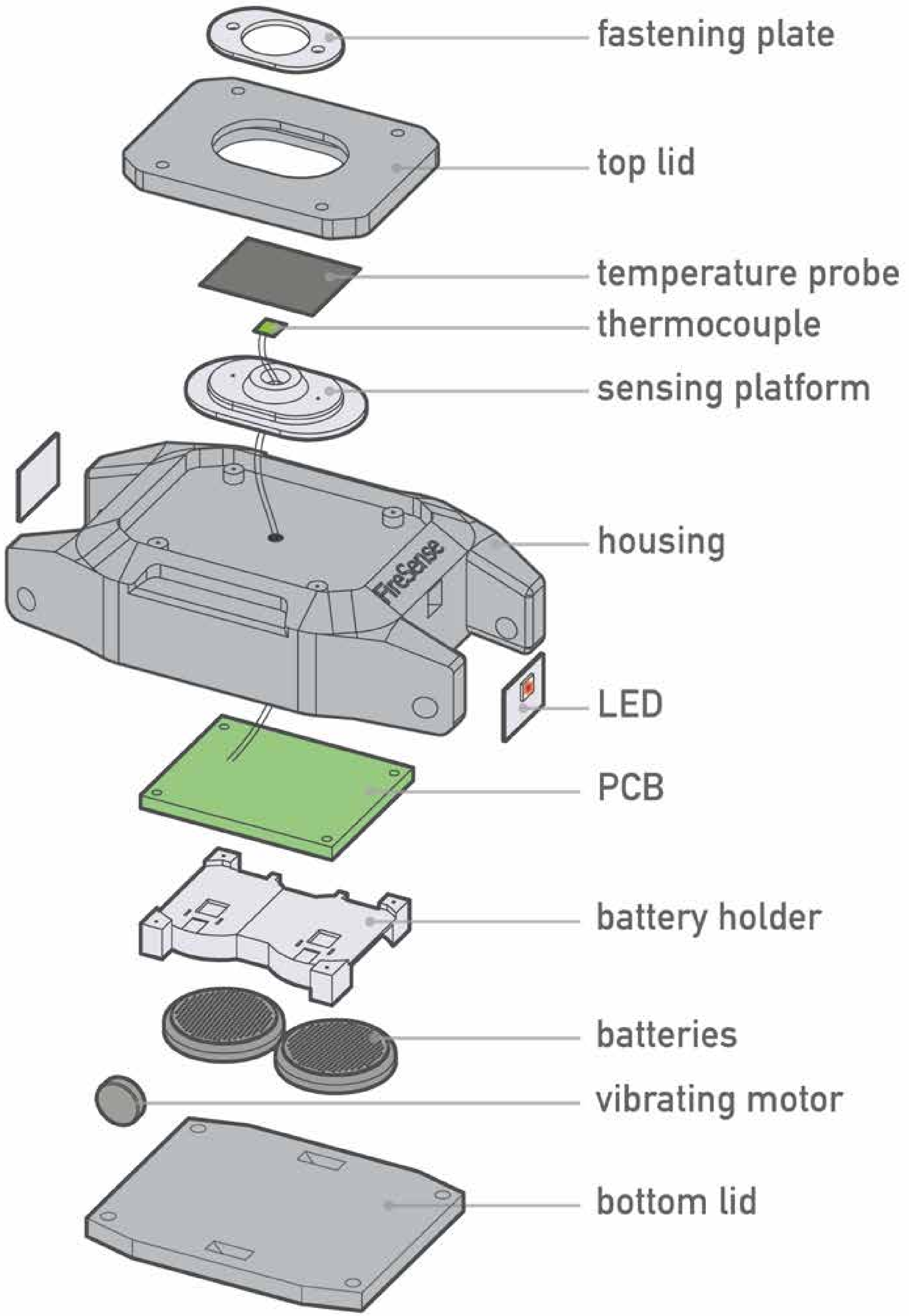
The final product chosen by my team for MIT's mechnical engineering cap stone class, FireSense is a wearable device for firefighters to help detect thermal dangers behind closed doors. In current practice, firefighters remove their protective gloves and use the back of their hands to feel the temperature of a metal door knob to estimate the probability of a fire behind a door. This process is dangerous and unreliable. FireSense uses a thermocouple and temperature probe to measure the temperature of a door knob and communicates to the firefighter if there is a thermal danger behind the door.

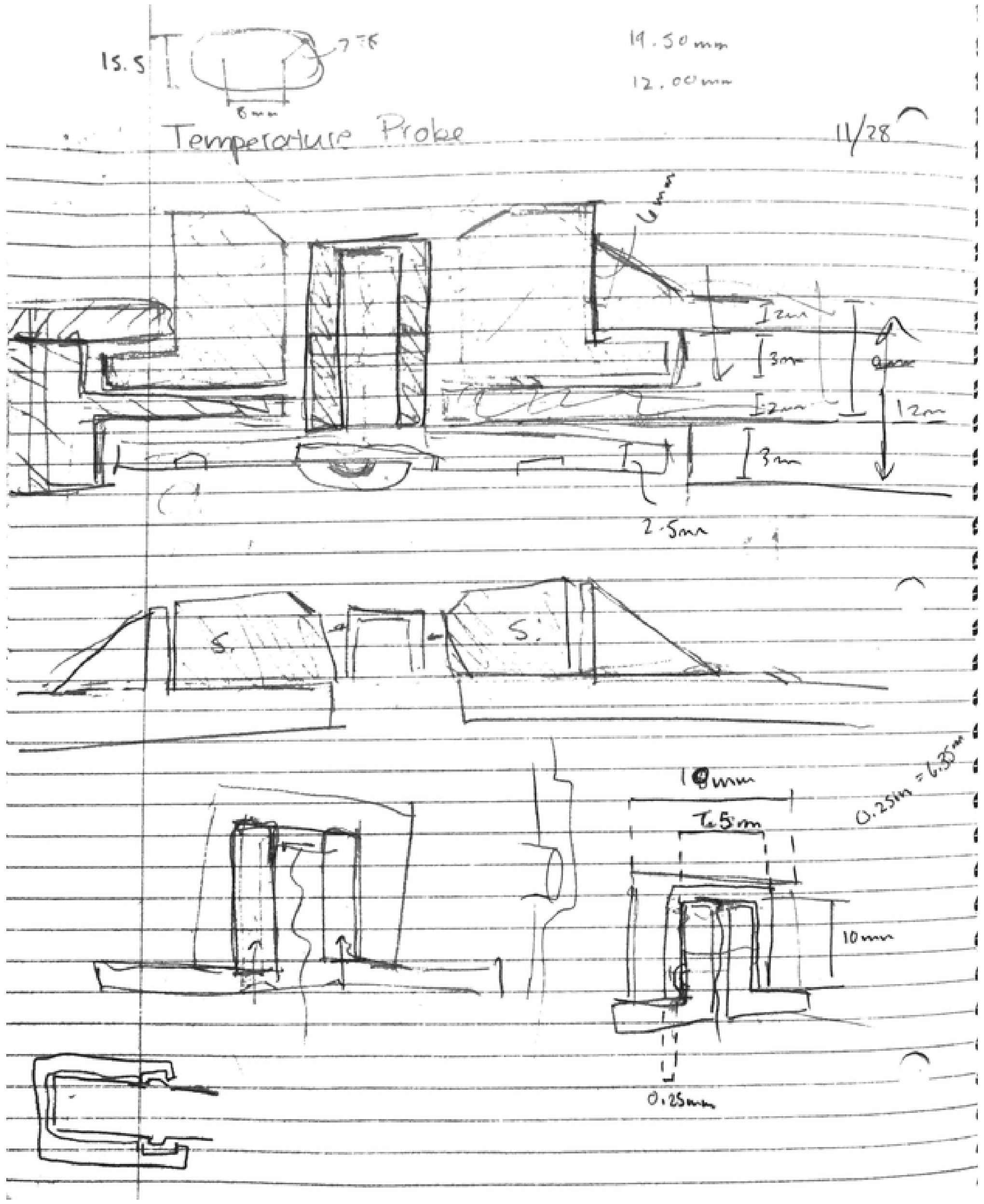


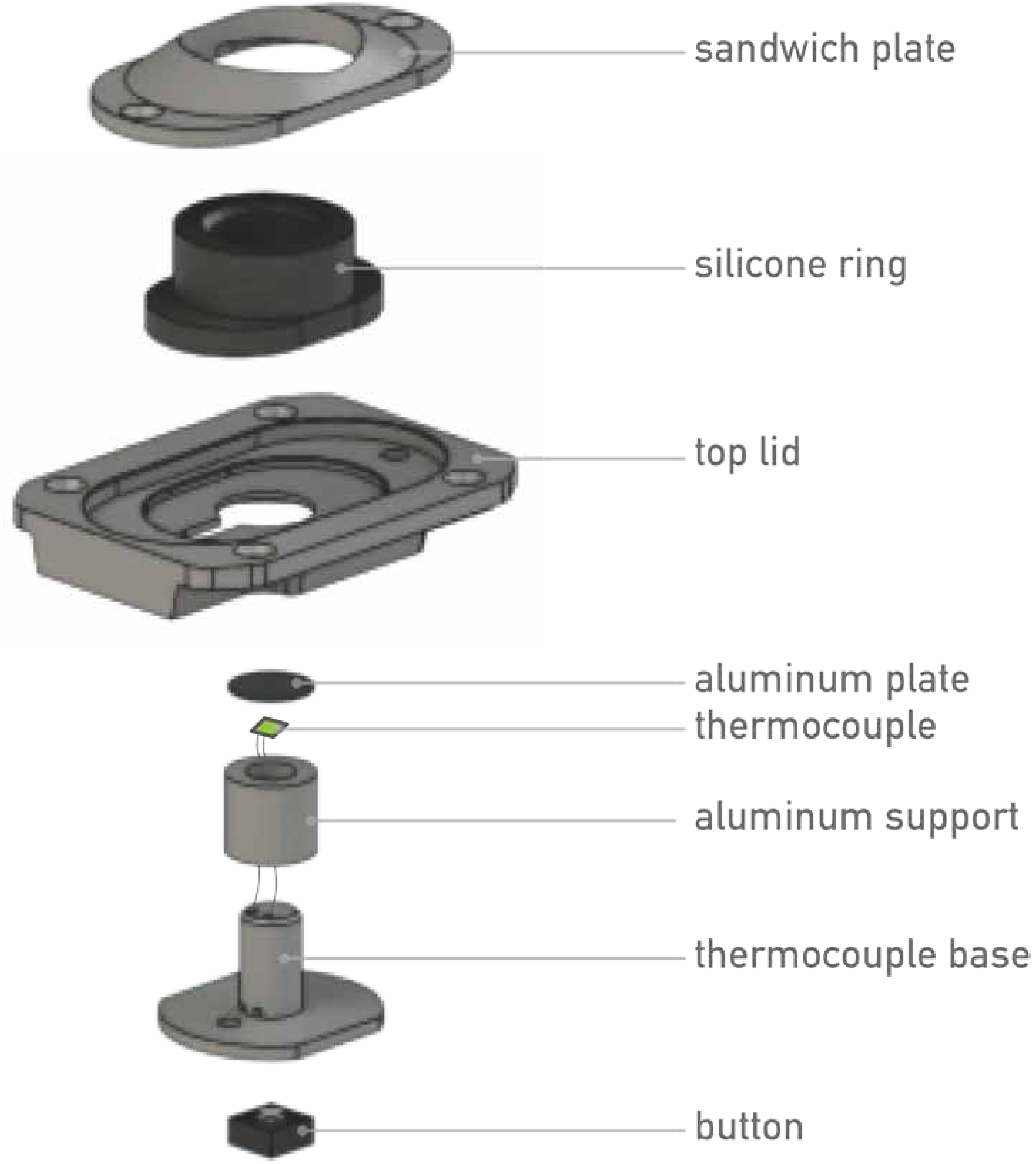

# Exploring Form Factor and Sensing Geometry

Different forms were explored: belt clips, flashlight attachments, gloves, but the wrist band was chosen as it did not interfere with any of the present protective gear worn by firefighters. Additionally, using the back of the wrist to measure temperature mimicked the gesture firefighters were already used to performing when testing door knobs with the back of their hands. The sensing platform was decided to be a single extruded surface as the firefighters indicated they wanted to have a geometry that clearly identified when the sensor was in contact with the door knob.

One of the prototypes pictured above shows the LED color system used to communicate with the firefighter. When the thermocouple is activated via a button below the sensing platform, the wristband vibrates to indicate it is sensing. When completed, the LED will either turn green to indicate there is no fire or if the temperature has reached a particular threshold, red lights will indicate the high probability of a fire behind the door.



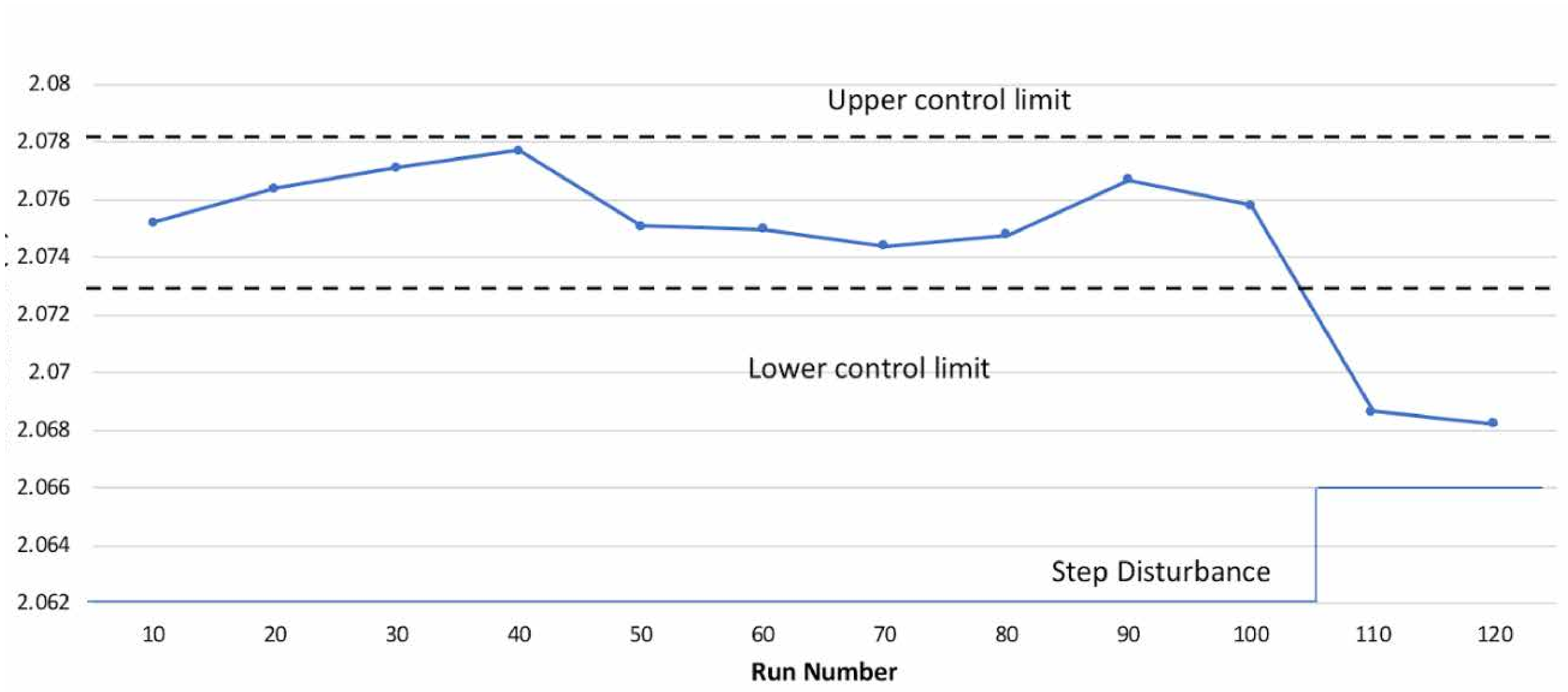




# Improving Sensing Platform Design

The robustness of the temperature probe was a major concern. In the final iteration of the sensing platform an aluminum plate mounted on a high temperature plastic ring clamped the thermocouple bewteen the aluminum piece and it's base. The addition of a high temperature silicone ring encircling the temperature probe protects the plaform while creating friction between the probe and door knob making it easier for the firefighter to hold the point of contact as the thermocouple measures the temperature.

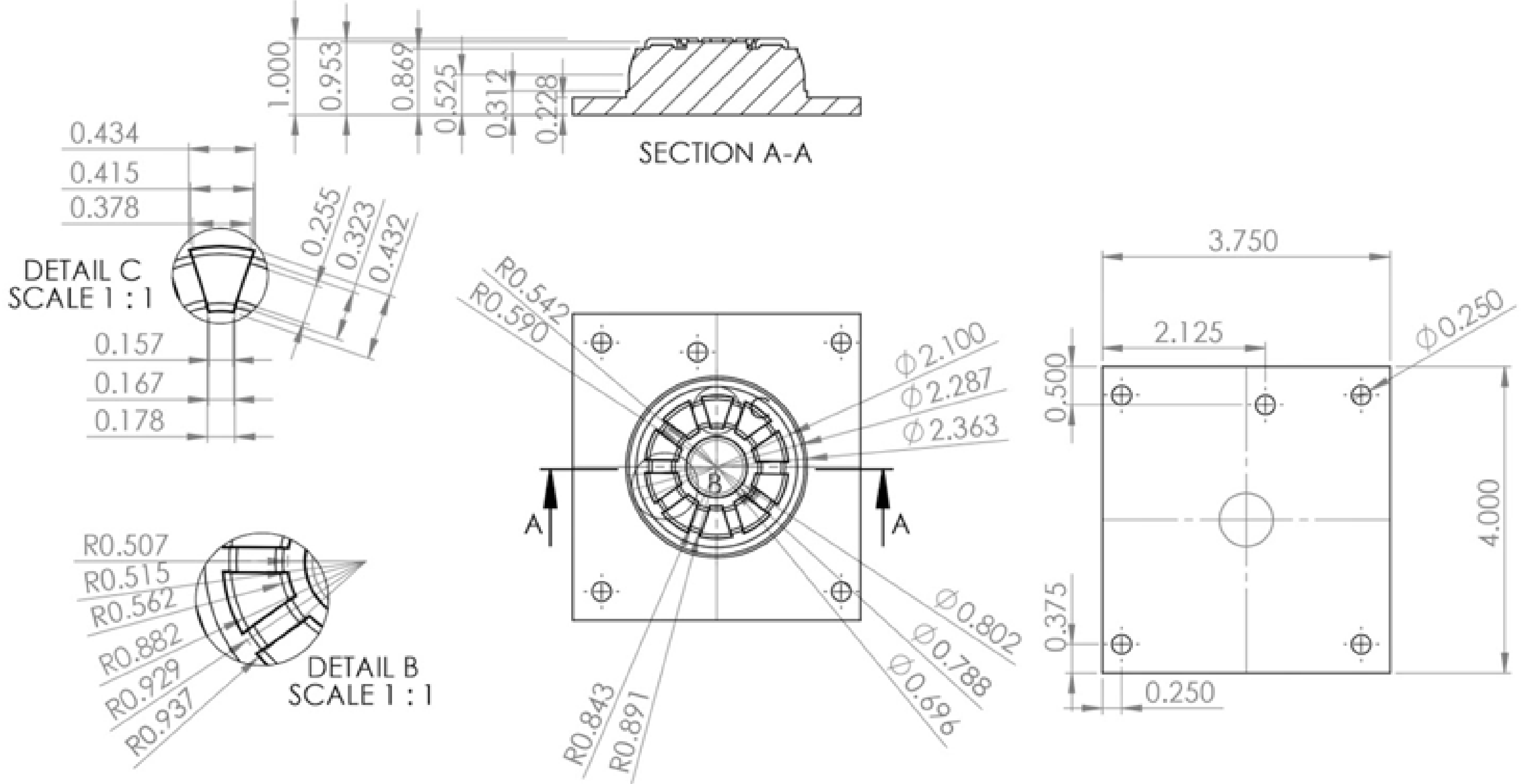


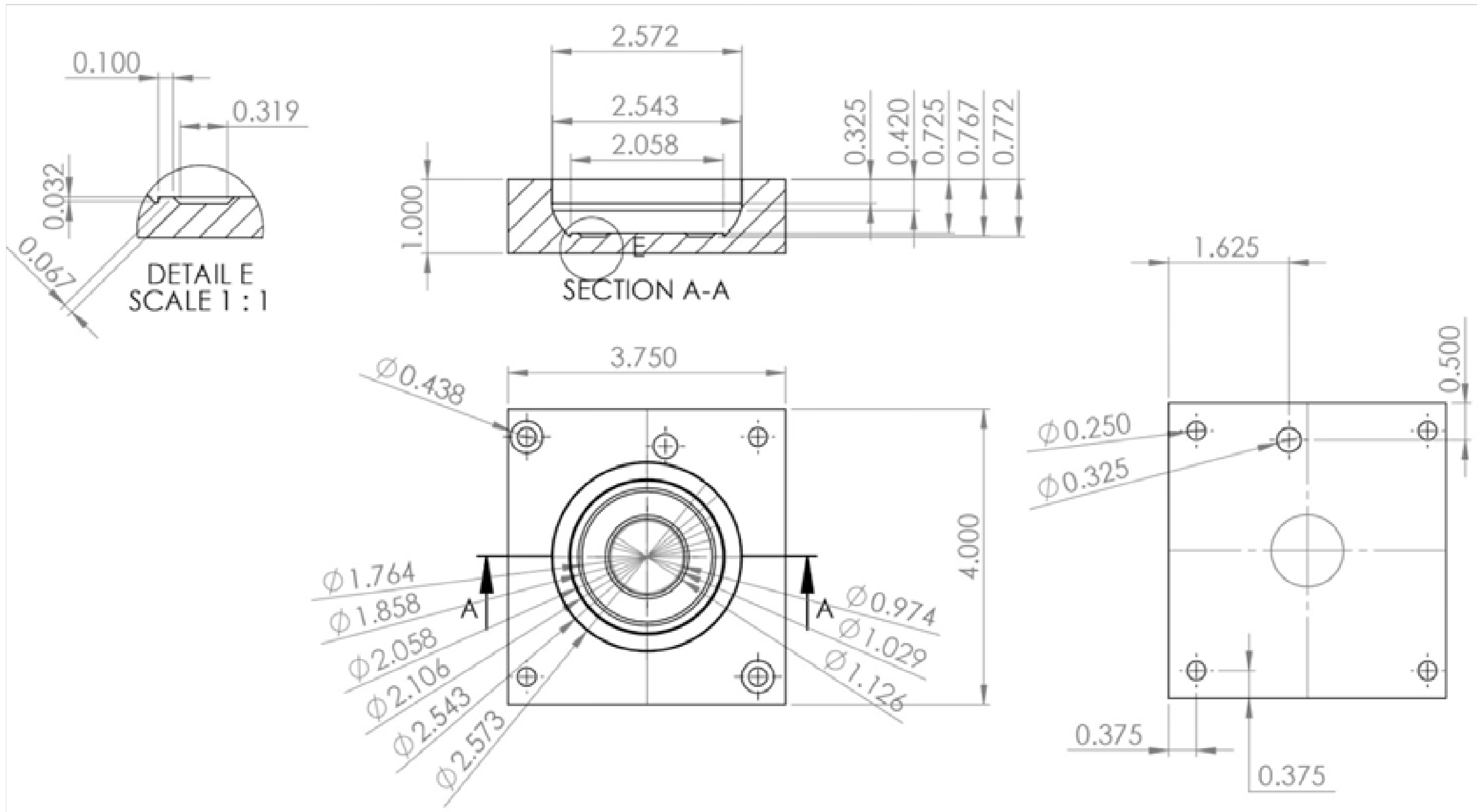

# 50 Yo-Yos

***2.008: Design and Manufacturing***

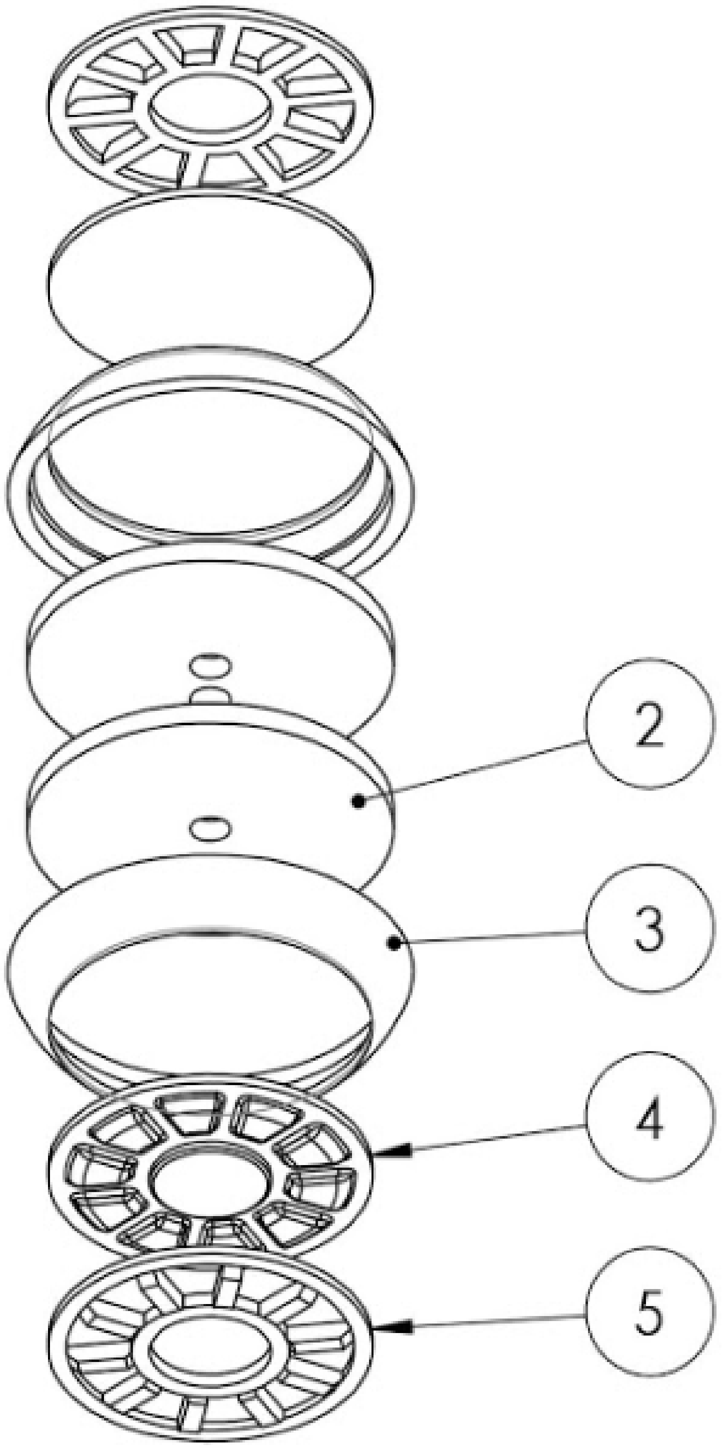
*Instructor: Jung-Hoon Chun*

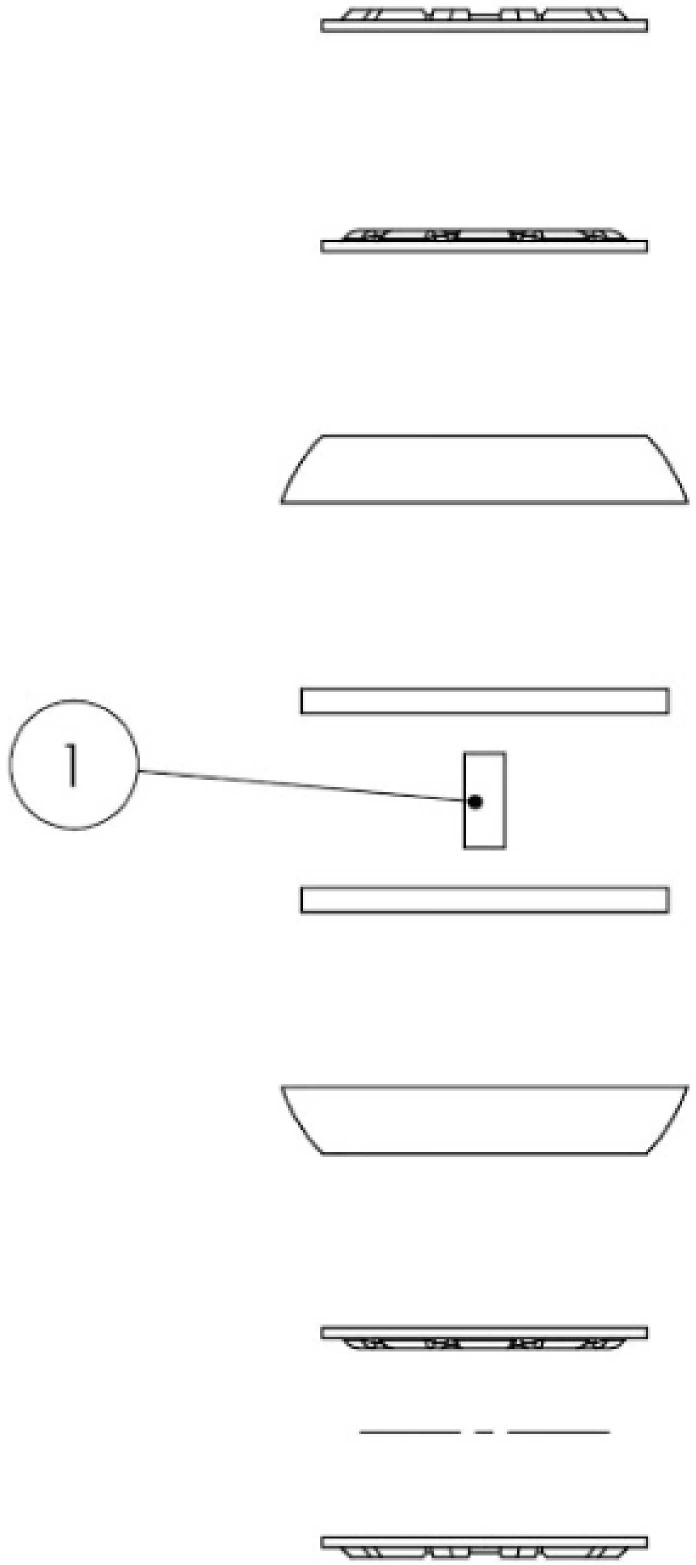
Part of MIT's mechanical engineering curriculum, this course is an introdcution to manufacturing tools and concepts. The final team project was to make 50 yo-yos which my team designed to look like the Iron Man arc reactor. I contributed to the Solidoworks model of the entire yo-yo, machining of the molds for the outer red ring and silver ring shown together on the left of the top picture and the injection molding and over-molding. After injection molding the inner silver rings, the outer red ring was over-molded over the silver ring and measured to snap fit into the bottom red base plate.



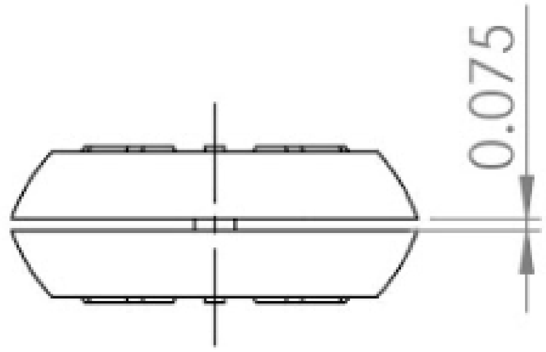




The cavity and core molds and thier early engineering drawings for the outer red ring. Because the outer red ring was overmolded onto the inner silver ring, the silver ring snap fit onto an embossed center lip on the cavity mold so it was held in place as the outer red ring was injection molded. Not shown in the drawings, the parting line on the mold had to be moved to accomodate the length of the tools availbale and decrease the depth of the cavity mold.



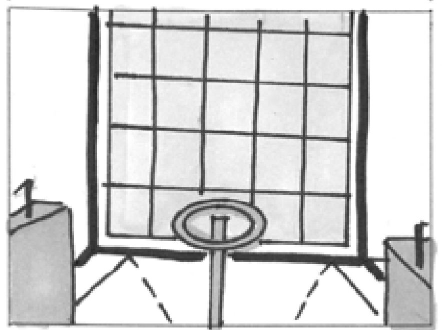

| ITEM NO. | PART NUMBER | QTY. |
|---|---|---|
| 1 | Axle | 1 |
| 2 | Base Plate | 2 |
| 3 | Outer Ring | 2 |
| 4 | Arc reactor thermoform | 2 |
| 5 | Arc Reactor Injection mold ring | 2 |



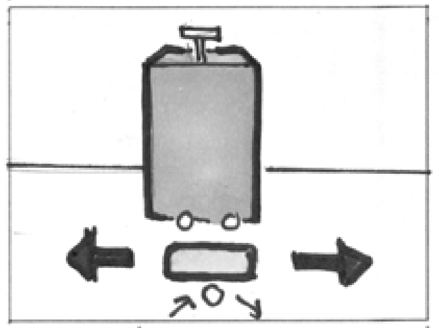

# Additional Sketches and Renderings

Emma Pearl Willmer-Shiles, MIT 2018

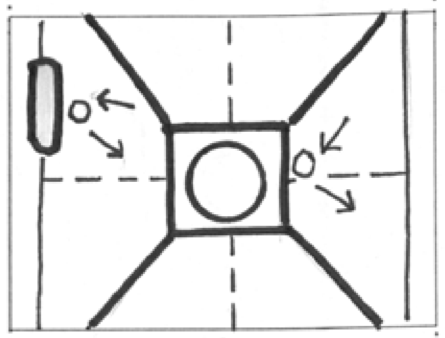
# Warping Block Breaker



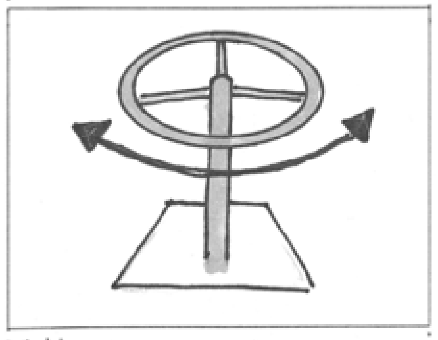
Upon entering, there is a wheel in the center and two sliders on the side. Digital blocks cover the exit.



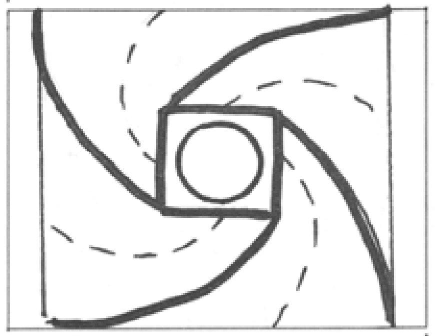
The sliders move to bounce the digital ball between slider and center block.



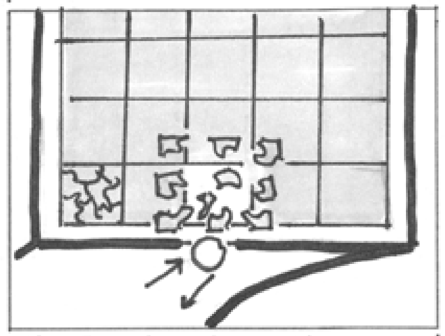
Projector from above displays game board.



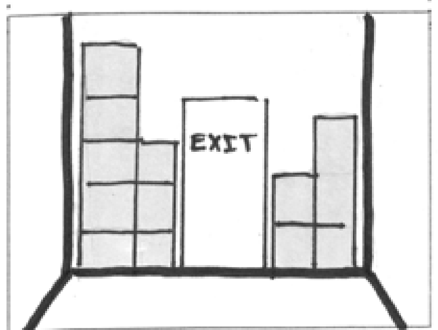
Middle wheel is controlled by one user to warp the game board.



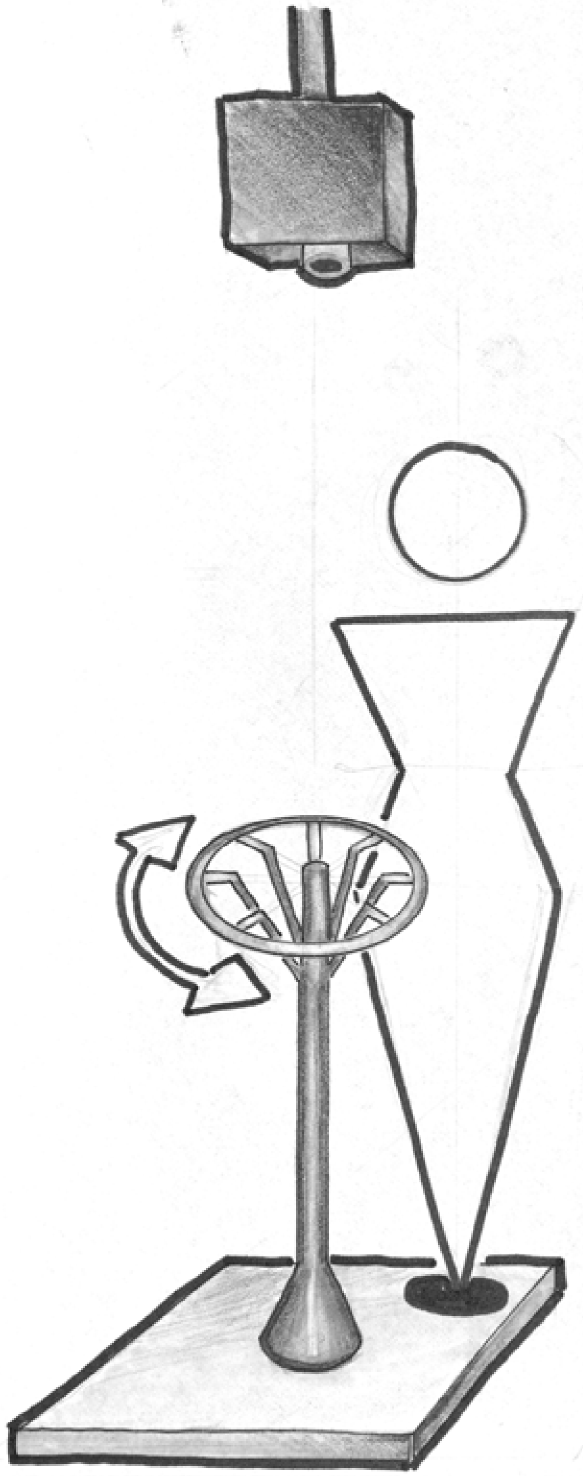
Warped version can make balls bounce against different walls.

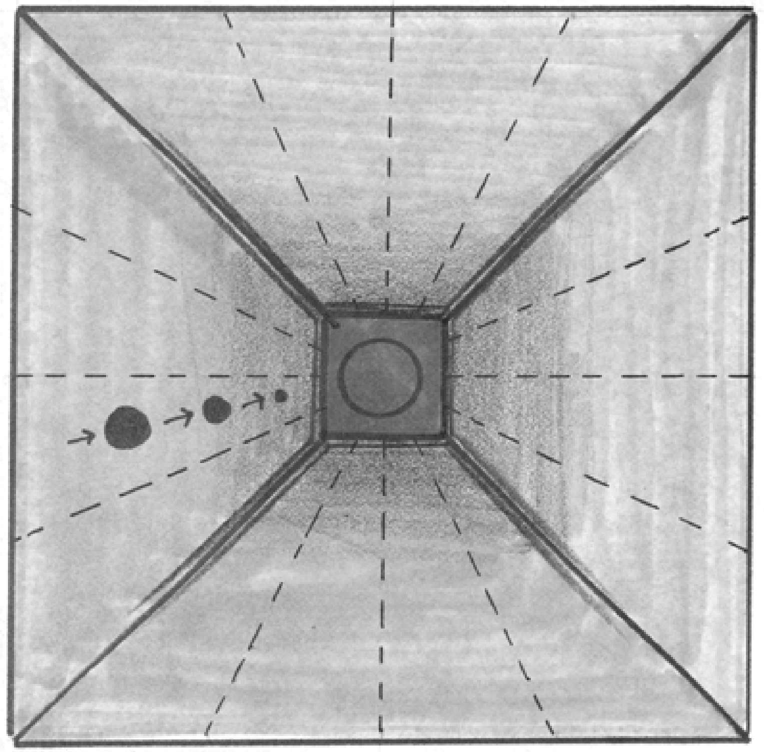


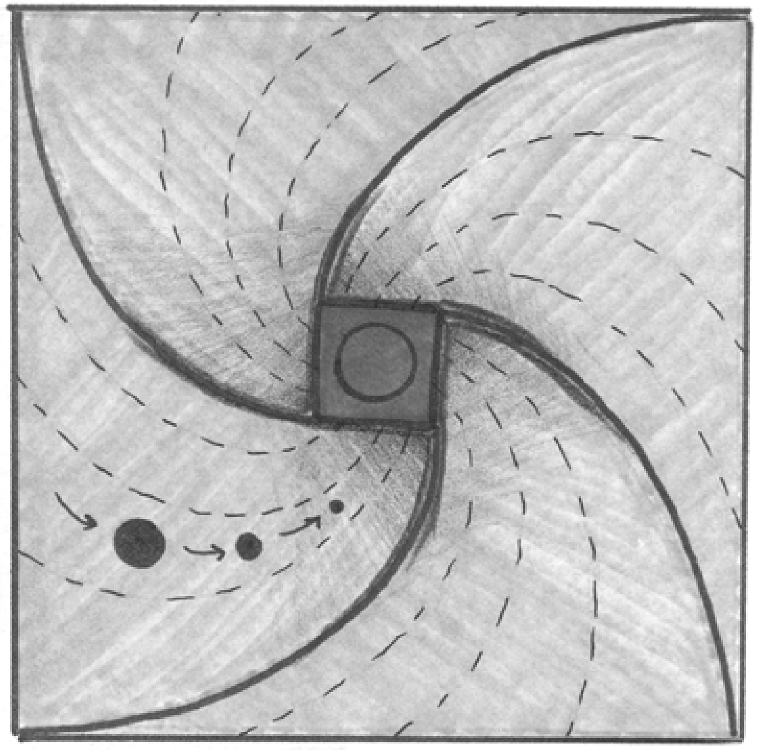
This allows balls to hit and break digital blocks covering the exit door.



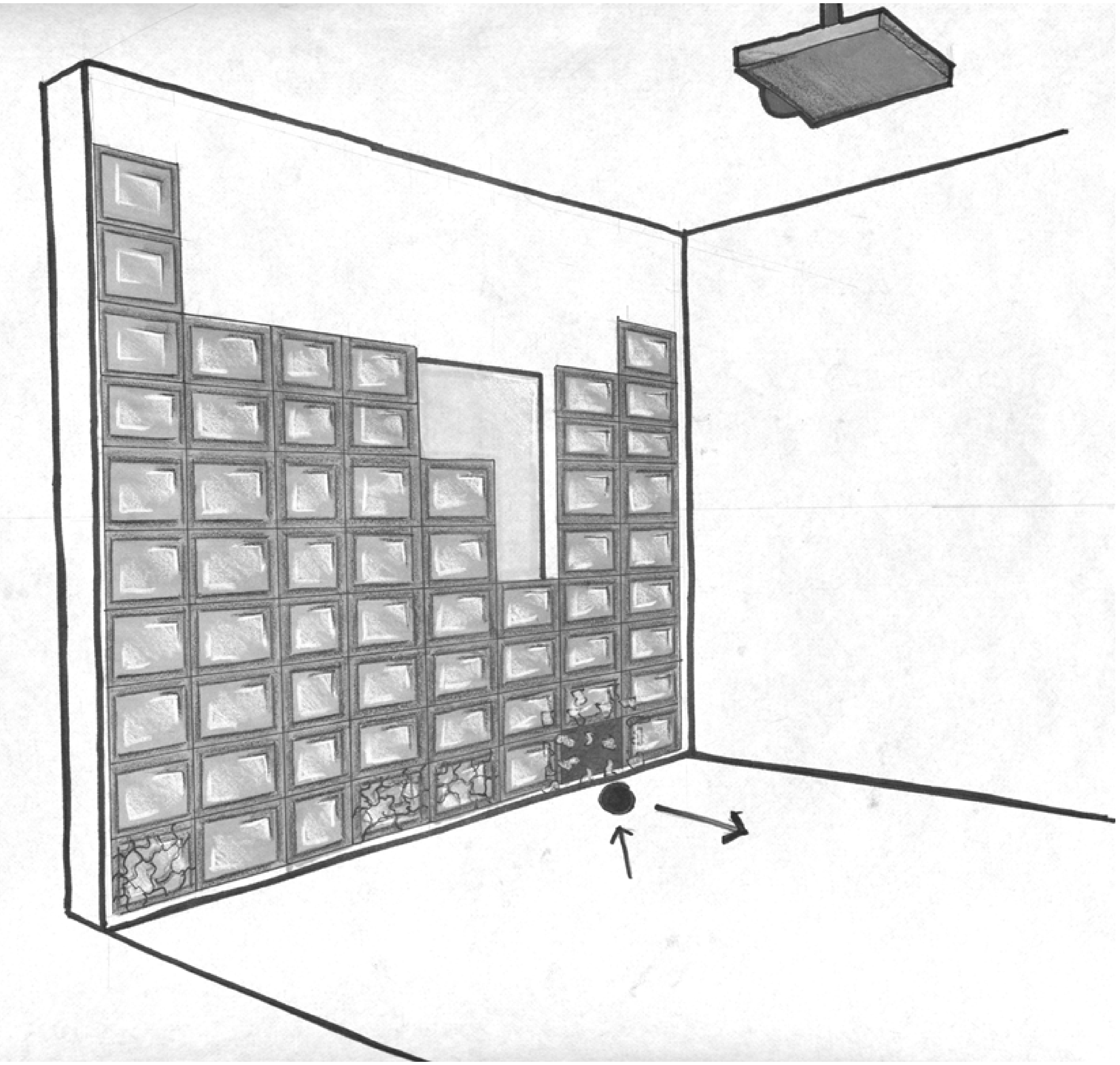

Once the blocks in front of the exit are broken, the players have won!



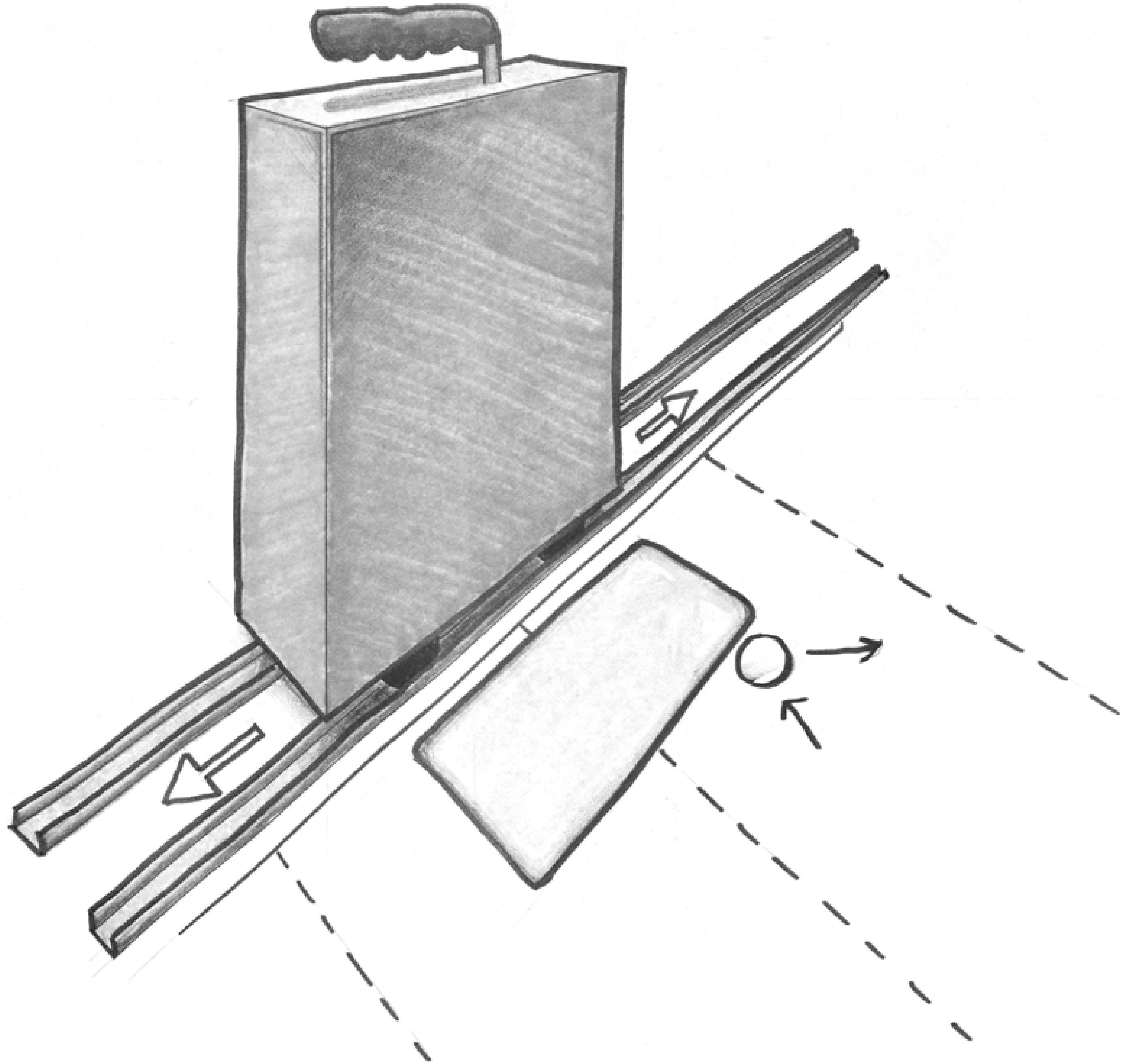




Storyboard and concept sketches for a puzzle, game room inspired by the classic game "Block Breaker". In this version, a projection on the floor twists to make it look like the sides of the room are rotating, changing which wall the digital playing balls bounce off of.



Wall and block breaking projection.



Slider moved by user to control where the balls bounce.




3D model: Solidworks, Rendering: PhotoView 360

3D model: Solidworks, Rendering: Keyshot


3D model: Rhino, Rendering: Keyshot