Rafael Bernstein
Product Design Portfolio

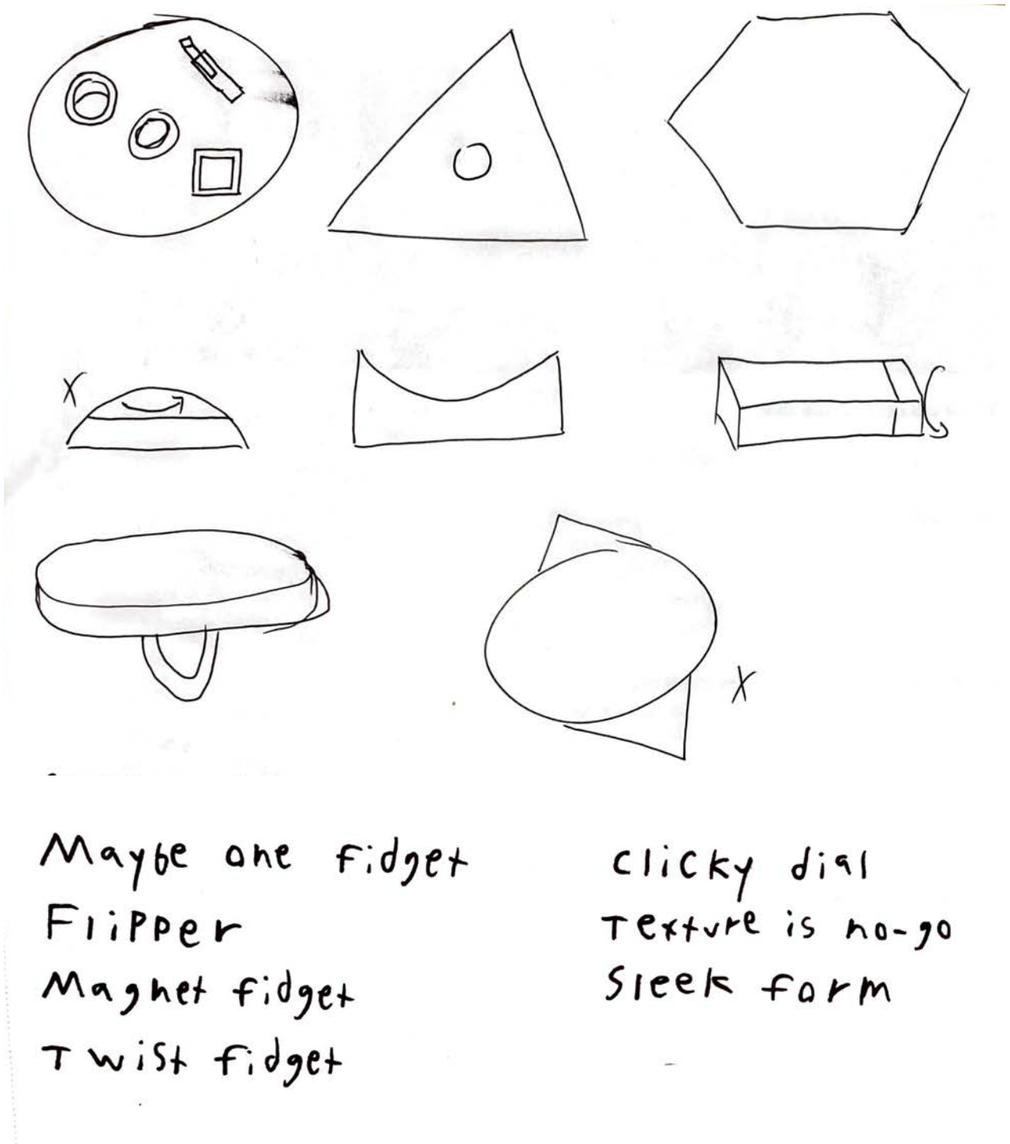
2024

Fidgy

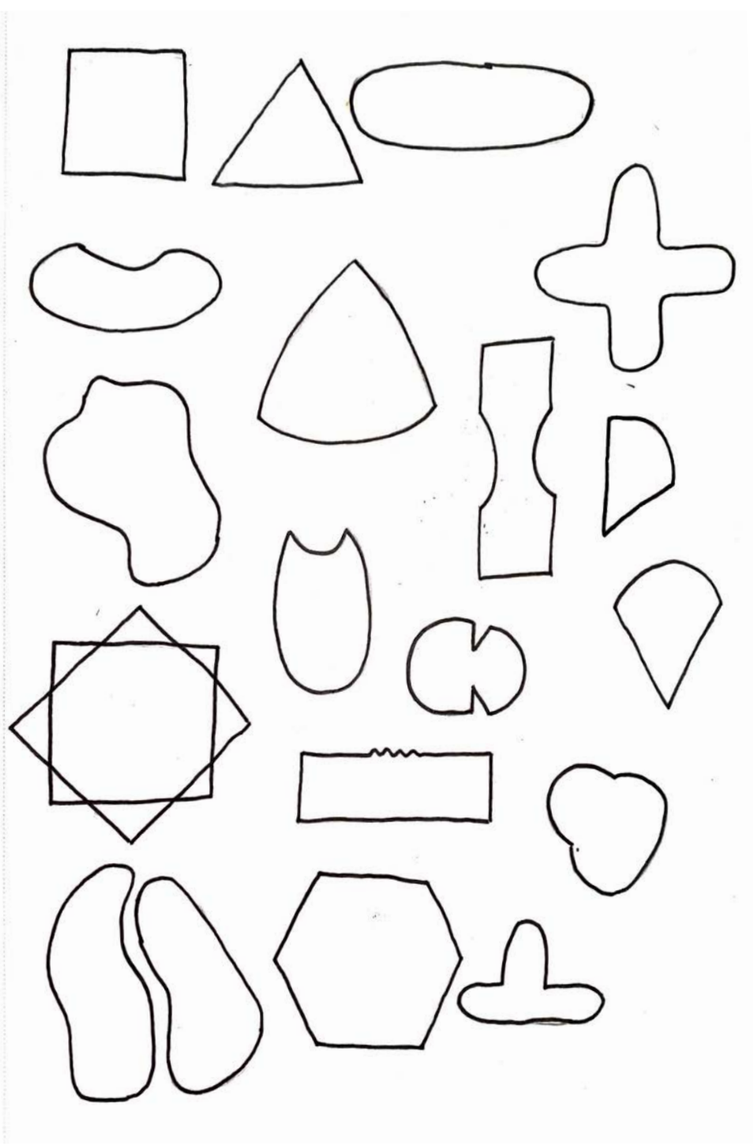
Design Prompt:

Design, manufacture, and sell an object for no more than $7 while still turning a profit.

Conception



Initial ideation about shape and features

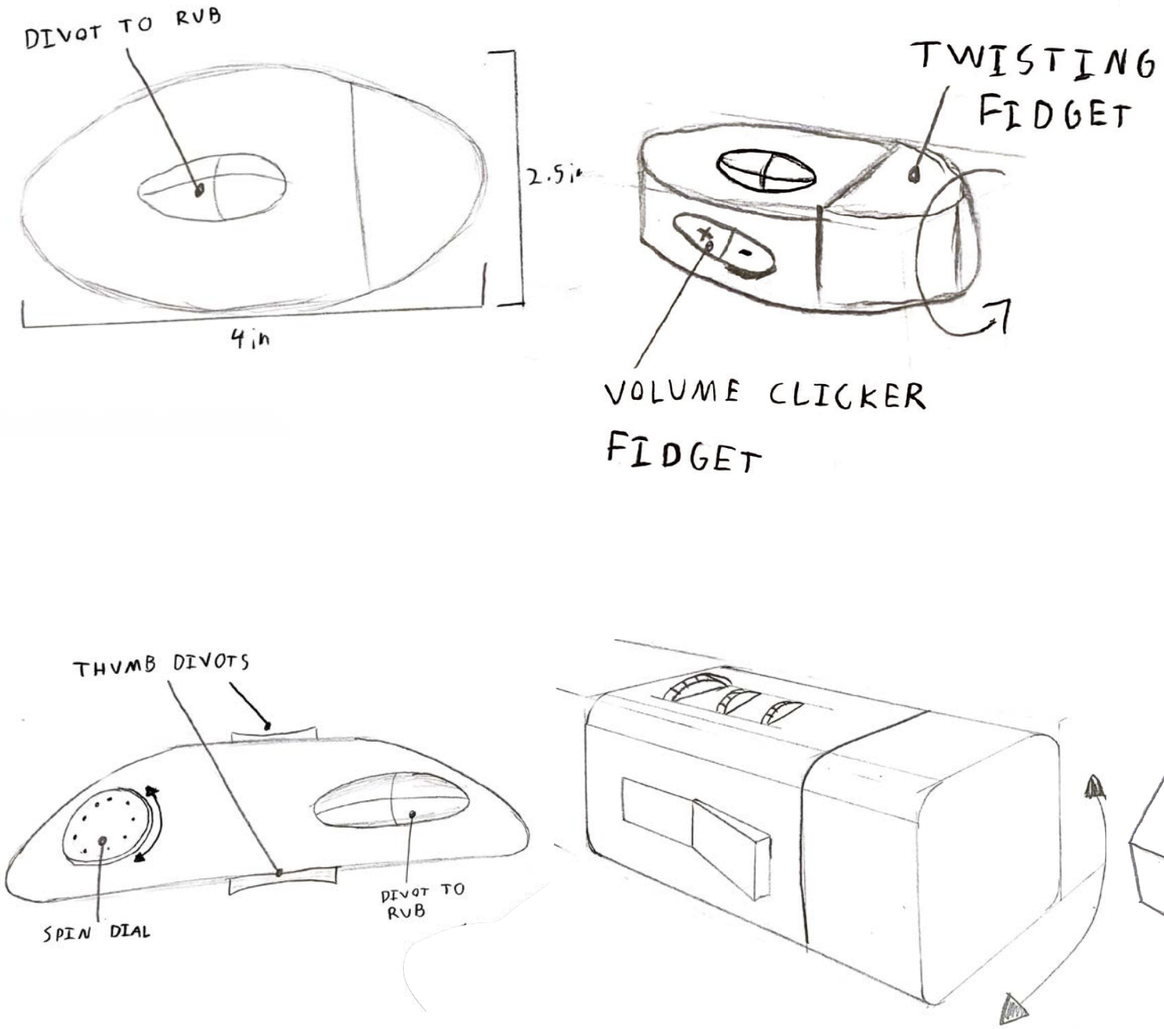


Shape study

Existing fidget toys

Early in our ideation, we decided that we wanted to create a fidget toy that appealed to a more mature demographic than typical fidget toys. We chose to make it out of wood since it was a natural material with a nice feel in the hand. These are our first rough sketches of possible features and how they would be implemented.

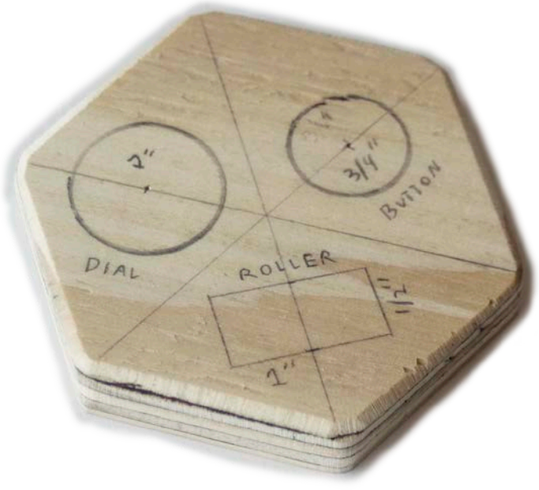
Shape Exploration



Narrowing down shape and features

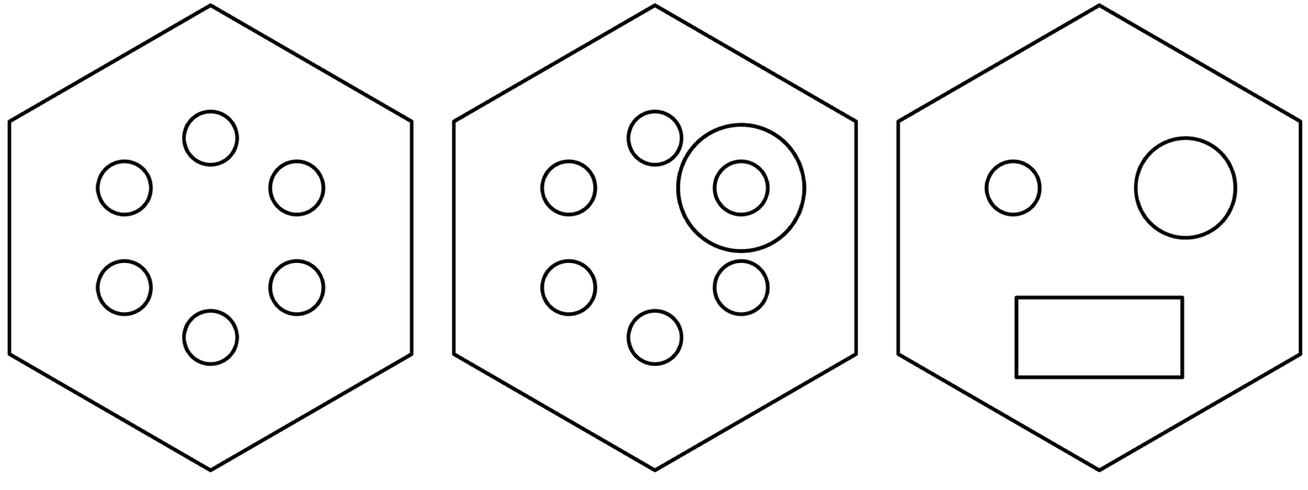
These sketches show possible shapes for the fidget toy. We were moving between more organic or geometric shapes, since we were using a natural material like wood, but machine processes such as a CNC router or laser cutter.

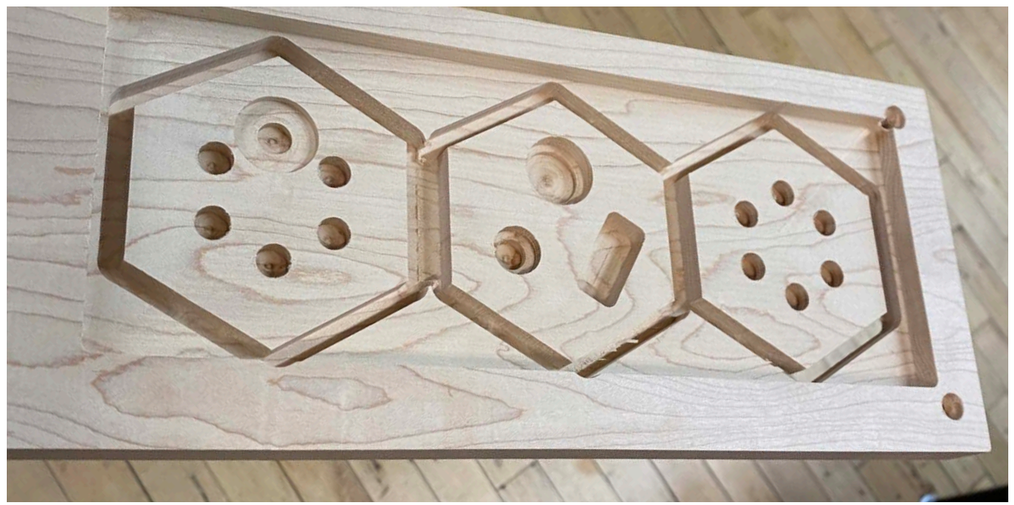
Prototyping



Shape and scale validation

Layers 1-3





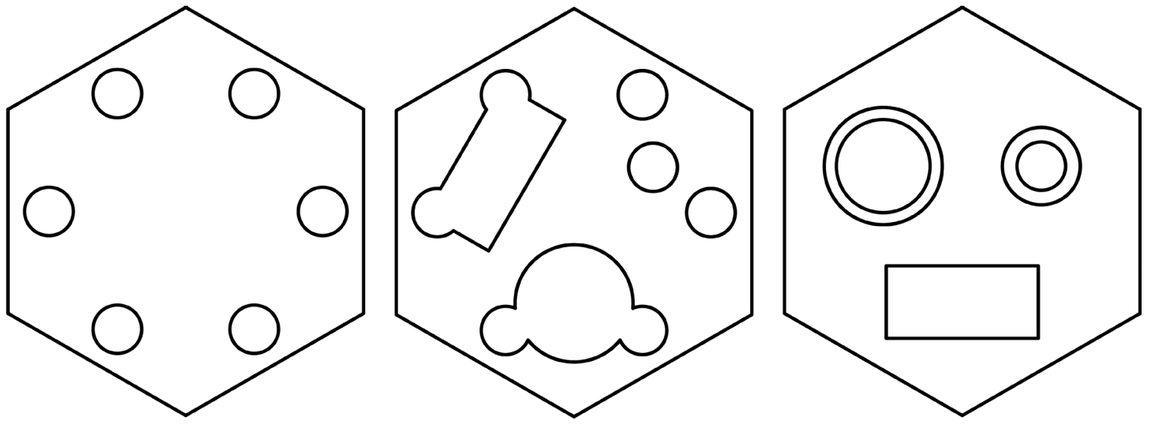
Prototype made on CNC router

First stacked and working prototype

We settled on the hexagonal shape since we liked the symmetry that it offered. We also finalized the fidgets that would be included and created a model to judge how such a geometric shape would feel in the hand. Because of the internal components it was necessary to have 3 layers that would be sandwiched after they were integrated.

Refinement

Revised CNC model

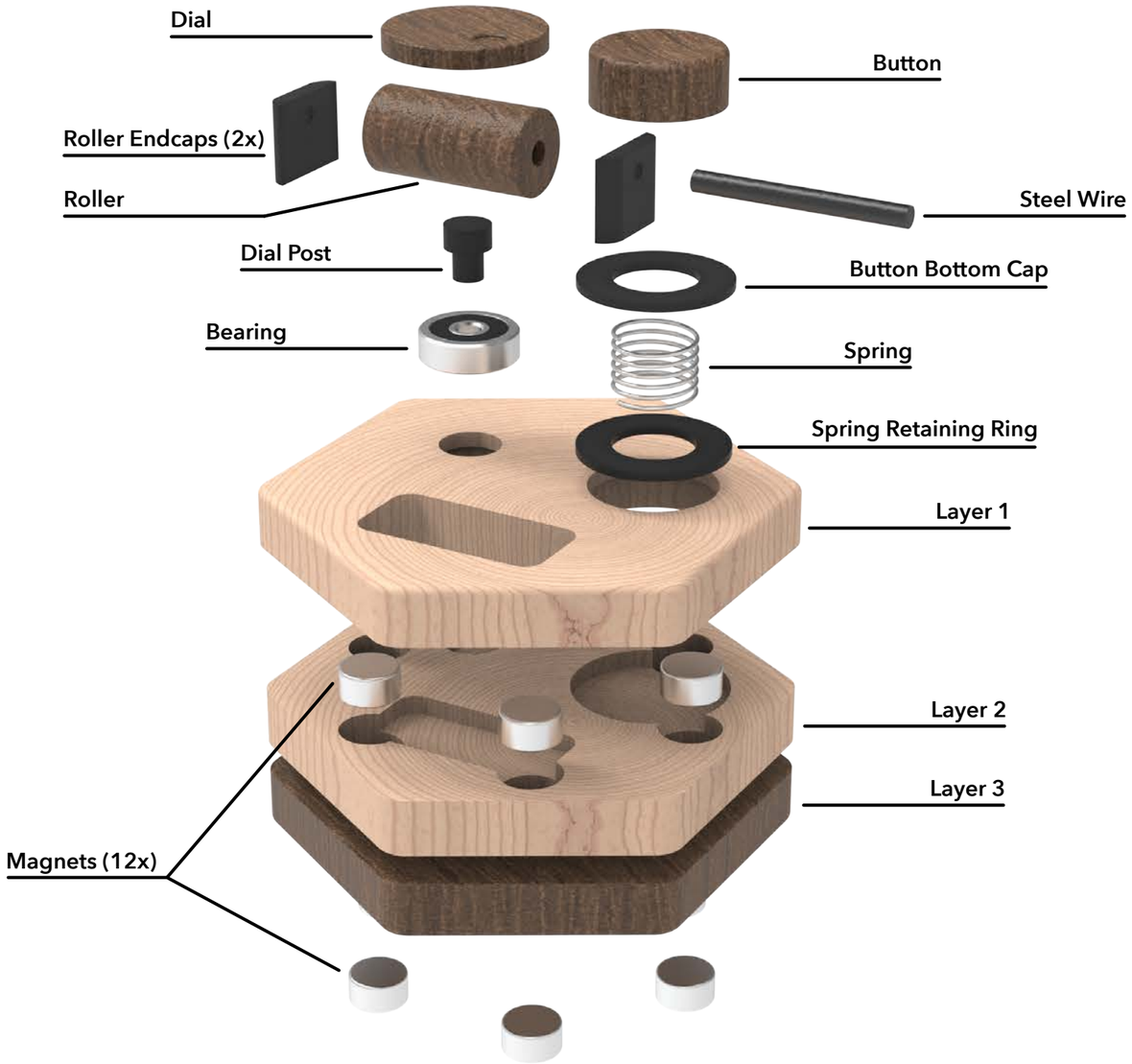


First batch of revised CNC hexagons

First finalized Fidgy

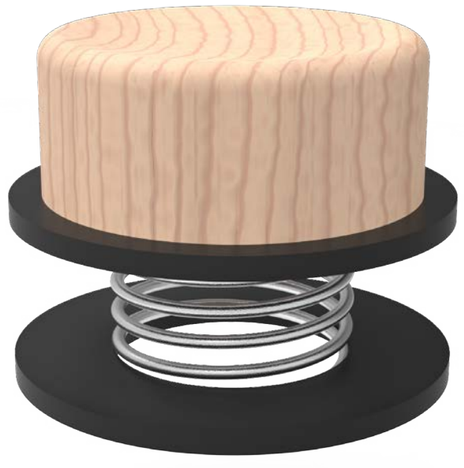
From our prototype, we found that we needed slightly different tolerances for our CNC model, as well as adjusting the distances for the magnet holes and adding extra space for internal components to ease assembly.

Design Detail



Button

- Four components
- Balanced and firm click

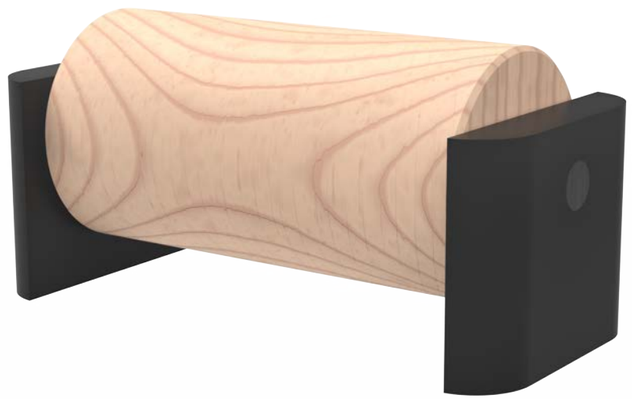


Dial

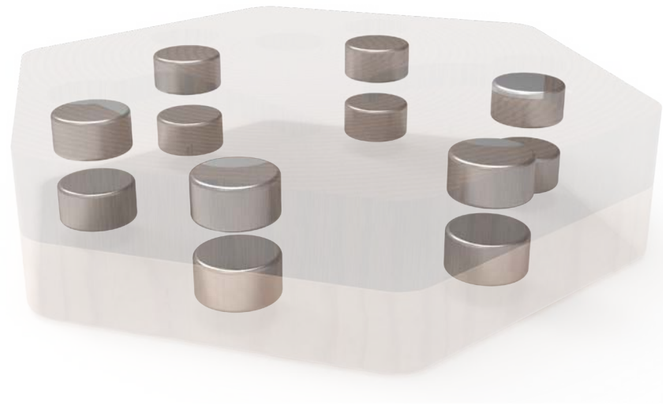
- Three components
- Smooth and consistent

Roller

- Four components
- Freespinning and sturdy



Magnet spinner



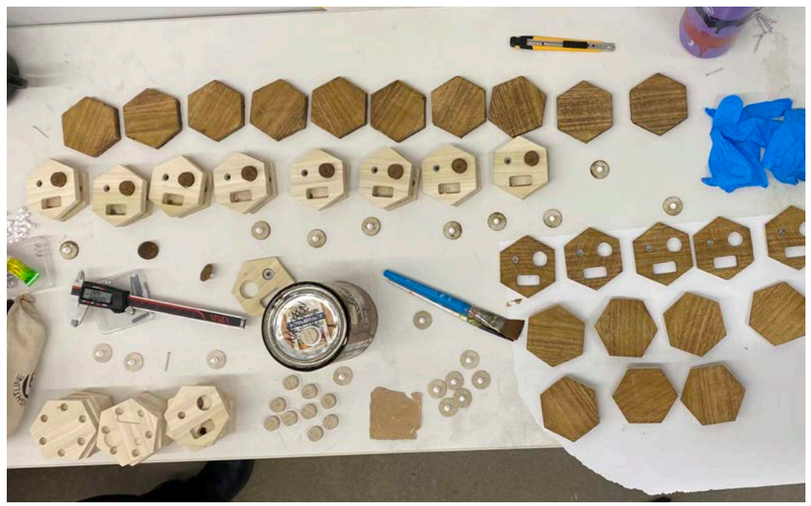
- Twelve components
- Satisfying click

Manufacturing

Material Preparation

Staining/sanding and initial integration

Full integration of components



Assembly line

Manufacturing and integrating all the components was a 25 step process involving a CNC router, a drill press, sanding, gluing, staining, hammering, and testing every component. The order of operations was crucial to ensure that every Fidgy went together perfectly.

Cost Breakdown

Magnets
6x
$6.35

Wire
3x
$2.29

Wood
1x
$45.00

Springs
4x
$5.38

1/2in Dowel
1x
$2.40

Material	Price of Material	Quantity per purchase	Number of purchases	Price	Price per fidget	
Bearings	$16.58	35	1	$16.58	$0.55	11%
Magnets	$6.35	60	6	$38.10	$1.27	26%
Springs	$5.38	8	4	$21.52	$0.72	15%
1/2 inch Dowels	$2.40	1	1	$2.40	$0.08	2%
3/4 inch Dowel	$7.99	1	1	$7.99	$0.27	6%
1 inch Dowel	$8.99	1	1	$8.99	$0.30	6%
Felt	$0.75	1	3	$2.25	$0.08	2%
Wood	$45.00	1	1	$45.00	$1.50	31%
Wire	$2.29	3	1	$2.29	$0.08	2%
Total	$145.12					
Cost per fidget	$4.84			Revenue:	$210.00	
Markup	44.71%					

Bearings
1x
$16.58

3/4in Dowel
1x
$7.99

30 at $7.00 each means $64.88 profit

SALES					
Who	When	Quantity	Paid?	Delivered?	Paid to
1 Schell	3/2/24	1	yes	yes	rafi
2 Isabella	3/8/24	1	yes	Yes	Rafi
3 Clara	3/9/24	1	yes	yes	Rafi
4 Isaac	3/9/24	1	yes	yes	Rafi

Felt
3x
$0.75

1/2in Dowel
1x
$8.99

We kept a detailed spreadsheet with all of our expenses and sales to keep track of our profit margin and to make sure we weren't going over budget. The sheet also helped us split our profit more evenly when we had finished sales.

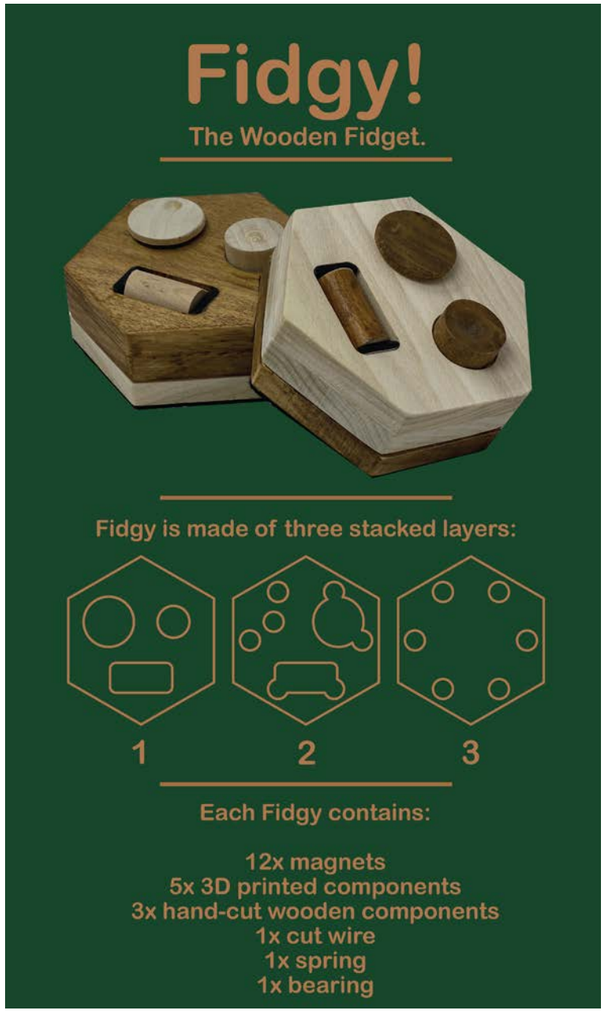
Total expenses: $145.12

Price per unit: $4.84

Sales: 30

Profit: $64.88

Sales



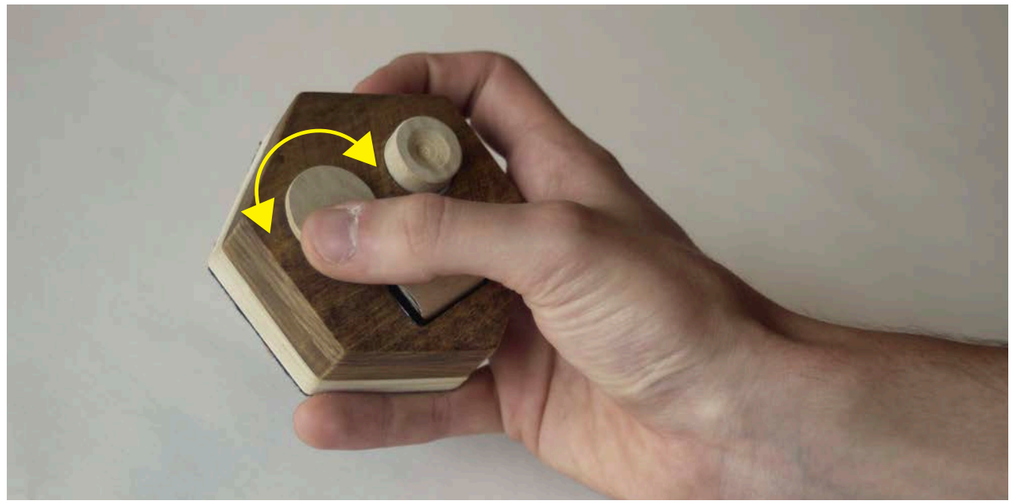
We held a pop-up sale at a busy intersection on campus to sell our product to passerby. We made a poster and were demonstrating how Fidgy worked to entice buyers.

Features

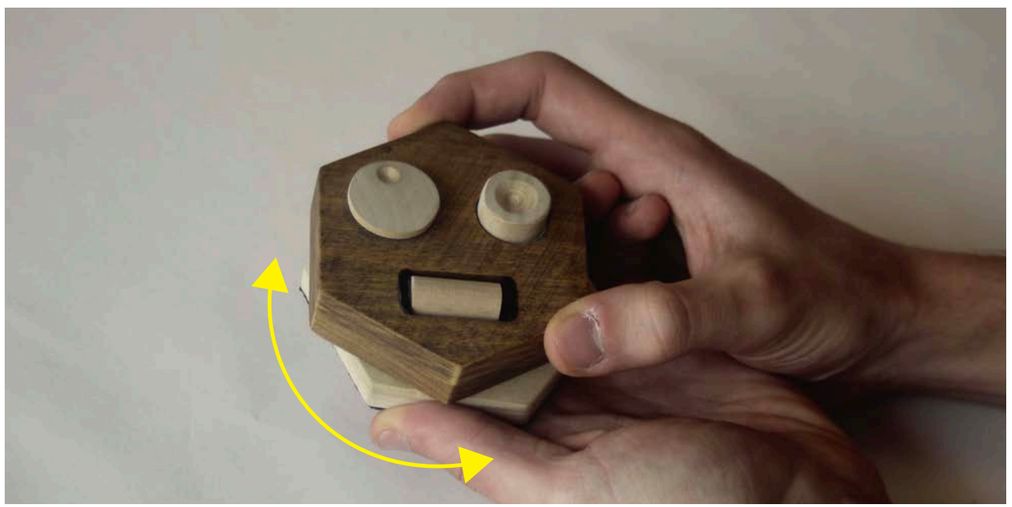
Push

Roll

Spin



Twist



Glide Light

Design Prompt:

Create an innovative and interesting light.

Why?

Existing solutions to turn lamps on and off are clumsy, feel cheap, and are not well integrated into the light itself. Switches on cords are a scourge and an affront to a civilized society.

I wanted to create a lamp that was beautiful and intuitive to control. I chose to make a lamp inspired by a dimmer switch that would allow the user to change the brightness simply by sliding the light itself up and down its base.

Inspiration

Geometric diffuse lighting

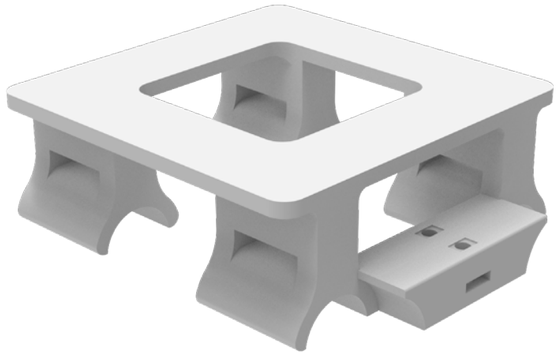
Interactivity

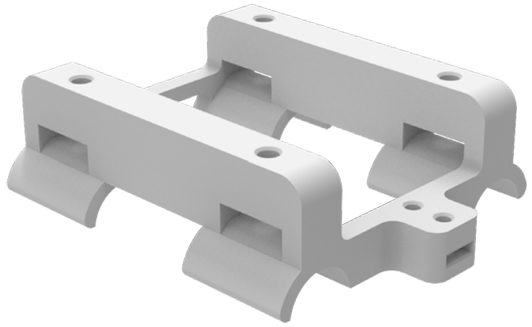
Integrated controls

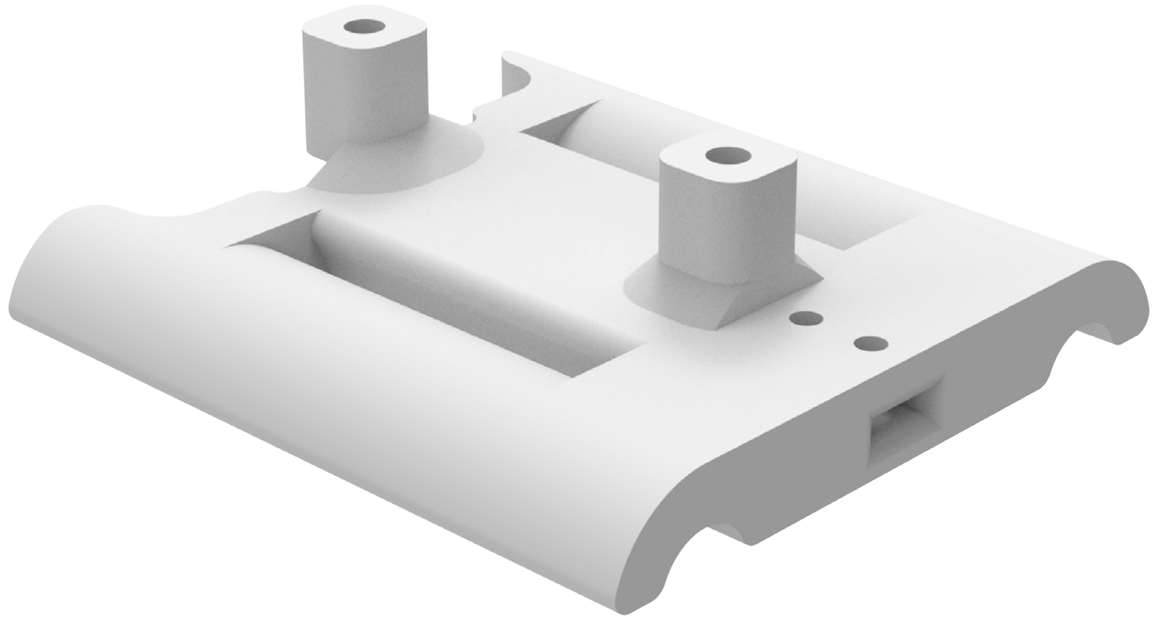
During a visit to a lighting store, the interactive lamps were the most interesting. I especially liked the ability to dim the light, as well as the evenly lit geometric shapes.

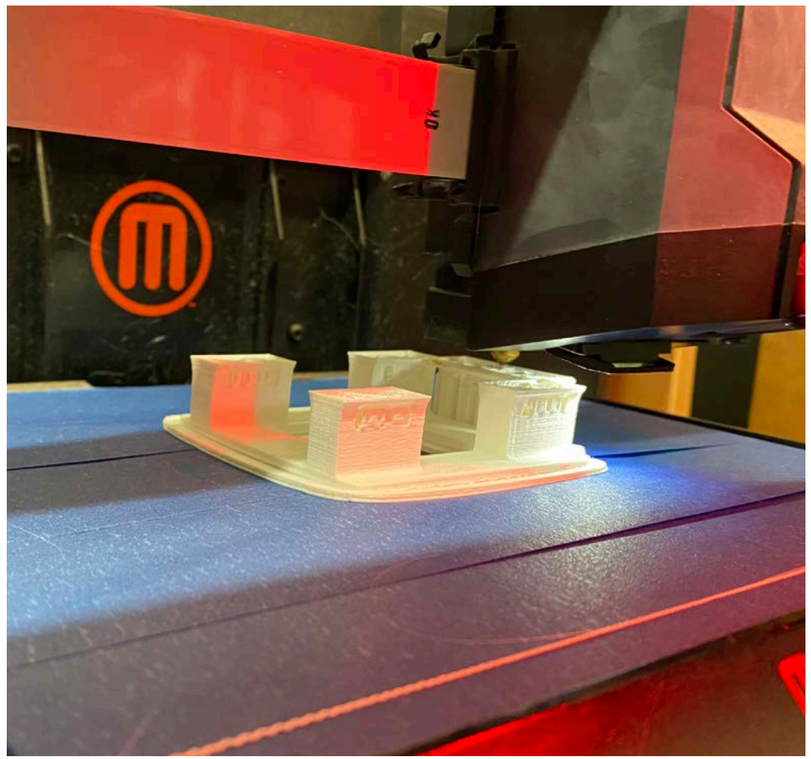
Mechanical Design

Carriage iterations





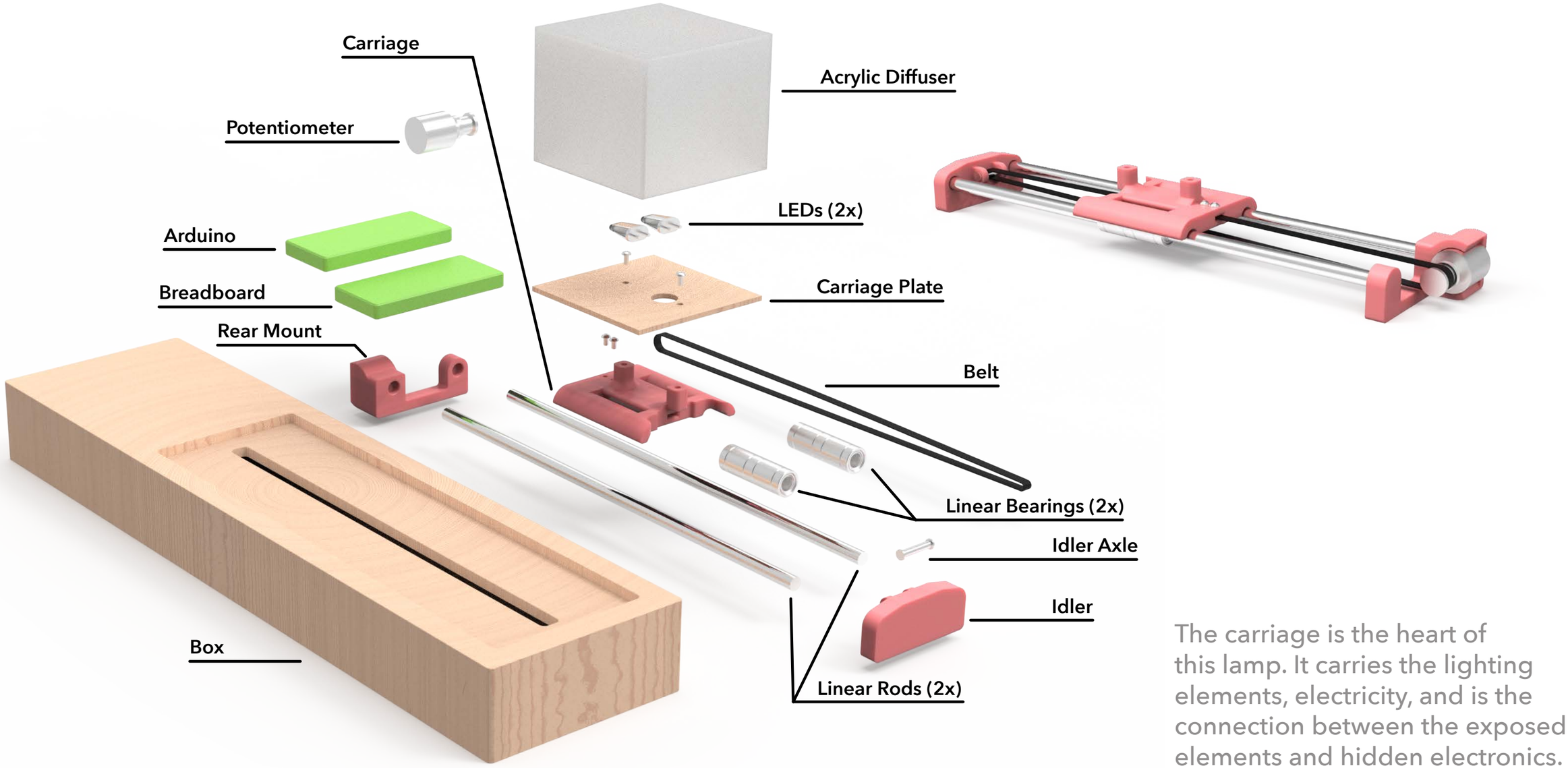




3D printing carriage

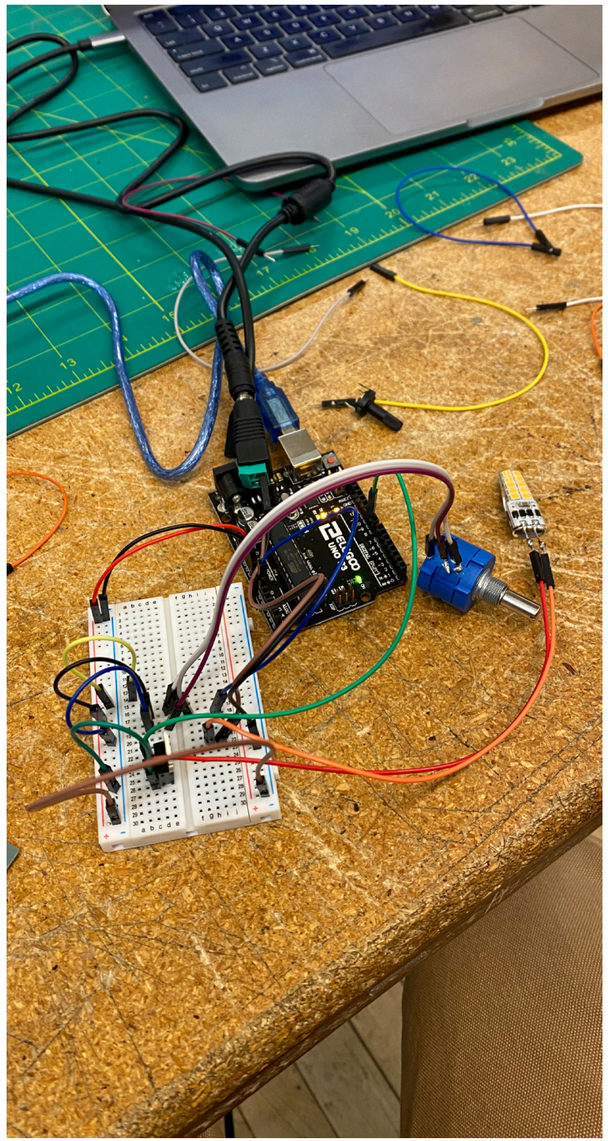
Integrated carriage

CNCing top plate

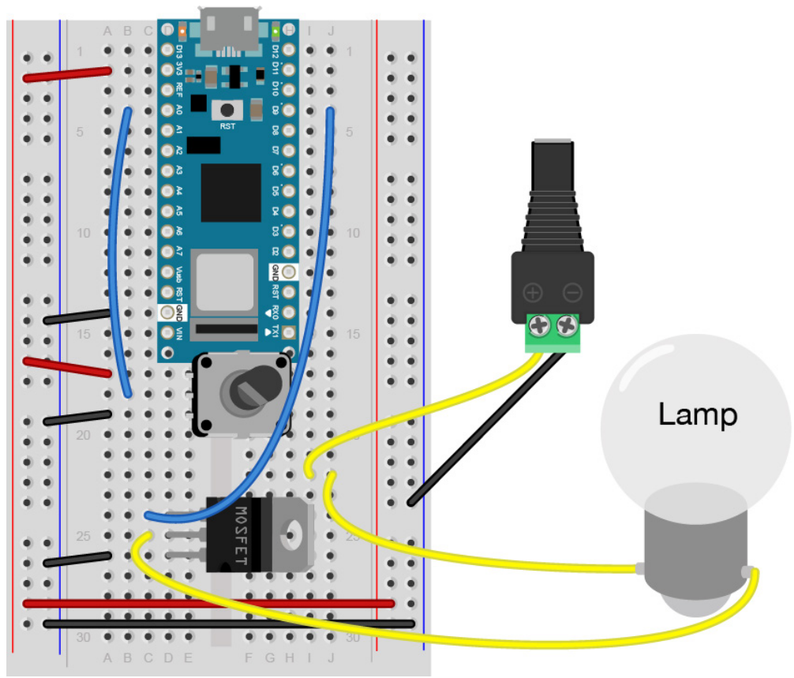


The carriage is the heart of this lamp. It carries the lighting elements, electricity, and is the connection between the exposed elements and hidden electronics.

Electronics Design

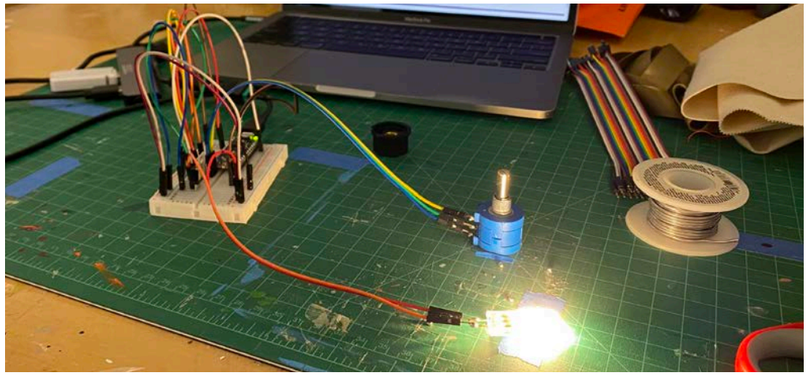


Electronics schematic




```arduino
const int transistorPin = 9;  // connected to the base of the transistor
int lowThreshold = 100;       // Adjust these values according to your requiremen
int highThreshold = 540;
int lowValue = 0;
int midValue = 75;            // Adjust this value to set the mid-range value
int highValue = 255;

void setup() {
  // set the transistor pin as output:
  pinMode(transistorPin, OUTPUT);
  Serial.begin(9600);
}

void loop() {
  // read the potentiometer:
  int sensorValue = analogRead(A0);

  // Map the sensor value to a new range with "low", "mid", and "high" values:
  int mappedValue;
  if (sensorValue < lowThreshold) {
    mappedValue = map(sensorValue, 0, lowThreshold, lowValue, midValue);
  } else if (sensorValue < highThreshold) {
    mappedValue = map(sensorValue, lowThreshold, highThreshold, midValue, highVal
  } else {
    mappedValue = highValue;
  }

  // use that to control the transistor:
```

Arduino code

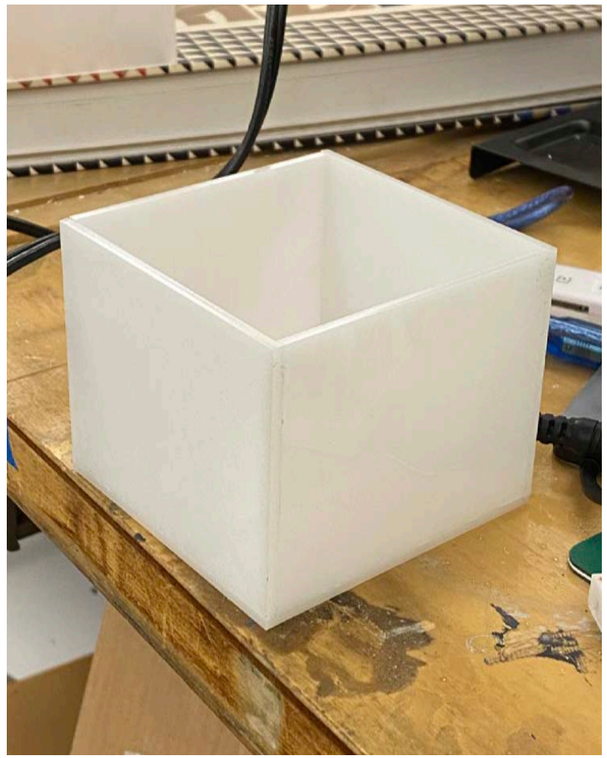


First light test

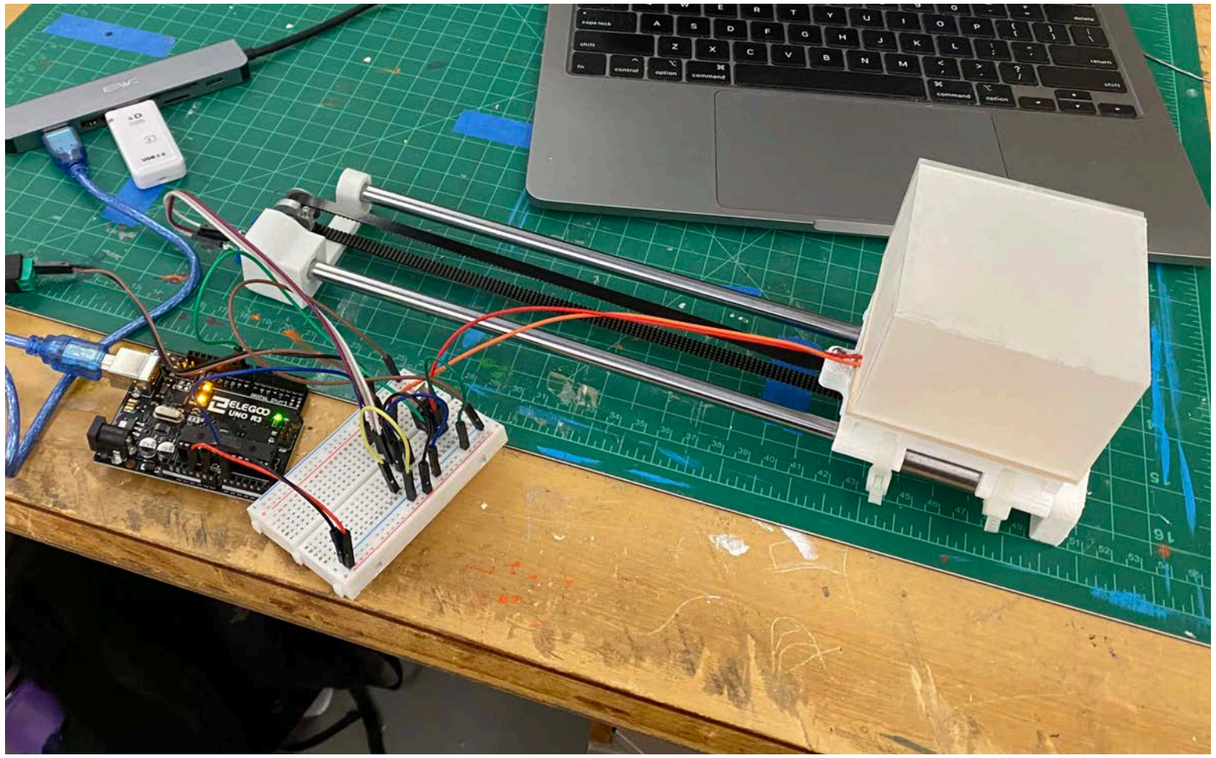
The electronics design was challenging for me since I hadn't worked with many of these components before. However, the code is fairly simple.

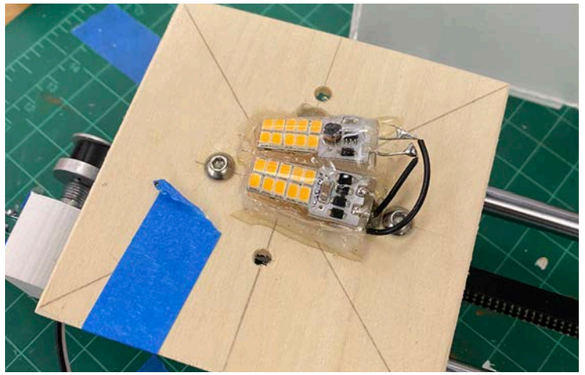
Integrated Design

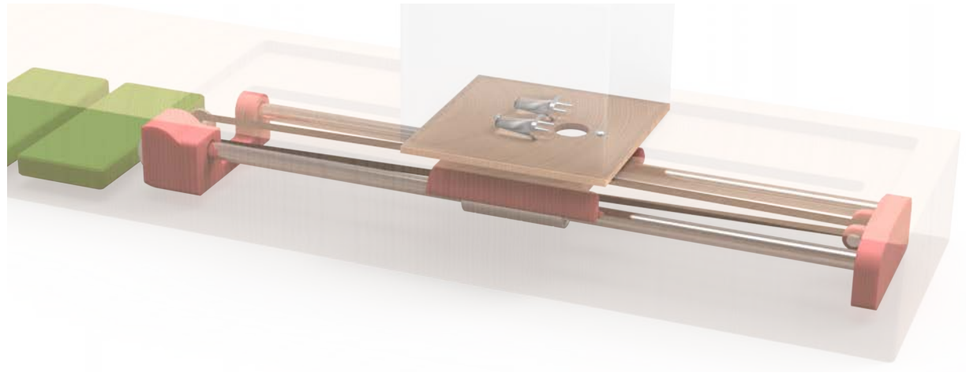
Full mechanical and electrical assembly



Acrylic diffuser

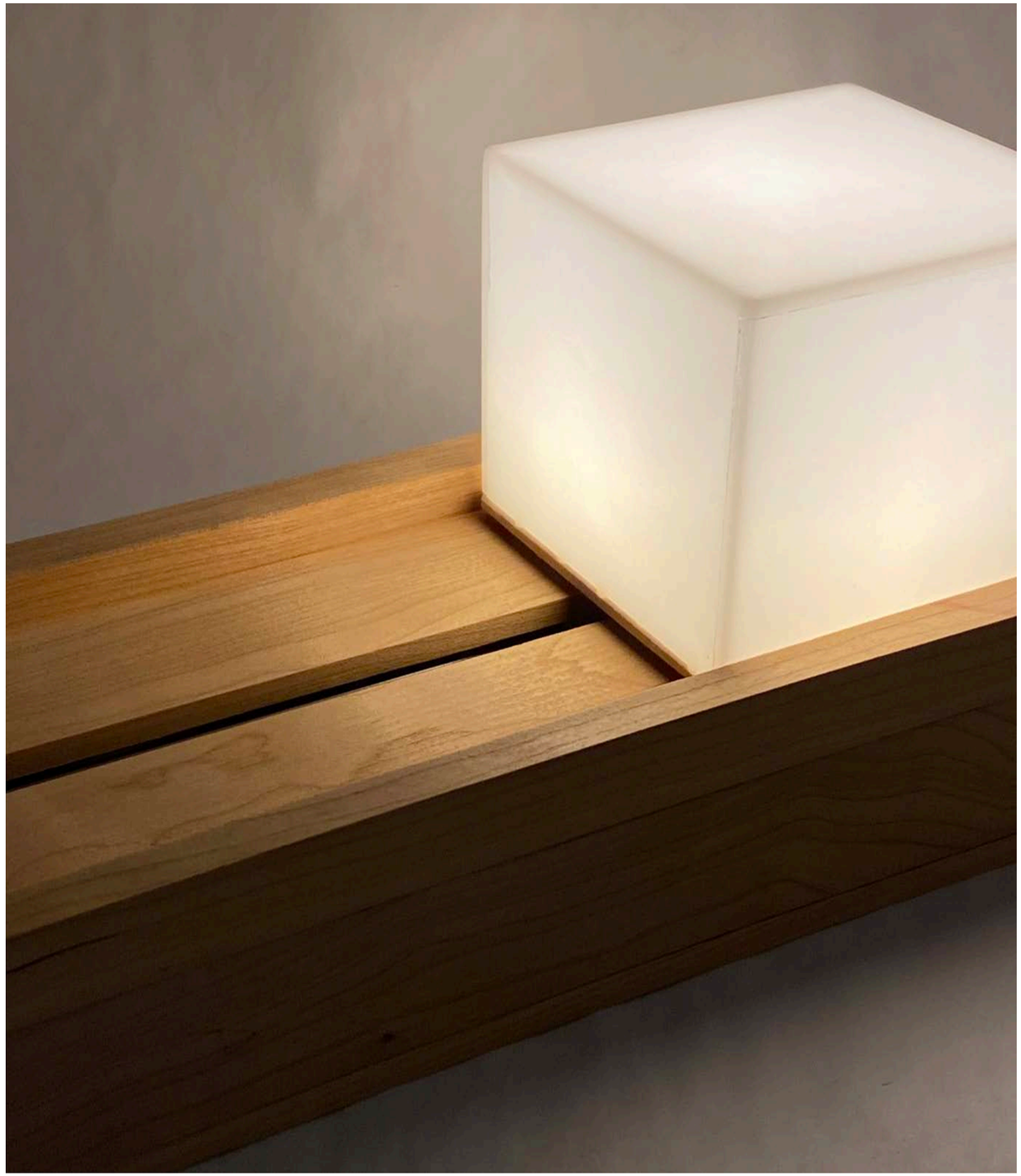


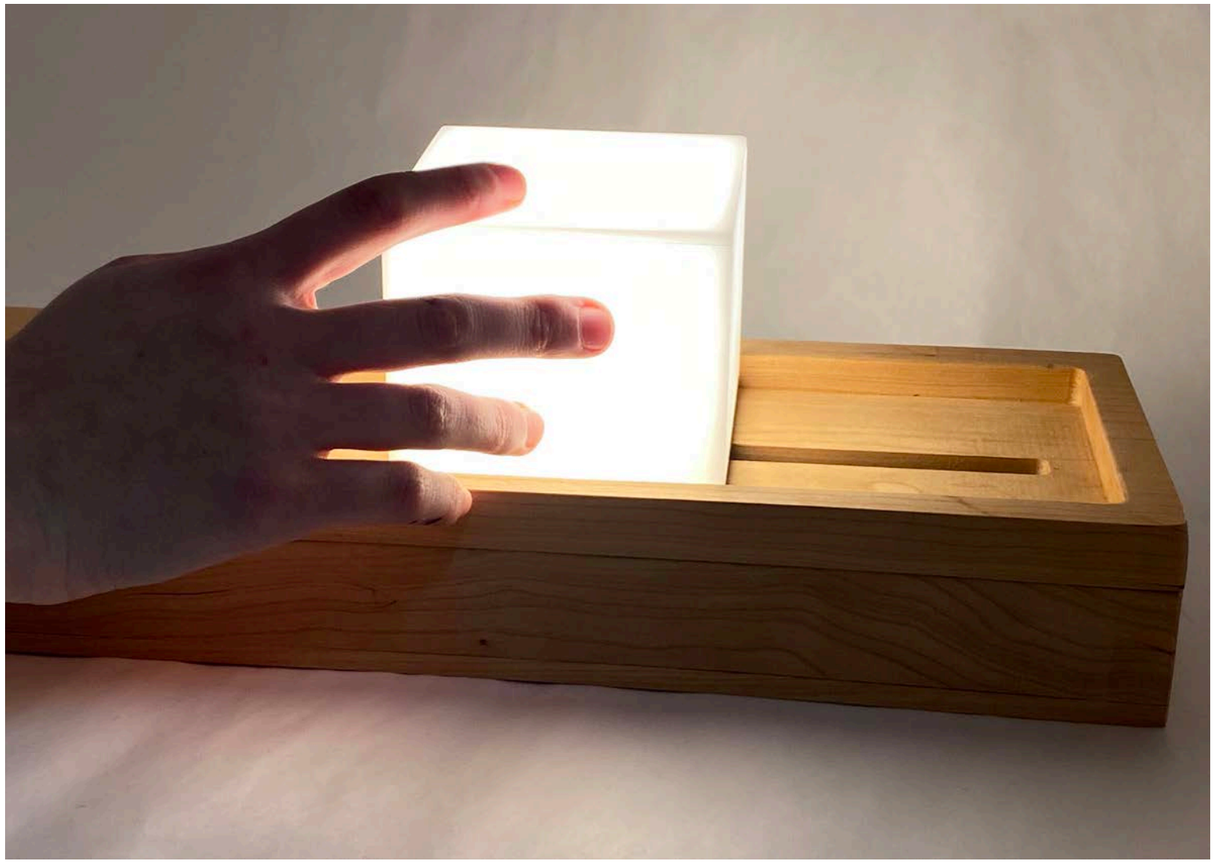




X-Ray view inside lamp

Verifying that all the parts worked before sealing them inside the lamp made the final assembly much easier.

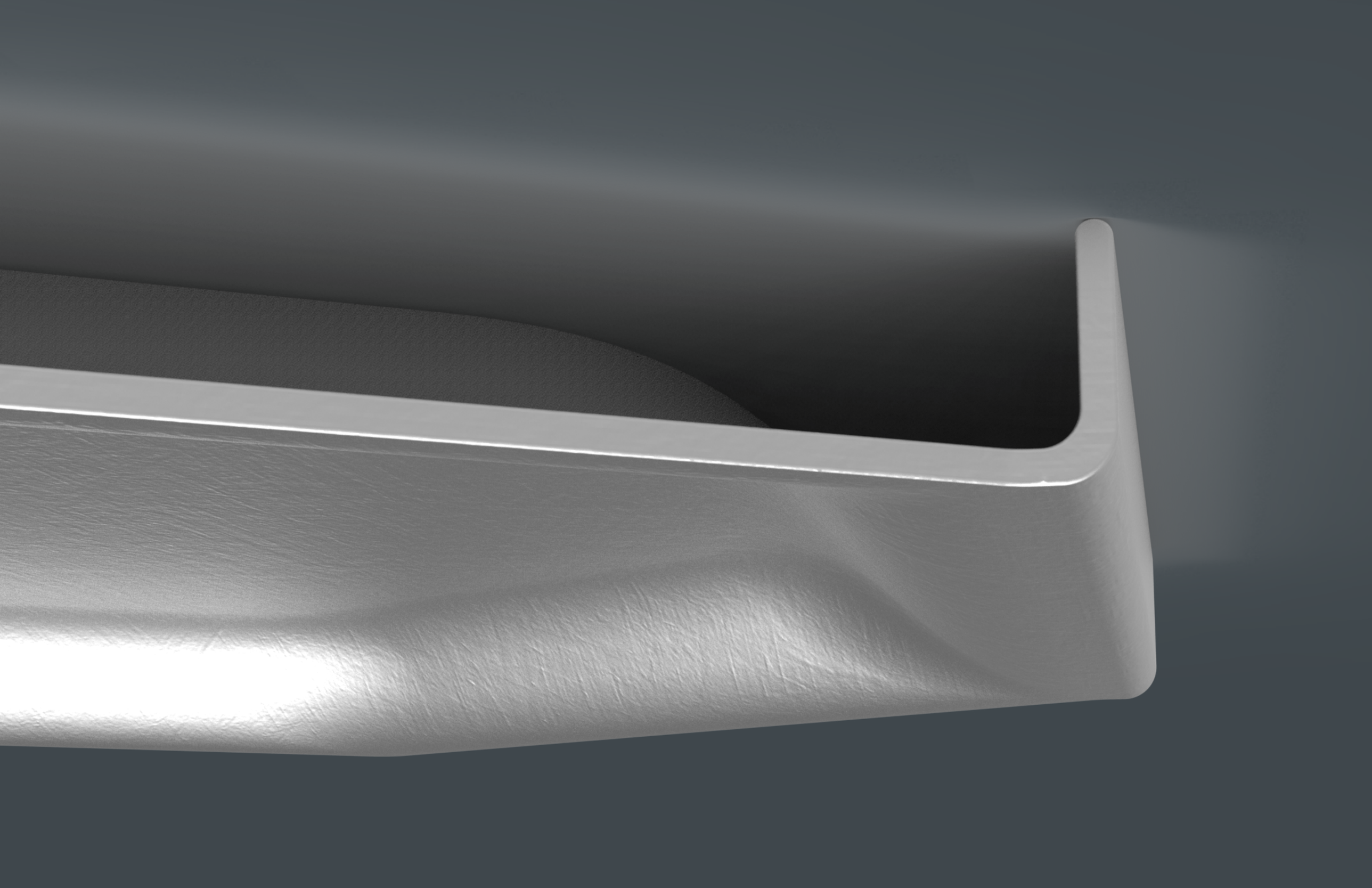




Concave Dishware

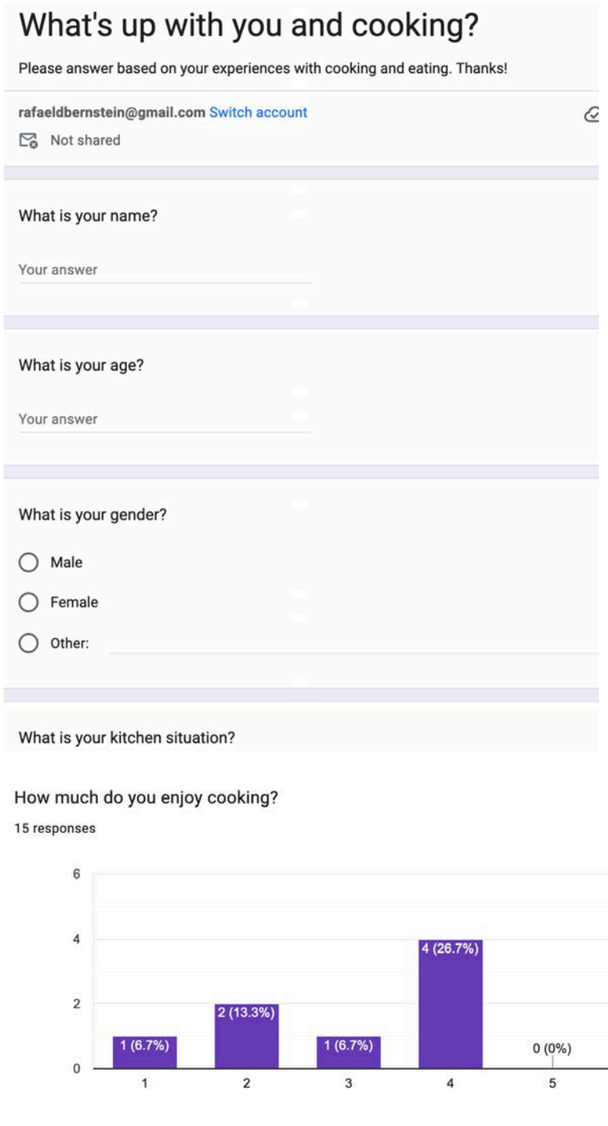
Design Prompt:

Create a kitchen product that enhances the cooking experience for college students.



User Research

Created survey to gain insights



What's up with you and cooking?

Please answer based on your experiences with cooking and eating. Thanks!

rafaeldbernstein@gmail.com Switch account

Not shared

What is your name?

Your answer

What is your age?

Your answer

What is your gender?

- Male
- Female
- Other:

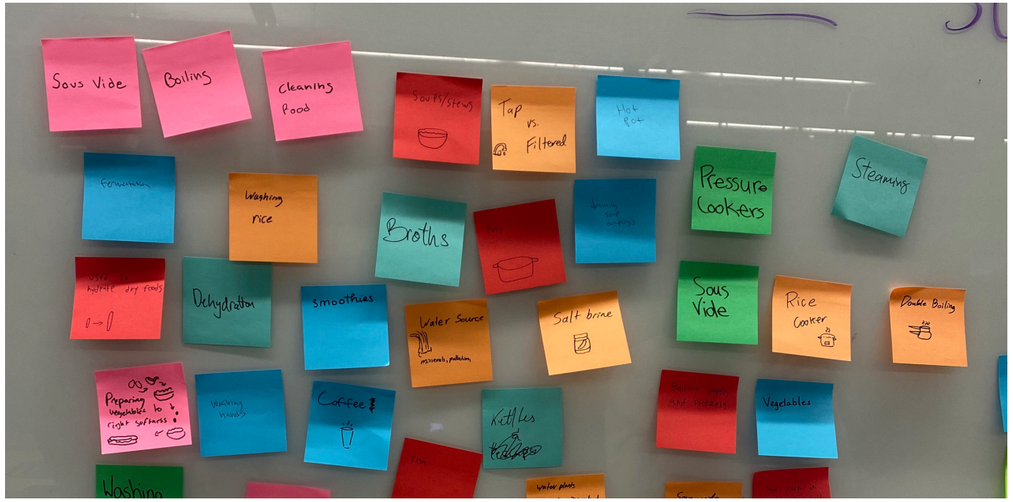
What is your kitchen situation?

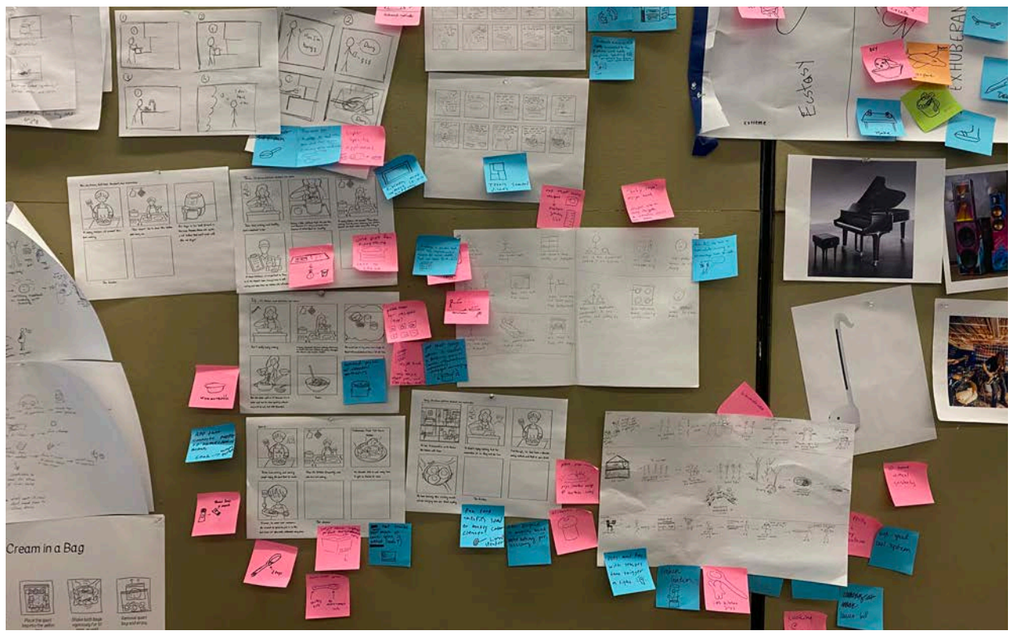
How much do you enjoy cooking?

Copy

15 responses

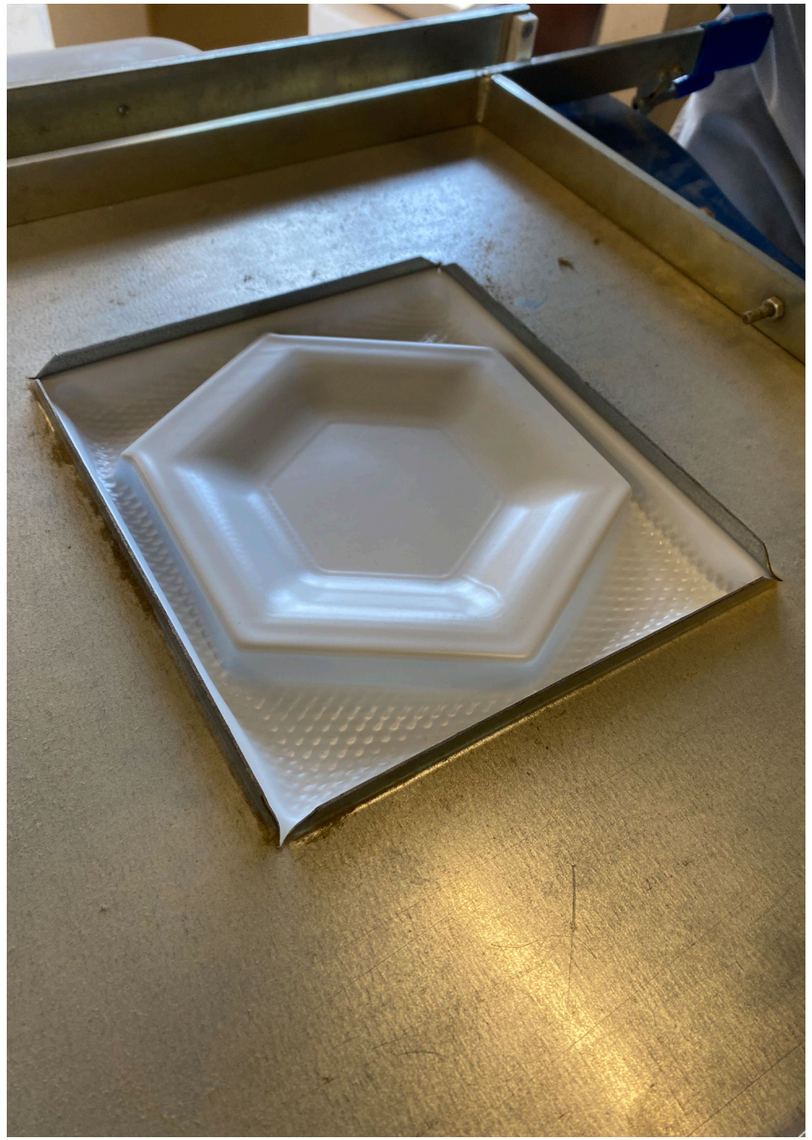
Brainstormed what users need





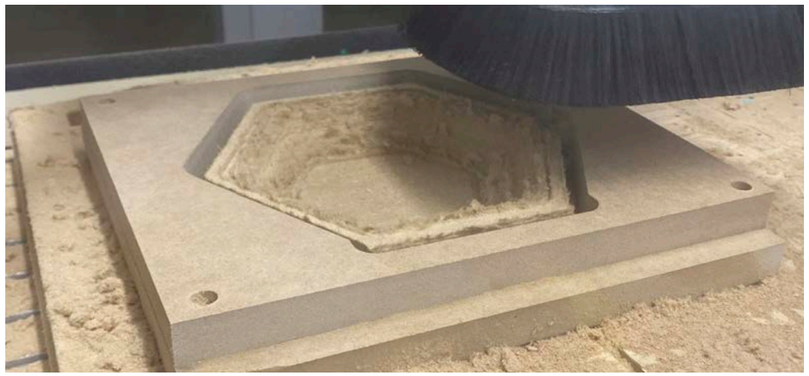
For our user research, we created a survey that was filled out by 15 people of university age. The main takeaways were that people enjoy cooking but simple frustrations get in the way of them cooking more. I chose to focus on lack of kitchen space.

Early Prototype

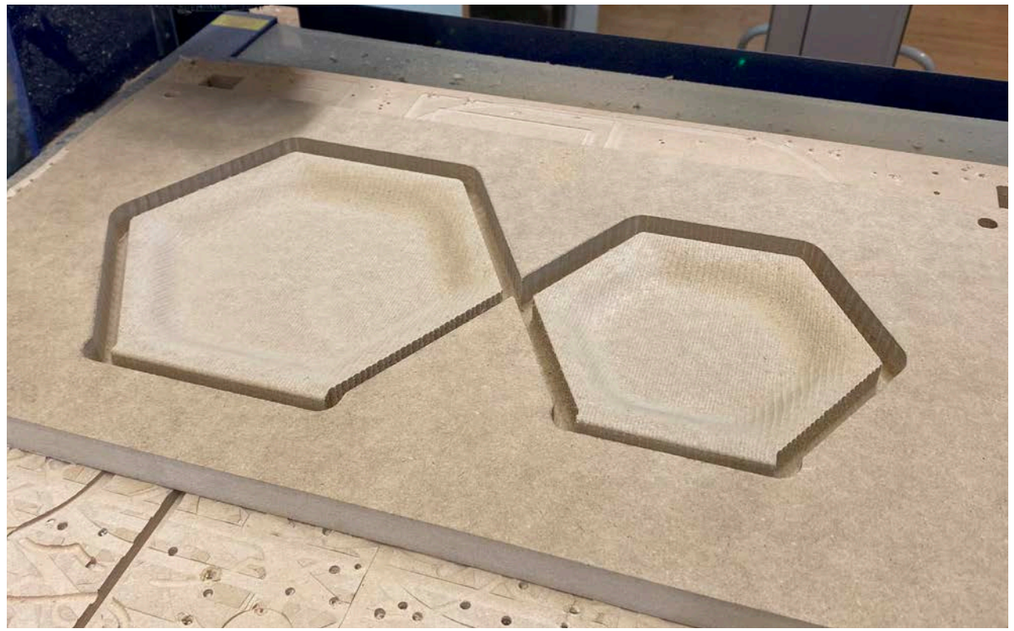


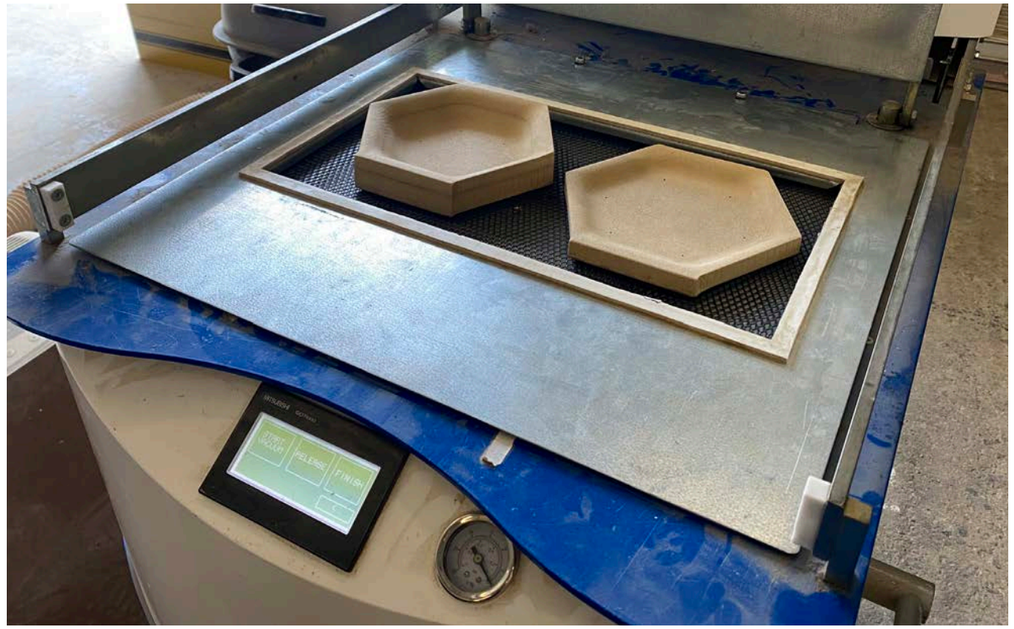
This prototype was my first attempt at vaccum forming. I used a 3D printed mold and 1/16th inch polystyrene sheets. The part came out well but the mold warped due to the heat. It served as a proof of concept to move forward with vaccuum forming.

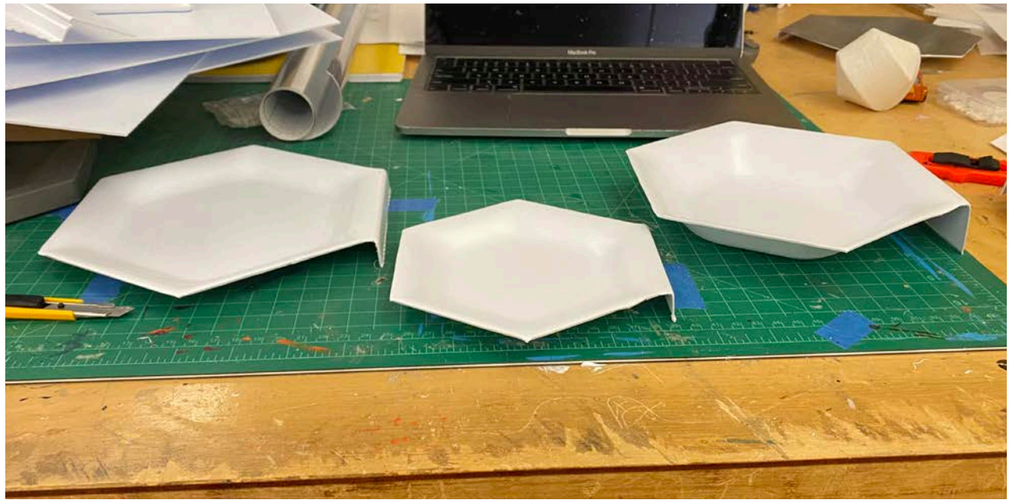
Production



The final molds were CNC'd out of MDF. They needed some slight post-processing but allowed for higher temperatures in the molding process.







Being able to load multiple molds into the same forming allowed for increased yield. The dishes were then cut out from the flash, sanded, and spray painted to simulate the finish of stamped steel.