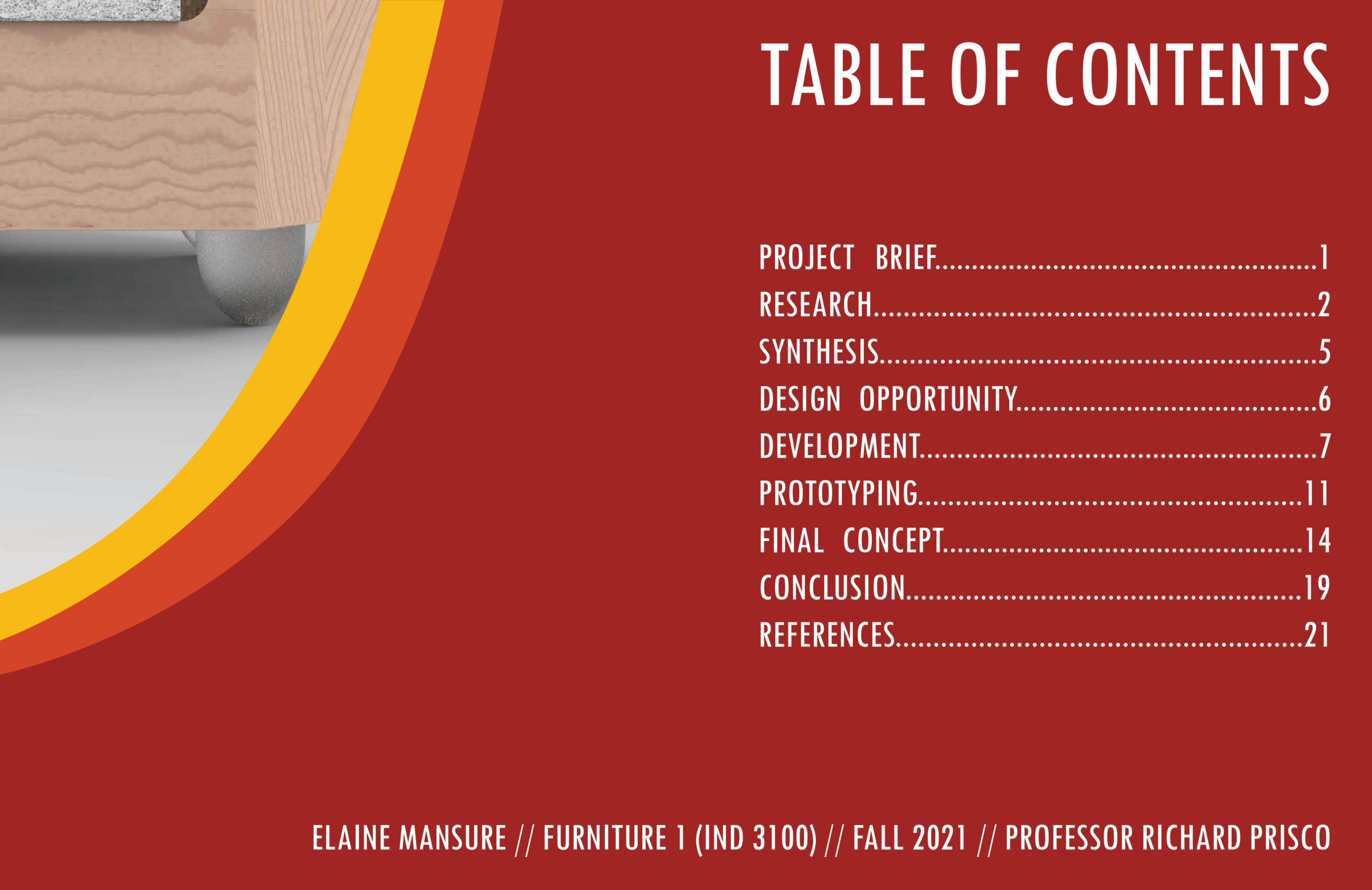




# POINT, LINE, AND PLANE: A LIGHTING PROJECT

ELAINE MANSURE

FURNITURE 1 (IND 3100) // FALL 2021 // PROFESSOR RICHARD PRISCO



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Using the fundamental design concepts of line, point, and plane as inspiration and a guide, design an object that can provide light to a room. Define an intended demographic, market, and function, and create a functional prototype of the final design.

In the context of my design, the lighting object that I created aims to meet the needs of children in households that value high quality, safe, and interactive items. My interest in playful design, as well as my own experience as a child that was fortunate enough to be enlivened by the stimuli around me, pushed my work in this direction.

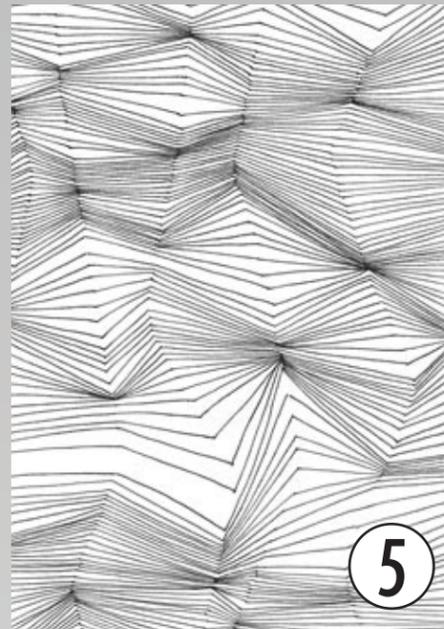
# PROJECT BRIEF



Before delving in to the conceptualization of the lighting object, I needed to gain a greater understanding to add context to my design. Starting from the ground up, my research was split into two main parts:

1. Understanding how the basic concepts of line, point, and plane can be used to create interesting forms
2. How these forms could meet the needs of an intended demographic and value-set.

# RESEARCH

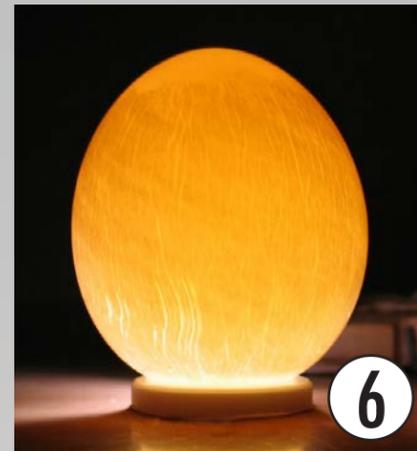


Because the fundamental elements of point, line, and plane act as the starting point for this project's conceptualization, it became integral to deepen my understanding of these concepts and how they can interact to create compelling forms in design. I primarily delved into the fields of architecture, furniture design, and nature to observe and collect repeated forms that are based on point, line, and plane in interesting ways. I distilled the many examples into a collection that I found most engaging.

Within nature, design, and architecture, points can help create intriguing forms. Basing radial designs around a point (1) was interesting to me because it creates focus while maintaining variation. Similarly, focusing attention to an implied point (2) allows the viewer to be drawn to a specific aspect or part of the design. I also wanted to explore the interaction between points and light (3) as a way to create detail.

Line has the ability to create interest beyond two dimensions. Just the line itself can create depth (4), and texture (5), in a way that can create excitement through illusion. Lines can also imply a playfulness that I was hoping to embody in my design, even when they are regular or patterned (6). Sprawling rivers (7), cracks in lava, and other natural forms made me wonder how light passing through lines could be used in my design.

Finally, planes can be anything but static, creating movement and engagement. Much like lines, they can create continuous, playful forms, rather than being confined to only one direction (8). When layered, flat planes can imply curvaceous forms (9), which appeals to my appreciation of organic designs. Their placement can force focus (10), bringing the viewer to a specific point or area of the design.



After becoming excited by the wide variety of design possibilities based on point, line, and plane, I needed to constrain my ideas to fit an intended market, pursuing forms and materials that satisfied the desired demographic. I chose to place my product in a market of which I was previously unfamiliar: children's lighting.

Within this market exists a variety of demographics with differing price points and value sets. I chose to pursue design that caters to upper-middle class families that value high quality, safe objects that provide their children with valuable stimulation. Companies that cater to these shared goals, such as Huckleberry Kids Rooms and The Natural Baby Company, helped inform my understanding of the price points, materials used, and general aesthetics that are typically available.

The companies that I researched prioritize using softened, playful forms (1, 2, 10), natural materials, with an emphasis on light wood with a subtle finish, (9, 11), colorful details (6,7), and typically range in price from \$60 to over \$1000, depending on the piece. This aesthetic direction and price point guided my conceptualization, but I also wanted to address some values and design elements that I felt were being unaddressed in much of this market.

The opportunity to explore non-gendered design (4), as well as interactive forms (3, 5, 8), intrigued me, as I felt that these design values were being underrepresented within the children's furniture market. My experience with and research into Montessori principles of learning informed this direction. Through designing a product with kids of all genders in mind, while also allowing them to be stimulated and involved in the object, I hoped to broaden interest and add variety to the types of products currently on the market.

The research process allowed me to start at a very broad point and then focus in, building from each level of research to eventually develop my final design. Through beginning with the exploration of the fundamental line, point and plane, my conceptualization became guided and informed by this research. Because I had already delved into the design possibilities of these basics, incorporating references from nature, interesting objects, and inspirations from other designers guided my thought process.

Through researching the demographic that I was attempting to target, I became aware of the potential of the children's product market. Viewing companies with price-points similar to my intended product helped me visualize the materials, aesthetics, and child interaction that are often prioritized. I also began to see points of the market that seemed to be overlooked. This includes products with high interaction or educative components, gender neutral focused items, and lighting targeted directly for children.

# SYNTHESIS



After becoming familiar with this research and intended demographic, I saw a hole in the market that could be filled, and I was interested in filling it. My interest in playful items, passion for learning, and appreciation of organic and “child-like” materials could be an advantage in developing my final product.

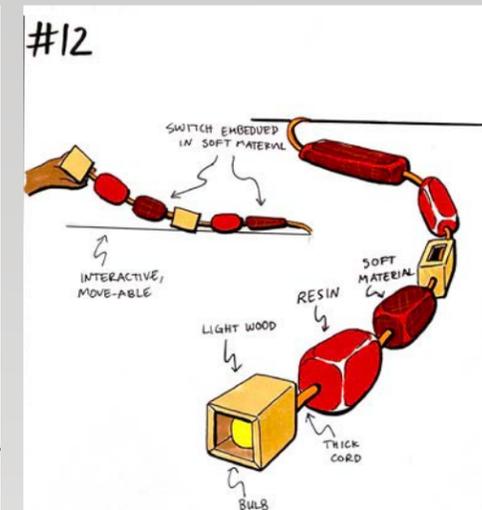
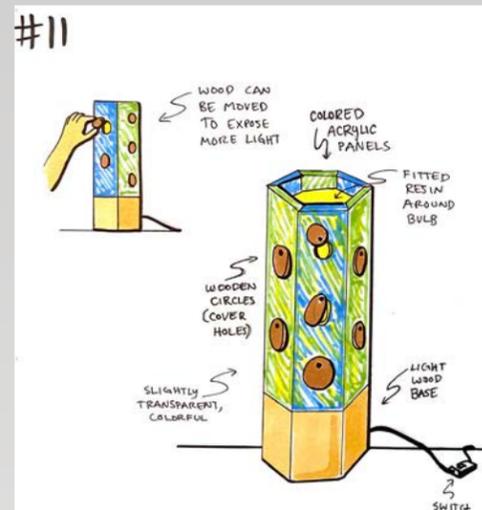
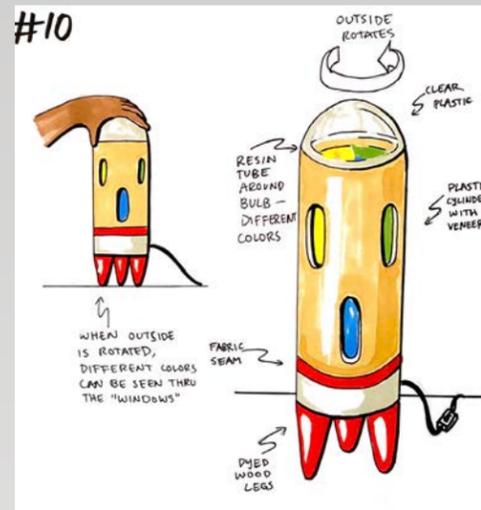
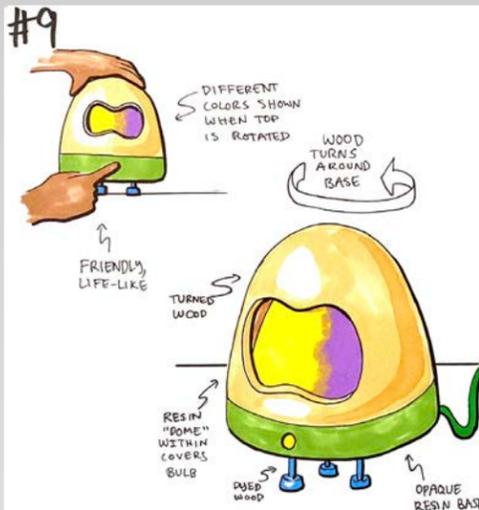
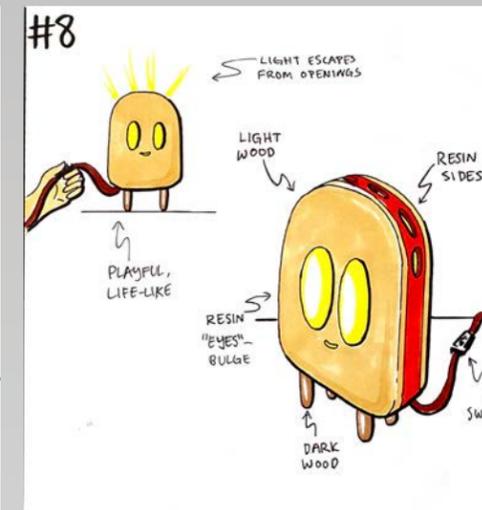
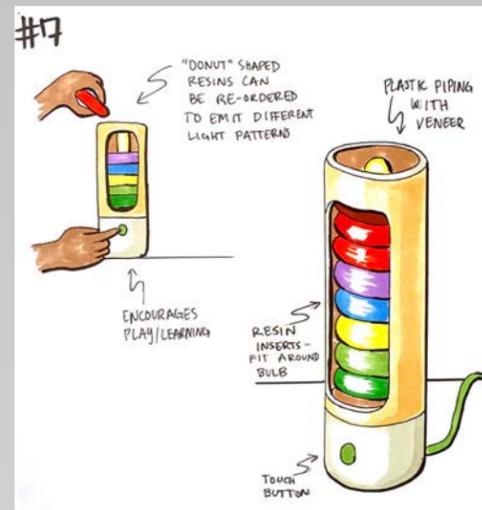
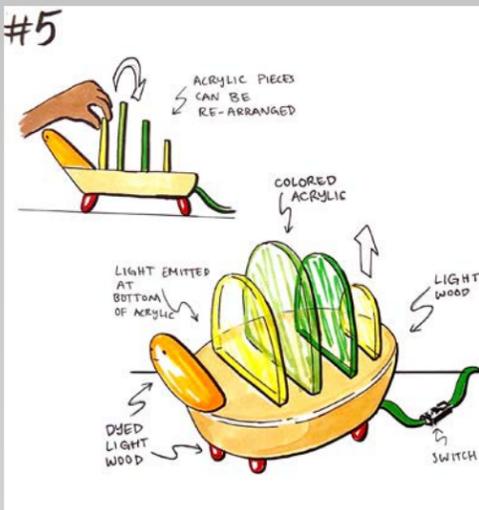
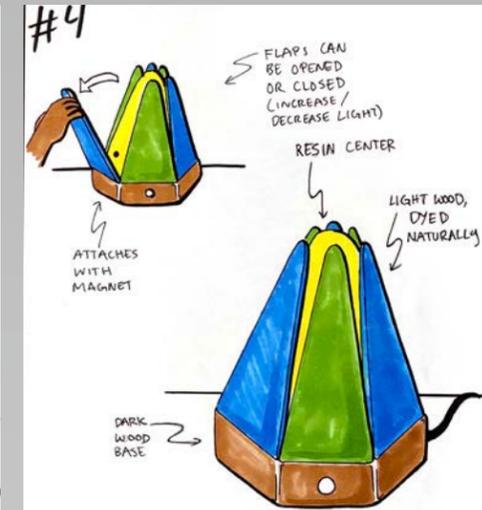
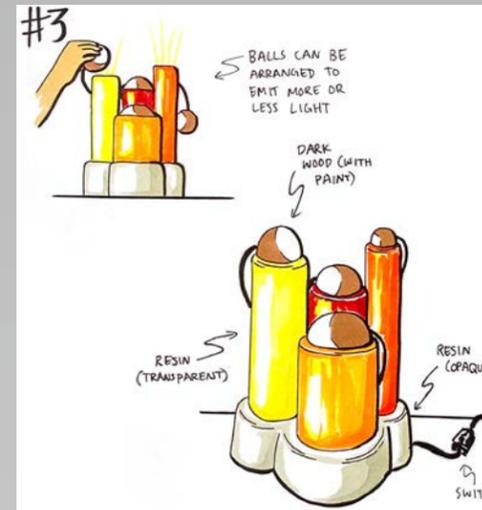
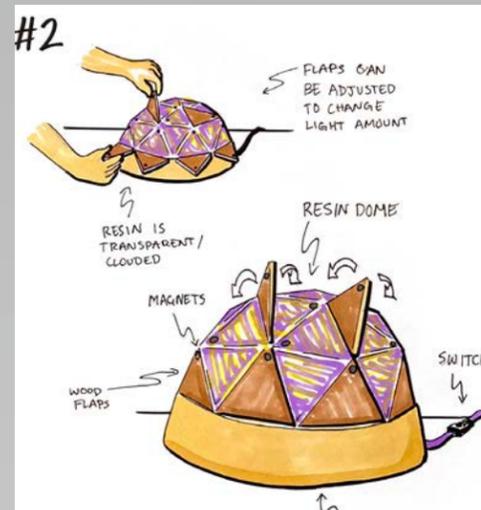
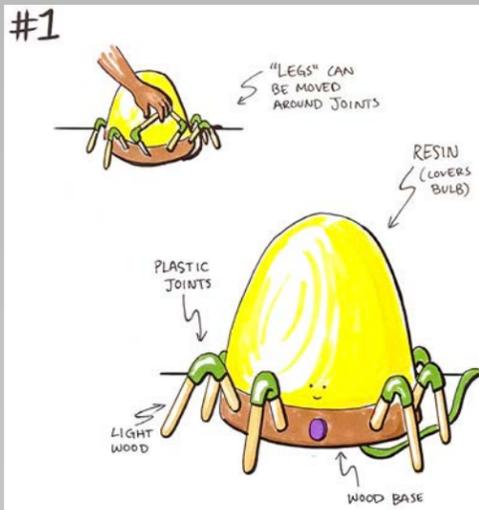
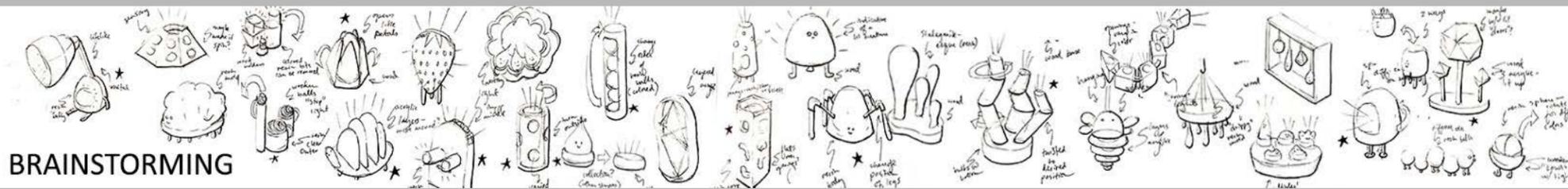
The market with which I want my project to identify is saturated with items, but many of them are unnecessarily gendered, do not allow for child interaction, or are, in essence, static decorations. I wanted to break this mold and create something that I hadn't seen before, but could imagine fitting well in the existing market. Designing something that both excites me now - and would have excited myself as a child - guided my entire process.

# DESIGN OPPORTUNITY

The process of developing my light moved from brainstorming to conceptualization, with constant peer feedback guiding my choices.

# DEVELOPMENT

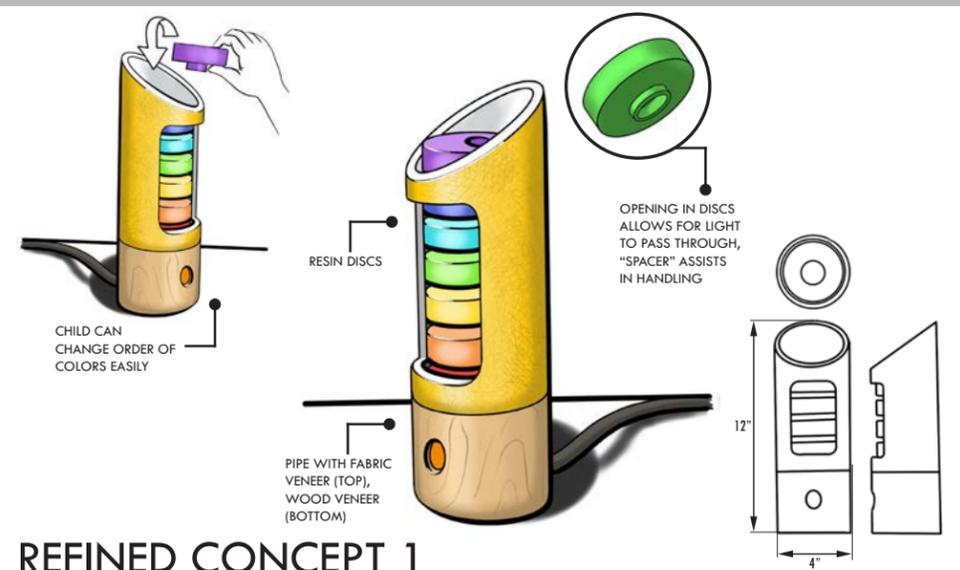




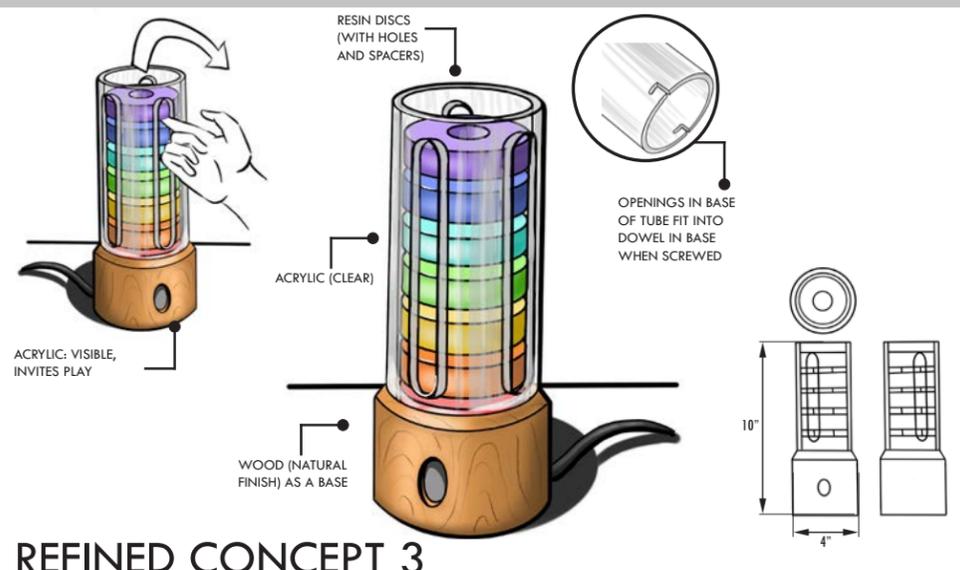
My initial concept development was informed by my research, striving to meet the needs of the demographic I was targeting while also creating lighting objects that I had not previously seen. I primarily focused on the use of plane to imply a focal point, implied line, and the interaction of repeated forms. All of my initial concepts require the child to interact with the lighting object in different ways.

Concepts #1, #5, #6, #8, #9, and #12 mimic the forms of living creatures, adding a toy-like element to the lighting design, and encouraging interaction. Concepts #2, #3, #4, #7, #10, and #11 allow the user to change the amount or color of light being emitted, either through moving opaque flaps, shifting the position of colored resin or acrylic around a light, or even covering the light source entirely. In this way, the lighting object is able to gently educate the child through showing the result of their action.

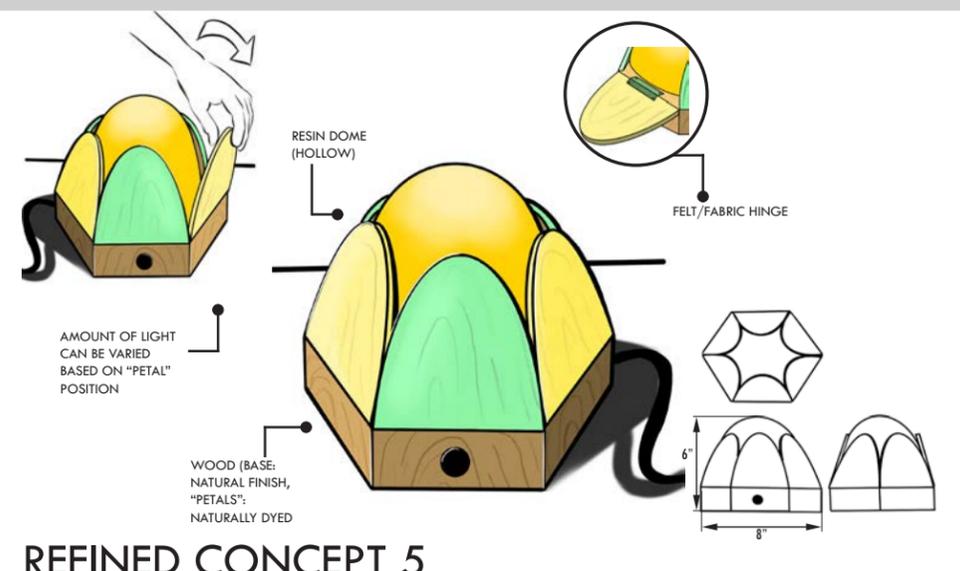
The feedback that I received on these concepts revolved primarily around simplifying my designs and refining down to two concepts that I could explore more closely. The designs that were less indicative living creatures were met with more positive feedback, as they may appeal to a larger age range than more animal-like forms. My inclusion of removable parts (such as in concepts #5 and #6) was also questioned, as these parts could easily get lost or broken. Concepts #4 and #7 were perceived to be my strongest concepts with which to move forward.



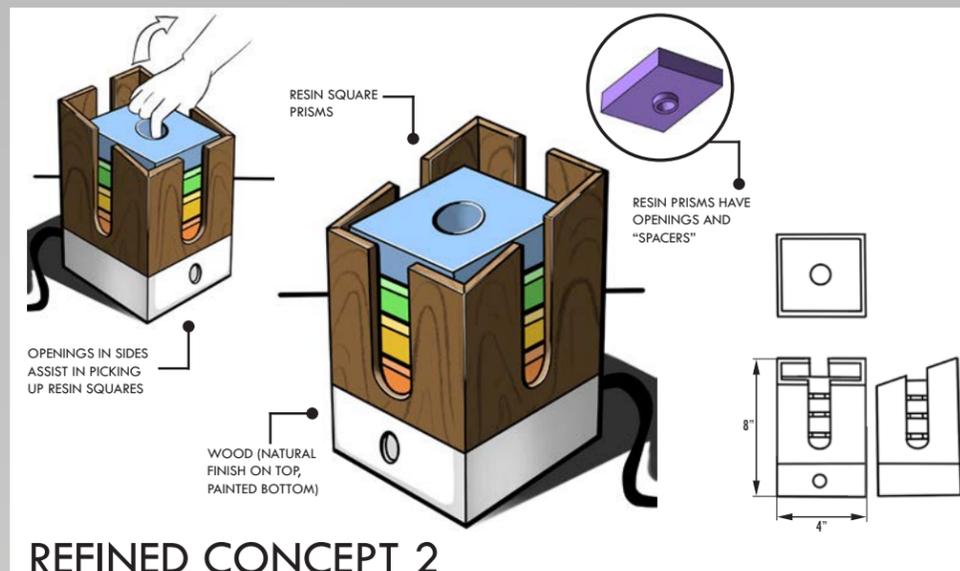
REFINED CONCEPT 1



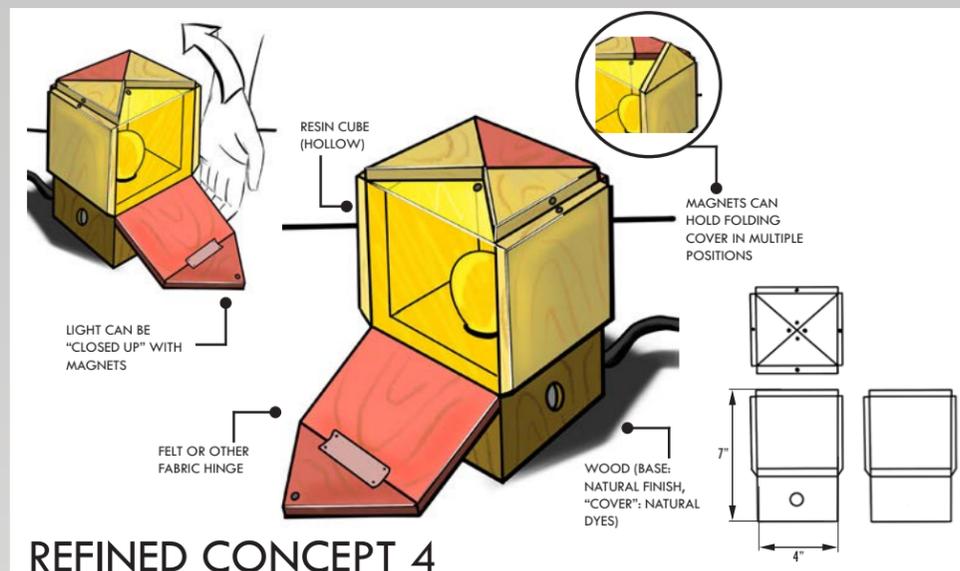
REFINED CONCEPT 3



REFINED CONCEPT 5



REFINED CONCEPT 2



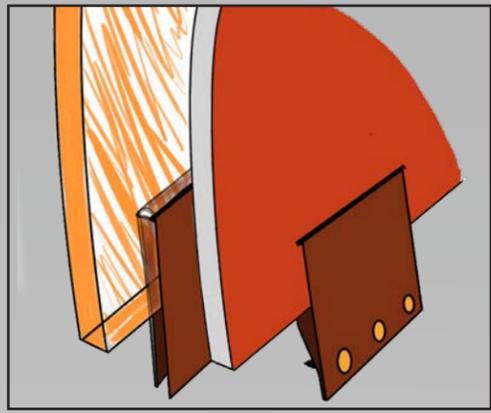
REFINED CONCEPT 4

Based on critique input, I developed my refined concepts based off of initial concepts #4 and #7. In this stage, I altered previous forms to simplify and add interest. Concepts #1, #2, and #3 were based on initial concept #7, while concepts #4 and #5 were developed from initial concept #4.

Concepts #1 through #3 allow the child to learn about the interaction of light with color through being able to vary the order and number of colored pieces stacked on top of the light source. With these designs, the removable discs or squares were to be made of dyed resin, while the outer housing was composed of varying opaque materials (PVC with veneer for #1, wood for #2, and acrylic for #3). Based on prior critique, I attempted to simplify these forms and include colorful details.

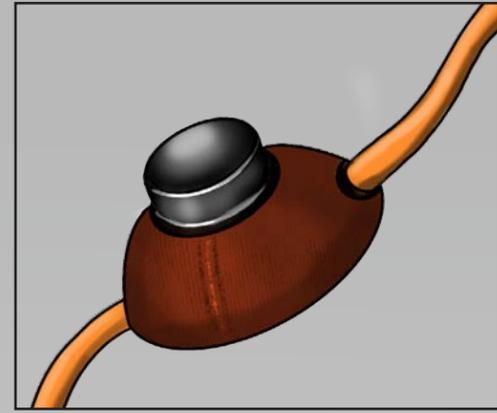
Concepts #4 and #5 are mechanically dimmable through the user changing how much light is covered by opaque components. Concept #4 imagines the initial concept to be more geometric, using interacting planes to fold over the light completely. Concept #5 refines the form from the initial concept, with the inclusion of fabric hinges that were suggested in prior critique.

The feedback that I received for these refined concepts was more positive for concepts #4 and #5 than for #1 through #3. Concern was expressed for the use of resin as a stackable material, as it would be challenging to be perfectly flat. The user interaction of these concepts was also discussed, as both concept #1 and #3 would cause the removal of the middle components to be challenging. The form of concept #5 was preferred over #4, and several peers expressed the possibility of using a transparent material (instead of wood for the "flaps") in order to add interest and allow for color change. Concept #5 was viewed as being most versatile for many ages of children, which encouraged me to move forward with it.

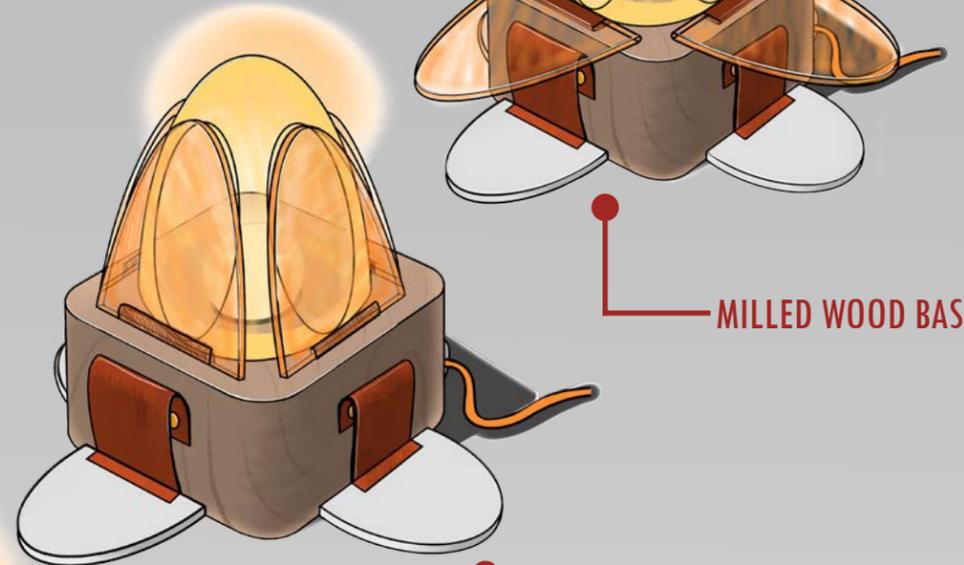


FABRIC HINGES THROUGH SLOTS IN ACRYLIC (CONNECT "PETALS" TO BASE)

"PETALS" OPEN TO CHANGE COLOR AND AMOUNT OF LIGHT



FOOT SWITCH

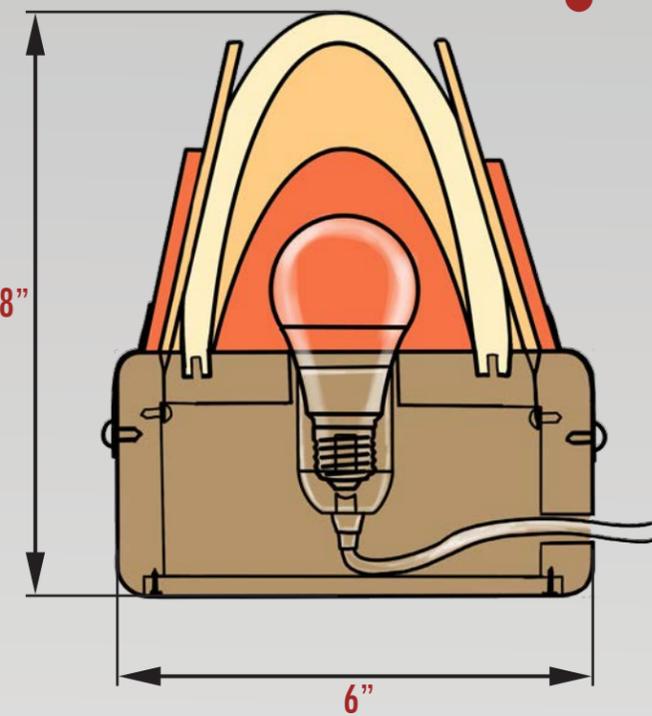
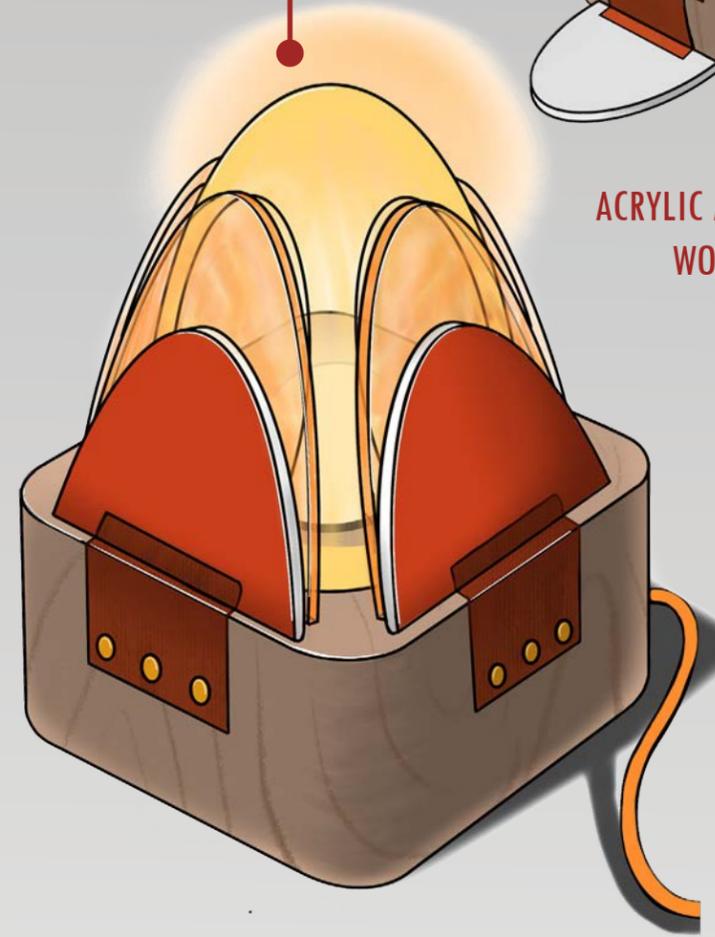


MILLED WOOD BASE

ACRYLIC AND PAINTED WOOD "PETALS"

RESIN DOME

SECTION VIEW WITH INTERNAL COMPONENTS



My final concept was developed from refined concept #5. Critique input encouraged me to include transparent flaps instead of opaque pieces, as well as to think more closely about the internal components that needed to fit within my design.

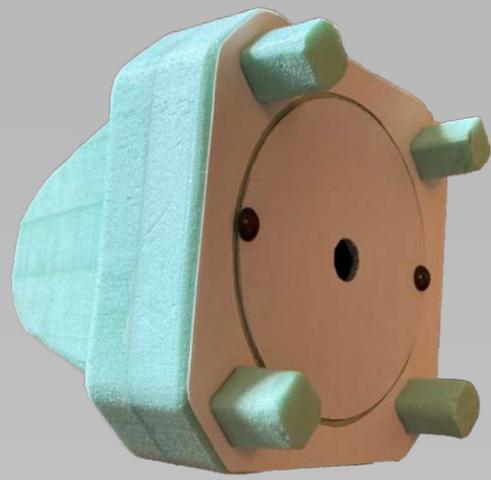
I further simplified my form to have only four sides with "petals" or "flaps" that open. Thinking about the interaction of parts also caused me to include flattened sides of my resin "dome" to both allow the "flaps" to rest in place and also add visual interest. I included both transparent "petals" and wooden ones, so that both the color and amount of light could be varied by the child interaction.

I received helpful feedback on this concept related to materiality, overall form, and interaction between pieces. Peers suggested that, rather than having opaque outer "petals," I could keep material continuity and replace them with red transparent acrylic. The form of the base was also questioned, as it appears to be too bulky and not indicative of the forms included in the upper part of the lamp. I was encouraged to refine the base's corners, make the base thinner, and include feet to both add a playful feel and allow the cord to exit through the bottom. The mechanism of opening the flaps was critiqued, and I was pushed to explore different hinge types.



After narrowing my ideas to one concept, I needed to work through problems in my design, confirm my volume and scale, and get a better understanding of my piece in a three-dimensional space.

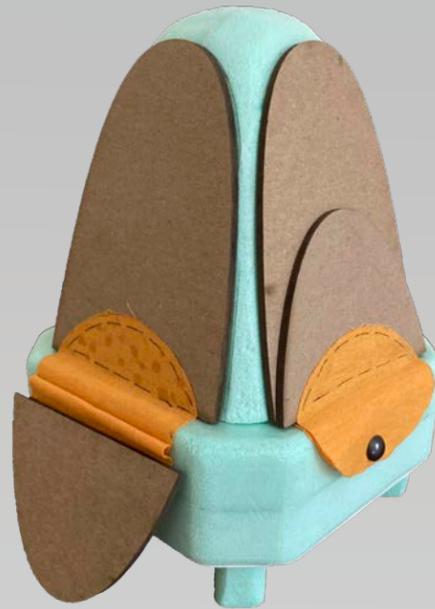
# PROTOTYPING



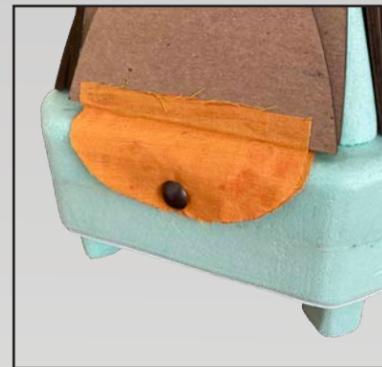
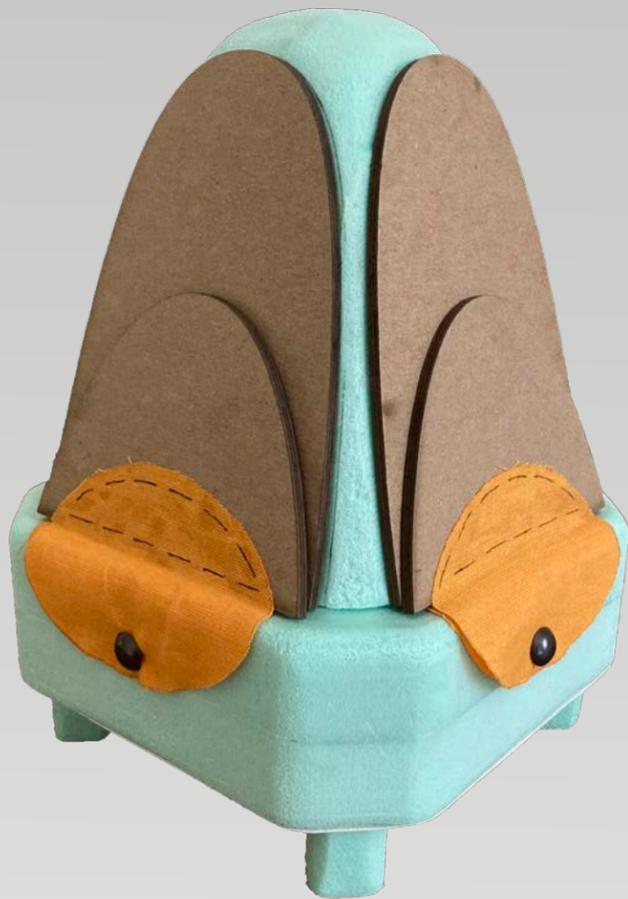
INTERNAL PARTS  
DEVELOPED: BASED OFF  
OF BULB, SOCKET, AND  
WIRING DIMENSIONS



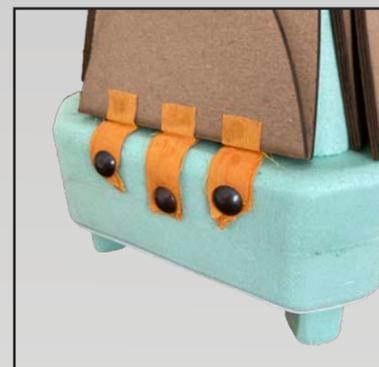
"FLAPS" OPEN, MIMIC  
ACTUAL MOVEMENT



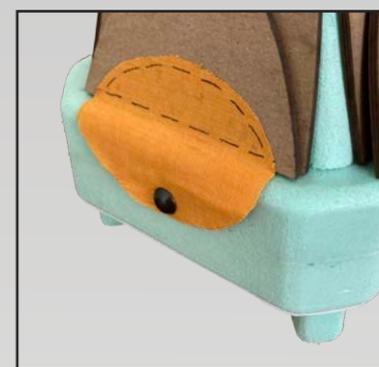
MATERIALS: GREEN FOAM, LASER-  
CUT CHIP BOARD, COTTON FABRIC,  
BRISTOL BOARD, FURNITURE TACKS



HINGE STYLE #1:  
ONE PIECE FED THROUGH  
SLOT IN ACRYLIC



HINGE STYLE #2:  
THREE PIECES FED THROUGH  
SLOT IN ACRYLIC



HINGE STYLE #3:  
ONE PIECE SEWN INTO  
HOLES IN ACRYLIC

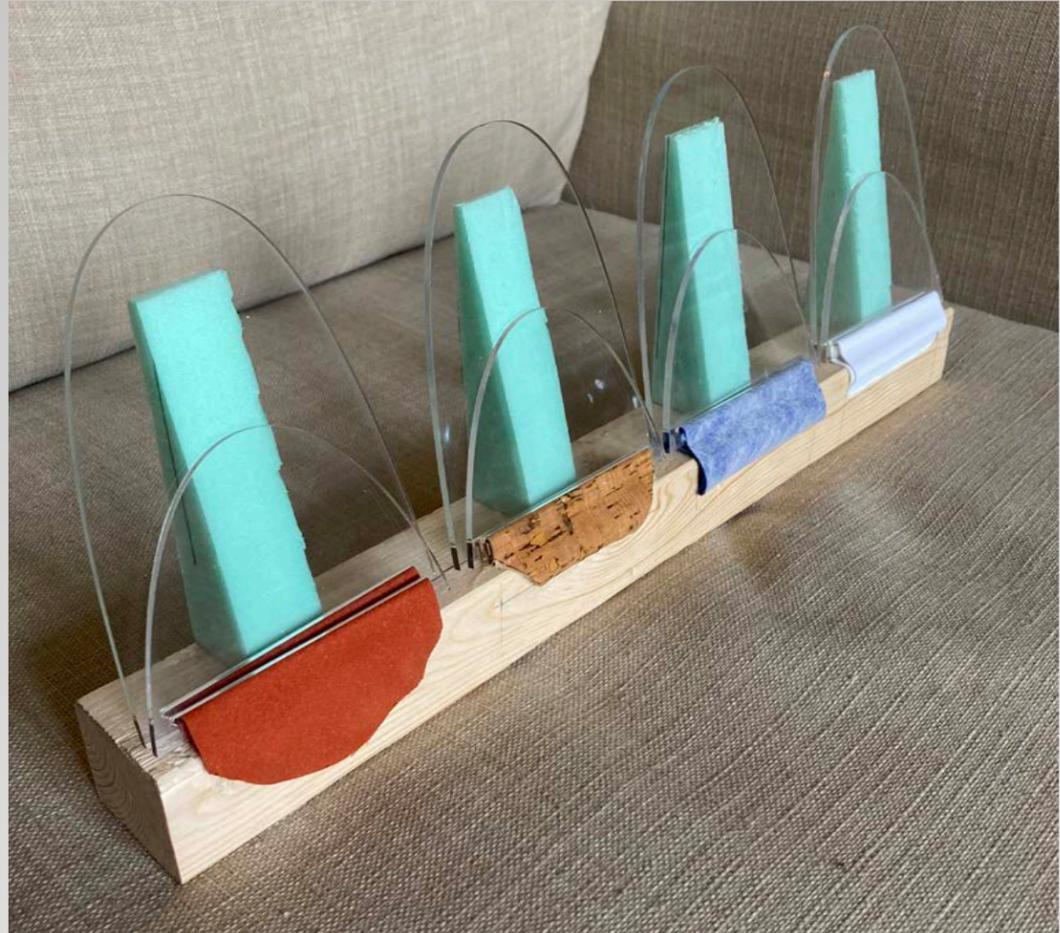
Based on feedback for my developed concept, I altered my volume study to include a more refined base with the corners chamfered, edges filleted, and thinner overall form. I added feet, altered the resin "dome" to have larger flattened sides, and explored different hinge types.

Through the addition of these formal changes, I was able to have a better understanding of how both the outer, more aesthetic-based parts interact (both physically and visually) as well as how the internal wiring components would have to fit in the base. I also was able to visualize hinge types that I had only previously imagined, and question how effective they actually were.

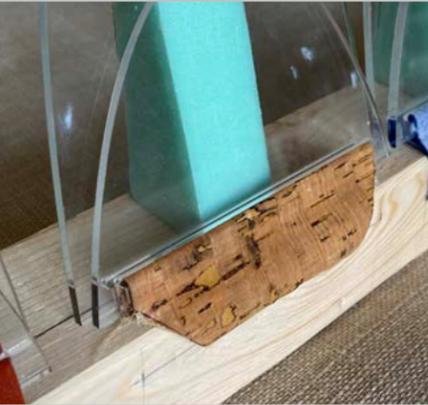
From this, I determined several aspects that I wanted to alter for my final design. Firstly, I realized that it would make more sense to mill the openings to fit my wiring in a square rather than using circular forms. I confirmed that I was happy with the visual interaction of my "dome" and its surrounding "flaps," as well as the scale of the base relative to the upper parts. I realized, however, that I would rather include more rounded forms for feet (to add playfulness). Though I confirmed that hinge style #1 was the strongest, I still needed to get a better understanding related to how the hinge would legitimately function.



USING REALISTIC MATERIALS ALLOWED FOR MOVEMENT AND POSITIONING OF “PETALS” TO BE BETTER UNDERSTOOD BEFORE MANUFACTURE



#1: SUEDE-STYLE FABRIC WITH TACKS HIDDEN BETWEEN LAYERS



#2: CORK-BACKED PLASTIC FED THROUGH SLOT IN WOOD



#3: FELT-BACKED PLASTIC (INSIDE OUT) SANDWICHED WITH TAB IN MILLED SLOT



#4: FELT-BACKED PLASTIC SANDWICHED WITH TAB IN MILLED SLOT (TAB SHOWN)

In order to understand the hinge mechanism of my light, I needed to explore both fabric options and ways to connect the fabric to the base of the lamp. I created a mock-up of the hinges, keeping the angle of the resin “dome” in mind for my foam rest, and using realistic materials for all other parts.

Hinge #1 uses pins sandwiched between suede fabric to fasten the hinge to the wood. While I thought that this would hide the fastening well, it looked crafty and weak in reality. Hinge #2 uses a cork-backed plastic pulled through a slot. While I liked the way this hinge looked, the slot was not a realistic with the geometry of my lamp. Hinges #3 and #4 work with the same plastic-backed material (inside out in #3). They both use milled slots with fitted tabs to fasten the material, however, I liked the look of the fabric on the outside (hinge #3) better.

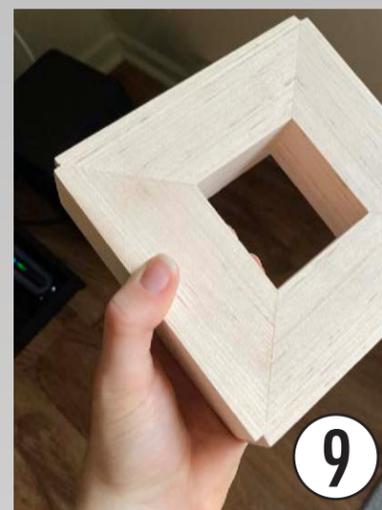
Through this detail study, I determined that I would move forward with hinge #3 for my light. Using the measurements and interactions that I determined in this step, I was ready to begin manufacturing my prototype.

The process of research, conceptualization, and prototyping brought me to a final, physical prototype. Through using realistic, product-quality materials to finalize my concept, design problems had to be solved in sensible and functional ways.

# FINAL CONCEPT







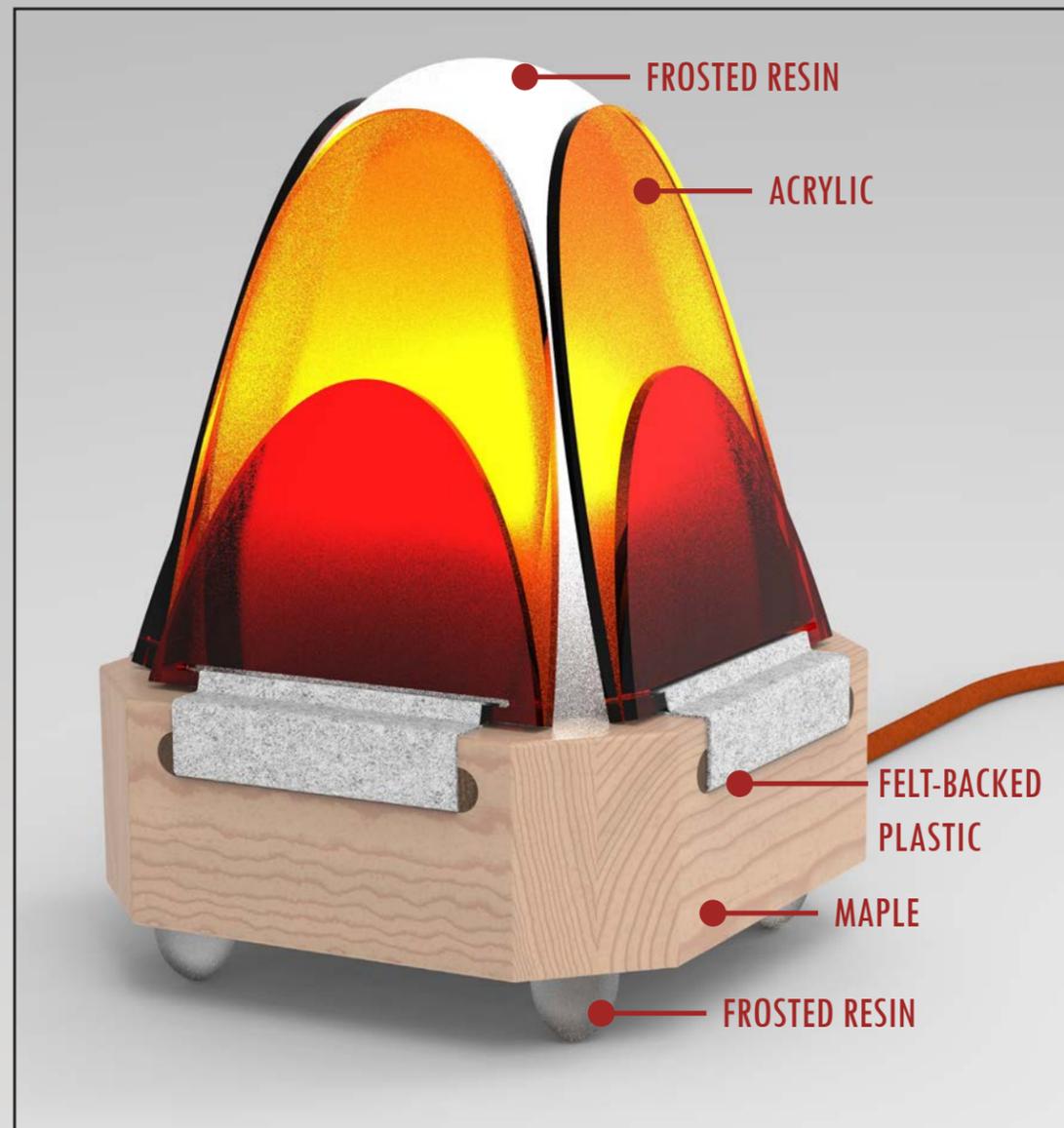
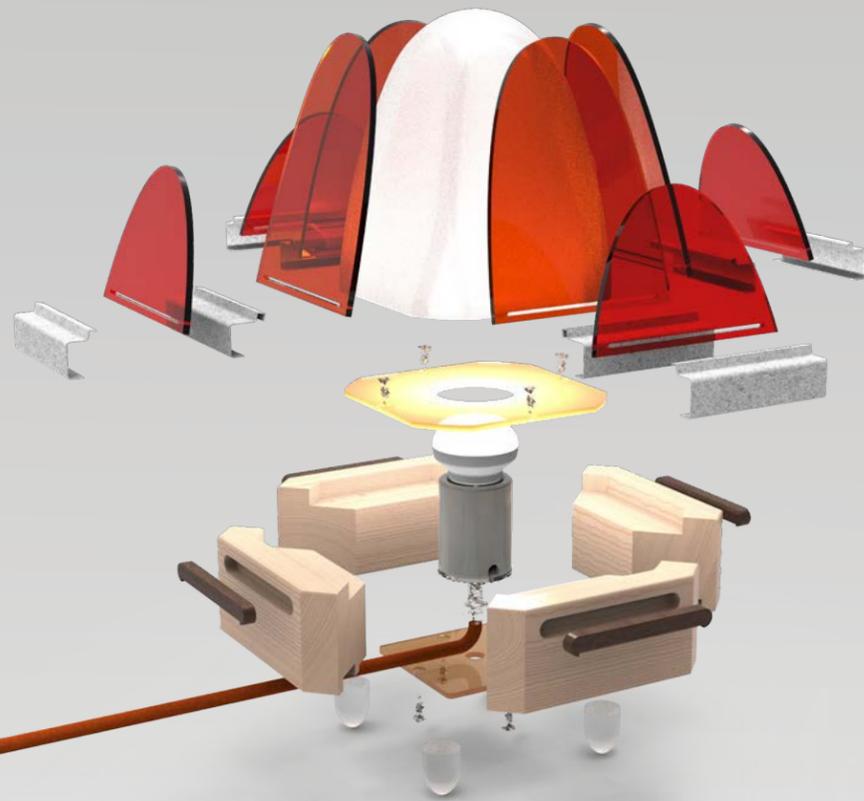
My production process involved materials and processes that I was not familiar with before. Some of the processes I completed, pictured to the left, include:

- 1) 3D printing and sanding my “dome” to the exact size that I wanted my final part to be.
- 2) Fashioning a piece to fit into the silicone mold’s plug for easy removal.
- 3) Pouring silicone into the inside of my 3D print, and
- 4) Removing the plug.
- 5) Making a sealed acrylic box and gluing the 3D print to the bottom.
- 6) Pouring silicone over the 3D print.
- 7) De-molding the 3D part to reveal the outer mold form.
- 8) Pouring the resin into the two part mold.
- 9) Creating the basic form of the base with a mitered glue-up.
- 10) Milling the bottom of the base to fit an acrylic plate that holds the inner parts.
- 11) Plunge routing the top of the base to fit the resin dome and milling the sides of the base to fit the fabric hinges.
- 12) Adding insets to hold the feet.
- 13) Sanding the base to 320 grit.
- 14) Placing the acrylic plate to it’s respective milled fitting.
- 15) Confirming the friction fit of the top “dome” to the base.

SECTION AND EXPLODED VIEWS REVEAL THE INTERACTION BETWEEN OUTSIDE FORMS AND INTERNAL FEATURES AND CONNECTIONS



ACRYLIC "PETALS" INTERACT TO CREATE A FORM REMINISCENT OF A FLOWER BUD, CAN OPEN / "BLOOM" TO REVEAL MORE LIGHT AND CHANGE THE COLOR OF LIGHT BEING EMITTED



Developing the models that are the basis of these renderings allowed for experimentation with form, position, and scale throughout the design process. Rendering the models helped me determine color and finish choices, as well as general materiality.



IN-CONTEXT AND STUDIO SHOTS OF THE FINAL MANUFACTURED PROTOTYPE. AS A BEDSIDE TABLE LAMP, THE LIGHT ILLUMINATES A ROOM WITH A WARM GLOW.

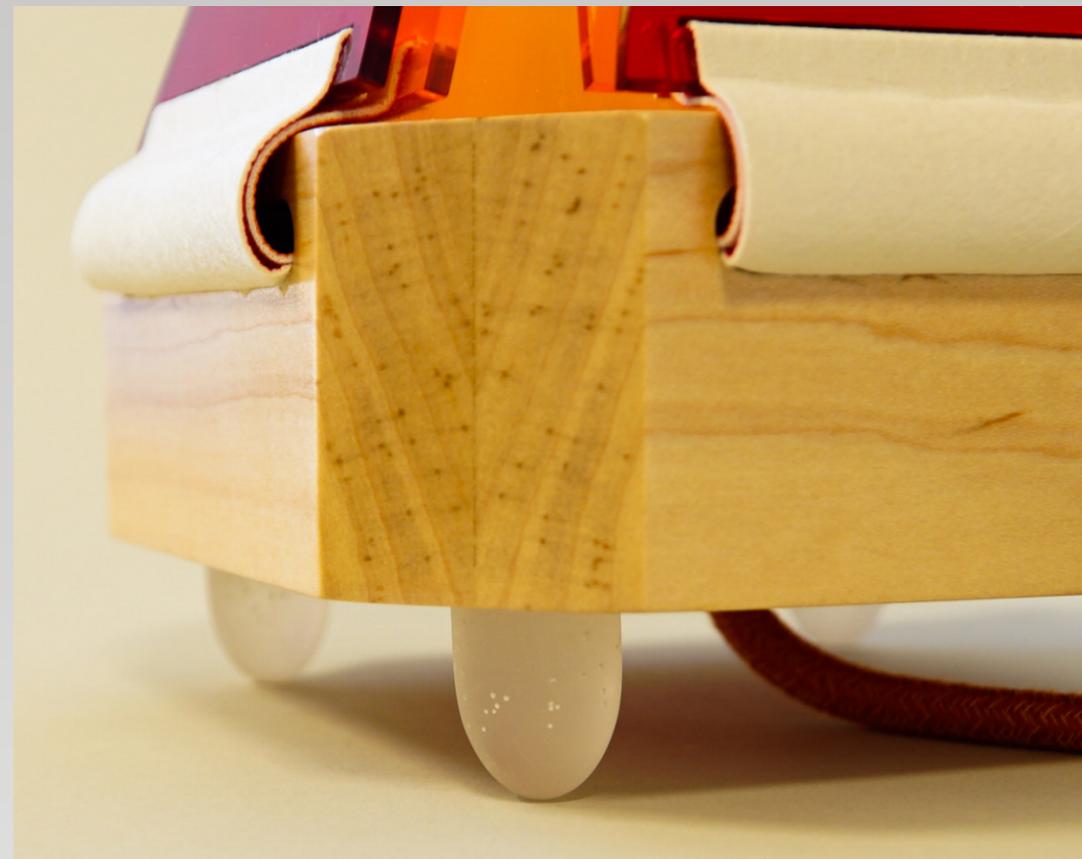
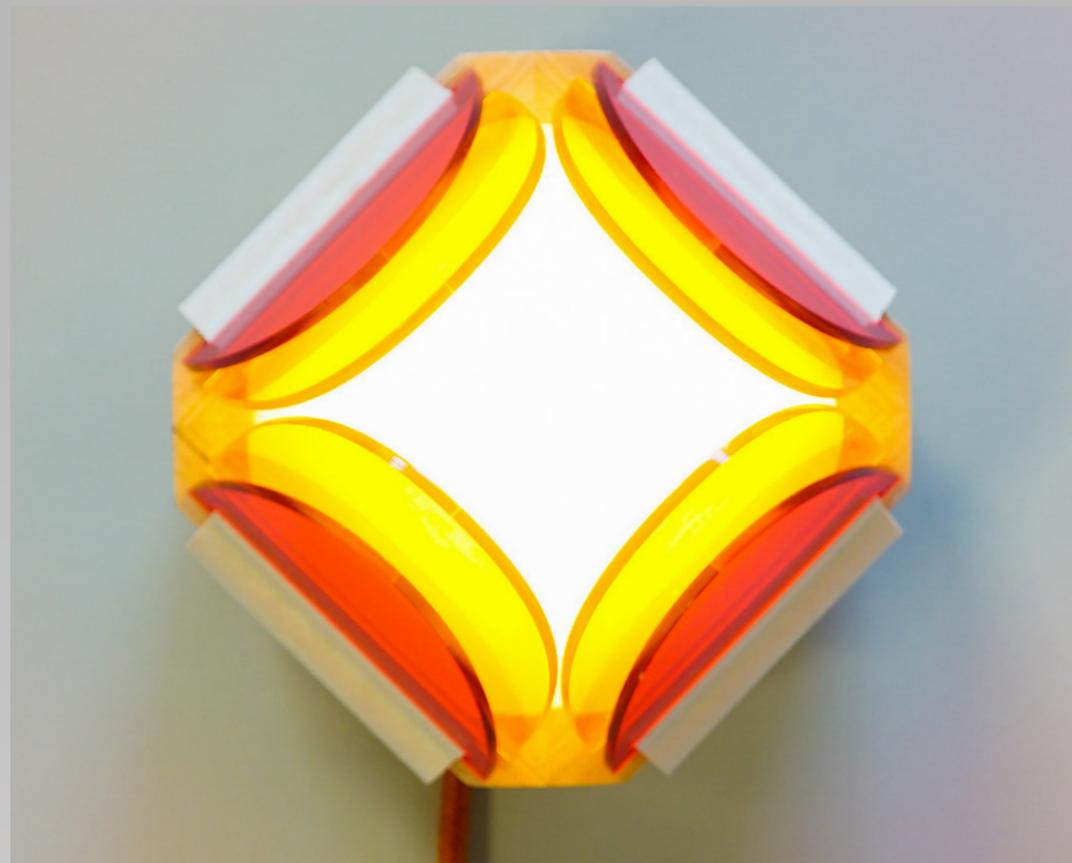
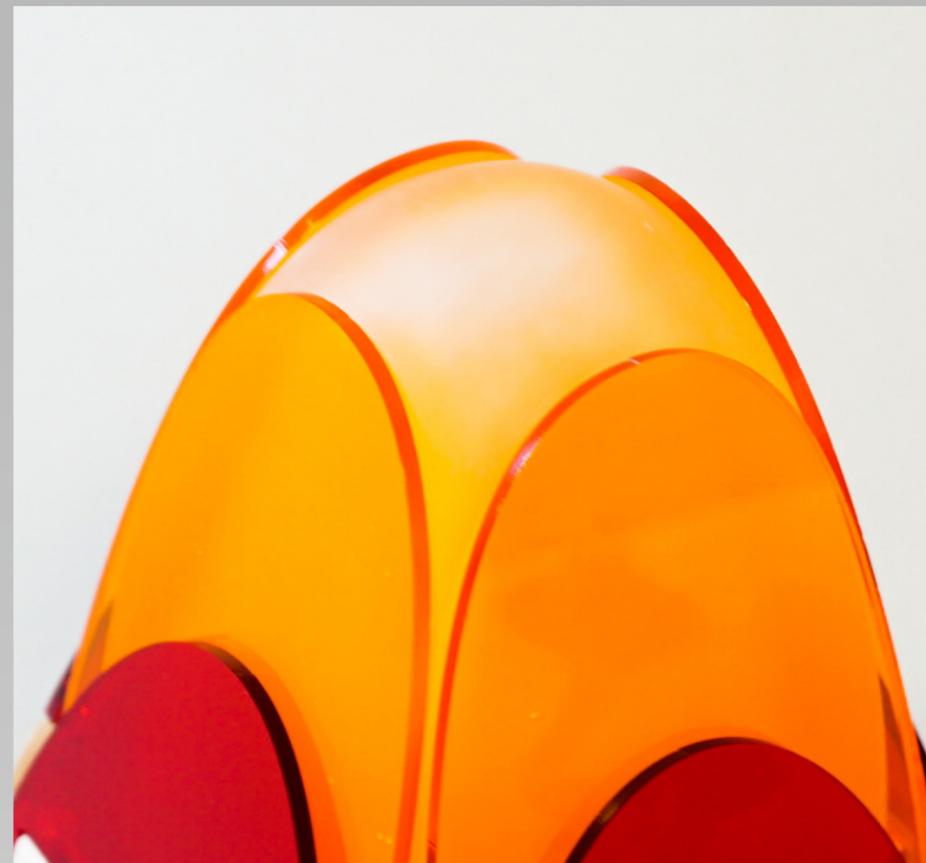


The final prototype features:

- a maple base finished with a semi-gloss lacquer
- a frosted resin “dome” that allows soft light to pass through
- colored acrylic “petals” that open and close over the light to change the light color and amount
- fabric hinges that are fed through slots in the acrylic “petals”
- rounded frosted resin feet that elevate the overall form.

Assessing the strengths, points of improvement, and overall contribution to design.

# CONCLUSION



Through the research, conceptualization, prototyping, and continual refinement of my lighting object, the light evolved from a basic idea: to create an interactive object to light a child's room.

I believe that I achieved the goal of creating a piece that would be well-received by middle-upper class families that value high quality products that can engage their child. The forms that make up the light are soft and organic, without being random or scattered. The repetition of slanted and sloping planes around the outside of the frosted resin dome create movement upward to a point, providing focus. The pieces were carefully machined to create a finished look, and this presents itself in both visual and tactile ways; the resin, acrylic, and maple are all pleasant and inviting to touch. The color scheme is bright and playful, intended for a younger user.

Components of the light, however, should be considered for future refinement and improvement. The resin dome, on an industrial scale, is not a viable option, and a vacuum formed or injection molded part should be considered as an alternative. Similarly, the fabric hinges are not a realistic feature in production, and considering a living hinge option could improve the overall design. Design considerations such as durability should also be investigated in further iterations of this design, as the product must withstand consistent child interaction.

In the context of the current market in which my light would be sold, I think that the design would both fit well with other products and also push the boundaries of children's design through its gender neutral aesthetic and interactive features. Marketed to children of all genders, the product appeals to a large demographic. Functionally, the piece acts as both a static lighting object and an interactive product, aiming to fit the child's needs for many years. As a result, families are met with a product that is more than just aesthetically pleasing - it appeals to their values.

Professor Richard Prisco

- Continual feedback, assistance, and guidance

Professor Joe Palmer

- Guidance on mold making and casting

Poul Henningsen, Artichoke Lamp

- Page 3, Research Image #2

Oki Sato, Thin Black Lines Chair

-Page 3, Research Image #4

Verner Panton, Wire Cone Chair

-Page 3, Research Image #6

Gerrit Rietveld, Steltman Chair

-Page 3, Research Image #8

Zaha Hadid, Galaxy Soho

-Page 3, Research Image #9

Richard Elaver, Joinks (Fat Brain Toys)

-Page 4, Research Image #8

Luca Nichetto and Oki Sato, Kurage

-Page 4, Research Image #10

Huckleberry Kids Rooms: <https://www.huckleberrykidsrooms.com/>

The Natural Baby Company: <https://www.thenaturalbabyco.com/>

# REFERENCES

