

The PIY Set

Paper it Yourself, Place it Yourself



Table of Content

Introduciton: Backgoround, Proposal		1
Research: About Paper, Recycling, User Study		5
Insights: Analysis, Brief		17
Ideation: Sketches, Testing, Final Concept		20
Exploration: Lamp Base, Organizer Units		30
Final Model: Material, Manufacture		45
Reference: Bibliography, List of Illustration		65

Sheridan College
Crafts and Design Program
Capstone Project 2022-2023
Yilan Luo
Advisor: Khalil Jamal

INTRODUCTION

- Project Background
- Designer Intention
- Design Proposal

Background

As our manufacturing technology develop and more materials become available, we are able to make high quality products with lower cost. It's great that we're getting better products, but sustainability problem also arise.

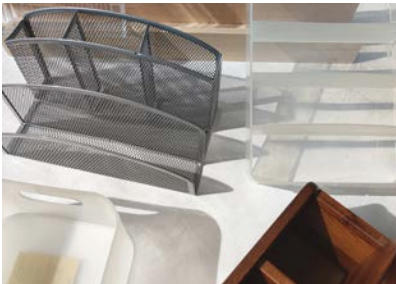
Many of our daily life products are having more functions that require extra manufacturing process and adding more types of material into the process. As the result, repairing and recycling such kind of products are also getting more difficult.

Designer Intention



Material:

As a natural material, paper has lots of environmental friendly properties. These include renewable, recyclable, and biodegradable. However, most of the paper products only focus on the functionality of paper rather than its green features. The designer want to extend the use of paper in more daily life product, making use of its sustainable features.



Product Choice

The objects chosen for this project are table light and desktop organizer. The inspiration comes from the piles of discarded table lights and organizers in the designer's home. Some high-tech table lights are wasted due to lack of repairing methods. Empty organizer sitting there because its function is no longer needed by the user. Another reason for choosing these objects is that they have less user interaction and they require less strength for the material.

Proposal

This project is aiming to create a set of desk top product which include a table light and a table organizer. The final product has to satisfy the following goals:

1. Using paper as the main material and minimizing the number of different material being used.
2. Functional as the original products.
3. Consider the recycling, repairing, and replacing of the product and embrace sustainability into the design practice.

RESEARCH

- Paper
- Properties
- Types of Paper
- Recycling
- Structure
- Innovative Material
- Paper Products
- User Study

Paper

Paper is categorized as natural material because it is made from bonding plant fiber. Most of the paper material we use today is wood base, which means it is made from tree barks. The type of plant used for papermaking is different base on geographic area. Literately, all plant fiber can be used to make paper if it can physically bond into shape.



Properties



Folding

Paper can be easily folded by hand and form a fold line. It tends to return to the flat sheet form if the folded shape is not fixed or holded by something. We can create shape, pattern, and structure by folding a piece of paper. This process is also called "Origami" which means "folding paper" in Japanese.



Light diffusion

When the plant fiber that form the paper is not dense enough, light is able to go through the material. With light coming through the paper, we're able to see the fiber of the handmade paper. And if the paper was folded before, the fold lines are shown clearly under light.

Water dissolvable

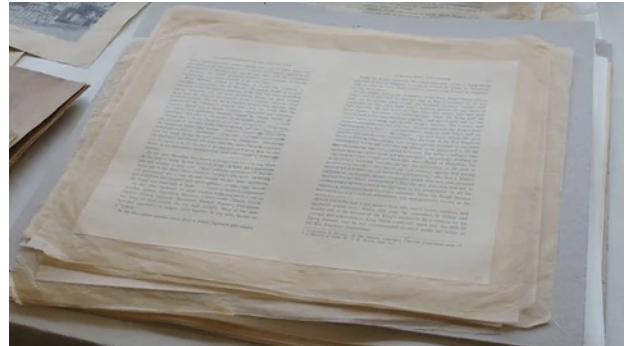
Paper is made by molding wet paper pulp into flat sheet shape and the fiber will tightly hold together after we dry it out. Therefore, paper will become soft and easy to tear in water. If we laminate paper with other material like plastic film, it will become water proof.

Print and write

As our primary writing and printing medium, paper has excellent ink absorbing ability. And the ink can stay on the paper as long as the material life span. This makes paper book a great form for storing information.

Long Life span

If kept in good condition, paper can remain in its form for hundreds of year. The length of the plant fiber is the key. Libraries use washi paper for conservation purpose because washi uses mulberry as the base material which has very long fiber.



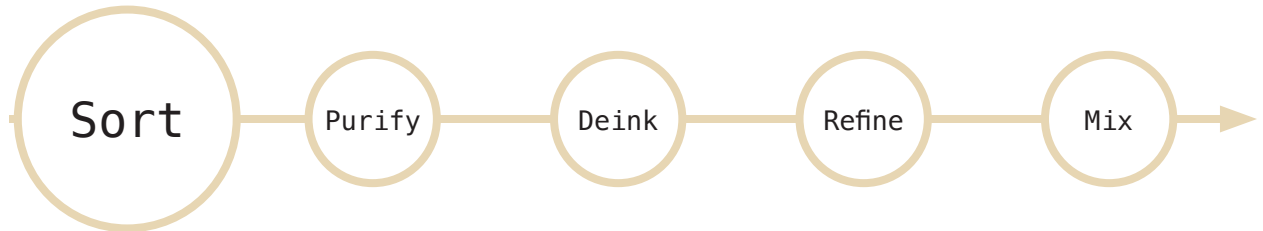
Types of Paper

There are various types of paper material which are categorized base on different manufacturing methods, area, type of plant fiber, paper pulp composition, etc. Most of the writing paper we use today is wood base paper made from tree barks. Cardstock and packaging box has a natural brown color because it contains lots of recycled paper. Washi paper is made in Japan specifically using the local mulberry plant. Plastic and resin is laminated with paper in order to form a stronger paper material.



Recycling Process

Firts step of paper recycling is sorting, separating paper from other recycled material. Also, writing paper and cardstock paper are two different category when sorting out paper waste.



The problem

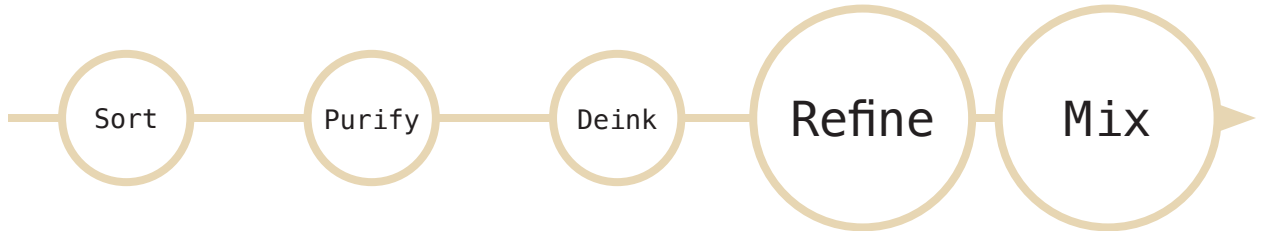
Paper is no longer recyclable if it is mixed with other material. For example coffee cup, a plastic film is laminated to the paper cup in order to make it water proof. It is hard to separate the plastic film, so coffee cup is non-recyclable. Other similar products are wax paper, gift wrap with glitter, paper composite that is bonded by resin.





Some typical items that can be removed during the purifying process are tape, glue, stickers, and staples. They're hard to take them off, but once we wet the paper and blend it into paper pulp, we can filter them out easily. Some paper waste may contain adhesive, but most of them are water soluble which can dissolve into water during this wet process.

The deinking process uses chemicals to remove ink from paper. The natural color of recycled paper is brown or grey, so in order to use recycled paper as writing/printing paper, we need to whiten it. Even the virgin paper pulp needs to go over the bleaching process to whiten the material.



Paper pulp need to be refined in order to make high quality paper with smooth surface. Handmade paper without the machine to fine screen and blend the pulp will have uneven surface.

Mixing recycled paper pulp with virgin paper pulp can also help increase the final quality of the paper. The plant fiber is getting shorter and shorter everytime it goes over the recycling process. If the plant fiber is too short, it cannot bond together when dried. Therefore, we need to add virgin pulp to make sure the fiber is strong enough to bond together.

Making Structure



Molding: Wet paper pulp can form 3D shapes using mold and the object will stay in its shape after the paper pulp is dried.

Support Structure: The traditional lantern uses wood or bamboo pieces to support the whole structure. Paper is glued onto the surface of the structure.

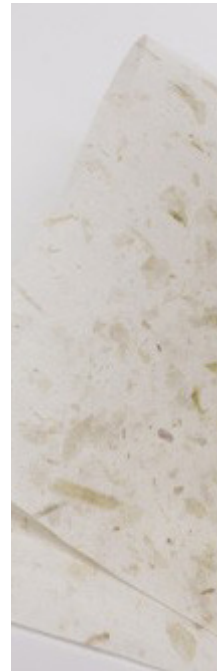
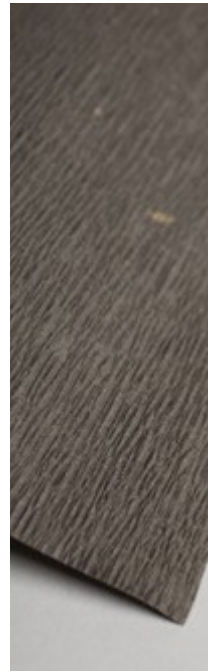
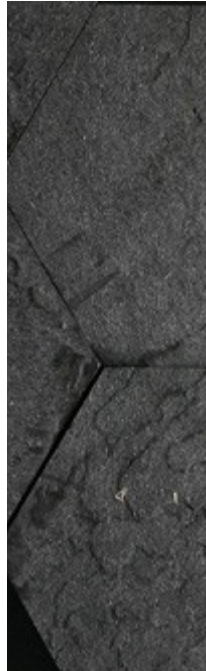
Folding: This method form shapes and structure using paper. And paper is one of the easiest material to fold.

Grouping: By laminating multiple layers of paper, the material can become hard and strong. Also, paper can hold heavy items with its thin side if we spread the weight to multiple pieces.

Innovative Material

There are several types of paper material from the Material ConneXion that might fit the purpose of this project. MC# 7128-01 Paper-Based Composite Tile is a very strong material that can support structure such as table top and ceiling. It is made with post industrial waste that would normally go into landfill. This tile is durable and light-weighted.

MC# 6918-02 Seaweed Paper and MC# 6776-01 Plum-Seed Charcoal Paper are made with plant materials that are by-products from the food industry. The Plum-Seed Paper has a very nice texture and its color comes from the natural color of plum seed. The Seaweed Paper contains seaweed pieces which gives the paper an interesting surface pattern. These two types of paper can be mixed with recycled pulp.



Paper Products



User Study



INSIGHTS

- Analysis
- Project Brief

Analysis

Material

Avoid using paper composite and non-recyclable paper material so that the final product can be recycled as a whole or partially. Also, ink and color will add more steps to the manufacturing and recycling process, the material should not be too colorful. In terms of adhesive, it should be removed easily from the paper, so water soluble or natural adhesive is the best choice.

Structure

Normal paper is too soft to support a structure, so maybe cardstock is more suitable as the material for the base structure. Adding wood or bamboo structure can also help supporting the shape of the product. The honeycomb shape is a very strong structure that worth for further exploration.

Recycle problem

The product should be easily disassembled so that the user can replace the pieces without disposing the whole thing. If the product need to use material other than paper, it should be able to separate from the paper material easily.

Aesthetic

Color and material is limited for this project, but still we can achieve an aesthetic look through other methods. Folding can create many patterns and shapes with paper only. It is worth to explore more folding pattern later in the exploration phase.

Project Brief

Designing a table light and a table organizer with paper that is not only functional but also easy to recycle and repair.

Sustainability is at the core of this project. There are several direction that can be explored during this project:

1. Minimizing the number of material use in the product
2. Reducing waste during the manufacturing process
3. Consider the customization and repairing of the product
4. Easing the recycling process at the end of product life
5. Sustainable packaging

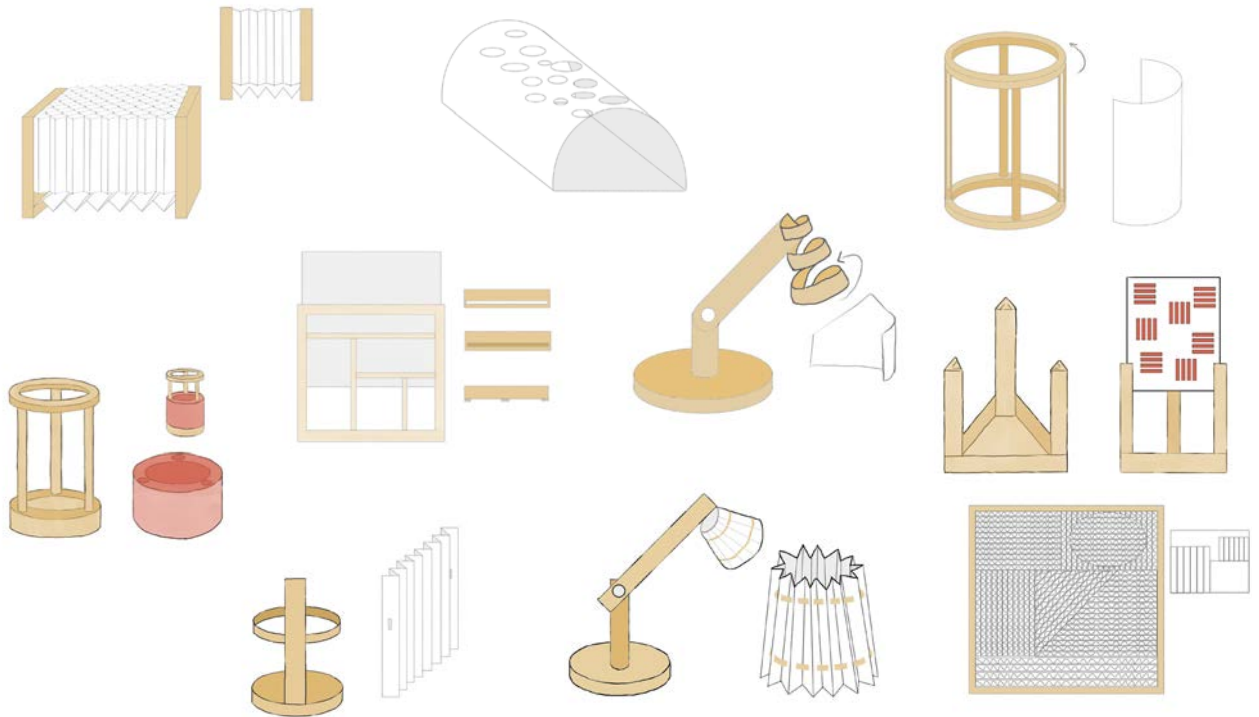
IDEATION

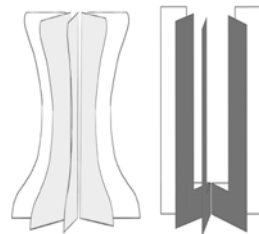
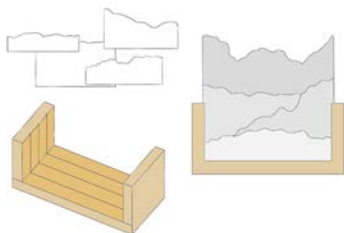
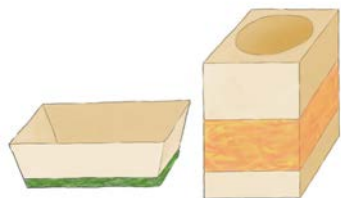
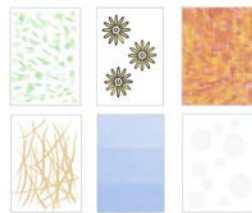
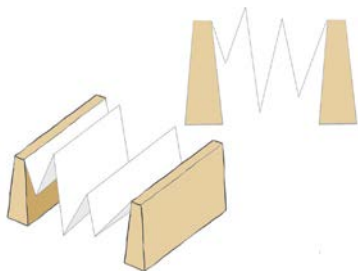
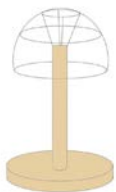
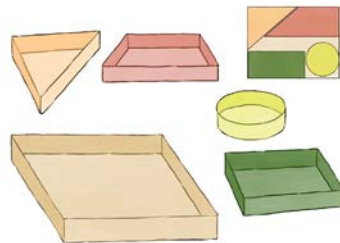
- Moodboard
- Sketches
- Storyboard
- Testing
- Final Concept

Moodboard

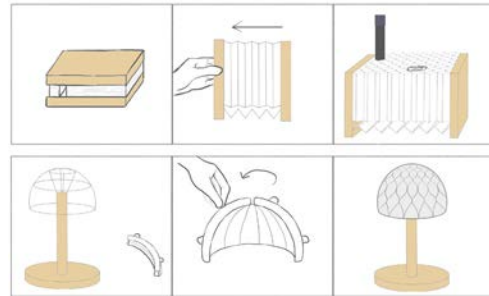
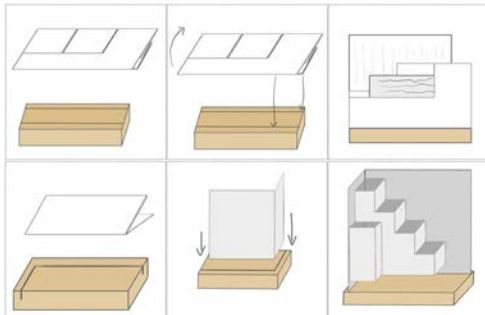
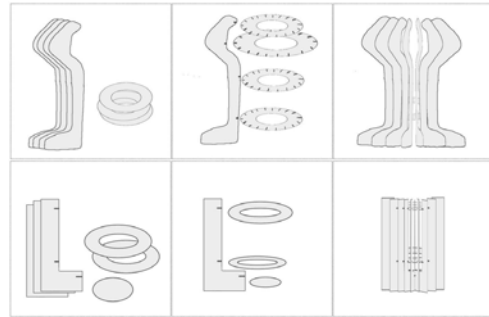
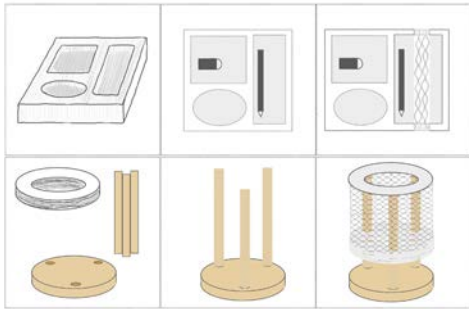


Sketches

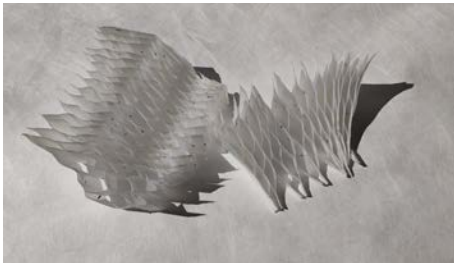




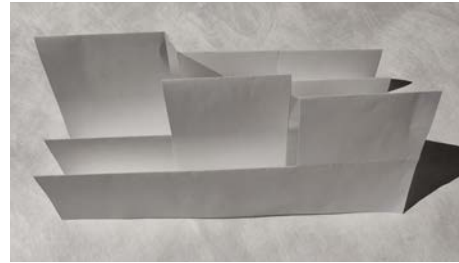
Storyboard



Testing



Honeycomb structure



Popup folding





Paper making



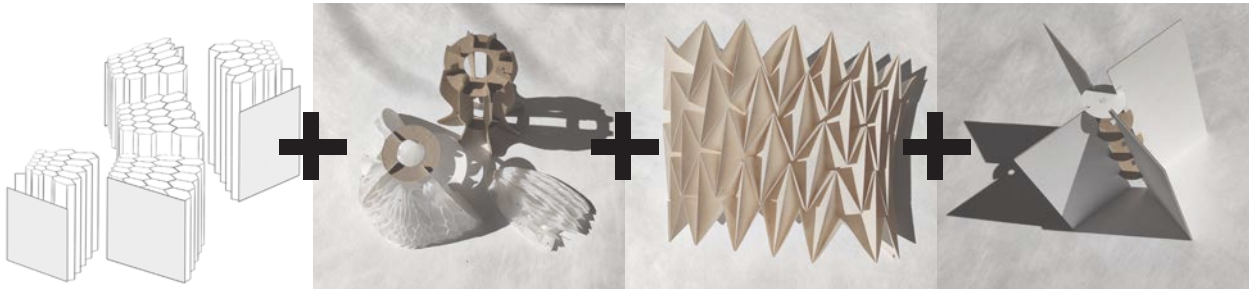
Folding pattern

The Sliding Model





Final Concept



For the final concept, the sliding methods seems to be strong enough to support the function. With a thicker material like cardstock, the material will not bent easily. Sliding into slots and fixing the pieces around a centered circle piece will be the main methods creating the structure. The folding pattern that can be opened up and closed is very suitable for the lamp shade. It doesn't require strength, and at the same time create an aesthetic look for the light. Although the honeycomb shape is very strong, it requires soft paper that can be folded, so it is not suitable for making the base structure. Its holes on the other side, can function as a penholder piece within the organizer.

EXPLORATION

- Base Material
- Lamp Base
- Lamp Shade
- Organizer Base
- Organizer Units

Base Material



Cardstock

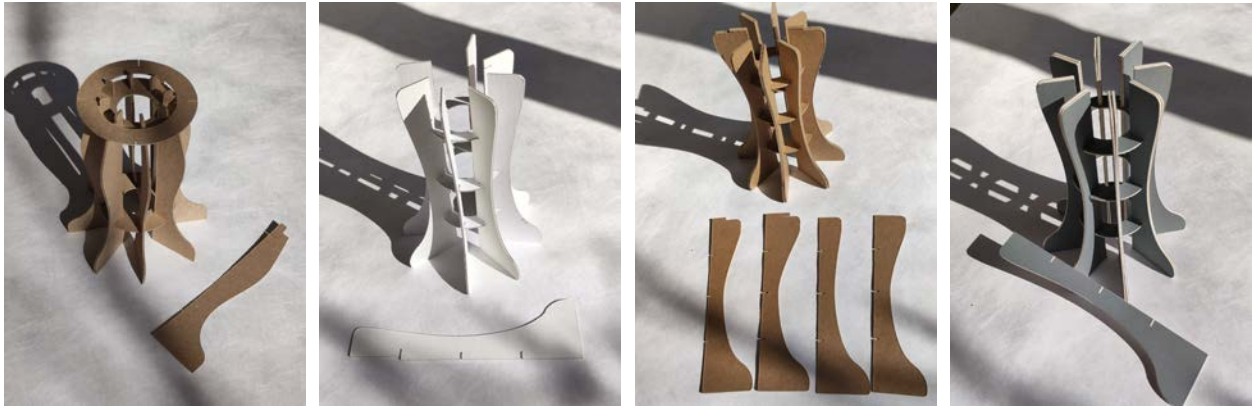
Matboard

Paper

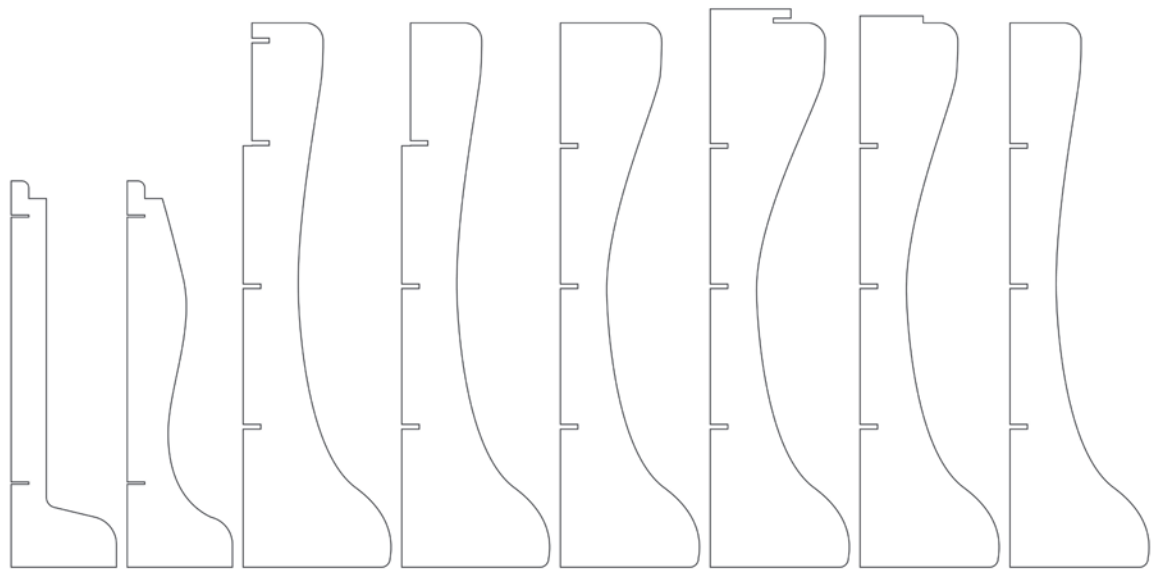
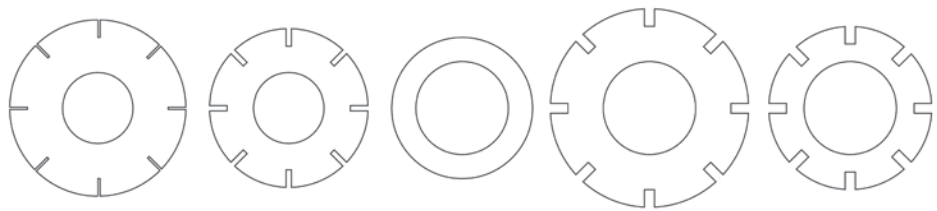
Light Socket

Testing the strength of cardstock in different thickness, finding the best type of cardstock for the final product. The folding part for the final product will be using washi paper, but it is unrealistic to use washi paper for testing and modeling. Normal paper can be a substitute for washi paper during the exploration process.

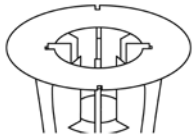
The Lamp Base



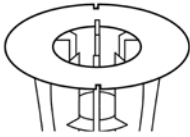
The early models have several problems: the leg is easy to bend, and the top part is too small for the lamp shade to sit on. In later models, the bending problem is solved by adding more circle pieces in the middle and using 2 pieces in one leg. The curve is added for easy holding, and the top part of the leg is tested for different connection with the lamp shade. The circle in the middle is also adjected several times to fit the light socket.



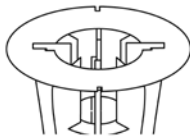
The Connection



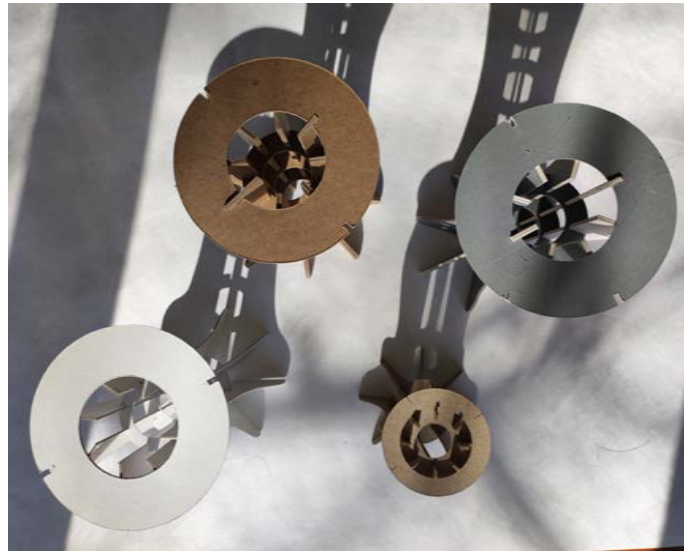
Fixed position



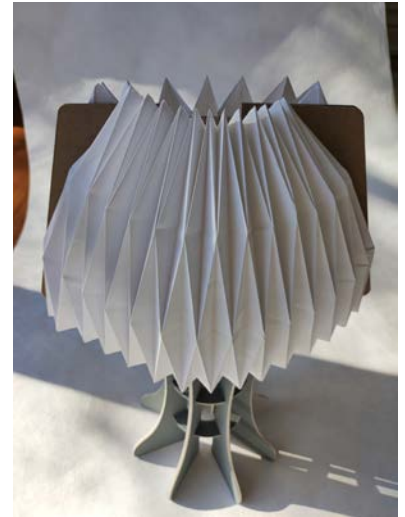
Sitting on top



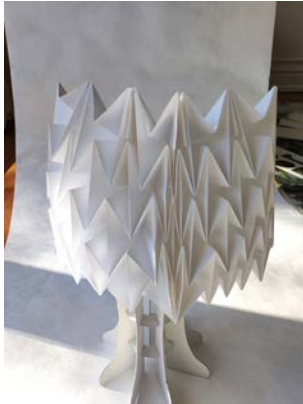
Sliding in slot

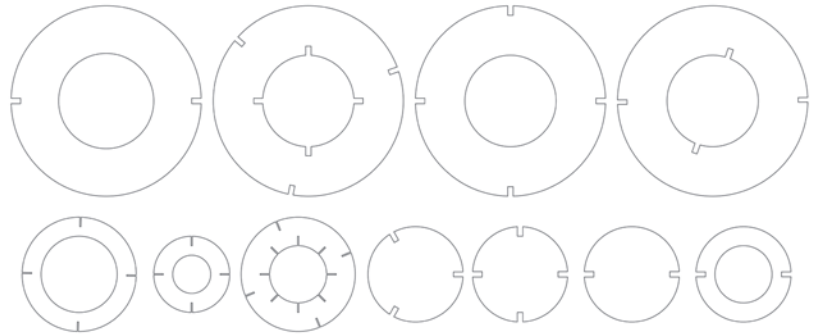
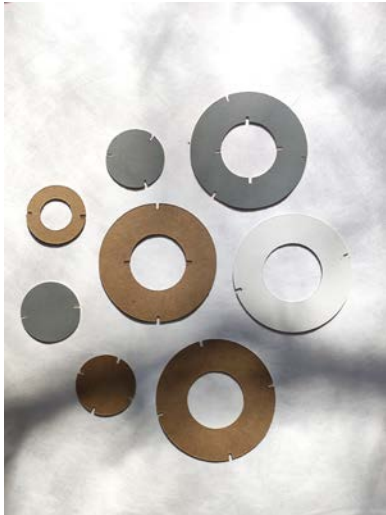


The Lamp Shade

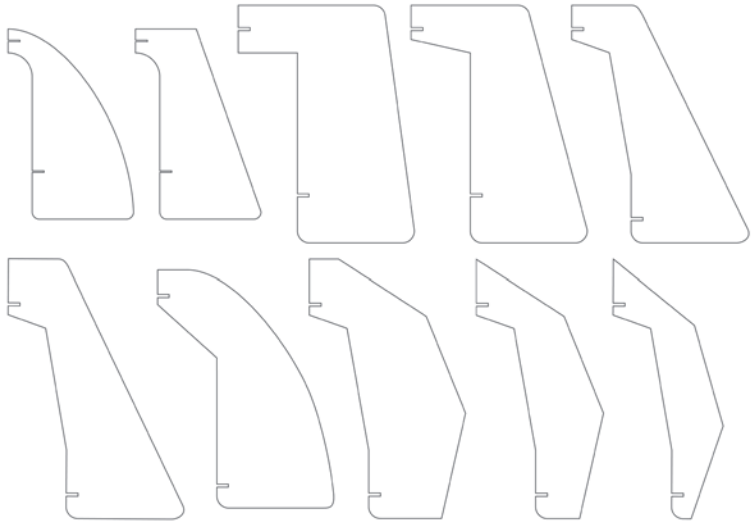
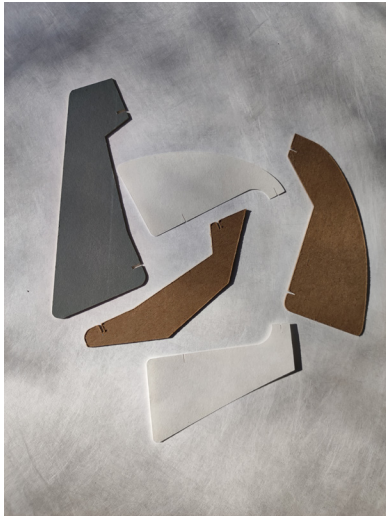


This is one of the folding pattern for the lamp shade. I didn't move forward with this one because of time constrain. The most successful test model indicates that the lamp shade is too small for this base, but the base cannot support any larger shades made with this pattern. It will either distort the lamp shape, or the lamp shade will become very unstable on the base.



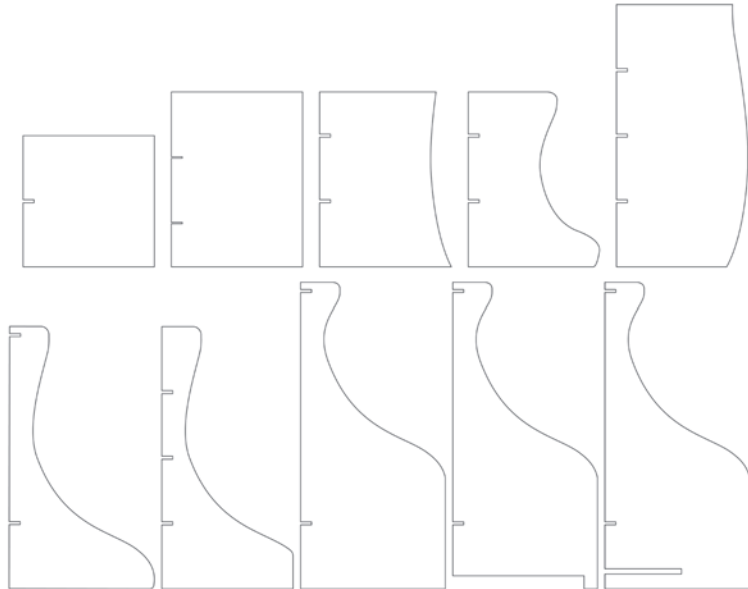


The center circle pieces are important for making the cone shape of the light. The top circle is smaller the bottom circle in order to create that tilted angle on the lamp shade. The circle need to be placed closer to the top and bottom of the folding pattern so that they won't block the light from the light bulb.

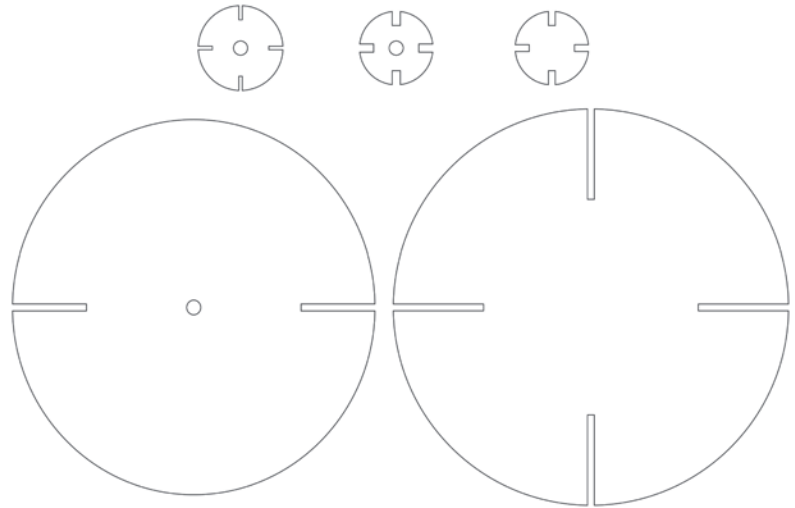


This piece is tested in various shape. It need to fit onto the folding pattern exactly not only for structuring purpose, but also to hide the structure into the folding part.

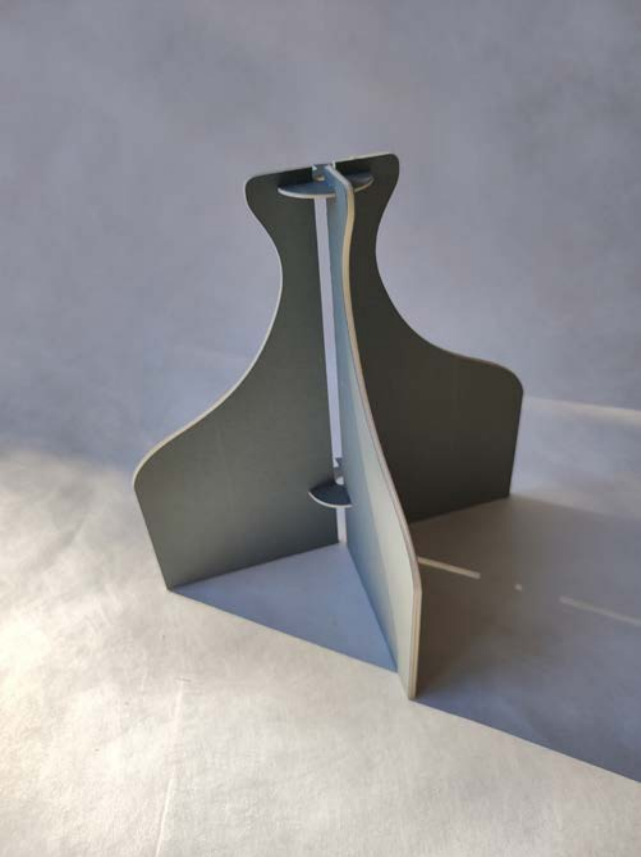
Organizer Base



These different shapes for the organizer are attempts to build connection between the two objects. The top row explored shapes that are negative to the legs of the light and the bottom row tried to transform the shape of the leg to make it fit with the organizer.

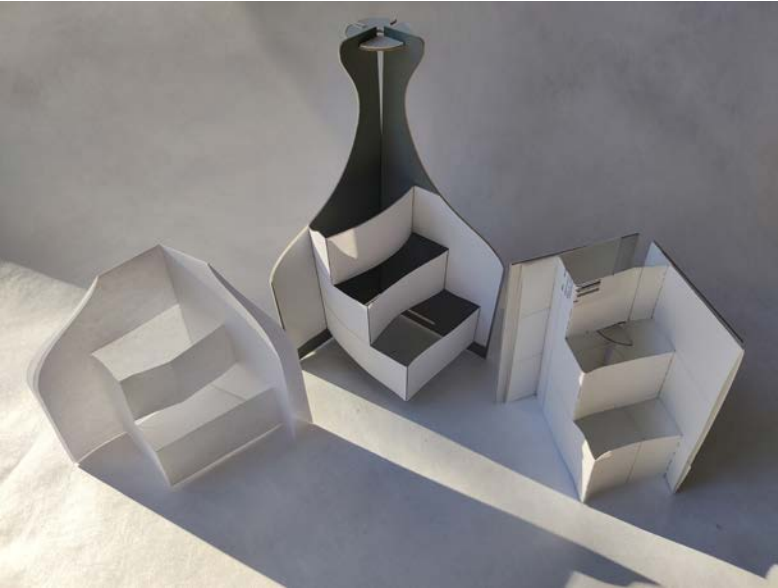


This exploration is aiming to add a bottom piece that hold the articles, so that when the user can pick up the organizer and move the whole thing by just holding the top part. Above are different methods of attaching the base circle, from sliding to adding wood stick in the center.



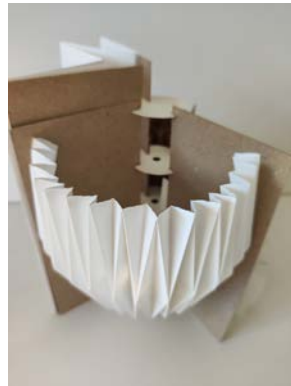
Individual Units





The Popup Unit
and
The Honeycomb Unit





FINAL MODEL

- Final Model
- Dimension
- Assembly Instruction
- Material Choice
- Manufacturing Method
- Packaging
- Self Reflection

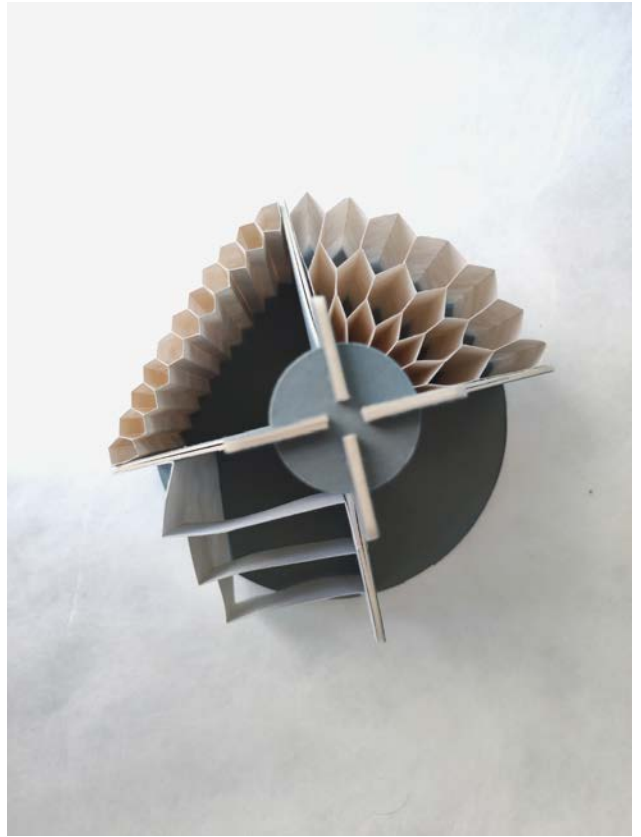


Final Model









Dimension

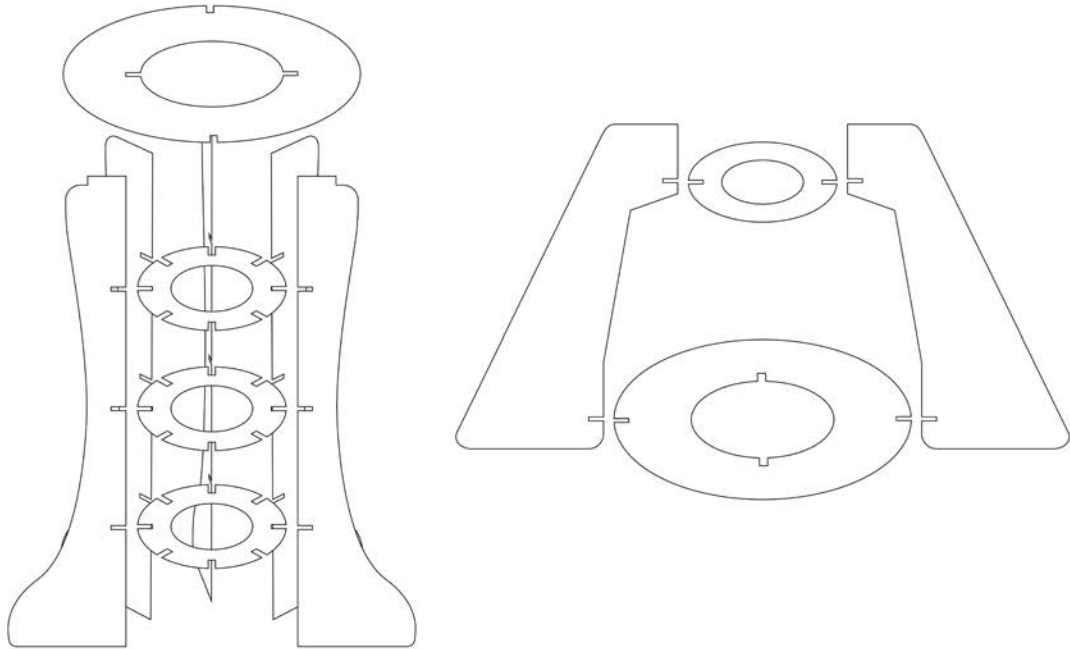


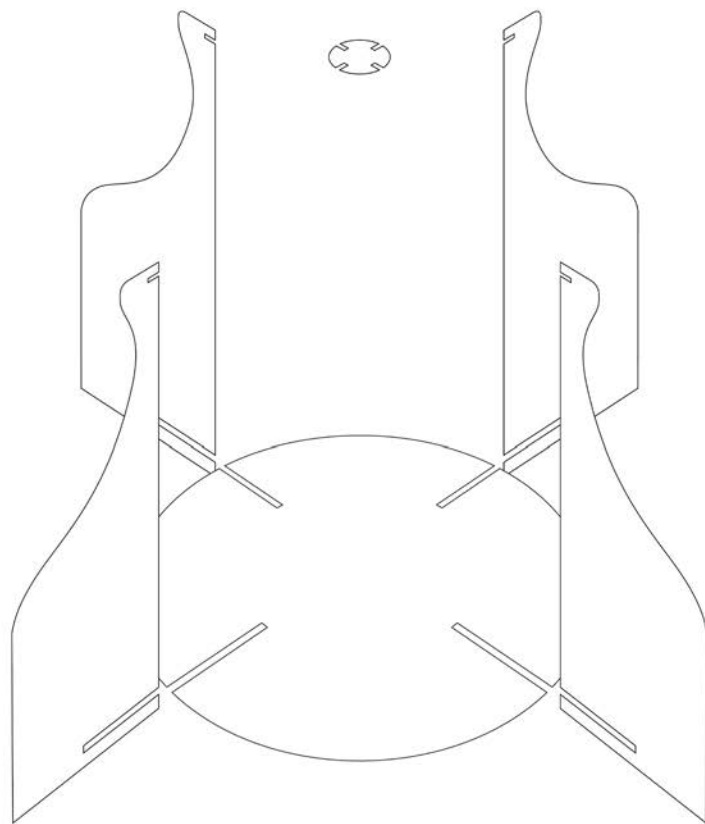
Light
Height: 14"
Width: 9"



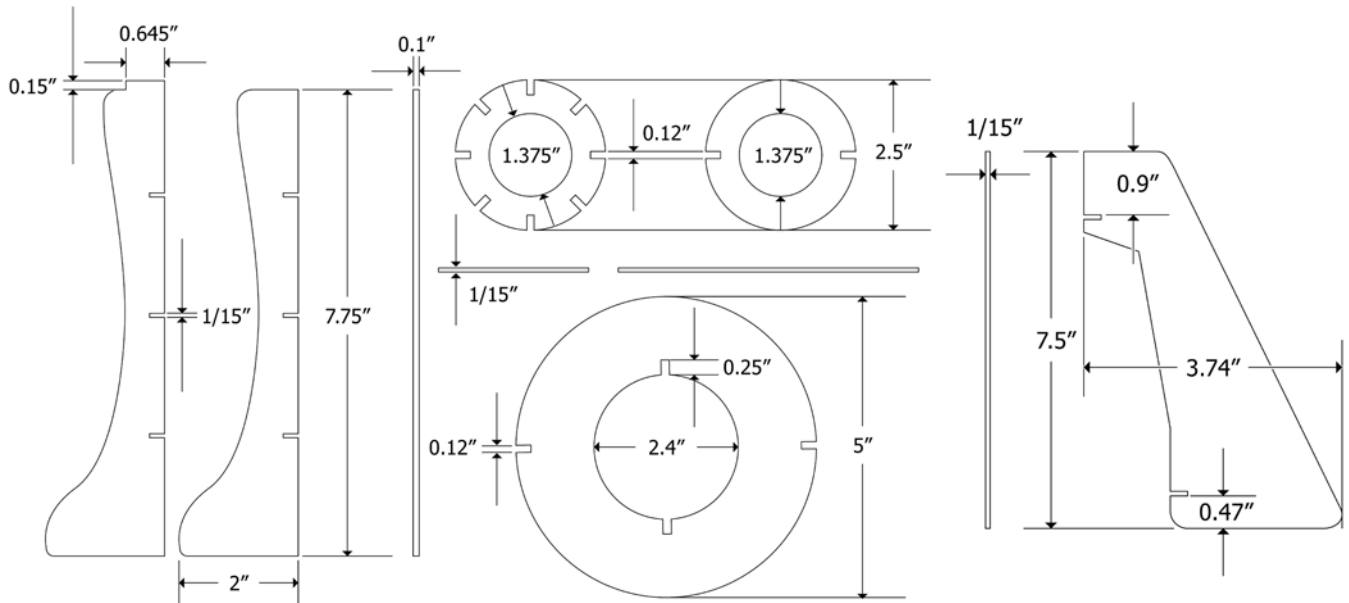
Organizer
Height: 7.5"
Width: 7"

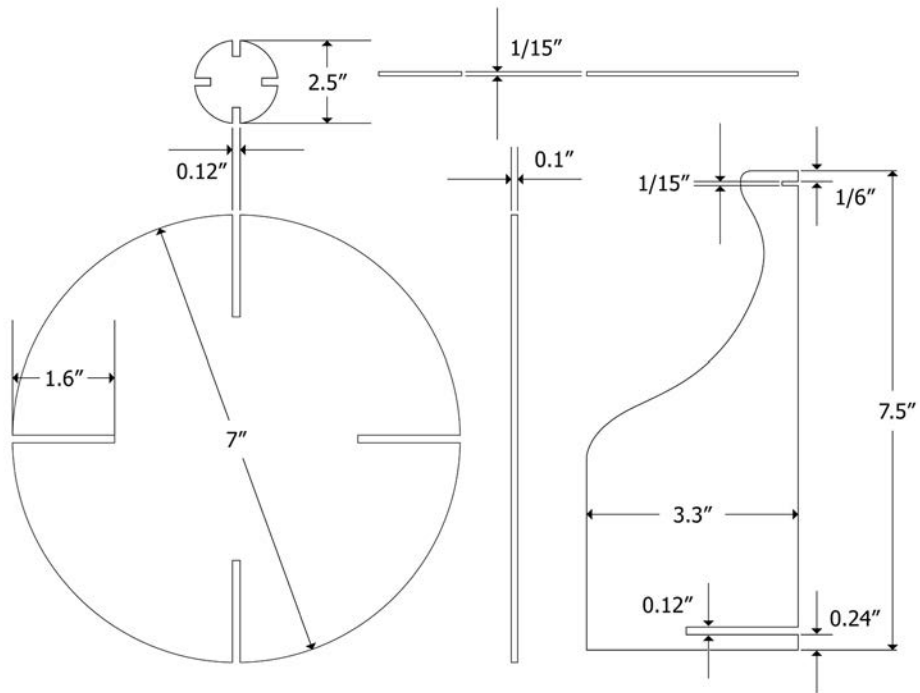
Exploded View



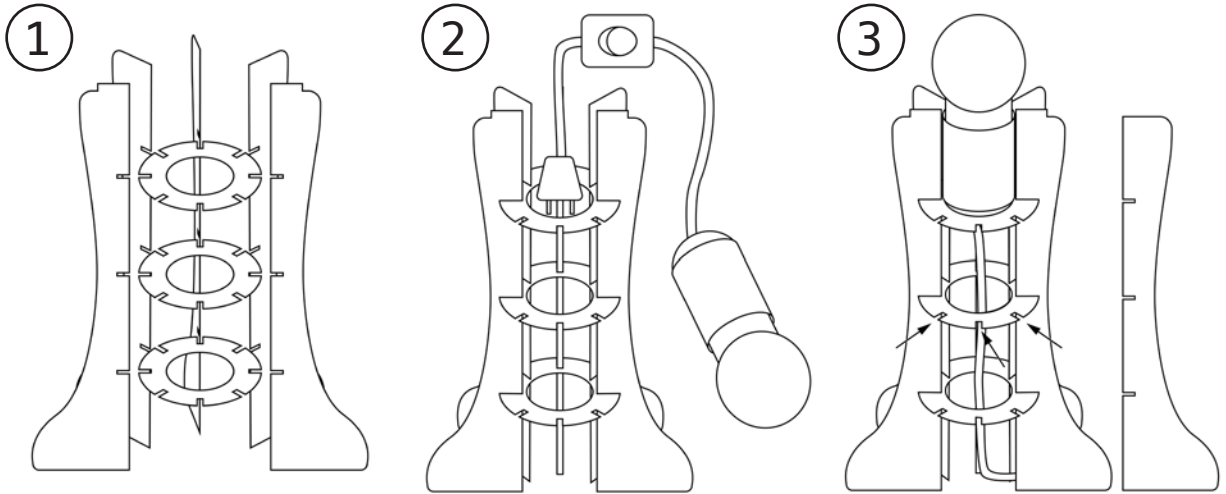


Individual Pieces

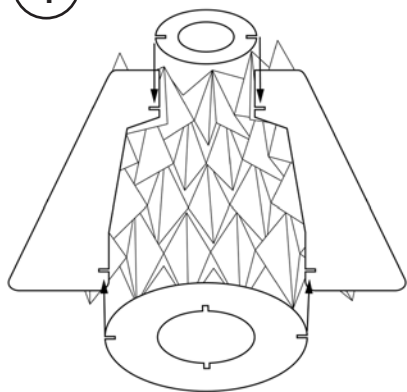




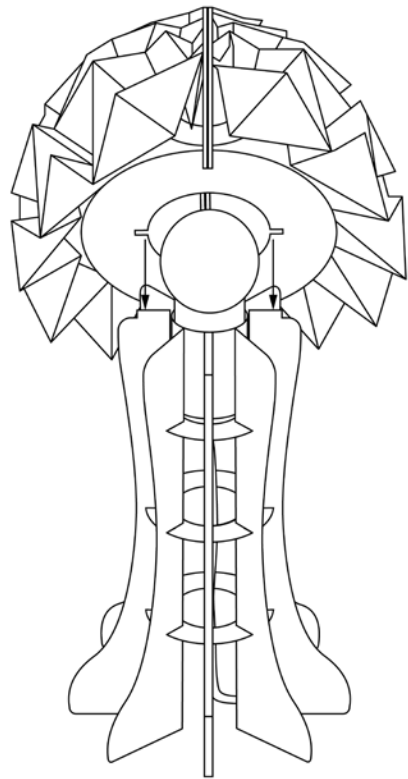
Assembly Instruction

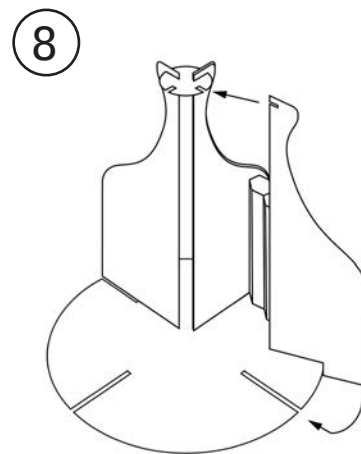
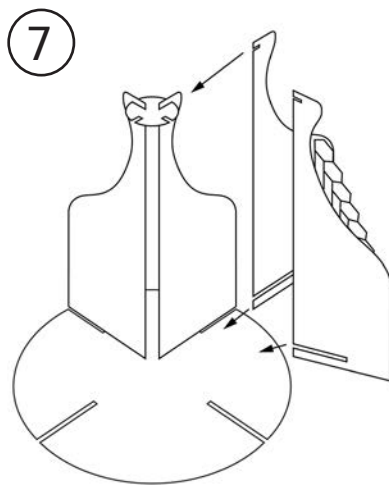
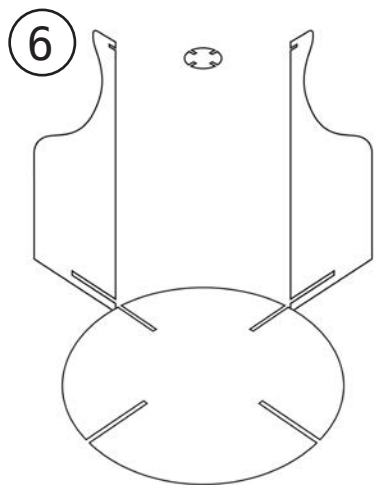


4



5





Material Choice



Matboard

Matboard is used in photo framing which is made to last. It is laminated paper with a layer of colored paper on top, so the whole thing is recyclable as paper.



Washi Paper

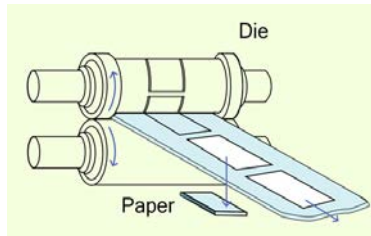
Washi paper is famous for its strength and long life span. Uwa Senka is the type of washi paper used in this project. It is hand made with a natural brownish color.



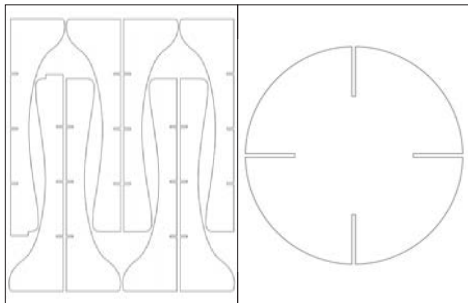
Adhesive

This project is planning to use natural adhesive that are water soluble. In Japan, wheat starch glue (Jinshofu) and konyac powder are the traditional adhesive for washi paper.

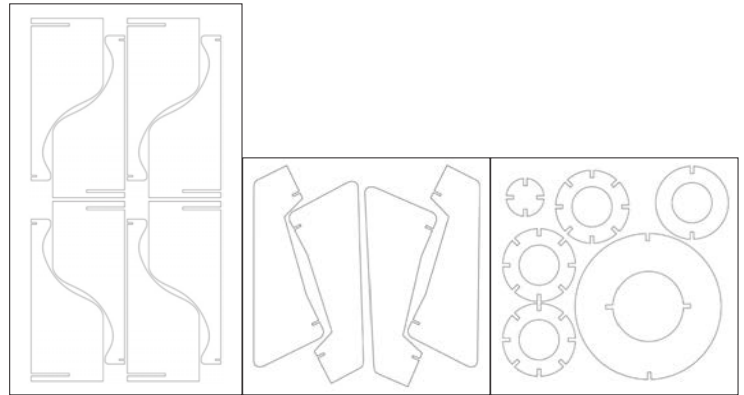
Manufacturing: Die Cut



The shape of the pieces are not very complex and most of them are repeated. Die cut would be a good choice for manufacturing the pieces. There are 2 different thickness in this model, the legs of the light and the base circle of the organizer is thicker than other pieces. The die pattern below can make 1 set.

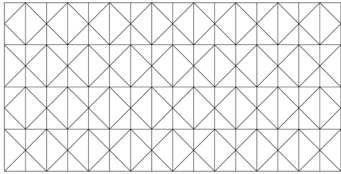


About 1/8" thick

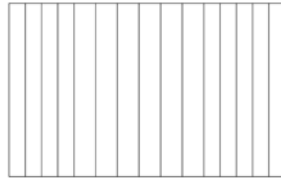


About 1/16" thick

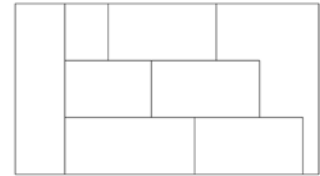
Manufacturing: Folding



Lamp shade: 11" x 22" x 2pcs



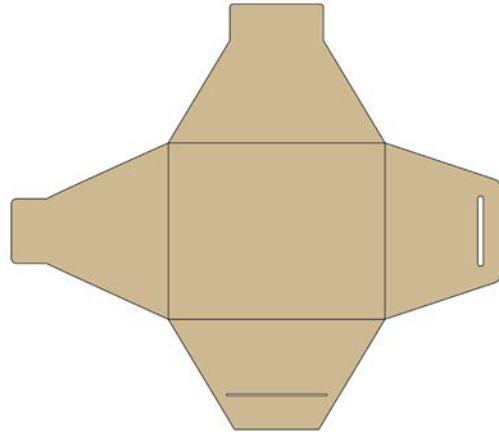
Honeycomb: 6.4" x 4" x 7pcs



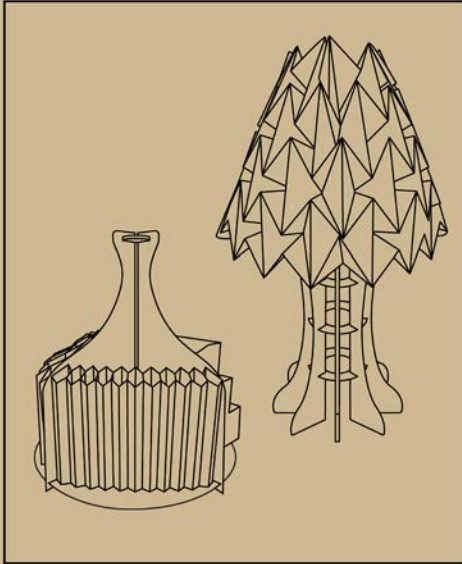
Popup: 7" x 4" x 1pc



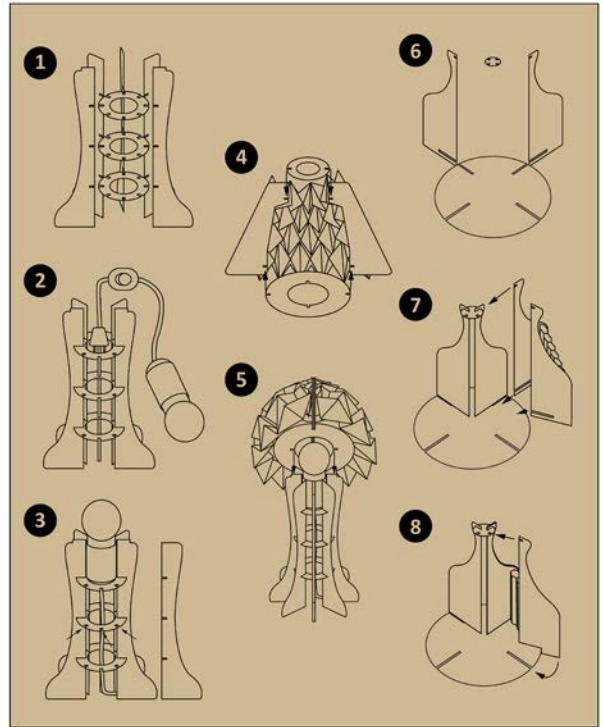
Packaging



Product Name



Front Graphics



Inside Graphics

Self Reflection

The current model isn't the final solution for this project, there's still room for improvement. One thing I want to further address is the user interaction. The self assembling process is not user-friendly enough, I still need to assemble it with carefulness and try not to rip it.

With more and more exploration of the model, I think there's lots of potential for this sliding structure and folding combination. This circular sliding-in structure can have various shapes and design, and the folding part attached to it can also create different functions and patterns.

Paper is an interesting material to work with. I can spend a whole day playing with one folding pattern, trying out different folding variations of the pattern. There's a lot more that I want to explore, but wasn't able to due to the time restriction of the project. In the future, I might also try to use paper to construct other daily life objects and make a full room of products that are only made with paper material.

Bibliography

Asunción J. (2004). The Complete Book of Papermaking. Lark Books.

Bajpai, P. (2014). Recycling and Deinking of Recovered Paper. Elsevier.

Commentz, S., Klanten, R., Ehmann, S., & Meyer, B. (2009). Papercraft: Design and art with paper. Gestalten.

Commentz, S., Klanten, R., Haeusler, S., & Meyer, B. (2011). Papercraft2: Design and art with paper. Gestalten.

Heller, J. (1997). Papermaking. Watson-Guption.

Worrell, E., & Reuter, M. A. (2014). Handbook of Recycling: State-of-the-art for Practitioners, Analysts, and Scientists. Elsevier.

Lucas, D. (2011). Green Design. Braun Publ.

List of Illustration

- Pg 6 | from Awagami website <https://awagami.com/>
- Pg 7 top | from Matthew Shlian <https://www.duranmashaalgallery.com/matthew-shlian>
- Pg 8 left | from Kozo Studio <https://kozo.studio/en-ca/blogs/journal/preserving-old-books-a-guide-to-paper-conservation-with-kozo-paper>
- Pg 8 right | from <https://orientalsouls.com/blog/traditional-crafts/etchu-washi-japanese-paper-that-lasts-a-millennium/>
- Pg 9 first from right | from <https://global-recycling.info/archives/1409>
- Pg 10 | from BBC <https://www.bbc.com/news/uk-northern-ireland-62812329>
- Pg 11 both | from <https://vipagroup.com/node/50>
- Pg 12 left | from <https://paper-pulper.com/what-is-wood-pulp/>
- Pg 13 top left | from Stephanie Angela <https://www.stephanieangela.com/new-index>
- Pg 13 top right | from Isamu Noguchi <https://shop.noguchi.org/products/akari-45x>
- Pg 13 bottom left | from CAN-V5 <https://www.creativeapplications.net/vvvv/folding-patterns-simulating-folded-paper-structures/>
- Pg 13 bottom right | from Paper Lounge <https://www.paperlounge.co.uk/products/foldable-paper-bench-recycled>
- Pg 14 all three images | From Material ConneXion
- Pg 15 top left | from Remodelista <https://www.remodelista.com/posts/origami-lights-from-holland/>
- Pg 15 top center | from Slate-ish <https://www.slate-ish.com/sand>
- Pg 15 top right | from KingKong Design <https://www.kingkongdesign.com/newshop/3box-set-white-brown-black-desk-organizers>
- Pg 15 bottom left | from Hidaka Washi <https://www.hidakawashi.com/>
- Pg 15 bottom center | from Nendo Design <https://www.nendo.jp/en/works/bi-color-washi-2/>

Pg 15 bottom right | from Molo Design <https://molodesign.com/collections/furniture/softseating-folding-paper-stool-bench-paper-furniture/>

Pg 21 top left 2 images | from book: Papercraft (see bibliography)

Pg 21 top first from right | from Molo Design <https://molodesign.com/collections/space-partitions/paper-softblock-modular-room-dividers/>

Pg 21 top second from right | from Pinterest <https://br.pinterest.com/pin/905575437546497571/>

Pg 21 bottom left 2 images | from book: Papercraft2 (see bibliography)

Pg 21 bottom second from right | from Pinterest <https://www.pinterest.es/pin/405886985182527830/>

Pg 21 bottom first from right | from Milk Design https://design-milk.com/chitaly-furniture-family-by-stefano-pugliese/?media_id=104624

Pg 59 first from right | from Japanese Paper Place <https://www.japanesepaperplace.com/adhesive-jin-shofu-100g/>

*Images not specified are taken by the author

