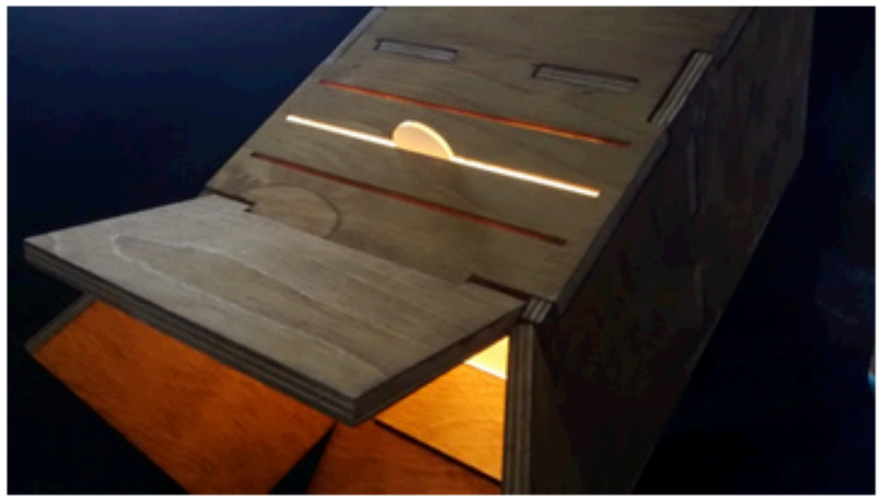
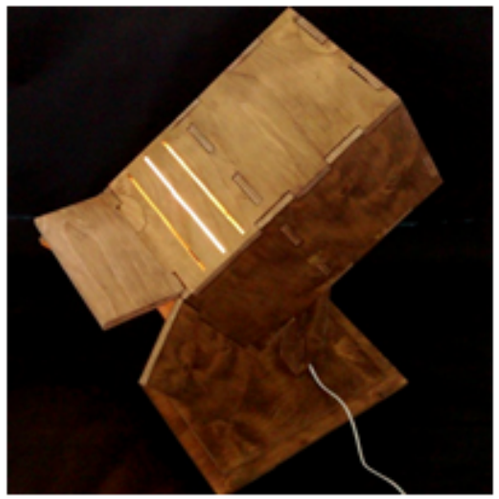
Final Project GCSE Self-assembly Products

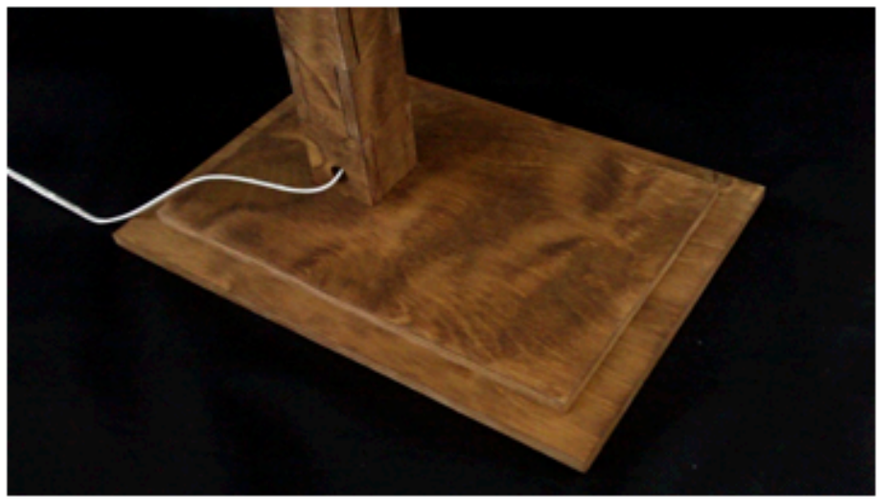




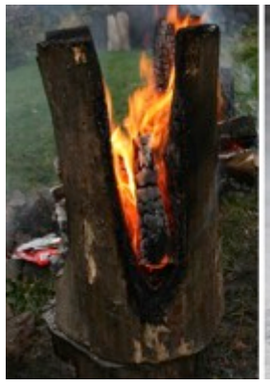
Joseph Sauer

Centre Number – 14737

Candidate Number – 1474



Final Project GCSE
Self-assembly Products



Context: Self-assembly Products
Products which are designed for self-assembly are popular for many reasons and help to keep costs as low as possible. An international furniture warehouse chain is constantly on the look-out for fresh ideas for their furniture and lighting sections. They are particularly interested in modular designs which allow the customer to assemble the products in a variety of ways.

Design Task 12
The furniture chain has provided a list of possible products (shown below) that they would be particularly interested in, although you may have ideas of your own. Design and make one of these products. The product will need to be manufactured in full-scale, packaged, and assembly instructions which do not rely upon text, will be required. The use of commercial knock-down fittings and/or standard components might be a key feature of the product. Accuracy will be a vital requirement and manufacturing aids such as drilling jigs or the use of CAM should be regarded as essential. Photographic evidence of the product, both assembled and flat-packed, should be provided.

Low voltage lighting products:	Furniture:
Table lamp	Low cost seating
Wall lamp	Occasional table
Floor lamp	Storage
Lamp shade	Display unit

Joseph Sauer
Centre Number – 14737
Candidate Number – 1474

Contents

Situation Brief

My client has recently complained about the lamp in his living room. His old lamp was an out dated basic lamp that did not fit the design and scheme of the room.

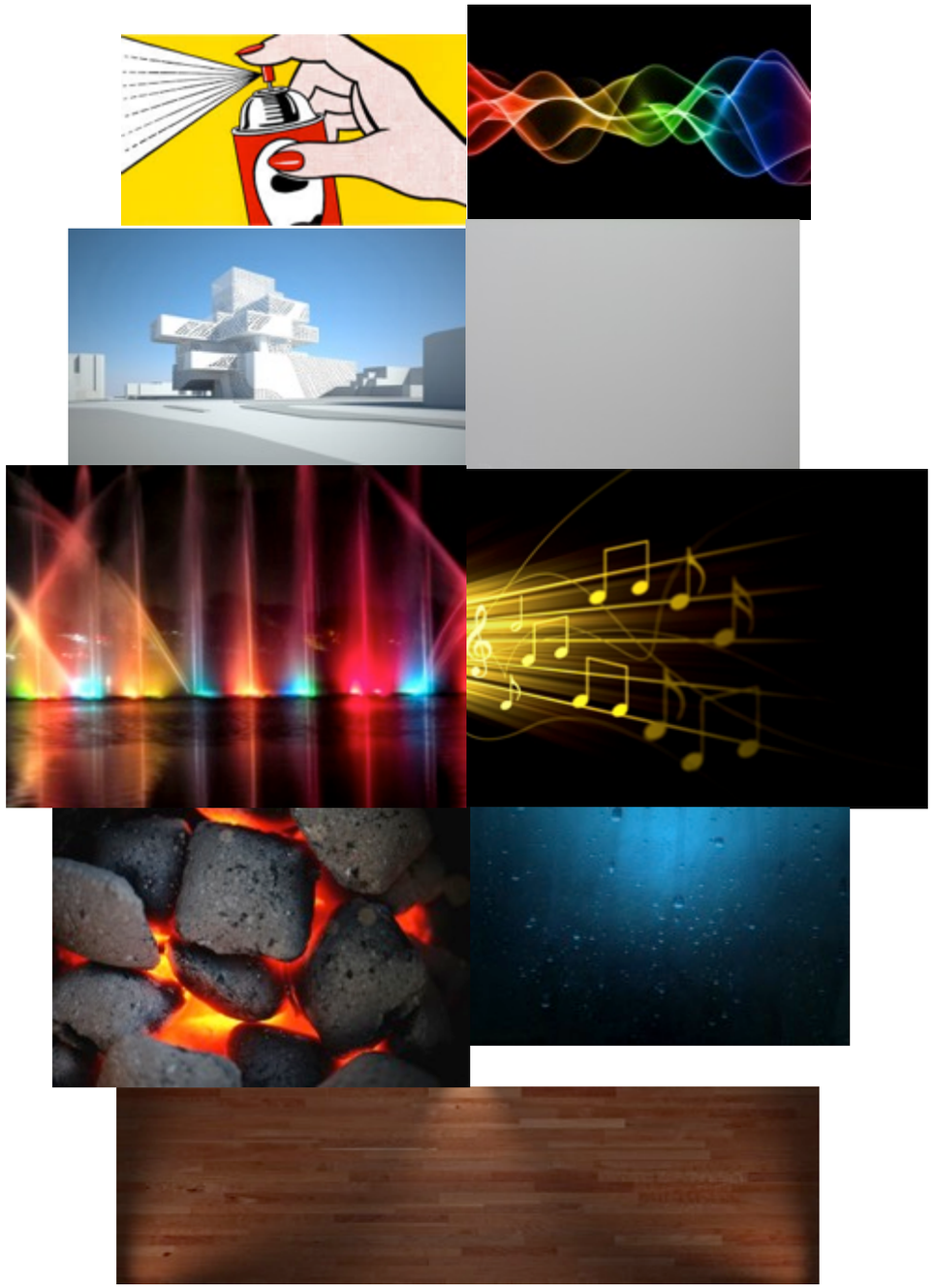
My client's living room has a log burning stove, wooden floor, a dark sofa and a dark wood table. He would like me to design it to fit with the the other objects in the room and not look out of place.

My client, however, lives about four hours away by car in South Devon so would like me to get it shipped out to him. Therefore in order to keep the costs down I will make my design flat packed with detailed instructions included as to how to make it. He is also unsure about the height and style of the lamp and would like me to design it so that it can be a desk light and an up light.

The lamp will use LED lights to illuminate the area. This will be brighter, energy efficient and over time, cheaper as they last for a longer time than filament bulbs.

Finally it should be built so that it is robust and can withstand a few knocks and bumps, also the wiring will need to be as thin as possible so that it can be flat packed and shipped cost effectively.

Themes



Joseph Sauer, Centre Number – 14737,
Candidate Number – 1474

Product Analysis

AnglePoise Type 75S Desk Lamp Aluminium - £120

- Anglepoise Type 75S Desk Lamp Aluminium. This is the new version of the original 3 spring Anglepoise lamp. With its broad range of movement and classic looks this lamp will suit a wide range of uses from reading in your armchair to working at your desk. It has a weighted table base for extra stability.
- Dimensions :
  - Reach 70 cm
  - Shade Diameter 14cm
  - Cable length 2.20m

Heal's Junction Table Lamps - £135

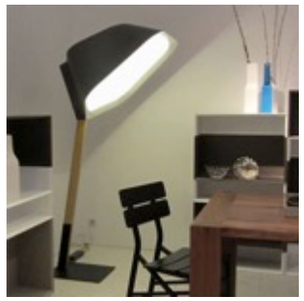
- Providing the perfect contemporary industrial look, the Junction Table Lamp is part of Heal's exclusive range of lighting.
- With its slim, understated profile, this lamp gives Bauhaus style tubular furniture a 21st Century makeover. Available in brass, copper and matt black finish, it makes an elegant, yet striking addition to a range of modern settings.
- To finish the look, pair with an oversized, bare filament bulb. Once illuminated, the soft glow of this sleek lamp is sure to set the right tone
- Dimensions
  - Height 55 cm
  - Diameter 15 cm

Kartell Taj Table Lamp By Ferruccio Laviani - £282

- Kartell Taj Table Lamp By Ferruccio Laviani Combining functionality with art to create a luminous sculpture. The Taj replaces the more traditional angled lamp for a simple form with stylish curves. An ideal desk or reading lamp which looks beautiful both on or off. LED lamp life is 50,000 - 100,000 hours with a white light emitted. 2 years warranty.
- Dimensions
  - Height 58 cm
  - Width 15 cm
  - Depth 61 cm

Ligne Roset Peye Floor Lamp - £2,298

- Ligne Roset Peye Floor Lamp. This statement floor lamp features a large hooded shade that diffuses the light in to a soft, wide beam. Includes 2m LED ribbon, with 492 LED giving off a total of 32W and a light intensity of 2,370 lumens or the equivalent of a 150W incandescent bulb
- Dimensions
  - Width 80 cm
  - Depth 95 cm
  - Height 188 cm



Evaluation

This was extremely useful research for me as it showed how versatile a lamp can be and that the best, and the most expensive, lamps are very simple designs but are the most effective at being visually interesting and serve the purpose and function of being a lamp

Initial Specification

- Purpose
  - Provide a stylish solution to my client's desk and up lighting problems .
- Form
  - It must be made from wood and inspired by colours and materials from a log burning stove due to my client having dark coloured furniture with a log burning stove and dark wooden cabinets.
- Function
  - Will provide a simple but effective lighting option that can be used either as an up light or desk lamp
  - Electronics must be hidden but also easily accessible to fix any problems
- User requirements
  - It must be a bright light that can be used as an up light but also a down, desk lamp
  - The colour of the light must be changeable
  - The lamp should look rustic and made from wood, preferably real wood
- Materials and components
  - Must be made from or look like it is made from real high quality wood
  - Must be strong and durable and not break when dropped
  - Must have a stand that can change the height from being an up light to a desk lamp
- Size
  - Must be able to light up the room in the up light position and illuminate the wanted area when in the down light position
  - Must be able to fit the light source (that I will choose later in the project)
  - Must have a space for all of the cables and electronics to go so to make it look professional
- Safety
  - All wiring must be routed so that it is not under stress and cannot break leading to the product short circuiting
  - Sharp edges, corners, etc. must be smoothed and rounded to make them safe
- Quality
  - I will conduct quality control checks throughout the making to ensure it is made to the highest standard possible
  - I will use materials that have tested and are safe and are quality materials
- Scale and production
  - It will be made as a one off product however it must be easy to turn it into batch production
- Cost
  - My client has no set price at this moment so I am working to a budget of around £80 - £100
- Sustainability
  - I will try to use materials that can be recycled and only use FSC certified wood so to not harm the environment

Evaluation

This is only the initial specification based on my initial thoughts inspired by the product analysis that I have conducted

It is useful to my project as it gives me the building blocks for my initial ideas and also means that I do not wander away from the brief

Research – Existing Products

During my research I came across these stained wood crates that I thought would be perfect for fitting with the theme of a log burning stove, they looked simple, however, would be very hard to perfect.

Finally, when looking for flat packed lamps they all had basic, uninspiring designs and looked like they would break very easily.

My product will try to incorporate these features:

1. Be designed to look like a stained crate
2. Be flat packed and cheap to ship
3. Be sturdy and robust

Evaluation

This was useful research to conduct as it allowed me to think of how my design will be new and innovative, meeting a criteria that has not been filled by any other product so far.

Also it allowed me to think more about the colouring of my product and ways in which I will make the product flat packed.

Research - Materials

Plastic	Properties	Uses	
Acrylic	Hard and stiff. Can be clear, Perspex. Scratches easily. Good electrical insulator. Can be coloured	Windows, lighting, units, baths.	
Ply Wood	Soft wood – but still hard Easy to use and manipulate	There are lots of grades available, designed to suit a variety of situations	
Medium Density Fibre Board (MDF)	Easy to shape with machinery, can be painted without the need for an undercoat or primer	Furniture, doors and internal panelling	
Polypropylene	Good chemical resistance. Tough with good strength properties. Can have a wide range of colours. Can have either a high or low density.	String, rope, milk crates, kitchenware, chairs, buckets, baths, water pipes.	
Polyvinyl Chloride (PVC)	Stiff, hard and tough. Good resistance to chemical attack. Good electrical insulating properties. Wide range of colours available.	Pipes and gutters, window frames.	
ABS	High impact strength. Tough. Withstands scratching. Resistant to chemicals.	Safety helmets, casing for household goods, car parts	
PTFE	Low frictional properties. Tough. Good chemical resistance. Used for bearing surfaces.	Surface for non-stick pans, plumbers' tape	

Evaluation

Even though I will probably only use the top three materials in my product, this has been useful research for me to do as it has allowed me to explore, different materials that I could possibly use on the interior of the product or as an external feature.

Research – Manufacturing Processes

There are a few manufacturing processes that we can use to make our final project, these are a few of them:

We can use a laser cutter to create precise and accurate parts that can be drawn on CAD software.

We can use hand tools to cut the pieces, although this will give the product the novel homemade feel, it is inaccurate with lots of places for error

- For wood - saws, files and sanders
- For plastics - scalpels, cutters and plastic benders.

We could use a vacuum former to create shapes impossible to make from hand. For example spheres and cuboids.

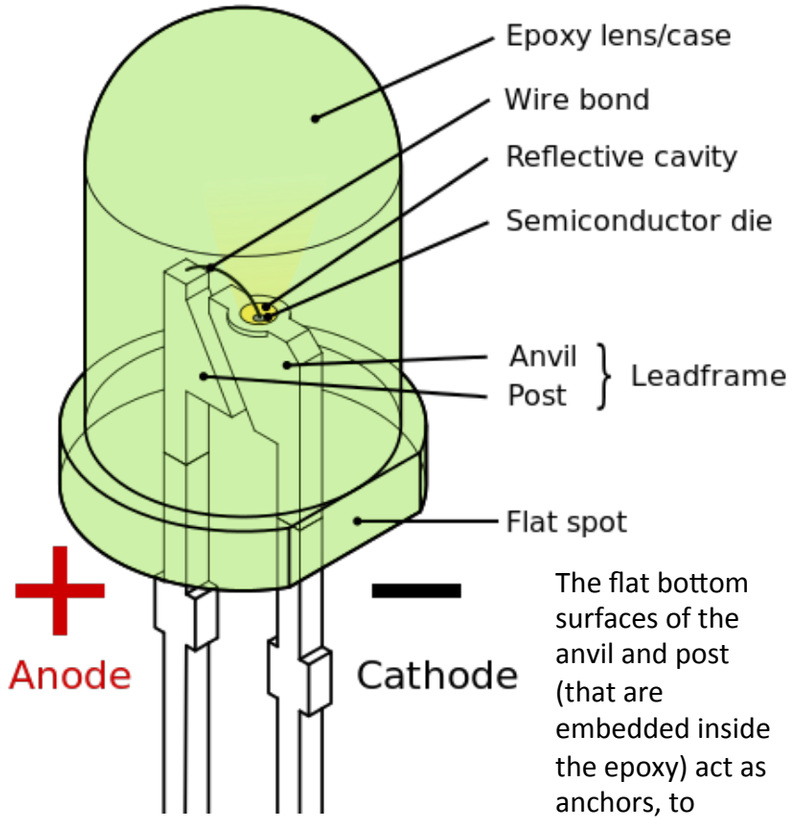
For plastics specifically, we could also use hot wire to melt the edges of our plastics in order to shape it into the curves desired.

Evaluation

For my project I was originally thinking of only using hand tools to make the entire product, however, after conducting this research it has made me think about other more effective ways of making my design. The most useful research to me was that of the laser cutter, although I have not stated this in the research, it can be used to either cut straight through wood or acrylic or can be used to engrave the material to give a very accurate outline of the design, much better than drawing it on by hand.

Research – LED

- An LED is "solid-state lighting" technology (SSL) instead of emitting light from a vacuum like a filament bulb, SSL emits light from a small piece of solid matter that is a semiconductor.
- A semiconductor emits light when electrons move about within its structure
- A semiconductor is made of a positively charged component and a negatively charged component.
  - The positive layer has "holes" (openings) for electrons
  - the negative layer has free electrons floating around in it.
  - When an electricity flows through the semiconductor, it allows the electrons to move freely from the negative layer to the positive layer.
  - Those excited electrons emit light as they flow into the positively charged holes.
- The problem with LEDs (for lighting in general) is that even though they emit a lot of light, the structure of an LED causes some of that light to get trapped inside, meaning LED's are dimmer than filament bulbs, a problem if they are used for home lighting
- Recently, however, LEDs bulbs have become brighter. You can now find LED bulbs that emit light equivalent to a 60-watt filament bulb, making then usable for home lighting.



The flat bottom surfaces of the anvil and post (that are embedded inside the epoxy) act as anchors, to prevent the conductors from being pulled out by strain.

Evaluation

This has been useful in depth research into the light source that I will most likely use, it is useful to now know that LED's will be bright enough for my function and find out how they work. Finally, it has been worthwhile to see how small LED's are and how easily they can be implemented into my product.

Research – Product Disassembly

LEDBERG

LEDBERG is a small one LED lighting solution used for hard to reach areas like confined spaces in cabinets, bookshelves and wardrobes. The product is from IKEA, cost £5, has an energy rating of A+ and is stated to emit low levels of heat.

PCB

Used to house the LED and resistors, it has a specific shape that allows it to fit perfectly into the casing.

PCB Casing

This protects all of the electronics and has cuttings and protruding parts so everything is fixed together with pressure and not glue

Light Diffuser

This fits on top of the LED and directs all of the light into a single spotlight

Light Fixing

This allows the light to be fitted onto a surface with screws.

Cable

This is one cable with a switch in the middle to allow the user to turn off the light without having to turn it off from the plug.

Power Supply

This contains a transformer that converts the electricity from 100-240V to the 24V required for the light

Evaluation

This research was extremely useful as it showed me different was of connecting parts together without the use of glue or screws.

Furthermore, it was useful to see how the product was laid out internally, how simple and and effective it was with nothing getting in the way. Something I need to replicate in my product.

Research – Questionnaire To My Client

What material do you want the lamp to be made from?	Wood
How tall do you want the unit? (mm's)	400 - 600
Do you want the unit free standing or mounted?	Free Standing
Do you want a simple or complex design?	Simple
What theme do you want the lamp do be?	Wood and Charcoal
Where would you have the unit?	Living room
Would you want a fixed or adjustable height	Slightly adjustable
Would you prefer a curved or straight edges?	Straight
What finish do you want	Charred or stained wood

Evaluation

These are the responses my client gave to the questions listed above.

This is possibly the most useful research so far as it gives me a clearer indication on what my client wants, most notably the style of lamp, height and colour or finish of the product.

I will incorporate these answers into my secondary specification and will bas my initial ideas on this.

Research - Flat Pack Packaging

The packaging of this IKEA billy case was well thought out and well designed for mass production and storage. The 80cm wide built unit fitted inside a box of about 30cm wide x the length of the full unit with all of the component parts fitting perfectly together.

There was also extra cardboard padding inside the box at the two ends to stop damage in transit. Finally all screws and fittings along with instructions were all securely placed in the box to ensure no damaged was caused to the unit.

Evaluation

This is useful to my research as it shows how batch produced flat packed products are very efficiently packaged and protected using cheap materials, in this case cardboard. The sizes of each piece ensures there is no movement within the package further protecting it and they have made spacers out of card to further hold everything in place.

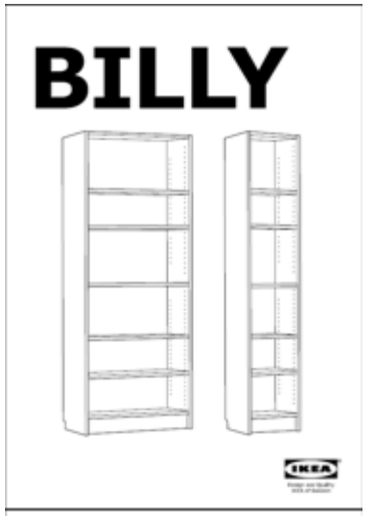
This is very good inspiration that I will look at when designing my packaging

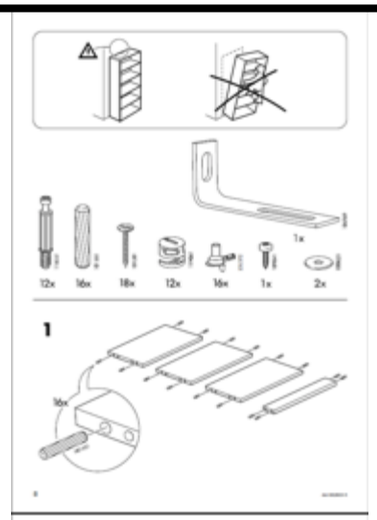
Research - Flat Pack Instructions

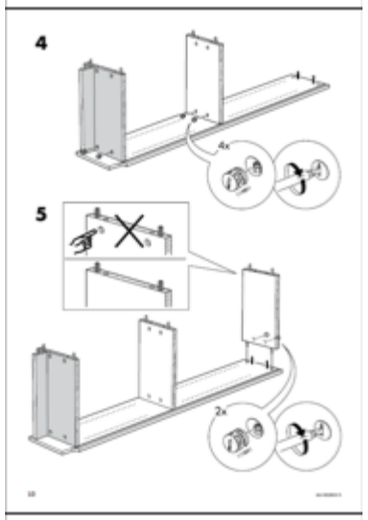
The instructions provided with the unit were simple and easy to follow. They included no words (except for warning information) and used diagrams and cartoons only to show how to build the unit, this means that these instructions can be used all over the world without having to create a new instructions booklet for each language. The instructions also included magnified areas to show which directions components face and tips to make the unit professional.

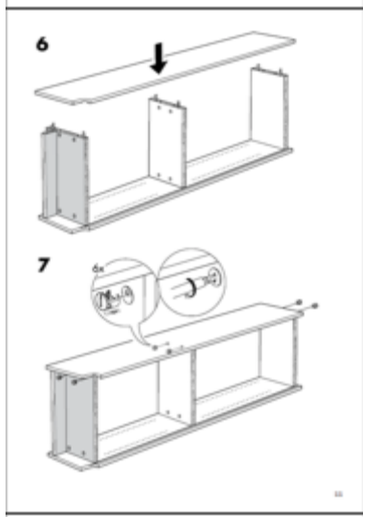
Evaluation

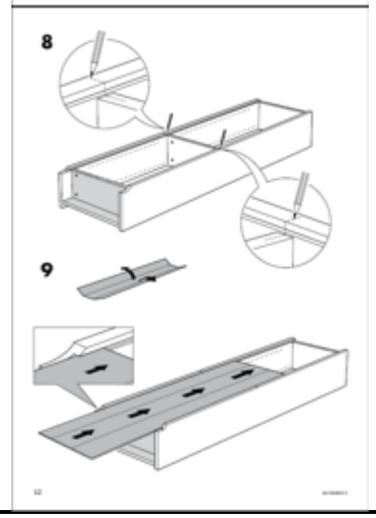
This is useful to my research as it shows me how I should lay out my instructions and how simple it should look.

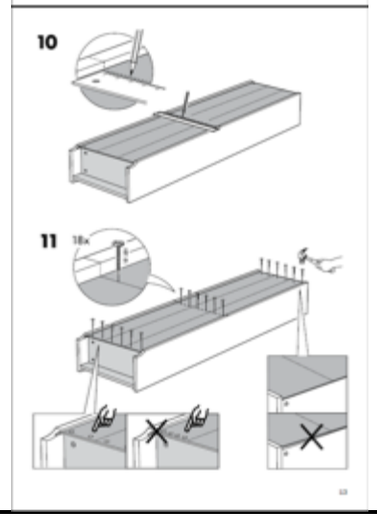


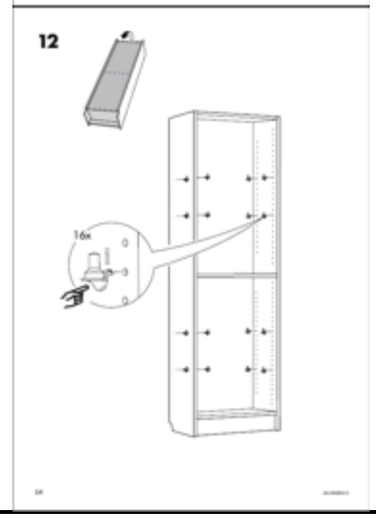


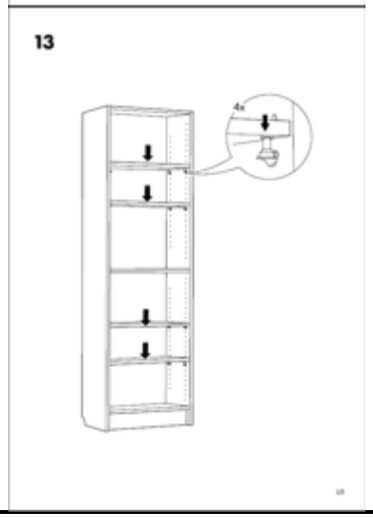


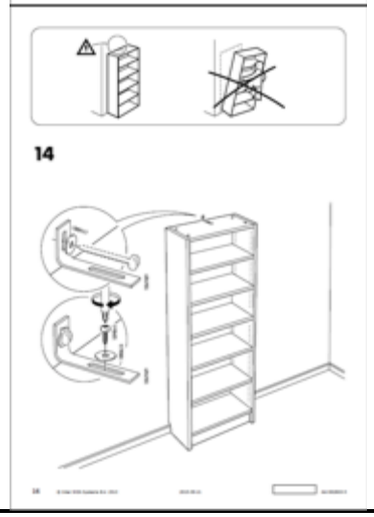






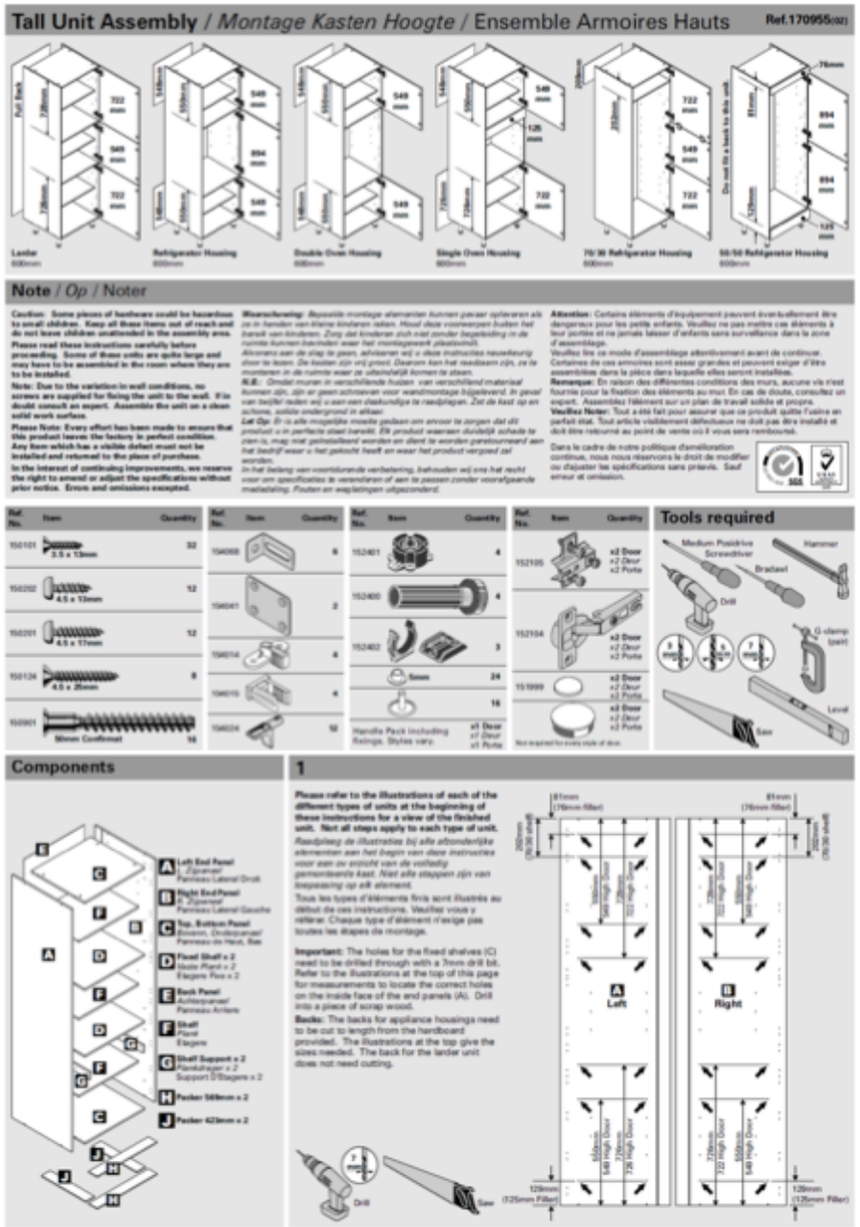


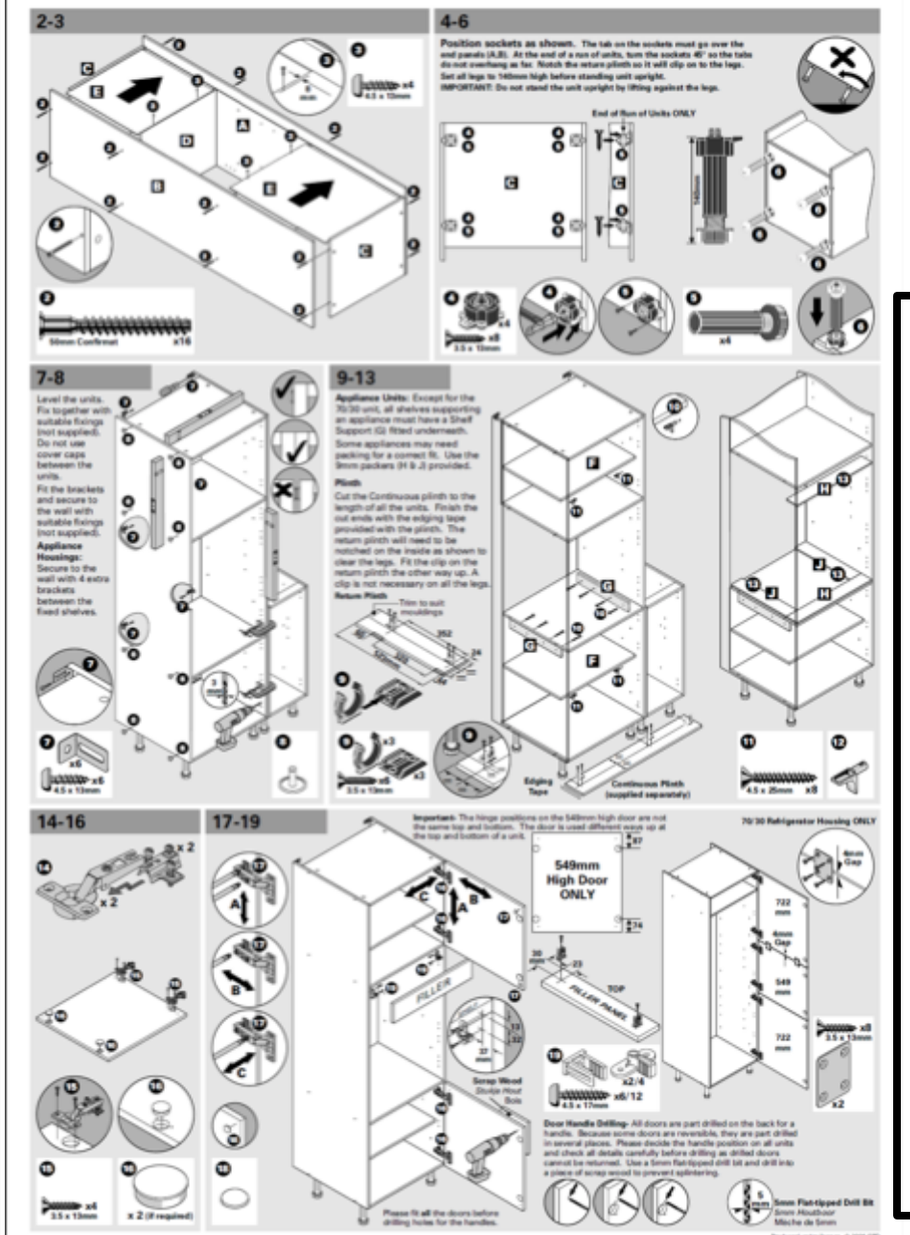




Research - Flat Pack Instructions

These instructions are for a tall kitchen unit and are very detailed, precise and fairly easy to follow. They show intricate illustrations especially for the parts and tools needed. However the crammed layout and huge amounts of writing make it look very confusing and harder to follow than the IKEA instructions and daunting to someone who has never seen instructions like this before or do not do a lot of DIY or building.





Evaluation

These Instructions are useful to my research as they show a confusing too detailed layout that I need to avoid for my product.

It does show a professional way of drawing that I will be inspired by when I do my instructions.

Secondary Specification

Time Scale

- For this project I have to complete everything before the Easter holidays.
- This will include all models and the final unit, all of the folder work including all evaluations, testing's and customer responses.

Purpose

- Provide a stylish solution to my client's desk and up lighting problems .
- My client is in his mid twenties and his current lamp in his living room has stopped working and he asked me if I could design one for him.

Form

- It must be made from wood and inspired by colours and materials from a log burning stove due to my client having a dark colour scheme with a log burning stove and lots of wooden furniture.
- My client would want this new lamp to have a similar design to all the other objects in the room.

Function

- Will provide a simple but effective lighting option that can be used for either an up light or desk lamp
- Electronics must be hidden but also easily accessible to fix any problems
- My design will have an adjustable feature or storage feature

User requirements

- It must be a bright light that can be used as an up light but also a down, desk lamp
- The colour of the light must be changeable
- The lamp should look rustic and made from wood, preferably real wood

Aesthetics

- I will try to make my design modern and aesthetically pleasing
- I am probably going to go with a design from wood inspired by old wine bottle crates and make the joints as simple as possible
- I will cover the LED's with a thin, maybe 1mm thick, translucent, plastic to ensure the light illuminates evenly and not blindingly.

Materials and components

- Must be made from or look like it is made from real high quality wood
- Must be strong and durable and not break when dropped
- Must have a stand that can change the height from being an up light to a desk lamp
- I will be using acrylic and ply for my design as they can all be laser cut, are relatively strong and are opaque enough so that it will not let out light from any unwanted areas.
- I will be using LEDs as they last for a long time and emit very little heat which I need as the product will be made from wood

Size

- Must be able to light up the room in the up light position and illuminate the wanted area when in the down light position
- Must be able to fit the light source (that I will choose later in the project)
- Must have a space for all of the cables and electronics to go so to make it look professional

Safety

- All wiring must be routed so that it is not under stress and cannot break leading to the product short circuiting
- Sharp edges, corners, etc. must be smoothed and rounded to make them safe

Quality

- I will conduct quality control checks throughout the making to ensure it is made to the highest standard possible.
- I will use quality materials that have been tested and are safe.

Scale and production

- It will be made as a one off product however it must be easy to turn it into batch production
- If the unit is made for mass production I will make it for a wide range of people and ages, it will come in a variety of finishes and sizes.
- The unit will be made entirely from flat pieces which will be laser cut or hand cut, they will then be sanded and joined to get the best finish
- The circuitry will all be contained so that my client does not have any risks of electric shock.

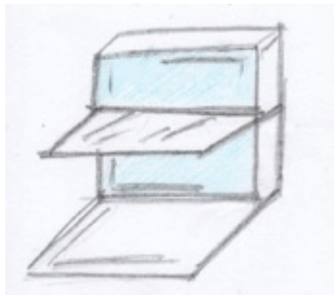
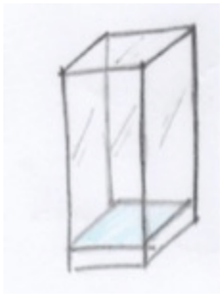
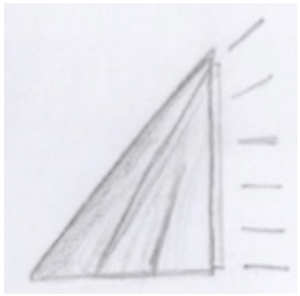
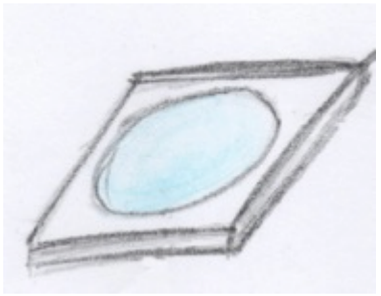
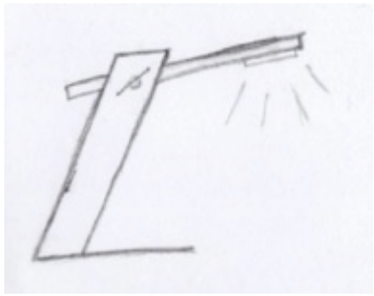
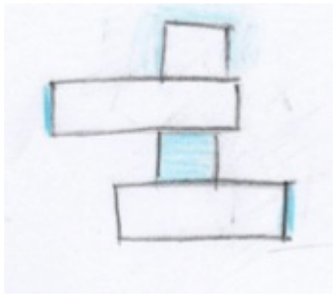
Cost

- Ideally I would like my product to have a manufacturing cost of about £30.
- I would then like to sell the unit for about £90 or £120, a little higher than previously thought.
- The higher price is so that I can have a enough profit margin so that I can continue to develop it and make more.
- I will keep the manufacturing price low but if this was mass produced in a factory it would cost even less and I will be able to buy all the materials cheaper in bulk and gain an even larger profit.

Sustainability

- I will try to use materials that can be recycled and only use FSC certified wood so to not harm the environment
- I will be using materials that are made without toxins or acids
- It will be joined together using an environmentally friendly method trying to avoid adhesives which are harmful

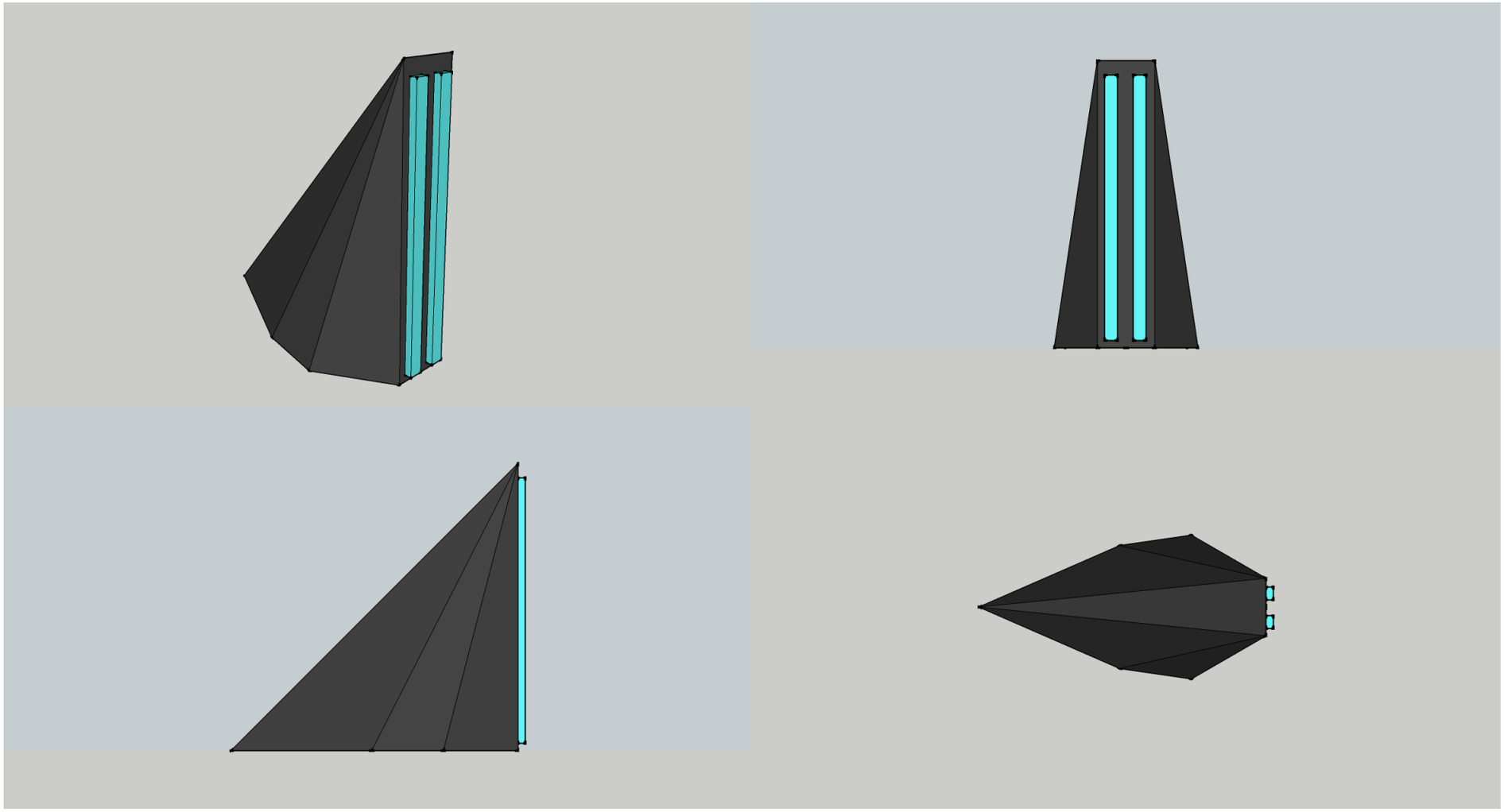
Thumbnail Sketches

				
This is a display shelf for glassware with a lighting panel at the back to illuminate all of the items. Made from acrylic.	This is a lamp inspired from a CCTV camera and studio film light, focusing light on one area. Made from ply wood or acrylic.	This is an up light that can be used as a storage unit for glassware also. Made from ply wood.	This is a light cube on top of a cube storage cupboard. Made from ply wood and acrylic.	This is inspired by a musical note with a small area for storage, the whole unit will light up. Made from acrylic.
				
This is a flower vase with an up light that is multi-coloured to make the flowers more interesting. Made from acrylic.	This is a desk lamp with lots of interesting angled parts. Made from ply wood or acrylic.	This is a drinks coaster with an up light to illuminate your drink. Made from ply wood and acrylic.	This is a desk lamp. The area that is being illuminated can be changed up or down. Made from ply wood.	This is a centre piece lamp illuminating in four directions. Made from ply wood.

Evaluation

I think I did ‘okay’ at portraying the ideas in my head in drawings and a small amount of writing, they are good initial sketches and ideas that can be developed later. Personally I feel that my drawings need to be better and where the LEDs will go needs to be clearer.

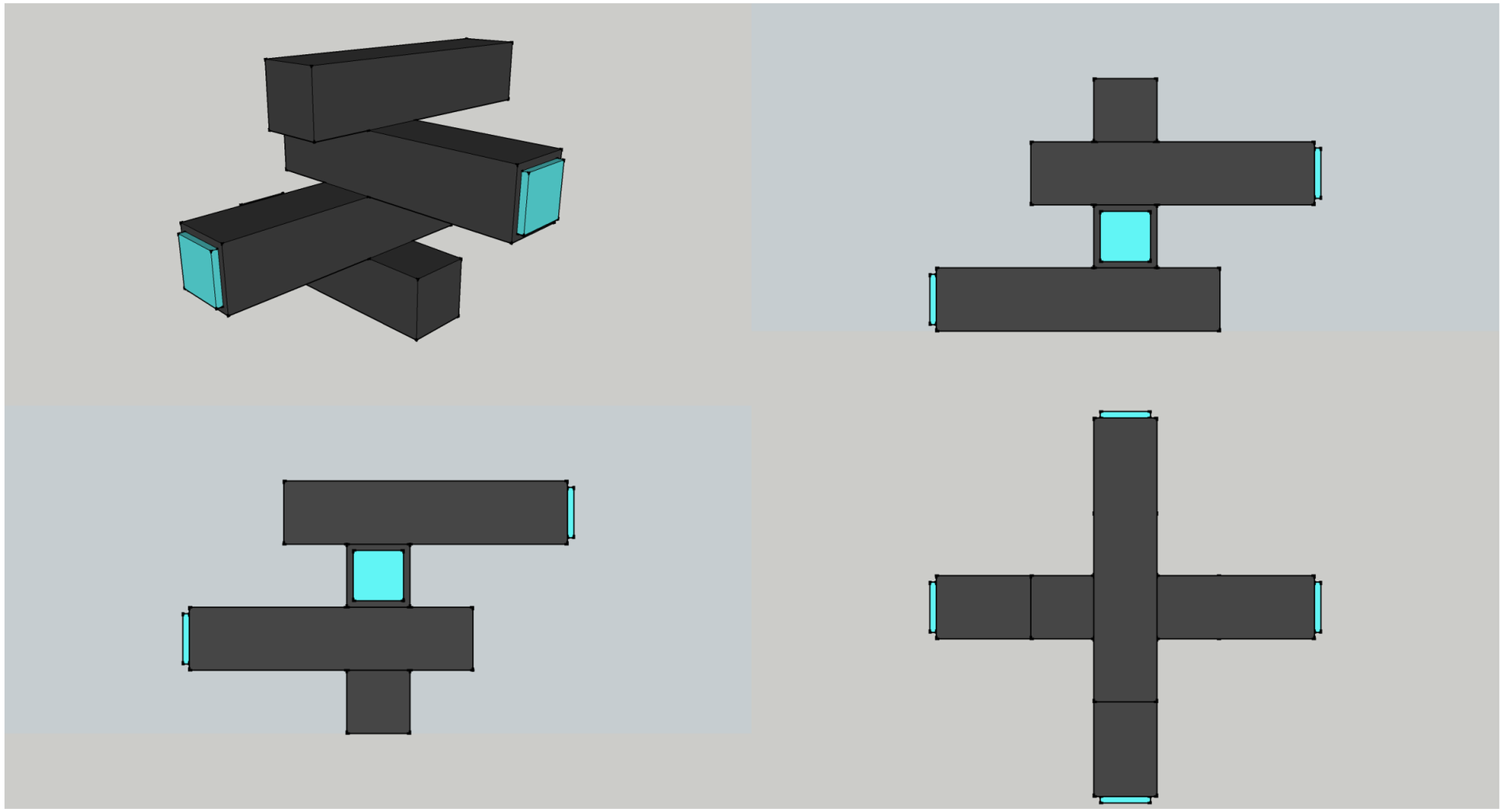
Initial Ideas 1



Overview – This design is an odd triangular pyramid shape with two strips of LED's, I will angle the LED's inside the design down, not blinding you and focusing the light onto the desired area. The product will be sent flat packed with the required glue needed plus information as to where to purchase more glue if needed

Making – It will be laser cut from acrylic, sanded and joined by an acrylic adhesive to keep all of the sharp angles. It will be joined using glue and small pins so to ensure that the joints are sharp and definite.

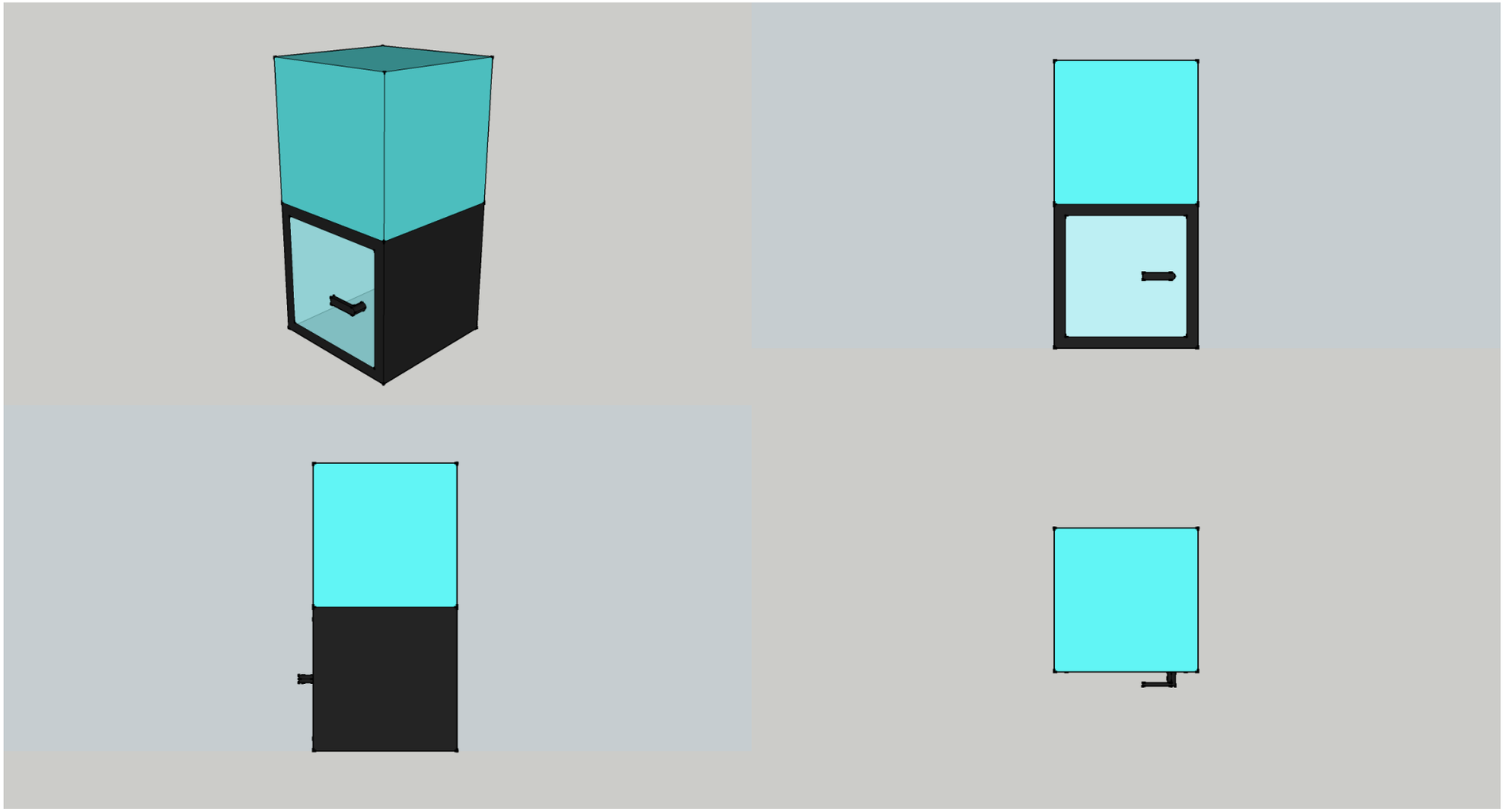
Initial Ideas 2



Overview – This design is a centre piece lamp that could by hung from the ceiling and giving out light in every direction, the bottom cuboid will be the heaviest so to keep the product balanced and upright. It will come in a compact flat packed packaging and come with different brightness's of light.

Making – It will be made from four identical cuboid shapes all made from ply wood with acrylic ends to diffuse the light evenly. The product will be joined together with finger joints.

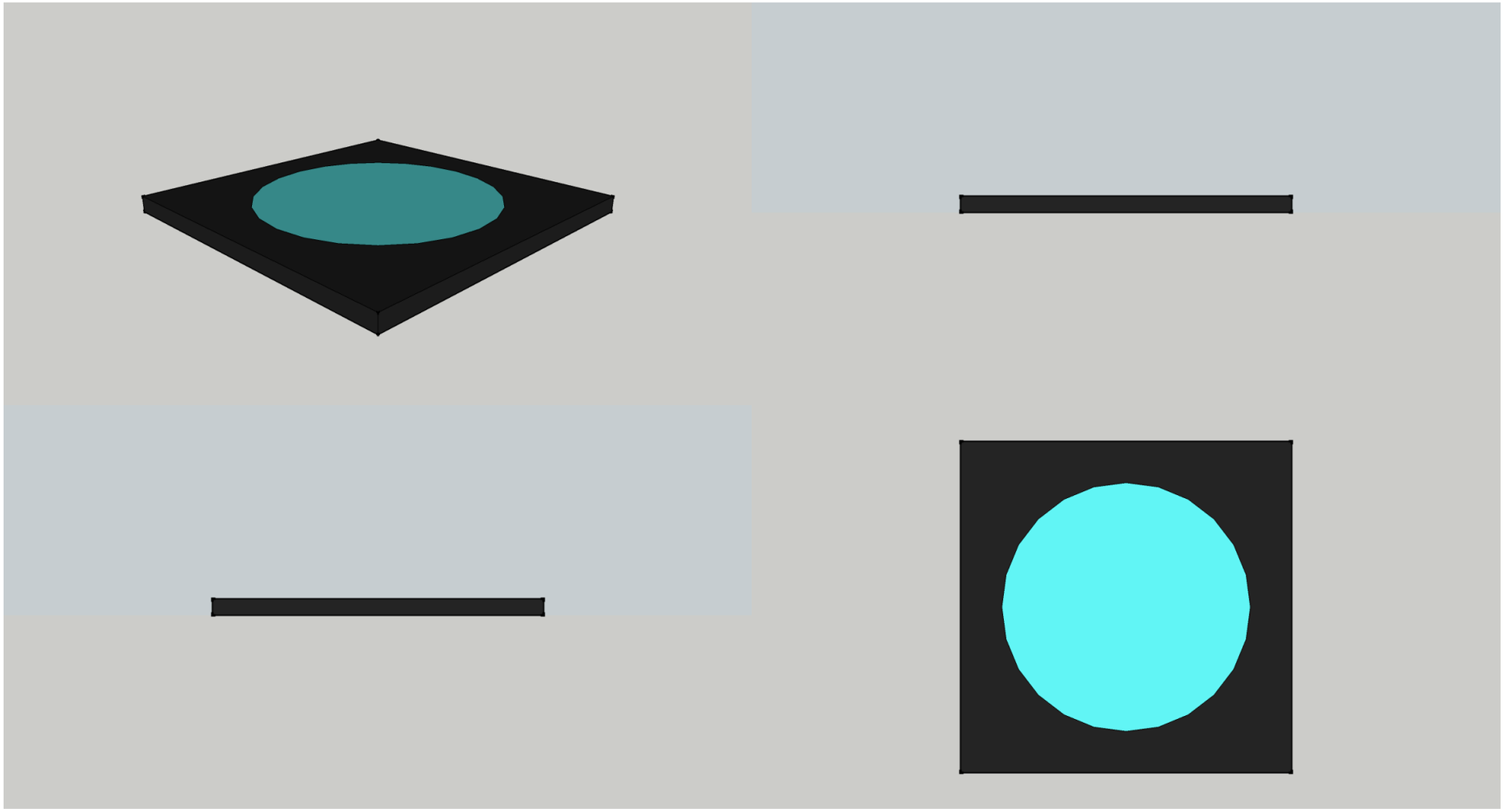
Initial Ideas 3



Overview – This design is a centre light cube with a cabinet for decorative items, the cube will have an inner cube which is covered with LED's so to illuminate the room. It will be flat packed making sure that the glass panel has more insulation so that it will not break.

Making – It will be made from an acrylic sheets with a ply wood base cube and a glass panel. It will be joined with finger joints and two hinges for the cabinet door.

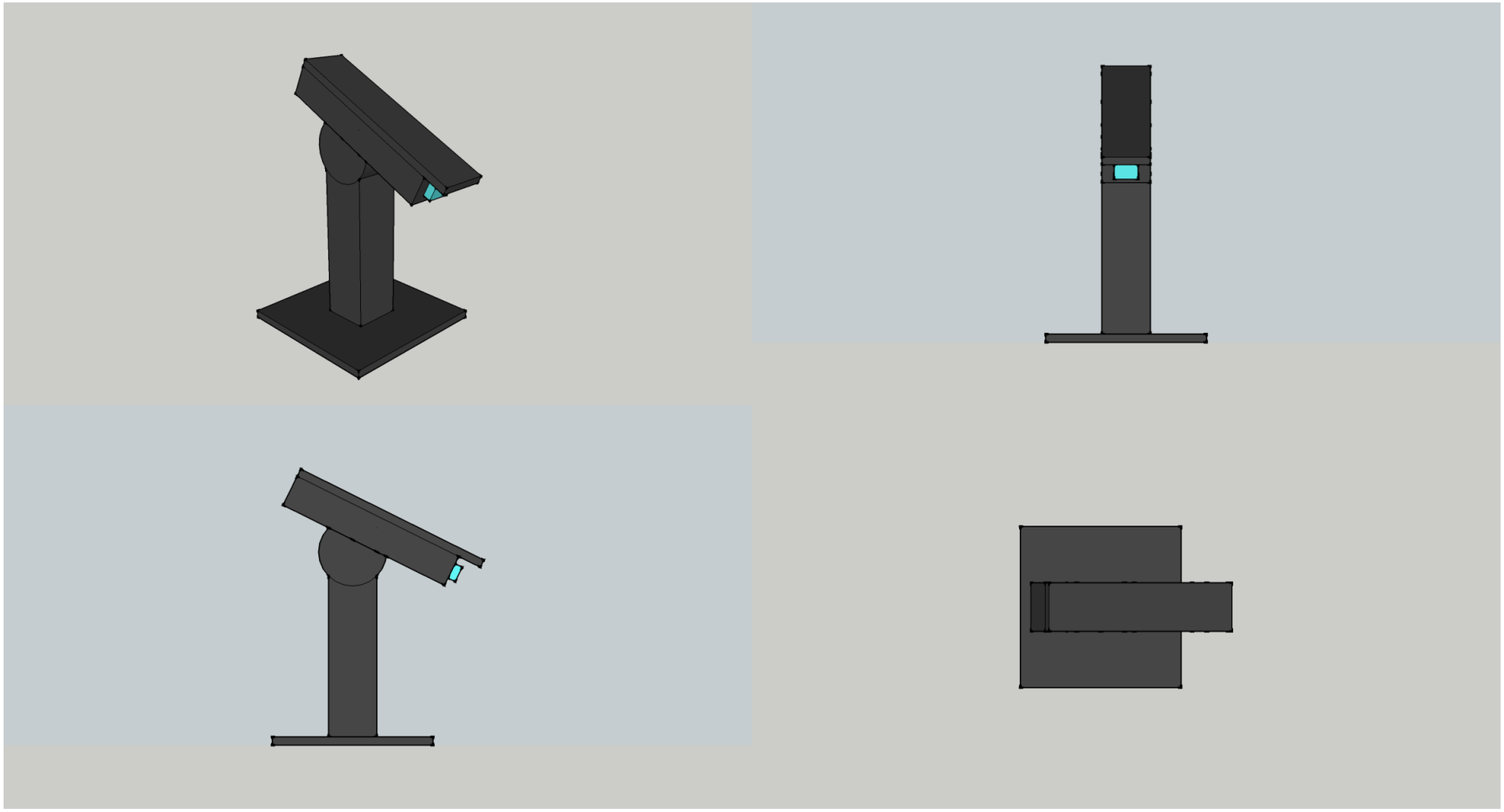
Initial Ideas 4



Overview – This design is a simple coaster that will illuminate your drink, it will come as a set of six with each light having a different colour and powered by AAA batteries for their small size and so it does not require a wire

Making – It will be made from thin ply wood sheets with a circle of acrylic to diffuse the light and be made waterproof. It will be joined by finger joints and glue so to waterproof the lamp and ensure that there is no risk of electrocution.

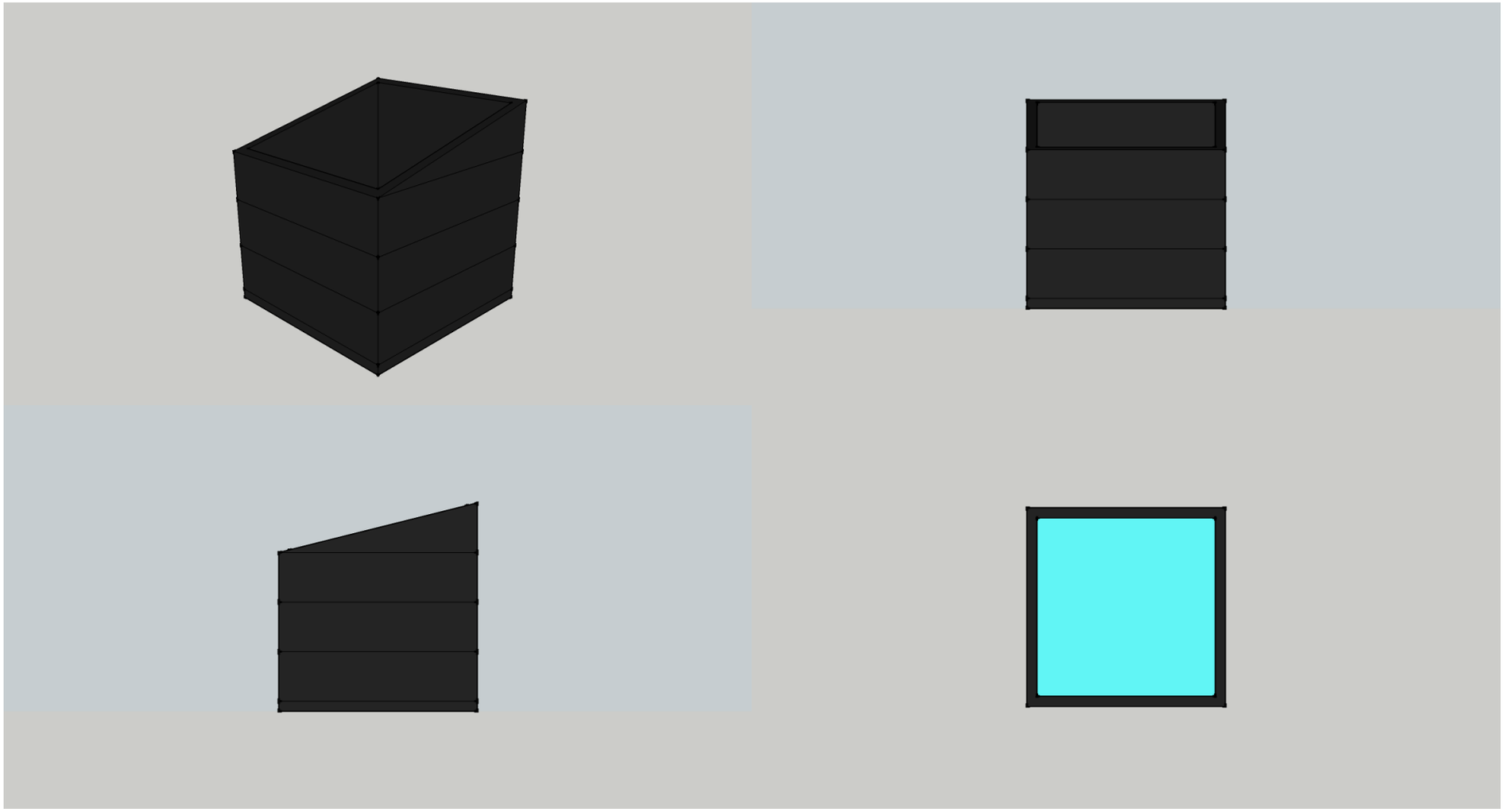
Initial Ideas 5



Overview – This design is based on a CCTV camera and studio film light. It will illuminate an area like a spotlight, and have an adjustable head to change from an up light to a down light. It will be flat packed.

Making – It will be made from ply wood and possibly acrylic and be joined using mainly finger joints and glue in a few areas.

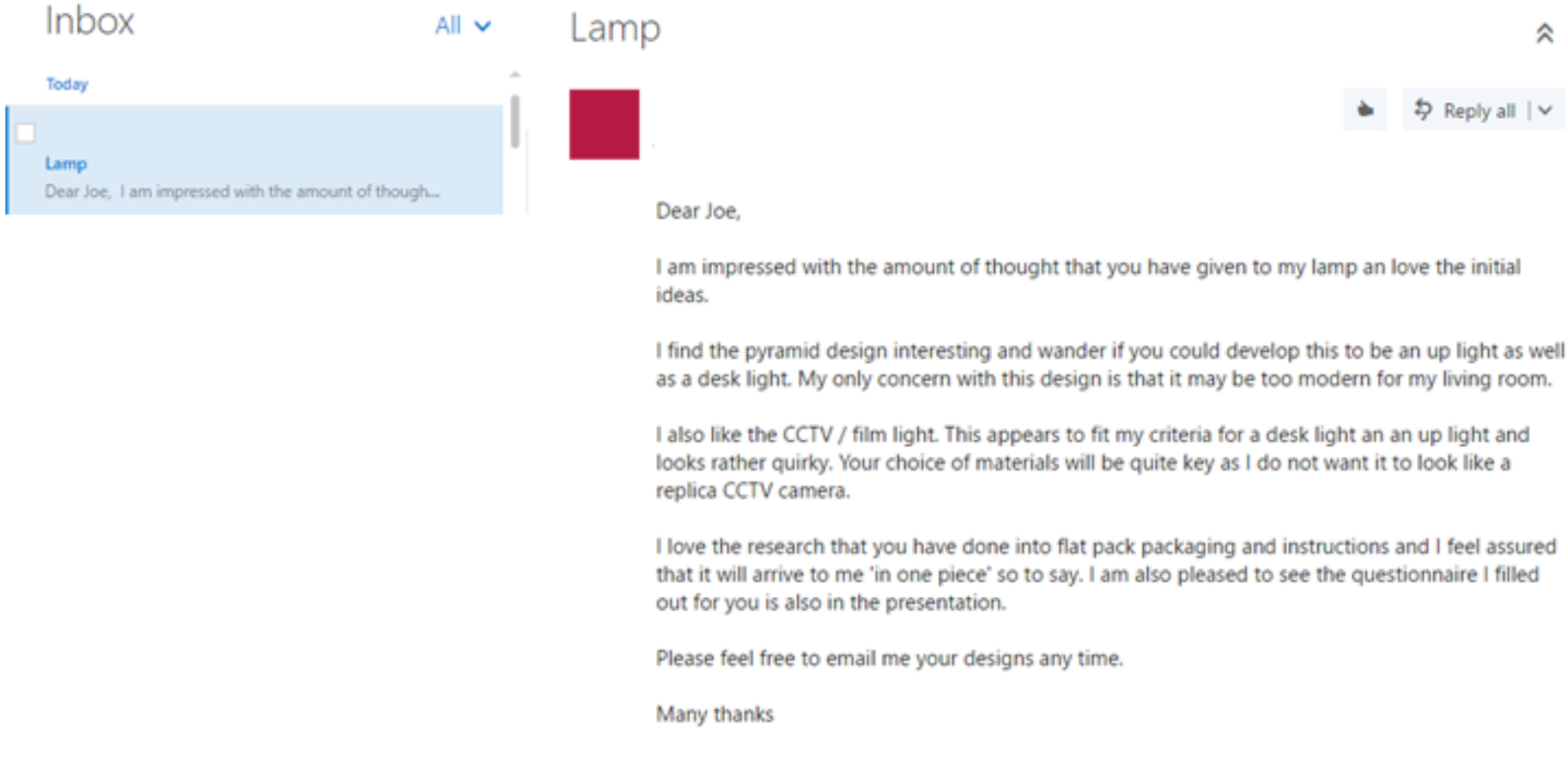
Initial Ideas 6



Overview – This design is an up light that can store bottles to create interesting light patterns and colours on the ceiling with a multi-coloured LED base plate. The design will be adjustable as the user can increase the height by adding more wooden slats.

Making – It will be made from slats of ply wood connected at the corners and an acrylic base with LEDs underneath. It will be joined with finger joints with glue supplied to reinforce the joints.

Client Feedback



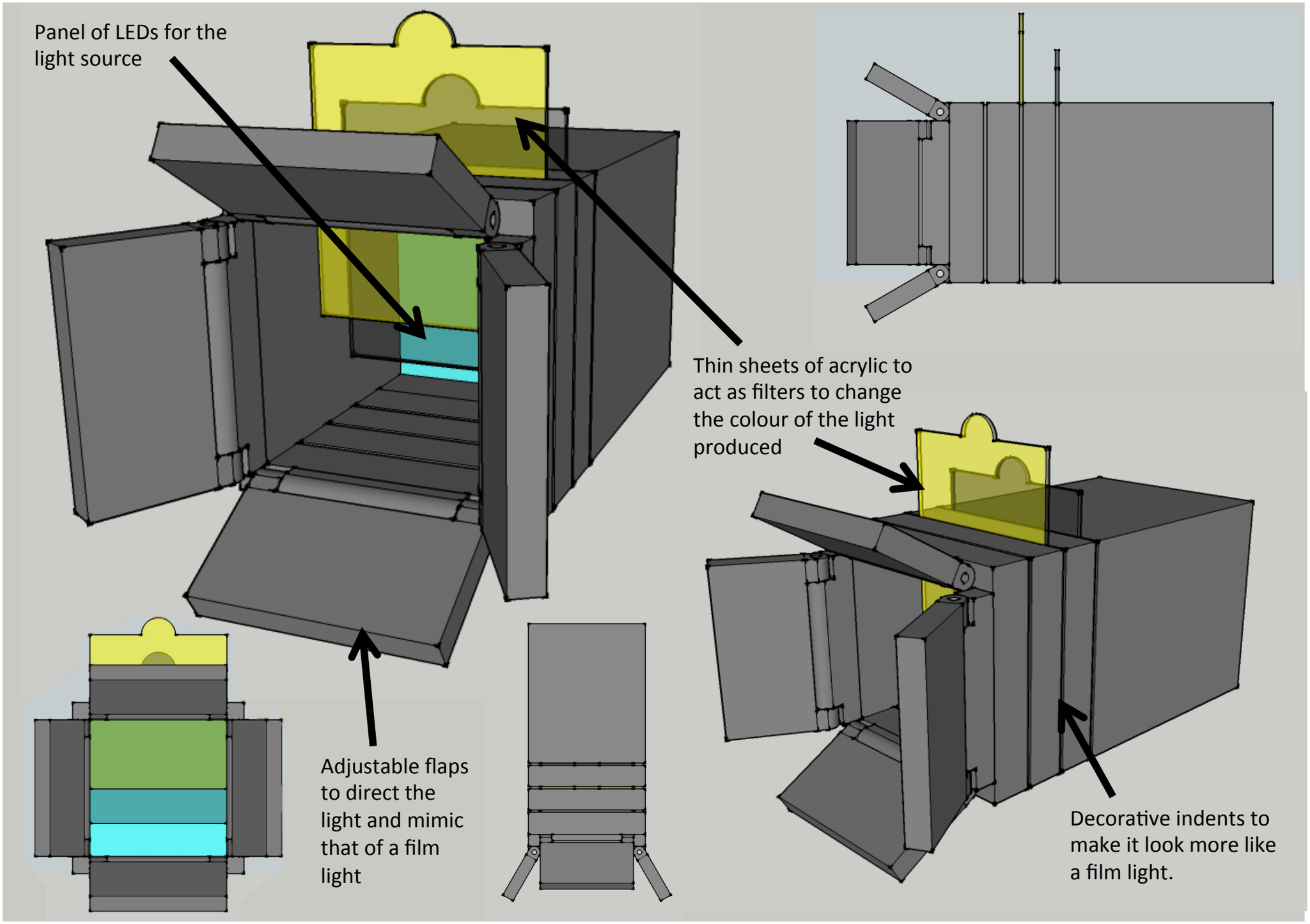
Evaluation

This is useful feedback as it gives me the direction my client would like me to take.

My client is keen for my design to be both an up light and a desk light.

Finally the expectation is that I will deliver this product with appropriate packaging and suitable assembly instructions.

Developed Idea 1



Developed Idea 1

Why I chose this design

- I like the look of the CCTV lamp however I thought it would look too simple, so I decided to develop it into a film light as I really liked the different shapes and styles of them, I also still wanted the design to look rustic like an old wood wine bottle crate.

Materials

- I will make the design mainly from ply wood as it is a cheaper wood than real hard wood but has a nicer finish than cheap MDF and chipboard. I will use translucent acrylic to form filters to change the colour of the light. I will use a blowtorch or wood stain to give it the distressed look that my client desires

Electronics

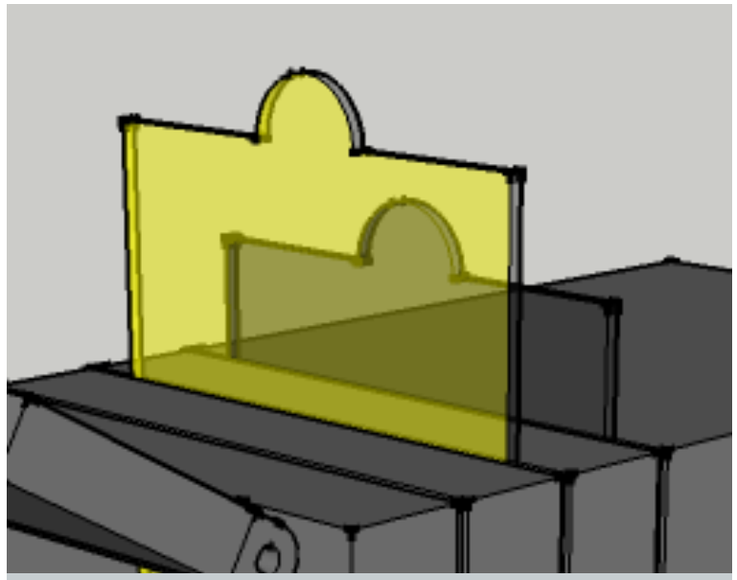
- All of the electronics will be behind a piece of wood with only the light sources on show; this is to protect the user from electric shocks but also make it easy to get to incase there is a malfunction.

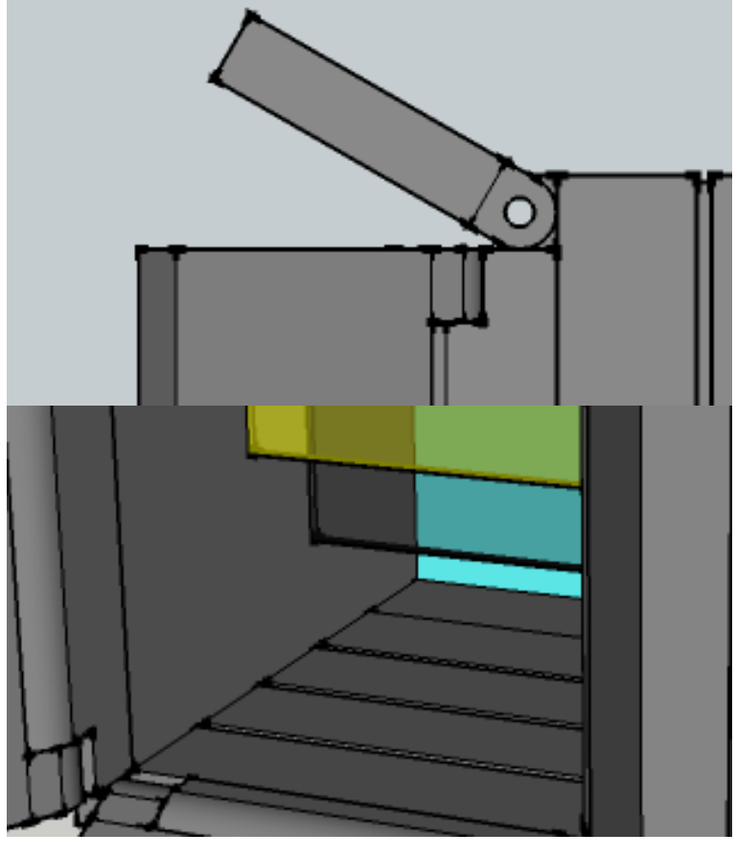
Size

- The main box will be about 20cm x 15cm x 15cm
- The flaps will be about 1cm x 7cm x 15cm

How it will be flat packed

- The main box will be joined using finger joints and adhesive, making a package about 300mm x 300mm x 100mm
- It should be about the size of a small parcel that can be easily shipped.

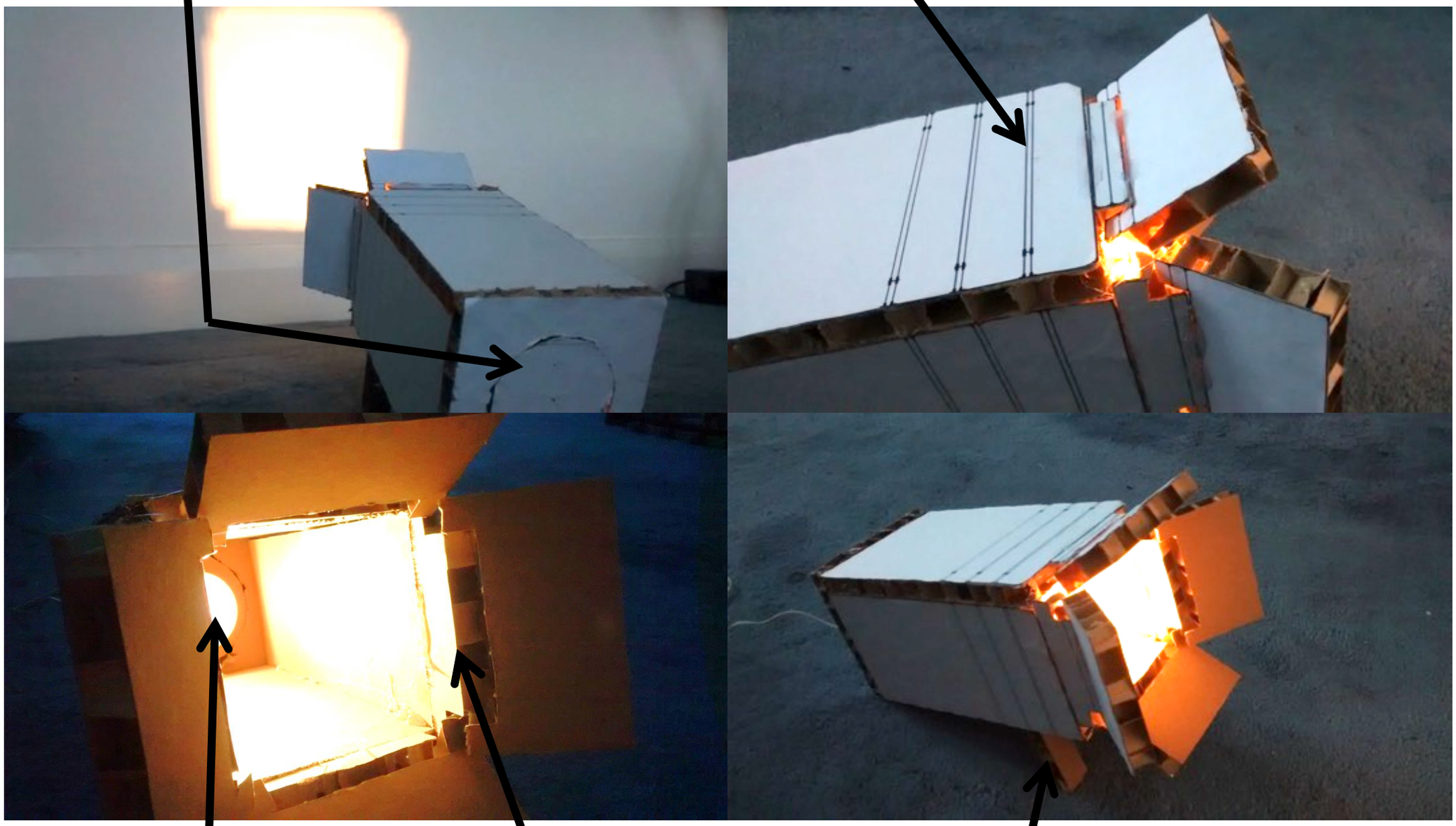




Developed Idea 1 - Card Model

Cut made so I could install the small light fitting

Marked area where the acrylic filters will be inserted

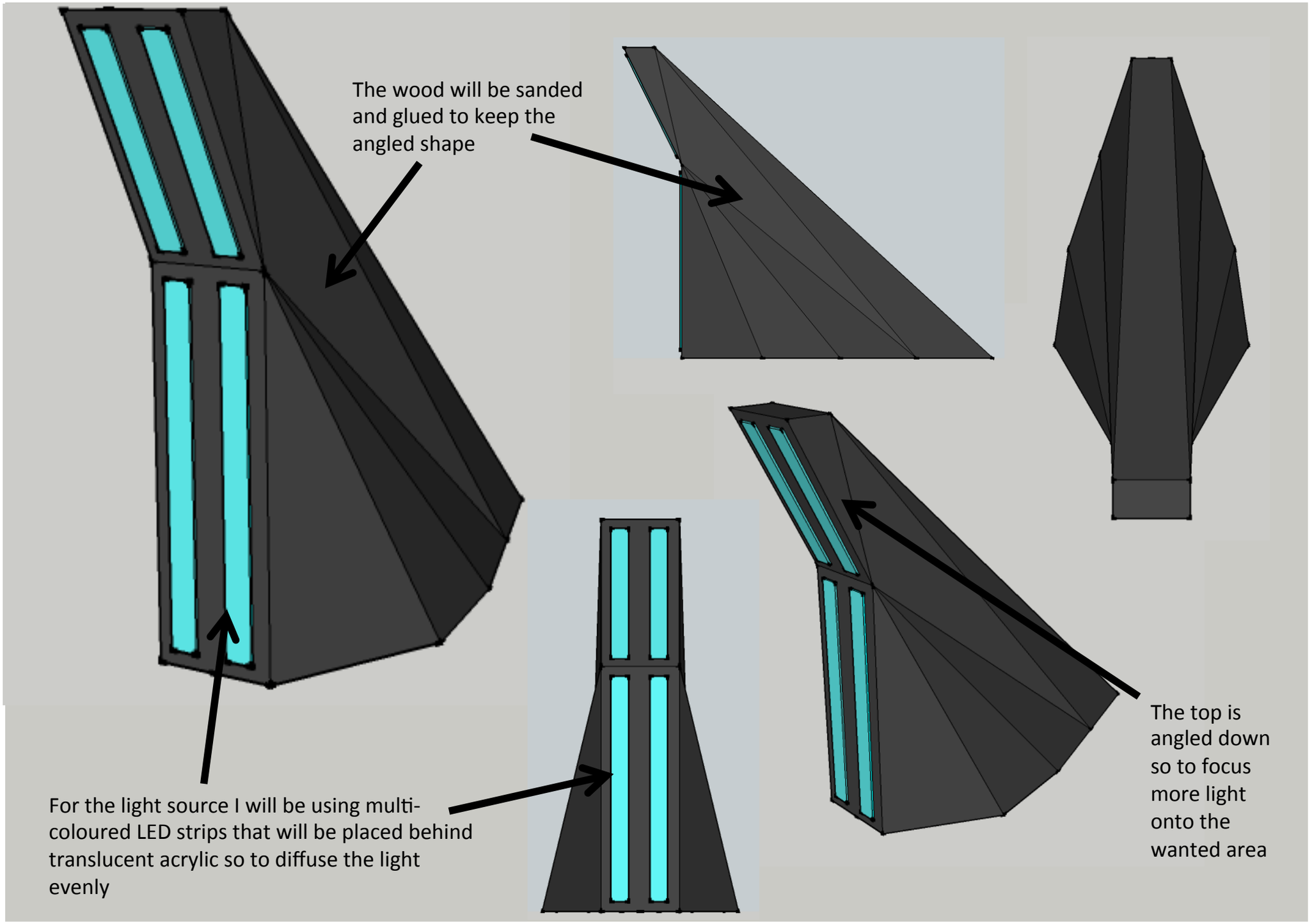


Repurposed Ledberg light from Ikea that I used for my product disassembly

Flaps attached with glue from a hot glue gun

An improvised stand as I have not yet designed a stand

Developed Idea 2



Developed Idea 2

Why I chose this design

- I really liked this design with all the sharp and interesting angles, I have modelled this off of a pyramid or triangular prism and finished it with four strips of LED's, I also want to challenge myself to make this design work and look professional.

Materials

- The design will be made from a coloured acrylic to make it look professional and appeal to a wider audience or wood finished with a charred look.
- It will then be accurately sanded and joined with an adhesive to keep the sharp angles.

Electronics

- All of the electronics will be in the base of the design which can be removed to inspect and fix the electronics.
- The LED's will be behind a sheet of thin, translucent acrylic to let out light and make it not patchy.

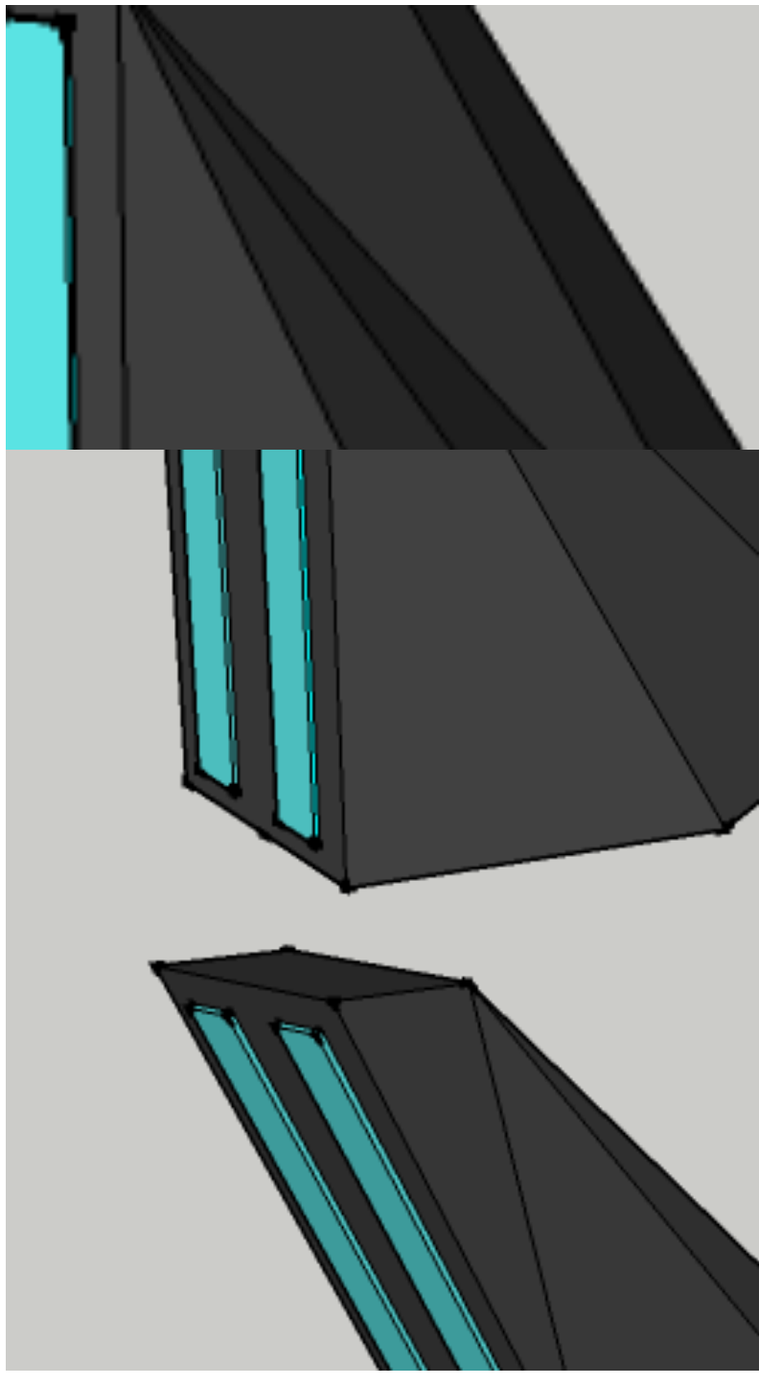
Size

- The final product should be about:

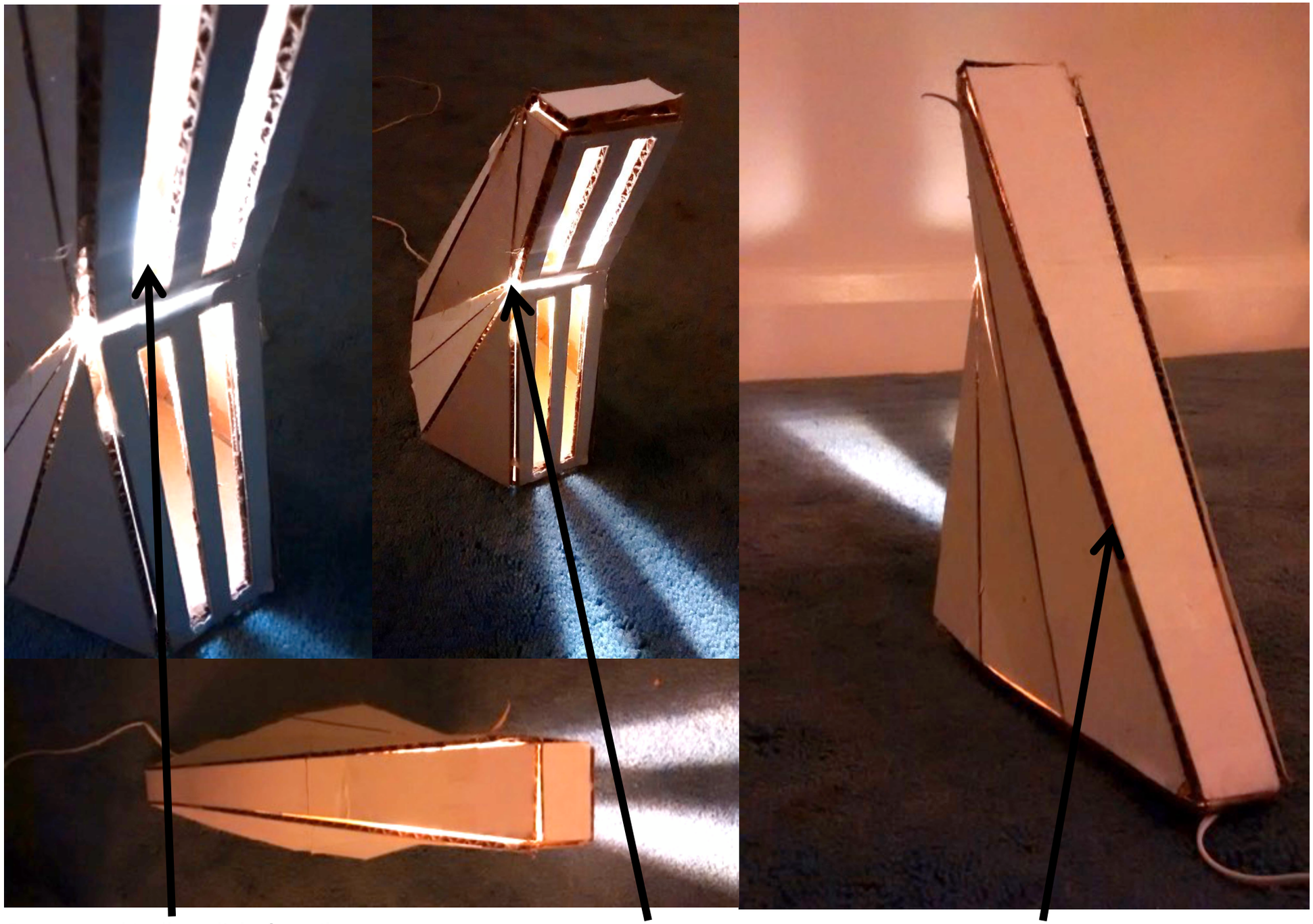
  200mm x 100mm x 200mm

How it will be flat packed

- The unit will come with all of its individual parts and detailed instructions on how to assemble it using only adhesives and information as to where to buy more adhesives.



Developed Idea 2 - Card Model



Repurposed Ledberg light from Ikea that I used for my product disassembly

Shows a weak spot where lots of light can be lost

All the sides were joined by tape at first then I used a glue gun to make secure joints

Client Feedback

Evaluation

This is useful feedback as it gives me a guideline as to what is required. Designing the stand and developing my film light further.

This feedback also tells me how I will make the product, not using the laser cutter but instead cutting it all with hand tools.

Furthermore, this feedback tells me the function my client wants the stand to have and that I need to find a way of adapting my design so that it can seamlessly change form being a desk lamp to being an up light.

Final Idea

Why I chose this design

- I really like the look and purposes of studio film lights, with all the different shapes, sizes, styles and brightness's. One way I will make this unique is by making the product predominantly out of wood and giving it a rustic, possibly charred look similar to that of an old wine crate.

Materials

- I will make the design mainly from ply wood as it is a relatively cheap wood compared to real hard or soft wood but has a nicer finish than the relatively very cheap woods, MDF and Chipboard.
- I will use translucent acrylic also in the project to form filters to change the colour of the light emitted from the unit, similar to what is used in a real studio light.
- I will use a blowtorch or multiple coats of wood stain to give it the distressed look that my client desires.

Electronics

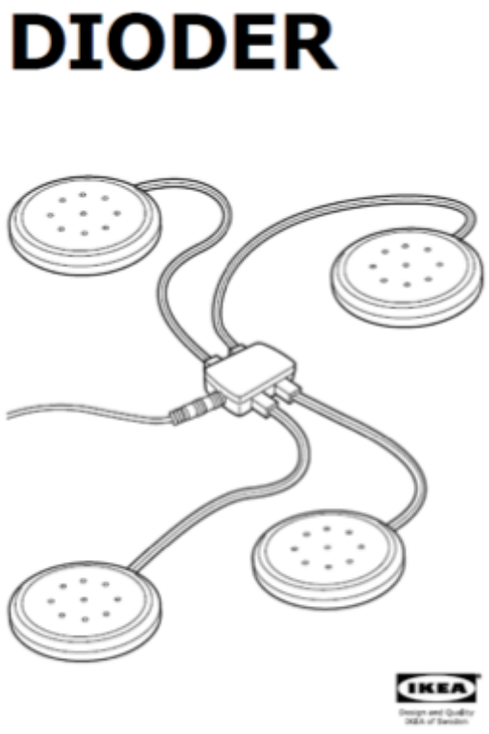
- All of the electronics will be at the back of the unit behind a central piece of wood with only the light sources and a little bit of the wires connecting to the light sources on show; this is to protect the user from electric shocks but also make it easy to get to encase there is a malfunction and an electronical part need to be replaced.

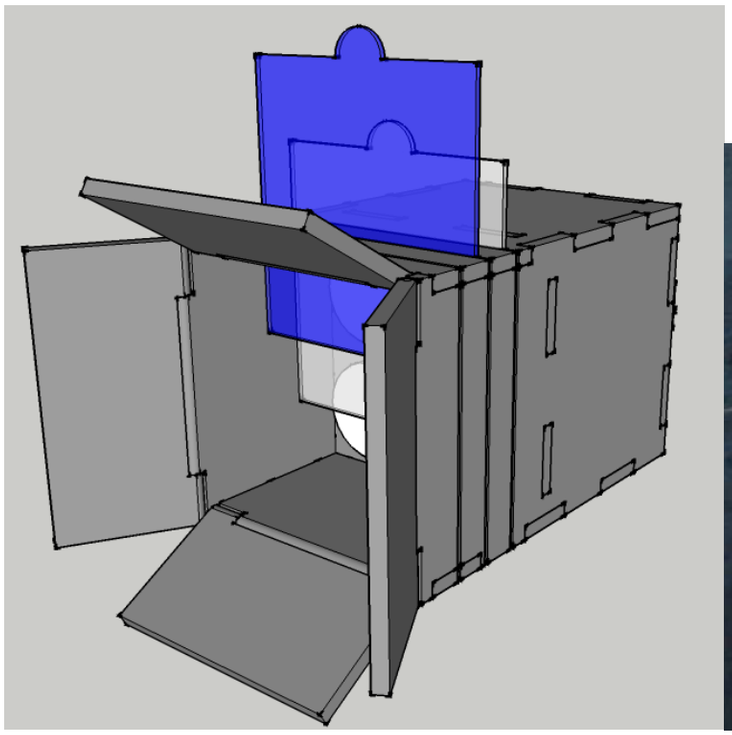
Size

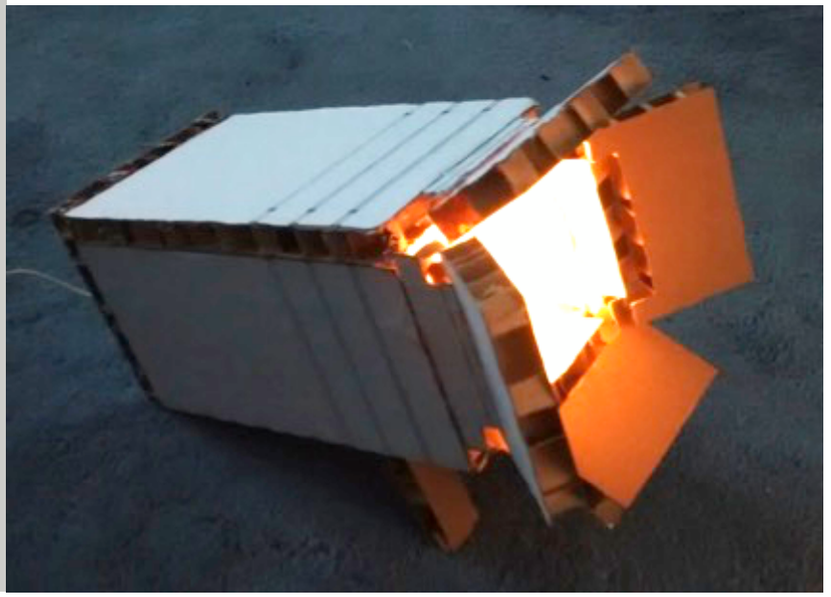
- The main box will be about 20cm x 15cm x 15cm
- The flaps will be about 1cm x 7cm x 15cm

How it will be flat packed

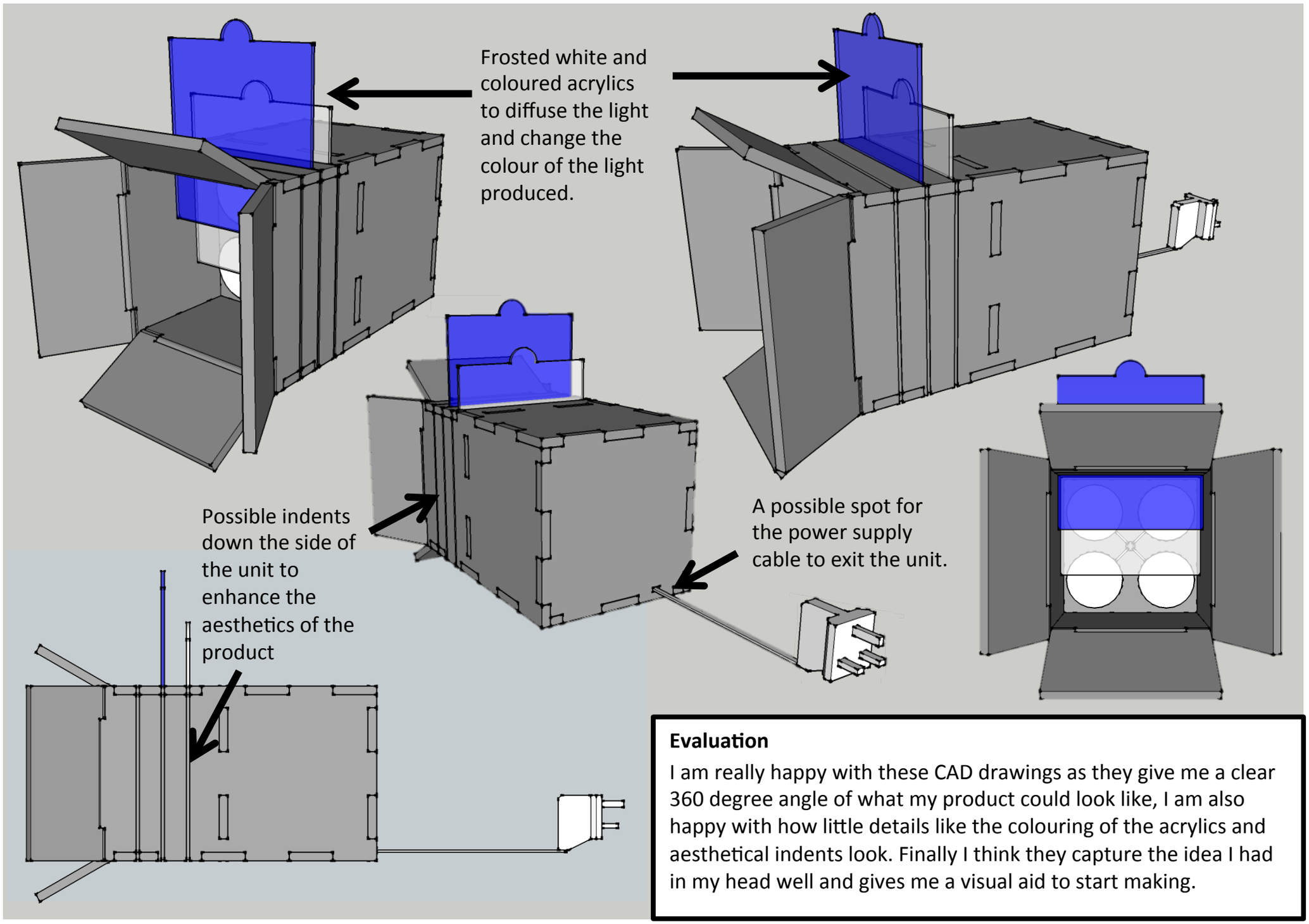
- The main box will be joined using finger joints and adhesive, making a package about 20cm x 15cm x 10cm
- It should be about the size of a small parcel that can be easily shipped, but it should have enough padding inside to fully protect all the pieces of the product.







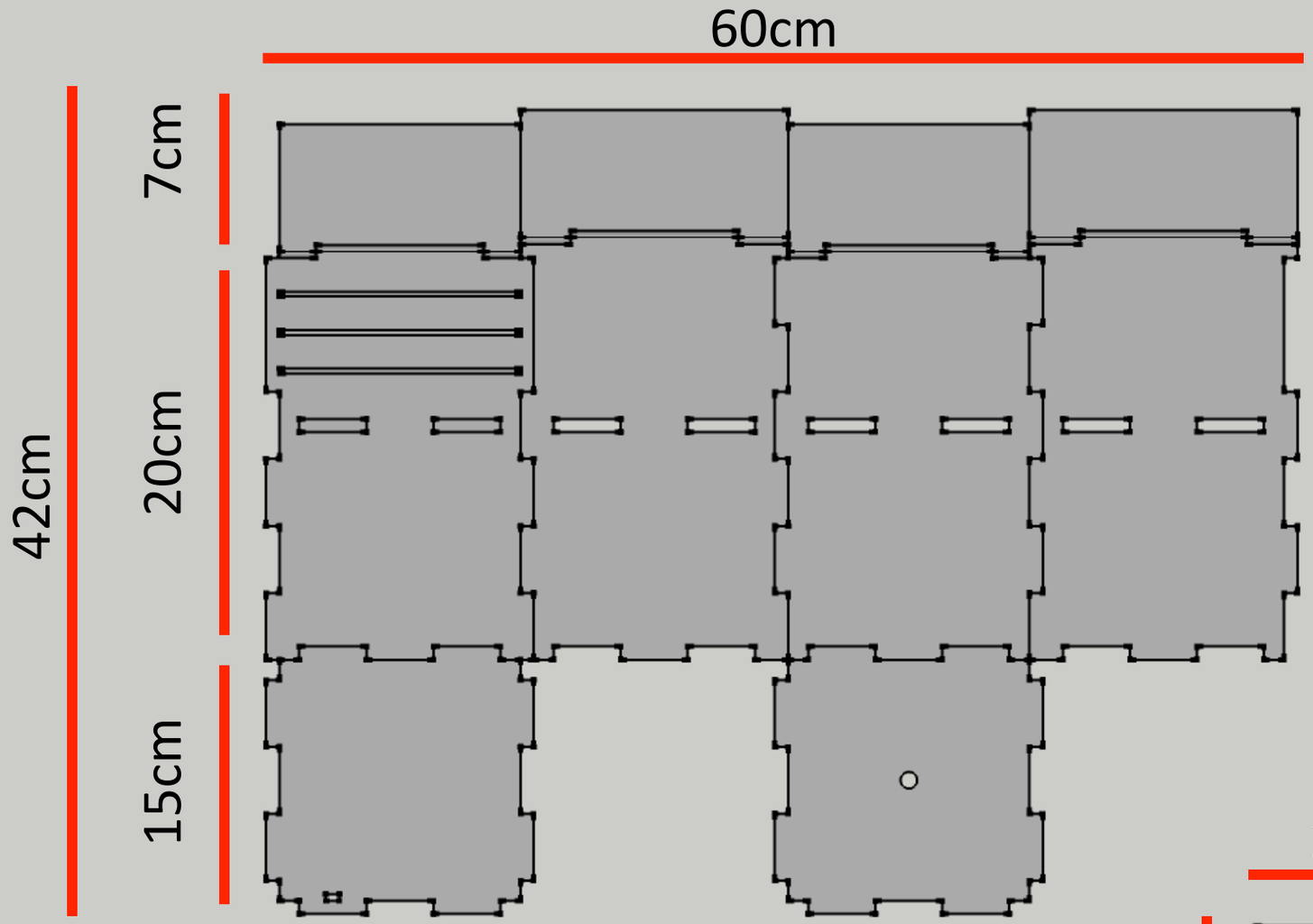
Final Idea Pictures using SketchUp



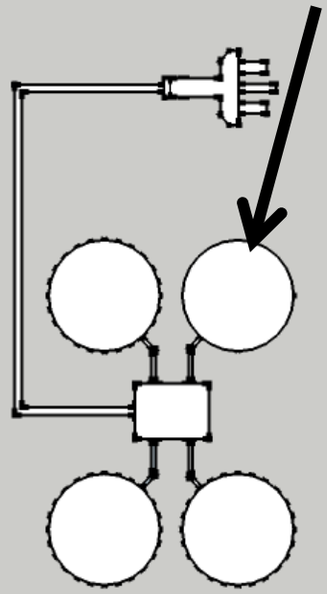
Evaluation

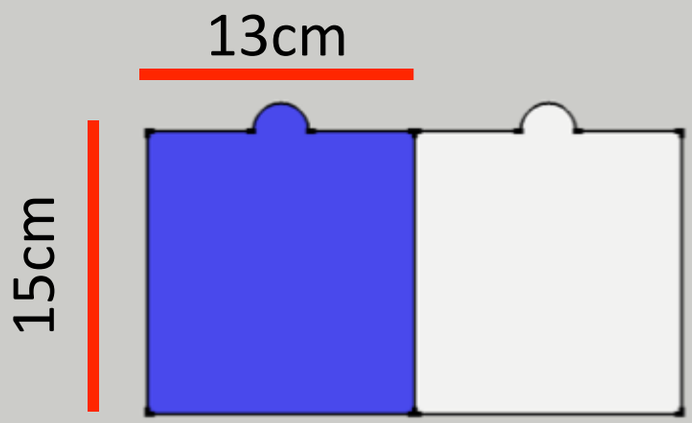
I am really happy with these CAD drawings as they give me a clear 360 degree angle of what my product could look like, I am also happy with how little details like the colouring of the acrylics and aesthetical indents look. Finally I think they capture the idea I had in my head well and gives me a visual aid to start making.

Final Idea Parts using SketchUp



Dimensions of the Dioder LEDs are:
Diameter: 59mm
Thickness: 6mm



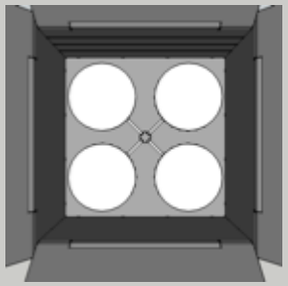


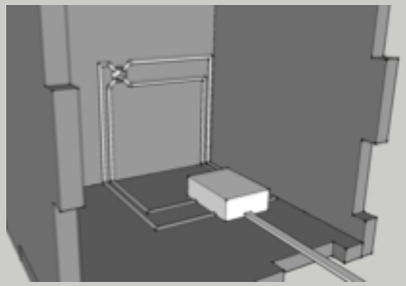
Evaluation

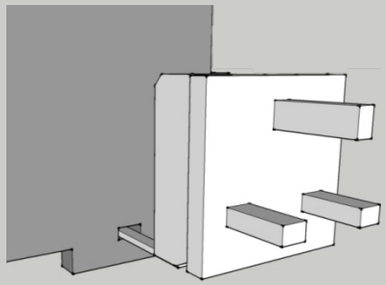
These CAD drawings combined with the previous page are extremely useful for showing to the client what their lamp will look like and the initial thought on dimensions.

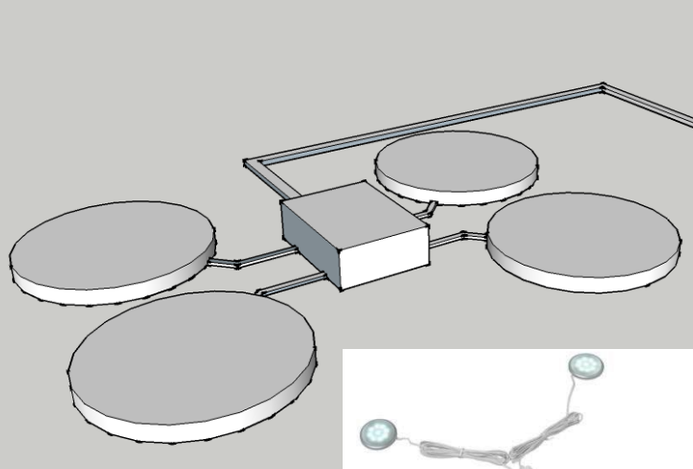
These are possibly more useful when making the product as it shows all of the parts I need to cut in order to have a finished product

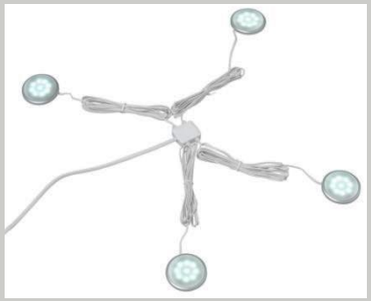
Final Idea Pictures - Electronics

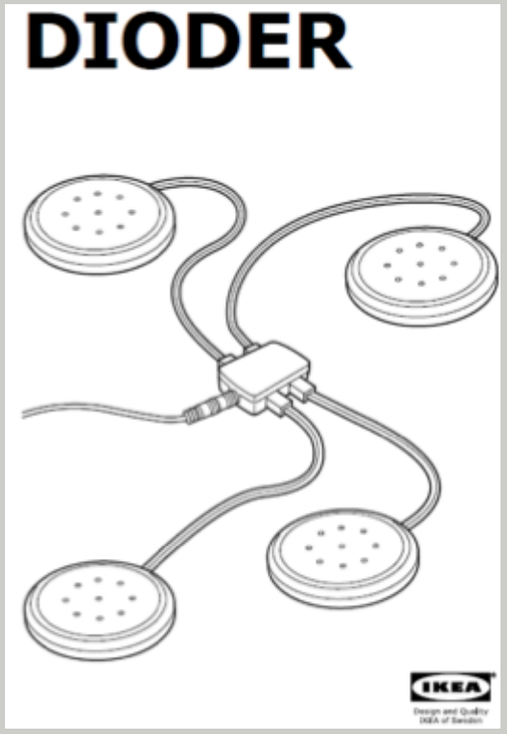












Cost - £20

For my final lamp I will be using the IKEA product 'DIODER LED multi-use lighting, white' which is a modular lamp with four light sources with each light source containing 9 LED's.

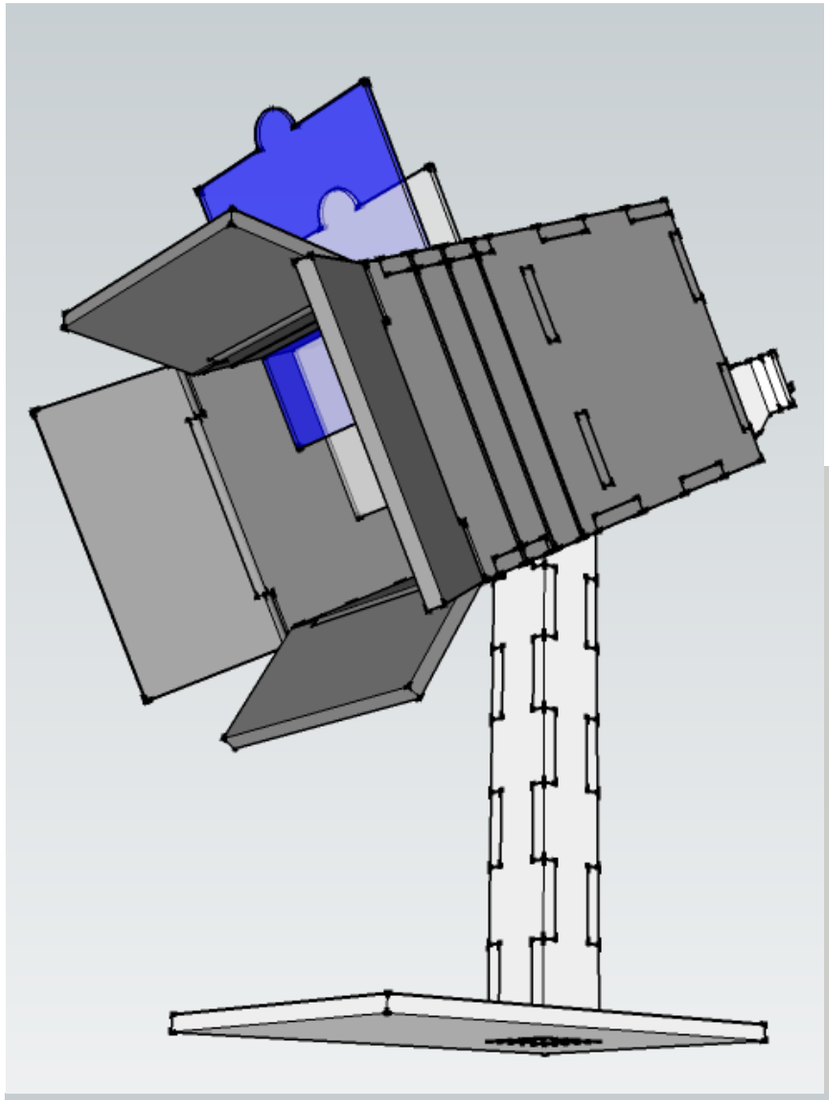
I decided to use this as I am not skilled enough at electronics to create my own matrix of LED's and circuit board and so I can focus on making my design flat packed and design my own instructions booklet and packaging.

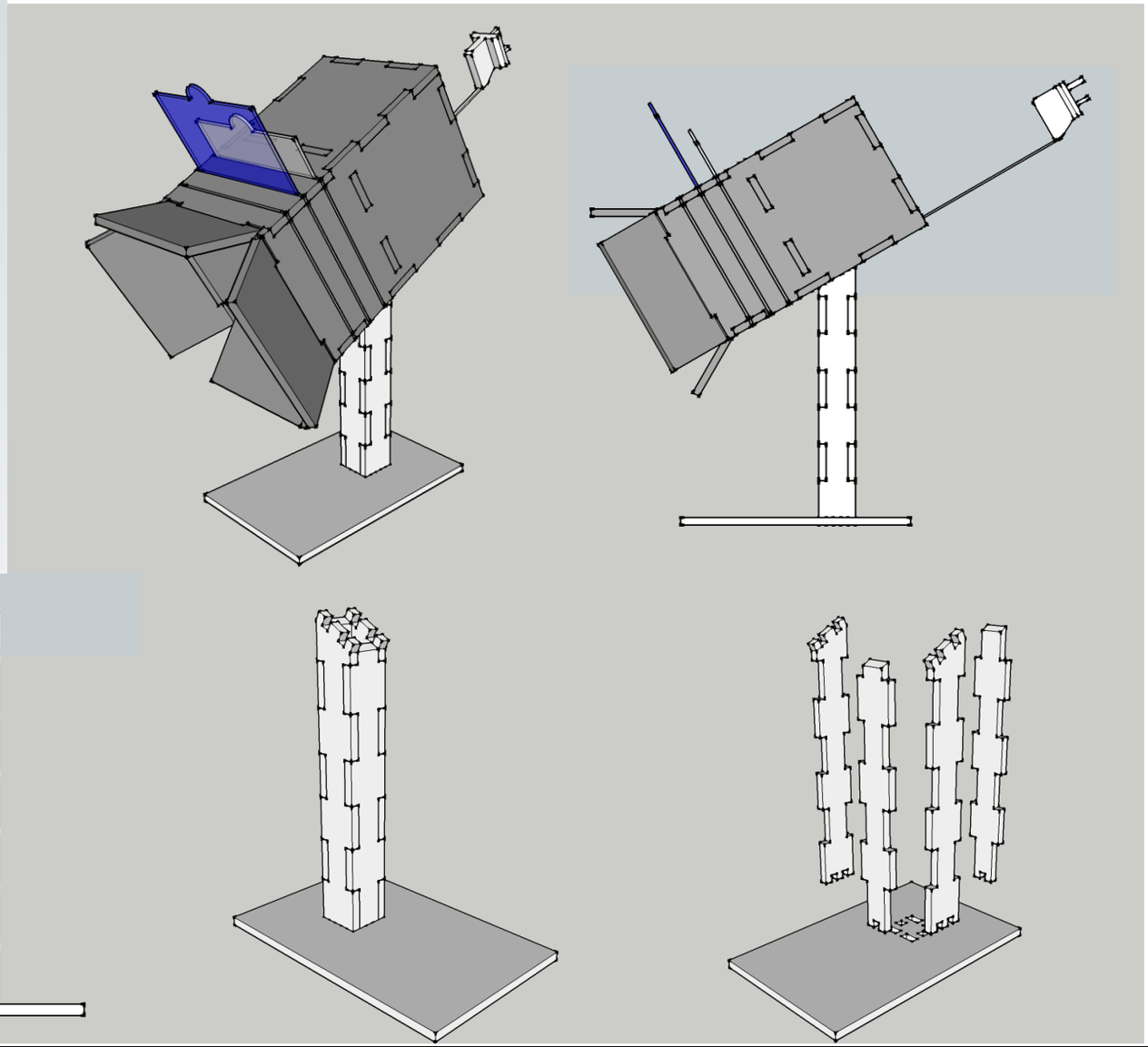
This lamp can also be easily flat packed as the light sources are very thin and all of the parts are separate from each other with the largest component being the plug.

My lamp will comply with British Standards as I will not tinker with any of the electronics and keep it as a sealed safe unit. I will simply attach it to my design.

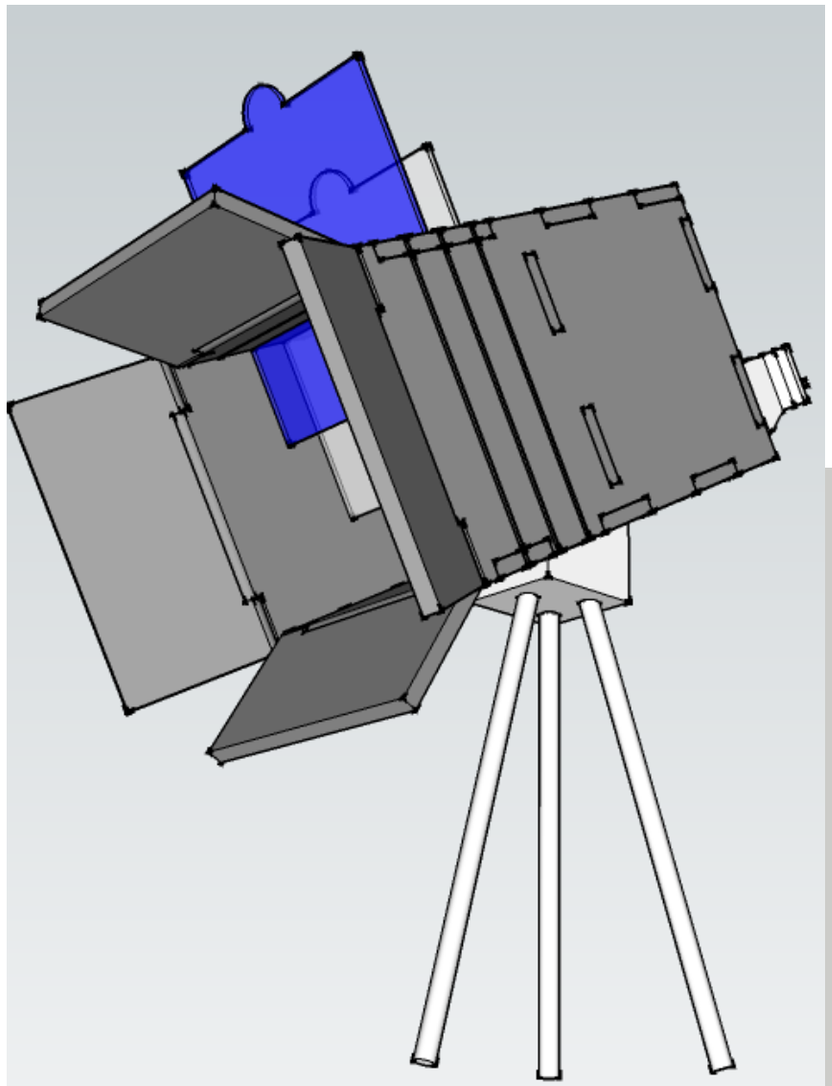
Initial Stand Idea 1 using SketchUp

- This is a robust stand idea that is designed not to break after one drop.
- It is a stable design with the wide base and thick column connecting the base to the main box
- It is also good as it could contain the power supply cable instead of it coming out of the back of the main box.
- It will use strong finger joints similar to that of the rest of the unit to keep uniformity



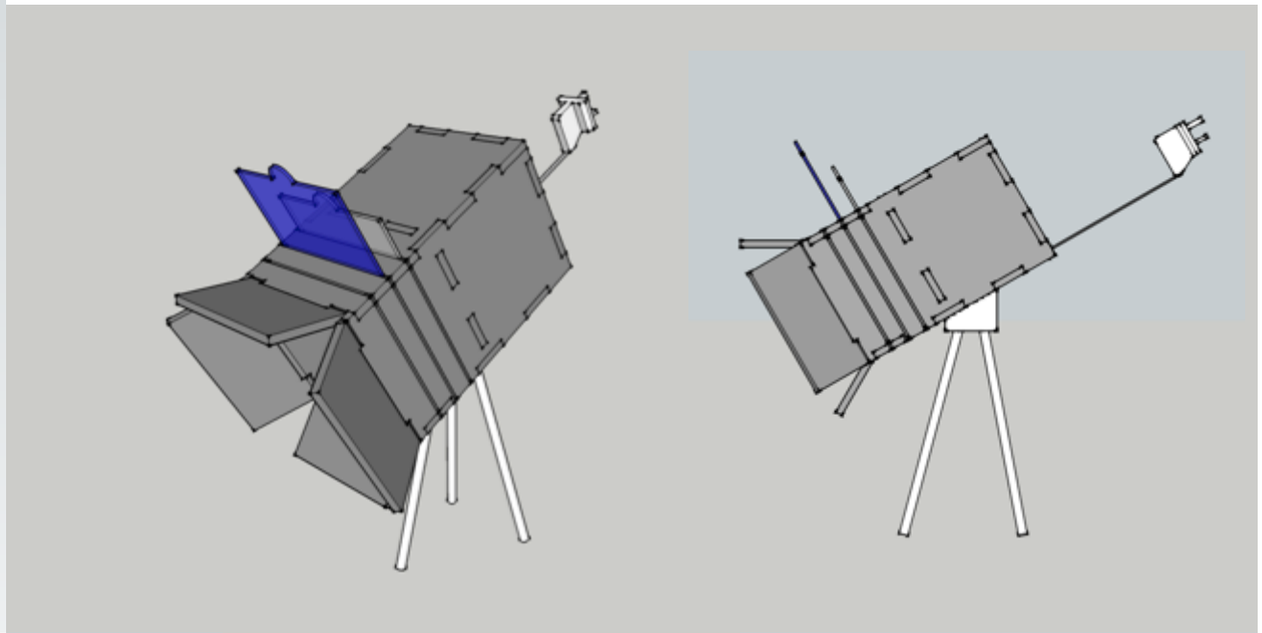


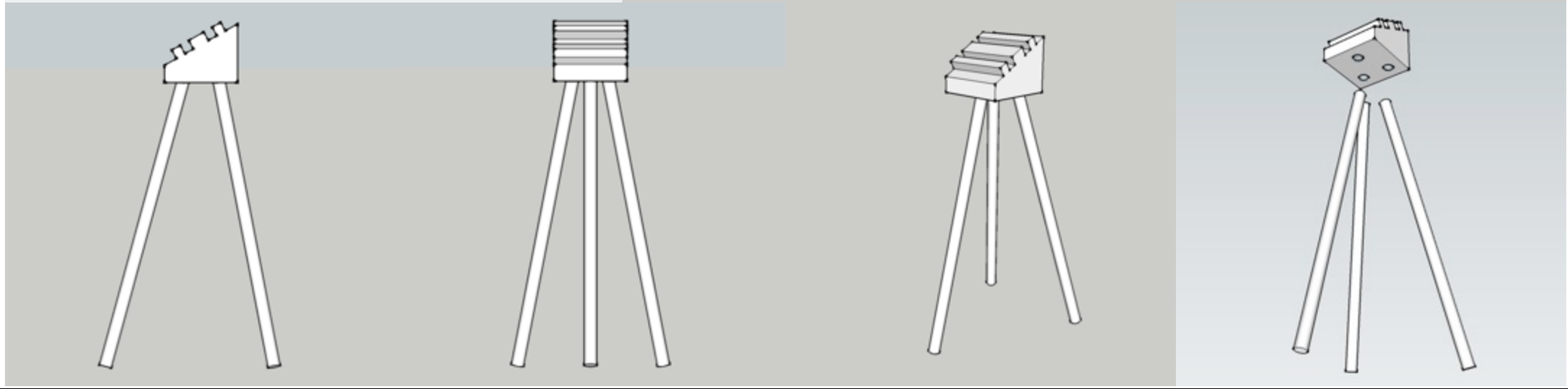
Joseph Sauer, Centre Number – 14737, Candidate Number – 1474



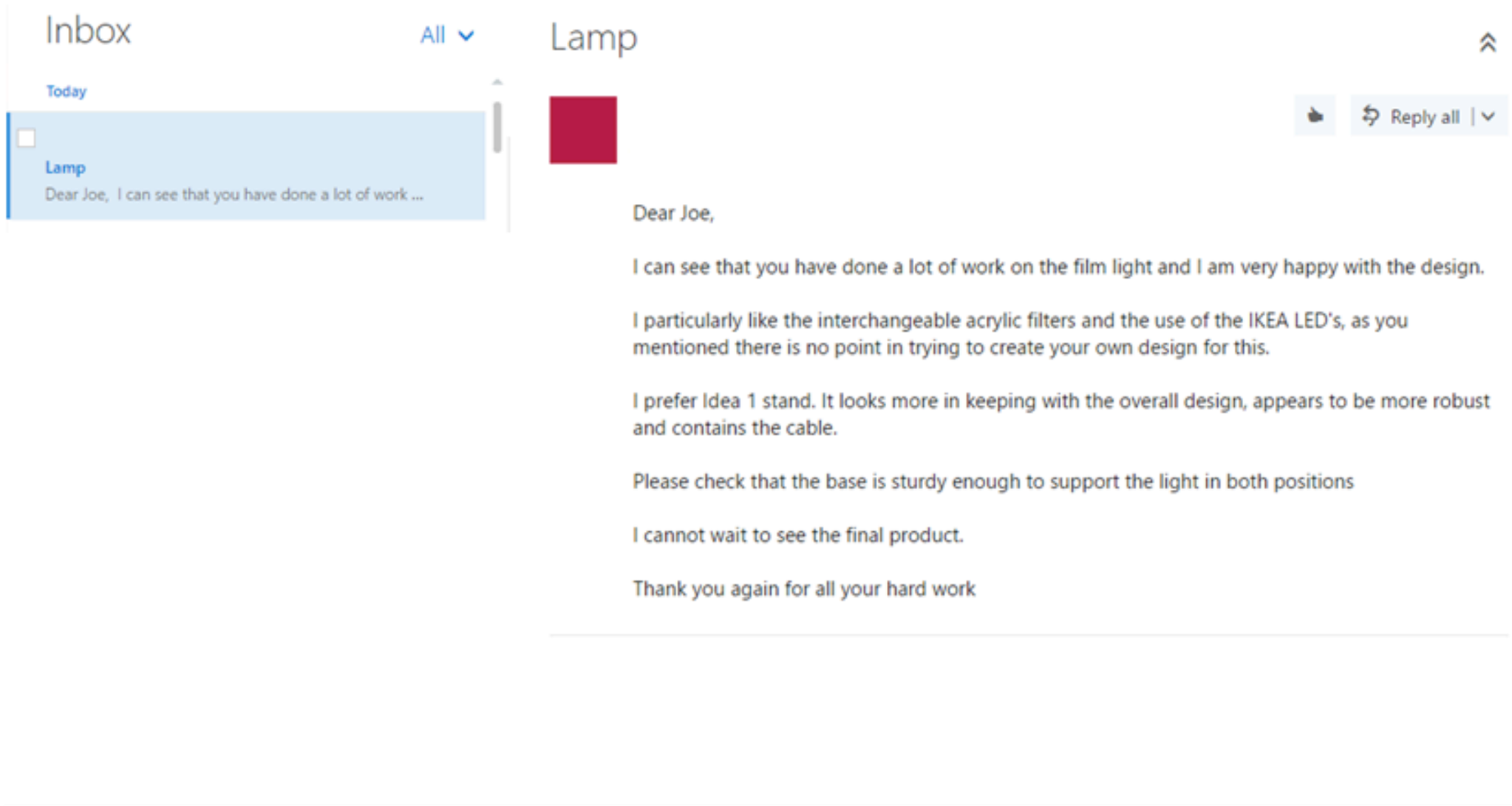
Initial Stand Idea 2 using SketchUp

- This is the weaker of the two designs but should still be able to survive a few knocks
- It is a stable design with three legs which means that all three will be on the table and will be less likely to topple
- It is a similar design to that of a traditional tripod stand with the three thin legs
- This design will be a lot smaller than the first design, reducing the size of the overall packaging, saving money on shipping





Client Feedback



Evaluation

I am pleased that my client likes the design and agrees with me that I do not need to design my own LED matrix.

I need to do more work on the design of the stand and base to ensure that it it strong enough for my client.

Ergonomics

Definition :-

Ergonomics (from the Greek word ergon meaning work, and nomoi meaning natural laws), is the science of refining the design of products to optimize them for human use. Human characteristics, such as height, weight, and proportions are considered, as well as information about human hearing, sight, temperature preferences, and so on. Ergonomics is sometimes known as human factors engineering.

- My lamp will be placed on a table about a meter high. It will therefore have to be designed so that all of the features work best when it is at this level but also work well at other heights.
- The lamp will have a back that can be taken off easily so that the components and electronics can be reached and 'tinkered' with if necessary.
  - The LEDs must also be easily accessible if one was to stop working and needed replacing.
- The acrylic sheets in front of the LEDs must be easy to remove and put in.
- The lamp must be lightweight and easy to transport when fully assembled.
- The main body should detach from the stand with ease and either put in the up or down lighting position with no strain on the user.
- The lamp must also be easy to assemble using pieces that are large enough to be handled and not too large that they become uncomfortable.

Evaluation

This is useful research to have done as it has opened my eyes to how the product need to interact with the user and how it should be easy put together with no really small or really big parts.

It has meant that I have revisited my design and changed the dimensions to suit that of an average human.

Risk assessment

Risk	**How to minimise risk**
Fret Saw	Fret Saw
• Cutting hand on the sharp blade	• Always keep the guard down and hands away
• Pieces flying off into eyes	• Always wear safety goggles
Mallet	Mallet
• Hitting hand	• Keep hands away from area you are hitting
Drill (Pillar drill)	Drill (Pillar drill)
• Cutting hand on spinning drill bit	• Always keep the guard down and hands away
• Pieces flying off into eyes	• Always wear safety goggles
Sand paper and wood files	Sand Paper and wood files
• Graze or cut skin on rough surface	• Sand away from body, hands away from paper
Stain	Stain
• Toxic fumes	• Use a well ventilated area
Laser cutter	Laser cutter
• Toxic fumes – especially with acrylic	• Let fumes ventilate out before opening
Craft knife	Craft knife
• Very sharp knives	• Use safety ruler when cutting
Wood	Wood
• Splinter into hand or face	• Wear gloves when handling the wood
Electricity	Electricity
• Electric shock	• Do not interfere with any of the electrics
LEDs	LEDs
• Can blind eyes	• Do not look straight at the light source

Packaging - Research

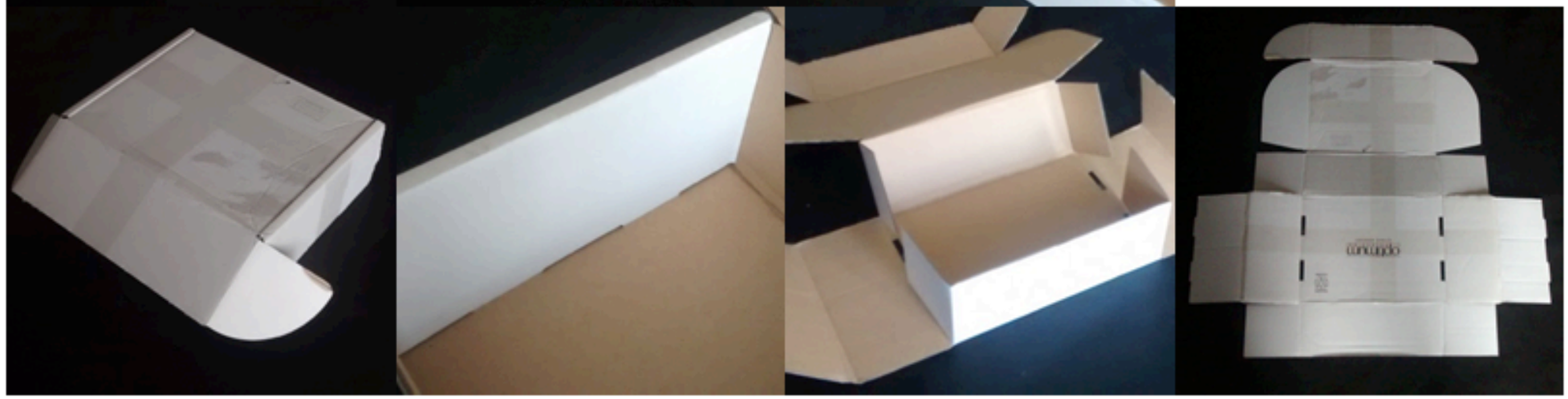
This is packaging from Liz Earle and is used to protect and ship skincare products all around the country. The packaging has to be strong enough to ensure that nothing can move around, break or spill open (Liz Earle uses polystyrene pellets inside their box to further protect).

This is a very good box for packaging, especially for mass production, using one sheet of card, utilising lots of 90 degree folds to construct a box that does not need glue or any other adhesive.

Evaluation

This was useful information to research as it gives me a basic net to work to when designing my packaging.

I especially like how this packaging solution needs no glue to function, something that I would like for my packaging

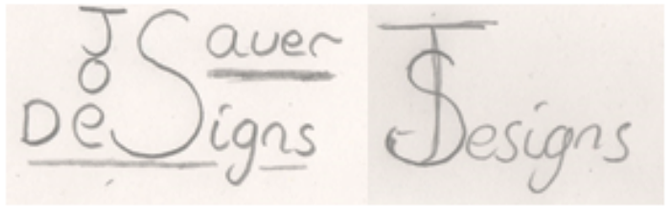


Logo Design

Initial Designs

These sketches from initial to final variations were very quick sketches that I did to come up with a simple logo to accompany the product as I thought it was necessary to have a logo

Developed Designs



Final Designs Variations

Final Designs

Final Logo Design

I further developed the ideas on CAD software (Inkscape) utilising different fonts until I found one that I liked.

(The final ideas section are my three favourite logo designs.)

Evaluation

I am pleased with how the final logo design has come out and I think my initials suit the function as a logo well.

Final Product

Why I chose this design

- I think that studio film lights are really interesting lights, with all the different shapes, sizes, styles and brightness's. I also really like the look of old wine crates that are made of wood, with a rustic, charred look. I wanted to incorporate both of these into my final design.

Price

- The price of materials ibn total was about £40, and it took over 20 hours to make.
- The cost of the lamp , I decided, is £120 as it covers the material costs, man hours time and gives a little profit.

Materials

- I have used ply wood predominantly in this product, I then used wood stain to finish product, giving it a rustic look, I then used translucent acrylic sheets to make filters that will change the colour of the light emitted from the lamp.

Size

- When it is in its packaging it is : 12cm x 45cm 24cm
- When it is built in the down light position it is : 54cm x 41cm x 28cm
- When it is built in the up light position it is : 62cm x 41cm x 28cm

CAD software

- For this project I used 2 CAD software's for the most part:
  - SketchUp Make – to draw the 3D models of the product.
  - 2D Design – to draw the net of the product that could then be used to laser cut.

Making

- The wood was laser engraved, then cut using the fret saw, it was then sanded down to the correct size and finally stained.
- The acrylic sheets were laser cut.

Joining

- It was all joined together using finger joints so that it can be built then disassembled quickly and easily.
- I did not use any adhesives as then it could not be disassemble and be flat packed.

Staining

- I used 3 coats of wood stain on all of the wood pieces letting it dry in between coats, this was so I could get the best finish on the product.

Filters

- These were made from translucent acrylic that was laser cut, these can be taken in and out of product extremely easily and change the colour of the light emitted and diffuses the light so to not blind the user.

Packaging

- This packaging was made to protect the light when it is shipped to the customer and holds all of the pieces compactly so nothing cam move around, reducing the possibility of it breaking.

Instructions

- These instructions are supplied with the product, they have no writing in the step by step making so that it can be used by any body all over the world, reducing the cost if it were to be mass produced and sold.

Promotion Leaflets

- This is to attract customers into buying my lamp if it were to be mass produced.

Final Product - SketchUp

Evaluation

I think that these images have come out well and realistically portray what my design will look like.

For these CAD drawings I used SketchUp make software.

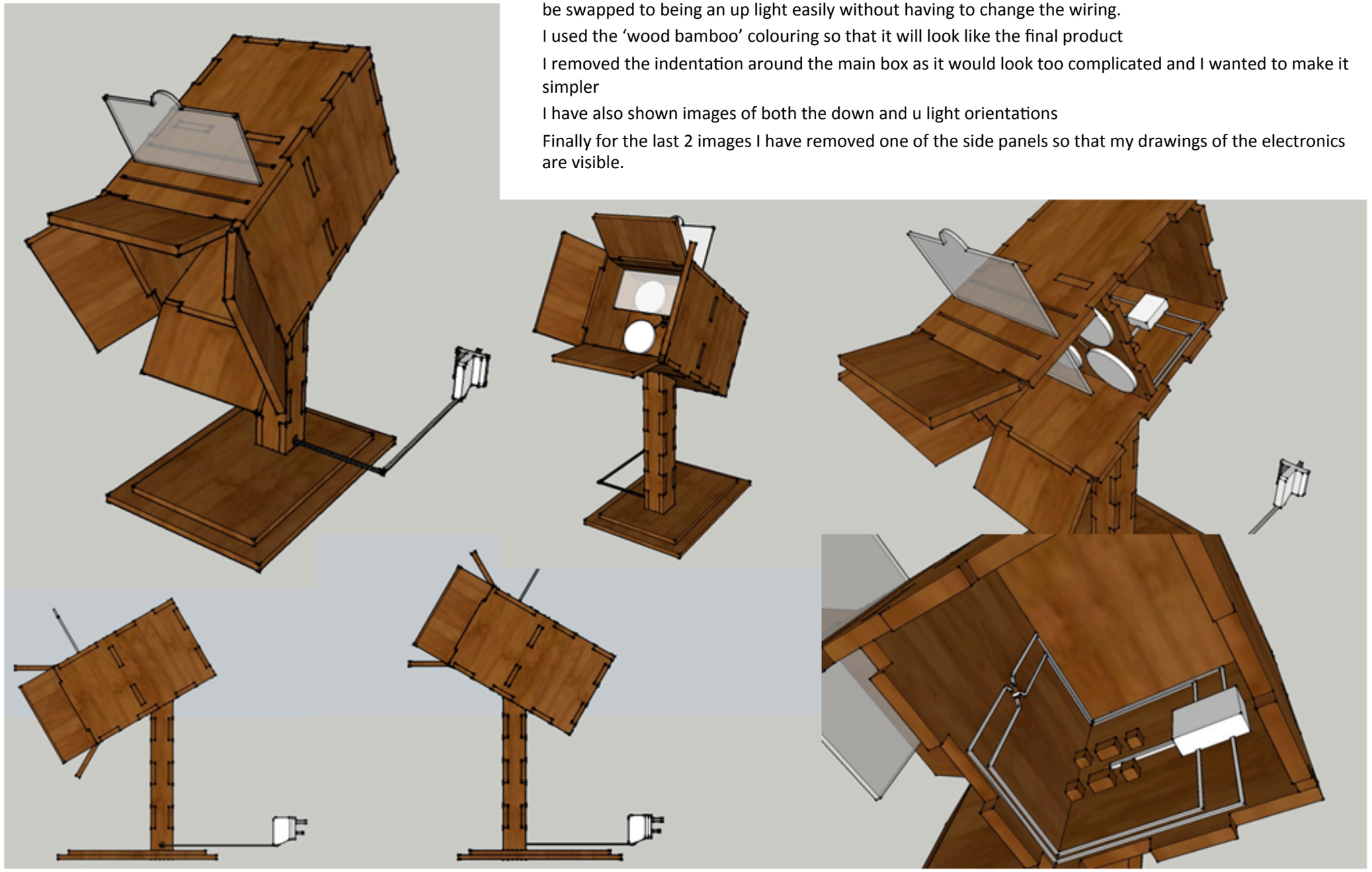
I have changed the design of the base to suit my clients needs and have decided to keep the wire coming out the side of the pillar instead of having a groove in between the two base pieces so that the design can be swapped to being an up light easily without having to change the wiring.

I used the ‘wood bamboo’ colouring so that it will look like the final product

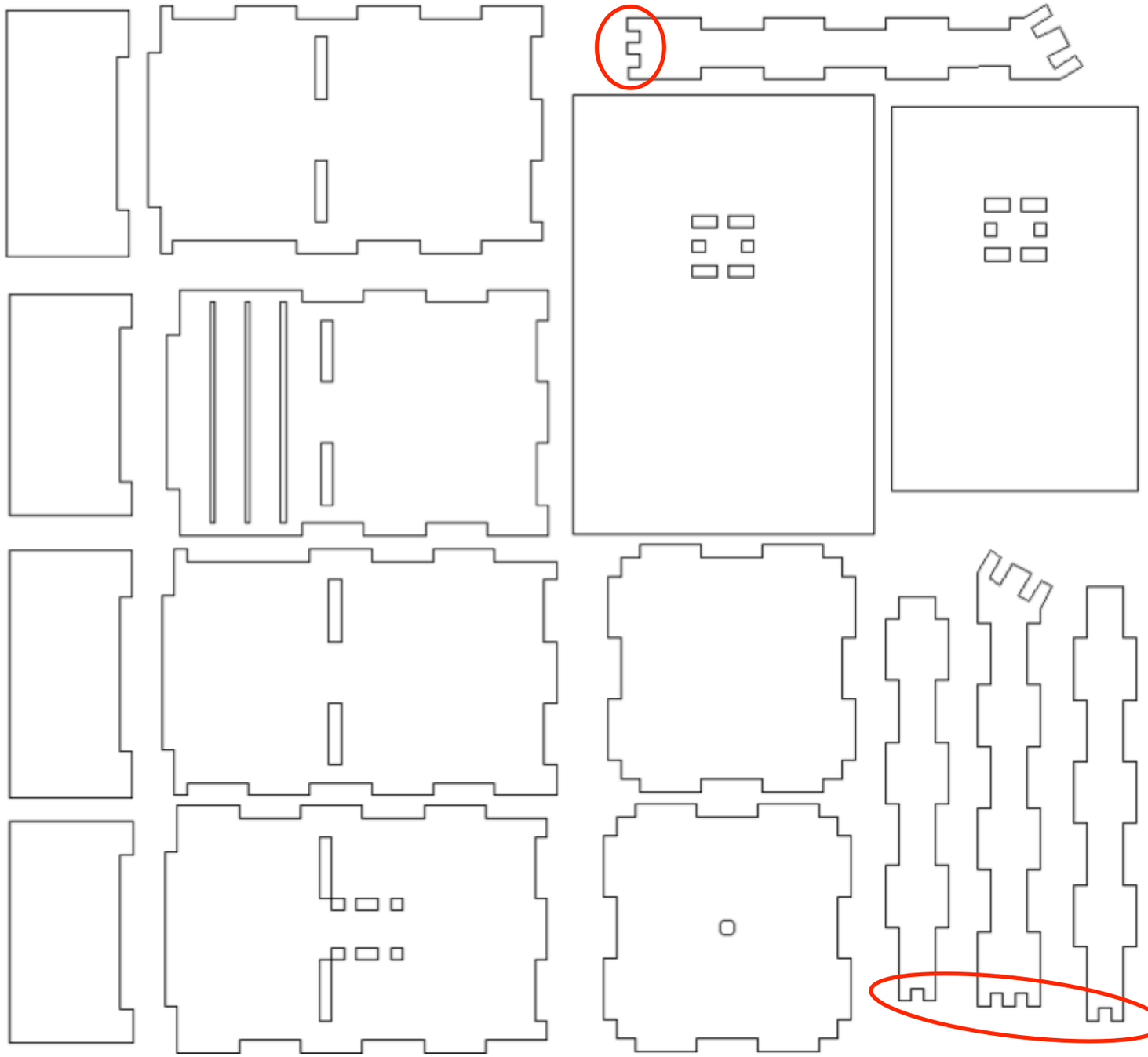
I removed the indentation around the main box as it would look too complicated and I wanted to make it simpler

I have also shown images of both the down and u light orientations

Finally for the last 2 images I have removed one of the side panels so that my drawings of the electronics are visible.



Final Product - Working Drawings



For my product I decided to draw it on 2D design software; this was because it would allow me to use the school laser cutter.

Even though my client asked for it not to be laser cut I thought that I could leave a millimetre border around the whole design so I could sand it down to the correct size removing the burnt exterior.

However the laser cutter cannot fully cut through 9 mm ply wood so the only thing I can use the cutter for is to engrave.

Engraving the design using the laser cutter would ensure pin point accuracy, much better than drawing the design by hand onto the ply wood where there can be huge inaccuracies.

To make the design easier to draw I designed the product for 8mm wood instead of 9mm. I then scaled the design up by 12.5% so it is designed for 9mm wood. This is why my measurements are not regular

After engraving the wood and cutting the first piece for the pillar I noticed a problem with the design, I had forgotten to extend the finger joints at the ends of the stand. To fix this problem I will cut the rest with hyperextended finger joints and I will then sand them down to size at the end

Evaluation

These drawings have allowed me to laser engrave giving me much higher accuracy.

They also show how much I have got to cut.

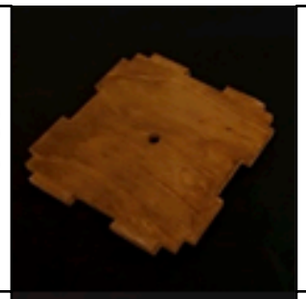
Final Product - Materials / Costing List

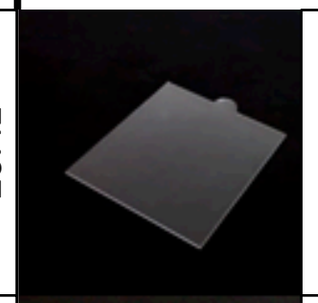
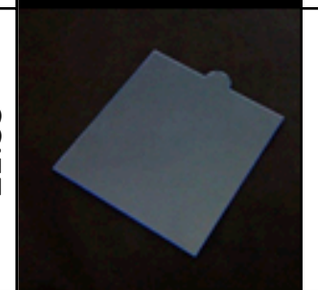
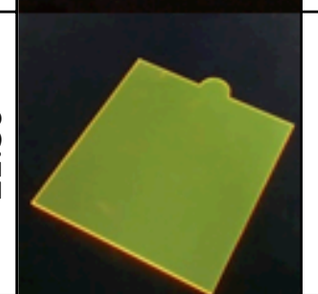
Plywood -> £76.44 for 2.9768 m^2 (1220 x 2440 x 9mm)

Source : http://www.championtimber.com/sheet-materials-and-insulation/Plywood/1220-x-2440-x-6-5mm-bb-wbp-latvian-russian-birch-plywood

Acrylic -> £5.99 per 1247.4 cm^2 (297 x 420 x 3mm)

Source : https://www.amazon.co.uk/Colour-Perspex-Acrylic-Plastic-Material/dp/B00LHSLUGC/ref=pd_sim_86_2?ie=UTF8&dpID=41t%2BB1hXggL&dpSrc=sims&preST=_AC_UL160_SR160%2C160_&refRID=MRCR3C8R1M9MJ7RC26WF

	45 x 304 x 9 £0.35		180 x 180 x 9 £0.83		90 x 180 x 9 £0.42		90 x 180 x 9 £0.42
	53 x 342 x 9 £0.47		180 x 180 x 9 £0.83		180 x 288 x 9 £1.33		180 x 288 x 9 £1.33
	53 x 342 x 9 £0.47		90 x 162 x 9 £ 0.37		90 x 162 x 9 £ 0.37		180 x 281 x 9 £1.30
	45 x 318 x 9 £0.37		180 x 279 x 9 £1.29		180 x 279 x 9 £1.29		220 x 321 x 9 £1.81

	161 x 186 x 3 £1.44		161 x 186 x 3 £1.44		161 x 186 x 3 £1.44		161 x 186 x 3 £1.44

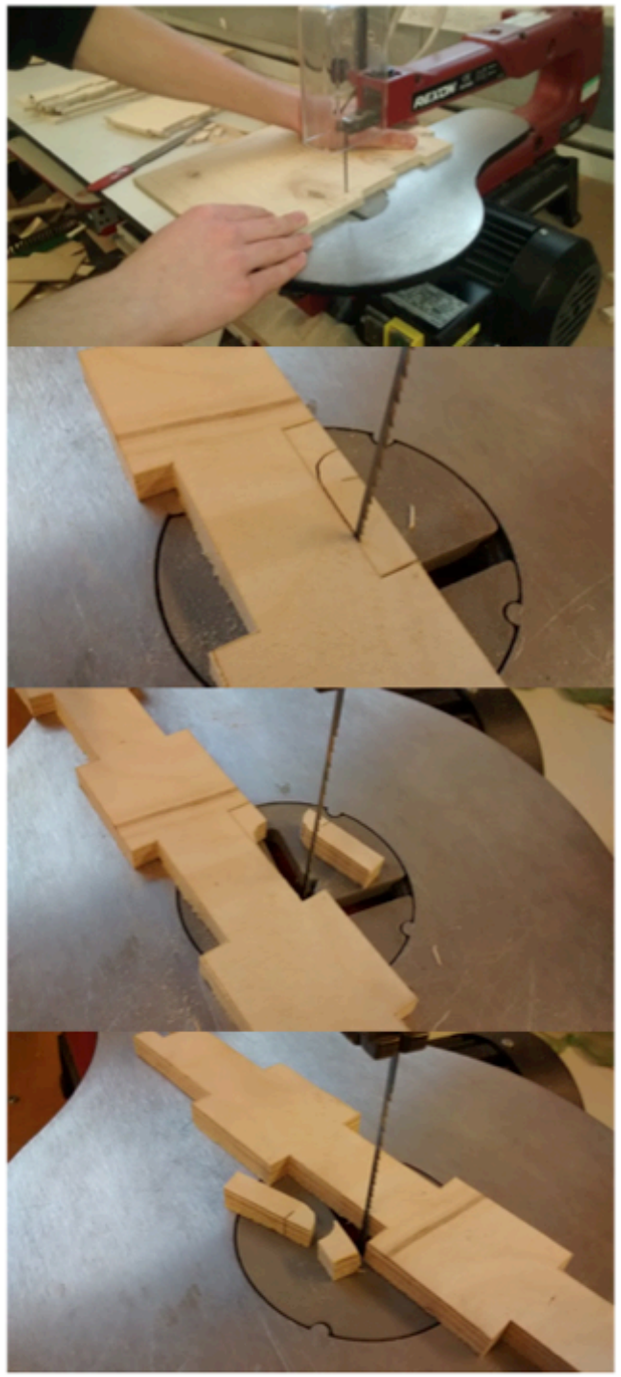
All measurements in Millimetres

Total Cost = £ 19.01

Final Product - Making Photographs

Images of my product being laser engraved and the three panels with the design engraved.

Images of how I cut out all of the finger joints, using the fret saw.



Images of all of the pieces cut out, before they are sanded.

Final Product - Making Photographs

These are the images for how I cut out all of the holes in the middle of the pieces using a small pillar drill then using the fret saw, taking the saw blade out then inserting it through one of the holes I had drilled

Evaluation – making photographs page 1 and 2

I think that the laser engraving has gone really well, giving a light outline that will be easily sanded away once I have cut the pieces. Using the cutting technique with the fret saw I managed to get high accuracy and cut all of the finger joints like this. The technique for cutting out the internal holes worked well as it meant that I didn't need any joining cuts making the product look messy, Even though it worked well it took a long time to make accurate holes and to thread the saw blade through those holes.

Final Product - Making Photographs

After cutting out all of the parts and holes I started using sand paper and wood files to sand the design down to the actual size

I then marked out all of the screw holes using the Dioder, Making sure that the wire would go straight to the hole in the centre of the piece of wood.

After I had fully sanded and marked out the design I decided to stain the whole design to give it the distressed look that my client and I wanted. I started by staining on a test piece to make sure I had the right colour, then I stained all the pieces.

Evaluation

The sanding went well but it took longer to do than I had originally expected.

The marking out of the screw holes was successful and I used a bradle to make a starting hole to so that it was easier to screw in the screws and to ensure the marks show up once it had been stained.

I did three coats of stain in total on all of the pieces with only two coats on the sides to keep the authentic ply wood look. The end product was an even stain with no patches, the stain also brought out the grain of the ply wood which added to the distressed, old wooden wine crate look.

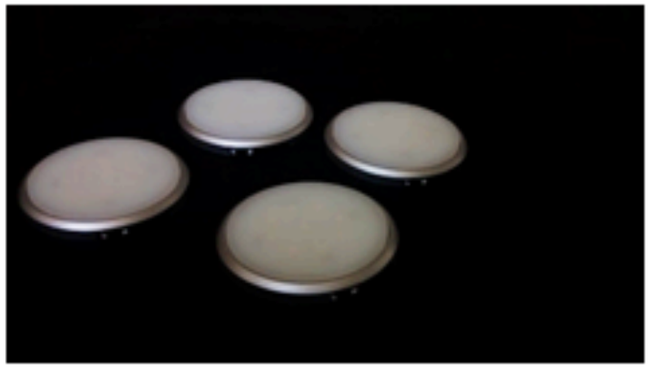
Final Product Pictures

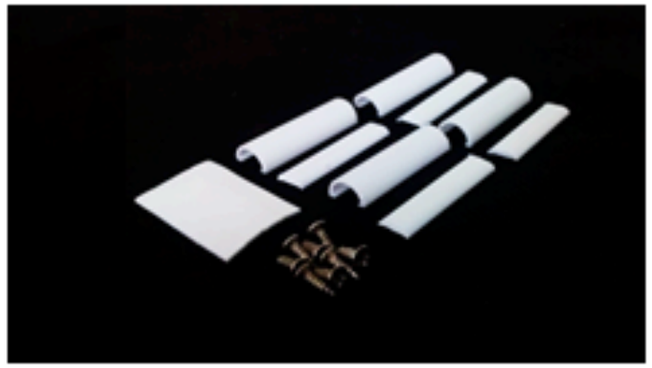
These photographs show all of the parts in the Dioder package the I brought from IKEA. I have not cut or interfered with any of the electrics on this product so to keep the European standards ‘CE’ safety symbol that is displayed on the product, this was also to reduce the risk of electrocution and malfunction.

If this was a mass produced product these electronics will be made by the factory to scale with the product so to bring the price down.

Evaluation

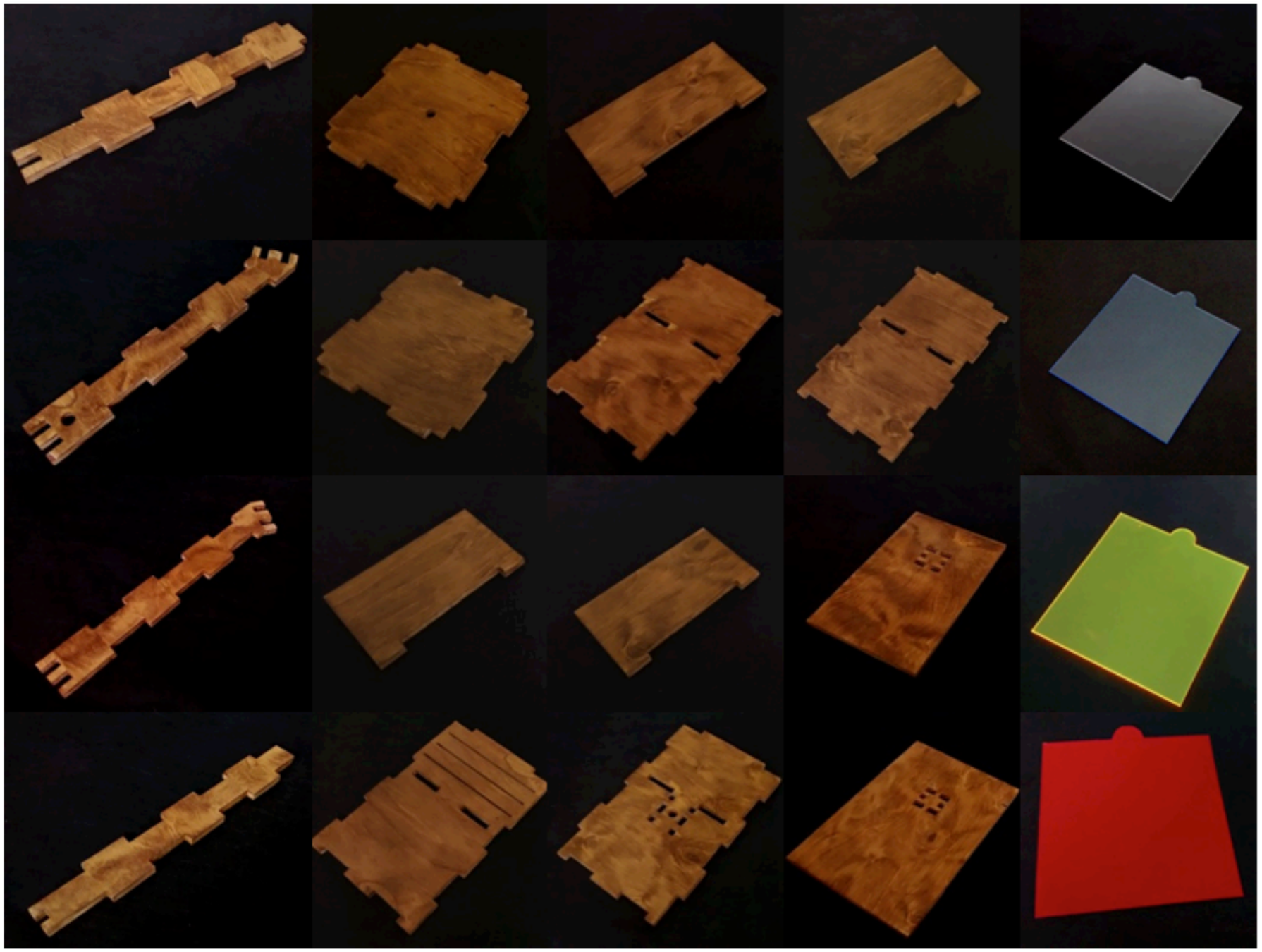
I think that these are good photographs that show every part in the Dioder package in detail and in an ordered layout





Final Product Pictures

These photographs show all of the ply wood and acrylic components present in my product, all of the ply wood parts were cut by hand and would be cut by a CNC machine if this were mass produced, the acrylic parts were laser cut and would probably be laser cut when mass produced

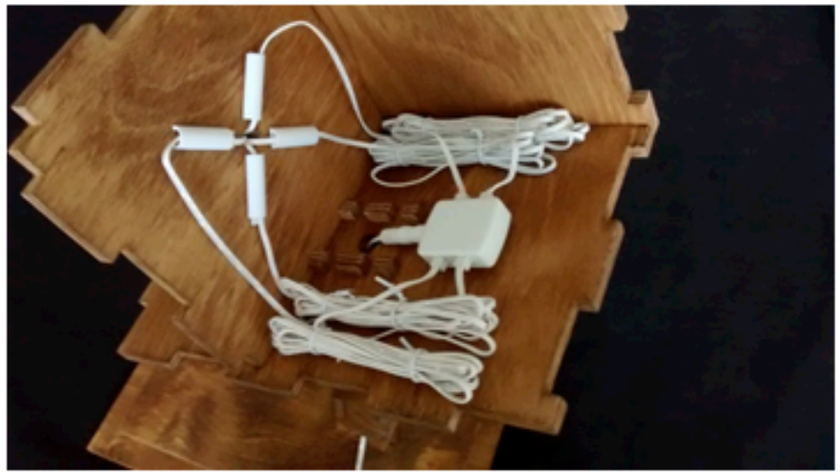


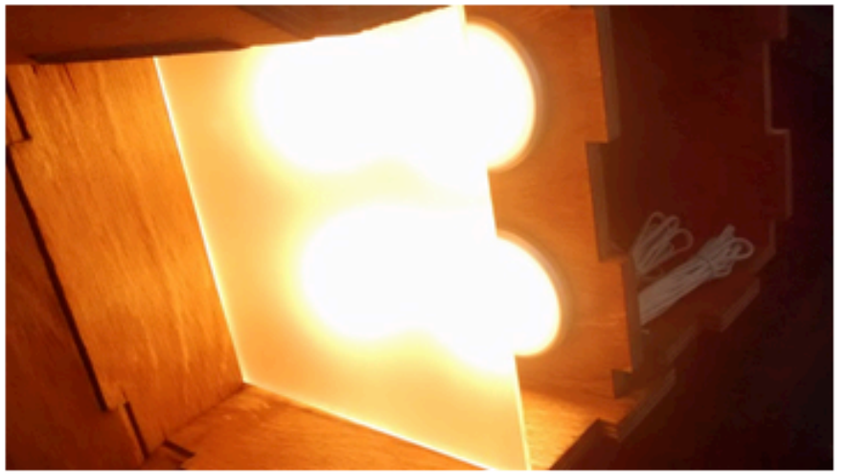
Evaluation

I think that I got good colouring with the staining on the ply wood and managed to clean the acrylics well so that you would not see the ash residue from the laser cutter.

I am really happy with the colours of all the acrylics and think that they will be able to change the colour of the light emitted from the Dioder, as planned.

Final Product Pictures





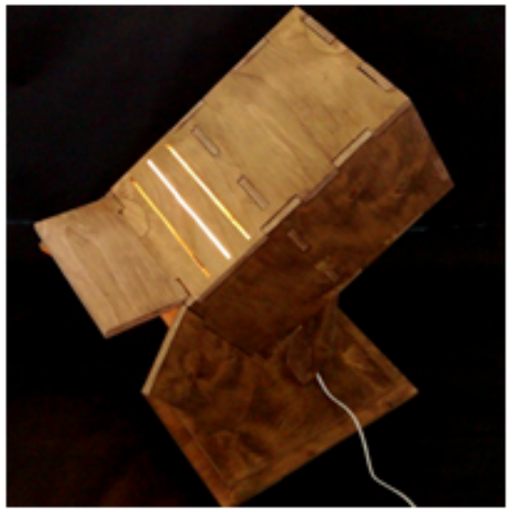
These photographs show all of the internal electronics of the product and how my client should lay out all of the wiring.

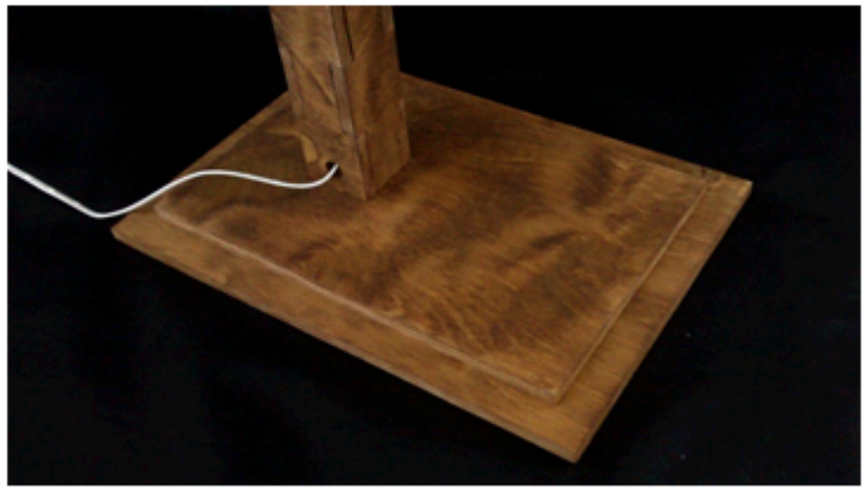
These photographs also show the brightness of the LEDs from the Dioder and how the sheet of frosted white acrylic manages to diffuse the light evenly, no longer blinding you.

Evaluation

I think that the Dioder fits really well within the product and that the diffuser acrylic works exceptionally well

Final Product Pictures





These photographs show the final product assembled in both the down and up light position just as my client had asked for.

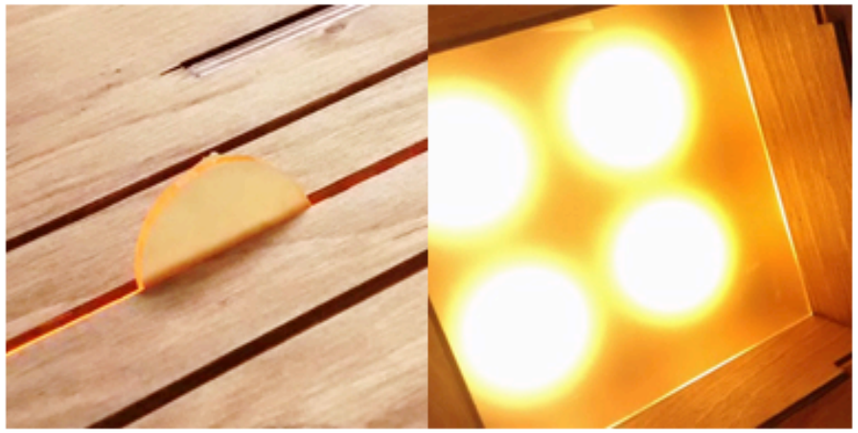
Evaluation

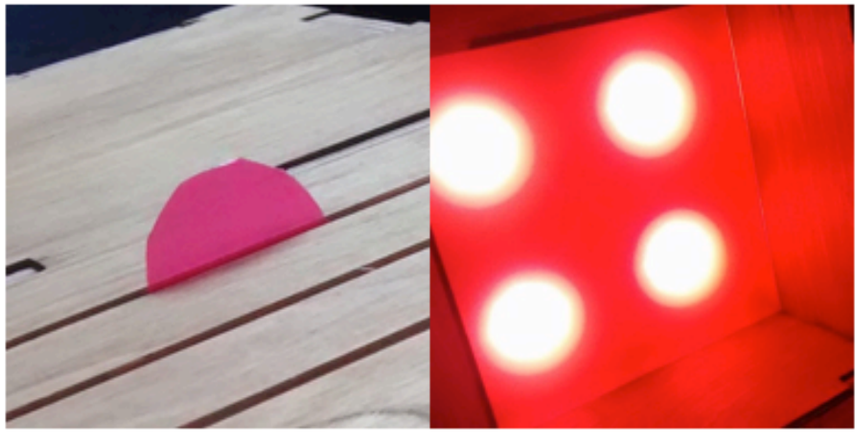
I am delighted with the final product. All of the pieces complement each other, especially the dark brown colour of the ply wood with bright warm yellow colour of the LEDs from the Dioder.

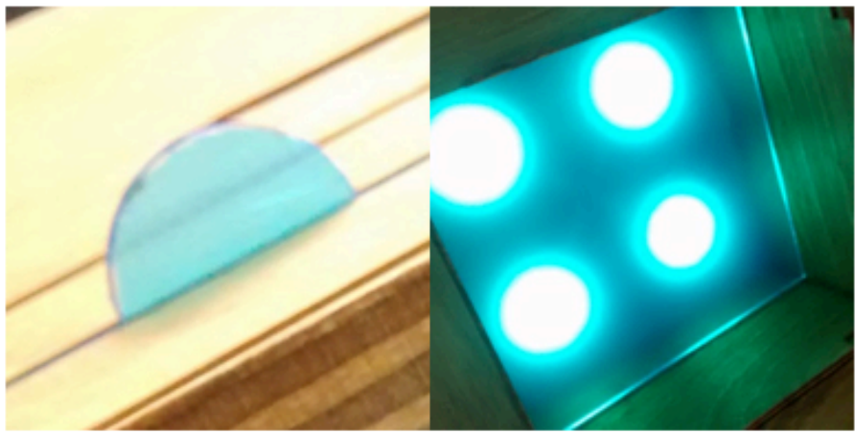
I am really pleased with the design of the stand and the functionality of it, being able to switch from up to down light works very well.

Another area of the product that I am very pleased with is that all of the joints are tight and stay together without the need for adhesives.

Final Product Pictures



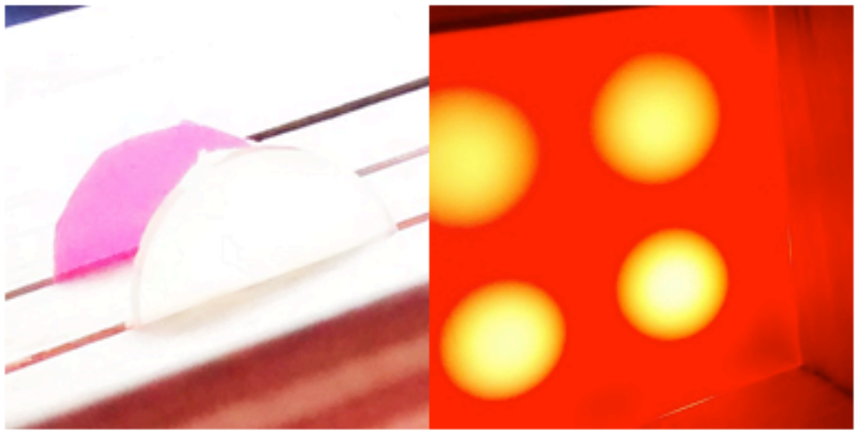


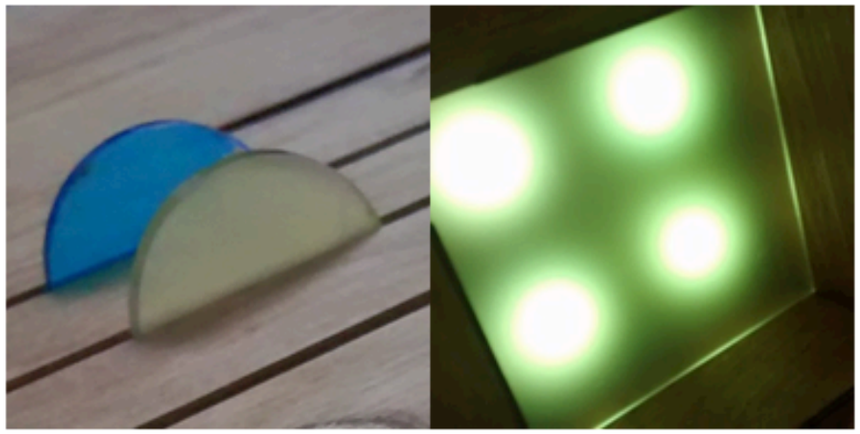


These photographs show the three coloured acrylic filters that I made to change the colour of the light emitted.

Evaluation

I am really happy with how the coloured acrylics turned out, managing to successfully change the colour of the light emitted from the lamp. I also pleased that even when two filters are used enough light still passes through and is strong enough to be a fully functioning desk lamp





Final Product Pictures - Packaging

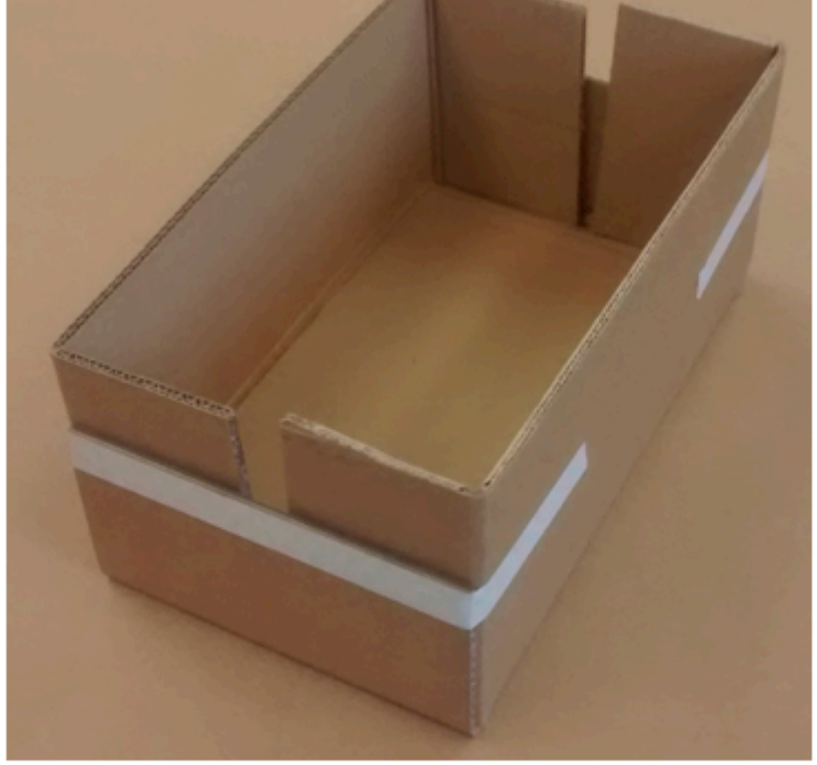
To make the packaging I made a scale model of my lamp using 4mm ply wood that was laser cut, this was so that I could make smaller packaging and not waste as much material in the design phase.

This is the inner box of the packaging and will house all of the components, however, it will not offer that much protection for the unit which is why I am gong to also make an outer box

Evaluation

I am happy with this design as it holds all of the pieces in a compact fashion.

I am also happy with the size of the full scale box as it holds the components compactly.



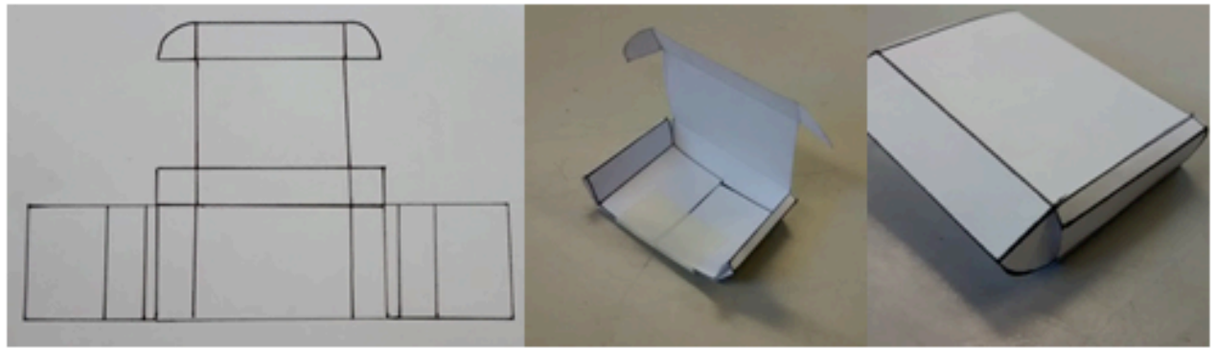
Final Product Pictures - Packaging

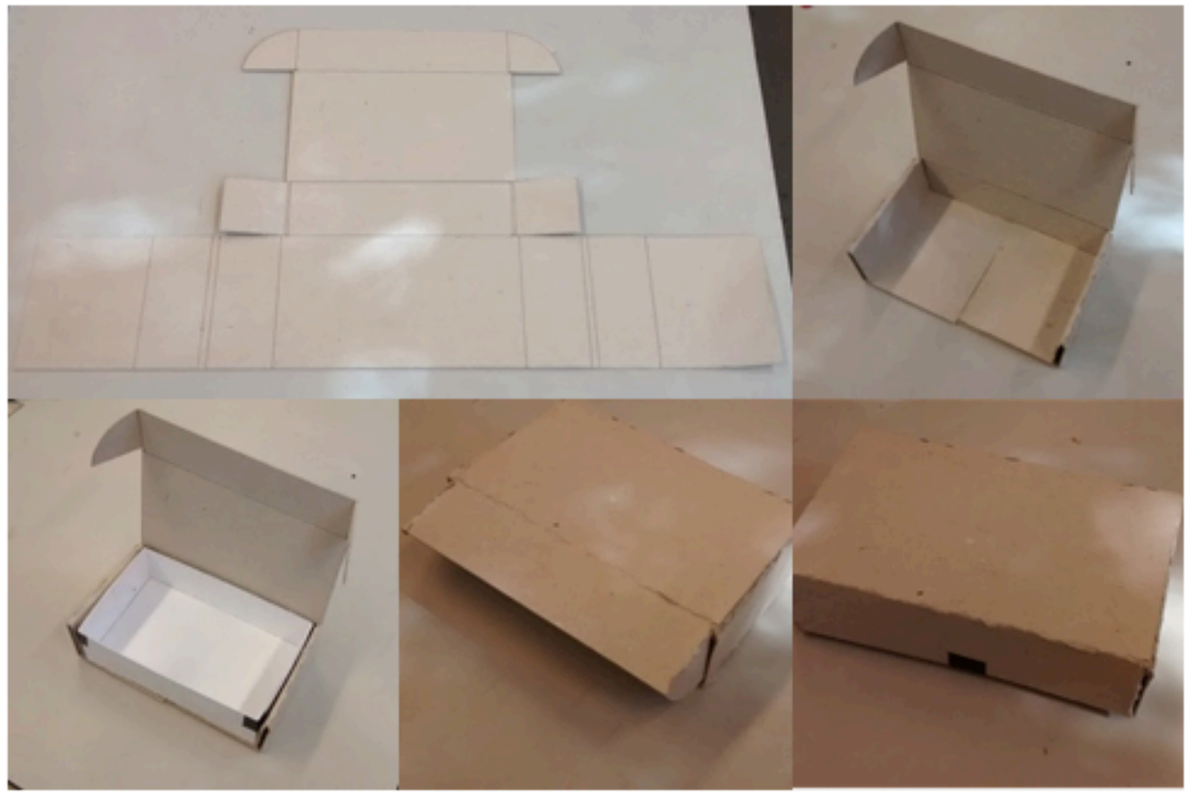
This is the outer box of the packaging and will house the inner box, This will give the most protection having more than 3 layers of card on the short edges and 1 layer on the long edge.

To make the packaging I started by making a sketch model from paper to create the net idea, taking inspiration from my research. I then used the scale model again to conserve materials to make a scaled version of the packaging, so I could work out the basic measurements. After making the scale packaging I cut out and made the full scale packaging, tweaking it slightly so to add more protection

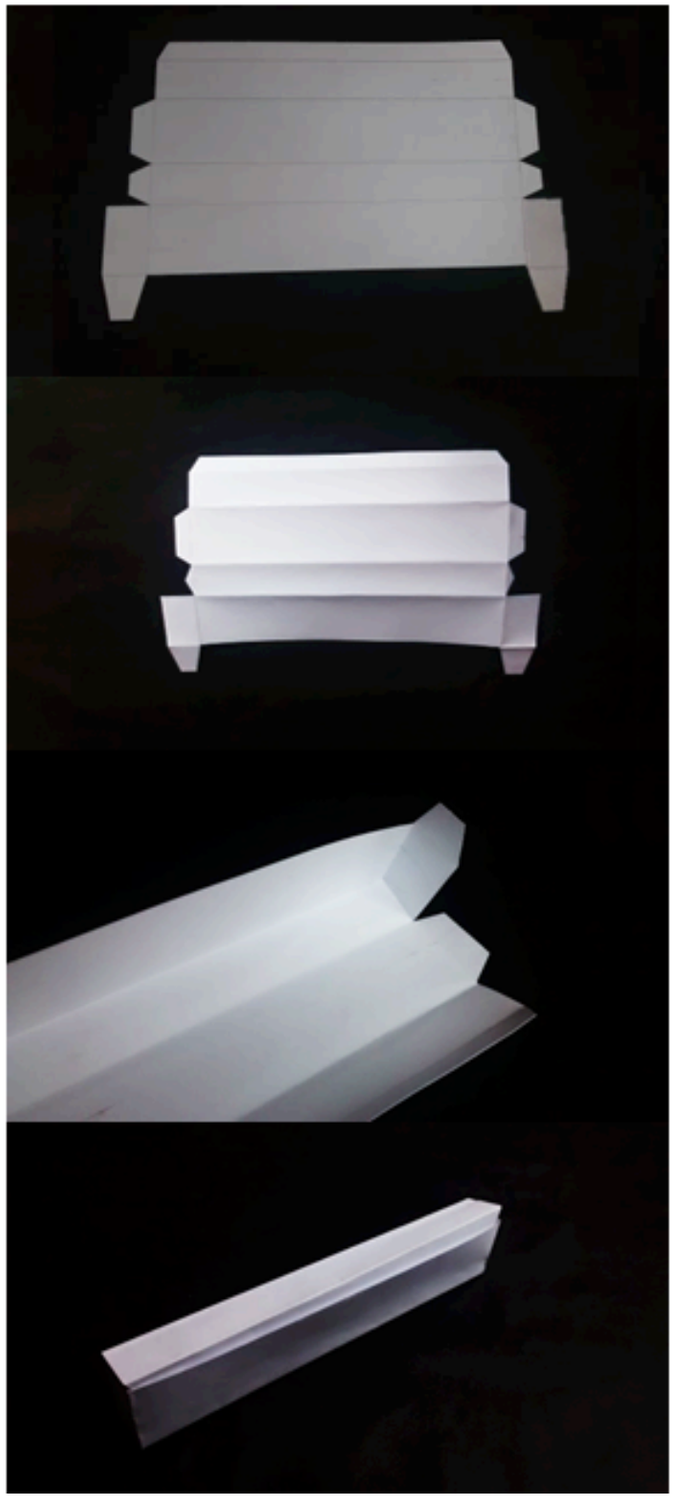
Evaluation

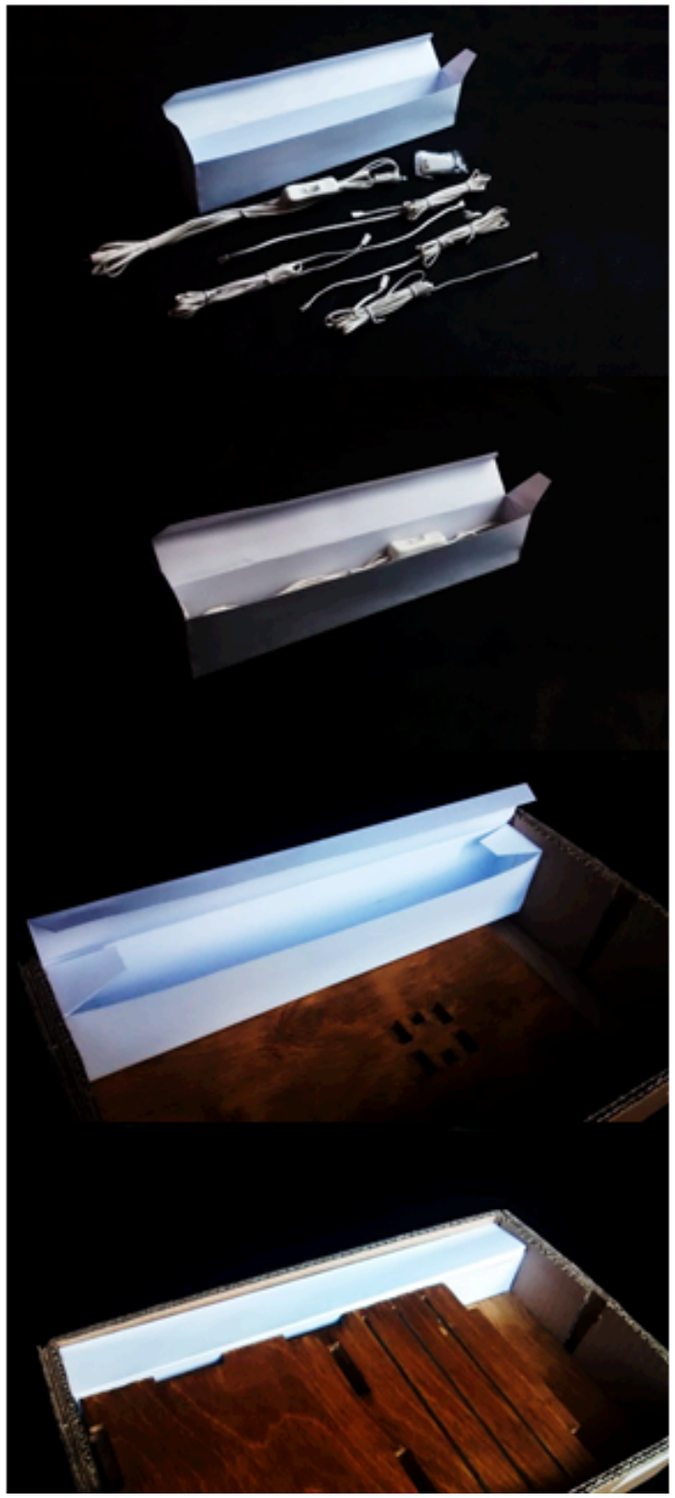
I am happy with this solution, I am particularly pleased that I managed to make it from one piece of card, making it easy to mass produce.





Final Product Pictures - Packaging





These photographs show the internal box that will house all of the wires for the Dioder, all the screws and any other small miscellaneous parts.

This is made from 320 gsm card that I bought from a craft shop, This was thin enough to house all of the pieces but also strong enough not to bend once inside the packaging.

I took measurements straight from the final product and designed it straight onto the card with pencil.

I used glue to secure the box together with the tabs and kept the lid free to that the components can be put in and be taken out easily.

Evaluation

I am very happy with this box, designing it straight onto the card was a risk but it paid off and fits into the packaging perfectly and stops the pieces from sliding around in the box.

I am delighted that it holds all of the wires and small parts compactly together.

I was contemplating making this box from black card but I chose the white card as it was cheaper and it makes the packaging look a lot more professional and realistic if it is to be mass produced.

Final Product Pictures - Packaging

This is the second internal box which will house the four LED units, the power supply plug and the splitter unit.

I also took measurements from the full scale product and designed it straight onto the 320 gsm card for this box, this went well however I made it 9 mm too high so had to go back and cut off a 9mm strip from the top of the box.

This box was to be open top but have tightfitting protection for the 3 different parts thus was a simpler net to design.

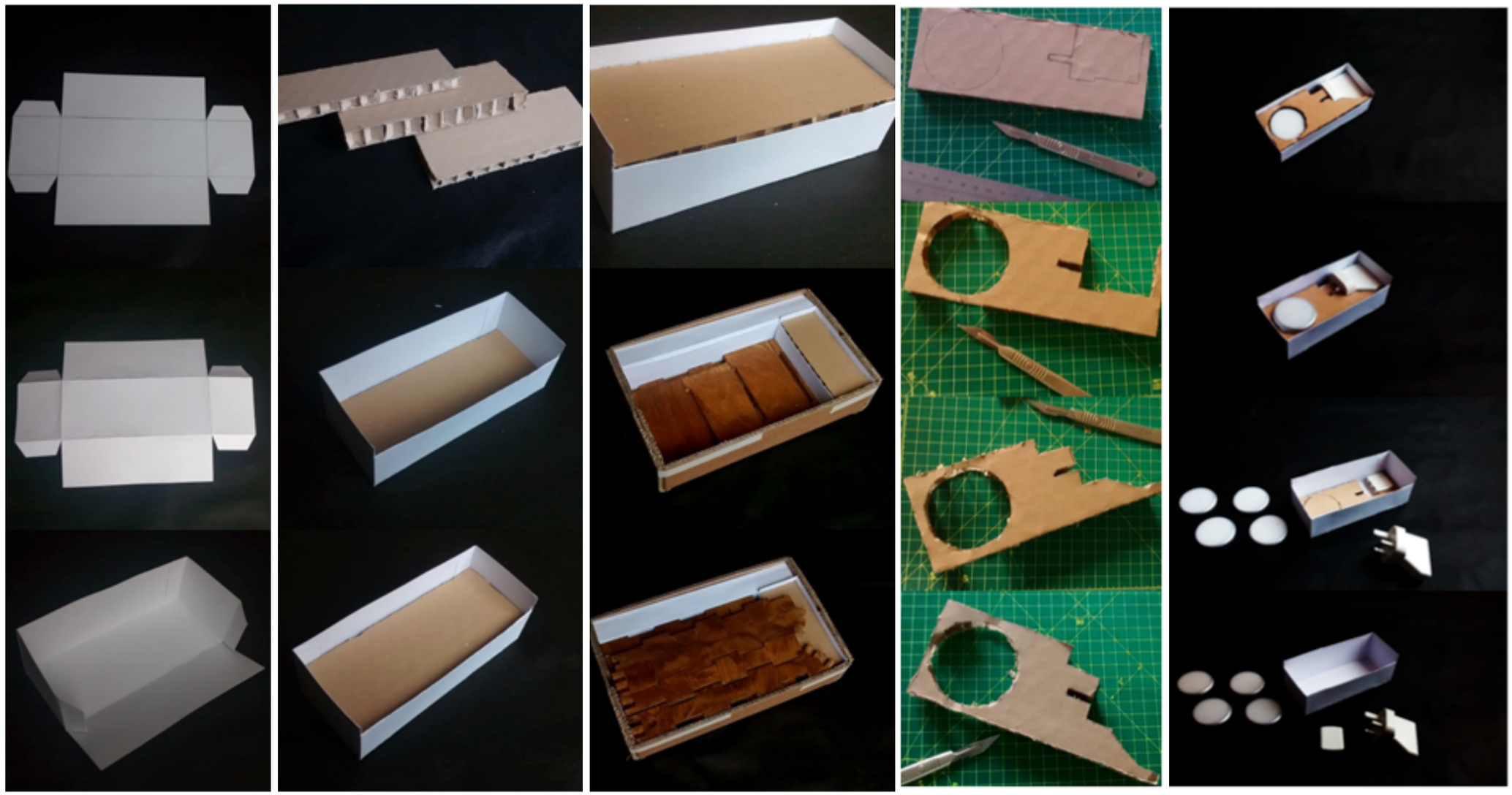
I then repurposed the thick corrugated cardboard protective pieces from the IKEA billy case and cut them so they would fit inside the box.

After cutting the card to size I then used a scalpel blade to cut out sections of the card so to fit the 7 pieces.

Evaluation

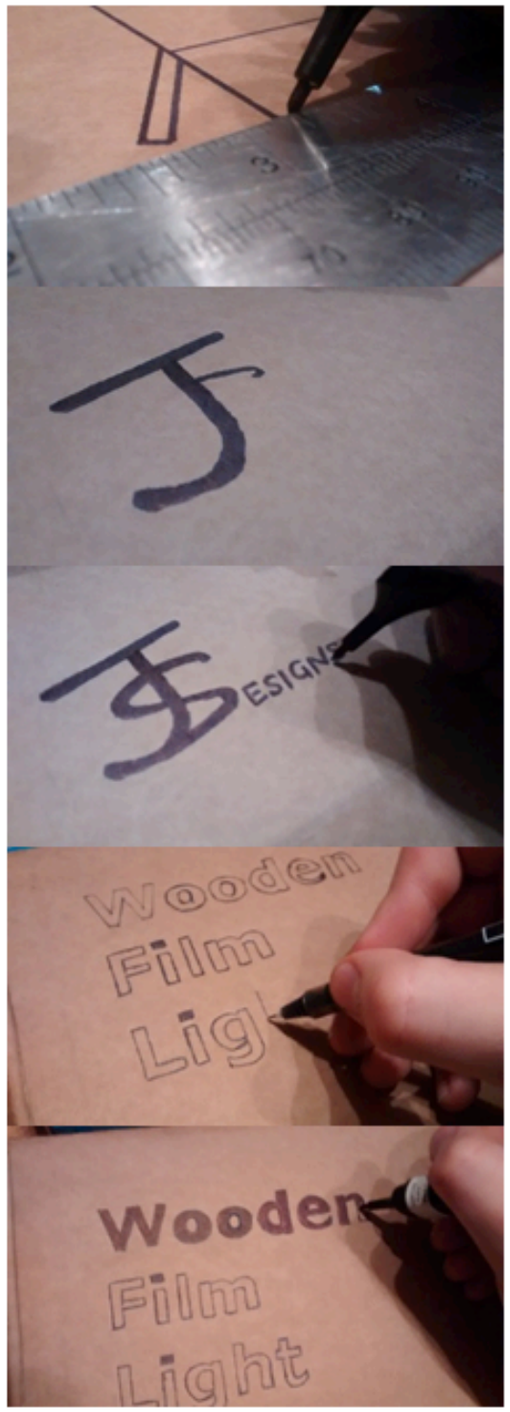
This was a lot more work than I thought it would be but I feel that the final product is good and holds the necessary items well making sure that they cannot move independently.

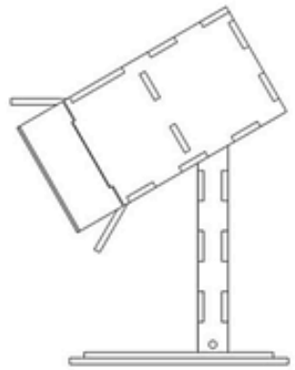
The box also fits in the main packaging well and now means that none of the parts can move around inside the packaging.



Final Product Pictures - Packaging

Wooden
Film
Light





For the barcode I used this website : https://www.barcodesinc.com/generator/index.php to generate a barcode for my product.

For the QR code I used this website : http://www.qr-code-generator.com/, if this was a mass produced product it would direct to a webpage showing the instructions and a step by step building video.

For the safety symbols I used google images to find high quality images of them, using all of the safety symbols present on the Dioder packaging and added the FSC symbol for the ply wood that I used.

I then used black pens to hand draw out the design on the front of the packaging, imitating the simple style of drawing that is present on IKEA packaging units.

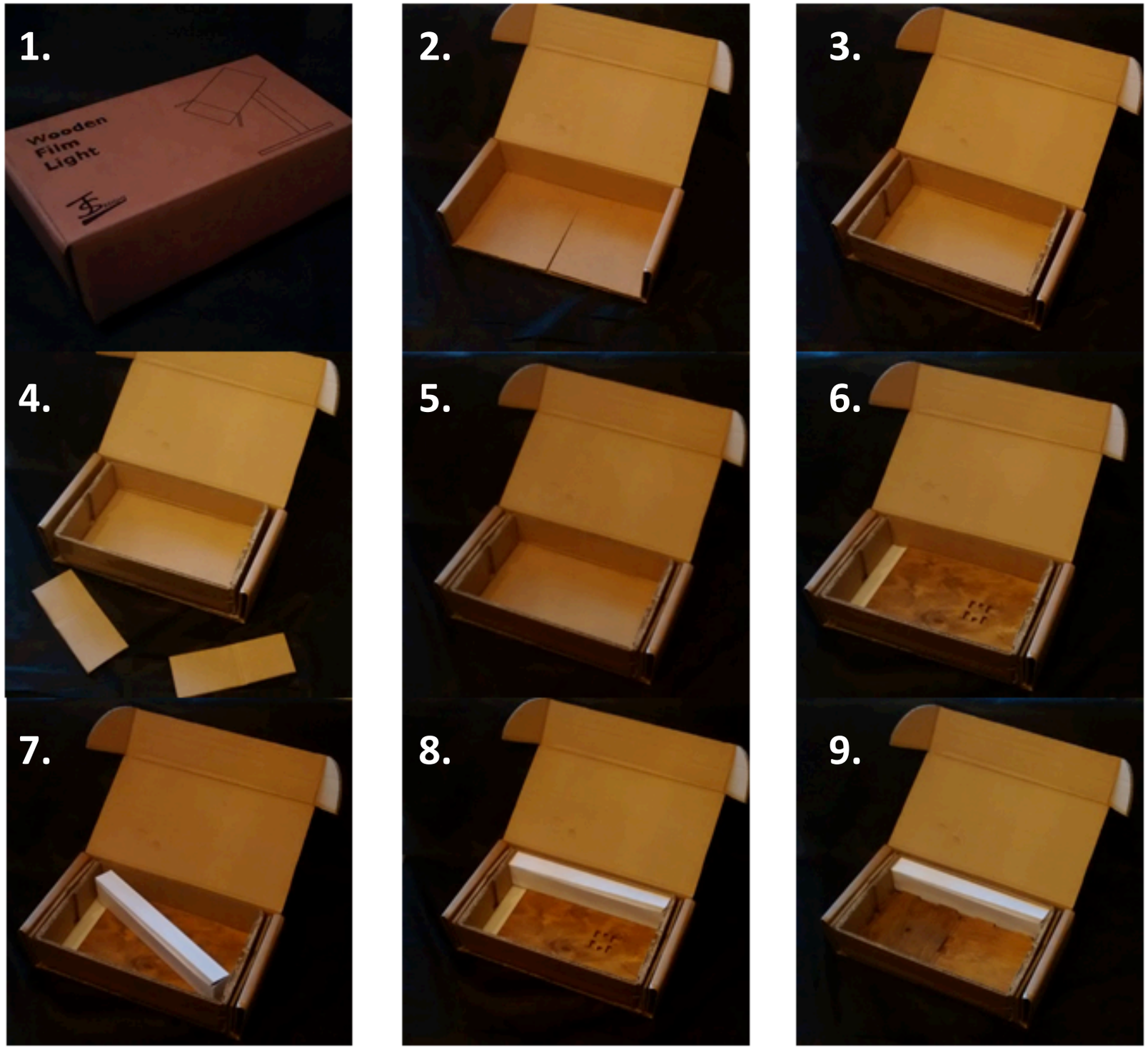
Evaluation

I think that the designs on the box went really well and look like they were done by a computer, if they were mass produced.

I am also happy with the sizing's of all of the design features. They retain the minimalistic look of the box whilst showing all of the necessary information

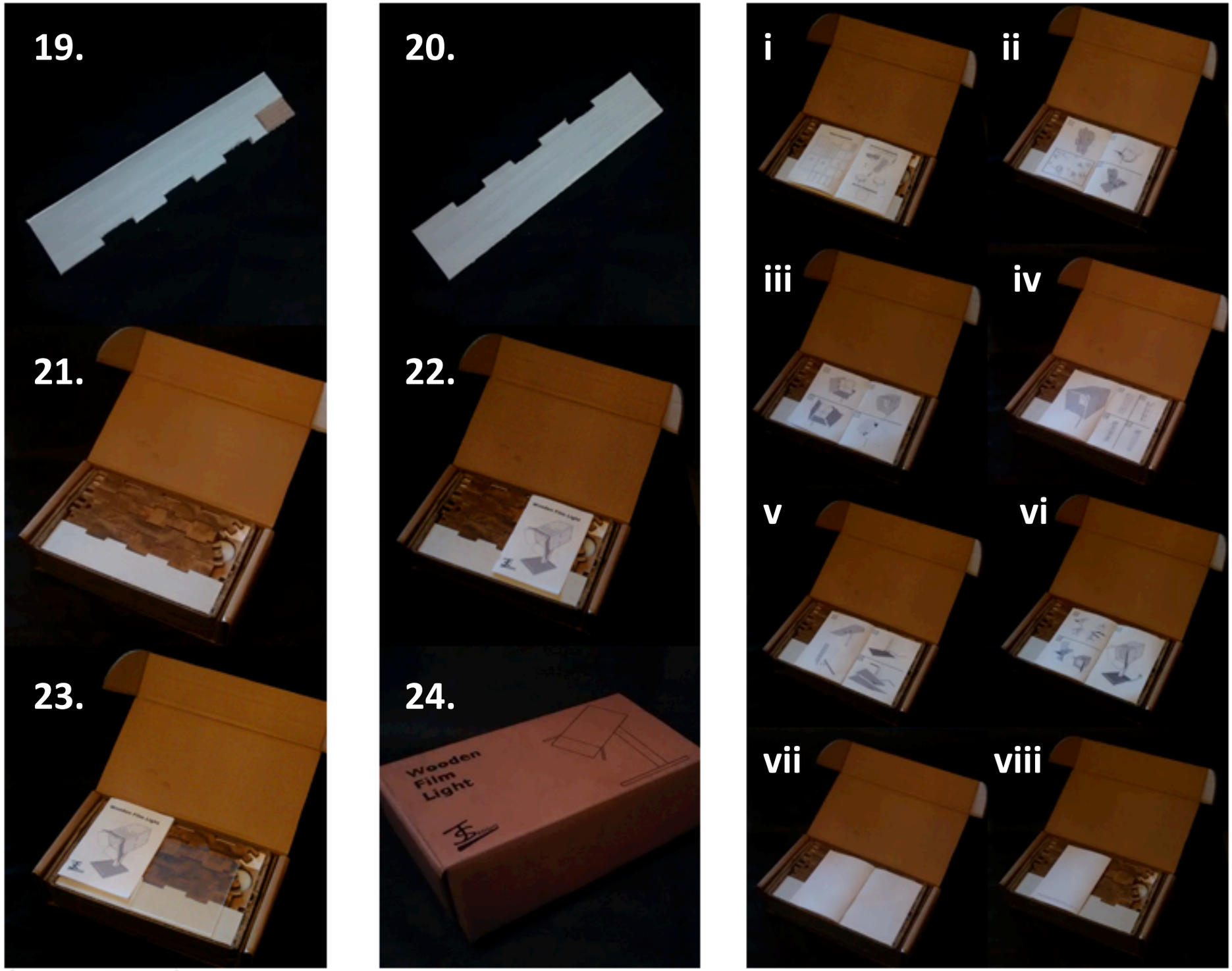
Overall I am very happy with how the packaging has turned out, and think it compliments the product well.

Final Product Pictures - Packaging

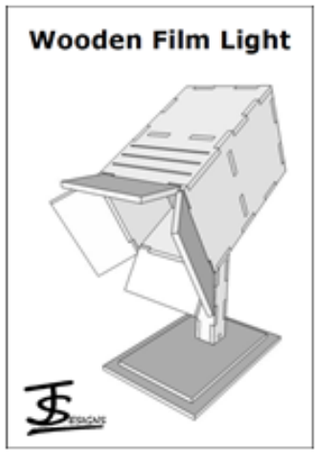


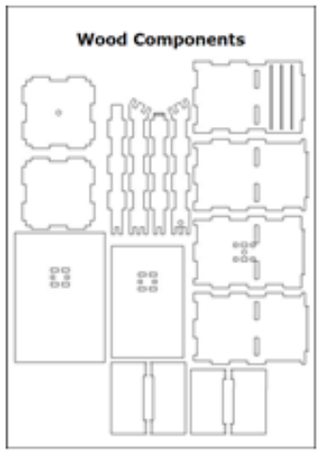
Final Product Pictures - Packaging

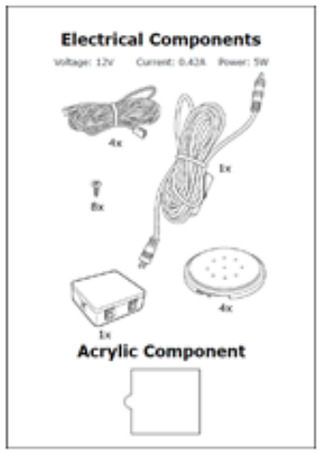
Final Product Pictures - Packaging

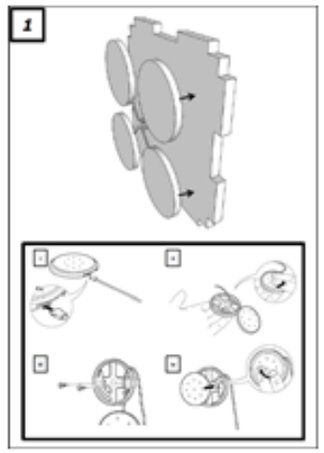


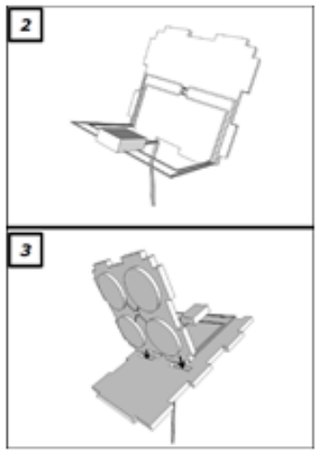
Final Product - Instruction Leaflet

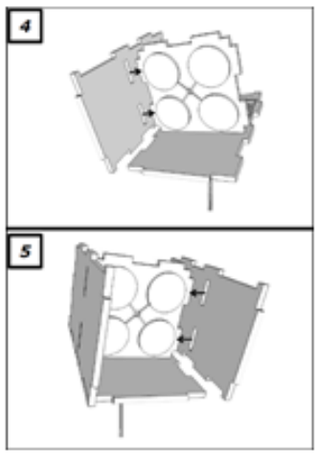


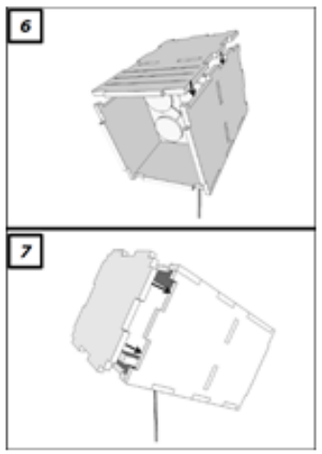


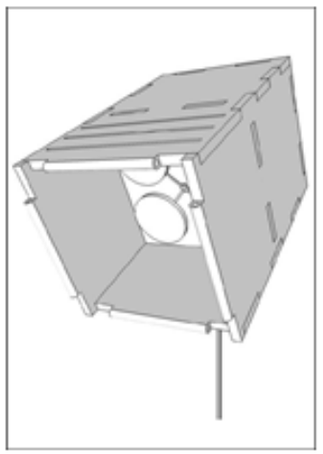


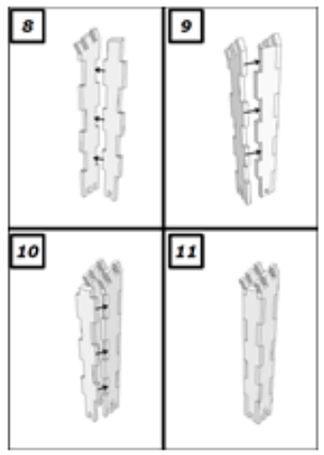


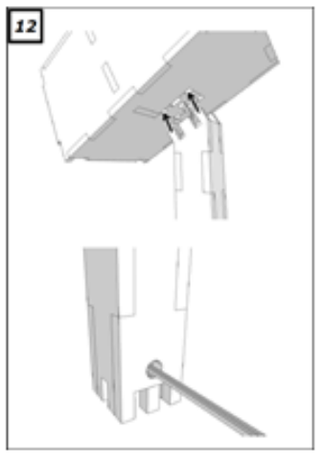


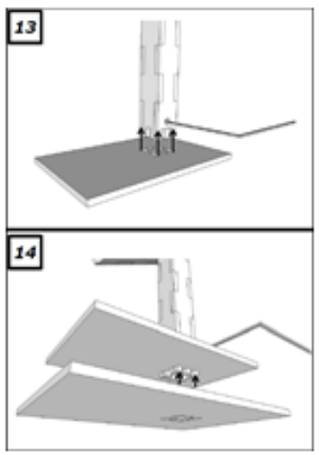


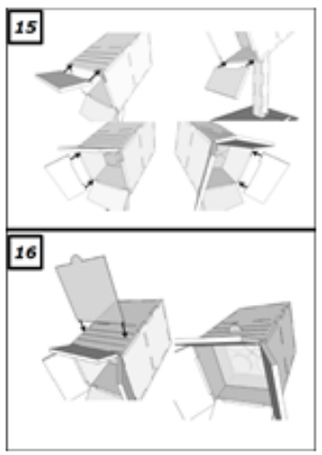


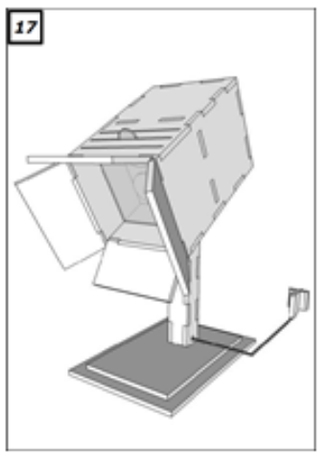












These are the instructions that will be supplied with the product. They show all of the components in the product and the step by step process of construction.

I used SketchUp make software to draw all of the illustrations and used PowerPoint to lay out the drawings and add the arrows.

Drawings of Dioder light contents and Assembly (pages 3 and 4) are from IKEA:
http://www.ikea.com/gb/en/assembly_instructions/dioder-led-multi-use-lighting__AA-1083021-3_pub.pdf

Evaluation

I very happy with these instructions, I think they show how to make the product simply and can be understood by anyone, allowing them to be used all around the world, reducing the cost if the product was mass produced.

Final Product – Video of Assembling

This is a video of the assembly process of my lamp, It is an easy to watch demo of how the lamp can be put together. I haven't directly followed the instructions as I wanted to show detailed internal views of the light assembly. I mounted my phone on a tripod to record the assembly process and then used VideoPad video editor software to edit the clips, speeding some sections up, to create the fluid, finished film.

For the real time version of the video please look in my folder.

Evaluation

I am extremely pleased with how this video has turned out, it clearly shows every stage in the assembly process. It is captured well showing most of the angles of the product and is shot in a way that does not need any words or narration.

Final Product - Graphics / Promotion

This was a very quick promotional poster that I have designed to attract customers to buy the product if it were mass produced.

I have designed it to draw in customers with the large photograph of the completed lamp with a very simple black background.

I have decided not to have too much writing on the poster only the most important information, the name of the product. The potential customer knows what it is called and the price, £120, this indicates that it is a professional lamp and will be built to a very high quality.

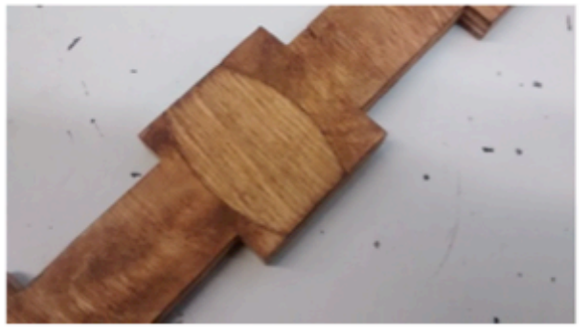
Evaluation

I am pleased with this poster as it is simple but effective.

Showing all of the necessary information, the price and name of the product.

I think that it is professional in look and is similar to the adverts I researched below.

Fault Findings and Corrections



I only noticed this after staining the product, there are oval shaped markings on some areas of the wood that did not fade away after sanding.

To correct this if I were to make the lamp again I would check to make sure that these ovals were on the inside of the unit or try to avoid then when marking out the design.

Even though they are a mistake they do not look out of place on the product and in some cases it looks like a natural knot that could occur in the wood and does add to the distressed feel I was aiming for, for the aesthetical look of the product

This was a really annoying mistake that could have been easily avoided, I had not marked out the bottom finger joints on the pillar of the stand so cut the first one only 9mm long where as it should have been 18mm so that it could fit through both layers of the base.

To correct this if I were to make the lamp again I would mark out the design correctly and double check all of my measurements before cutting any of the pieces

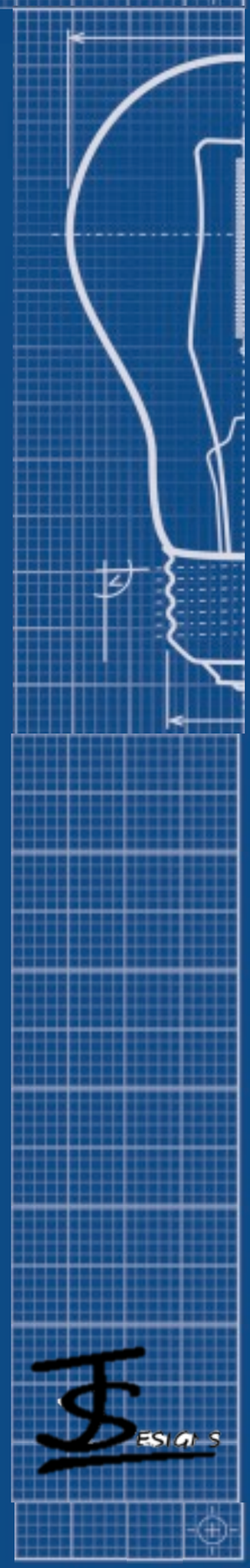
This mistake does not reduce the effectiveness of the stand which still functions properly and is strong enough to support the weight of the lamp.

This was a small mistake that was common almost throughout the whole product. In places ,when cutting the pieces, some of the top layer of ply wood would splinter off, leaving behind a groove where it had once been.

To correct this if I were to make the lamp again I would not use ply but real hardwood that would not splinter so easily, also I would score along every edge first on both sides to indent the design, compacting it and causing it to not splinter.

This mistake was fine as the splintering mainly occurred o the inside face of the pieces that are not on show.

Final Product - Social and Moral



- In this project I need to ensure that all the materials I use during the product are reliable and sustainable.
- I need to make sure that the materials I use will not affect anyone around us, any one in different countries or the environment.
- I made sure to conserve the materials that I am using so to not waste them which could damage habitats in other counties. I did this by using a scale model to create the design and test prototype models and then scaled them up for the full product, this ensured that I did not mess up and waste a large quantity of material.
- The consumer, if the product was mass produced, would want their product to be made to a very good quality due to the high price, this includes where the materials are sourced from and how well the workers are treated; meaning I will only use materials that comply with European standards and testing's.
- Social issues occur when producers use materials that are sourced from areas where the workers work either on an extremely low salary or in conditions that are awful.

<u>Social Issues</u>

- My lamp unit is very unlikely to cause too many social issues due to the one off build and uses very little material. However if it were mass produced social issues could increase. A way to remove any likely hood of any social issues is to only used materials that are from reliable sources that comply with European safety standards. I would also visit the area that produces the materials to make sure that the conditions and the pay of the workers is up to my very high standards

<u>Reducing cost but keeping high quality</u>

- Mass production is a very effective way of reducing costs, using machines and an assembly line so that people don't need to be employed and keep every product made to the same quality.
- However, in this case, I am not mass producing my product, so there is not much of an issue when it comes to cost as it will be relatively small compared to costs of mass production
- Selling my product as a one off costs a lot more than it would if it was mass produced as there are more man hours to cost and the materials I have bought had to be bought in small quantities that is more expensive than buying in bulk.

<u>Moral Issues</u>

- My product is unlikely to be made illegally or help someone profit illegally.
- Being only a lamp there are very few areas in which illegal activities can take place that can exploit people or cause moral issues.
- However if it is mass produced in the far East, there could be moral issues with factories using slave labour to make the product.

Evaluation

Research

- The research that I conducted was invaluable in developing my final design. It allowed me to narrow down my options . From this I was able to do focussed research specific to my product. The most useful research was looking into existing products as it gave me a design direction that had not been previously explored.

Initial, Developed and Final Ideas

- I developed my initial thumb nail sketches into working drawings using SketchUp. This enabled me to fully explore my ideas and consider the types of materials that I could use and how it might be made. I developed 2 of my ideas based on the feedback that I received from my client. The working drawings were more detailed and I gave more thought to the construction and considered the manufacture further by making sketch models from card. I was very pleased with the final idea . It looks professional and the design is simple enough to be made as a one off or mass produced. In addition, I can all be made from one sheet of 9mm ply wood.

Final Product

- The project has gone extremely well and it looks almost identical to the drawings that I created on SketchUp. I think the colouring/staining of the ply wood is in line with the brief and has the characteristics of an old wine crate. The ply wood pieces have finger joints and fit together tightly without the need for adhesives. The filters complete the product as they allow the user to personalise the lamp. Finally, the stand is strong enough to support the main box in both configurations and I believe that the design is sufficiently robust and can withstand knocks and bumps.

Packaging and instructions

- The packaging has been very successful, all the components fit together in a tight, compact layout, they cannot move and thus the chance of any components arriving damaged is vey low. The elevation view of the lamp on the packaging is simple and uncluttered and looks both striking and professional. The instructions have a clear, step by step format and do not use any words. This will reduce the cost If it is mass produced as they will not need to be translated or reprinted for different countries

What I would do differently, if I were to repeat the project

- If I re made the lamp I would use a better quality wood, for example, oak. This would reduce splintering in manufacture. I would take more care when cutting and sanding to achieve a more precise finish with straighter edges. I would make the flaps rotate by adding circular indentations and protrusions. I would also design my own LED matrix in order to produce a brighter lamp. Finally, I would use a blow torch to give the wood a charred effect that would look more authentic.