

INFO

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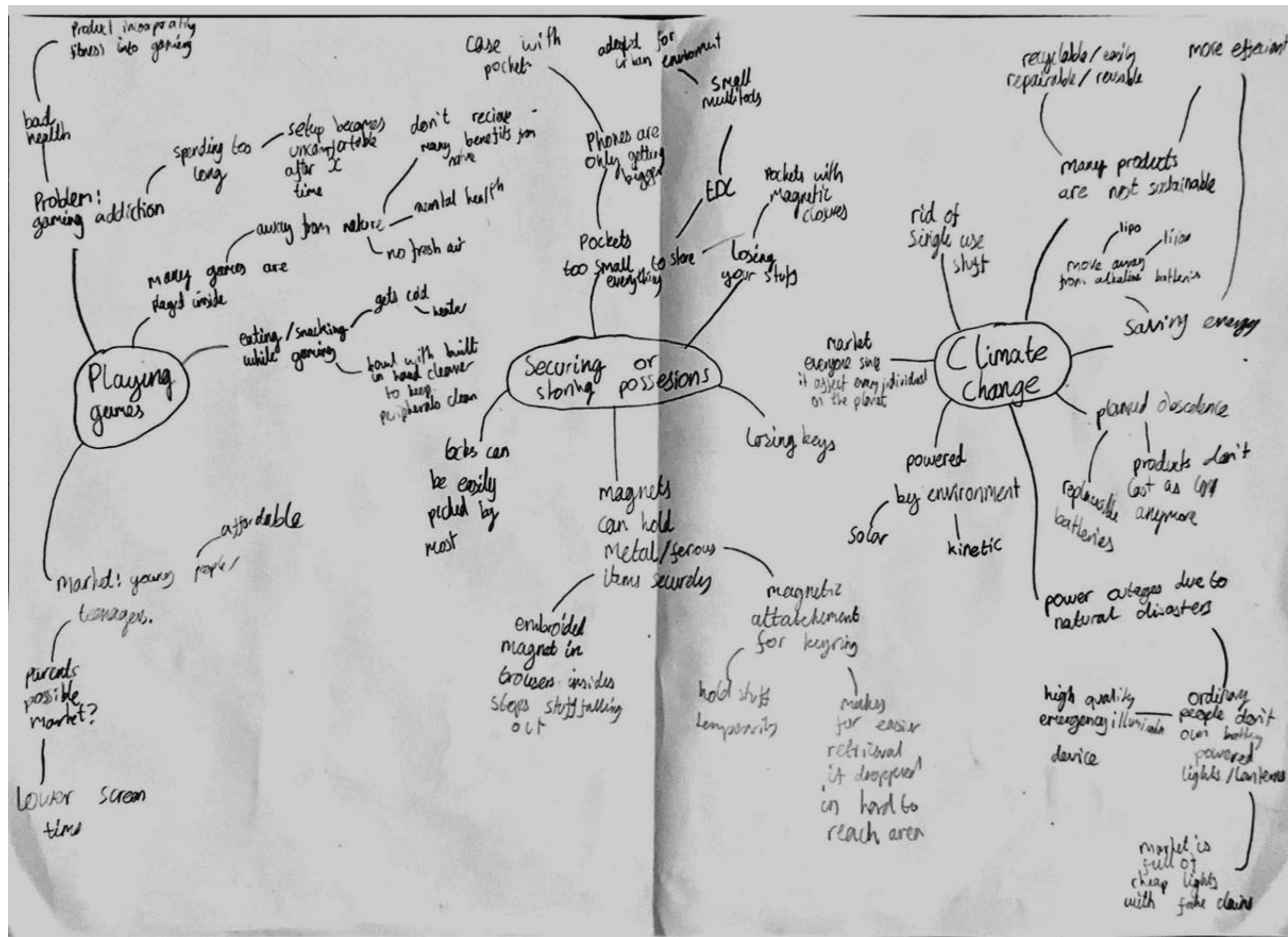
DT Coursework



Section A Research And Investigation Plan

Research / Investigation	Primary	Secondary	Reasoning	Time taken (Hours)
Initial Ideas And Context Selection			I need to decide on a context for my product and brainstorm possible ideas for development.	1
Context Analysis			Once I select my context, I want to delve into it deeper to try to find gaps in the market and explore possible solutions to problems that my product can solve.	3
Client Profile			I need to interview my client to identify his preferences and possible problems that my product can solve.	2
Bauhaus			I want to explore my client's design style so I can try make my product adhere to its design principals	0.5
Flashlight Disassembly			I need to disassemble a product similar to the one I intend to produce so I can gain an idea of how it functions and so I can implement similar ideas into my product	0.5
Design Museum London			I need to visit an art gallery/design museum to see what ideas existing designers have implemented into their product	5
Ikea Croydon Visit			I need to visit a furniture store to observe first-hand how designers' concepts have been translated into commercially successful products. This is different from viewing purely conceptual pieces in a Design Museum, as these have proven their viability in the marketplace.	4
Ceiling Bouncing			I wanted to explore the concept of ceiling bouncing for my product as it is an extremely effective method of lighting a room.	1
Initial Ideas			To start generating potential designs for my product so that I can get a better idea of what it will look like	4
Section A Evaluation			So I can see my progress through the investigation stage and sum up all my ideas	0.5

Initial ideas and context selection



My chosen context will be Climate change as it is one of the most pressing issues of our time, and it aligns with my values as well. I have chosen to concentrate on minimizing the effects of extreme weather events caused by climate change by creating a product that will help my client deal with the effects of climate change while utilising sustainable and ecological practices to not be a part of the problem but rather part of a solution. An instance of such extreme weather that had a profound impact on the UK was the summer heat waves of 2022. These heat waves resulted in extreme discomfort, business closures, droughts, and put immense strain on the national grid. In my project, I will prioritize ecological sustainability by reusing components, using ecological materials and ensuring easy repairability.



Client Profile

Name	Dr Alexander Korenberg
Age	48
Occupation	Partner at patent law firm
Budget	£300
Dislikes in a product	Planned obsolescence, Over complicated
Likes in a product	High quality, standardised, simple to use

Needs, Wants and Values

Needs - A product that will help him light up his home in case of a power outage or other type of light failure.

Wants - An aesthetically pleasing product that will blend in well with the rest of his home.
A simple UI that wont be cumbersome to use and will only control brightness.
A USB-C ports so all his devices can be charged
It should have a bright light with High CRI so it can light up the room while not appearing too artificial.

Values – My client values long lasting products that don't need to be thrown away due to them becoming obsolete. He expects to get a lot out of a product before it fails.
Repairability

Client interview

Q: How often do you lose power?
It's been a while but it definitely does happen, its when I am travelling that I experience the most blackouts.

Q: Would you use this product in the event of a power outage?
Yes of course however the majority of the time I think it would be used as general lighting and an ordinary power bank. However it will still certainly need to be able to effectively aid me in a power outage.

Q: What do you do when your electricity cuts out?
I keep working on my laptop and phone until they run out of battery then I generally find other ways to entertain myself. At night I rely on a low quality flashlight I bought on Amazon for lighting which results in me not being able to get much done.

Q: What rooms would you want to use the light in the most?
My bedroom light recently broke so I'd likely use it there. However the lights in my bathroom and kitchen are unreliable so I would also use the product there whenever the break.

Q: what design styles do you like?
Simple and space efficient like Bauhaus. I also like the look of wood in a product but this is not necessary if it would sacrifice the durability or reliability of the product.

Q: How important is portability to you?
Portability would be nice, as it means I could move it from room to room depending on where I need the light.

Q: Do you own any power banks?
Yes, but they are low capacity and their only real use is to recharge my phone once on long flights most of the time they are depleted and sit in a drawer.

Q: What battery powered lights do you own?
A "zoomie" flashlight that runs on AAA batteries, it's not very bright and the light the produces is a very cold blue which I don't like as it doesn't light up much area and ruins the atmosphere.

Q: If you had to guess how many alkaline batteries do you use a year?
A relatively high amount, maybe around 40.

Q: Are you interested in reducing your carbon footprint?
Yes I feel climate change is one of the biggest problems we face as a society so I want to do my part.

Q: What turns you off from a product?
If it's overpriced, bad for the environment or low quality I generally wouldn't consider purchasing it

Q: What colour temperature (CCT) in a light do you like the most and does CRI (how well the light renders colours) matter to you?
I like 2700K – 4500K generally as long as it's in that range I don't mind. CRI plays a big factor in how much I like a light and I would like high CRI.

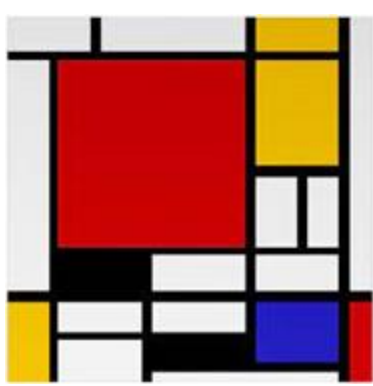
Q: How long would you require the battery life to be?
I'd like the light to be able run at low levels (just to read my book) for a week and it to be able to light up a room for a few hours.



My client owns a Monolith Classic a high quality ceramic barbecue that retails at £1500. It is capable of cooking nearly any food making it very versatile. Overall this product indicated to me that my client is willing to pay for an expensive product if he can get a lot of use out of it.



My client owns an Apple MacBook Air which tells me he values simplistic clean designs and products that are easy to use even if they aren't always the best value for money.



General concept of Bauhaus

The Bauhaus teaching method replaced the traditional pupil-teacher relationship with the idea of a community of artists working together. Its aim was to bring art back into contact with everyday life. It placed emphasis on function coming with form.



Bauhaus products

Perhaps one of the most famous creations out of the school of Bauhaus was the Bauhausian chair an immensely popular design becoming a staple of European homes. The chair's unique form made it functional (doesn't use a lot of space and comfortable) while not sacrificing on aesthetics. I'd like to follow this philosophy when designing my product.

Bauhaus originated in a German art school operated between 1919 and 1933. It was founded by architect Walter Gropius in Weimar. Bauhaus means building house in German which align with the Bauhaus message of function over form.



Inspiration from the current market Searching the web for modern takes on Bauhaus I found two lamp projects which I felt aligned with the principles of Bauhaus. The first - a lamp I found on Wayfair - has a simple rounded top where the light comes from, which is not only simple and aesthetically pleasing, but also allows the lamp to light up a large area due to the large space given to the bulb. Here the electrical components are intelligently incorporated into the design making it a feature, instead

of hiding them like most products. The second design - the Onu pendant from Sabu Studios - also followed the minimalistic efficient style of Bauhaus. The light consists of a round piece of wood split in the middle lined with LEDs having a small footprint and being unobtrusive.

Bauhaus



How Bauhaus revolutionised the world

Bauhaus didn't just stop at revolutionising the design of the house it also made huge leaps in how everything we interact with should be as space efficient and useful as possible. In the example on the right you can see just one of the many works of the Bauhaus movement, a stool with four separate sizes that takes up the same space as one stool. These aspects are extremely beneficial to have in a product and I will aim to incorporate some of them in my product. This could be done through the use of simple shapes and distinct forms while preserving aesthetics and functionality



Walter Adolph Georg Gropius was the founder of the Bauhaus School. He has had one of the biggest influences of any individual on what we now know as modernist architecture and design. Walter also showed to the world that modern/Bauhaus design could be applied to much more than just houses. He himself designed furniture, a railroad car, and an automobile.



Flashlight Disassembly

All uncommon terminology on this slide have a clickable link to a website that I think best explains the term.

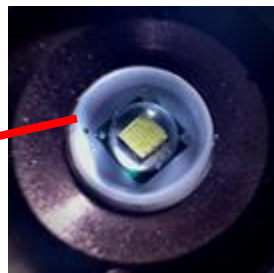
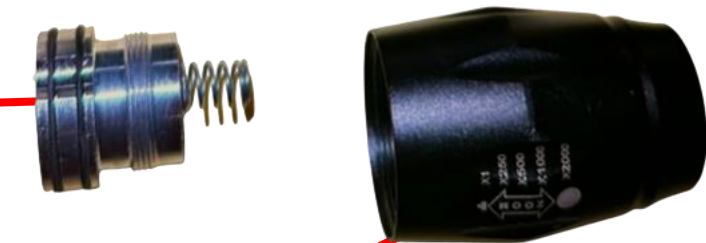
Runs on three AAA batteries at 1.5V with a total capacity of around 3000 mAh. However due to the nature of alkaline batteries this runtime can only be achieved at very low discharge rates (0.1A) meaning there is a lot less available power.

Uses an aspherical lens which allows for the adjustable beam angle.

High resistance steel springs that reduce efficiency. Inefficient driver which reduces runtimes.

Moving head to create distance between aspherical lens to focus the light from the emitter and provide a more throwy/spot/tight beam. The moving part does however decrease dust and water resistance, reduces reliability and total light output.

Dim emitter with bad cri, very high cct, low lumen output and positive DUV. This results in a harsh blue dim light with a green tint and badly rendered colours



CNC machined from aircraft-grade aluminium and anodized for a durable finish. Aluminum has high thermal conductivity and is lightweight making it an ideal material for a flashlight.

Powerful neodymium magnet for easy mounting to most metal surfaces.

Runs on a 21700 cell, this specific cell runs at 4.2 volts and has a discharge rate of 45A. It has a capacity of 4500 mAh. This gives it a relative high capacity and very high discharge rate

Beryllium-Copper springs with 45% [IACS](#) superior to stainless steel alloys used for springs with only 2% [IACS](#). Allows for significantly less internal resistance

Stainless steel bezel increases drop resistance

Carclo quad optics which are efficient and UK made. Provide a floody beam with high brightness.

This flashlight configuration utilises four domed Nichia 519A 4500k in a quad optic. This gives the torch great [CRI](#) (95), Neutral [DUV](#) (0 to three decimal places), high lumen output (~3800 lumens) and a warmish neutral [CCT](#) (4500k). This results in a very bright torch with high quality light that gives a pleasant warm feeling and renders colours very accurately.



Design Museum London

I paid a visit to the London Design Museum to garner inspiration for the design and aesthetics of my product and to find a sustainable way to manufacture my product. I saw the exhibitions “Making sense”, “Designer Maker User” and “How to Build a Low-Carbon Home”. The exhibitions all varied greatly from each other each teaching me something new or giving me an inspiration for my product.

Making sense



“Making sense” featured many design/art pieces that focused on subverting our expectations and exposing the fragility and disposable characteristics of our modern products.

Featured to the left is a takeaway box and toilet paper carved from marble, Ai created the take away box in the marble medium over the normal Styrofoam to show how our desire for convenience has given rise to hyper-disposable objects. A Styrofoam takeaway box is a throwaway item, but carved in marble Ai transforms it into a monument. The permanence of the marble medium also demonstrates the longevity of a takeaway box’s lifespan as marble and stone are often associated with permanence and resistance to corrosion just how Styrofoam resists nature and takes hundreds of years to break down.

Ai also presented a recreation of a piece of twisted rebar in the exhibit to memorialise the lost lives in the 2008 Sichuan earthquake and to hold the CCP accountable for their cheap flawed building practices. The commemorative piece had no utility and existed simply to project the artist’s provocative message. While this didn’t clearly relate much to my project I still felt it was important to include as it demonstrated to me that not all features of a project must have an explicit purpose

Making sense featured a glass helmet which I was particularly drawn to as for me it represented the fragility of modern products and planned obsolescence while making me reconsider whether we can really trust our life with the products that are meant to protect us. While I’m relatively sure that this was not the artist’s intended interpretation of the piece it was the one that stuck with me the most.



The final exhibition I saw was Designer Maker User which is the museum’s largest exhibition featuring over 1000 products from all corners of the design world. The two products that I wanted to explore further were the “Goodnight Lamp” and the “Chubby Chair”.

The “Chubby Chair” was developed by Dirk van der Kooij and the first example of a non injection moulded plastic chair. It used a form of low resolution 3D printing made from 10Kg of used fridge filament making it both eco-friendly and comfortable.

The “Goodnight lamp” is a social communication tool that allows you to stay connected with your loved ones, no matter where they are in the world. You can use the Good Night Lamp to tell someone that it’s a good time for a chat, that you’re thinking of them, or just to call you when they get home. I really liked the idea of this product and would definitely consider adding a smart aspect to my lamp as well.



How to build a low carbon home













How to Build a Low-Carbon explore how seemingly traditional and outdated raw materials are being revolutionised for contemporary homes in an attempt to minimise the impact that the construction industry has on our planet. I decided to visit this exhibition to as my product will need to also be eco friendly, sturdy and durable just like a low carbon home. This means I could use and adapt the materials presented in the exhibition for my product.

Although straw may seem like a flimsy by-product of farming by combining it with other natural materials such as clay or bio waste resins it can suddenly be used make walls, bricks, insulation and other modern components. Straw also absorbs carbon dioxide and are generally air dried and not fired in a kiln at high temperatures meaning they require a lot less energy to manufacture compared to traditional bricks. These two factors make them a suitable material for a more ecological future and perhaps to maybe even be used in my product although it doesn’t appear very practical for my product at this current stage of development.

The exhibit also features a scale model of 15 Clerkenwell Close, a revolutionary new building in central London. Although revolutionary may not be very accurate as in fact the building was constructed following megalithic architectural methodology making it more rediscovery rather than revolutionary. The entirety of the building is held up by a solid stone exoskeleton which allows the building to reduce its use of steel and concrete and also optimise the use of space by eliminating the need for columns while also celebrating the natural beauty and history of the stone material. On top of these benefits the head architect of the project, Amin Taha, claims this way of building is also greener, cheaper, simpler and quicker than traditional building practices. I may try to incorporate a strong durable exoskeleton into my product as these factors greatly appeal to me, fit my clients requests and suit my context.

Finally I also decided to take a deeper look into the “Venice bricks” as the idea of drawing waste materials from my local environment and turning them into something new and useful fascinated me. The “Venice bricks” are created from a combination of environmentally friendly locally sourced materials hemp was used as the fibre to provide flexibility and strength, crushed bricks, stone and concrete as the aggregate and a blend of lime and canal silt as the binder. All together these materials form a strong, attractive, net zero brick that could be used for future construction within the city. These values align with my project so I will certainly consider using materials from my local environment to help reduce my carbon footprint..



Secondary research	<p>Anker SOLIX F1200 (Powerhouse 757)</p>   	<p>Daylight Twist 2 go</p>    	<p>Sofirn BLF LT1</p>   
Aesthetics	The product has a sleek and modern design, with a black, grey and blue colour scheme. It has a smooth and glossy finish, with a smooth double handle for easy, convenient carrying. It has a small logo and a name on the front, and a lighting bar on the top giving it a minimalist aesthetic. The product looks attractive and professional.	The product has a smooth, stylish and elegant design, with a white and teal colour scheme. It has a smooth and matte finish, with a silicon handle for easy carrying. It has a very small minimal logo and a name on the inside, and a large lighting bar on the inside top section. It can be closed when not in use which forms a clean smooth aesthetic and can easily be opened back up again. There is a small USBC charging port and minimal battery indicator hidden at the back.	The lantern is cylindrical and has a very functional and rugged look. It comes in a dark green, orange or black anodized finish.
Cost	The product costs around £1000, which is quite expensive compared to other portable power stations. However, it also offers more features and benefits, such as a longer lifespan, faster charging, higher power output and more ports. The price reflects the high quality and durability of the product, as well as the innovation and technology behind it.	It is a premium product which costs £90, which is reasonable compared to other portable lamps. For this you get much more features such as battery indicators, high CRI LEDs, three brightness levels, rubber grip and flexible neck. While there are certainly similar products at a fraction of a price I feel as if this product is certainly worth it due to its plethora of features.	This product is very good value for what is offered. It can be had for around £60 (from official website or AliExpress) with free shipping and batteries included. For a high quality torch with this many features and advantages this is very well priced.
Client	The product is designed for customers who need portable power for purposes, such as camping, travelling, working outdoors, or backup power during blackouts. The product can power up to 95% of home appliances, such as microwaves and fridges as well as being able to charge personal devices such as phones and laptops. The product has an impact on the customer's quality of life by providing convenience, comfort, security and entertainment/situation in an environment where these electricity would've previously been severely limited. The product is promoted through online platforms, such as YouTube and Instagram, this tells me that the product is aimed at young adults as they are the predominant users on these platforms who also have enough money to purchase it. This makes sense as this is an outdoorsy product which is popular among young fit adults.	The product is aimed at those who want a simple to use, minimal and high quality lamp.. It appeals to clients who need a lamp that they can carry around with them and place down anywhere. An example of somebody who may use this is somebody who loves to read books and wants a product that they can quickly deploy anywhere to light up their book when away from power. It is sold in many places from their website to popup stands at markets which allows it to reach a wide market of all ages. This makes sense as a portable life source has no one set market as darkness effects everyone and this is a stylish easy solution to that problem.	The customer for the lantern is someone who enjoys outdoor activities such as camping, hiking and fishing. They need a reliable, bright and durable light source that can last for long periods of time. They also appreciate the ability to adjust the color temperature and brightness of the light, depending on the atmosphere and time of day as well as the power bank function. They are willing to pay more for a premium product that meets their needs. It is also a collaboration with BLF(a flashlight enthusiast forum) making it extremely popular within the enthusiast community.
Environment	The product has a positive impact on the environment by using renewable energy sources, such as solar panels which can come included as an optional addon. On the other hand it also has a negative impact by using non-renewable materials, such as plastic, lithium and metal. The product can be recycled or disposed of safely when it is no longer needed, by following the instructions provided by the manufacturer. The product also has a smart temperature control system that prevents overheating and reduces energy waste. It has a predicted lifespan of 10 years which is amazing in the industry.	This product is not very environmentally friendly as it runs on a lithium battery and uses non recyclable materials like plastic. This is however nearly unavoidable in a portable lamp so it is acceptable. The company does also offer a two year warranty where they will repair the product free of charge which not only means that it is less likely to end up in the landfill but it is also an indication of a high quality product meaning it will most likely have a long lifespan. In addition spare parts can also be purchased from the website meaning that the product wont become obsolete just because one part goes missing.	The lantern uses lithium batteries which is actually environmentally friendly in this market as many competing products use disposable alkaline batteries. It also uses standard parts which makes it very easy to find replacement parts online which extends the product's lifetime significantly. Overall this is an environmentally conscious product for its sector.
Safety	The designer has considered safety issues when designing the product by using premium materials and an upgraded Battery Management System (BMS) that ensures complete protection for the user and the devices. The product meets recognised safety standards, such as CE, FCC and RoHS. The product also has a built-in LED light that can be used in emergencies or dark situations. The product protects the user from electric shocks or overheating by having insulated wires, protective covers and vents. This product also features two large ribbed rubber pads to provide a slip free secure base.	The product features a LED that does not get hot or emit UV rays that prevents any burns or damage to the skin. It is also well insulated with plastic meaning electric shocks wont be an issue. Lastly the company is LIAQA certified meaning it has met the quality assurance and has rigorous quality control. Both of these factors contribute heavily towards what makes a safe product.	The lantern has a thermal regulation system that prevents over heating and adjusts the brightness according to the ambient temperature ³⁴ . It also has a lockout function that prevents accidental activation. The handle and the diffuser are made of plastic, which reduces the risk of electric shock or burns. Its also waterproof to 1 meter which prevents short circuits.
Size	It is relatively large (463x288x237mm) and heavy (20.1kg) compared to other portable power stations, but it also has a higher capacity and power output. Its proportions are appropriate for its use by having enough space for the large battery, the ports and the display. The product is easily able to fit in a car trunk or a tent making it relatively portable for long trips.	The product is small in size but still has an impressive max extension of 26 cm, and weighs 1 kg. It is relatively small and light compared to other portable lamps on the markets. Making it a good option for a portable light as being lightweight and small is nearly essential in a portable product	The product is small enough to comfortably fit in the hand(50mm in diameter and 176mm tall), it weighs 642 grams which gives it a nice solid, hefty feeling in the hand.
Function	The product works well by providing stable and reliable power for various appliances and devices. It works this way by using LiFePO4 batteries that have a high energy density and a long lifespan. It is also extremely durable by having a solid drop-proof design and a smart temperature control system that prevents overheating and damage. It could be improved by utilizing a data connection to force the orderly shutdown of connected computer devices as without this there is risk of data loss or at least an alarm to warn you when the battery is nearly depleted. It is easy to use by having a simple interface with buttons and indicators. It also has a smart LED display that shows the remaining power and other information.	The product is simple to operate as it only has three levels of brightness. It features a USB-C plug on the back which makes it easy and convenient to charge as USB-C is one of the most prevalently used connectors. It has a simple light up battery indicator on the back which is cleverly placed alongside the port as it allows for it to be out of the way but also visible while charging and logically placed. On top of the product there is a comfortable soft grippy silicon loop for easy carrying and a twisty joint allows for the light to be positioned in any orientation. It can also neatly fold up into a compact rod for easier carrying and it features a large slit for easy reopening by those less dexterous. To improve this product I would suggest including a warmer light option at around 3000K to create a more pleasant and relaxing experience. This would also be better for reading before bed as it decreases the blue light that enters your eyes. I would also add more colour options to appeal to a wider range of people but I do understand that there is a problem of scale as it is a relatively small company.	The lantern provides a bright, high CRI and CCT adjustable light that can illuminate a large area and create a cosy atmosphere. It has various modes and features that allow the user to customize the light output, colour temperature, brightness, duration and more. It also has a power bank function that can charge other devices via USB-C port. It also is very versatile as it features a camera mount and a handle to hang it from. The torch can also handle water due to its IPX7 rating making it suitable for hiking and camping. The lantern can be charged via USB-C making it easy to charge due to how widely adapted the connector is. For long trips the torch has an extremely long battery life allowing it to run for a month straight on the lowest setting.
Materials and Manufacture	The product is made of plastic and metal materials that are durable and resistant. The plastic is used for the casing and the handle, while the metal is used for the ports and the frame. The plastic is injection moulded, while the metal is probably cut and welded. The product is produced in Shenzhen, China using a revolutionary new method of manufacturing called "smart manufacturing" which utilizes modern technology to increase speed, reduce costs, improve quality, decrease risk and enhance efficiency	The product is made of plastic that is durable and resistant. The plastic is used for the casing and the handle and is most likely injection moulded. It is also probable that the product is batch manufactured as it comes from a small London based company that doesn't have a large enough clientele to justify mass producing their product.	The chassis is made from anodized aluminium for a strong attractive finish and heat dissipation. The lens is made from 40% frosted polycarbonate for balanced light smoothing and output while being highly crack resistant. The product is mass produced as it uses standard components.



Ikea Croydon Visit



Use of light in design

Walking through the IKEA, I was impressed by the incorporation of Nordic design into the illumination of the store. Light wasn't just used to illuminate the space, but also to enhance the design and style of the products. The light was blended with various forms and textures, creating a sleek and minimal look that matched the contemporary Swedish furniture on display. One of the products that caught my eye was the NORA FORS light (shown top left). It was a pendant light with a flat circular disk surrounded by a ring/ halo of light. It featured a dimmer switch that allowed the customer to adjust the brightness and mood of the room. I thought its modern and simple design would suit my client's taste. So, I might incorporate something similar into my product.



Rubbish dump

Unfortunately near the Ikea we discovered a colossal dump of rubbish in the middle of a disused road. However I decided to make light of the situation by searching for useful discarded items among the rubbish. I found a large aluminium heatsink in good condition that I could use to draw heat away from the LED in my project which is essential for high powered illumination. This fits perfectly within my context (climate change) as I reused (one of 6 Rs) an old heatsink that would've otherwise needed to purchase which would cause more carbon emissions in the manufacturing and shipping.

FREK VENS spotlight



I was drawn towards this particular lamp due its unique cube design which created a very sleek look and meant it could be oriented in any direction (assuming the cable has somewhere to go). The FREK VENS spotlight also featured some smart capacities such as the ability to sync its light pulses to the beat of the music playing. An easy way to improve this product would be to change the connector to USB-C and include a battery making it more versatile, portable and easier to use.

Use of wood

Wood is a key element in Ikea's products, both as an accent and as a background material. It creates a contrast with the sleek and minimalist Swedish design, and offers strength, durability and environmental benefits.



Power bank



On my visit I also looked at the power banks that Ikea had to offer. The VARM FRONT was the one that I was most drawn to due to its simple, function over form design which allowed it to be both durable, practical and high capacity. It features three ports at the front and a small battery indicator meaning multiple devices can be charged at once and that the remaining power can be checked quickly. However I believe this design can be improved, as it can only be charged with USB-C.

Investigating hinges



The mounted lights also interested me as they demonstrated how a flexible mount can transform a fixed light into an easily adjustable versatile light with minimal trade-offs. The two products featured above have incorporated different types of mounts into their design. The one on the right has used a hinged mechanism that allows the light to be positioned in one plane, while maintaining high stability and durability. This makes it more suitable for applications where strength and reliability are important, but some flexibility is also desired. On the other hand, the one on the left has used a gooseneck that enables the light to be angled in any direction and orientation, while sacrificing some sturdiness and rigidity. This makes it more appropriate for applications where flexibility is essential, such as a bedroom light.

BETT ORP lamp



My favourite lighting product I saw on my trip was the BETT ORP lamp. It is a bedside light, lantern and wireless charger all in one. It features a dimmable warm white light with three brightness modes allowing you to adjust the light to your needs. The lamp's base features the two wireless charging pads that can simultaneously charge two Qi-compatible devices at 5 Watts and backs up as a charging dock for the lantern. The use case for this product in my opinion is as a bedside table with a detachable lantern to be used at night for quick trips (e.g. going to the toilet). To improve the product instead of having three separate brightness levels I'd suggest using a smooth ramping UI which is simpler and allows for more customisability. Additionally, incorporating a USB port for wired charging compatibility would provide more flexibility for users and adding magnets in the base and the lamp so they snap together would make it easier to charge and more secure for when being used as an ordinary night stand.

Bounce Flash / Ceiling Bouncing

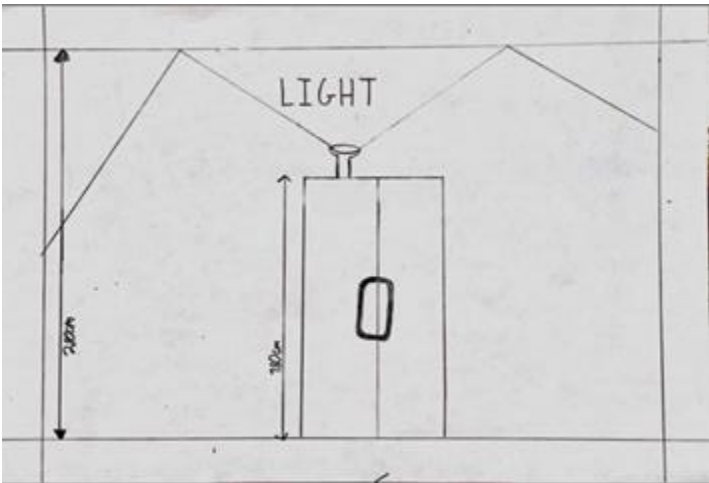
Explaining the Bounce Flash concept

Since my client wants the product to be able to light up a whole room for when his lights aren't functioning I will need to find a method that can do this that is both practical and easy to implement. This is where ceiling bouncing/bounce flash comes in, an efficient way to easily light up a room by utilising the reflective nature of white walls which is arguably even better than a lantern due to its smaller size, wider and more even spread and versatility.

The conventional way to light up a large room is with lighting shining down from the ceiling as this creates a smooth and even light pattern that doesn't blind the occupants of the building. So the light can be "bounced" off the ceiling to create an even smooth light pattern that is capable of lighting up a room. This works due to the reflective qualities of white paint (the average wall will reflect 80-90% of light) which means by pointing a significantly bright light source at a ceiling you can effectively light up an entire room. The photo I took (featured above) is a proof of concept which demonstrates that a torch can easily light up its surroundings if directed up at a flat white surface. I will most likely implement it into my product.



Looking how to implement bounce flash into the home



However, Ceiling bouncing/Bounce flash is not generally used for indoor lighting and is more often used for photography, home decorations and videography. To implement it into an actual product I need to make a couple changes.

Firstly the room the client will store the product in has an area of 25m² meaning that a conventional light source such as light strips or a small LEDs will not suffice. Instead I will have to opt for more modern emitters with offer more lumens while still maintain high CRI.

Since my product will now be using high power LEDs it means that a lot of heat will be produced meaning I'll need to invest in a heatsink or active cooling system and an efficient LED driver.

Lastly in most other applications ceiling bouncing is done on top of a tripod to minimise the risk of looking directly into the light. However in my product use of a tripod would be impractical so I'll need to place it on top of a tall piece of furniture such as a fridge.

[Photography bounce flash patent](#)

Testing bounce flashat my clients home

1000 Lumens



3000 Lumens



32,000 Lumens

I tested three lights in total all with different outputs to determine the ideal compromise between brightness and Energy consumption. I aimed to find the minimum amount of light needed to effectively light up the entire room to a degree that allows my client to use his kitchen as normal. I placed the torches on top of the fridge and set them to their max brightness. Then I proceeded to walk around the room opening drawers and checking the corners to ensure the whole room is well lit. I tested three torches overall: a Wurkkos TS10, an Emisar D4K and a Nightwatch NS59. Each torch has different light characteristics meaning I will be able to judge what matters to my client in a light.

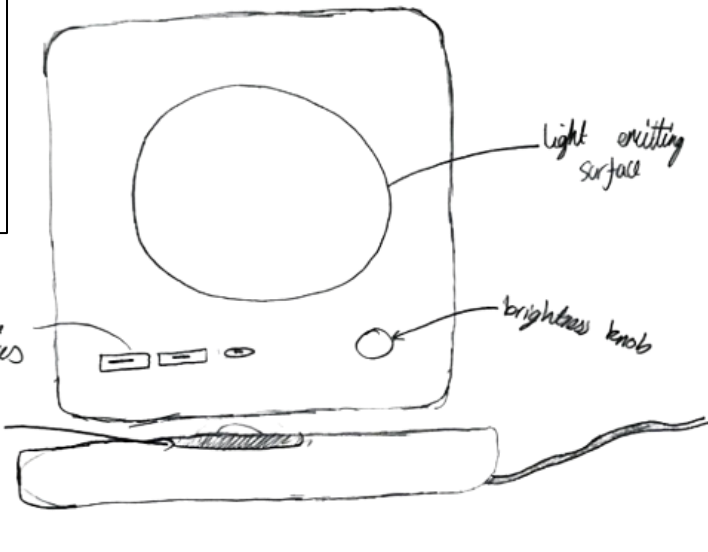
Torch	Output (Lumens)	CRI	CCT	Overall opinion
Wurkkos TS10	1000	99	3000K	Nice colour accurate warm light but not bright enough
Emisar D4K	3000	95	4500K	Nice colour accurate neutral light that effectively lit up the room
Nightwatch NS59	32,000	70	6000k	Definitely overkill and light looks too artificial

Overall after my testing I'd want to choose an emitter that is around 2-3000 Lumens (as it is more than enough to light up a room), has a CRI of ~95 (as colours being rendered naturally is important to my client) and a CCT of around 3500K (my client indicated to me that he prefers warmer lighting).

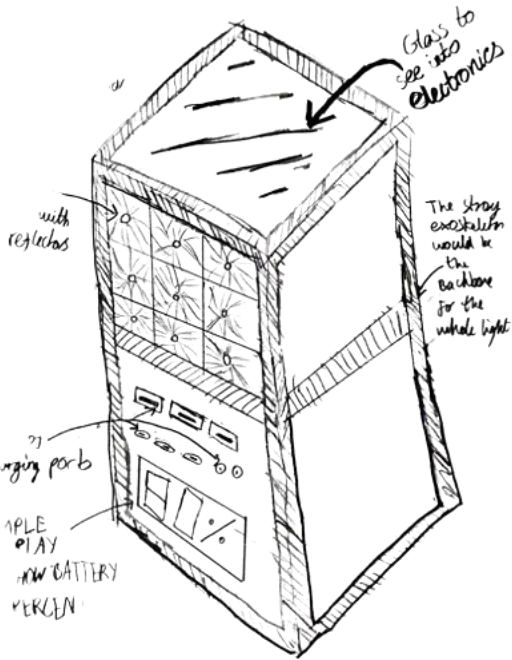
Initial Ideas



Due to my clients enthusiasm for the below design I decided to use a text to image machine learning model to create a more detailed mock up of the product. My client really liked this image and was intrigued by the AI image generation

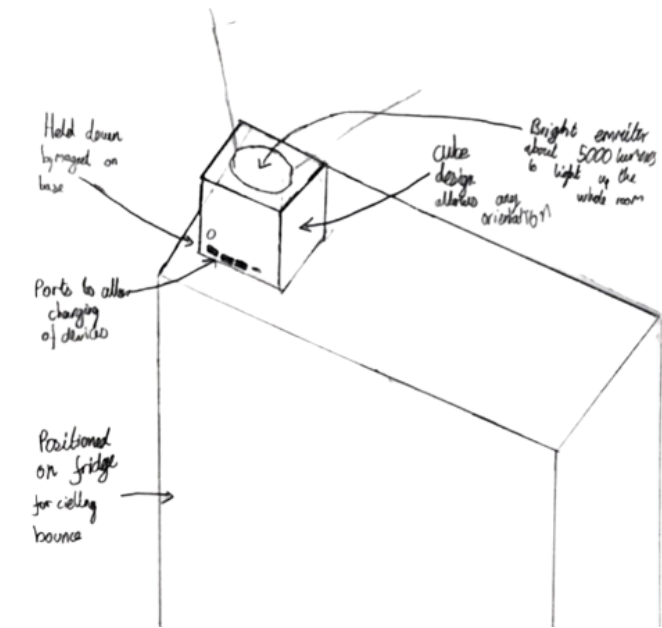


I gave my client all my sketches to review and asked his opinion on each one so I could refine my design so it suits him best.



This light design takes inspiration from the exoskeleton design of 15 Clerkenwell close to make it sturdy and strong. It features a glass panel on top to give an interesting aesthetic which allows the user to see the internal components of the product.

My client said he found the design to cluttered but still liked the idea of an exoskeleton he just would prefer it to be simpler.



This light was inspired by the FREKVENS spotlight keeping a cubic design and LED in the centre. The cubic design allows for the light to be positioned in any orientation meaning it can be pointed sideways if needed while still having the capability to “ceiling bounce”. I tried to create a very minimal design with this lamp as in my interview I found out y client likes simple designs such as Bauhaus.

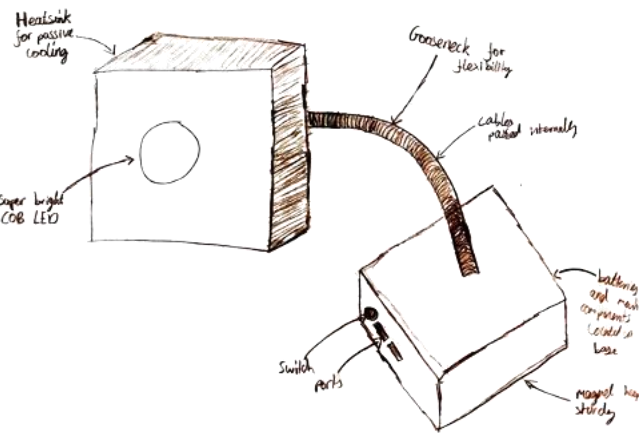
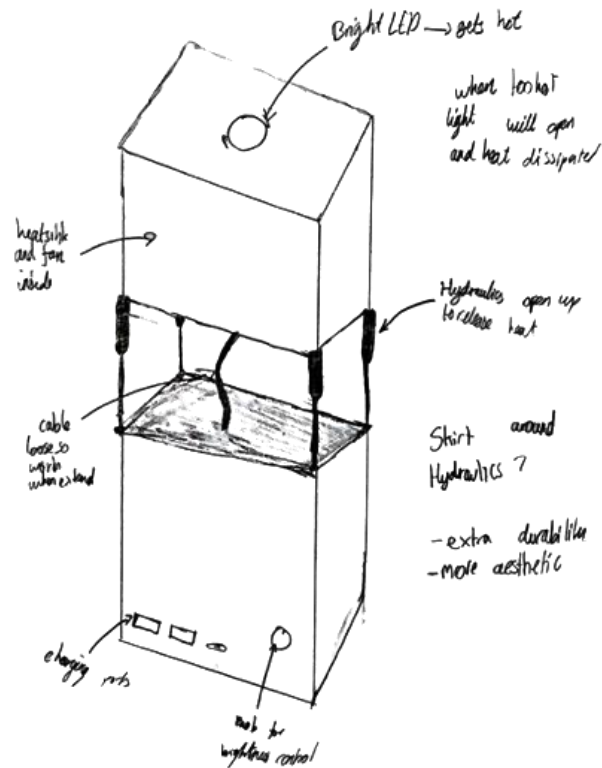
My client really liked this light but wanted the edges rounded, a way to carry it and a magnet integrated into the base like the previous design

This light was a combination of my two favourite lights from Ikea, the FREKVENS and the BETTORP. I implemented the cubic design from the FREKVENS and used the concept of a wireless charging base that recharges the light when placed on top of it. This makes the product very portable convenient and versatile. However it is also an inefficient method of charging generates lots of heat which makes it have a bigger carbon footprint than conventional charging which goes against my context. Overall while this design does have it flaws I think it is definitely still a solid concept.

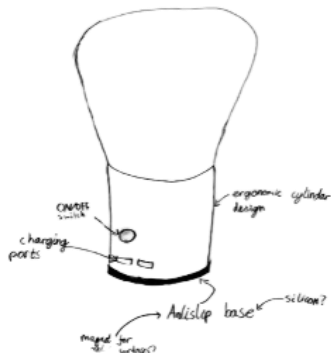
My client liked the convenience of the product but found it to be slightly too complicated and agreed with me on the efficiency issue. He said he’d like the light if it didn’t need a wireless charging base

This light was focused purely on taking heat away from the LED to maximise the performance of the product. When the light begins to overheat the hydraulics (upon second thought these would be replaced by electrical piston as hydraulics are expensive and unnecessary) expand opening up the light to dissipate the heat. This however was an inconvenient design which would make the light fragile and prone to breaking.

This design was the one my client liked the least as it completely went against his principles of simplicity. He did however acknowledge that the products simplicity might have to be compromised a little in order to maximise performance.



This sketch used a gooseneck connector, which I saw on my visit to Ikea, this allows for greater flexibility and makes it easy for my client to point the light in the desired direction. This design also allows the LED to run at higher levels for longer since it has a heatsink integrated within. My client said he liked the flexibility that the design provided and the integrated cooling but found the aesthetic displeasing and would prefer a simpler design.

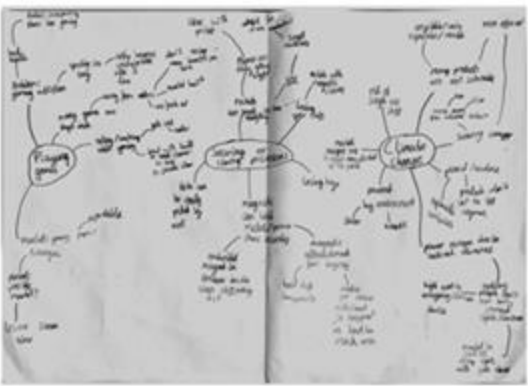


On this design I tried to improve the ergonomic by creating a more rounded design which fits better in the hand. This allows my client to easily and comfortably carry it around. I also came up with the idea of creating an anti slip base with a magnet inside which allows it to be held against ferrous surfaces. However this design would struggle with cooling as it is difficult to dissipate the heat of the LED in such a small body. This design took inspiration from the Sofirn BLF LT1 featuring a similar cylindrical design and prominent reflector as they are both well loved features on the lantern.

My client really like the design of the base and said he would definitely be interested in having a magnet to stick the product to metal surfaces. However he didn’t love the design of the top commenting that the diffuser was too big and clunky.

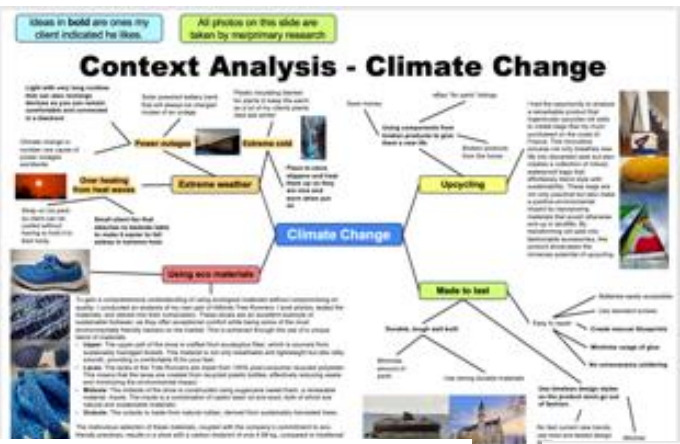
Section A Evaluation

Initial ideas and context selection



My chosen context will be climate change as it is one of the most pressing issues of our time, and it aligns with my values as well. I have chosen to concentrate on minimising the effects of climate change by creating a product that will help my client deal with the effects of climate change while utilising sustainable and ecological practices to not be a part of the problem but rather part of a solution. An instance of such extreme weather that had a profound impact on the UK was the summer heat waves of 2022. These heat waves resulted in extreme discomfort, business closures, droughts, and put immense strain on the national grid. In my project, I will promote ecological sustainability by reusing components, using ecological materials and ensuring easy reparability.

This slide helped me choose my context and gave me a good place to start for my project.



This slide is where I delved deeper into my context finding ideas my client liked, analysing products for inspiration and looking at how to implement something similar in my product. It gave me new ideas for my context and helped me find ways to make my product ecological.



Client Profile

Name	Dr Alexander Rosenberg
Age	45
Occupation	Partner at patent law firm
Budget	£500
Details in a product	Personalised, clear, sophisticated
Uses in a product	High quality, standardised, simple to use

Client interview

- 1. How often do you use light?
- 2. What do you use the light for?
- 3. What do you use the light for?
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This slide helped me find out what my client wanted out of the product, what design styles I should aim to follow and to identify his needs, wants and values.



This slide helped me see how other designers have developed their products and also gave me Bauhausian ideas such as keeping a simple form to implement into my product.



This slide helped me see how other designers create their products and deepened my understanding of the process that goes into designing it also gave me new idea on how to minimise the carbon footprint of my product



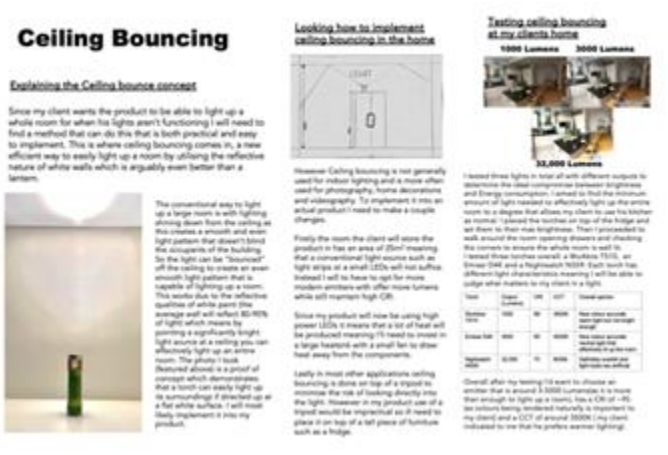
This slide taught me about the internal of a lighting product making it easier for me to create a well executed lighting project of my own, avoiding common mistakes.

Secondary research	Asker SOLAR P1000 Proformance T5T	Design Team 2 go	Sofus BLF L17
Cost	£100	£100	£100
Cost	£100	£100	£100
Environment	£100	£100	£100
Quality	£100	£100	£100
Price	£100	£100	£100
Features	£100	£100	£100
Materials and Manufacturing	£100	£100	£100

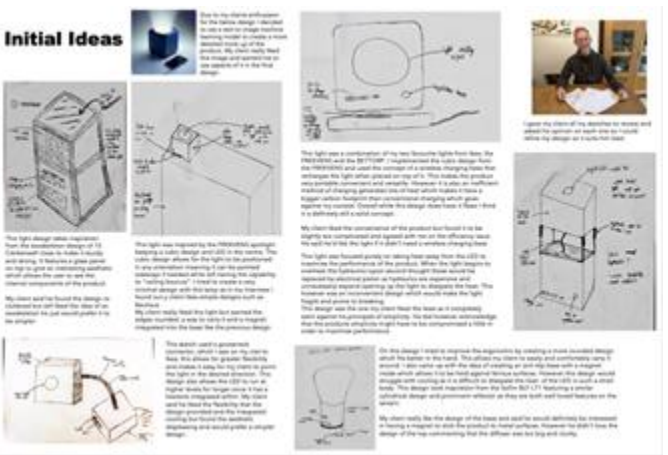
This slide gave me the opportunity to look at other products similar to mine and see what features I would like to borrow from them and how they could be improved. It also allowed me to begin thinking off how I would like to implement those features into my product.



This slide allowed me to see similar products to mine in IKEA so I could get inspiration and implement similar design styles and ideas into my product.

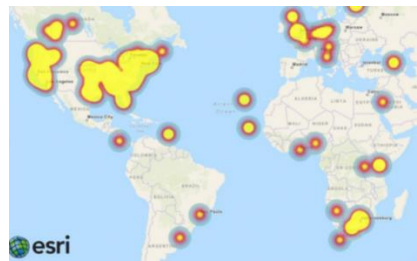


This slide helped me introduce and explore the concept of the ceiling bounce in my product which will be a great feature and selling point of my product.



This slide helped me develop some initial ideas for my product so I could get a better idea of what I actually planned to build.

Design Brief



Background:

After carrying out a wide range of primary and secondary research and interviewing my client, I identified that my product’s primary goal should be able to provide power to recharge essential devices and light in case of a blackout as a result of the rise in extreme temperatures and weather events facilitated by the acceleration of climate change. My product could also be used instead of inefficient overhead lighting when the full room doesn’t need to be lit, saving energy and therefore decelerating climate change.

Brief:

I will design and prototype an efficient bright portable battery-powered light that is capable of illuminating my clients rooms and recharging his phone and laptop to allow him to continue to work in the increasingly probable event of a power outage that should retail at £110.

Target market:

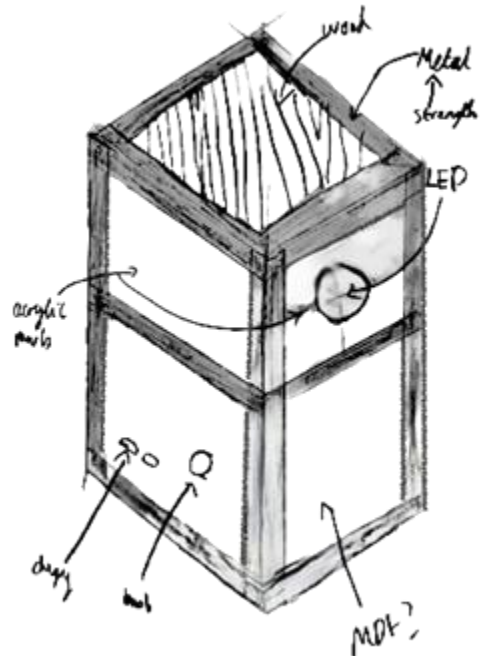
My target market will be those who are aware of climate change and its impact upon the environment and cities, homeowners as they are in need of such a product, middle class as they are able to afford such a product while not having dedicated emergency lighting and somebody who is a heavy user of technology as they are more likely to need a high capacity power bank to recharge their many devices. However my target market is not limited to this as my product solves an issue that affects us all (climate change), the previous is only an example of an ideal expected user not all the users. As the Heatmap on the left shows power outages are still a major problem in the developing and developed world



Needs	<ul style="list-style-type: none">- Light up a room- To charge up at least two devices fully
Wants	<ul style="list-style-type: none">- Long battery life- Portable- Follows Bauhaus design- Have high CRI- Warm color temperature
Values	<ul style="list-style-type: none">- Designed for disassembly- Be made from sustainable materials- Have a minimal impact on the environment

Specification	Requirements	Justification	Measurement
Aesthetics	1.1 Be stylish, sleek and smooth 1.2 ports/buttons as recessed as possible 1.3 Incorporate Bauhaus design style 1.4 Buttons should blend in and kept to a minimum 1.5 Have as smooth finish	1.1 So that the product can seamlessly fit into the modern home without looking out of place 1.2 To give a clean finish/aesthetic to the lamp 1.3 Gives the product a timeless aesthetic and ensures the product is efficiently constructed and designed and it is also one of my clients favourite design styles. 1.4 So that the buttons complement the minimalist design and don't ruin the clean aesthetic. It also prevents accidental activation. 1.5 To look as clean as possible so it doesn't look out of place if my client wants to use it in a more modern setting.	1.1 Ask for clients opinion 1.2 Measure how far the buttons and ports stick out with an accurate metal ruler 1.3 Compare my product to other bauhaus products and ensure it follows the basic rules 1.4 Ask for clients opinion 1.5 Ask peer to test with touch
Client requirements (Needs, Wants and Values)	2.1 Be small enough to fit on a fridge 2.2 Be able to charge my clients device 2.3 Be able to light up a room 2.4 Be portable enough to carry around	2.1 As my client told me that it is the place he would like to store the product due to it being out of the way while still able to light up the room. 2.2 my client needs a product that can recharge his devices in case of a power outage so that he can stay connected and work. 2.3 My client needs a product that can light up a room in case of a power outage so that he can do everyday tasks comfortably. 2.4 My client needs a product that can be moved around depending on what room needs light.	2.1 See if product fits on top of the fridge with visual confirmation 2.2 Plug in my clients devices and ensure they can be charged to full 2.3 Place it in a large room and turn off lights, then turn on product and walk around the room ensuring that the entirety of the room is lit by visuals checks 2.4 Ask my client to carry the product sound the house and make him rate it from 1 - 10 on how portable he finds it
Materials and components	3.1 Use Wood 3.2 Use lithium ion batteries 3.3 Use a BMS system 3.4 Use a bright LED 3.5 Use a heatsink if necessary and an efficiency driver.	3.1 Its cheap, sustainable and easy to apply finishes to. 3.2 They are widely available, have excellent performance and power density and are more sustainable than disposable batteries. 3.3 So that the batteries are kept at safe operating conditions and pose a minimal risk to the user. It also expands the lifespan of the product 3.4 So that the product can comfortably light up a room. 3.5 To prevent the LED from overheating and improve runtimes and lifespan.	3.1 Simple check if component/material has been used 3.2 Simple check if component/material has been used 3.3 Simple check if component/material has been used 3.4 Simple check if component/material has been used 3.5 Simple check if component/material has been used
Function	4.1 light up my clients home 4.2 Be able to charge a device via usb-c easily 4.3 Be able to be stored in various places 4.4 Easy to carry 4.5 Be used in multiple rooms 4.6 Be able to be pointed in multiple directions	4.1 So my client can continue to live his life with minimal disruption in case of a power outage 4.2 To make it simple for my client to use the product, as USB C is the standard connector for nearly all devices 4.3 To make the product as versatile as possible, and allow my client to place it nearly anywhere 4.4 So my client can transport the product easily from room to room so he can have a light source in multiple rooms 4.5 My client told me the product would have to be able to be used in multiple rooms 4.6 This makes the product versatile and allows it to be used for multiple applications, as it can be pointed to where light is needed.	4.1 Place it in a large room and turn off lights, then turn on product and walk around the room ensuring that the entirety of the room is lit by visuals checks(same as 2.3) 4.2 Ask client for rating from 1-10 4.3 Place product in various places where my client would want to store the product and ensure its placed suitably 4.4 Ask my client how easy to carry the product on a scale of 1-10 4.5 Use the product in multiple rooms and ensure it works 4.6 Check the product in at least 3 axes of rotation.
Safety	5.1 Well insulated 5.2 Smooth edges so client won't get cut or have splinters 5.3 Not flammable 5.4 Batteries well managed and secured	5.1 Prevents the user from getting electrocuted and keeps them safe 5.2 Prevents the user from getting cut or getting splinters which could get infected 5.3 Prevents users from getting burnt and reduces the risk of fire spreading to the product, which could result in a lithium battery fire due to high temperatures. Lithium battery fires are much more dangerous than ordinary fires. 5.4 Prevents short circuits and overheating which could lead to battery fire which as aforementioned are extremely dangerous.	5.1 Test with voltmeter 5.2 Get peer to test the smoothness by touch 5.3 Hold a sample of the materials used over a safe and controlled flame and see if it catches light 5.4 Run battery through a few cycles
Environment	6.1 Be mostly made from sustainable materials 6.2 Use efficient LEDs over bulbs 6.3 Be repairable and designed for disassembly 6.4 Be long lasting 6.5 Use standard components 6.6 Minimise use of glue 6.7 Cut in an efficient manner to minimise scrap wood	6.1 By being sustainable the product would fit into the chosen context of climate change and have a lower impact on the environment 6.2 LEDs are more energy-efficient than traditional bulbs, which means they use less energy to produce the same amount of light. This can help reduce the product's carbon footprint and save energy. 6.3 By being repairable the product doesn't need to be thrown away when it breaks but instead can be fixed and given a new life 6.4 Long lasting products help reduce the environmental impact of manufacturing and transportation as a product only needs to be made once. 6.5 Using standard components can help make the product more compatible with other products, which can help reduce waste and increase the lifespan of the product. It will also make my product easier to repair 6.6 Minimising the use of glue can help make the product easier to disassemble and repair. It can also help reduce waste by making it easier to recycle or reuse components. 6.7 Cutting wood in an efficient manner can help minimise scrap wood, which can help reduce waste and save resources.	6.1 Do an environmental assessment on the product 6.2 Simple check if component/material has been used 6.3 Attempt to disassemble the product with simple tools 6.4 Check if it has attributes of other long lasting durable products? 6.5 Simple check if component/material has been used 6.6 Simple check to see if glue has been used unnecessarily 6.7 Tally how much wood has been used and ensure at least 50% of the material has been used
Dimensions	7.1 Be small enough to fit on a bedside table 7.2 Large enough to still have a large battery capacity and effective heat dissipation 7.3 Light enough to carry with one hand	7.1 So my client can use the product as a temporary bedside lamp as his current one is broken and when travelling abroad as he mentioned to me that there sometimes isn't a bedside lamp. 7.2 So that the product can be able to charge up multiple devices and have long runtimes as power outages can often last several days. 7.3 So that my client can carry around the product easily when it needs to be moved from room to room.	7.1 By replacing my current bedside light for a day and seeing how much space it occupies on the table 7.2 Do a runtime test to see how bright it can be for a certain amount of time 7.3 Ask my client to see if it weighs too much while carrying it around / putting it on a scale
Cost	8.1 Material cost shouldn't exceed £50 8.2 Should retail at around £110	8.1 So it can be made on a budget and so many units could theoretically be made if it were to be retailed 8.2 This is a reasonable price as it takes into account the estimated cost of materials and labour, and is not too expensive for the general public, but still ensures that profit would be possible.	8.1 Tally total costs of all components 8.2 Simple check to see if retail place is reasonable

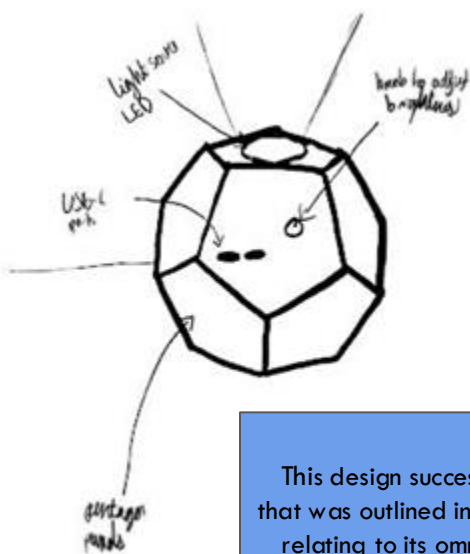
For this sketch I was heavily inspired by my research in section A on the method of construction found on 15 Clerkenwell Close. I based the design around the concept of an exoskeleton to support the designs and expanded from there selecting materials, LED and button placements. However I felt this held back my design as I was confined to the exoskeleton which led to the designing looking relatively boxy and unoriginal.



My client found this design interesting and very "efficient". He liked the focus on sustainability and minimalism but found the overall aesthetic boxy and boring. He suggested using rounded shapes or 3D tessellations.

This sketch complies with the need to be sustainable and designed for disassembly as the simple exoskeleton structure and use of screws makes it easy to disassemble. However, it wasn't very sleek or stylish(1.1), had sharp corners(5.2) and would be difficult to carry(4.4).

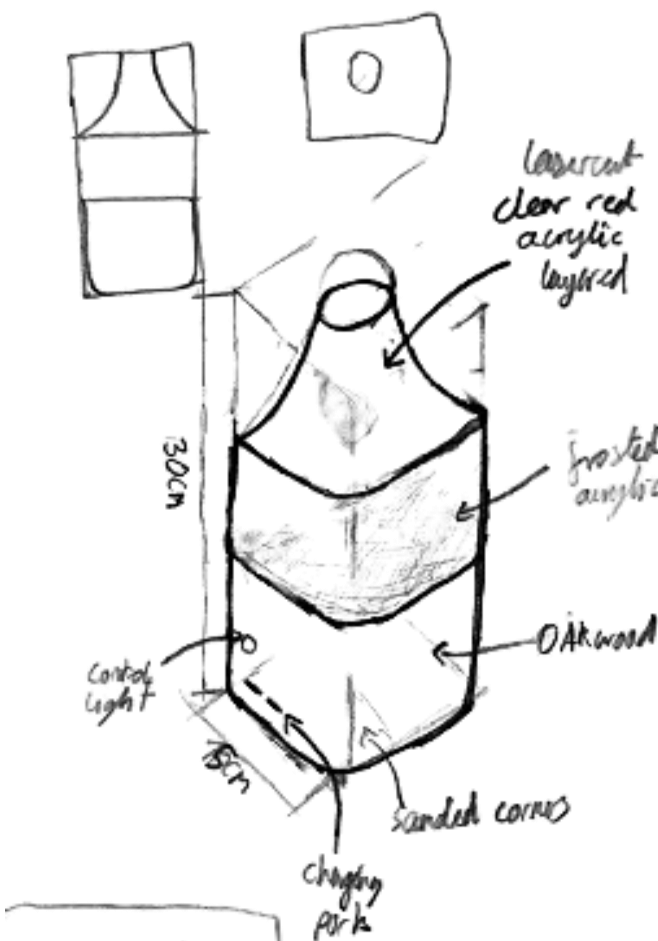
This sketch was based upon a 3D tessellation of pentagons. This design was very interesting as it could be oriented in any direction due to the properties of the shape. However it wouldn't be very practical as it isn't very space efficient meaning the component sizes would have to be reduced in order to fit them all in.



My client liked this design for its simplicity and symmetry but agreed with me that the inefficient characteristics of the pentagonal tessellation was too big of a drawback to make it a valid option due to the smaller components with lower brightness and smaller batteries that would be required.

This design successfully addressed the clean minimal aesthetic that was outlined in 1.1 and 1.2 and the versatility in 4.3 and 4.6 relating to its omnidirectional properties. However it failed to address the need to be easily carried(4.4) and designed for disassembly due to the complex pentagonal shape.

The sketch below was inspired by the unique curvature found in the roofs of shaolin temples, which was implemented in a modernised fashion into this design. This design also benefited from having two possible places to emit the light from(through the frosted acrylic in the midsection and from the top of the "chimney"). This makes the light more versatile and allows it to be used for near illumination and full room illumination. However this design would require the use of two LEDs or a movable part on a vertical axis which would greatly complicate the design and introduce more points of failure. The top of the design would most likely be built from translucent coloured acrylic which creates a soft aesthetic light feature without need for extra RGB LEDs.

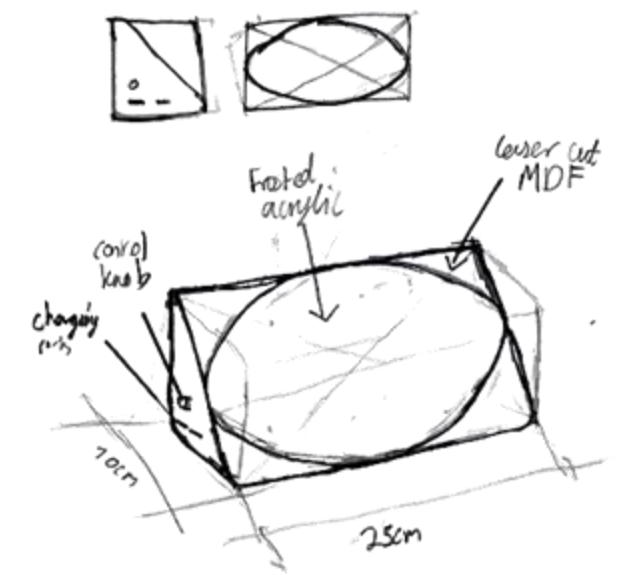


This was my client's favourite design so far, saying he found it "unique" and loved the sloped top of the light and the curved surfaces. He said that with a few revisions he easily thought this could be the final design.

This design has very strong aesthetics, complying with 1.1 - 5. It fits nearly all points of the specification barring 4.6 which is its greatest flaw as the light can only be pointed in one direction as the design doesn't work when put on its side. This would need to be addressed in the final design.

This design utilises a triangular prism as a foundation and features a large piece of frosted acrylic to act as a diffuser in the centre of the lamp. It follows the principles of Bauhaus by being as minimal and efficient as possible. This does however make for a plain design. The geometric properties of the design did mean that the light points up at the user which isn't ideal. It does however work well with the ceiling bouncing concept which I aim to implement into my product.

Overall my client felt relatively neutral on this design. He found the triangular prism shape interesting but not very practical and the surface area of the light source too large.

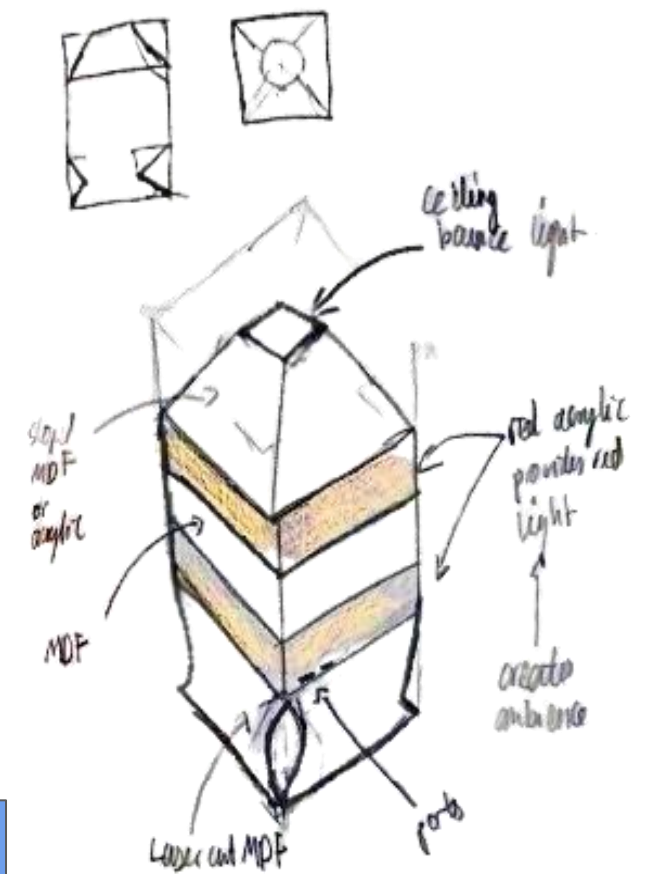


This design has a sleek aesthetic (1.1) and was inspired by the Bauhaus movement(1.3) with simple geometric shapes. The design would also have the ability to be pointed in multiple directions(4.6) due to the many flat faces of the design, which allows it to be stable in many different orientations. However, the oversized LED was overkill and made the design impractical to implement.

This lamp design was inspired by a simple chimney blending modern and classic styles. The light features a warm orange light feature intended to mimic the fireplace's cozy and rustic charm. The chimney's top is utilised as the light emitting surface as it provided a suitable platform for ceiling bouncing light and blends the LED in with the rest of the design.

My client liked this design and told me that it was his second favourite. He really enjoyed the cozy aspect of the design as he enjoys indoor fires and the "warm orange flickering" light they produce which could be replicated ecologically with this design. He also enjoyed how the light source had been implemented into the design to be a "natural" part of it and not "stick out" like in some other designs

This design has sleek aesthetics (1.1) and would look good in multiple locations in the home (4.3 and 4.5). In addition the light can effectively illuminate my clients home as it incorporates the concept of ceiling bouncing effectively (4.1). The design does fall short in its ability to be oriented in multiple directions (4.6) due to the chimney like design which only looks correct when orientated upright.



Overview
Client feedback
Evaluation against spec

AI image generation

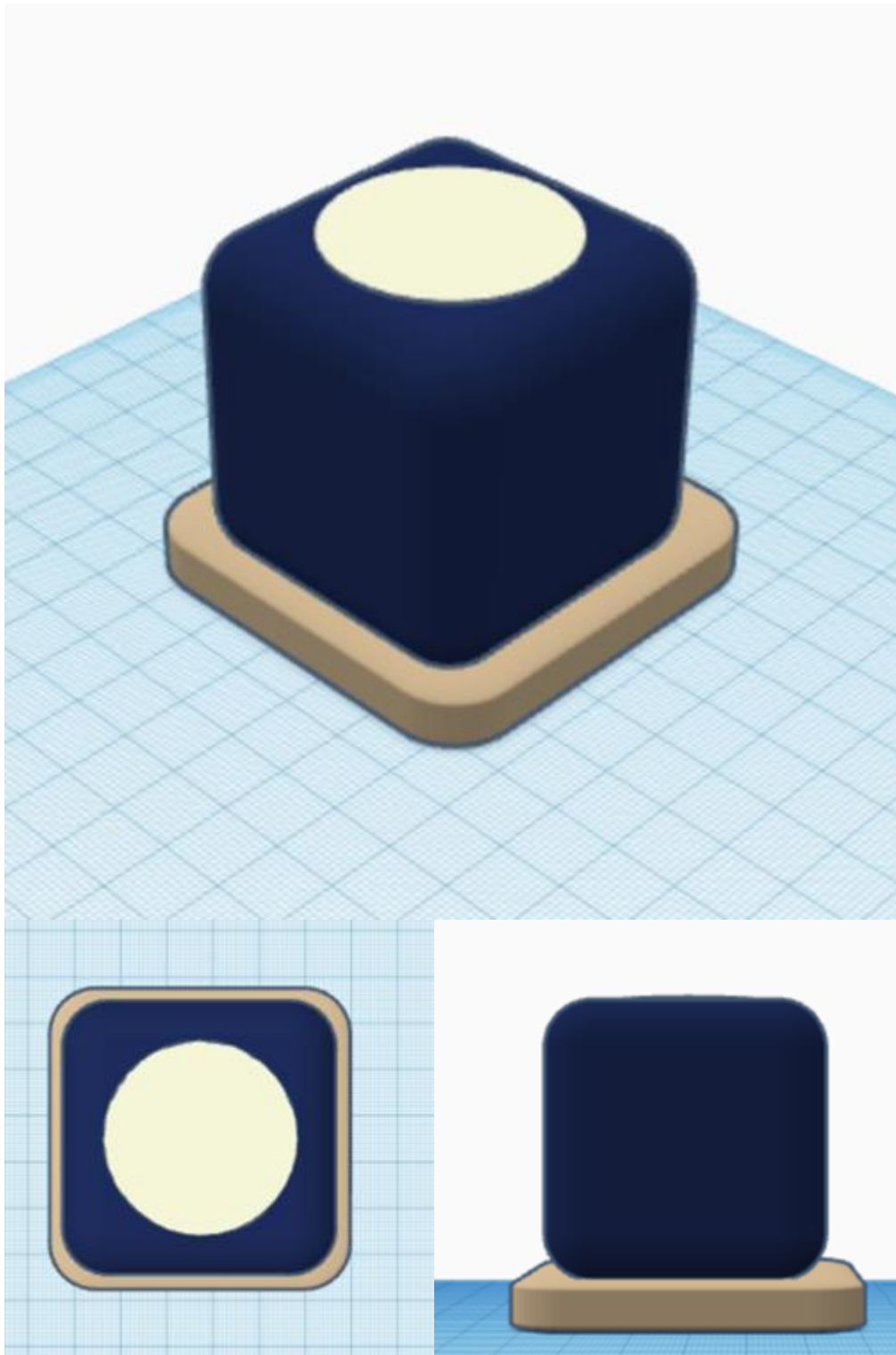
Pros	Cons
Free	Restricted to 2D square image
Produces high quality mockups	Sometimes ignores parts of prompts
Very quick	
Can come up with unique designs	



One of the most useful tools I had available to me was AI image generation (DALLE 2), this new rapidly evolving technology helps designers to quickly preview what a product will look like and garner inspiration to be implemented into their own designs. Personally, I found that AI image generation allowed me to avoid design fixation(a phenomenon where designers limit their creative output by relying too much on existing designs or a specific body of knowledge) and was useful for quick mock-ups. It also allowed me to identify what features my client liked in a light and would want to be implemented in the final design. The three features my client enjoyed the most were: addition of legs, simple design and orange/red lighting features. We decided I'd try to implement these into these into the final product.

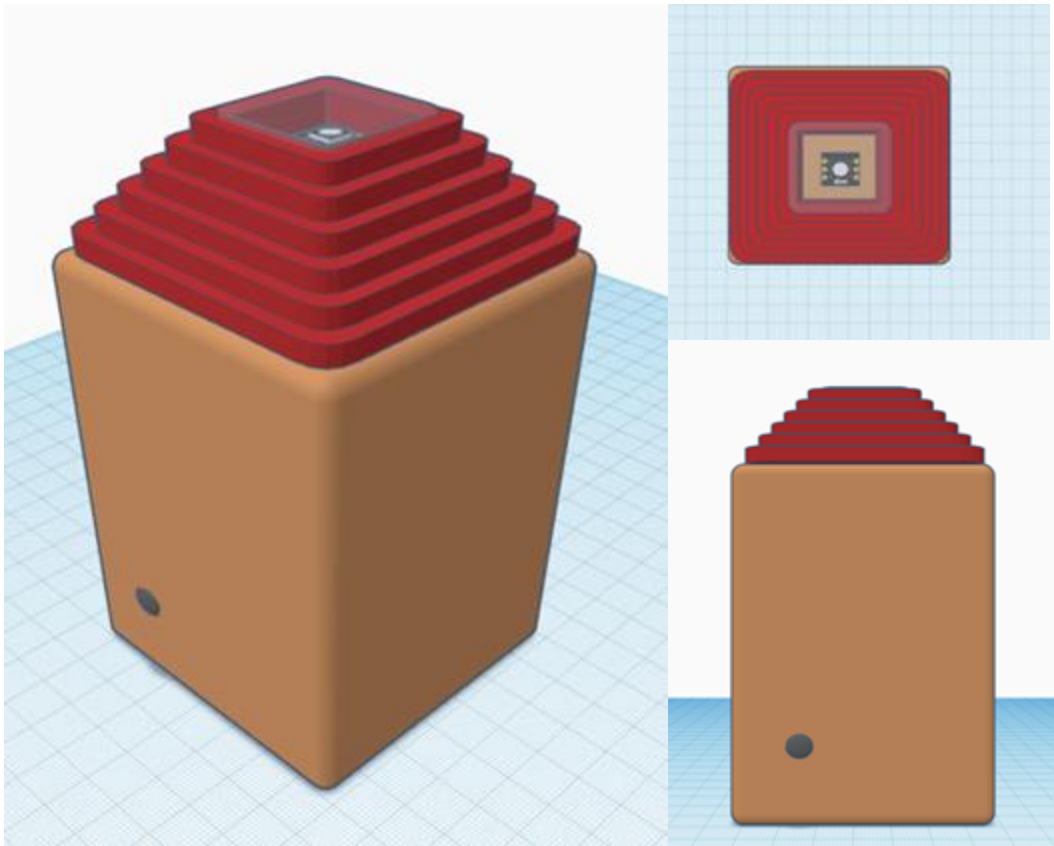


3D modelling - outlines for designs



The design on the right incorporated the chimney-like design from the sketches prior, to create a simple minimal design. The design was relatively large in order to house all the electronic components and create adequate air circulation for the electronics. It featured a curved pyramid area at the top from where the light comes from. My client liked this design because of its simplicity and functionality. He did however tell me he found it also to be a bit plain and too big. My client also liked my other design, once again praising it for its simplicity and modernist approach. The light was largely inspired by my visit to Ikea drawing on the FREKVENS and BETTORP lamps, mimicking the cubic shape of the FREKVENS while incorporating the charging base of the BETTORP lamp.

Pros	Cons
Free	Limited freedom as can only use shapes and tools provided by software
Produces very accurate shapes	Time consuming
Easy to modify	Limited palette
Quick to switch between plan, isometric and front view	



I made a deliberate choice to incorporate **Computer-Aided Design (CAD)** software into my design process. The purpose was twofold: to create mock-up models and gain a preliminary understanding of the final product's appearance. This decision allowed me to swiftly evaluate different design iterations and identify where improvement was needed. The CAD mock-ups served as visual prototypes, enabling me to explore the aesthetic and functional aspects of my different designs. By translating my abstract ideas into visual CAD models, I gained an idea of if my concept was feasible and how it would look in reality.

My chosen CAD software of tinker lab had limitations when modelling custom shapes which had unexpected benefits. Since complex shapes were challenging to model, I was pushed towards simplicity in my designs. This unintentionally aligned with the Bauhaus principles of efficiency, minimalism, and clean design.

My client appreciated the alternative viewpoint offered by CAD mock-ups. These digital representations allowed him to see the design from various angles, allowing us to discuss what aspects of the model he liked and disliked. This allowed me to form a better idea of what the final product would look like. Among the models I presented, two stood out as his favourites. My client praised their efficiency, simplicity, and overall cleanliness. These selections further allowed me to refine the final concept for the product.



Cardboard Model

One of the tools that designers can use for quick prototyping is cardboard modelling. I decided to try this method to test the size and ergonomics of one of my possible designs. I also found a torch that contained the same emitters (Nichia 519As) that I planned to use in my final product. I used the torch as a substitute for the light source in my cardboard model. This helped me to get a better idea of how my future product may look.

The cardboard model also gave me an opportunity to realise flaws in my design that can't be seen in two dimensions. I realised that the design I'd planned on developing had too much empty space for the components required, this could only be made obvious to me through seeing the physical size of the product in the physical world. To combat this problem I decided that legs may be required and the midsection of the body should be compacted to keep aesthetics(and perhaps even improve them) while not wasting space.

Pros	Cons
Physical interaction	Cardboard isn't always available(took 10 minutes to find some of reasonable quality)
Test ergonomics	Hot glue can be messy
Easy to identify flaws	Restricted by cardboard colour
Not limited by software or paper	Time consuming

Client Feedback And Design Selection

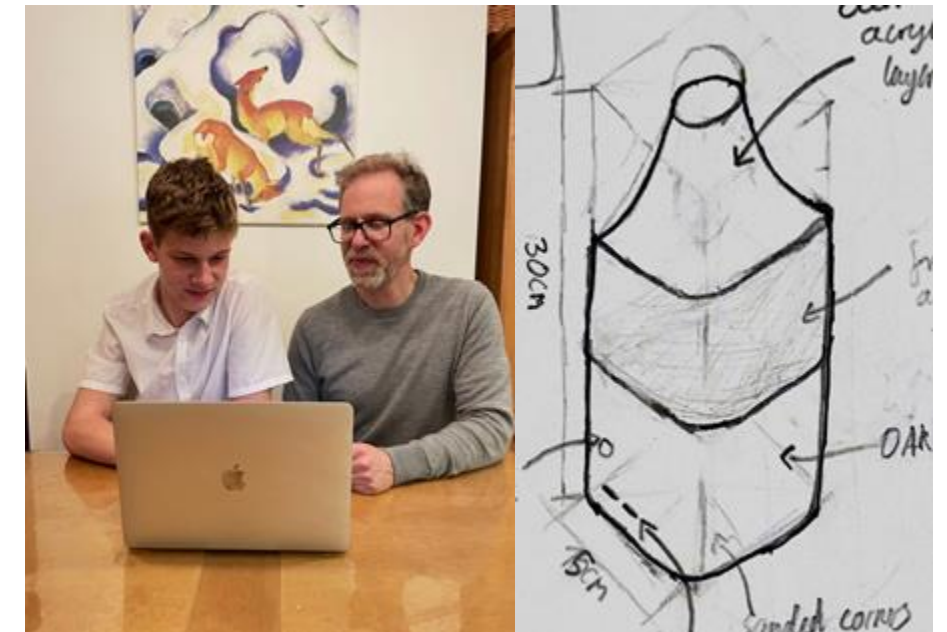
I asked my client regularly for feedback and his preferred design choices throughout this project. His input was especially useful during section C, as this is the final design development stage of and where I can ensure that I have a design that suits his preferences and aligns with his needs.

In this section, we talked extensively about any changes he'd like to make and I narrowed and streamlined my design to fit his needs. For example, he communicated to me that he wanted the device to only have one USB-C port (in order to be minimalist and clean) and the implementation of legs into the product (to increase aesthetics, protect from spills and allow the light to be directed to the ceiling with less spill). I also pitched the idea of making the legs removable to maintain the portability of the product and to give the ability for the product to be more compact when needed, my client agreed that the legs should be removable.

The design we then decided to modify and implement these changes was the one on the top left as it suited the spec and was his favourite design.

I then looked at multiple ways that other products implemented removable legs on the web and narrowed the possible implementations into three distinct possibilities: screw and nut based systems, magnetic connectors and physical locking mechanism. After careful consideration I presented them to my client and we decided to use magnets to connect the legs to the main product

In order to convey the strength of modern magnets I showed him a neodymium magnet and how it could be implemented into the product, which he was very enthusiastic about and admired the versatility magnets would have. I showed him a lighting product that utilised magnets and an extremely strong magnet (400 kg pull force) to show the strength of modern magnets and the security they can provide.



Deciding on legs

- Aesthetics (10)
- Simplicity (5)
- Client opinion (15)
- Total (30)



This simple square based leg system appeals to the Bauhausian aspects of the design specification. It is a stable yet simple build which provides aesthetic that follows the principle of form follows function.

- 7
- 5
- 11
- 23



This diagonal modern design requires only two beams as support creating a cleaner overall aesthetic. The diagonal supporting beam across the centre provides the leg design with excellent strength and support (cross-bracing).

- 8
- 3
- 14
- 25



This novel mono-leg design aims to create a sleek and elegant piece with a single leg. The leg is composed of smooth curves that form a continuous and organic shape, resembling a fluid motion, designed to achieve a balance between stability and aesthetics.

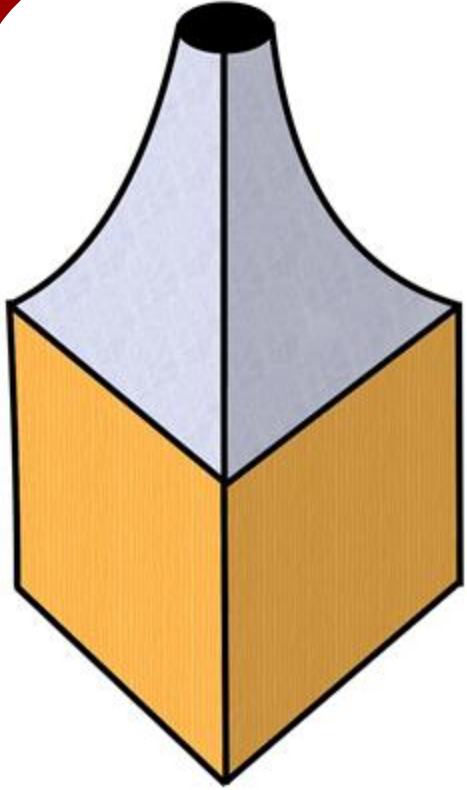
- 7
- 3
- 7
- 17



This diagonal gradient leg system attempts to reflect the Bauhausian ideals of the design brief. The gradient creates a sense of movement and contrast, but also distracts from the overall harmony of the design.

- 6
- 4
- 3
- 13





I created a digital sketch with the basic shape of my product without the legs in order to gauge what legs would best fit the design by using the sketch as a template which could be printed and legs drawn in. I drew in adapted legs based on the inspirational designs to see which design I should base my legs on. This is an effective and efficient method as the main segment of the lamp doesn't need to be redrawn each time and eliminates the human error in sketching as the sketch is digital and the same each time.

Choosing materials

Having decided upon the leg design I needed to select a suitable material to create the design out of which would meet my clients requirements. The three main general materials I considered were wood, metal and plastic. I immediately decided to eliminate plastic as it didn't fit the context of climate change (as it is one of the most ecologically destructive materials) and wasn't necessary. Between wood and metal I decided to go for wood as it: has the necessary compressive strength, is easier to work with and obtain and is a renewable resource. I did however acknowledge that having a midsection and legs made of wood wouldn't be very aesthetically pleasing due to the lack of contrast. To fix this I will either use woods with contrasting colours, use different stains or paint the wood.

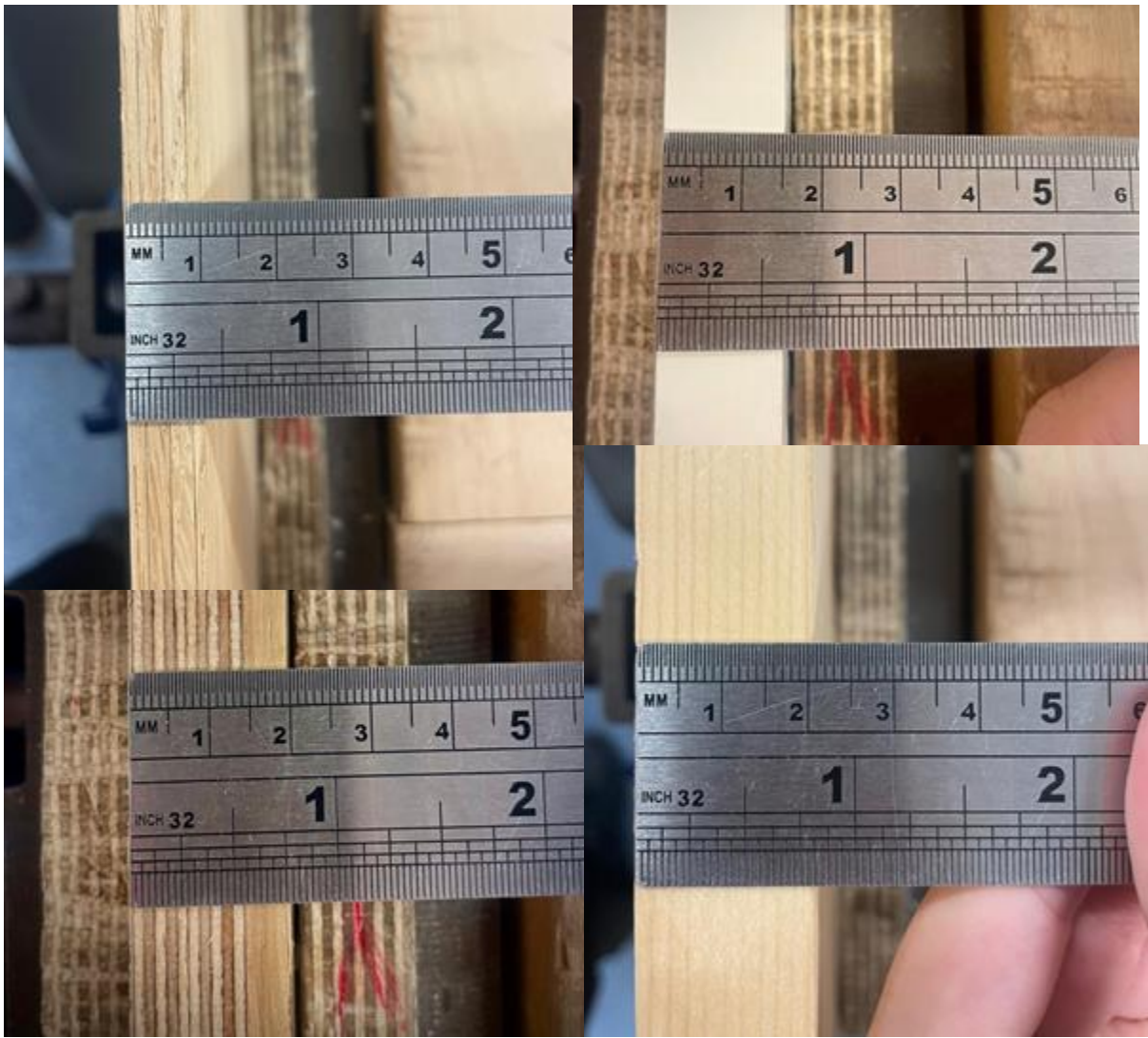
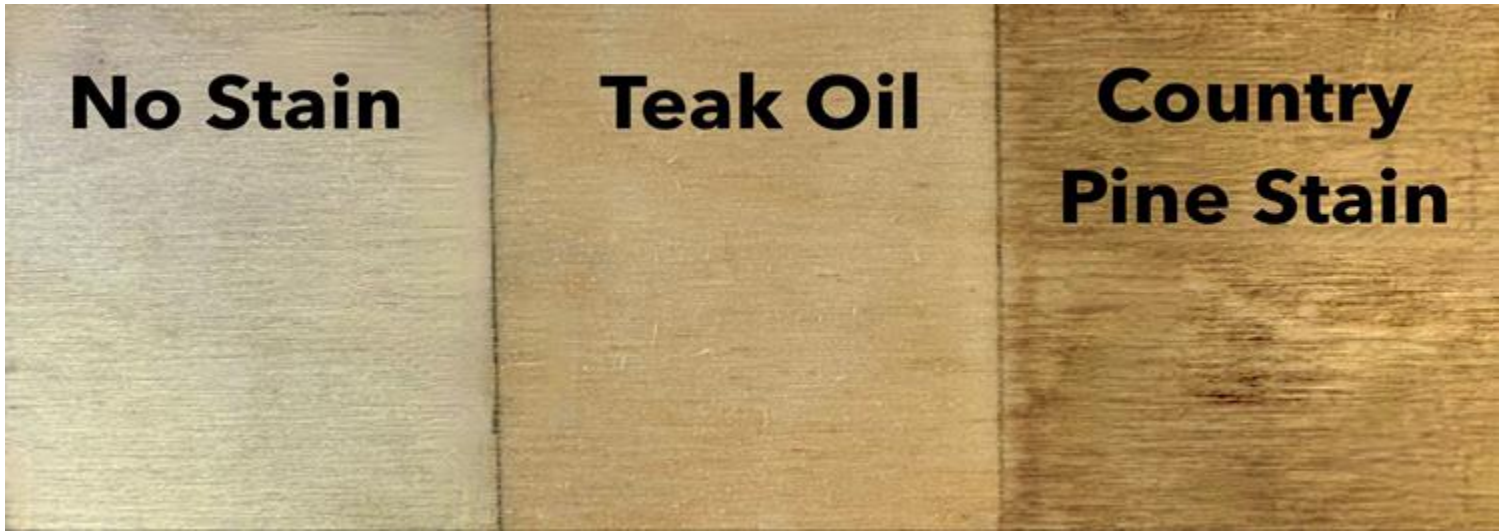
Choice of legs

I looked into dozens of legs from the web and chose four that best suited my product to analyse. From these I decided upon the second design as not only did it score the highest total on the point based system, but also was one of the most aesthetic and unique. I also thought I could manufacture it with relative ease due to the simple 7 part design.

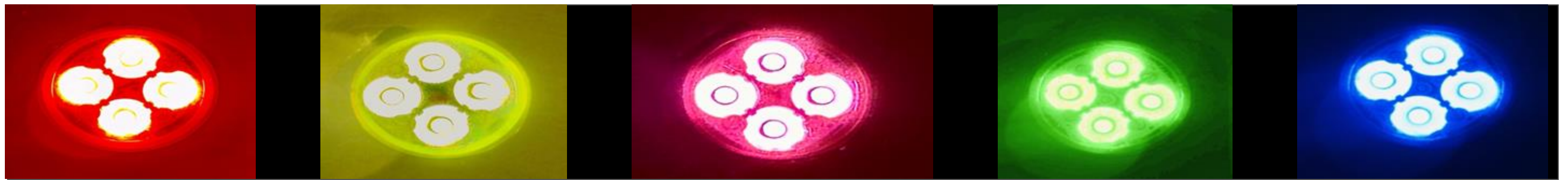
Testing Wood - Group Research Project



We also looked at the textures and aesthetics of the wood to gain a better understanding of which wood we'd use in our product. We were however limited to the selection and quantity of woods stocked in the workshop. Taking into account these limitations I settled on the use of birch plywood due to its high strength, availability, beautiful colour once stained and positive climate impact(made from scrap wood). These qualities were well suited for a lamp meant to serve in power outages and overall made it the ideal material for the exterior of my lamp. I also considered what stain/oil I should utilise to enhance the natural grain of the wood that would be utilised for my product. In the end I settled on using Teak oil, due to its protective qualities that ensure durability and it's appealing colour.



We measured the thickness of various wood types: so that we could gauge their strength, weight and overall aesthetic. We measured using a metal ruler as it had a high degree of accuracy and was quick and easy to measure. We discovered that wood that is too thick is too bulky and heavy, while wood that is too skinny loses a lot of strength. This helped us gain a better understanding of the type of wood that would be suitable for our projects.



Testing opacity and colours of acrylics

I decided it would be necessary to test which colour of translucent acrylic best fit my design ideas, as some of my designs feature an acrylic light feature. This provides an aesthetically variable look depending on the colours chosen and can even serve a legitimate purpose in some cases (Red light maintains a person's night vision). A green light feature makes the product feel vibrant and full of life whereas an orange light feature makes the product feel cosy and warm. This means that if I do decide to implement a light feature it must be very well thought out in order to keep the aesthetic I'm aiming for.



I tested a variety of light colours by shining a torch (with similar characteristics to what my final product will emit: high CRI and 4000K) through each piece of translucent acrylic and documenting the results with a camera. I looked at a variety of factors for each piece of acrylic from the opacity (couldn't be too high as it would be uncomfortable to look at), overall tone (I aimed for something calming and relaxing) and how easy it was to obtain. Based on these factors I eliminated blue acrylic as the light it produced was too harsh, I then proceeded to eliminate yellow as it let too much light through and looked slightly displeasing. Finally I eliminated green as I felt it didn't contrast very well with wood which my product would be primarily built from. This left me with orange and red which I felt equally about so asked some of my peers and the general consensus was that the orange was superior as it felt "more modern" and the red looked "plain". Further consultation with my client showed me that I had made the correct decision as it was also his preference.

One way of implementing the acrylic light feature into my product that I was drawn to was a conical layered chimney which my teacher had showed me. I liked this idea a lot because it allows for different gradient and shapes while in addition having an interesting texture. It is also extremely easy to manufacture as it only requires acrylic, hot glue and a laser cutter which are all readily available in the workshop.

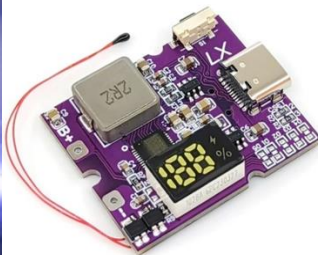
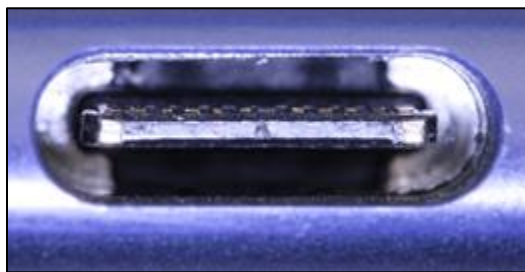


Electrical components



Batteries

To power the project I used six 21700 cells in parallel as they provide very long runtimes and have the required potential difference of 4.2 - 3.2 Volts for the driver. I used a battery case to wire them in parallel and meet the specification of being designed for disassembly.

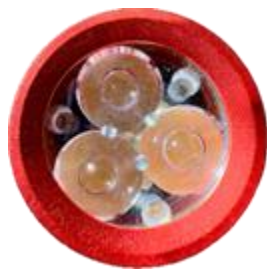


To manage the USB-C charging aspect of the product I bought a USB-C charging module which enabled the batteries to be recharged via a USB-C cable and charge devices.



Cooling components

To cool the lamp I ordered thermal paste and a thick copper cylinder to dissipate heat and create a spacer between the driver and the MCPCB.



LEDs

For lighting I used the famous Nichia 519A emitter marvelled for its high CRI, brightness and neutral DUV among the enthusiast torch community. I ordered the LEDs in a triple configuration to make the light more efficient and brighter than a single emitter light. As an optic I used a triple Carclo TIR optic as it is channels light extremely effective and creates a good balance between flood and throw.



Wires

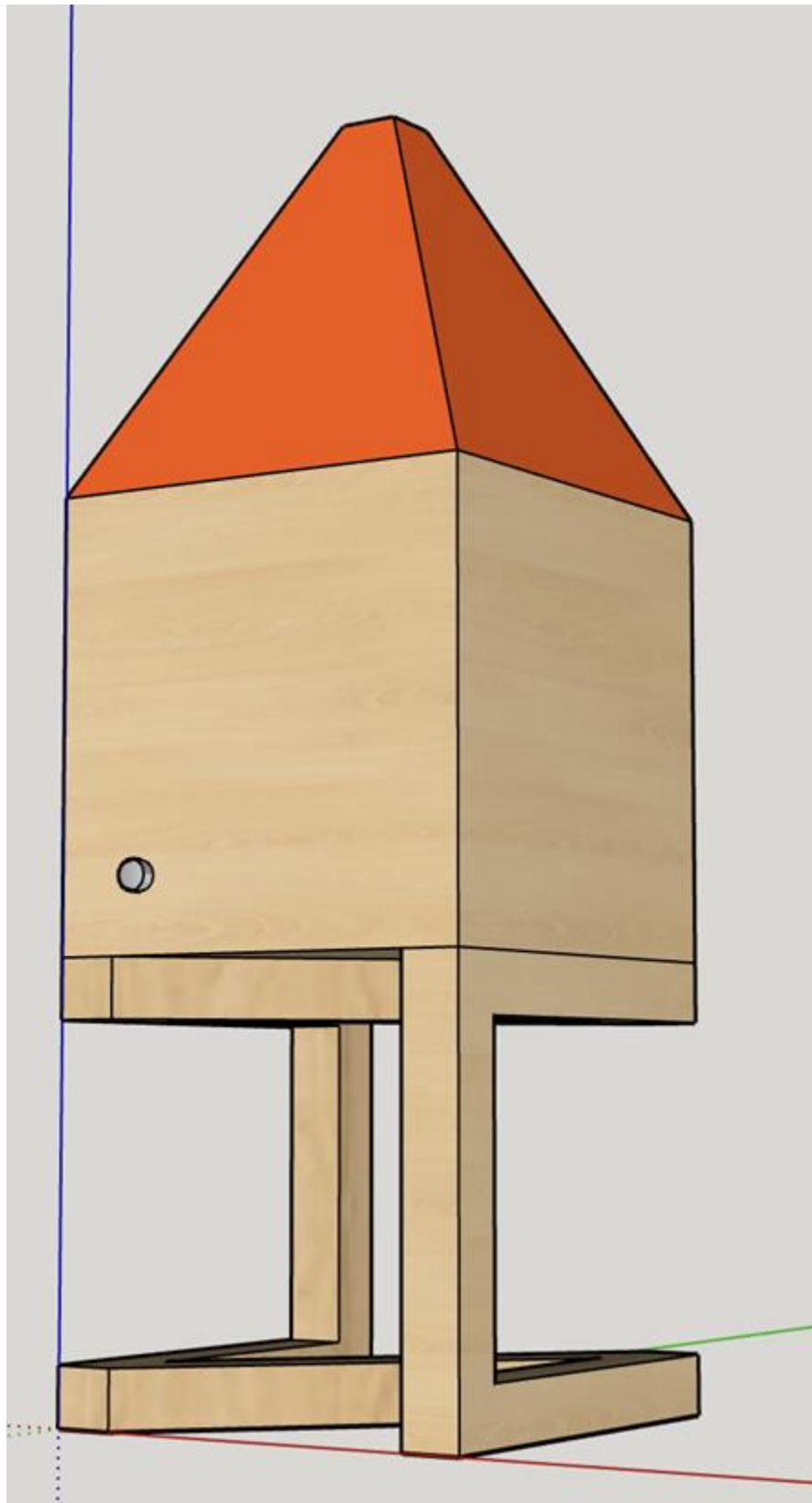
For wires I decided I would look for discarded utilities on the street that had exposed leads that could be harvested. I decided on this as not only do components from appliances have higher power tolerances and durability but also harvesting components from electronics that would end up in a landfill is a carbon negative practice



Driver

To regulate the power levels and increase runtimes LEDs need a driver to manage power. For my driver I chose the Convoy 17mm 8A 3V buck driver as it was compatible with my 21700 batteries and the Nichia 519As, The driver also contains a simple customisable UI for the torch which makes it simple to operate.

Final Design



Final Design

Following extensive consultations with my client and an iterative sketching process which allowed me to improve upon each design until I arrived at this final design. It blends a unique aesthetic, repairability, and robust functionality to provide a product that meets the vast majority of my specification and suits the needs, wants and values of my client. I explored digital sketches, hand sketches and using CAD software to produce a final model for my product. I found CAD to produce a nicer output but require a large time investment, whereas digital sketches were used for quick impressions, adjusting small parts of the design and testing out placement of buttons and orientation of legs. Overall both methods served different necessary purposes in helping me reach my final design.

Legs

For the legs I settled on a “Z” shaped design as they provide exceptional stability and adequate strength while being visually appealing. Additionally, the incorporation of magnets into the legs and base enables seamless assembly and modularity, allowing for easy adaptation to my client’s different needs and situations. E.g. if the product is being used for long periods of time it may benefit from legs but if being moved around and used on its side legs may not be suitable.

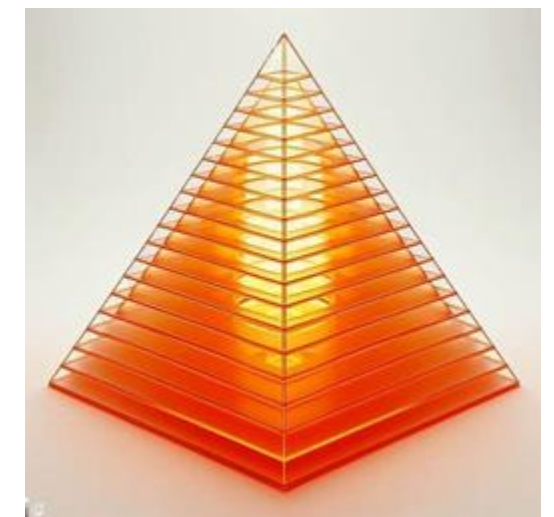
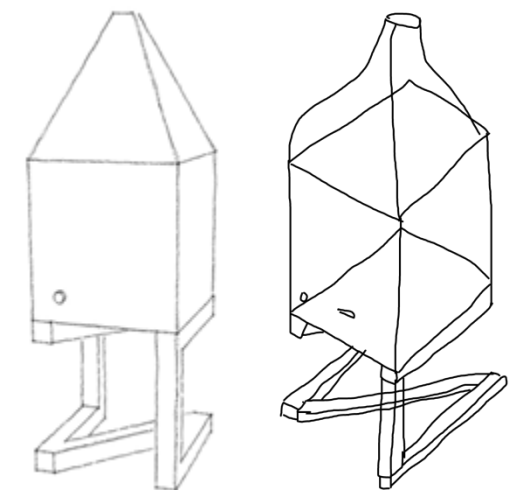
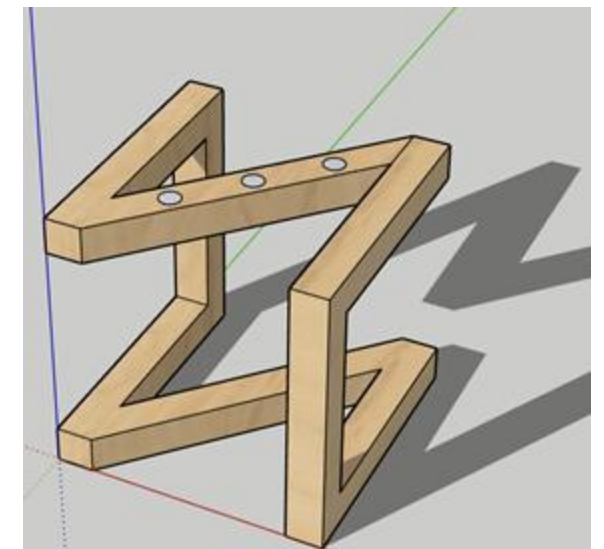
Midsection

For the midsection I chose to use a simple cubic design which creates a spacious midsection ensuring optimal airflow for the electronics, prevents overheating and allows ample space for future modifications. The cubic design also allows the product to be laid on its side and prioritises form over function or repairability, I decided to employ a pin system within the base, eliminating the need for glue, minimising the need of tools and facilitating effortless access to the electronic components for repair or future upgrades.***This was changed to a friction fit later for aesthetics and practicality***

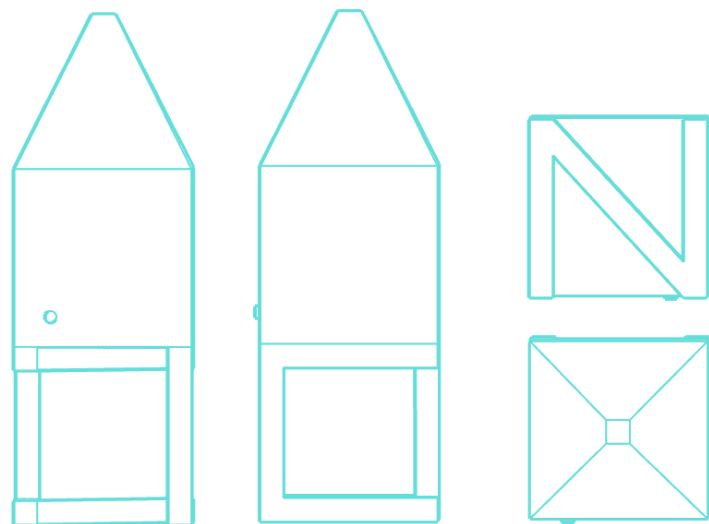
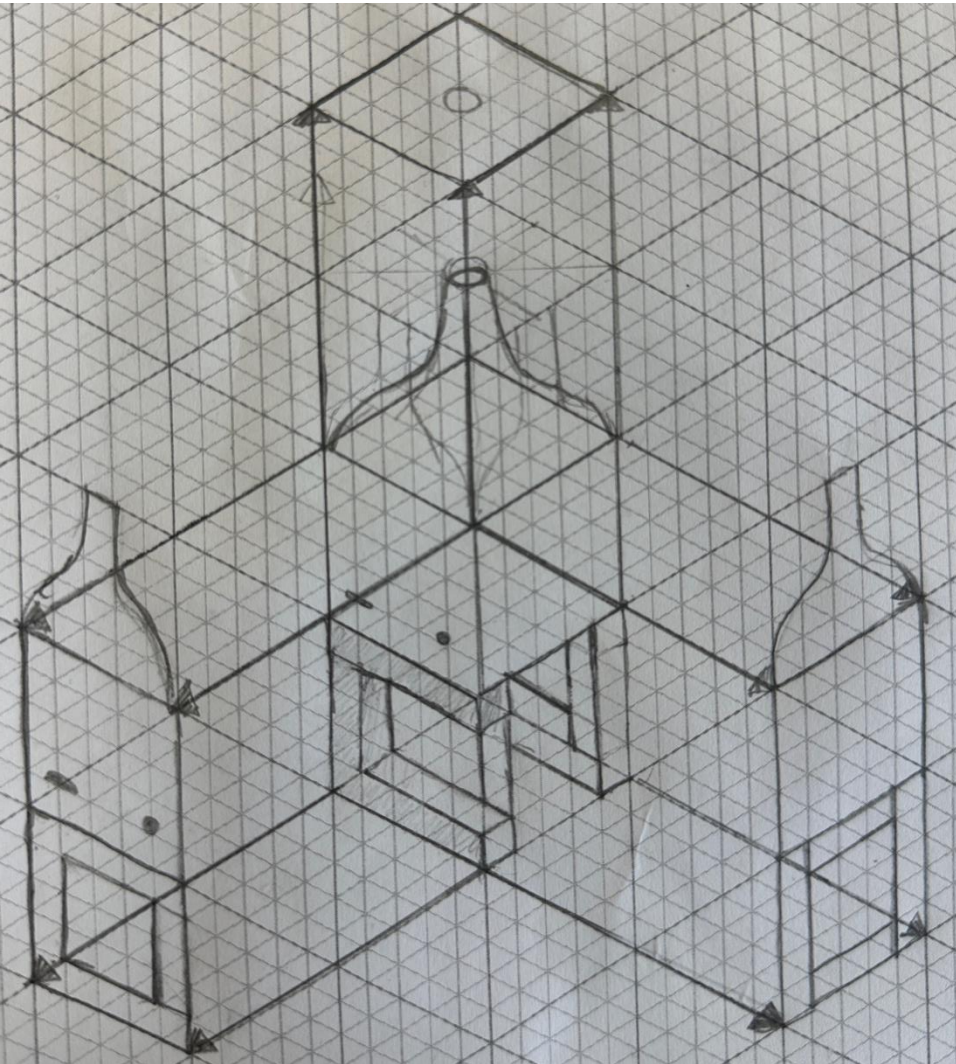
Acrylic top section

The orange acrylic top, chosen for its contrasting modern aesthetic, evokes the warm ambiance of a fireplace, adding a touch of visual intrigue to the overall design and providing a housing for the LEDs.

Overall this design blended the key aspects of my specification, uses an innovative design and is environmentally friendly.



Orthographic Drawing And Isometric/Exploded Sketches

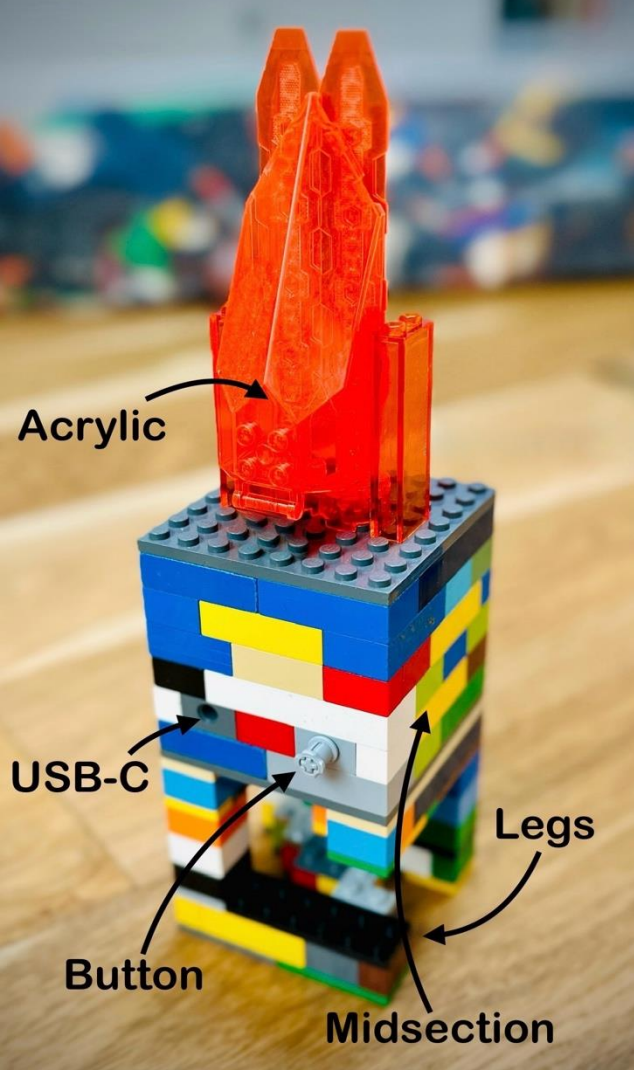


Once I'd settled on my final design, I decided to create an exploded isometric sketch and an orthographic drawing. I decided to create an orthographic drawing with four angles over the traditional three as I found that with only three angles the sketch didn't fully represent my design. I also created an exploded isometric drawing over a traditional isometric drawing as it gave me a better idea of how each side should look like compared to its traditional counterpart.

These sketches also provided a lot of aid in the improvement and finalisation of my design and manufacture as they allowed me to:

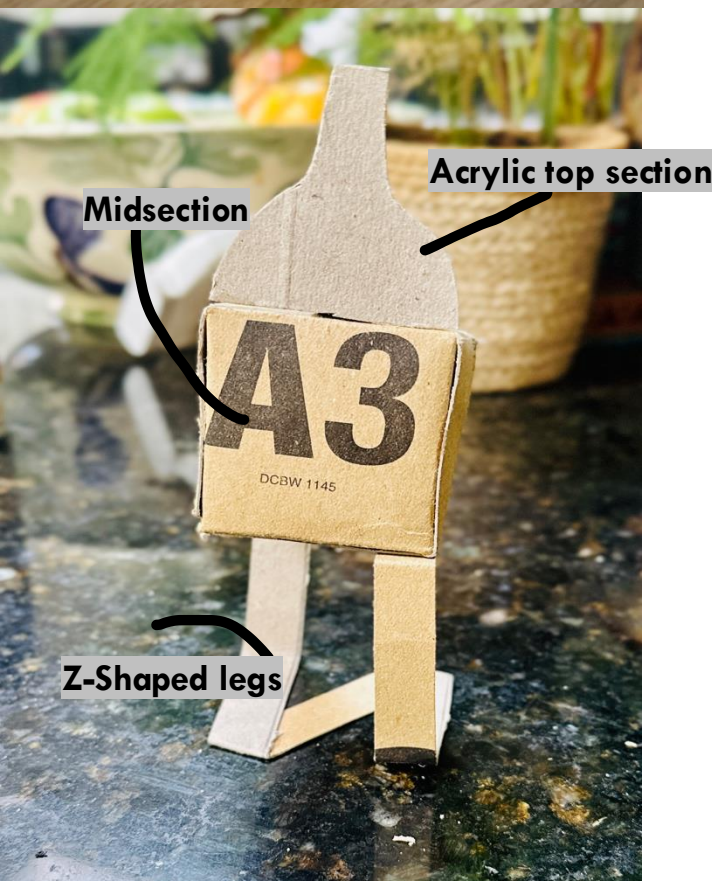
- Better understand the processes which I would need to carry out when manufacturing my product, as I could get a clearer idea of how all the pieces would fit together e.g. the orientation of the legs of my product, I sketched two different orientations for the legs in the isometric drawing and the orthographic drawing.
- Identify any potential issues with my design as these sketches allow me to see the product from all angles, not just one which allows me to identify any aesthetic issues. Such as the legs looking too thick and bulky on my isometric sketch which is why they were narrowed down in the orthographic drawing.
- Communicate my ideas to my client, he found them useful in understanding what exactly the final product would look like as they offered him multiple perspectives, not just one as an ordinary sketch offers.
- Serve as documentation if I decide to modify my design so I have a reference point for my design and how it should look this ensures I'll stay on track while manufacturing.

Modelling My Design – LEGO and Carboard



As part of finalising my design I decided to model my design from two mediums: carboard and LEGO. These models allowed me to visualise the structural integrity of the legs, the geometry of the acrylic top piece and the aesthetics of the overall model. From this I could then make final adjustments to the prototype, such as adding an extra support beam for the legs and deciding on button and port placement.

Using LEGO allowed me quickly prototype my project, giving me freedom to rapidly refine my design. Due to LEGO's modular nature I was able to experiment with the button and port placements to optimise both looks and functionality. Plus, LEGO's inherent reusability made it an environmentally conscious choice for prototyping models when compared to other modelling techniques such as 3D printing and foam modelling.



Using Carboard to model my design allowed me to gain an idea of how my design looked in the real world. I also placed the model in various environments around my client's home to see how it would suit my client's home. I concluded that it matched the interior décor of the home. I also used carboard that was going to be thrown away and therefore generated no waste in the modelling process in contrast to traditional modelling methods.

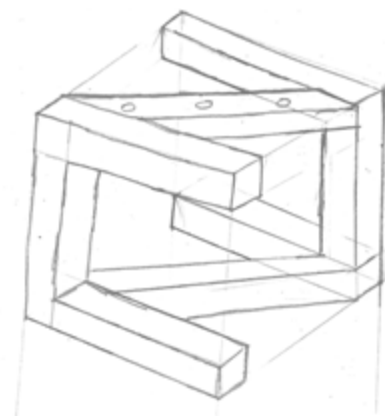
Manufacturing specification

Tools required



- Coping saw
- Dovetail saw
- Bandsaw
- File
- Forstner bit (25mm)
- Drill with various bits (including 3mm and 15mm)
- Rubber mallet
- Chisel
- Pliers
- Orbital sander
- Sandpaper (240 grit)
- 2D design software
- Laser cutter
- Mitre saw
- Tenon saw
- Plane
- Lathe (for copper heatsink)
- Soldering iron
- Needle nose pliers
- Screw driver
- Belt sander
- Drill press
- Handheld drill

Creating legs



Design sketch

I adapted the leg design that I decided upon in section C to fit the use of wood material over metal and integrated magnets into the design in order to make the product modular and versatile. The addition of a second diagonal piece also greatly increase the structural integrity of the legs making a product that is stronger, more stable and last longer.



Template

My leg design contained many repeating parts so I created a template so all the pieces made with the template would be the same size and shape as each other (example of low scale batch manufacturing). This ensures the legs fit together well.



Sawing

Once I had made my markings from my template I used a dovetail back saw to cut the mitres ensuring that I was always cutting on the outside of the markings to leave myself space for minor mistakes and inconsistencies which could be sanded away or planed.



Planing

I used a plane to ensure that all the parts were even and level to ensure that all the pieces would fit together well. Planing the pieces also removes any bends in the wood and leaves a smooth clean finish which makes the timber appeal to the spec of having a smooth finish.

Sanding

I sanded all the pieces using progressively higher grits from 120 - 230 down to smooth them before gluing down and examined each piece with a ruler to ensure they were all the same size and shape and there were no serious flaws. This is an example of dimensional quality control which is essential to ensuring that all the pieces fit together cleanly. In addition once the pieces were glued together I sanded using 230 grit a final time get rid of glue stains and to round some of the edges.



Mitres and final assembly

To connect the legs I used 45 degree mitres measured with a mitre square for the straight "C" sections of the legs. However the diagonal sections of the legs required me to use trigonometric functions to figure out the required angle for the mitre cut which was approximately 40 degrees which I measured with a protractor and transferred to an adjustable mitre bevel to score onto the diagonals to be cut. I then used wood glue and a clamp to join the mitres together and create the final leg design.



Final touches

After completing the manufacture of my legs I found a few imperfections that I wanted to remove such as a small chip and a slight wobble in the design. I filled in the chips with wood filler which was blended in near perfectly with the colour and texture of the wood. To fix the wobble I added silicone leg caps (have added benefit of preventing scratches and sliding) and sanded down the ones that were causing the wobble. I was very pleased with final product as it had come out how I intended and would complement the rest of my product well.



Magnets

To integrate magnets into the design I used a handheld drill with a wood drill bit with the same diameter as the magnets I planned to use. I ensured all the magnets were correctly aligned by marking a common pole (can be found by holding the magnets to another magnet) with a sharpie. The magnets were then all glued into their respective holes with aligned poles using Loctite then clamped it to a piece of scrap and left to cure.

Safety Precautions Taken: Apron or other similar form of PPE worn while working on product, goggles used during sanding processes, plastic gloves worn while working with Loctite as it is classified as an irritant, clamps used while sawing and planing to avoid cuts and nicks caused by their sharp blades.

Creating top acrylic section



Laser Cutting

To create my top section I concluded that the best tool to use to create my acrylic top section would be the laser cutter as it has extremely low tolerances (± 0.1 mm), high reliability and is relatively quick. To design my pieces I used the CAD program 2D design tool which allowed me to create 2D vector files which could then be sent to the laser cutter to be cut.



Choosing curvature

After updating the design I needed to find a curvature for my design. I decided to make 8 different curvatures and the three above were the ones I selected as the best of the 8 after careful consideration. After deliberating with my peers and client I selected number 1 to be my selected curve.



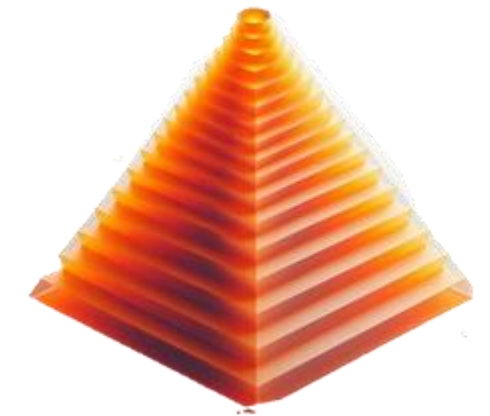
Cutting metal tube

To improve the structural integrity of the acrylic top section I decide to use a metal tube that would go through the centre of each acrylic piece to hold it in place and house the electronics. The tube I selected had a mirror finish applied to it as it would reflect the acrylic pieces and blend in, with the acrylic partially hiding the electronics and also create interesting optical illusions.



Assembly

After the acrylic pieces has been laser cut, I slotted them all together to create my structure. I decided to go for four connecting pieces over eight as it created a simpler more aesthetic design. To bind the assembled design I used Acrylic solvent which creates extremely strong acrylic "welds".



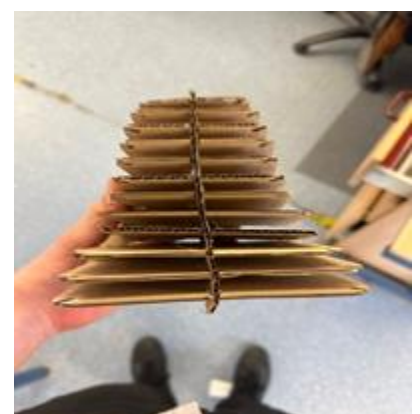
Layering

To create an acrylic top section with a strong structure and to allow me to have greater control over the curve of the cone/pyramid I decided to use layering of laser cut acrylic pieces. ****After prototyping this design out of Cardboard I felt the aesthetics weren't suitable for the product so went down an alternate design path****



Initial cardboard prototype

I initially prototyped utilising a layering method to create the cardboard top section. However, I found the aesthetics and the height unsuitable for my product so I decided to go back to the drawing board to create a new design.



Updated cardboard model

To prototype my second design I used laser cut cardboard and assembled it using hot glue. This time I felt that the design had a lot more potential so I proceeded to finalise my CAD sketches.

Final touches and result

After having assembled and bonded the acrylic I used multipurpose gorilla glue to bond the wood to the acrylic as the materials had different compositions. I also removed any stains left by the solvent and filed down a few rough edges to create the smooth design I had in mind. The metal tube is held in by friction to allow easy repairability. Overall, the building process of the acrylic went smoothly and produced a very aesthetically pleasing top section as I had hoped.

Safety Precautions Taken: Apron or other similar form of PPE worn while working on product, goggles used during sanding processes and gloves used while handling the acrylic bonding solvent and laser cutter opened only once turned off.



Wooden Mid-Section



Summary

I began the mid-section with joinery opting for strong box joints, chosen for their simplicity over time-consuming dovetails, providing my product with a solid foundation. I addressed minor gaps at the bottom by switching to a friction-fit design, preserving repairability without sacrificing the aesthetics. Next I slowly filed out holes for the USB-C port and button, ensuring snug fits for the electronics. Finally, the assembled sections were glued, sanded smooth, and finished with a coat of Teak oil, accentuating the wood's natural grain. Resulting in a functional and aesthetically pleasing midsection that I was proud of which would complement the rest of my product.



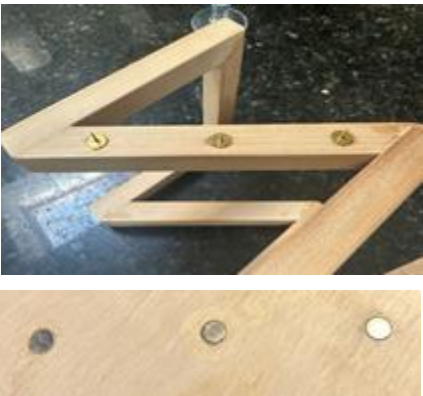
Making holes for electronics

My electronics also needed to be accessible from the outside of the product. To create the hole for the button I used a spade drill bit to make the largest hole and then used a smaller wood drill bit to make the hole for the button. I then filed the button hole down to ensure a tight fit and hammered it in place with a mallet. The USB-C hole was made using a 3mm drill bit and drilling two holes 8mm apart and then filing the gap between them. To accommodate the USBC board I slowly removed layers of plywood using tweezers, pliers and files to remove the material gently eventually I was left with a large rectangular blind hole in which the module could fit into.



Gluing and finishing the midsection

After cutting and fitting all the sides of the wooden cube, I used a PVA-based wood glue to securely bond the sides together. To ensure seamless joints, any gaps were filled using a chemical wood filler which was sanded, hiding any gaps left by the imprecise nature of hand tools. In addition, I sanded the corners and entire product to 240 grit to create a smooth transition between pieces, resulting in subtly rounded edges. Finally, I applied three coats of Teak oil to accentuate the wood's natural grain and texture.



Safety Precautions Taken: Apron or other form of PPE worn while working on product, goggles used during sanding and gloves used and items clamped down while sawing

Adding magnets

To add Magnets to the base of my midsection I first lined up the legs with pins attached to the magnets with the base. I used these as a marking point and drilled holes using a wooden drill bit that matched the diameter of the magnets. To ensure the magnets were properly aligned I used another magnet to check the polarity of each individual to ensure that it was the opposite to the magnets in the legs allowing them to stick together. I then glued the magnets in place using Loctite super glue to ensure that they would remain in position for a long time

Joinery

Initially I decided to use dovetail joints for my product as they were aesthetically pleasing and are one of the strongest joints in woodworking. However after experimenting with dovetail by making one side using dovetails I realised that the time investment required to manufacture all the dovetail joints would outweigh the benefits that they provide. Instead I decided to opt for box joints due to their simplicity and comparable strength to dovetails.

The box joints were cut to a rough shape using a bandsaw and then finished up with a file to ensure a tight fit and neat edges. The joints were glued together using Wood glue and clamped for together for 24 hours.

Repairable base

My initial design prioritised repairability, utilizing a pin and box joint for the base of the midsection. This allowed for easy disassembly and reassembly without damage. However, during construction, I encountered a minor aesthetic issue: the hand cut box joints, despite sanding, created slight gaps in the base. To achieve a clean look while preserving repairability, I opted for a friction-fit base to replace the base. This involved carefully sawing off the box joints with a Japanese wood saw and meticulously sanding the base on a flat surface to ensure a snug, level fit. I then proceeded to manufacture the interference fit piece by cutting inexpensive plywood roughly to shape (removing the corners) then precisely sanding the edges till a strong friction fit was achieved. The interference piece was then glued and screwed to the bottom piece to create a strong bond. I lined the interference piece with friction tape to increase the amount of force required to remove the base so it was more secure. The friction fit can still be disassembled relatively easily, allowing for future maintenance or repairs if needed.

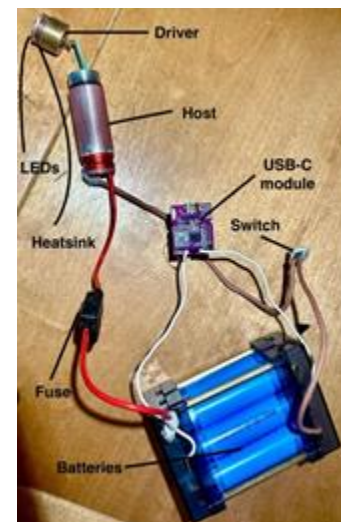


Electronics



Creating a Repair guide

To ensure that in the rare case my product breaks/malfunctions it won't be discarded and end up as E-waste in a landfill, I created a repair guide that my client can use to fix the product. I ensured that the guide was as simple as possible to follow by running it by my client to see if he could figure out how to fix the product. To store the repair guide I decided to use a file hosting service and created an automatic download link by reformatting the URL. To access the link I engraved a QR code(which I generated using a simple program) into black acrylic (which creates a high contrast between the code and material) using the laser cutter. I added the MDF piece to the bottom of the midsection so it was hidden and didn't ruin the aesthetic but still easily accessible. [Repair guide](#)

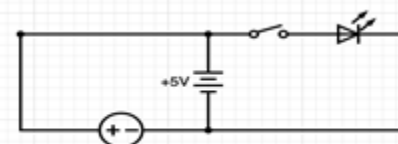


Creating the battery pack

To create the battery pack in a way that could easily be disassembled for replacement I used standard 21700 cells as these are widely available and easy to replace. To connect the batteries in parallel I used a case that could be disassembled with just a Phillips head screwdriver and a wrench or pliers. This makes the batteries very easy to replace for somebody with only basic tools which is very important as lithium ion cells only have a limited amount of cycles so need to be replaced after about 500 cycles in order to maintain the battery health and capacity. To connect the battery pack to the rest of the circuit I stripped the wires I upcycled from old appliances in the street and wrapped them around the brass contacts of the batteries securing the contacts down with a nut.

Soldering electronics

Once I had gathered all the electronics required for the product they had to be connected up in parallel and on series for the charging module using upcycled wires and solder. To ensure I soldered my electronics safely and correctly I designed a simplified circuit diagram to follow.

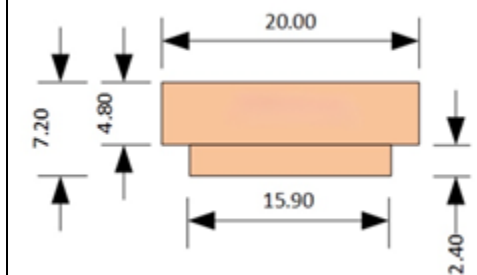


Brass pill and copper spacer and heatsink

The brass pill that holds the LEDs up in the host needed to have a hole drilled into the middle so that wires could pass through onto the MCPCB to power the LEDs. To create the hole I first used a centre punch to mark the centre of the brass pill and to give the drill bit something to grip onto then I used the drill press with a small metal carbide bit to create a uniform hole in the centre.

The host I was using to hold the LEDs and driver was designed to accommodate a reflector with a single emitter but my product called for a triple emitter configuration for more brightness and higher efficiency. This did mean I had to use a TIR optic to focus the beam instead of the reflector which took up more space which resulted in me needing to manufacture a copper spacer to make up for the extra space and to draw heat away from the LEDs. To create the copper spacer that would be required to fill this space I ordered a 20mm solid copper tube and drew up plans for it to be cut on the metal lathe. I then used the lathe along with a vernier calliper to lathe the copper cylinder into the dimensions I had designed to within ± 0.1 mm of my prescribed measurements. I also used the lathe to drill a hole into the centre of the spacer I had made to create a hole for the wires to be thread through.

To finish the spacer I used the lathe to debur the edges of the spacer, remove the oxidised layer to allow for better thermal conductivity and finished by sanding the spacer to 1500 grit.



Safety Precautions taken: While working with live wires, I ensured safety by using pliers with rubber grips to avoid direct contact. During the operation of the drill press and the lathe, I wore safety goggles and an apron to protect myself from metal chips. Additionally, when the soldering iron was not in use, I made sure to place it in its holder to prevent accidental burns.

Specification	Requirements	How did I meet my requirements?
Aesthetics	1.1 Be stylish, sleek and smooth 1.2 ports/buttons as recessed as possible 1.3 Incorporate Bauhaus design style 1.4 Buttons should blend in and kept to a minimum 1.5 Have as smooth finish	1.1 My client found the product “Beautiful” and “modern” MET 1.2 Ports were seamless and button stuck out 12 mm which was an overall good result MET 1.3 While my product was very functional and aesthetic, the acrylic top section wasn’t strictly necessary and didn’t add much function to the product. Other products I found contained no such aspects. However, my product did meet other elements of the Bauhaus design movement such as the removable feet. PARTIALLY MET 1.4 The product only contained one button and my client said it blended in rather well MET 1.5 My peer found the product very smooth MET
Client requirements (Needs, Wants and Values)	2.1 Be small enough to fit on a fridge 2.2 Be able to charge my clients device 2.3 Be able to light up a room 2.4 Be portable enough to carry around	2.1 My product easily fit stably on top of the fridge MET 2.2 The product had 100 watt-hours, allowing it to charge my clients laptop fully twice, or his phone 8 times. The product uses a USB-C port which aligns with the modern standards and my clients cables. This meant overall the product could successfully charge my client’s devices. MET 2.3 When placed in the kitchen and powered on my product could fully light-up the kitchen for two minutes, before stepping down due to thermal limitations, however at this level ordinary tasks such as cooking, looking through cabinets and writing were still perfectly facilitated by the light. MOSTLY MET 2.4 While the product could easily be moved and adjusted its lack of a handle made it slightly “clunky” to move around the home. My client rated it at a 6. PARTIALLY MET
Materials and components	3.1 Use Wood 3.2 Use lithium ion batteries 3.3 Use a BMS system 3.4 Use a bright LED 3.5 Use a heatsink if necessary	3.1 MET 3.2 MET 3.3 MET 3.4 MET 3.5 MET
Function	4.1 light up my clients home 4.2 Be able to charge a device via usb-c easily 4.3 Be able to be stored in various places 4.4 Easy to carry 4.5 Be used in multiple rooms 4.6 Be able to be pointed in multiple directions	4.1 After simulation of a power outage the torch initially could light up the entire room easily, it soon stepped down to a lower brightness to prevent overheating. At this level 90% of the room was lit and tasks could still be carried out. However, it did not equate to ceiling lighting. MOSTLY MET 4.2 My client rated it as a 10 as the port was easy to access and could charge at a fast output of 22.5W. MET 4.3 The product could be stored practically anywhere in the household from the shed to the bedroom. MET 4.4 The product wasn’t very easy to carry due to lack of a handle and slightly awkward shape. My client gave it a 3/10. NOT MET 4.5 Testing in five places the product passed with flying colours being able to work across the household. MET 4.6 The Product could be pointed in any direction in the X plane and straight up. MET
Safety	5.1 Well insulated 5.2 Smooth edges so client won’t get cut or have splinters 5.3 Not flammable 5.4 Batteries well managed and secured	5.1 The multimeter read 0, confirming well insulated leads and a fuse was added to prevent short circuits 5.2 Rated as “very smooth”. MET 5.3 The wood of the product was flammable. However, the legs would hold the electronic components above a flame increasing the time before a lithium ion battery fire occurred, giving the client time to put it out. NOT MET 5.4 Battery functioned fine and fuse was present. MET
Environment	6.1 Be mostly made from sustainable materials 6.2 Use efficient LEDs over bulbs 6.3 Be repairable and designed for disassembly 6.4 Be long lasting 6.5 Use standard components 6.6 Minimise use of glue 6.7 Cut in an efficient manner to minimise scrap wood	6.1 The product used plywood as its main material making the material used overall very sustainable. Electronics were all salvaged/upcycled except for the button, driver and LEDs as these were unable to be found. Materials that weren’t fully used were donated to the school to be reused. Such as surplus fuses and copper tube. MET 6.2 519As were used which have an efficiency of 167 lumens per watt, compared to the typical LED bulb which have an efficiency ranging from 75 - 110 lumens per watt or incandescent bulbs which have an efficiency of 14 lumens to watt. This makes my product very power efficient. MET 6.3 Disassembling the product was easy due to the friction fit lid and the repair guide provided through the QR code. The only improvement would be improving the cable management through planning the lengths of the cables more thoroughly and using zip ties. MOSTLY MET 6.4 My product had features of other durable products such as a repair guide, thick cables, fail safes and high quality components. MET 6.5 The product used standard components all that can be found in the repair guide. MET 6.6 Unfortunately the product did often make use of glue, to preserve aesthetics and when screws could simply not be used. NOT MET 6.7 The wood was cut efficiently on a large cutting list with other students, however, the some acrylic pieces had to be recut a few times due to shattering. At least 50% of the wood and acrylic was used. PARTIALLY MET
Dimensions	7.1 Be small enough to fit on a bedside table 7.2 Large enough to still have a large battery capacity and effective heat dissipation 7.3 Light enough to carry with one hand	7.1 The product fits on my bedside table, however the button can be a little difficult to press at night due to its small size. MOSTLY MET 7.2 The light has extremely strong runtimes of above a year on the lowest setting and about two weeks on medium, yet when on the brightest level it did not last long before stepping down to a lower brightness due to thermal limitations. MOSTLY MET 7.3 Client said it was not too heavy but still not light. Product weighs 1.4 Kg without electronic and just over 2 Kg with electronics. This weight was seen as acceptable by both me and my client. MET
Cost	8.1 Material cost shouldn’t exceed £50 8.2 Should retail at around £110	8.1 The product cost approximately £60 in total however, with a second iteration I believe the price could be brought down to under £40. NOT MET 8.2 The product would likely have to retail at £150 as the cost was higher than expected and the labour was time consuming than predicted. (approximately 350 hours put in including R & D). A second iteration would likely allow me to price my product at £80 as now that plans have been made, CAD files sketched and issues ironed out, labour would only be around 15 - 20 hours. NOT MET

I managed to successfully meet or at least partially meet the vast majority of my specification with the total tally being 22 **MET**, 5 **MOSTLY MET**, 2 **PARTIALLY MET** and 5 **NOT MET**. I think this tally reflects how my product has successfully addressed its specification while also evolving throughout the project to points where it slightly strayed from the initial specification, however this also shows how I didn’t end up in the trap of design fixation. My largest fallback is probably going over budget however this is mostly acceptable as most initial designs go over budget which is brought down through subsequent iterations.

Main Evolution Of My Design

Throughout the design and manufacture of my product I constantly considered any modifications I could make to the design to improve its functionality and aesthetics. This helped massively in avoiding design fixation and producing the best possible product I could. Below are the biggest changes I made during the project that allowed me to create my final product.



I initially began my design with a “tower” like design with multiple light sources. As the project progressed and I conducted client interviews I expanded on my design by compacting the design, adding legs, switching to a single port design and removing the secondary light source. This change made the product smaller, more portable and subjectively more aesthetic.

I decided upon using these legs and modified a design I had found online to increase stability, form and strength. It was at this point I also decided to add magnets to the leg to make the model more modular as the legs could simply be taken off if they weren’t needed or hindered the functionality

During the creation of the base of my product I found there to be gaps between the box joints at the bottom of my product which took away from the aesthetics of my product. Due to my commitment to the ability for the electronics to be easily accessed I couldn’t use wood filler as this would seal the base and prevent disassembly. To resolve this I removed the box joints and replaced it with a friction fit which allowed the user to access the electronics while maintaining the aesthetics.

I initially planned to use a layered design to create the acrylic top. However, when modelling this design through cardboard I found it to not match my initial sketches and looked unattractive when compared to the rest of my product. I decided to redesign this and ended up with an acrylic lattice design which I much preferred over the previous model. Overall this may have been the most impactful change on my design and really increased it’s aesthetics.

This was my finalised design an accumulation of all the changes that I had made during the project, which resulted in a design with excellent form and function. Through conducting regular client consultations I was able to avoid design fixation and create a product that effectively met it’s specification and accomplished its purpose.

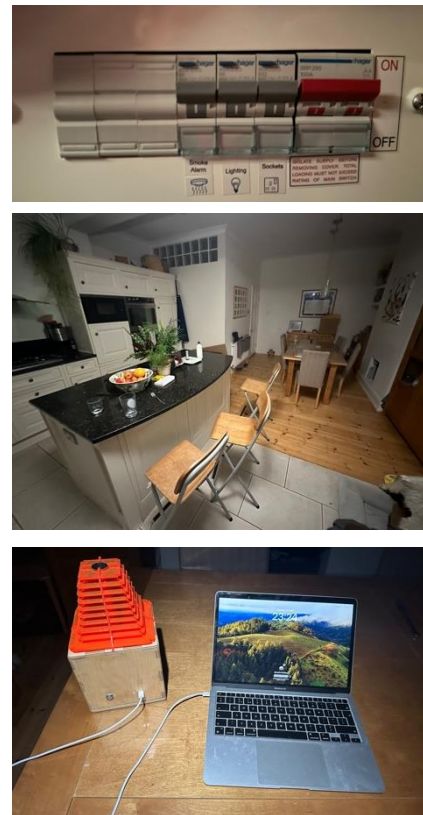
ACCESSFM on my design

Aesthetics	The wooden mid section of my product is made from light-coloured plywood with a visible grain pattern, which creates a sense of quality craftsmanship and gives the product a natural feel.. In contrast, the translucent neon red acrylic top section is modern and unique it creates a visually interesting design that draws the eyes in. The legs are also intriguing as opposed to the ordinary four or three leg design it contains only two yet is very stable thanks to its form.
Cost	My product would theoretically cost £150 which is relatively expensive for a lamp. This price is justifiable once the cost of materials and labour is taken into account. I feel that at this price, and taking into account the cost of living crisis this product would have to be targeted at the upper middle class. However, I believe with refinement and iterations this could be brought down to £80 if techniques such as batch manufacturing and bulk discounts which would make it much more accessible.
Client	The product is designed for customers who need power and light in cases of blackouts, it appeals to a growing market as climate change is increasing extreme weather and therefore also the occurrence of blackouts. This product seems to fill a gap in the market with very little competition. It's aimed at the upper middle class due to it's premium cost.
Environment	The product utilises efficient LEDs, rechargeable batteries and ecological materials (wood) which means it has a minimal impact on the environment. The product also uses standard components and features an inbuilt repair guide giving it a long lifespan, as it can easily be repaired and won't end up in the landfill. Overall the product contrast most modern lamps which are often designed to intentionally malfunction in order to increase sales.
Safety	My design has rounded corners which prevents splintering. In my product, I have also utilised well known batteries and components decreasing the likely hood of dangerous shorts, the product also features a fuse which shuts the circuit down in the case of a dangerous electrical short.
Size	My product is 450mm tall and has a footprint of 150mm x 150mm. It weights 2kg which is reasonable for the battery capacity and size of the product. Overall this is an acceptable weight.
Function	The product serves to act as a battery bank and high powered lantern in the event of a blackout. It's light has a brightness of around 2000 lumens which is enough to fully illuminate a room and allow the user to live their lives relatively comfortability during a blackout. The power bank side of the product has a capacity of 100 watt hours which should provide the average consumer with three days of laptop and phone usage and around a week of solely phone usage, which is more than enough when taking into account that the average blackout lasts six hours. Overall this product allows users to continue living their lives in the case of a blackout.
Materials and Manufacture	My product has been mostly made primarily from birch plywood, pine wood and acrylic. These materials are strong, aesthetic and durable allowing the product to last for a long period of time while being aesthetically pleasing. This product has been manufactured as one-off meaning the process has not yet been fully refined and there is a high lead time and cost associated, however this method of manufacture generally leads to a custom high quality product.

Testing Of My Design

Simulated Power Outage

To simulate a blackout I turned off power to the kitchen at the mains. I carried out two simulated blackouts: one during the day and one at night. In the day I tested my product's capability of charging my client's devices. By plugging them and checking if the power was increasing. For the night-time test I decided to test the capability of the product to light up my client's kitchen (the largest room in the house). The light was able to light up the vast majority of my client's kitchen but as seen in the picture some dark spots were left at the very back of the room. Overall this was fine as if light was needed for the dinner table the product could always be moved onto the table and the light in the back was still enough to navigate the room. For the daytime test I decided to see if the product was able to charge my client's laptop. The laptop was left to charge for an hour and was initially at 21% and managed to climb to 74% in the hour. This proved that in the event of an outage the product could be used to allow my client to continue working



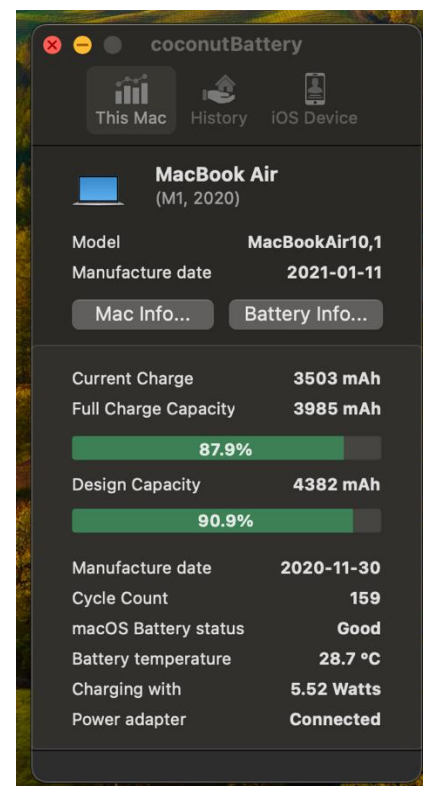
Testing Brightness

To test the brightness of my product I waited for it to be dark and brought it outside to my garden. According to ANSI (standard for measuring light output in products) I let the product run at max brightness for seconds before taking this picture to demonstrate its brightness. The picture also demonstrates the wide beam angle of my product which is essential when using lights for indoor illumination as it increases how widely the light is diffused. Through use of my product I estimate it to be around 2000 lumens. I also tested the temperature and thermal stepdown on the product to ensure it remains at safe operating temperature with a digital thermometer. The product reached a maximum temperature of 53.4 Celsius before stepping down which was suitable as it was well below the softening point of the acrylic lattice. Skin contact was not a concern either as the components that reach these temperatures aren't accessible to touch.



Battery discharge test

I tested the battery capacity of my product by downloading an application called coconutBattery to my a laptop to gain information on how my product was charging the device. I found that the product produced 5.52 watts which was likely limited by the computer for safe charging. This showed me that the product could not only effectively charge a computer but that it also could communicate with devices to ensure charging occurs safely. I also ran some calculation to calculate the battery capacity of my product and the battery capacity of my clients computer and phone. The product could charge the laptop twice over and the phone five times over which was more than enough to last most blackouts.



Aesthetics – Suitability in my client's home

I also tested the aesthetics of my the product in my clients home by getting him to select three places that he would use the product and asking him how well he felt it fit the aesthetic of the rest of the room. For the first picture he said that the product brought a nice touch of “modernity” to the room and liked it. For the second picture he said that he liked how the product looked next to the plant and said that it created an “interesting” aesthetic. For the final picture on top of the fridge he said it was nice and out of the way but in this room a little “too flashy” as his eyes were drawn to it when he wanted it to be out of the way. Overall the product fit well into my client's house complementing many of his rooms. It may however be a little too attention drawing.



Final Client Interview



Needs, Wants and Values Met	Client Rating
Product that can light up a room	7/10
Product that can charge his devices	9/10
Repairability	10/10
A durable product	8/10
An aesthetically pleasing product	9/10
Simple to operate	8/10

At the end of the project I decided to conduct a final interview with my client where I presented him with the product to see if my product effectively addressed his needs, wants and values. I used this as a metric to see how successful my product was in meeting its requirements and satisfying the client. This interview also helped me identify any modifications that should be made.

Do you think this product can effectively serve you in the event of a blackout?
Yes, after seeing the performance of this product I believe that it would be able to effectively serve me in the event of a power outage that would last a few days. The light is bright enough to illuminate the rooms of my house to a suitable degree and the product has a high enough battery capacity to keep my devices charged.

Do you find the product aesthetically pleasing/good looking?
I love the look of the product. While it doesn't really follow Bauhaus conventions I still think it looks really nice and suits my tastes. The acrylic piece on top looks really nice and the way it refracts light is super unique and awesome.

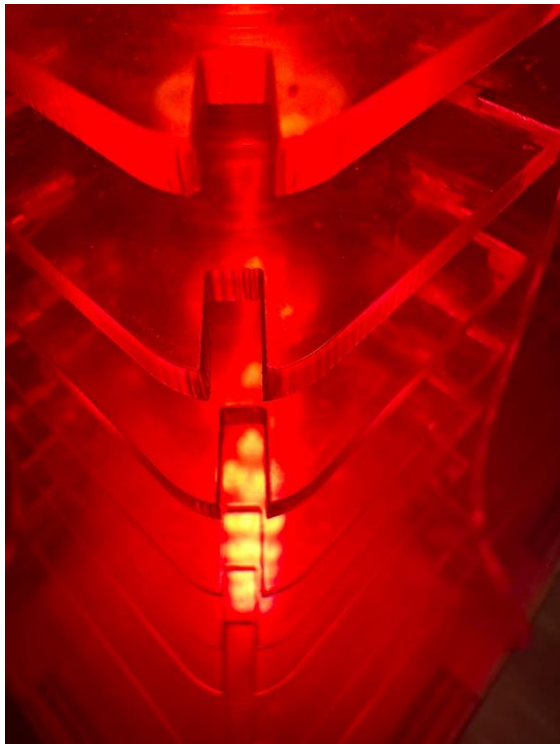
What is your favourite part/feature of the product?
My favourite part would have to be the legs of the product, I think they have a beautiful, unique look to them and I find the way they attach to the rest of the product through magnets ingenious as it allows me to use the light with or without legs.

If you could change one part of the product what would it be?
I would probably want the size of the acrylic top to be shrank as while it looks really good it takes up quite a bit of space. I think if it was reduced to half its height it would still retain much of the aesthetics while reducing the space it took up, making it more practical and make it more portable.

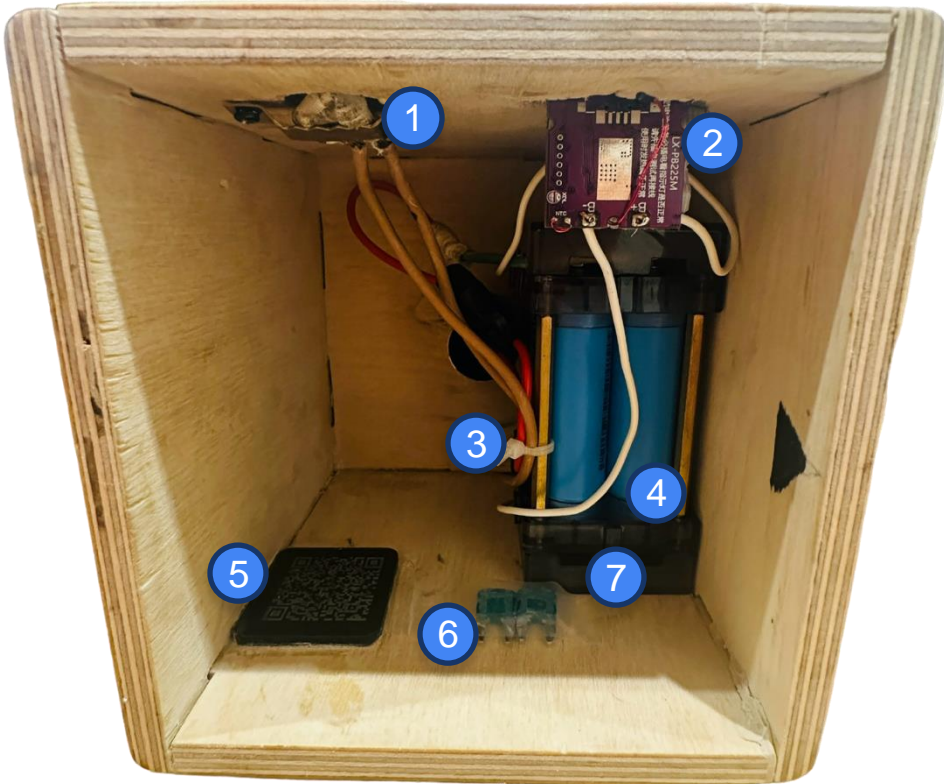
Overall my client is satisfied with the product and I have successfully built a lamp and power bank to be used in the event of a blackout.



Here my product can be seen charging a pair of Apple AirPods



Here the top acrylic section of my product can be seen transmitting red and orange light which mimics the atmosphere of a fireplace. The photo was taken by shining a light down the side of the acrylic



- Electronic**
- 1 – Button held in by fixing and screws
 - 2 – USB-C module held in by hot glue
 - 3 – Zip tie to organise cables
 - 4 – Batteries wired in parallel
 - 5 – QR code linking to repair guide
 - 6 – Spare fuses in case the fuse blows
 - 7 – Battery case to keep cells secure

Technical Pictures



This is a picture of the legs of my product. There is a line of three magnets that attach to the rest of the product securely.

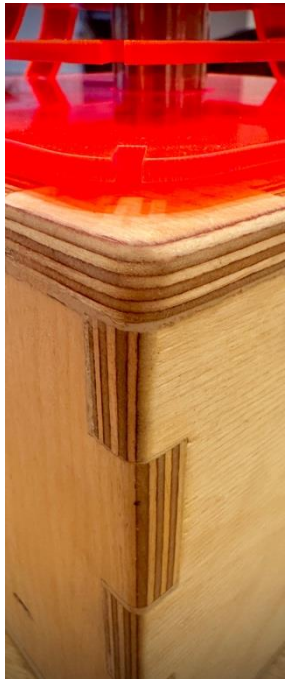


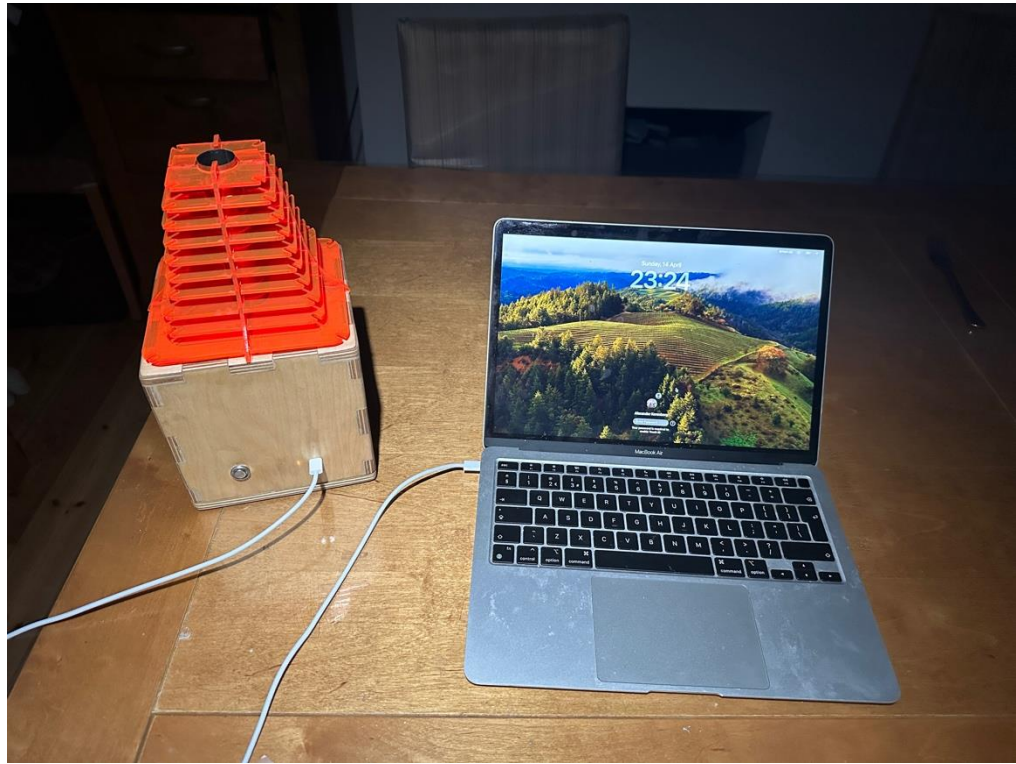
This photograph shows the product lighting up a room to demonstrate it's function. It is placed on top of the fridge to be unobtrusive and closer to the ceiling for refraction purposes.

USB-C port and Metal button



Product Box Joints





Pictures Of My Product



**Some of these pictures are missing the USB-C port as It was being resoldered*