# Commercial Project

**Megan Joyce**

N0981130

BA(hons) Furniture and Product Design

# Week 1 & 2

**23rd September - 6th October**



# Commercial Project

BA FPD

## PROD30004 - BA Furniture & Product

## BENCHMARK

### The Brief

Benchmark manufacture furniture from solid timber. We love the beauty, character, and warmth of this natural material. How can we utilise more of the felled tree, celebrating and making the most of this amazing material? It is important to understand the raw materials you will be designing and making with; we must as designers and makers look to the world for what regenerative materials are on offer and what is currently in our global woodlands for what materials we should be working with. There is increasing demand for uniformity and perfection; how can we celebrate the natural beauty and character of wood.

We believe that quality materials and thoughtful manufacture lead to long-lasting furniture, but design thinking is important to ensure the product is relevant and remains so for as long as possible. Circularity is essential; as we move to a circular economy, we need to consider what happens when products need repairing or adapting. We need to be thinking of their second and third life when designing for their first.

With longevity and sustainability in mind, and an understanding of the Benchmark brand, design a **simple, small and useful** piece of furniture made from timber that celebrates the natural material. Focus on narrative of species, timber selection or crafted construction to bring meaning and purpose to the final product.

https://benchmarkfurniture.com

Migo, designed for Benchmark by Pascal Hien

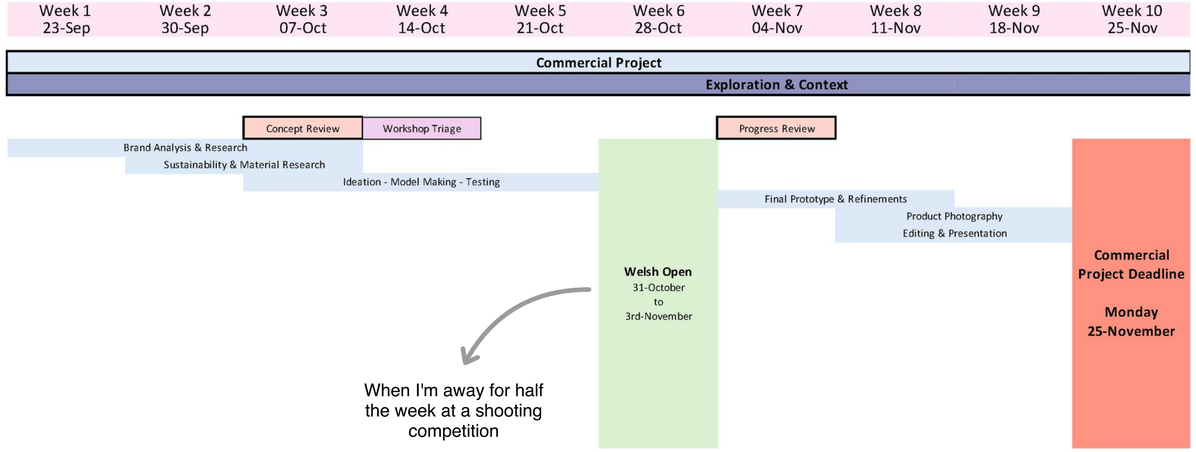
# Initial Time Plan

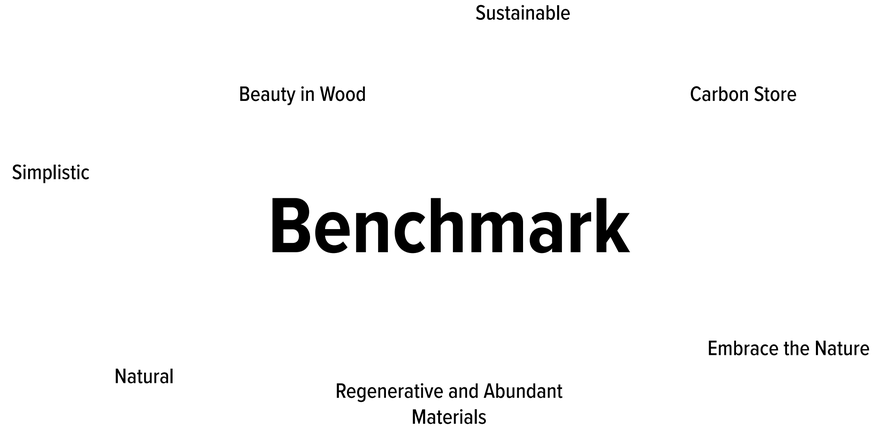
A rough layout to try and plan weekly milestones to ensure I can complete the project.

I've kept the plan fairly open so I don't get overwhelmed if I don't stick exactly to the plan.

Also working on context and exploration at the same time.

Rough Weekly Plan:
Monday - Wednesday - Commercial
Thursday + Friday - Context



# Benchmarks Story

The company has expanded from three people to a team of 70.
Every skilled craftsman cares deeply about the process and ensures that the care and attention that goes into creating each piece brings an integrity that cannot be replicated through a mass manufacturing process.

New technology and their facilities are highly invested in. There's workshops for:
- Milling
- Cabinet Making
- Veneering
- Finishing
- Metal Working
- Upholstery
- 5-axis CNC Machine

The whole process can be contained and controlled by benchmark from the best materials to the final installation.

Every Piece is designed for functionality and lasting Beauty.

"Everything we make is designed and built to last, with the next 100 years in mind."

"We are a company with a deep-rooted belief in the value of craft and craftsmanship."



# Sustainability

"We design and make for longevity"

"It is our mission to create furniture that makes a positive contribution to human health and the environment."

"We believe that it is only when we consider the materials we use, the way we design, the quality of our making, how we manufacture and distribute, and what happens to our furniture at the end of its life, that we can create something that is truly Made WELL."

DESIGNED FOR WELL-BEING
We draw upon the restorative power of nature to design and make furniture with health and well-being in mind.

Our non-toxic furniture is made with natural materials, colours and textures, soft profiles and nature-inspired ergonomic shapes, to create spaces that are more human, welcoming and personal.

A CIRCULAR MINDSET
We commit to keeping our furniture and joinery in use for the longest time possible.

We design and make for longevity – creating pieces that can adapt to changing needs, made with materials that can be easily refurbished.

We promise a lifetime of care – offering a Repair & Refurbish service and a Take Back Scheme where furniture can be returned to us when it is no longer needed for it to be refurbished, re-purposed or donated to charitable enterprises.

# European Ash

Ash trees are tall and graceful , they often grow together forming a domed canopy up to 35m high. The bark of the tree is a pale brown to grey and it fissures as it ages.
The trees can live to an old age of 400 years, this can be even longer if coppiced, the stems traditionally providing wood for fires.

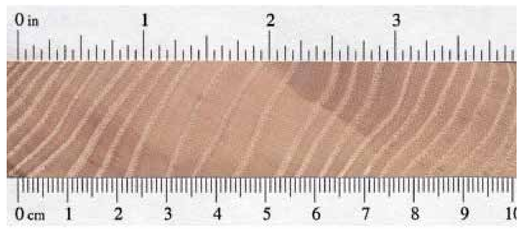
- The heartwood is a light to medium brown colour with darker streaks seen throughout, this is sometimes sold as Olive Ash.
- Sapwood can be very wide and it tends to be a beige or light brown.
- It's texture is medium to coarse similar to Oak.
- The grain is almost always straight and regular.
- Responds well to steam bending as well as gluing, staining and finishing well.
- Heartwood is rated as perishable/ only slightly durable in regards to decay. Ash isn't resistant to insect decay.
- Ash is not listed in the CITES appendices or on the IUCN red list of threatened species

**History**
Historically the Ash tree was thought to have medicinal properties and the wood would be burned to ward off evil spirits.
In Norse mythology ash was the 'Tree of Life" and the first man on earth was said to have come from an Ash tree.
In Britain druids regarded the ash as sacred and their wands were often made of ash because of its straight grain.

**Threats**
The main threat to Ash trees is Ash dieback (Chalara Dieback).
Dieback is a disease caused by a fungus, Hymenoscyohus fraxineus.
It causes trees to loose their leaves and the crown to die back, usually resulting in the trees death.
If the disease cannot be contained or eradicated then tens of thousands of trees could die, changing the UK landscape forever as Ash is the third most common tree in Britain.

**European Ash Turned**

**European Ash Sealed**




**European Ash Endgrain**



# English Oak

Oak trees supports more life than any other native tree species in the UK. It's a very common tree in deciduous woods, especially in central and southern Britain, it's so frequent that it's been made the nations emblem.

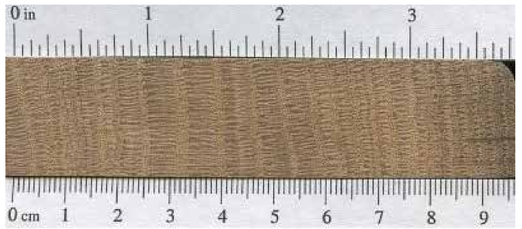
**History**
The Oak tree was sacred to many gods including Zeus, Jupiter and the Celtic Dagda. Each of these gods ruled over thunder and lightning, Oak trees are often hit by lightning as they are the tallest living feature in the landscape.
Druids practised rituals in Oak groves and cherished the mistletoe that grows on Oak tree branches.
Oak is also linked with royalty, ancient kings and Roman emperors wore crowns of Oak leaves.
It's the emblem of many environmental groups such as the Woodland Trust.

**Threats**
Acute Oak decline and chronic Oak decline are serious conditions affecting Britain's Oak trees; with several contributing factors linked to the diseases. Decline of mature Oaks first aroused concern in the 1920s and today most of the cases are in central, southern and eastern England.
The Oak processionary moth is a non-native pest that's been found in London, Surrey and Berkshire. It damages the foliage of the trees and increases the Oak's susceptibility to other diseases. It's also a risk to human health, the moth hairs are toxic and can lead to itching and respiratory problems.

- Heartwood is a light to medium brown, commonly with a olive cast though the colour variation can be fairly extreme. Sapwood is white to light brown and not always demarcated from the heartwood.
- Grain is straight with a coarse uneven texture, may have irregular grain depending on growing conditions
- English Oak has been rated as having a very good resistance to decay.
- Can react with iron (particularly when wet) and cause staining and discolouration.
- Responds well to steam bending as well as glue, stains and it finishes well.
- This wood species is not listed in the CITES appendices and is reported by the IUCN as being a species of least concern.

**English Oak Turned**

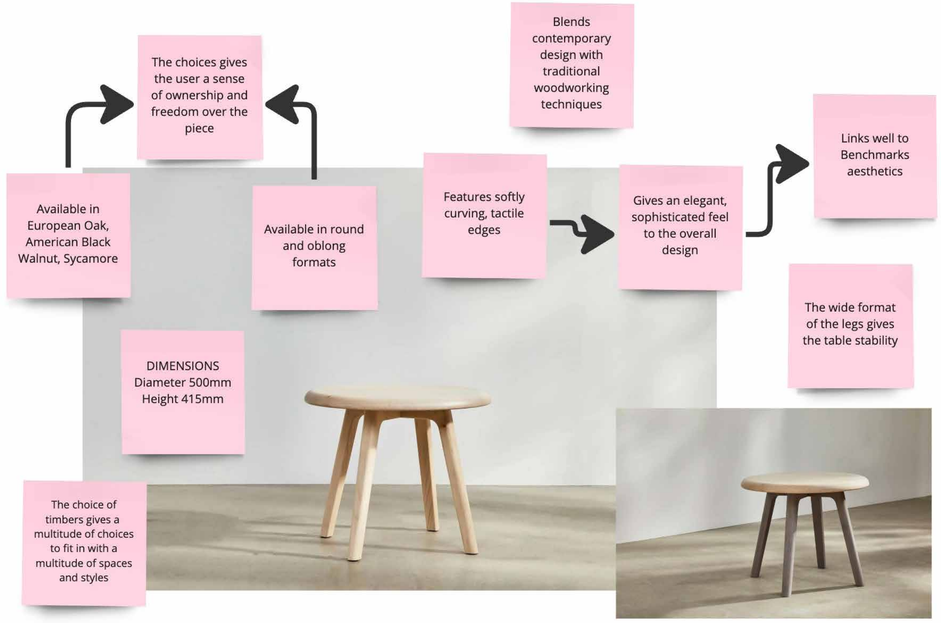
**English Oak Sealed**




**English Oak Endgrain**

# Benchmark - Side Table Analysis

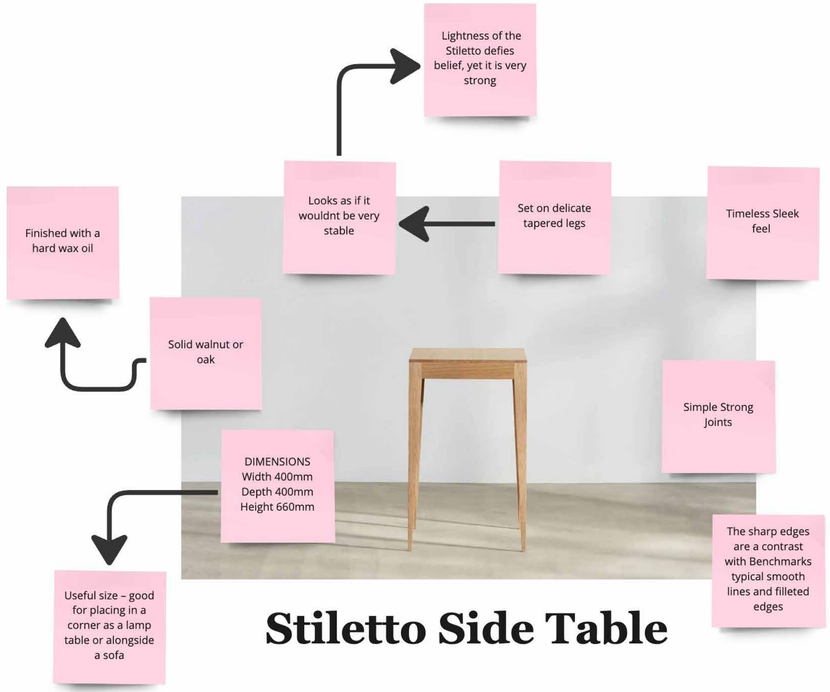



# Sage Side Table

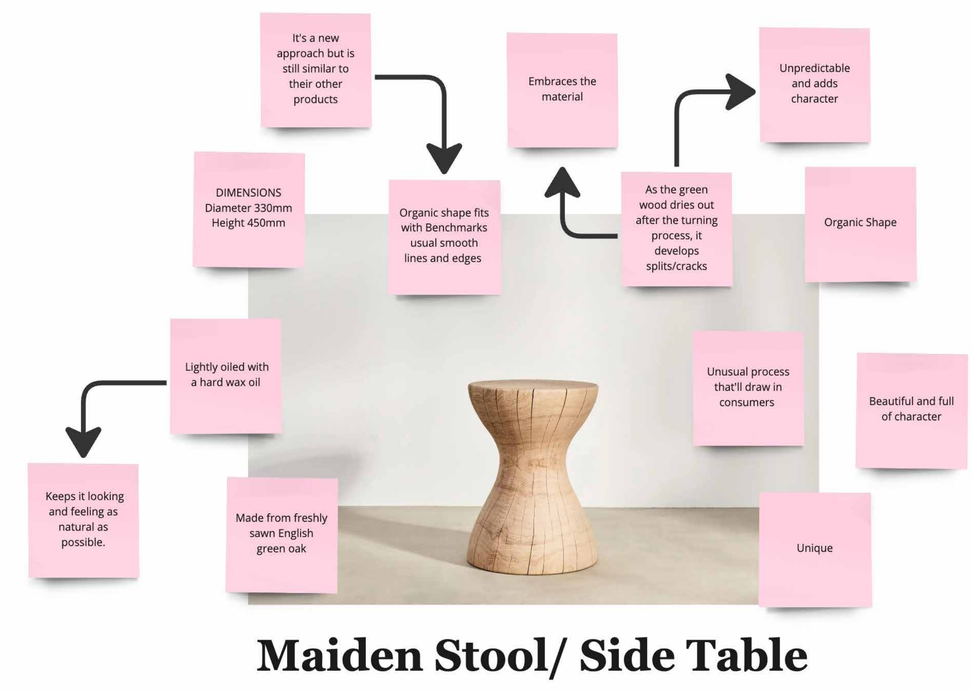



# Eelanor Side Table




# Stiletto Side Table






# Maiden Stool/ Side Table




# Circular Design

**Circular design is the practice of creating durable, reusable, repairable and recyclable products that generate zero waste to support a circular economy.**

Designers consider all stages of a products life-cycle and ensure that it is sustainable from manufacturing to disposal

**Raw Material:** What is the source material, and how can we extract it sustainably?

**Production Specifications:** Is the product reusable, repairable and recyclable?

**Manufacturing Process:** Is it energy efficient and does it generate any waste?

**Distribution and Use:** How much energy does it take to deliver and use the product/service? Where does this energy come from?

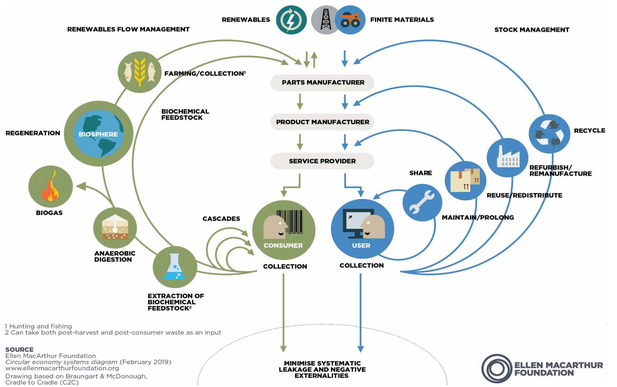
**Disposal:** Can the product be dismantled? Can we use the parts as is in the manufacturing process again? Can we return the raw materials to the earth?

**Eliminate** waste and pollution, including toxic substances that harm soil and water and reduce emissions. Everything generates waste, so we need to redesign everything.

**Circulate** products and materials at their highest value for as long as possible. Further recycling should not result in a substantially inferior product.

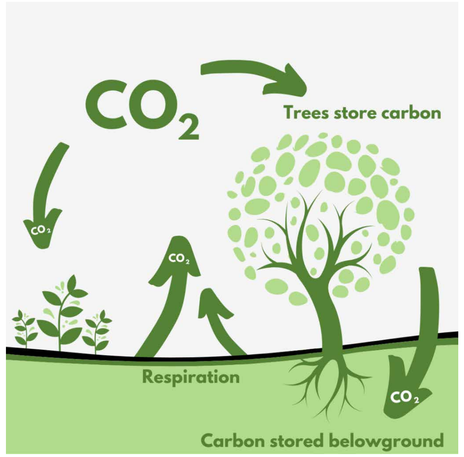
**Regenerate** natural systems by returning natural resources to the earth.

**Learn** about different materials and new techniques to manufacture.
Shift from a product mindset to a **system mindset**.
Transform business models from selling products to selling **services and experiences.**



# Carbon Stores

**Carbon sequestration is the capturing, removal and permanent storage of CO2 from the earth's atmosphere.** Around 45% of the CO2 emitted by humans remains in the atmosphere, which is a significant factor behind global warming.
Carbon sequestration can happen in two basic forms: biologically or geologically. Also, while it's being encouraged artificially through various biological and geological methods, it also happens naturally in the environment on the biggest scale.




| Type of Store | Description | Examples |
|---|---|---|
| **Atmospheric** | Carbon stored in the atmosphere primarily as carbon dioxide ($CO_2$) and methane. | $CO_2$ from respiration, burning fossil fuels |
| **Biological** | Carbon stored in living organisms and organic matter. | Forests, plants, soil, animals |
| **Geological** | Carbon stored in the Earth's crust and fossil fuel deposits over millions of years. | Coal, oil, natural gas, limestone |
| **Oceanic** | Carbon dissolved in seawater or stored in marine organisms and sediments. | Phytoplankton, deep-sea sediments, dissolved $CO_2$ |
| **Cryospheric** | Carbon trapped in frozen soils and permafrost. | Permafrost in Arctic regions |



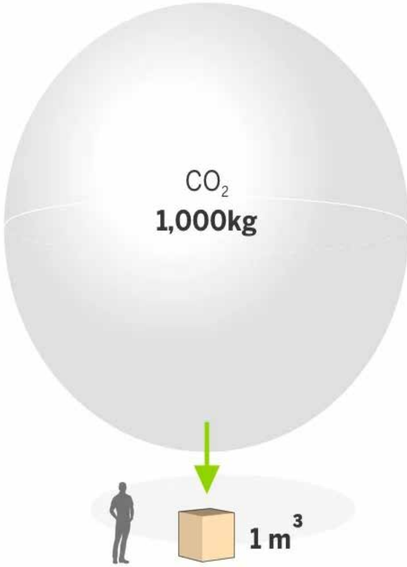
# Wood Specific Stores

As a tree grows it absorbs carbon dioxide from the atmosphere, stores the carbon in its wood fibres and then releases the oxygen back to the air through the process of photosynthesis.
Carbon storage is a unique attribute of wood that doesn't occur in other structural materials. It's a natural process that's available now, without any waiting for new carbon capture and storage technologies to be developed. This allows us to meet near term carbon reduction goals and transforming our built environment into carbon sinks instead of sources.

Although it varies by species, wood is roughly 50% carbon by dry weight. If you know the density of the wood in question, you can easily calculate its stored carbon.

$$6\,CO_2 + 6\,H_2O \rightarrow C_6H_{12}O_6\ \text{(stored)} + 6\,O_2\ \text{(released)}$$

Carbon dioxide isn't stored in wood exactly. Carbon is stored in wood and if that carbon were released into the atmosphere, it would then combine with oxygen to form carbon dioxide.




One cubic meter of wood stores approximately 1,000kg of $CO_2$.

# Week 3

**7th October - 13th October**



# Commercial Project

## Benchmark Project Proposal

**Proposal -**

Design a small piece of furniture that can fit anywhere in the house and be a generational product, with a focus on function and sustainability as well as embracing and showcasing the beauty of solid wood.

**Context -**

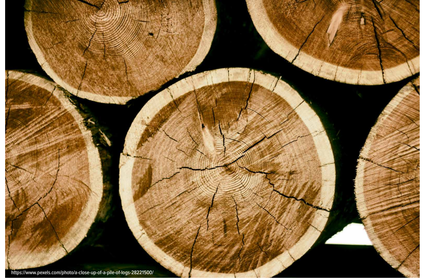
Currently the majority of products are designed to follow a current trend, meaning within a decade products are 'out of style'. Companies like benchmark are trying to move away from this idea and focusing more on circular design and sustainability. They do this by mostly ignoring current trends and designing pieces that use quality solid wood and celebrates the natural materials beauty.

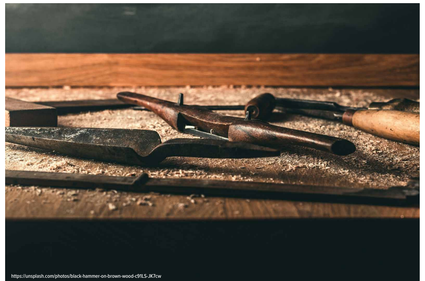
**Parameters -**

- Focuses on solid wood, celebrating natural material
- Create a product that follows circularity principles
- A product that disregards trends and becomes generational

**Keywords -**

- Functional
- Useful
- Simple
- Natural Beauty


https://www.pexels.com/photo/a-close-up-of-a-pile-of-logs-28227500/

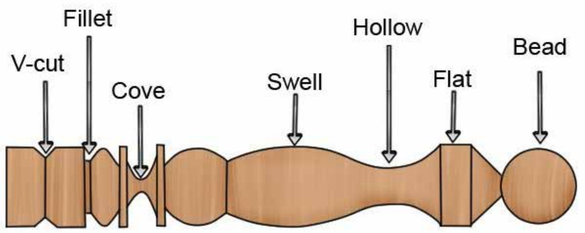

https://unsplash.com/photos/black-hammer-on-brown-wood-CRLS-JK7cw

# Wood Turning

Turning is the art and craft of using hand-held tools on a wood lathe to turn a piece of wood into an object, it dates back to the 12th century. The lathe is the tool used to rotate the piece of wood and they come in all shapes and sizes.

The craft has evolved over the years and started to incorporate other mediums as well as wood such as resin and acrylic. People have further built on this by adding paints, stains and other mediums of colours to enhance the natural grain of wood or hide it.

You can use all types of wood from exotics like Zebrano to domestic woods such as Oak, Beech and even Plywood. You can go as far as amalgamate a number of wood species together to create different effects.

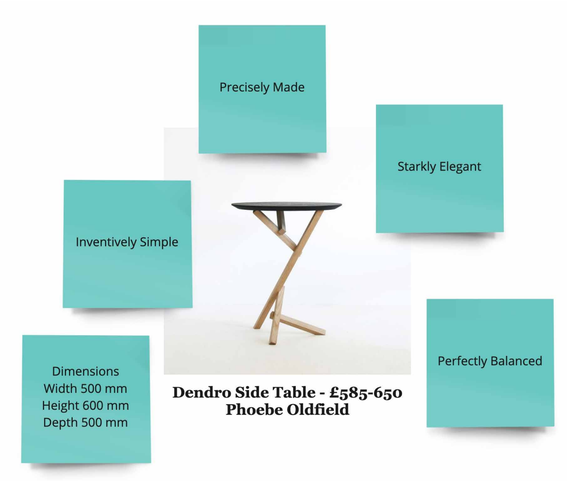




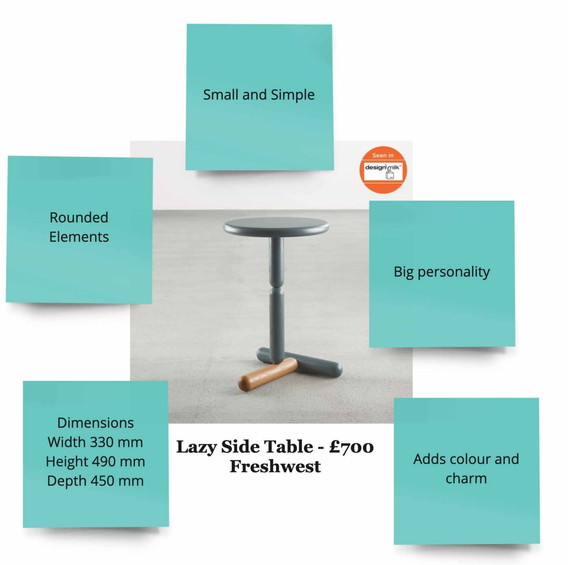

# Joined and Jointed

Joined + Jointed is a collective of celebrated designers and artisans brought together by a shared love of contemporary design and meticulous craft. Together they have created a collection of original, accessible and exclusive furniture pieces.

Samuel Chan's purpose - To turn new design concepts into beautifully made pieces of furniture using his artisan production knowledge, and to offer them to like-minded furniture lovers at sensible, attainable prices.

# Cork Family


Small and Simple
Rounded Elements
Big personality
Dimensions
Width 330 mm
Height 490 mm
Depth 450 mm
Adds colour and charm
Lazy Side Table - £700
Freshwest

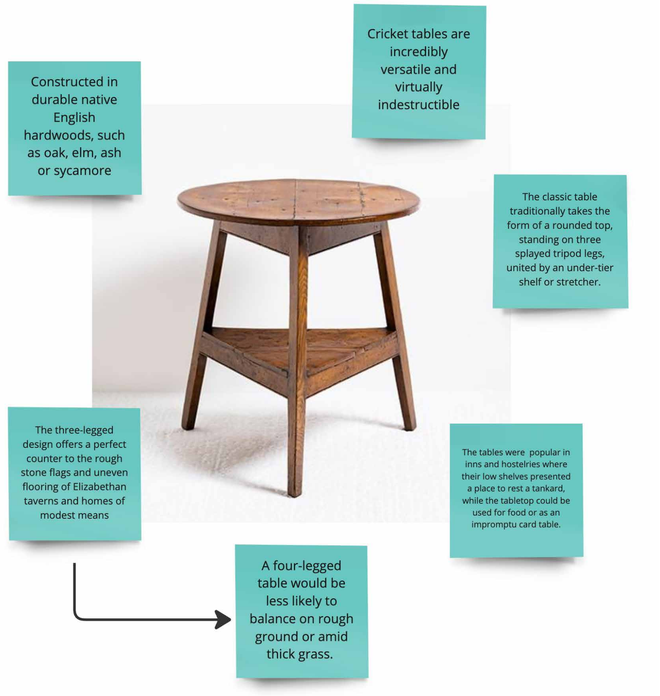

A side table and magazine hold
Back to basics with this simplest of forms
Eminently useful
Dimensions
Width 225 mm
Height 450 mm
Depth 225 mm
Solid materials
Mono Side Table - £515
Wales & Wales


A family of small tables turned from light agglomerate cork.
Unique
Interesting
Waterproof, rot proof, even termite proof material
Makes use of a pressed cork granulate made with the waste material of the wine bottle cork stopper business

# Nendo Tokyo Tribal Collection




# Cricket Table

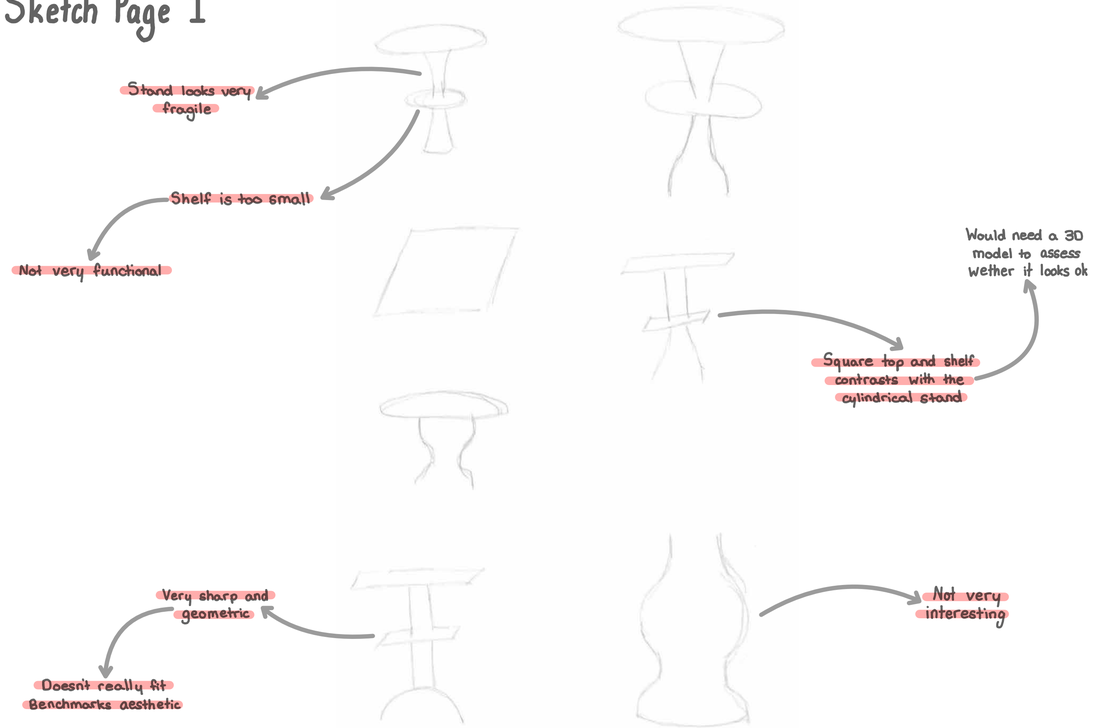


# Week 4

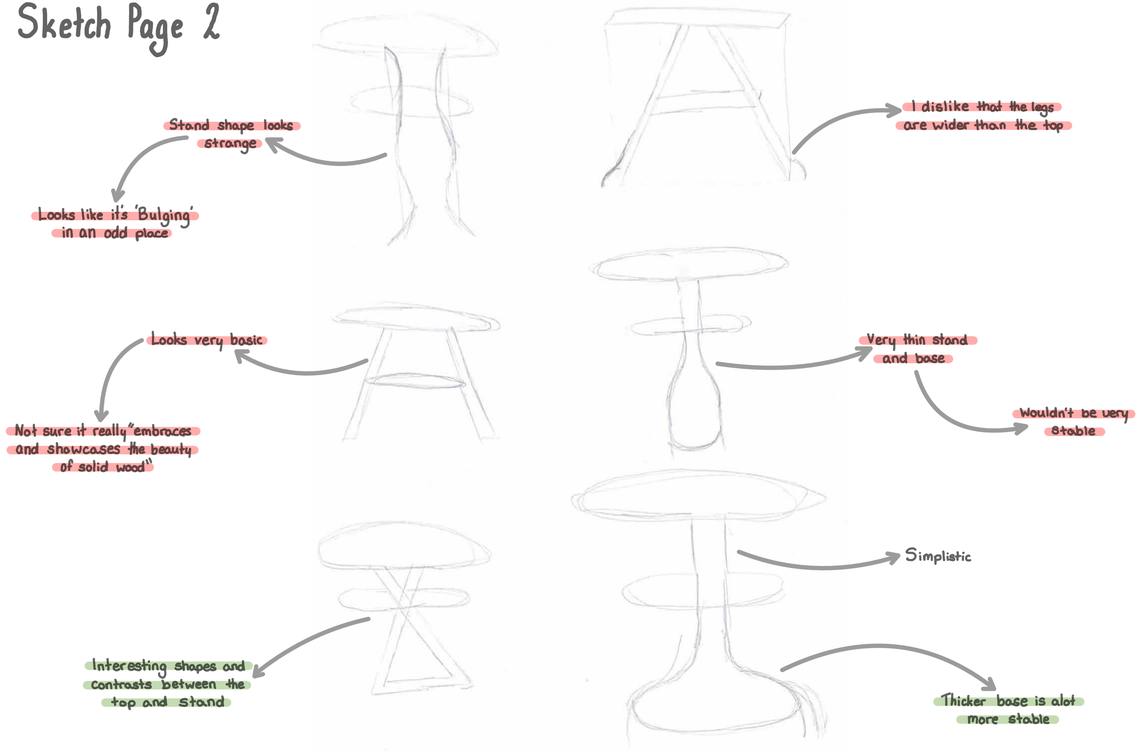
**14th October - 20th October**



## Sketch Page 1

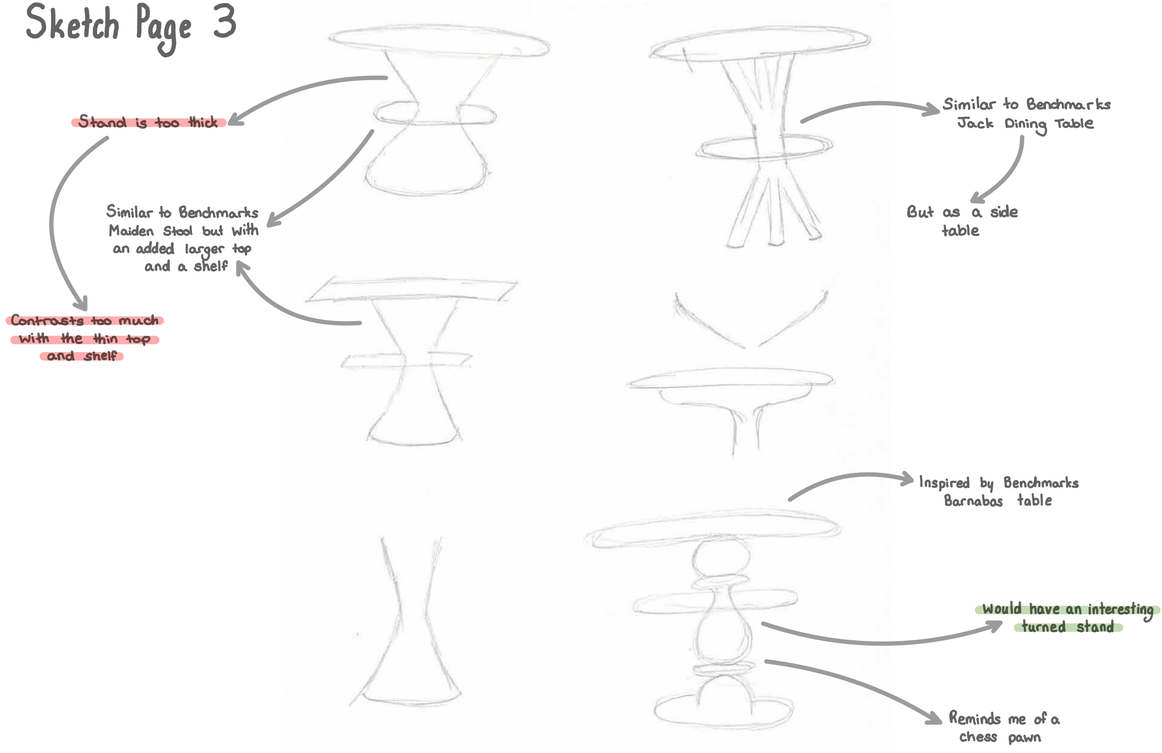


# Sketch Page 2

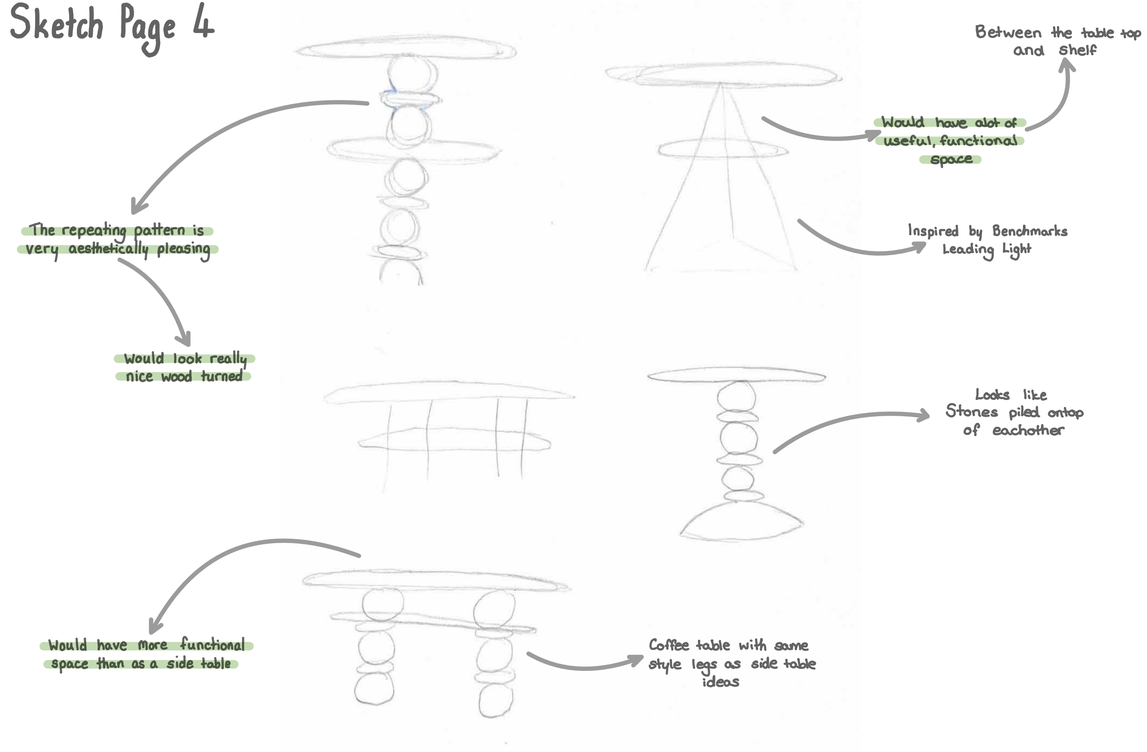





# Sketch Page 3

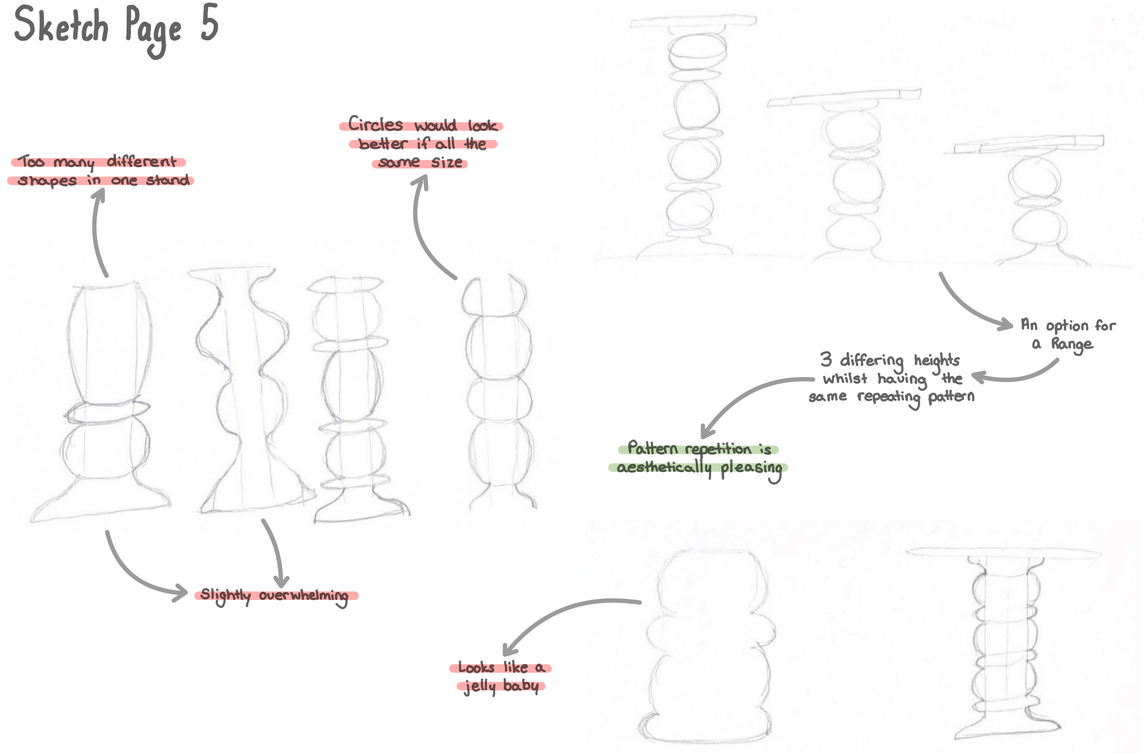


# Sketch Page 4

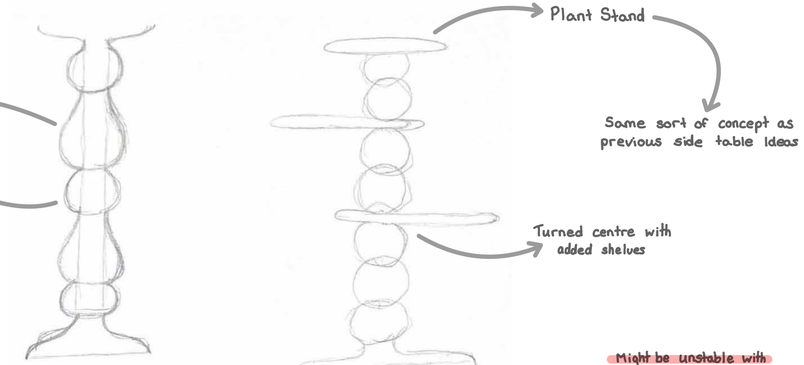





# Sketch Page 5



# Sketch Page 6



Tear drop shape

Might be interesting shape when turned

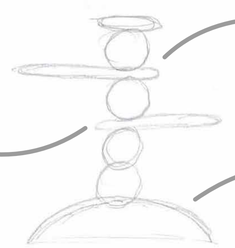
Stand Idea

Plant Stand

Same sort of concept as previous side table ideas

Turned centre with added shelves

Might be unstable with such a thin base



Reminds me of a Stick Man

Plant Stand

Bigger/chunkier base would provide more stability especially with the added height of a tall plant stand



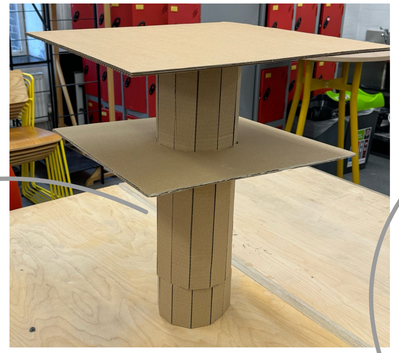
# Side Table Initial Model

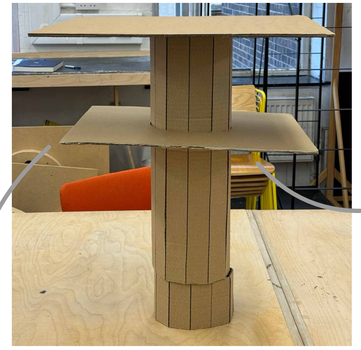
Making the second level round will take away even more usable space

I think the top and second level will have to be round to tie in with the cylindrical stand

Not much would fit on it

It's too small and useless because of the stand through the middle



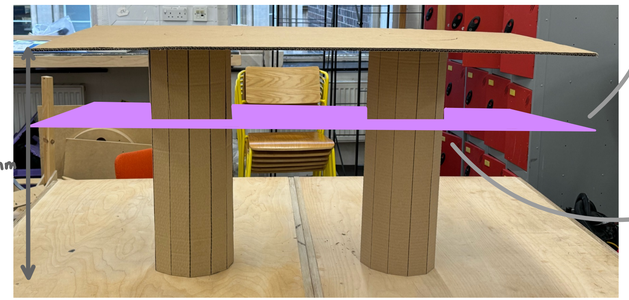


Physical model felt too tall to be a side table

Second level is supposed to add functionality

Depending on where the side table is located it might be hard to access the second level

# Coffee Table Initial Model



Second layer is alot more functional as a coffee table than a side table

Tried a coffee table as I liked the idea of a second level for functionality

Too tall for a Coffee Table

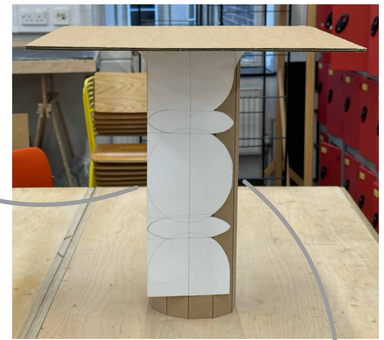
600mm

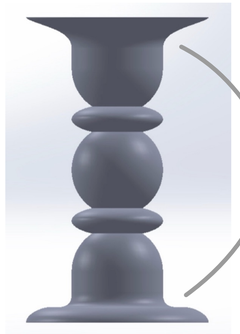
Standard coffee table height is 510mm

Square top/shelf clashes with cylindrical legs

# Base Idea 1

Quick sketch model to show how a turned stand may look physically





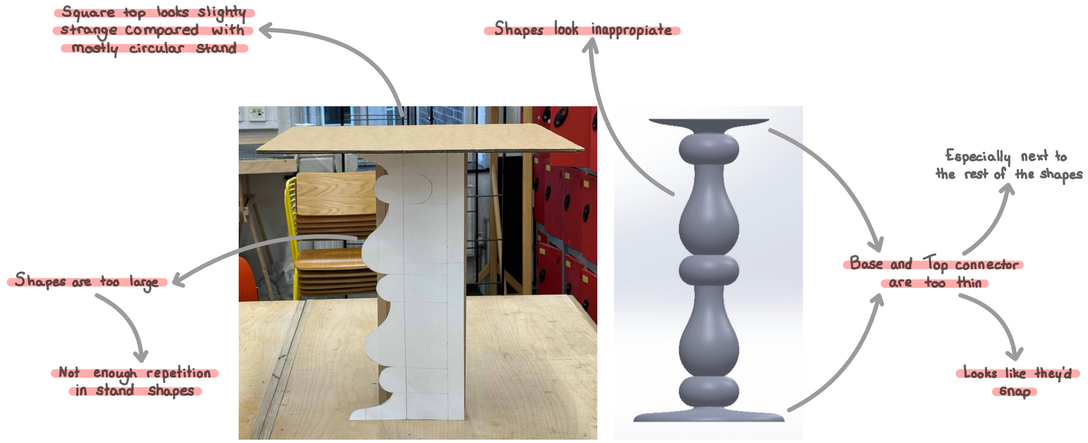
The shapes merging into the connector/base looks better

Can be Woodturned

Top and bottom parts are too bulky

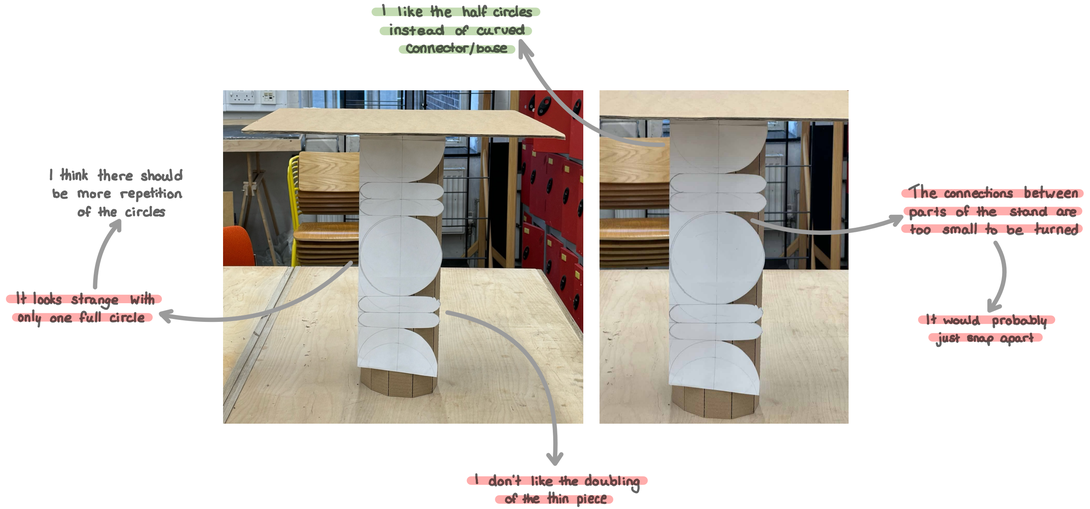
Not enough shape repetition

# Base Idea 2

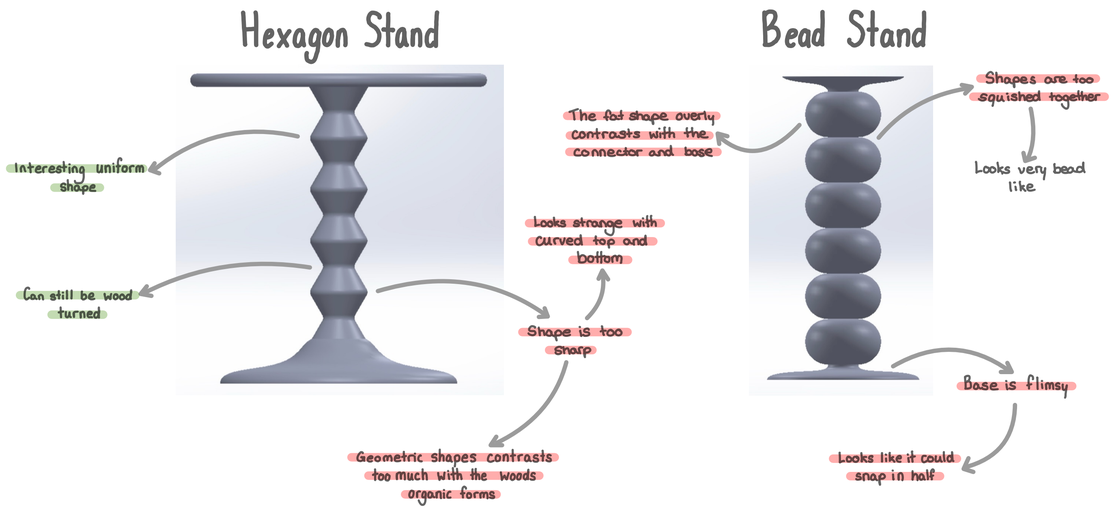





# Base Idea 3

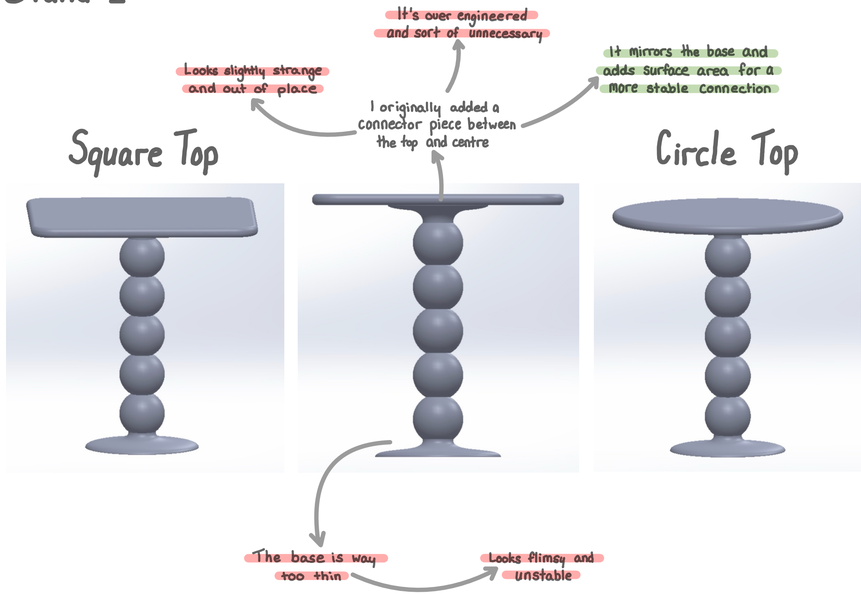


# Base Idea 4 and 5






# Sphere Stand 1



# Plant Stand Initial Model

After I spoke to Madeline at the workshop triage she made me a small turned piece and it gave me some inspiration for a plant stand

The shelves can spin around the centre stand

I really like how the wood grain is shown on the turned balls

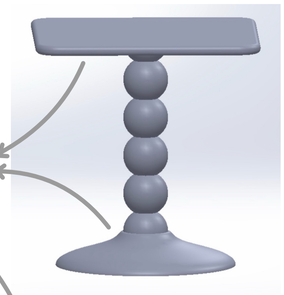
The dimensions look ok now but may not work in a full scale model

It might be unstable from the different sized shelves



# Sphere Stand 2

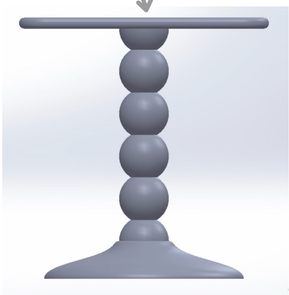
## Square Top



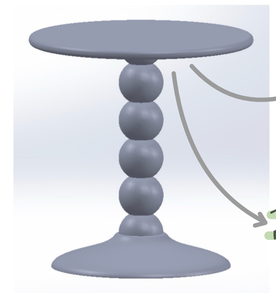
It's an interesting contrast between the square top, the spheres and the circular base

While it looks interesting I think the top should have a better relationship with the rest of the design

The flat surface of the hemisphere should be more than enough for a stable connection



## Circle Top



It's currently just a flat surface and nothing else

The top isn't as functional as it could be

The circular top relates more to the rest of the design

During my interim review with Benchmark, Martin seemed to have to have alot of ideas about this idea

Martin suggested that instead of just Ash I could use multiple types of wood

As this may best achieve my goal of showcasing the natural beauty of solid wood

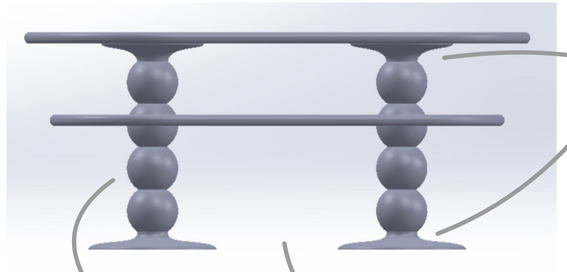
He wondered wether I could make the height adjustable

As each sphere is a separate part and connected by a threaded bar so it can be rethreaded infinately

# Coffee Table Ideas

I wanted to increase the functionality by adding a second layer

It didn't work with the side table so I thought a coffee table would work better



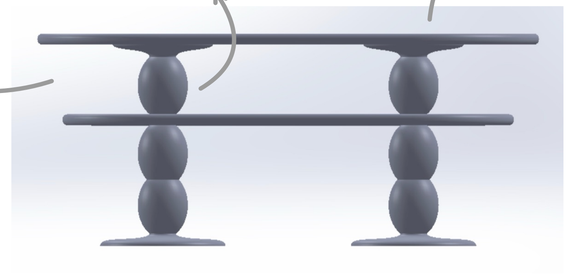
The connection between the top and the stand as well as the bases looks strange and out of place

Looks very stubby and out of place

As coffee tables are quite low to the ground you wouldn't see the spheres very much and they're the design feature I want to highlight

Looks Strange

The egg shape doesn't fit with my idea or Benchmark's aesthetics



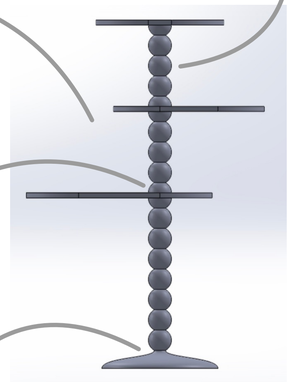
Martin from Benchmark liked the idea but still thought the side table was more thought out and could highlight the woods beauty better



# Plant Stand Idea

Has the repetition of spheres I like and shows off wood grain nicely

Multiple levels for multiple plants

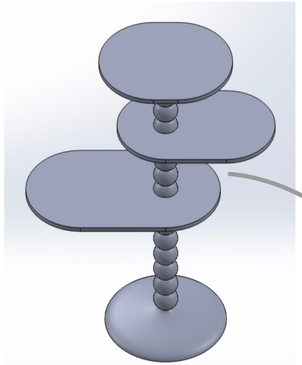


Half spheres bisecting the shelves look odd

Base shape doesn't relate at all to the rest of the design

It was quite rushed compared to my other ideas

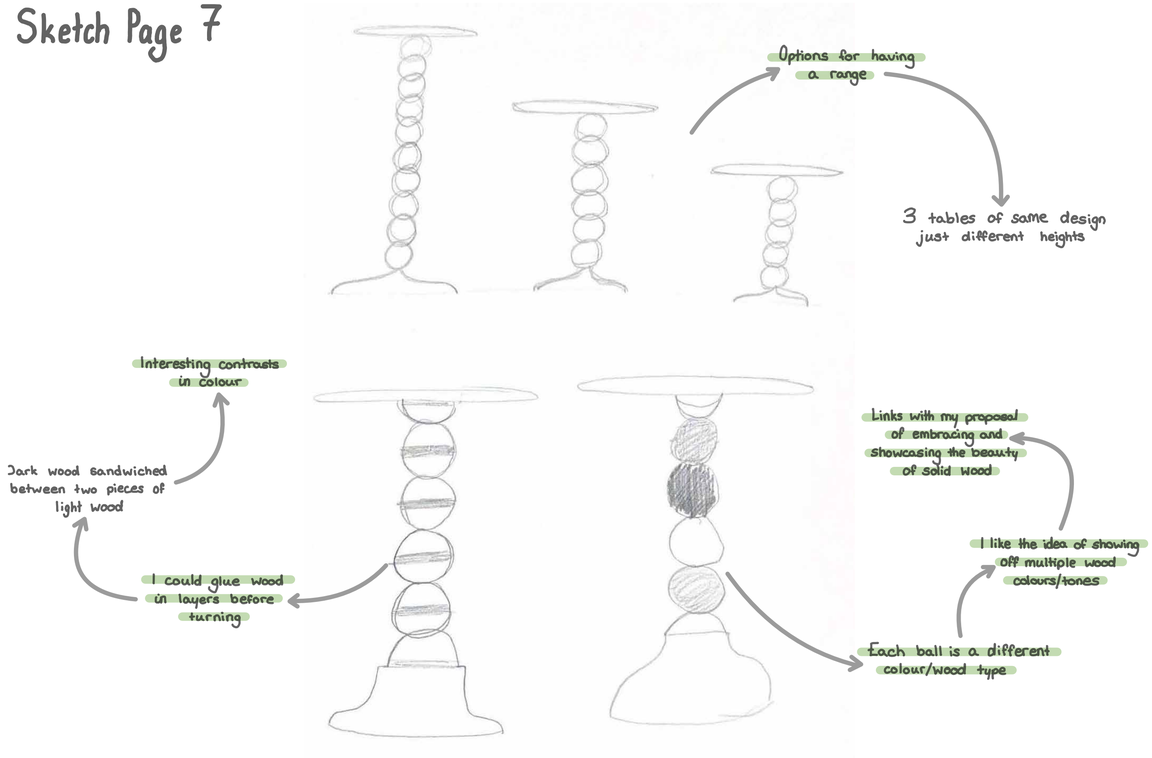
Whole stand seems overcomplicated



May not be the most stable with the shelves being different lengths

I showed the design to Martin from Benchmark during the Interim Review and he didn't seem as interested or excited about it as my other ideas

# Sketch Page 7





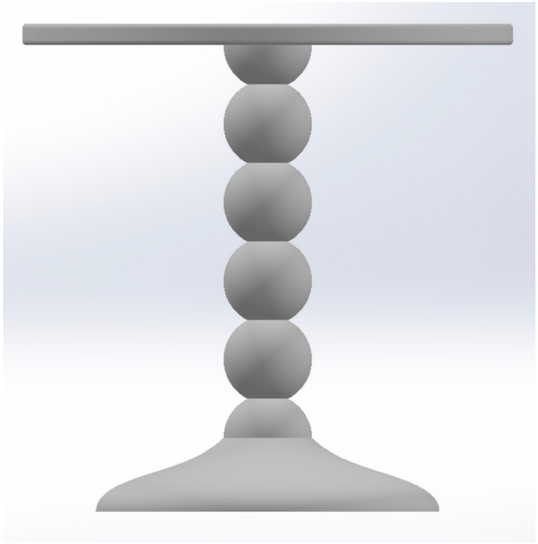

**Reframed Brief -**

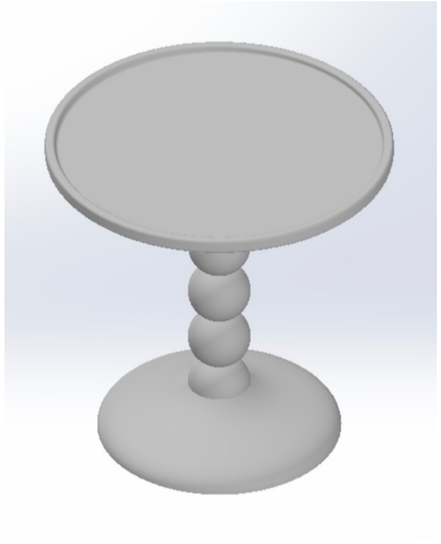
Design a small piece of furniture that embraces and showcases the beauty of solid wood whilst still having a focus on function as well as sustainability

# First CNC Model

My first full scale foam model that I CNC'd. It's more accurate than my cardboard models and means I can accurately assess the dimensions physically.

It's especially helpful for the spheres which are hard to make and visualise in cardboard









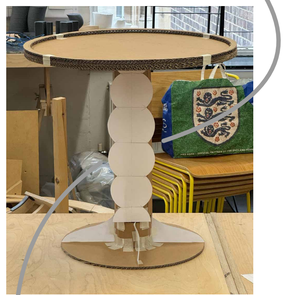
# Week 5 & 6

**21st October - 3rd November**

# Full Scale Model Development

It's a rough model to vaguely see the shape of the turned centre pole

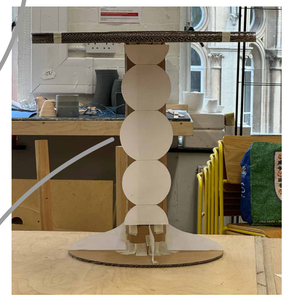
Looks like a caterpillar



Each sphere has a different diameter but the same height

Looks too squished

Middle sphere is the biggest with the two eitherside being slightly smaller



The dimensions look strange

Middle sphere looks way too big



# Full Scale Model Development

It's a rough model to vaguely see the shape of the turned centre pole

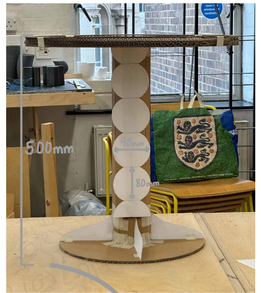
A smooth flow from rim to top

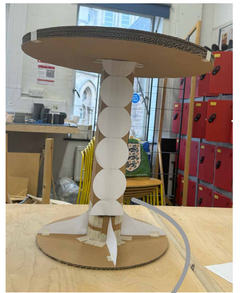
It should have filletted edges

Prevents crumbs/dust from getting stuck

All of benchmarks products have smooth, sleek profiles with filletted edges

I like the raised rim of the tabletop

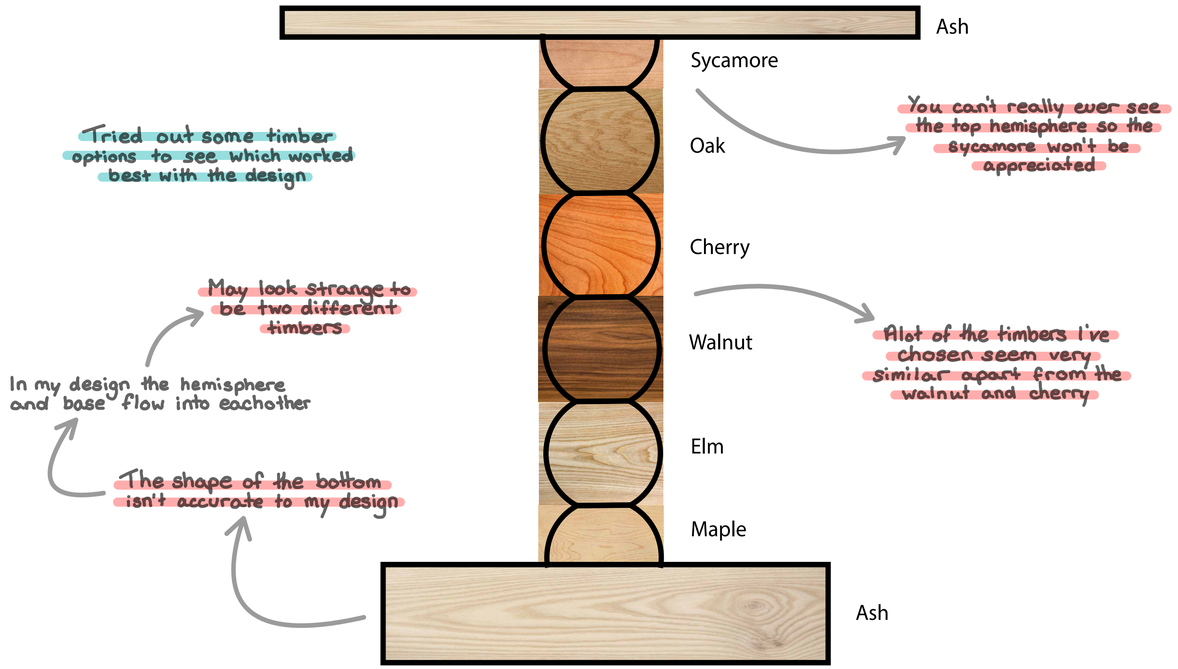


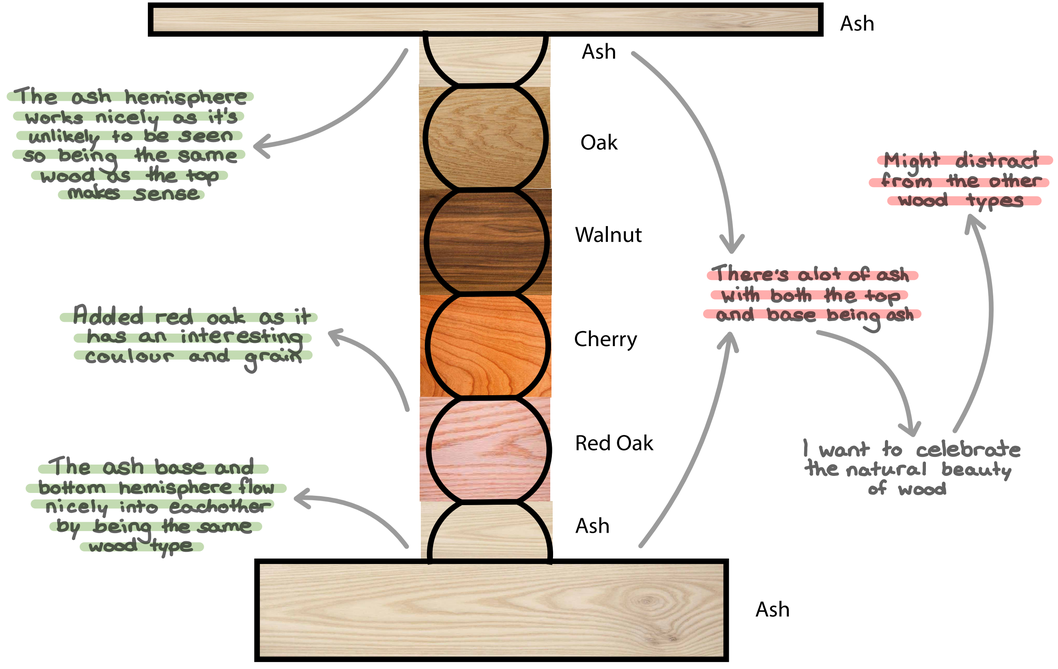
The overall height feels appropiate for a sidetable

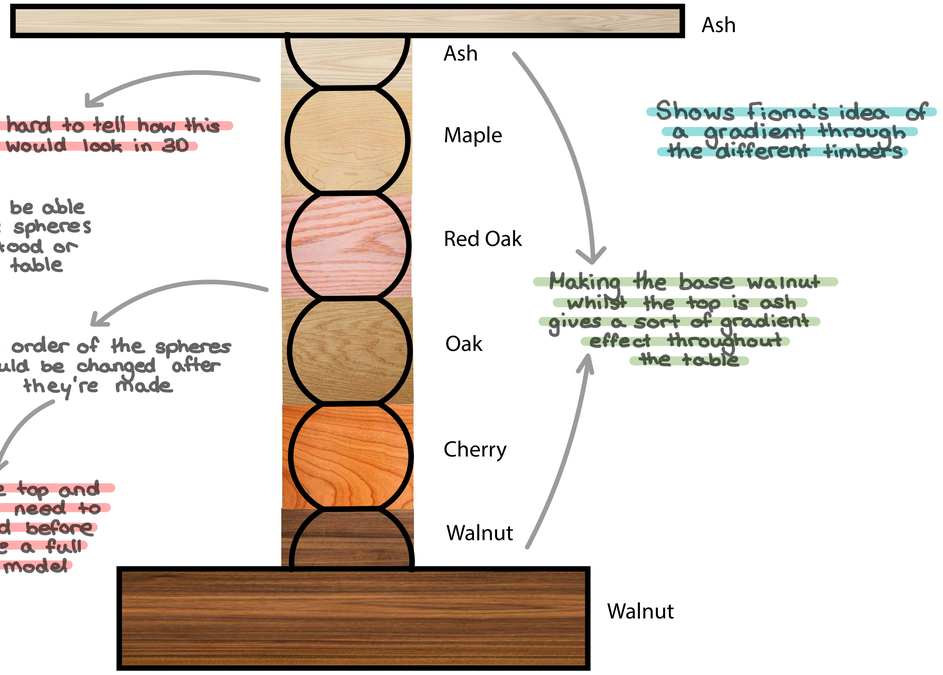
I kept all the spheres the same size in this model

Gives a nice uniform aesthetic


Ash
Sycamore
Oak
Cherry
Walnut
Elm
Maple
Ash
Tried out some timber options to see which worked best with the design
You can't really ever see the top hemisphere so the sycamore won't be appreciated
May look strange to be two different timbers
Alot of the timbers I've chosen seem very similar apart from the walnut and cherry
In my design the hemisphere and base flow into eachother
The shape of the bottom isn't accurate to my design




Ash
Ash
Oak
Walnut
Cherry
Red Oak
Ash
Ash
The ash hemisphere works nicely as it's unlikely to be seen so being the same wood as the top makes sense
Might distract from the other wood types
There's alot of ash with both the top and base being ash
Added red oak as it has an interesting coulour and grain
I want to celebrate the natural beauty of wood
The ash base and bottom hemisphere flow nicely into eachother by being the same wood type



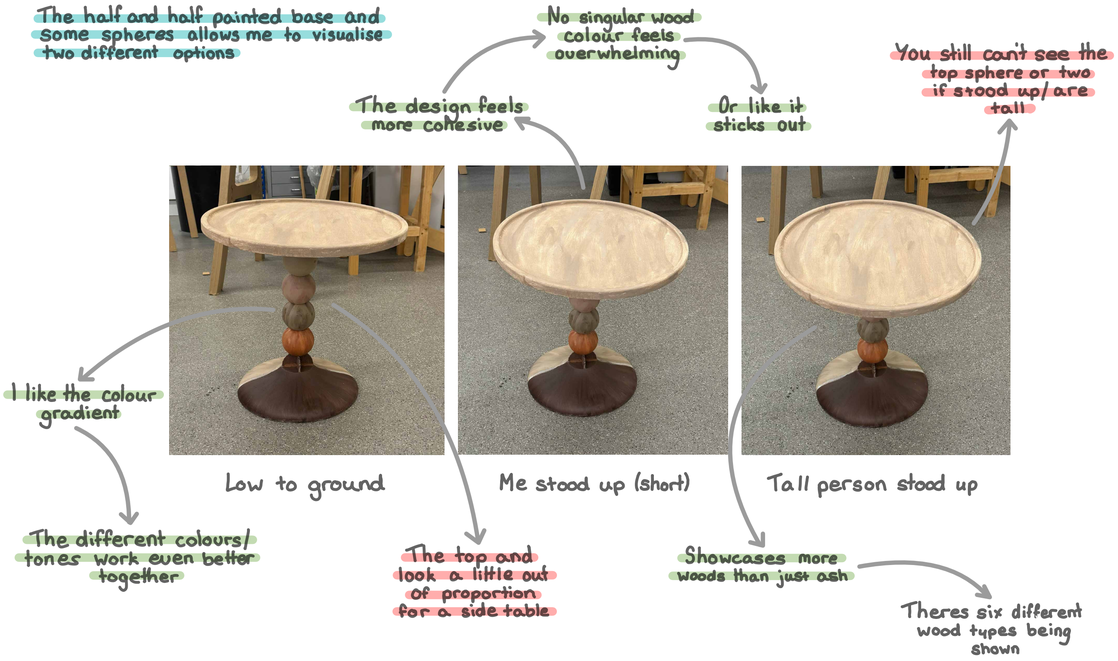



# Ash Top and Base

Roughly painted to simulate the different wood types

Gives me a view of what the different wood types looks like from different angles

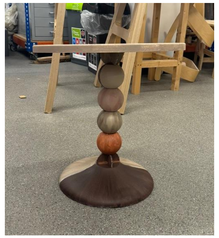
# Ash Top and Walnut Base

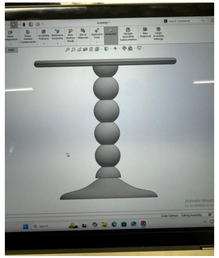





# Parts List

| Part | Quantity | Material | Height (mm) | Length (mm) | Width (mm) |
|---|---|---|---|---|---|
| Top | 1 | Ash | 22 | 500 | 500 |
| Base | 1 | Walnut | 75 | 350 | 350 |
| Half Sphere 1 | 1 | Ash | 40 | 90 | 90 |
| Half Sphere 2 | 1 | Walnut | 40 | 90 | 90 |
| Sphere 1 | 1 | Cherry | 80 | 90 | 90 |
| Sphere 2 | 1 | Oak | 80 | 90 | 90 |
| Sphere 3 | 1 | Red Oak | 80 | 90 | 90 |
| Sphere 4 | 1 | Maple | 80 | 90 | 90 |

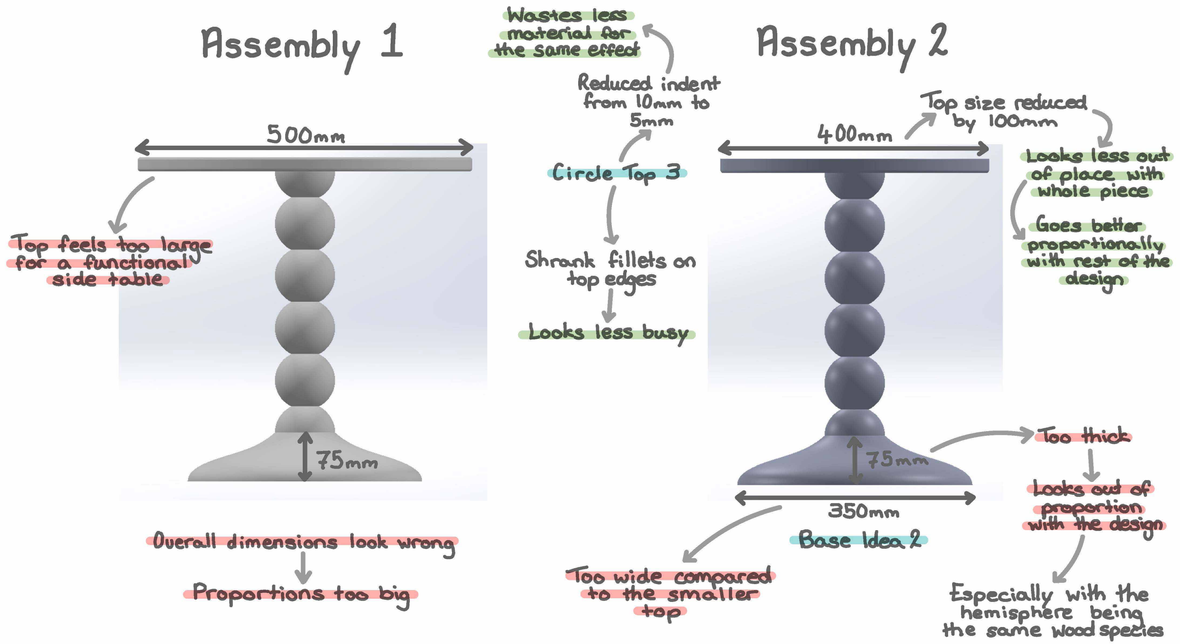




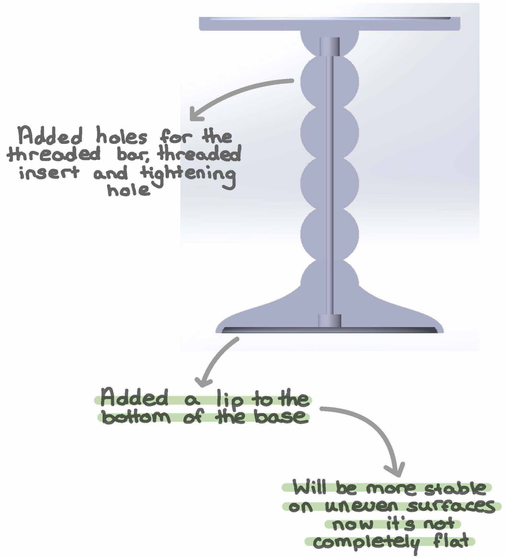
# Week 7

**4th November - 10th November**

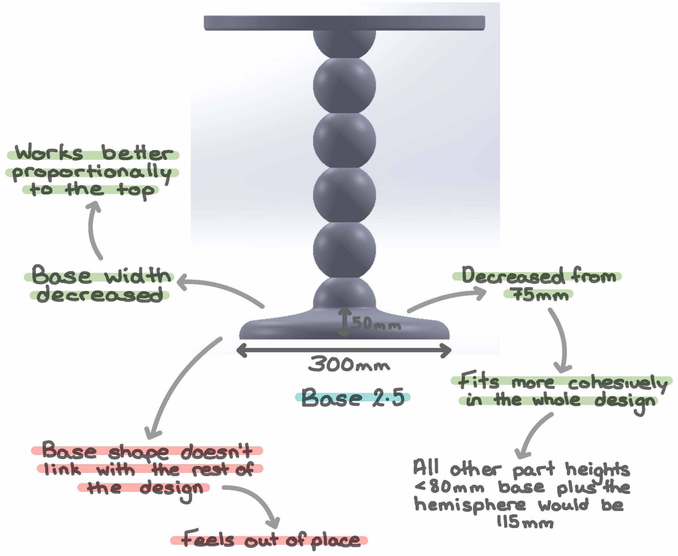




# Assembly 3

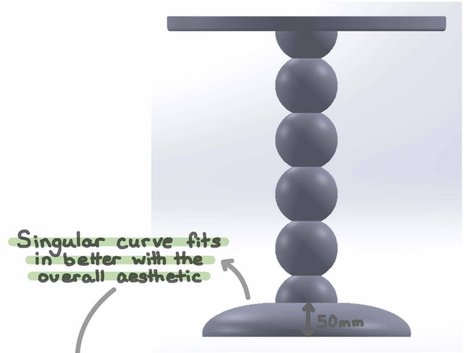



# Assembly 4

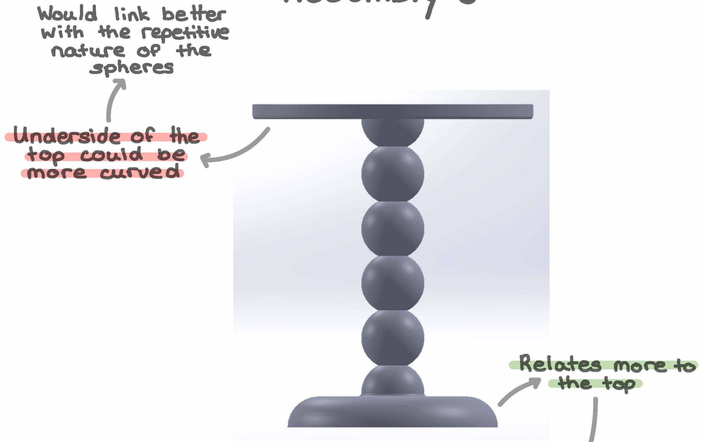




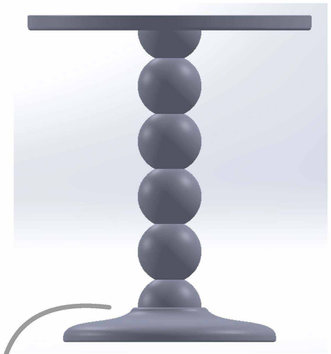

# Assembly 5




# Assembly 6



# Assembly 7

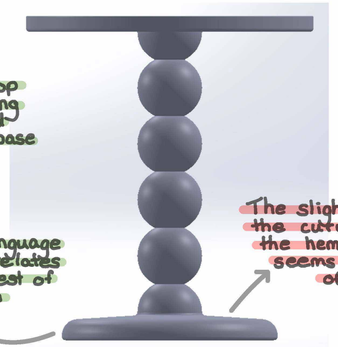


Base Idea 5

It's like the original base but with an added lip between the base and the hemisphere

Doesn't flow with the rest of the design

# Assembly 8.1



Base Idea 6

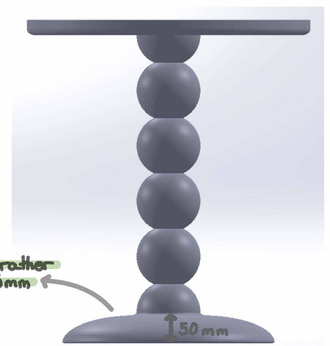
It mirrors the top whilst still looking stable and solid enough to be the base

The design language of the base relates nicely to the rest of the design

The slight angle from the curved edge to the hemisphere still seems a little out of place



# Assembly 9



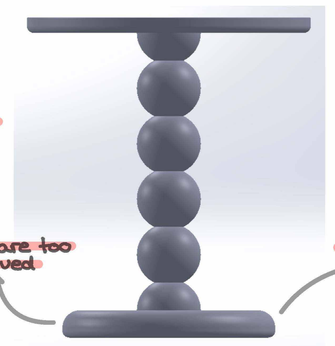

Base Idea 7

Only 50mm rather than 75mm

Shape still contrasts too much with the top

Looks bulky in contrast with the uniform nature of the whole design

# Assembly 10

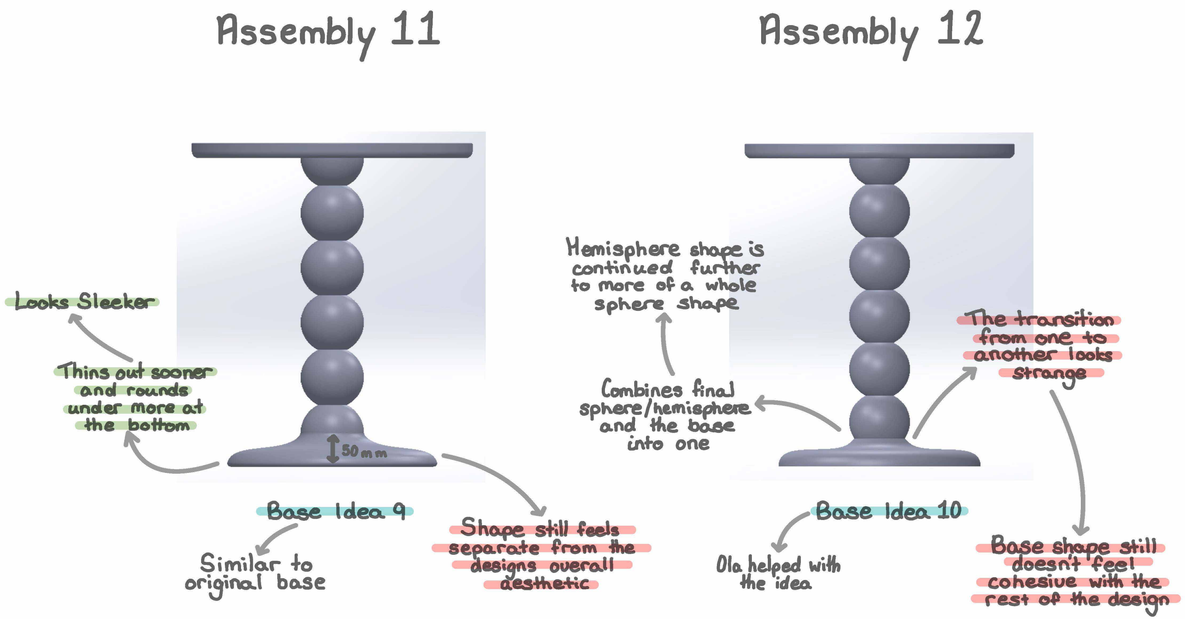


Base Idea 8

Looks very thick and out of place with the designs aesthetics

Edges are too curved

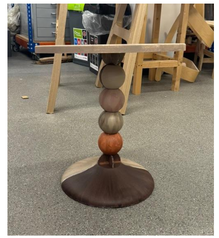
Reminds me of a doughnut






# Final Parts List

| Part | Quantity | Material | Height (mm) | Length (mm) | Width (mm) |
|---|---|---|---|---|---|
| Top | 1 | Ash | 25 | 400 | 400 |
| Base | 1 | Walnut | 50 | 300 | 300 |
| Half Sphere 1 | 1 | Ash | 40 | 90 | 90 |
| Half Sphere 2 | 1 | Walnut | 40 | 90 | 90 |
| Sphere 1 | 1 | Cherry | 80 | 90 | 90 |
| Sphere 2 | 1 | Oak | 80 | 90 | 90 |
| Sphere 3 | 1 | Red Oak | 80 | 90 | 90 |
| Sphere 4 | 1 | Maple | 80 | 90 | 90 |
| Sphere 5 | 1 | | 80 | 90 | 90 |



I drove to Benchmark near Newbury to pick up my timber as they'd kindly offered to provide me and Paddy with the timber we required for our projects. Before I went to benchmark I hadn't made a final decision on the wood type for the fifth sphere.

Whilst I was there I had the chance to talk about my design with Wesley Cripps their design manager. I asked for his opinion on what wood would be a good fit for my fifth sphere, he told me about some brown oak they had for a project and that it would probably fit nicely with my design and the other timbers I had chosen.

As Benchmark was providing me with all the timber I wanted to ensure that I was using timber they could easily procure but that still fit within my deign and the brief.

# Gifted Benchmark Materials

| | | |
|---|---|---|
| Ash 1 | 1073 × 184 × 31 | ×6 |
| Ash 2 | 821 × 100 × 71 | |
| Walnut 1 | 1090 × 115 × 44 | ×3 |
| Walnut 2 | 1044 × 100 × 48 | ×2 |
| Brown Oak | 807 × 109 × 52 | |
| Oak | 801 × 158 × 45 | ×2 |
| Cherry | 854 × 100 × 47 | ×3 |
| Maple | 1055 × 100 × 70 | |
| Red Oak | 1085 × 100 × 47 | ×2 |



# Timber Plan

Top – Ash

Top Half Sphere – Ash

Sphere 1 – Maple

Sphere 2 – Cherry

Sphere 3 – Red Oak

Sphere 4 – Oak

Sphere 5 – Brown Oak

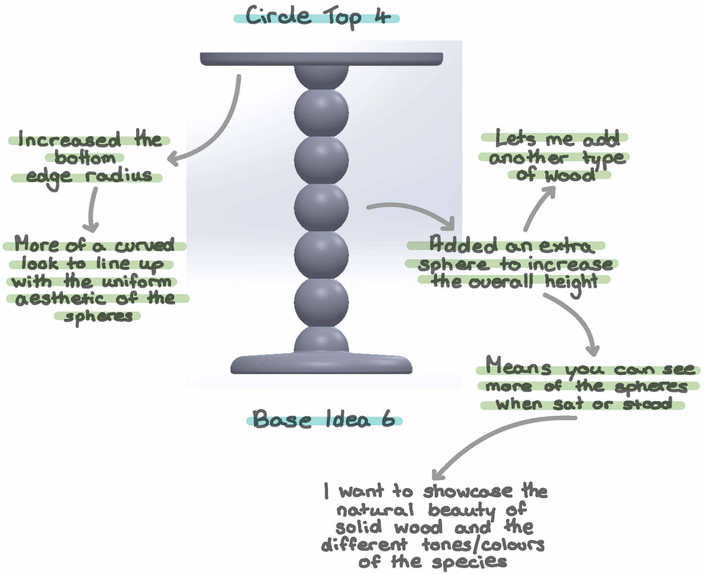
Bottom Half Sphere – Walnut

Base – Walnut

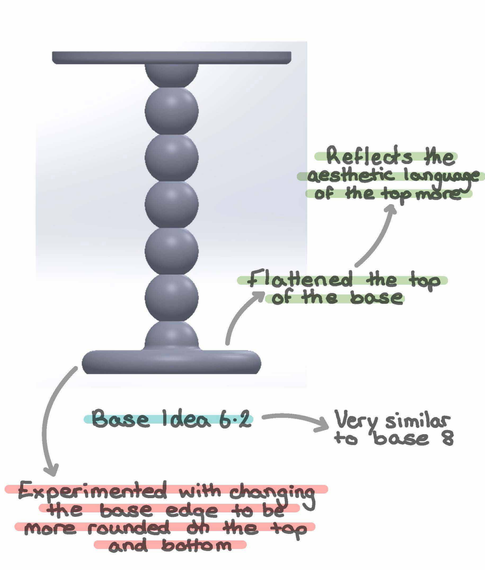


# Final Design Refinements

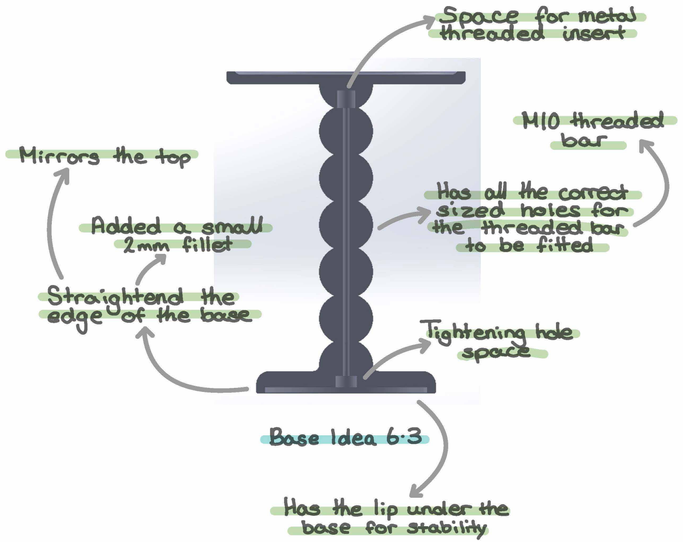
## Assembly 8.2



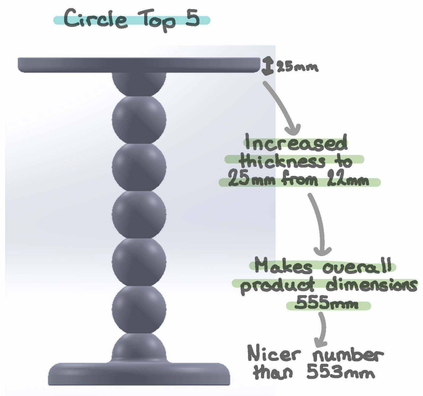

## Assembly 8.3



# Assembly 8.4




# Assembly 8.5






Looks sort of like a mountain range

Choosing which ash pieces to glue together for a nice grain on the tabletop

These pieces looked the best next to eachother

When choosing the grains I forgot to check the end grain directions so they weren't alternating

3 planks Glued

The darker grains all seemed to be on the same sides so it was hard to find pieces that looked nice next to eachother whilst alternating the end grains

I'm using more of the middle of the boards as these have the nicest grain patterns

# Week 8

**11th November - 17th November**

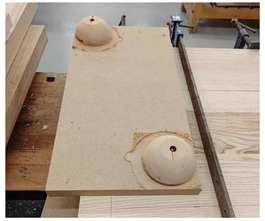


Week 8
Week 9

## Week 8 and 9 Time Plan

- [ ] Add research from Miro into Process Doc
- [ ] Add initial ideas and cardboard models into Process Doc
- [ ] Get rest of CNC'd parts, Glue and Sand them
- [ ] Test out oil samples
- [ ] Hopefully Oil final prototype
- [ ] Fit Metal insert and threaded bar
- [ ] Render CAD Models
  - [ ] → With different wood options
- [ ] Photos of final Model
- [ ] Sales Board
- [ ] Manufacturing Methods
- [ ] Costings
- [ ] Tech Pack
- [ ] Future changes/Improvements
- [ ] Gantt chart → Analysis of time Management
- [ ] Think of Name

# Spheres



The hemispheres in my design were able to be CNC'd in one go.

To make one sphere in the CNC they had to be done in two halves.
The wood was attached to MDF to prevent any sliding around while being CNC'd

The hemispheres had to be glued together to form the spheres in my design, it was quite difficult to glue the pieces together as they kept slipping when I tried to line the glued halves together to clamp them. With hindsight I should have made a jig to hold the pieces together whilst they were clamped and glued.
This problem would not occur in normal production as the pieces are designed to be wood turned. Turning the wood wasn't feasible with the university workshop and technician limitations; the technician that is able to wood turn wasn't comfortable with turning pieces that had been glued together out of multiple pieces of wood.

The spheres and hemispheres all required sanding for finishing, their spherical shape made them difficult to hold and sand. The spheres required significant finishing as the halves had slipped slightly during clamping and some glue had seeped out.



# Threaded Insert

To attach all of the parts together I have an M10 threaded bar running throughout the middle. The most secure way to attach the bar was with a custom threaded insert in the top hemisphere, the hemisphere is then glued to the table top.

# Base

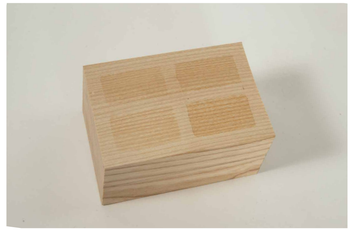
To get the right size for my base I had to glue four pieces of 100mm wide wood together for the right overall width, whilst three pieces may have been sufficient as my base is only 300mm wide I needed to leave a margin for the CNC cutter.
After it came out of the CNC I had to do a fair amount of sanding to get a smooth surface to oil, the CNC had also singed some parts of the wood and you could see a number of blade marks.

# Top and Hemisphere

The best way to glue the hemisphere to the table top would have been with custom made jig sized to hold the hemisphere held the hemisphere in place whilst being glued and clamped, to keep everything central and prevent any slipping.
For my prototype I didn't make this jig as it would need to be CNC'd and with other students needing things for their projects time and resources were limited. I therefore completed the process manually, finding the centre of the table top and placing small markers to try and ensure everything



# Osmo Top Oil Samples



Top Left - Satin
Top Right - White
Bottom Left - Matt
Bottom Right - Natural

Both the natural and white left a small white milky sheen on some parts of the darker woods (Brown Oak, Walnut)

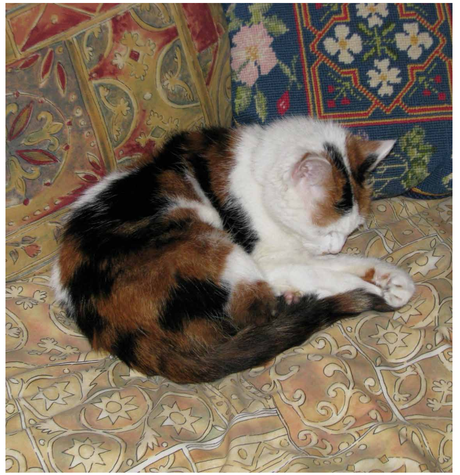
# Oiling Final Prototype

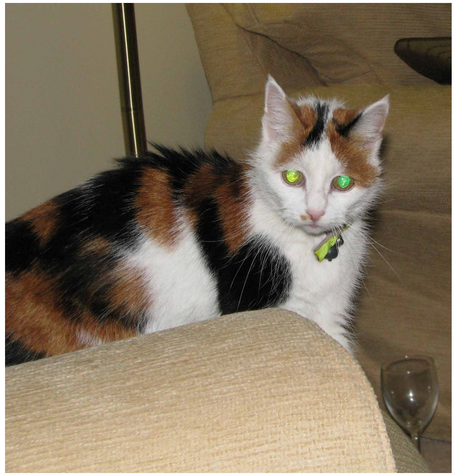
I decided to use Osmo Clear Satin Top Oil on my final prototype. It gives the wood a slight shine and doesn't have any white pigment unlike some of the other oils which would work nicely on the lighter woods but could give a strange milky film on the darker woods such as the Walnut and Brown Oak.



# Product Name Idea

Benchmark often names it products after people that they know/mean a lot to them. Such as: Eleanor Side Table, Jack Dining Table and Victoria Bench.
When thinking of a name for my side table I remembered my first childhood pets, my family's cats Freddie and Charlie. They were a big part of my family and life before they passed away aged 18 and 19.
Freddie was a Calico cat, mostly white with black and brown patches all over. My side table with it's multiple colours from the different woods reminded me of Freddie's distinctive colouring.





**Freddie Side Table**

Week 8
Week 9

## Week 8 and 9 Time Plan

End of Week 8

- [ ] Add research from Miro into Process Doc
- [x] Add initial ideas and cardboard models into Process Doc
- [x] Get rest of CNC'd parts, Glue and Sand them
- [x] Test out oil samples
- [x] Oil final prototype (Hopefully)
- [x] Fit Metal insert and threaded bar
- [ ] Render CAD Models
  - [ ] → With different wood options
- [ ] Photos of final Model
- [ ] Sales Board
- [ ] Manufacturing Methods
- [ ] Costings
- [ ] Tech Pack
- [ ] Future changes/Improvements
- [ ] Gantt chart → Analysis of time Management
- [x] Think of Name





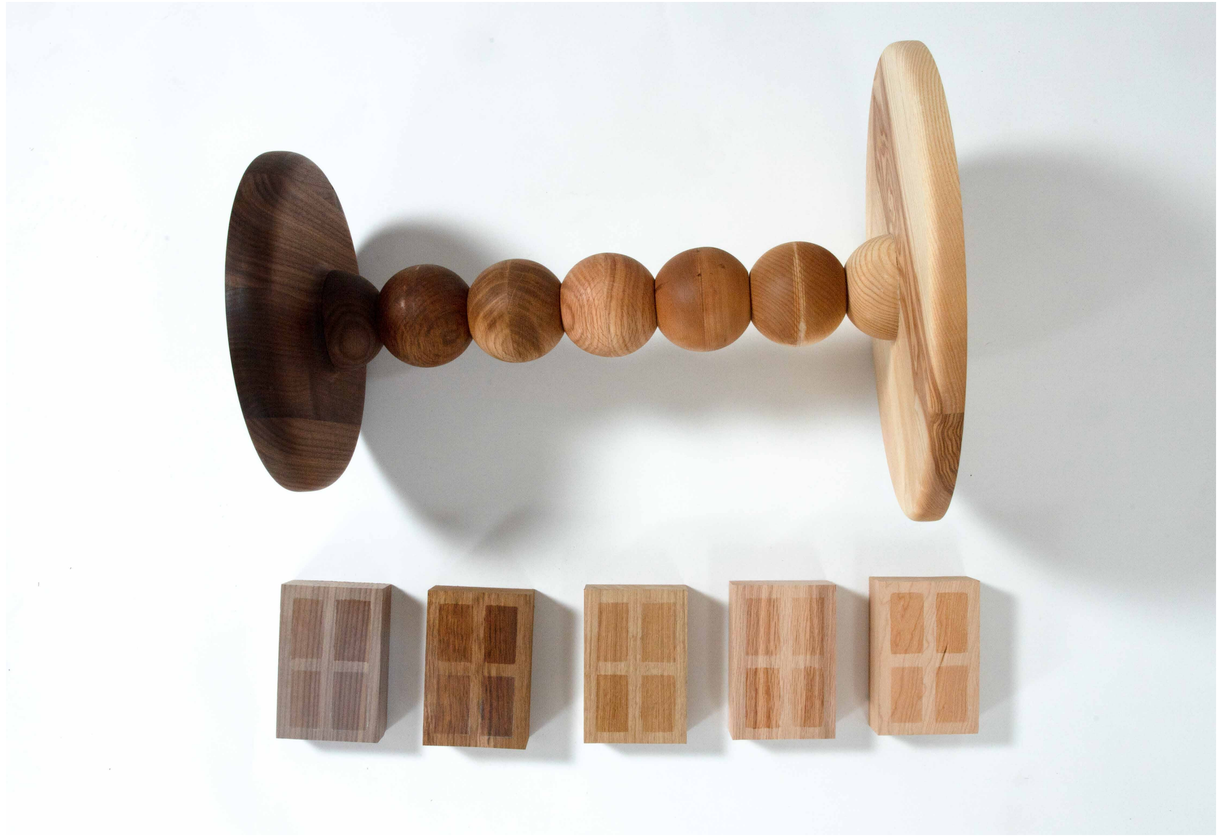
# Week 9

**18th November - 24th November**

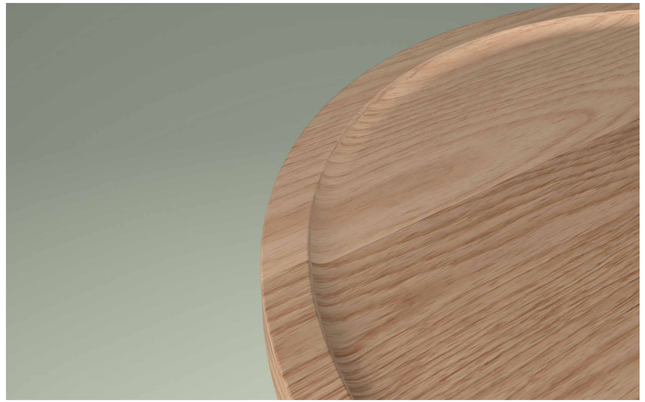
## Week 9 To-Do List

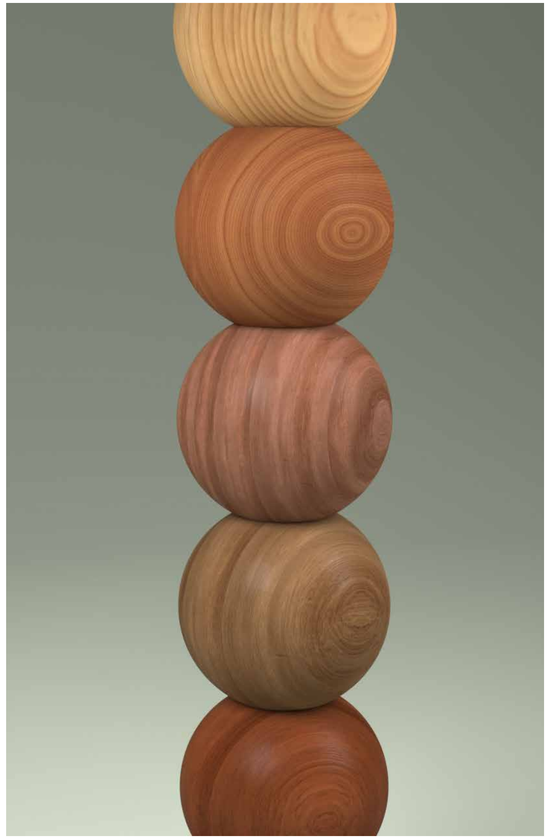
- [ ] Add research from Miro into Process Doc
- [ ] Render CAD Models
  - [ ] → With different wood options
- [ ] Photos of final Model
- [ ] Benchmark Website
- [ ] Manufacturing Methods
- [ ] Costings
- [ ] Tech Pack
- [ ] Future changes/Improvements
- [ ] Gantt chart → Analysis of time Management
- [ ] Evaluation
- [ ] Presentation













# Industry Manufacture

## Top

To manufacture the table top, firstly the wood would need to be glued and clamped together to get the overall width required for the top plus some extra for the CNC cutting edge.
Once the glue has cured it needs to be planed flat for best results in the CNC. The CNC is necessary to make the indent in the top and curve the edges.

## Base

For the base manufacture, three pieces of 125mm width wood will need to be glued and clamped together.
After being glued it will need to be planed flat before getting CNC'd into the base shape.

## Spheres & Hemispheres

Before gluing two 50mm pieces of wood together I would cut out half the hole for the threaded bar so that once the pieces are glued together the threaded bar hole would already be prepared.
The spheres would be wood turned using a sphere jig. Turning shows off the wood grain the best and gives the smoothest results. Whilst on the lathe the spheres and hemispheres would be cut into shape, sanded and oiled all in one go.

## Threaded Insert

In batch production the insert would be turned on the centre lathe out of 30mm solid round bar. A small amount of texture would be added to the bottom edge for some friction when it's slid into the wooden hemisphere. On the top side a threaded insert would be cut out of the middle 20 mm deep.

# Costings

For a batch of 10 :
*(Measurements in mm)*
Ash - 32 x 150 x 5,000 - £1250 per M3
Ash - 50 x 100 x 1000 - £1450 per M3
*Maple - 50 x 100 x 2000 - £1300 per M3
Cherry - 50 x 100 x 2000 - £1350 per M3
*Red Oak - 50 x 100 x 2000 £1150 per M3
Oak - 50 x 100 x 2000 £2495 per M3
*Brown Oak - 50 x 100 x 2000 £2895 per M3
Walnut - 50 x 100 x 1000 £3800 per M3
Walnut - 64 x 125 x 4000 £4200 per M3

## Workings for Wood Prices

**Ash Top - £1250 per m3**

32 x 150 x 5000 (mm)
0.032 x 0.15 x 5 (m)
= 0.024 m3

1250 x 0.024 = 30

**£30**

**Ash Hemisphere - £1450 per m3**

50 x 100 x 1000 (mm)
0.05 x 0.1 x 1 (m)
= 0.005 m3

1450 x 0.005 = 7.25

**£7.25**

**Maple Sphere - £1300 per m3**

50 x 100 x 2000 (mm)
0.05 x 0.1 x 2 (m)
= 0.01 m3

1300 x 0.01 = 13

**£13**

**Cherry Sphere - £1350 per m3**

50 x 100 x 2000 (mm)
0.05 x 0.1 x 2 (m)
= 0.01 m3

1350 x 0.01 = 13.50

**£13.50**

**Red Oak Sphere - £1150 per m3**

50 x 100 x 2000 (mm)
0.05 x 0.1 x 2 (m)
= 0.01 m3

1150 x 0.01 = 11.50

**£11.50**

**Oak Sphere - £2495 per m3**

50 x 100 x 2000 (mm)
0.05 x 0.1 x 2 (m)
= 0.01 m3

2495 x 0.01 = 24.95

**£24.95**

**Brown Oak Sphere - £2895 per m3**

50 x 100 x 2000 (mm)
0.05 x 0.1 x 2 (m)
= 0.01 m3

2895 x 0.01 = 28.95

**£28.95**

**Walnut Hemisphere - £3800 per m3**

50 x 100 x 1000 (mm)
0.05 x 0.1 x 1 (m)
= 0.005 m3

3800 x 0.005 = 19

**£19**

**Walnut Base - £4200 per m3**

64 x 125 x 4000 (mm)
0.064 x 0.125 x 4 (m)
= 0.032 m3

4200 x 0.032 = 134.4

**£134.40**



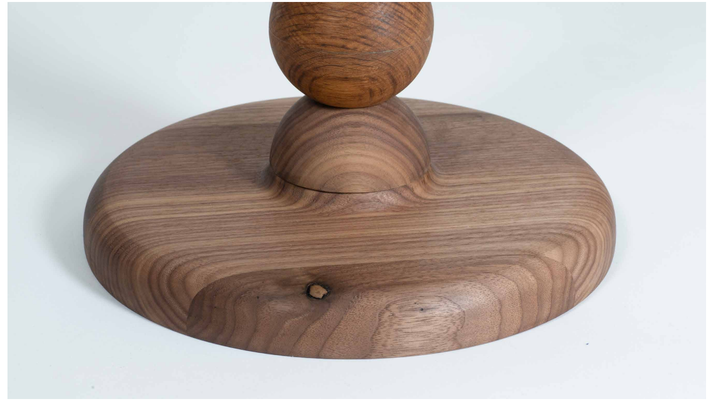
# Bill of Materials and Manufacture

## - Ash to Walnut Gradient

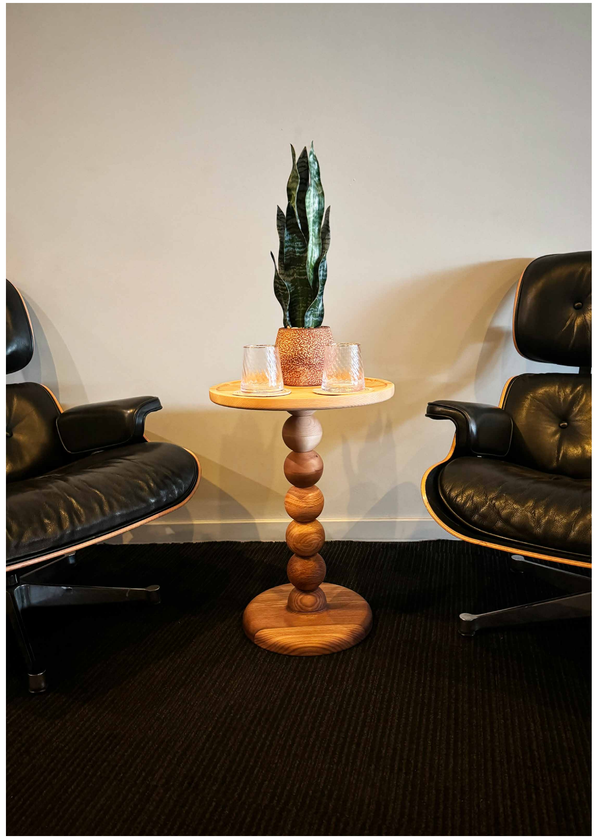
| Material & Manufacture | Part | Quantity | Source | Cost (10 Units) | Individual Cost |
|---|---|---|---|---|---|
| **Top** | A | | | | |
| - Wood Cost (Ash) | | 1 | Benchmark | £30.00 | £3.00 |
| - CNC Router Cost (£60 per Hour) | | | | £120.00 | £12.00 |
| **Top Hemisphere** | B | | | | |
| - Wood Cost (Ash) | | 1 | Benchmark | £7.25 | £0.73 |
| - Lathe Cost (£60 per Hour) | | | | £150.00 | £15.00 |
| **Spheres** | D | | | | |
| - Wood Cost (Maple) | | 1 | Benchmark | £13.00 | £1.30 |
| - Wood Cost (Cherry) | | 1 | Benchmark | £13.50 | £1.35 |
| - Wood Cost (Red Oak) | | 1 | Benchmark | £11.50 | £1.15 |
| - Wood Cost (European Oak) | | 1 | Benchmark | £24.95 | £2.50 |
| - Wood Cost (Brown Oak) | | 1 | Benchmark | £28.95 | £2.90 |
| - Lathe Cost (£60 per Hour) | | | | £900.00 | £90.00 |
| **Bottom Hemisphere** | E | | | | |
| - Wood Cost (Walnut) | | 1 | Benchmark | £19.00 | £1.90 |
| - Lathe Cost (£60 per Hour) | | | | £150.00 | £15.00 |
| **Base** | F | | | | |
| - Wood Cost (Walnut) | | 1 | Benchmark | £134.40 | £13.44 |
| - CNC Router Cost (£60 per Hour) | | | | £180.00 | £18.00 |
| **Threaded Insert** | C | | | | |
| - Metal Cost | | 1 | Metals4U | £4.80 | £0.48 |
| - Centre Lathe Cost (£60 per Hour) | | | | £150.00 | £15.00 |
| - M10 Threaded Bar | G | 1 | Accu | £27.60 | £2.76 |
| - Hex Nut | I | 1 | Accu | £3.40 | £0.34 |
| - Plain Washer | H | 1 | Accu | £2.80 | £0.28 |
| **General** | | | | | |
| - Oil Finish | | | | £44.80 | £4.48 |
| **Genral Labour** | | (Hours) | | | |
| - Assembly time | | 0.3 | | £200.00 | £20.00 |
| - Gluing time | | 0.5 | | £300.00 | £30.00 |
| - Sanding time | | 2 | | £1,200.00 | £120.00 |
| - Extra time | | 0.5 | | £300.00 | £30.00 |
| | | | **Totals** | **£4,015.95** | **£401.60** |
| | | | | **Wholesale** | **£903.59** |

I've added a 125% markup between the manufacturing cost and the wholesale price. I chose 125% to bring the price of my product more in line with benchmarks other products.
This markup will be primarily profit however some other costs will need to be accounted for such as marketing sales and delivery costs.











Freddie Side Table - Benchmark

https://benchmarkfurniture.com/product/freddie-side-table/

Finish update

BENCHMARK

FURNITURE PROJECTS SUSTAINABILITY ABOUT US CONTACT 0

PRODUCT SHEET (PDF)

DESIGN FILES (2D/3D)

# *Freddie Side Table*

DESIGNED BY MEGAN JOYCE

FROM £ 880.00

SELECT TIMBER

SELECT FINISH

1

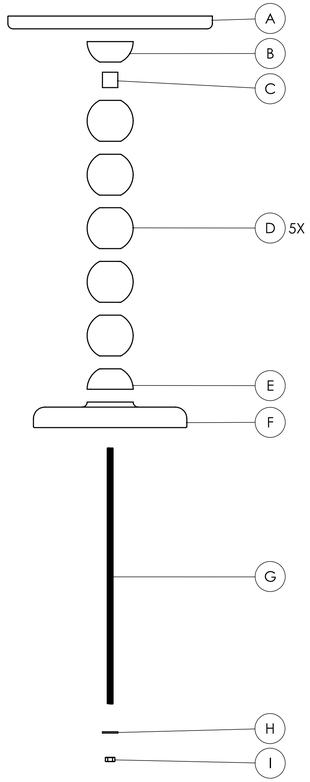
ADD TO BASKET +

The Freddie Side Table is a collection of circular wooden tables manufactured in a variety of natural woods and constructed so as to highlight the beauty of the woods used. The tables have a turned wooden base and top with a stand formed from a selection of solid wooden spheres. The original piece in the collection has an Ash top and Walnut base connected by a column of spheres made from Maple, Cherry, Red Oak, European Oak, and Brown Oak. Also available in the collection are tables with the top and base woods reversed and single-wood versions in `Ash, `Oak, or `Walnut. The tables are finished with a satin wood oil to complement the wood's natural grain.

Bespoke wood options are available upon request.

DIMENSIONS
dia400 h555mm





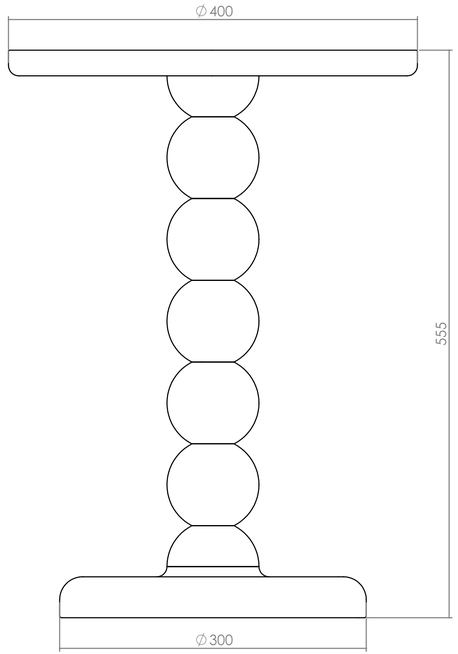

| PART | NAME | MATERIAL | QTY. | DIMENSIONS |
|---|---|---|---|---|
| A | Circle Top | Ash, Walnut, European Oak | 1 | ∅400 x 25 mm |
| B | Top Hemisphere | Ash, Walnut, European Oak | 1 | ∅90 x 40 mm |
| C | Threaded Insert | Mild Steel | 1 | ∅30 x 30 mm |
| D | Sphere | Ash, Maple, Cherry, Red Oak, European Oak, Brown Oak, Walnut | 5 | ∅90 x 80 mm |
| E | Bottom Hemisphere | Ash, Walnut, European Oak | 1 | ∅ 90 x 40 mm |
| F | Base | Ash, Walnut, European Oak | 1 | ∅300 x 50 mm |
| G | M10 Threaded Bar | Stainless Steel | 1 | M10 x 500 mm |
| H | Plain Washer | Stainless Steel | 1 | M10 x 25 mm |
| I | M10 Hex Nut | Stainless Steel | 1 | M10 x 8 mm |

DO NOT SCALE DRAWING

PROJECT TITLE: FREDDIE SIDE TABLE

PROJECTION | SIZE: A3 | SCALE: 1:6 | PART: N/A

DRAWING: EXPLODED VIEW | SHEET: 1 of 11

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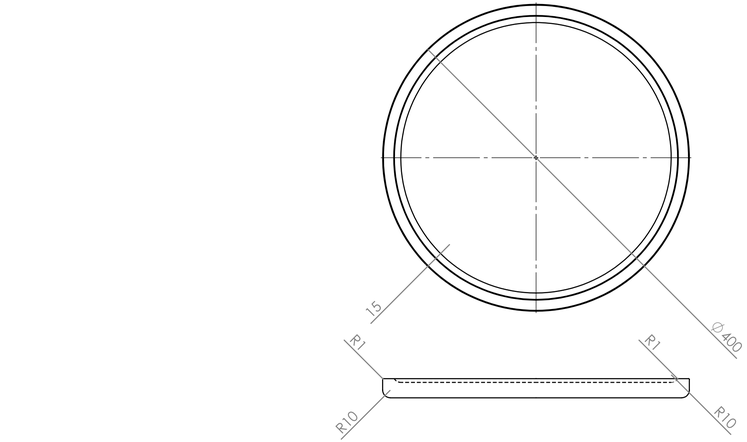
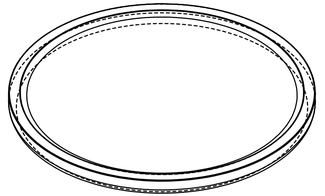
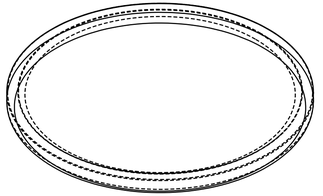
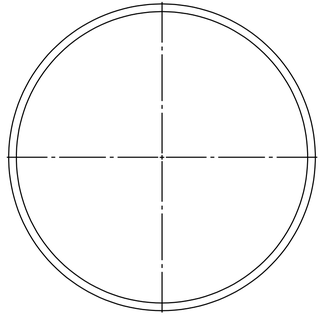
| PROJECT TITLE: FREDDIE SIDE TABLE | | | |
| PROJECTION | SIZE: A3 | SCALE: 1:3 | PART: N/A |
| DRAWING: GENERAL ASSEMBLY | | | SHEET: 2 of 11 |









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|---|---|---|---|
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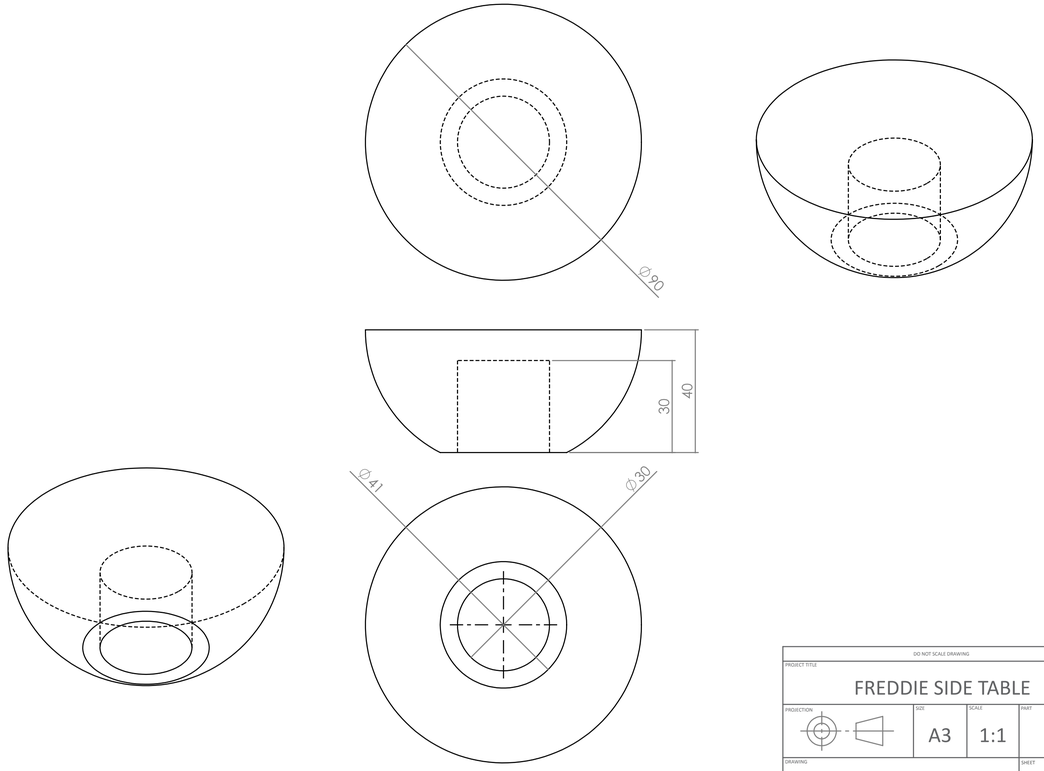
| PROJECT TITLE: FREDDIE SIDE TABLE | | | |
| PROJECTION | SIZE: A3 | SCALE: 1:4 | PART: A |
| DRAWING: CIRCLE TOP | | | SHEET: 3 of 11 |




| | | | |
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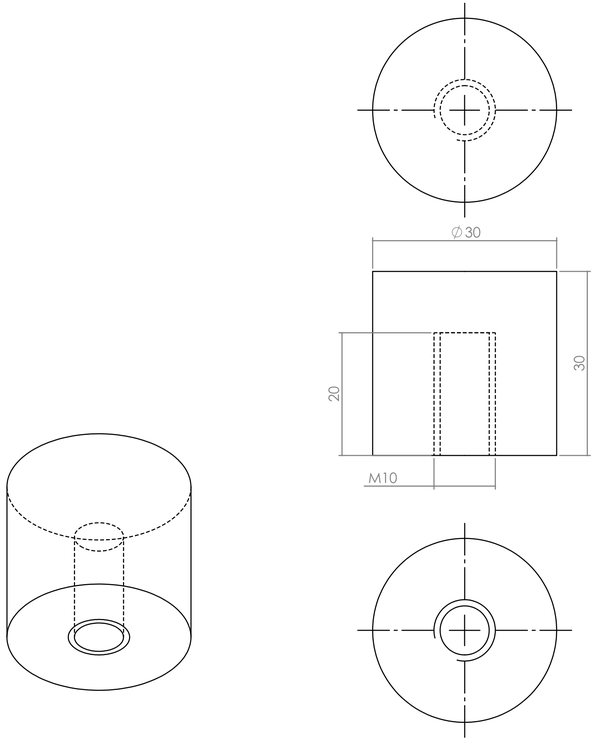
| DO NOT SCALE DRAWING | | | |
| PROJECT TITLE: FREDDIE SIDE TABLE | | | |
| PROJECTION | SIZE: A3 | SCALE: 1:1 | PART: B |
| DRAWING: TOP HEMISPHERE | | | SHEET: 4 of 11 |



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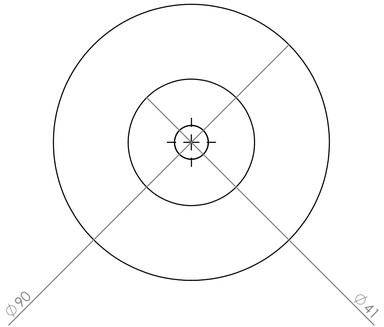
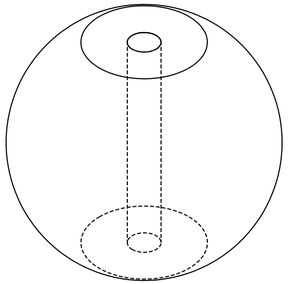
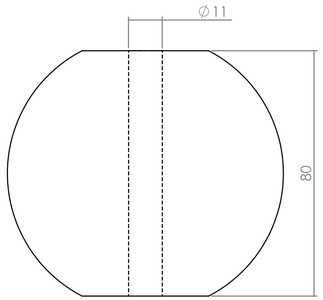
| PROJECT TITLE: FREDDIE SIDE TABLE | | | |
| PROJECTION | SIZE: A3 | SCALE: 2:1 | PART: C |
| DRAWING: THREADED INSERT | | | SHEET: 5 of 11 |



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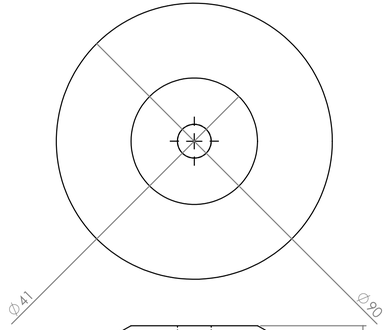
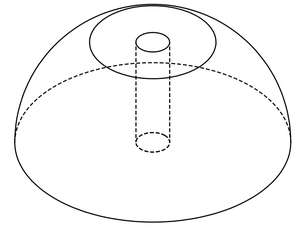
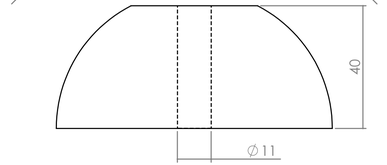
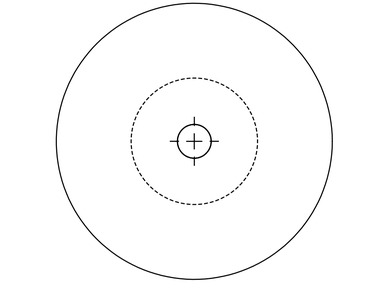
| DO NOT SCALE DRAWING | | | |
| PROJECT TITLE: FREDDIE SIDE TABLE | | | |
| PROJECTION | SIZE: A3 | SCALE: 1:1 | PART: D |
| DRAWING: SPHERE | | | SHEET: 6 of 11 |







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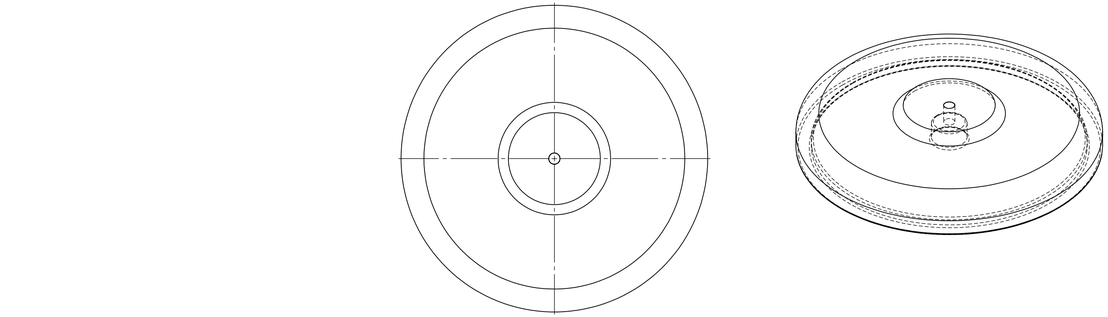
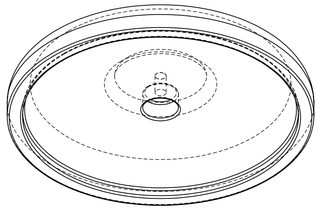
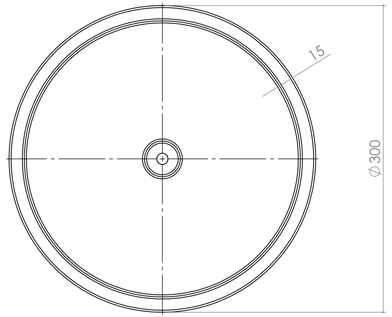
|---|---|---|---|
| DO NOT SCALE DRAWING | | | |
| PROJECT TITLE: FREDDIE SIDE TABLE | | | |
| PROJECTION | SIZE: A3 | SCALE: 1:1 | PART: E |
| DRAWING: BOTTOM HEMISPHERE | | | SHEET: 7 of 11 |



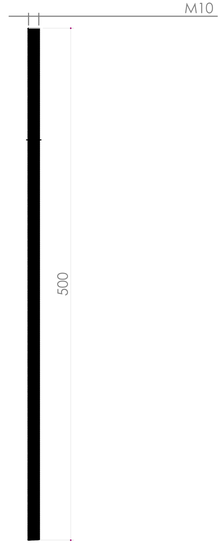






DO NOT SCALE DRAWING

| PROJECT TITLE | | | |
|---|---|---|---|
| FREDDIE SIDE TABLE | | | |
| PROJECTION | SIZE | SCALE | PART |
| | A3 | 1:3 | F |
| DRAWING | | | SHEET |
| BASE | | | 8 of 11 |

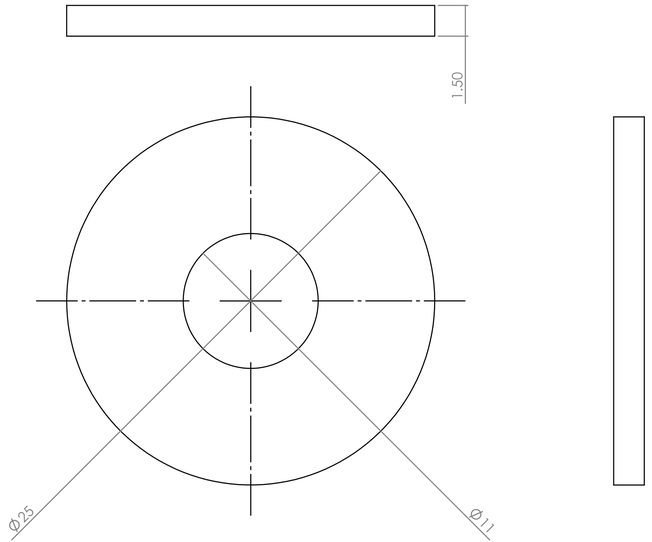






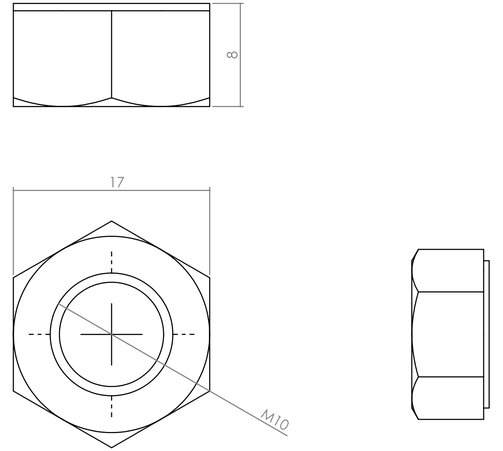

DO NOT SCALE DRAWING

| PROJECT TITLE | | | |
|---|---|---|---|
| FREDDIE SIDE TABLE | | | |
| PROJECTION | SIZE | SCALE | PART |
| | A3 | 1:3 | G |
| DRAWING | | | SHEET |
| M10 THREADED BAR | | | 9 of 11 |




| | | | |
|---|---|---|---|
| DO NOT SCALE DRAWING | | | |
| PROJECT TITLE: FREDDIE SIDE TABLE | | | |
| PROJECTION | SIZE: A3 | SCALE: 4:1 | PART: H |
| DRAWING: PLAIN WASHER | | | SHEET: 10 of 11 |



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| DO NOT SCALE DRAWING | | | |
| PROJECT TITLE: FREDDIE SIDE TABLE | | | |
| PROJECTION | SIZE: A3 | SCALE: 4:1 | PART: I |
| DRAWING: M10 HEX NUT | | | SHEET: 11 of 11 |

# Future Improvements

In the future I would give multiple options for timber choices.
Current Timber Option is Light Top (Ash) to Dark Base (Walnut)
Future Timber Options:
- Dark Top (Walnut) to Light Base (Ash)
- Fully Ash
- Fully Walnut
- Fully Oak

# Dark to Light Option



# Bill of Materials and Manufacture

## - Walnut to Ash Gradient

| Material & Manufacture | Part | Quantity | Source | Cost (10 Units) | Individual Cost |
|---|---|---|---|---|---|
| **Top** | A | | | | |
| - Wood Cost (Walnut) | | 1 | Benchmark | £91.20 | £9.12 |
| - CNC Router Cost (£60 per Hour) | | | | £120.00 | £12.00 |
| **Top Hemisphere** | B | | | | |
| - Wood Cost (Walnut) | | 1 | Benchmark | £19.00 | £1.90 |
| - Lathe Cost (£60 per Hour) | | | | £150.00 | £15.00 |
| **Spheres** | D | | | | |
| - Wood Cost (Brown Oak) | | 1 | Benchmark | £28.95 | £2.90 |
| - Wood Cost (European Oak) | | 1 | Benchmark | £24.95 | £2.50 |
| - Wood Cost (Red Oak) | | 1 | Benchmark | £11.50 | £1.15 |
| - Wood Cost (Cherry) | | 1 | Benchmark | £13.50 | £1.35 |
| - Wood Cost (Maple) | | 1 | Benchmark | £13.00 | £1.30 |
| - Lathe Cost (£60 per Hour) | | | | £900.00 | £90.00 |
| **Bottom Hemisphere** | E | | | | |
| - Wood Cost (Ash) | | 1 | Benchmark | £7.25 | £0.73 |
| - Lathe Cost (£60 per Hour) | | | | £150.00 | £15.00 |
| **Base** | F | | | | |
| - Wood Cost (Ash) | | 1 | Benchmark | £46.40 | £4.64 |
| - CNC Router Cost (£60 per Hour) | | | | £180.00 | £18.00 |
| **Threaded Insert** | C | | | | |
| - Metal Cost | | 1 | Metals4U | £4.80 | £0.48 |
| - Centre Lathe Cost (£60 per Hour) | | | | £150.00 | £15.00 |
| - M10 Threaded Bar | G | 1 | Accu | £27.60 | £2.76 |
| - Hex Nut | I | 1 | Accu | £3.40 | £0.34 |
| - Plain Washer | H | 1 | Accu | £2.80 | £0.28 |
| **General** | | | | | |
| - Oil Finish | | | | £44.80 | £4.48 |
| **Genral Labour** | | (Hours) | | | |
| - Assembly time | | 0.3 | | £200.00 | £20.00 |
| - Gluing time | | 0.5 | | £300.00 | £30.00 |
| - Sanding time | | 2 | | £1,200.00 | £120.00 |
| - Extra time | | 0.5 | | £300.00 | £30.00 |

| | | |
|---|---|---|
| **Totals** | **£3,989.15** | **£398.92** |
| | **Wholesale** | **£897.56** |

# Ash Option



# Bill of Materials and Manufacture

## - Ash

| Material & Manufacture | Part | Quantity | Source | Cost (10 Units) | Individual Cost |
|---|---|---|---|---|---|
| **Top** | A | | | | |
| - Wood Cost | | 1 | Benchmark | £30.00 | £3.00 |
| - CNC Router Cost (£60 per Hour) | | | | £120.00 | £12.00 |
| **Top Hemisphere** | B | | | | |
| - Wood Cost | | 1 | Benchmark | £7.25 | £0.73 |
| - Lathe Cost (£60 per Hour) | | | | £150.00 | £15.00 |
| **Spheres** | D | | | | |
| - Wood Cost | | 5 | Benchmark | £72.50 | £7.25 |
| - Lathe Cost (£60 per Hour) | | | | £900.00 | £90.00 |
| **Bottom Hemisphere** | E | | | | |
| - Wood Cost | | 1 | Benchmark | £7.25 | £0.73 |
| - Lathe Cost (£60 per Hour) | | | | £150.00 | £15.00 |
| **Base** | F | | | | |
| - Wood Cost | | 1 | Benchmark | £46.40 | £4.64 |
| - CNC Router Cost (£60 per Hour) | | | | £180.00 | £18.00 |
| **Threaded Insert** | C | | | | |
| - Metal Cost | | 1 | Metals4U | £4.80 | £0.48 |
| - Centre Lathe Cost (£60 per Hour) | | | | £150.00 | £15.00 |
| - M10 Threaded Bar | G | 1 | Accu | £27.60 | £2.76 |
| - Hex Nut | I | 1 | Accu | £3.40 | £0.34 |
| - Plain Washer | H | 1 | Accu | £2.80 | £0.28 |
| **General** | | | | | |
| - Oil Finish | | | | £44.80 | £4.48 |
| **Genral Labour** | | (Hours) | | | |
| - Assembly time | | 0.3 | | £200.00 | £20.00 |
| - Gluing time | | 0.5 | | £300.00 | £30.00 |
| - Sanding time | | 2 | | £1,200.00 | £120.00 |
| - Extra time | | 0.5 | | £300.00 | £30.00 |

| | | |
|---|---|---|
| **Totals** | **£3,896.80** | **£389.68** |
| **Wholesale** | | **£876.78** |

# Walnut Option



# Bill of Materials and Manufacture

## - Walnut

| Material & Manufacture | Part | Quantity | Source | Cost (10 Units) | Individual Cost |
|---|---|---|---|---|---|
| **Top** | A | | | | |
| - Wood Cost | | 1 | Benchmark | £91.20 | £9.12 |
| - CNC Router Cost (£60 per Hour) | | | | £120.00 | £12.00 |
| **Top Hemisphere** | B | | | | |
| - Wood Cost | | 1 | Benchmark | £19.00 | £1.90 |
| - Lathe Cost (£60 per Hour) | | | | £150.00 | £15.00 |
| **Spheres** | D | | | | |
| - Wood Cost | | 5 | Benchmark | £190.00 | £19.00 |
| - Lathe Cost (£60 per Hour) | | | | £900.00 | £90.00 |
| **Bottom Hemisphere** | E | | | | |
| - Wood Cost | | 1 | Benchmark | £19.00 | £1.90 |
| - Lathe Cost (£60 per Hour) | | | | £150.00 | £15.00 |
| **Base** | F | | | | |
| - Wood Cost | | 1 | Benchmark | £134.40 | £13.44 |
| - CNC Router Cost (£60 per Hour) | | | | £180.00 | £18.00 |
| **Threaded Insert** | C | | | | |
| - Metal Cost | | 1 | Metals4U | £4.80 | £0.48 |
| - Centre Lathe Cost (£60 per Hour) | | | | £150.00 | £15.00 |
| - M10 Threaded Bar | G | 1 | Accu | £27.60 | £2.76 |
| - Hex Nut | I | 1 | Accu | £3.40 | £0.34 |
| - Plain Washer | H | 1 | Accu | £2.80 | £0.28 |
| **General** | | | | | |
| - Oil Finish | | | | £44.80 | £4.48 |
| **Genral Labour** | | (Hours) | | | |
| - Assembly time | | 0.3 | | £200.00 | £20.00 |
| - Gluing time | | 0.5 | | £300.00 | £30.00 |
| - Sanding time | | 2 | | £1,200.00 | £120.00 |
| - Extra time | | 0.5 | | £300.00 | £30.00 |

| | | |
|---|---|---|
| **Totals** | **£4,187.00** | **£418.70** |
| **Wholesale** | | **£942.08** |

# European Oak Option



# Bill of Materials and Manufacture

## - European Oak

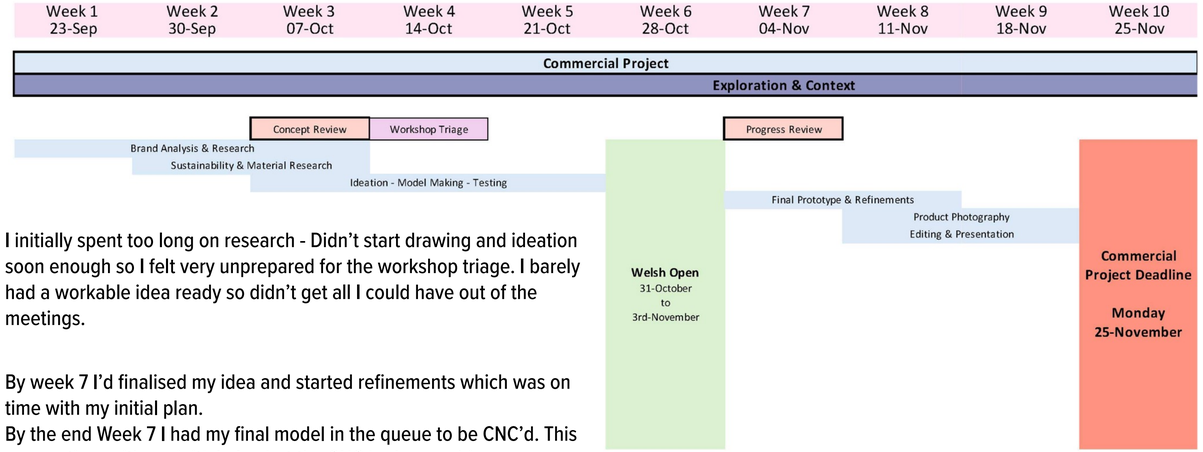
| Material & Manufacture | Part | Quantity | Source | Cost (10 Units) | Individual Cost |
|---|---|---|---|---|---|
| **Top** | A | | | | |
| - Wood Cost | | 1 | Benchmark | £59.88 | £5.99 |
| - CNC Router Cost (£60 per Hour) | | | | £120.00 | £12.00 |
| **Top Hemisphere** | B | | | | |
| - Wood Cost | | 1 | Benchmark | £12.48 | £1.25 |
| - Lathe Cost (£60 per Hour) | | | | £150.00 | £15.00 |
| **Spheres** | D | | | | |
| - Wood Cost | | 5 | Benchmark | £124.75 | £12.48 |
| - Lathe Cost (£60 per Hour) | | | | £900.00 | £90.00 |
| **Bottom Hemisphere** | E | | | | |
| - Wood Cost | | 1 | Benchmark | £12.48 | £1.25 |
| - Lathe Cost (£60 per Hour) | | | | £150.00 | £15.00 |
| **Base** | F | | | | |
| - Wood Cost | | 1 | Benchmark | £79.84 | £7.98 |
| - CNC Router Cost (£60 per Hour) | | | | £180.00 | £18.00 |
| **Threaded Insert** | C | | | | |
| - Metal Cost | | 1 | Metals4U | £4.80 | £0.48 |
| - Centre Lathe Cost (£60 per Hour) | | | | £150.00 | £15.00 |
| - M10 Threaded Bar | G | 1 | Accu | £27.60 | £2.76 |
| - Hex Nut | I | 1 | Accu | £3.40 | £0.34 |
| - Plain Washer | H | 1 | Accu | £2.80 | £0.28 |
| **General** | | | | | |
| - Oil Finish | | | | £44.80 | £4.48 |
| **Genral Labour** | | (Hours) | | | |
| - Assembly time | | 0.3 | | £200.00 | £20.00 |
| - Gluing time | | 0.5 | | £300.00 | £30.00 |
| - Sanding time | | 2 | | £1,200.00 | £120.00 |
| - Extra time | | 0.5 | | £300.00 | £30.00 |

| | | |
|---|---|---|
| **Totals** | **£4,022.83** | **£402.28** |
| **Wholesale** | | **£905.14** |

# Evaluation



# Final Time Analysis




I initially spent too long on research - Didn't start drawing and ideation soon enough so I felt very unprepared for the workshop triage. I barely had a workable idea ready so didn't get all I could have out of the meetings.

By week 7 I'd finalised my idea and started refinements which was on time with my initial plan.
By the end Week 7 I had my final model in the queue to be CNC'd. This was on time with my initial plan but the CNC had a very big queue so it took longer than I expected to get my final model. Unfortunately I couldn't avoid using the CNC as due to technician limitations I was unable to turn my spheres and my top and base has too many curves for me to easily make myself.

Starting in Week 7 whilst I was in the CNC queue I began to add all of my miro research into my process document. This took alot longer than expected and in the future I will probably add my research straight into the process document to avoid having to redo things.

At the start of Week 8 I made a plan of what was left that I needed to do in the final two weeks of the project. This helped me feel as if things were more under control and made sure I wouldn't forget something important that I needed for the hand in. I could have done these lists week to week but I think I may have become overwhelmed by everything and that would have resulted in me not completing the work. This was the reason my time plan wasn't overly detailed to start off with.

# Design Evaluation

Overall I'm very happy with my final design, I feel that it's met my reframed brief of a small piece of furniture that embraces and showcases the beauty of solid wood whilst still being functional. Throughout the project I struggled to settle on an idea. I initially thought I'd come up with a great idea that was different to benchmarks  current products but still fit into the companies aesthetics as well as meeting all the specifications that I'd set. However when I made my first full scale model I realised that the second level/ shelf I added didn't add the functionality I thought it would.

After my initial idea of adding functionality through a shelf didn't work out, I felt a little confused and lost, I ended up with multiple options consisting of coffee tables and plant stands.
During the project I was lacking in self confidence in my design choices so when things didn't go exactly as I planned it made me question everything. To help with my lack of self confidence I mostly talked to other people on the course like Ola and Az, they reassured me that my design was good and helped me come up with alternative solutions to problems I was having. Towards the end of the project I felt more confident in my design and this enabled me to make decisions and stop questioning my choices.

Whilst my model isn't perfect it was the best I could achieve in the universities workshop whilst competing with other students for scarce resources such as CNC and technician time. I would have preferred to have turned my spheres instead of CNCing them. CNCing meant that I was stuck in a fairly long queue and I had to do a lot more finishing by hand than would have been the case if I had been able to use the lathe.

## Improvements

The future improvements to my product would mostly focus on the material. Whilst I like the timbers I've chosen for my product and I think they meet the companies aesthetics, I also understand that people have other preferences and other timbers may fit better with their personal aesthetics. This is why I would add in a range, offering different timber choices, this range would include gradients of timbers like my original design but also the option of having only a singular timber. I would also like to include bespoke options, where the customer can contact Benchmark and work with them to choose timbers that best suits the client and their needs.

## Sustainability

Benchmark think of sustainability at it's core, throughout this project I am not sure that I've considered sustainability enough.
The way that I've designed this product does allow for most parts to be replaced as very little glue has been used in the parts assembly due to my use of the threaded bar that goes through out the whole product. For example if one of the spheres gets damaged the nut tightening everything together can be removed and all the parts can be taken off the threaded bar so the broken part can be replaced with a new one. As the spheres use fairly small sections of wood they could be made from offcuts that would otherwise be wasted, this however may not be commercially viable.