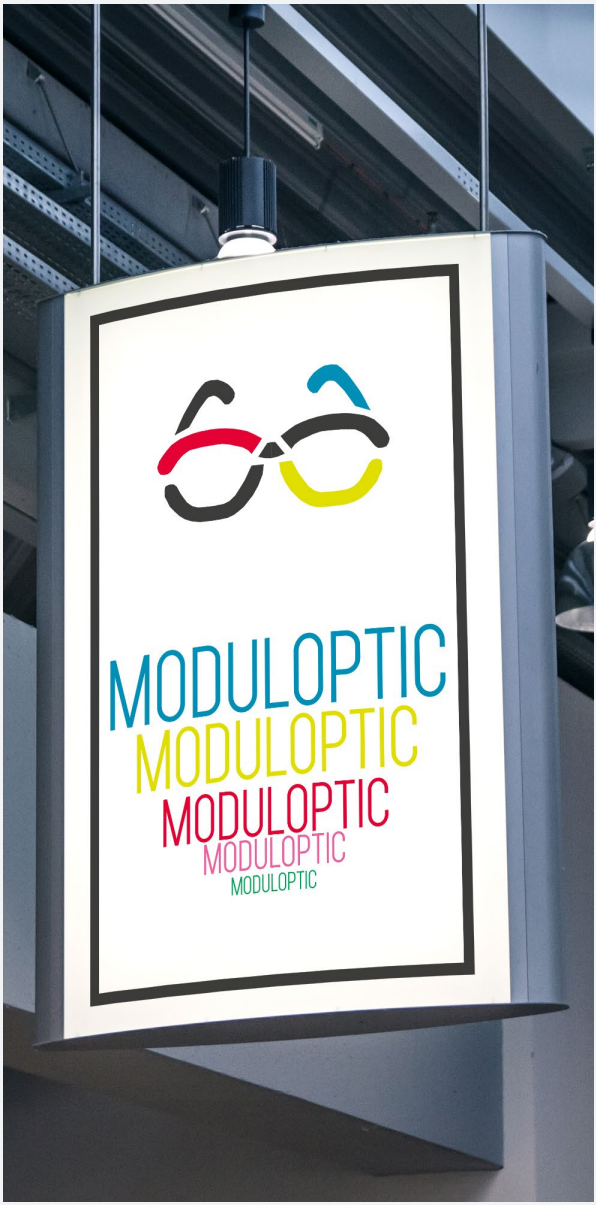
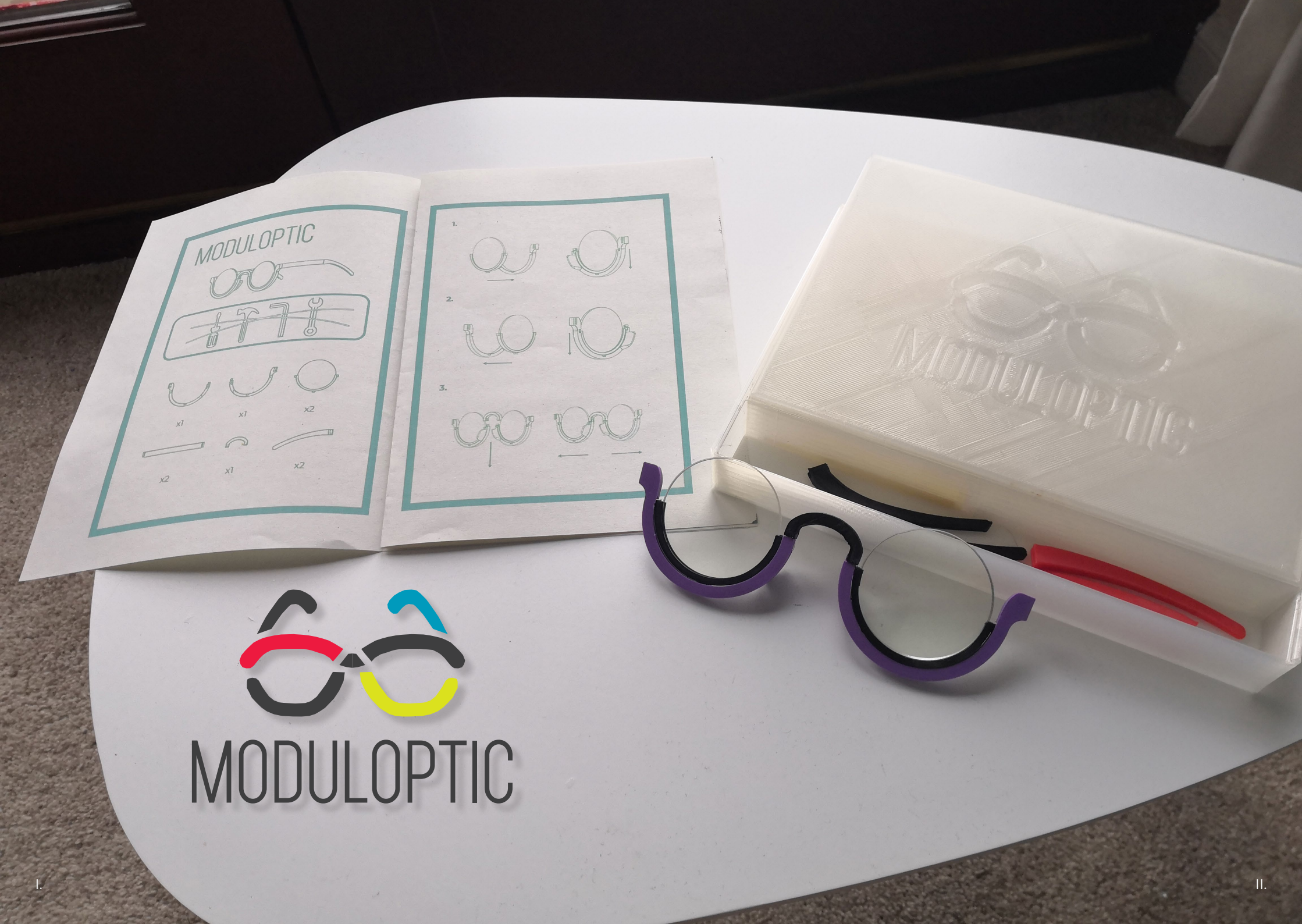
ALISTAIR CHARLES HORNER



MODULAR GLASSES CATERED FOR YOUR NEEDS.

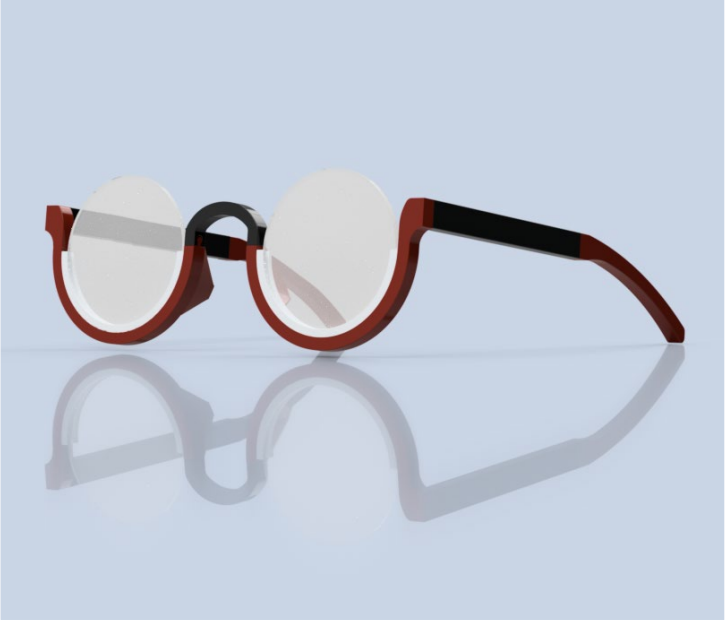


MODULOPTIC

Table of **Contents**

“Simplicity and common sense should characterize planning and strategic direction.”

Ingvar Kamprad



About me

Hello! My name is Alistair Horner, and I am a fourth-year Product Design student at the University of Dundee.

As a designer, I strive to develop eye catching and high quality products that answer the problem at hand. The insight produced by user input is something I value highly.

I'm fascinated by how a product might be perceived as visually appealing, as well as the psychological factors that contribute to this.

Throughout my design process, I enjoy learning and experimenting with many creative disciplines to obtain the desired results.

My love of colours and personal aesthetic have strongly influenced this project.

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01 Introduction

Acknowledgments

I would like to thank all of those who have spent time helping me throughout the entirety of the project. From passing comments regarding my project, right through those who have been guiding me since the beginning.

A special thanks to my family who have had to put with relentless questioning throughout my project.
and another special thanks to my flatmate who had to act as my guinea pig for most of my project as well as my model for many photos.

Similarly, I would like to give a massive thank you to all the academic staff that gave me input throughout the design process. Giving me valuable assistance and guidance for the entirety of the year.

Finally, I want to thank my 3D printer for not breaking on me and going through so much abuse.

Academic staff

Andrew Cook
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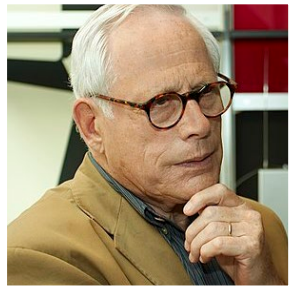
Inspiration

Dieter Rams - Braun

Rams' idea of minimalism in design provided me with a lot of inspiration throughout the design process.



Ingvar Kamprad - Ikea

Kamprad's concept of self-assembly caught my attention and inspired me. His approach to affordability is similar to mine.

Ole Kirck Christiansen - Lego

When you think of modularity, the first thing that comes to mind is often Lego. My work was inspired by his idea of interconnecting blocks.

Project Overview

What is Moduloptic?

More than six in ten adults wear glasses in the United Kingdom. Statistics show that the number is increasing slowly every year. With so many adults having to wear an accessory daily in some cases, the aesthetic is a very important aspect.

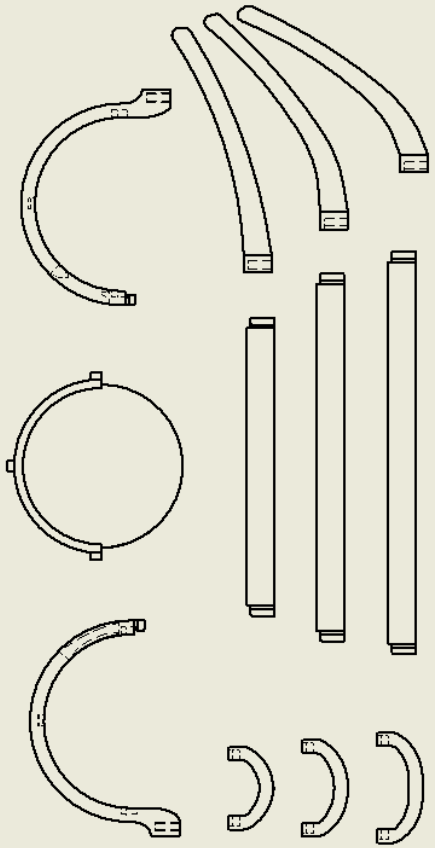
Moduloptic is a pair of modular glasses which allows the user to change colour and/or shape to cater to individual preferences. If one day you would like a yellow pair and the next an orange one, moduloptics can provide.

A collection of 3 different types of nose bridge, temple and arms are available in a wide array of colours. The Frame front also comes in a variety of colours. The lenses can either be prescription lenses, aesthetic lenses or sunglasses lenses with a black or white highlight.

Preliminary Brief

I began this project with a single idea in mind. “To create modular glasses”. With this, I began by doing questionnaires and preliminary research. Eventually, I came up with this brief which I have followed through with, during the entirety of the project.

Title - Modular Optics
Brand type - quirky, young, minimalist.
Price Point - low to mid range
Target Audience - 16 - 40 (Young adults)
Parameters - the glasses have to be modular.
- various components have to be available.
- easy to assemble for the user.



02 Research

Existing “Solutions”

Most of the existing solutions to the issue of glasses that have to fit specific outfits are to use four distinct styles of glasses.
A couple of modular glasses exist, but not to the extent I envisioned for my project.

The four major types of frames that fit most outfits are these:
- White or black frames.
- “Frameless Front” frames (Metallic arm attaches directly to the lenses.
- Metallic frames.
- Clear frames

Pre-existing modular glasses.

Elizabeth Stegners “Specs Modular Glasses” have the ability to change the noze rest and the arms (combined with the temples) independently.
This is the most similar to my idea but it lacks the ability to change the lenses, the nose bridge and the temple independently from the arms.

Modular Glasses JULIO allows the user to add a specific lense attachement to the base lens (sunglasses, blue-tint, etc).
The idea of “adding” tinted lenses is interesting to me, combined with an extended version of Stegner’s glasses is more similar to my vision

The History of Glasses

Modern glasses in their current forms did not exist until the 18th century. Glasses are rich in history, the first documented pair of glasses with lenses came from China in the 12th century, but they were sunglasses.

The first vision improving glasses were documented to have been invented in Italy in the 13th century. They were primitive glass-blown lenses that were slotted into wooden and leather frames.

12th century chinese sunglasses

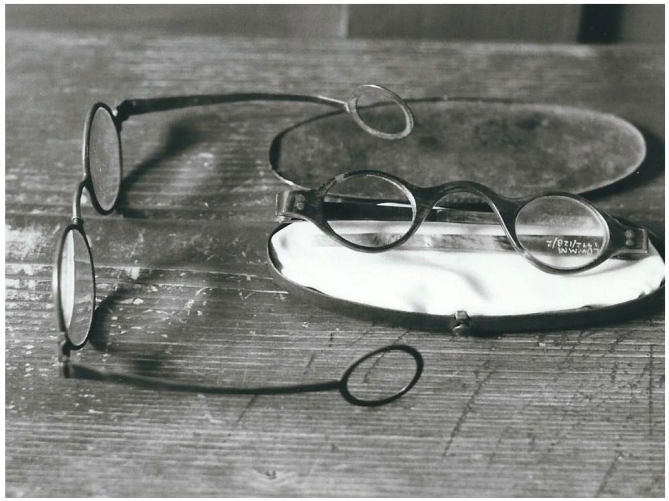
13th century Italian glasses

In the 1400s, with the invention of the printing press, demand for glasses was made more prevalent.

By the 1500s, the frames were made of primarly bones, tortoise shells (where the term tortoise pattern originated) and leather. A nose clip held these glasses.

In the 1600s, the frames were fixed with a ribbon tied around the head of the user, affixed to a stick, which was also hidden under the wig or the hat of the user.

The modern glasses style was invented in 1727 by British optician Edward Scarlett. He was the first to develop a pair of glasses that were held by the nose and ear. This was in contrast to traditional glasses of the time that pressed into the skull from the temple.



18th century “temple glasses”

In the 1850s, “temple glasses” started to become more widespread despite having been invented a century prior. Their design having gone relatively unchanged, with minor modifications in regards to comfort.

In 1873, John Wesley Hyatt discovered celluloid. This was the first artificial form of plastic which led to the creation of unique shaped frame which shapes modern glasses to this day.

From the 19th century onwards, glasses moved from an item of function to one of fashion. As a result, what was once a “single style that would fit all” option, became available in various colours and patterns. Glasses also become more open to children that had been left out of the development of spectacles unless born from wealthy families.

A women wearing “browline” glasses

Marilyn Monroe wearing “Cat Eyes”

The “browline” fashion style first arose in the 1940s. It is defined by having a thicker top frame than the bottom frame.

A decade later, one of the most iconic eyewear looks, the “Cat Eye,” was launched, with movie stars such as Marilyn Monroe popularising the design.

Elton John wearing jewel-encrusted frames in the 1970s

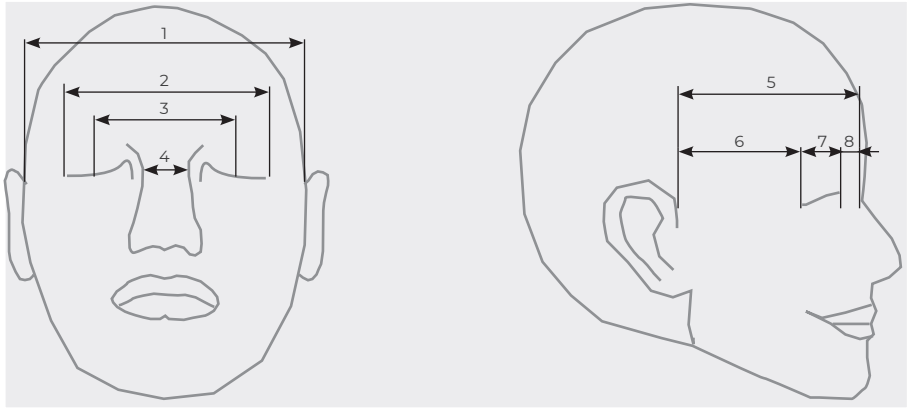
Tom Cruise wearing his Iconic Aviator, 1980s sunglasses

The usage of metallic frames alongside plastic frames came back in the 1980s. More intricate shapes, colours, and materials were experimented with during this period.

In the 1990s and onwards, various styles from many different materials and colour schemes are now available.

Anthropometric Research

Before I could start modelling, I had to research anthropometric data. This would allow me to create a comfortable pair of glasses f most users.



head breadth	1
biectophangus breadth	2
biocular breadth	3
nasal root breadth	4
sellion to otobasion superius length	5
tragion to ectophangus lenght	6
sellion to ectophangus length	7
nasal root protusion	8

1.	♂	♀
5th	141.0	141.0
50th	151.5	151.3
95th	163.0	163.0

5.	♂	♀
5th	82.2	82.3
50th	92.8	92.3
95th	102.0	102.7

2.	♂	♀
5th	74.8	75.1
50th	85.0	84.8
95th	96.1	95.3

6.	♂	♀
5th	66.3	66.2
50th	74.3	70.4
95th	83.2	82.7

3.	♂	Ca. ♀
5th	56.7	57.0
50th	65.6	65.8
95th	74.3	74.9

7.	♂	♀
5th	13.1	13.0
50th	18.9	18.9
95th	24.9	24.9

4.	♂	♀
5th	16.7	16.5
50th	21.2	21.1
95th	25.7	25.7

8.	♂	♀
5th	6.2	5.9
50th	10.5	10.6
95th	14.5	14.7

Repartition in Percentile of face dimensions (mm)

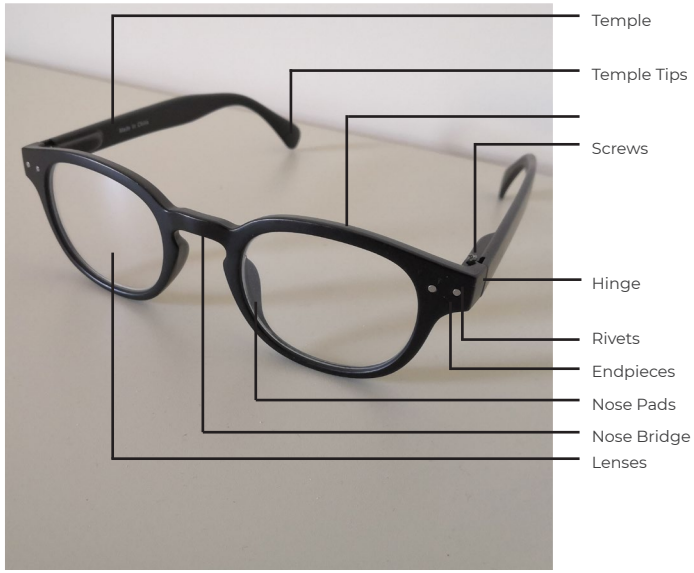
With the measurements done, designing a model will be more easy, and the final product will be more comfortable for the user.

For the pieces that have a multitude of options, there will be three pieces each catered to the 5th, the 50th and the 95th percentile.
For unique pieces, they will be designed with one of these three percentiles in mind (it depends on the part).

Glasses Components

As part of the research process, I looked at what constitutes a pair of glasses and the different components used.

I did this so that it would help with the designing of a frame later during the development.



I also deconstructed various types of glasses in the hopes of understanding how they were assembled.

Some insight gathered from this exercise is that metallic frames tend to have more components (the nose pads, for example, add 4 parts to the frame).
Some plastic frames do not include rivets.

Material and Manufacture

The manufacturing aspect of the glasses was researched for if the glasses were to be made professional on a mass-produced scale

Before I had a tangible idea of how the glasses operated, I looked at every traditional glass frame material. This included metals which I eventually decided to not use in favour of plastics.

Metals

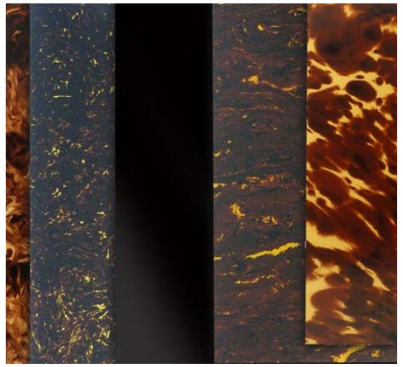
Monel: A mixture of various metals, this is the most used material in the manufacture of glasses. It is resistant to corrosion and is hypoallergenic. Specific plates can improve some of the conditions of the metal.

Titanium - Silver-grey metal with durable, strong and corrosion-resistant properties. It can be produced in a variety of colours which would have fit the general original idea.

Beryllium - A steel-grey metal, cheaper than titanium. It can resist corrosion and tarnish, which is ideal for high acid environments. It can come in a wide range of colours.

Monel

Berrylium



Zylonite Sheets

Zylonite - also called cellulose Acetate, is the most widely used material. Very cost-effective and lightweight. It can come in a variety of shapes and colours. Perfect for the project.

Raw Cellulose Propionate

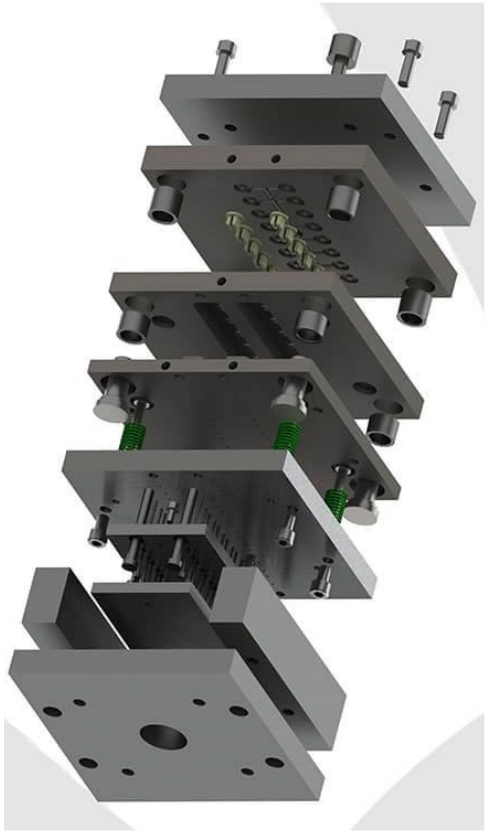
Cellulose propionate - a nylon-based plastic which is hypoallergenic and lightweight. Lighter and more glossy than Zylonite. An over-coating adds colour.

Nylon - Introduced initially in the 1940s, the material is now mostly phased out in favour of blended nylon. These composite materials are both strong and lightweight.

Manufacture

Manufacture was chosen later during the development of the product because I needed an idea of how the design of each component would have to look.

The material was then also chosen despite having done the research earlier to accommodate for the manufacturing process.



Injection Mould

Having seen the models, I decided that injection moulding would be the most suitable method because it can produce high-quality intricate products.

Due to having chosen this method of manufacture, Zylonite had to be removed from the option

This left me with either cellulose propionate or blended Nylon.
After careful deliberations, I chose that Nylon would be more suitable because it can come in a variety of colours (that don't have to be over-coated), it is cheaper than cellulose propionate, and it can be bio-based.

Thus I chose that the glasses, if mass-manufactured, would be made of blended Nylon with Injection moulding.

Nylon Rods

Market Research and Positioning

Research

An essential stage of the research process is understanding the users' needs and how they have interacted with glasses.

I created a questionnaire which would ask a couple of critical questions regarding glasses. I then compiled the data and then interviewed specific individuals who had varying opinions regarding glasses in a more personal manner.

I also contacted various opticians and gathered data regarding glasses being sold and what type of frames are more popular with which demographic.

Insights

1. Women are more likely to wear glasses. (56% and 46% respectively).

2. Younger people care more about aesthetic than older individuals.

3. Many users who chose to wear metallic frames did so because it had a neutral look.

4. Younger people would prefer owning more than one pair but cannot due to cost.

5. For many, glasses are part of their personality.

> ***It is a big part of my look. Because I wear them all day."***
>
> An Interviewee

Positioning

The first insight demonstrates that a larger share of the glasses market is aimed at women. Despite that, I designed my concepts to be inclusive to all genders, thus tapping into the women's market and the others.

Since younger people care more about the aesthetical value than older individuals, as gathered from insight 2, I positioned my ideas around the interest of younger people.

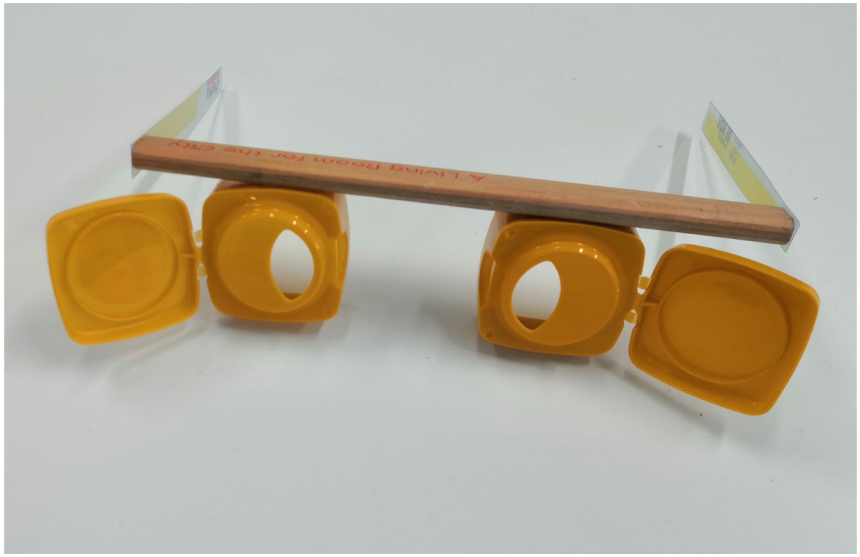
Since I am offering a wide range of colours, such as brown, white and black, Moduloptic frames will cater to the neutral look. This means that more consumers from the metallic frames market will be interested in Moduloptic frames.

The aim is to create an affordable pair that changes design, thus fulfilling the want of younger demographics to own multiple pairs.

The modifiable components will allow the user to fit their frames for their personalities. This helps tap into the market shown in insight 5

So, the positioning on the market needs to cater to;

- All Genders.
- Younger Individuals.
- Those that are looking for neutral glasses.
- Those on a budget
- Individuals that wear glasses as a personality trait.



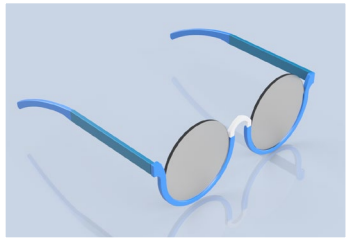
03 Prototyping and Developments

Timeline

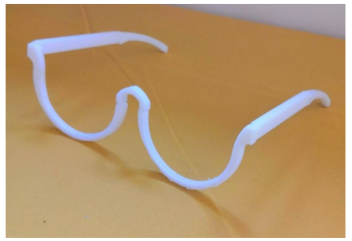
Initial Modelling

Resin Printing

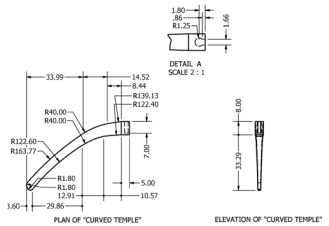
Further Development



Cad Modelling



Minimum Viable Product.

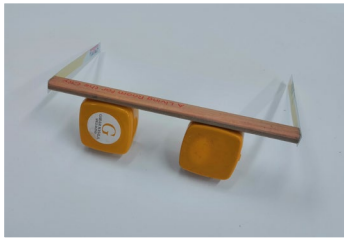


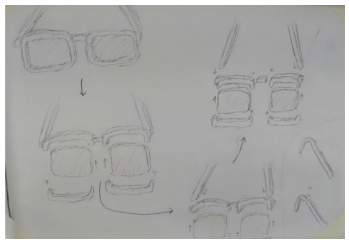
Final Adjustments

The Initial stages.

Rough Modelling

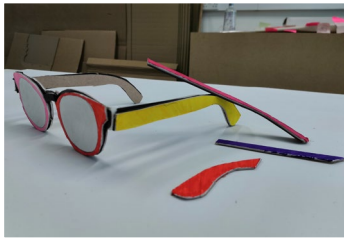
My first prototype is made from a “hand sharpening” pencil, two lids from Tesco’s spice collection, and two strips of plastic cut from an egg carton.

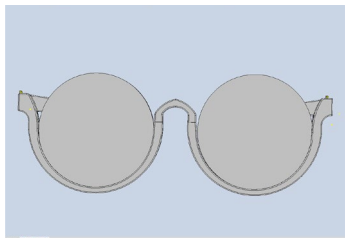




A preliminary sketch of an idea of how the glasses would function. It displays varying degrees of modifiability.

A card prototype with different coloured magnetic attachments. A magnetic sheet covers the entire base model as well as the extensions.

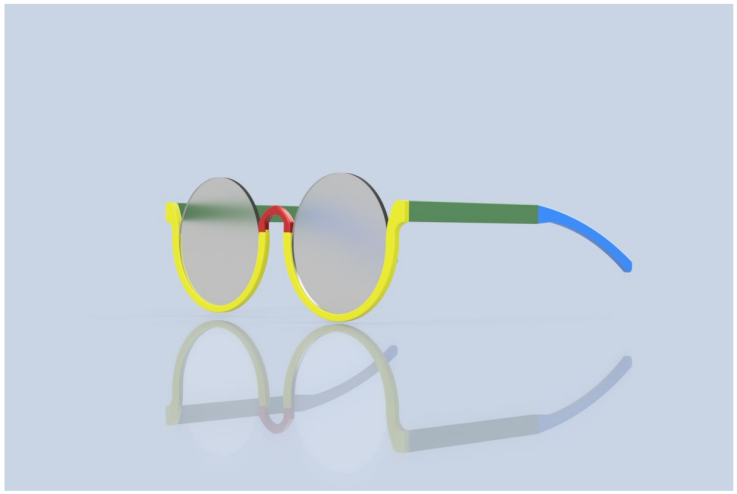


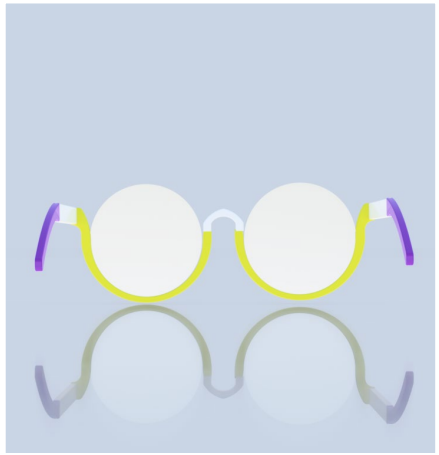


A rough CAD model of a pair of glasses which shaped a lot of the project going forward. The arms, lenses and front frame are detachable.

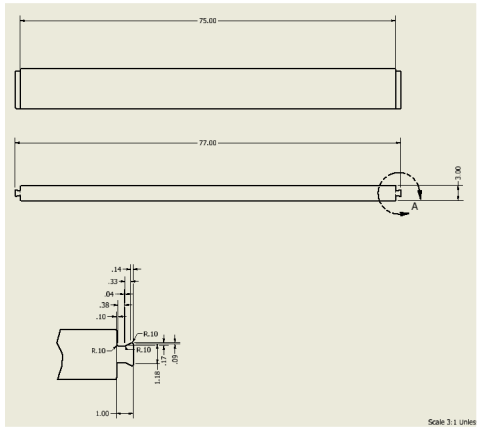
CAD Modelling

With the anthropometric data and the rough initial model that I had made, I decided to create an improved version of the model, which I would then attempt to 3d print.

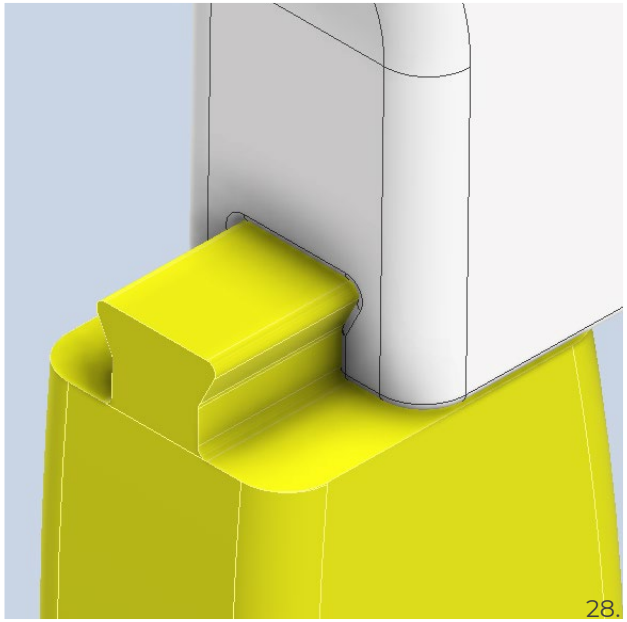




This first model had no nose pads and no way to attach the lenses to the glasses. The plan was to create those after a successful print.



A basic joint was designed with modularity in mind. I did not want any screws on my project because I did not want a consumer to have to fiddle with small items on a daily basis.



Resin Modelling

For my developmental prototypes and final outcome, I had decided to make the frames out of 3D printed resin. This proved to be problematic. A couple of pieces came out with suitable quality, but most parts had either technical problems or simply could or would not print.

I spent many months attempting to create a working model out of resin but could only manage to make the nose bridge successfully and not other components.

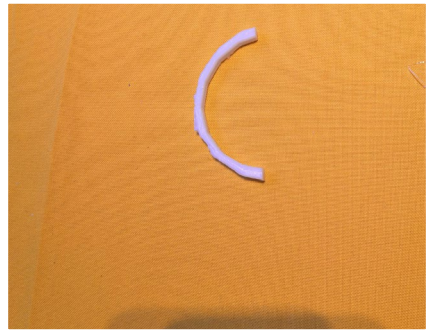
A failed resin print

The only succesful printed components

Since I had spent so much time and money on resin printing, I felt like I had to continue with that idea until I realised that if I continued with the resin printer, I might not have anything that I could hand in.

Thanks to that realisation, I was no longer stuck in the sunk cost fallacy loop and eventually started working with other materials.

Traditional 3D printing



Since I had not done much 3D printing over my past 4 years of university, this was also a teaching moment for me. The first prints made ended up in failure. A lot of the failed prints were due to inadequate support for the models. The more I failed, the more I learned about the filament-based 3D printing process.

A pile of all my failed prints

Some of the commons problems occured are as follow.

Printing Nozzle too hot for the filament.
Nozzle too close to the bed.
Inadequate support.
Inadequate suction to the plate.

The nozzle being too hot is an easy fix, simply rewriting the value in the software.

The nozzle being too close to the bed is also an easy to perceive issue that it changed simply by making the bed a tad lower.

The following two issues are more problematic, on the other hand. Adding supports to some pieces would sometime ruin the quality of the printmaking impossible to sand it down without weakening the part. I experimented with different supports and angles for the components until I found one suitable for each piece.

Inadequate suction to the plate can result in the print moving whilst it is printing, it can also make the component stick to the nozzle.

Minimum Viable Product

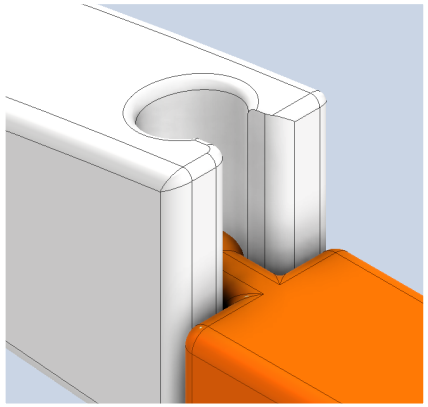
Having finally decided to change the materials and modelling method, I went with traditional 3D printing using Polylactic acid (PLA).

I had a couple of misprints trying to figure out how the system works until I eventually managed to make the first attachable tangible model, just in time for the Mark 2 presentation.

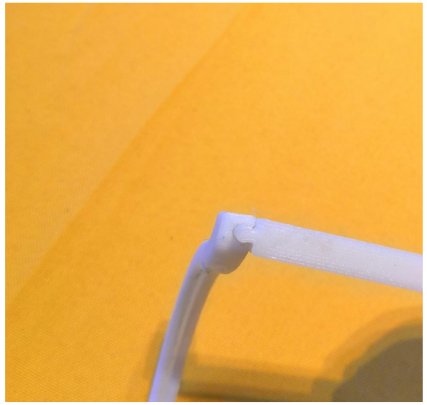
The initial model did not have the ability to attach the lens to them, but it was the first pair that could we worn on a face.
The model also had no nose pads.

First Wearable model.

Since the creation of the original CAD model, the joint had changed from a triangular one to a circular one, I found out that it connected better and required less support as a 3D printed item.



Cad render of joint



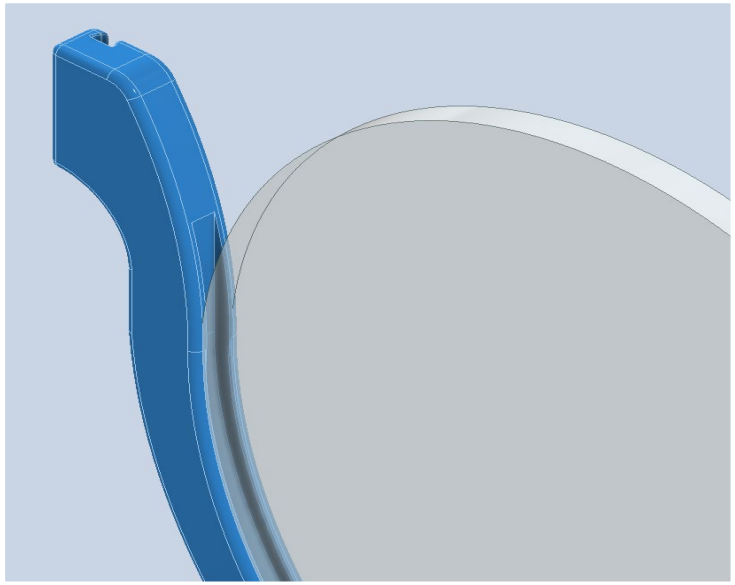
Joint in real life.

Further Development

Attaching the lenses

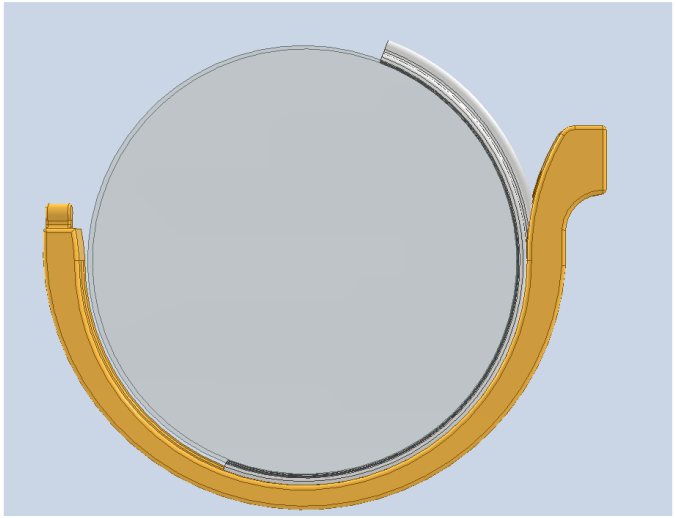
After creating this model, I started improving it.
I had to find a way to attach the lenses to the frame and incorporate nose pads.

The first idea I had for the lenses was to make the frame elastic so that I could wedge the lense in.
This proved too difficult to achieve since the frame only has a bottom section and no top section.



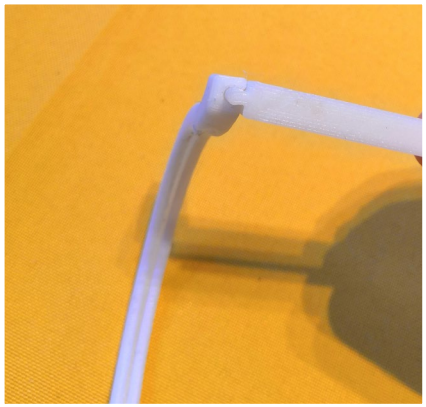
A CAD render of the elastic joint

CAD model of “slot in” idea

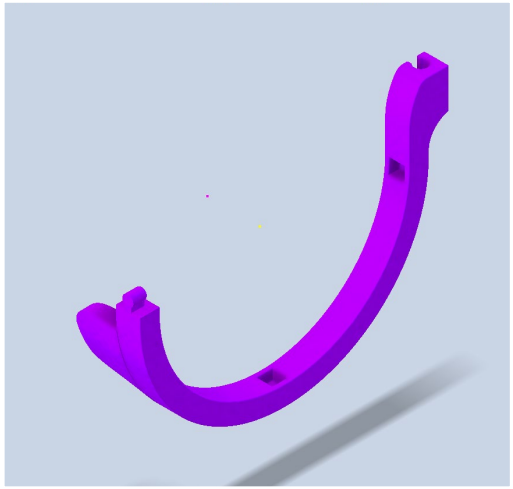


Another joint idea was to create a small piece that would attach to the lens. Then the lens would “slot in”.
This did not work either because the printer could not create such a small detail on the front frames.

CAD model above, printed..

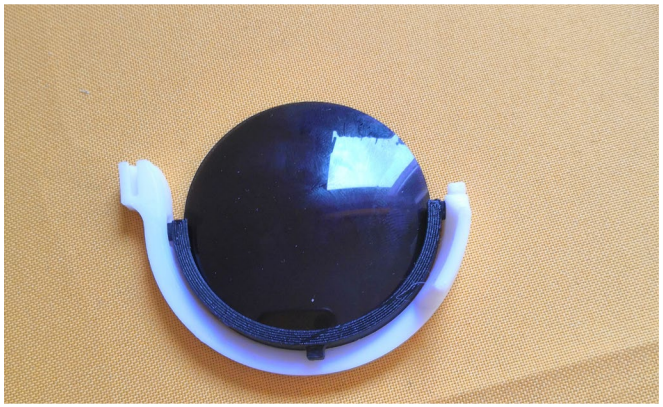


CAD Render of the piece

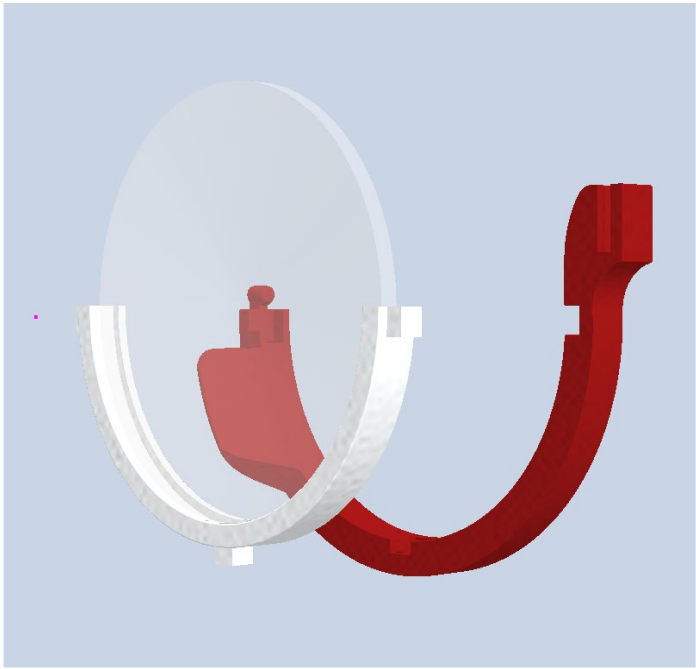


I modified the frame fronts to accommodate the new pieces. This was the final development on that aspect of the frames.

The next idea was to create an attachment that would “click” into place. This idea had a modicum of success. The first iteration did not work because I overlooked how elasticity works.



3d Printed piece that doesn’t slot in.



3d Render of “click” joint.

This works by slotting the piece from the back of the frame front, then pressing the top and bottom to allow the piece to “click” into place.

The Nose Bridge

Three different iterations of the nose pads were made. At each iteration, I made it more comfortable for the user.

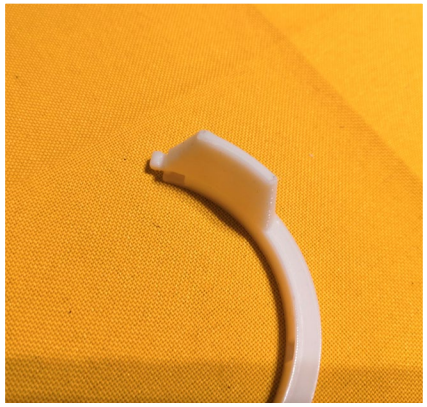
I also asked people to wear the glasses with the new nose pads to gather their opinion on them.

"The side are too sharp."

"It less comfortable than without"

After hearing those two pieces of feedback specifically, I curved the edges of the nose pads more. The feedback was more optimistic this time, but there were still a couple of things to change.

The edges of the nose pads were still uncomfortable, so I changed them once again. The pieces look sharper in the CAD model because I had to take into account the sanding that I would be doing by hand.



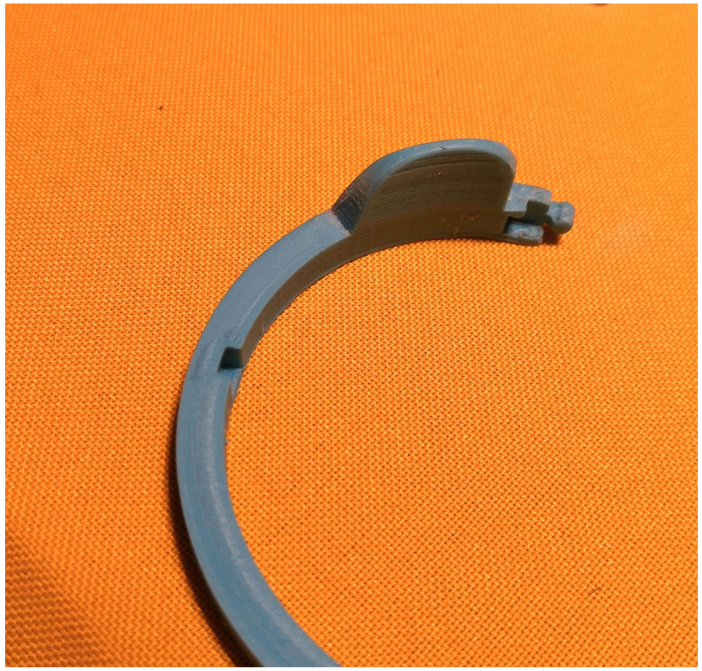
3D Printed 1st Iteration Nose Pad

3D Printed 2nd Iteration Nose Pad

The sanded third iteration provides the most comfort out of the three. The same people who had given the initial insights gave more positive ones.

"It's betternow."

"This is the best one so far."



Sanded 3D Printed 3rd Iteration Nose Pad

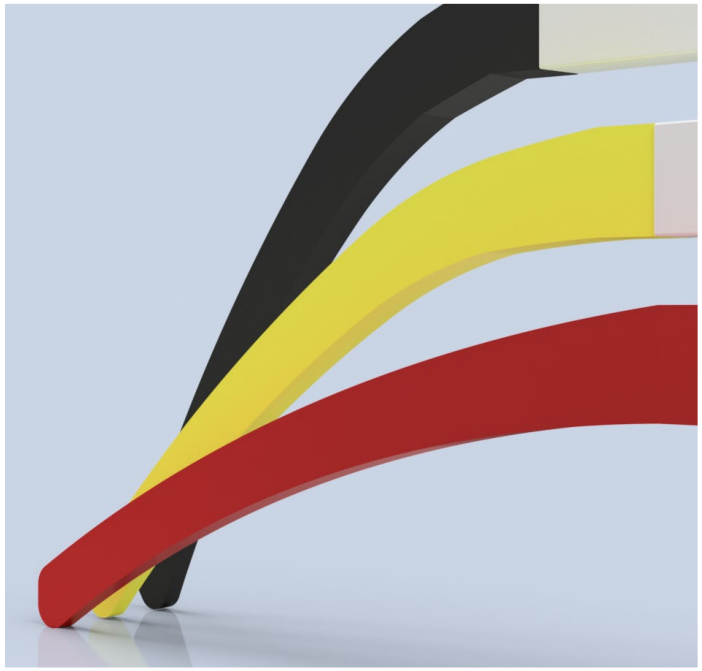
Final Adjustments

With the nose pad and the lenses problem solved, all I had left was to create the extraversion of components such as the temples, the temple tips and the nose bridge.

The first thing I did was create longer temples which were the easiest of the three. I made the middle longer.

The nose bridge was; next, this required a bit more finesse since the piece was small, but it also ended up mostly making the middle longer.

The last piece I wanted to create three versions of, was the temple tips. These were the hardest to modify. Unlike the other two pieces where the change was to make it smaller or bigger, this one required to change the shape drastically.
The different temple tips cater to the comfort of different people.



04 Branding and Cost

Existing brands

Ray-ban - Optics

I looked at many different glasses brands to inspire my branding. Ray-Ban, one of the most recognisable glasses brands, was one of those.

Lego - Toys

I wanted to also look at the logos of modular objects. Lego being the most iconic modular item and an inspiration to me is why I looked at its branding.

OCADU - University

The OCADU logo is not from a glasses brand nor a modular object, but the logo itself is modular, so I looked at it due to the ideas it could give me.

Logo Design.

After looking at logos, the first thing I did was find a name for the line of glasses.

I asked a large group of people for their opinions on the names and then proceeded with creating an identity based around that name.

After that, the next thing was to create logos that fit with the brand identity and the name.

Moduloptic
Modular
+
Optics

29 (31.9%)

Modulorama
Modular
+
Hórāma (Ancient greek for a sight)

16 (17.6%)

Glassularis
Glasses
+
Modularis (Latin for Modular)

5 (5.5%)

Specularis
Specula (Latin for Glasses)
+
Modularis (Latin for Modular)

23 (25.3%)

Speculata
Specula (Latin for Glasses)
+
ta

14 (15.4%)

Horamaris
Hórāma (Ancient greek for a sight)
+
Modularis (Latin for Modular)

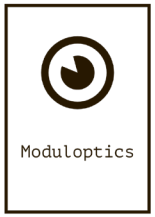
4 (4.4%)

Since Moduloptic was the most popular name, I chose it for the rest of the branding development.

Moduloptic

6 (10.2%)

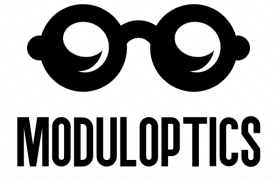
1 (1.7%)



6 (10.2%)

Moduloptic

11 (18.6%)



9 (15.3%)

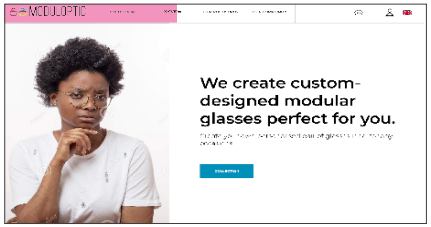
26 (44.1%)

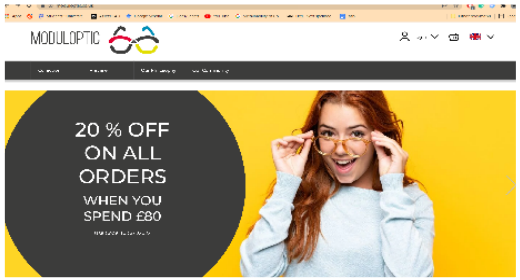
Using a different groupset for the vote, the sixth logo was the most popular by a large amount. I proceeded to add the colours to it and make variants.

I used the three RYB primary colours since most people will say those three when asked what the primary colours are. I wanted the logo to show that glasses were available in many colours.

Website Design

One of the aspects I worked on was the website design. I created mockups. Despite one of my mockups being more popular than the other ones, it proved too difficult to make and thus, a different one was chosen instead.





Then with the help of a friend E. Pegeot (since I knew nothing about website design), a website about Moduloptic was created. The website is a combination of mockup one and mockup two.

In the centre of the website, a rotating 3D render of the glasses is displayed. Random colours are shown at a regular timed interval.
This allows the consumer to view a unique pair of glasses on a regular basis.

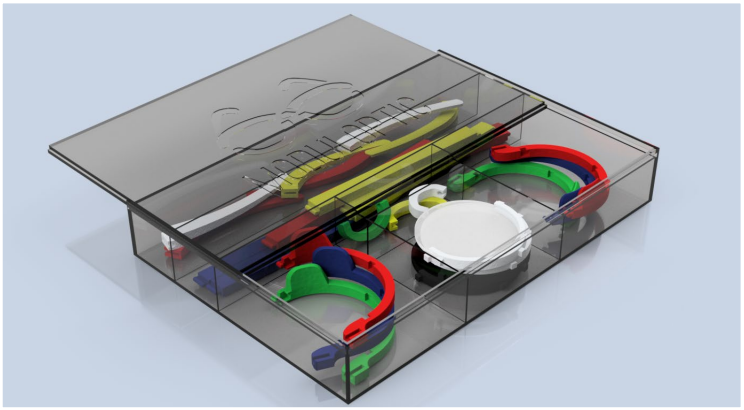
Packaging and Instructions

Packaging

A container that can hold all the components is critical for the user. I sketched a few ideas for how the boxes could be made; I then created a 3d model for the one I liked most.

The CAD model was made in multiple colours, and I asked people which they prefered.

There were four options for both the lid and the box.
Translucent white
White
Black
Coloured
Interestingly enough, the most popular were the transparent ones.



CAD Render of the Box

The 3D Printed tangible box is not as transparent as I had wished. This is due to the limitation of a PLA 3D printer.
The lid of the container is engraved with the Moduloptic logo.

Each container can contain eight total pairs of glasses and eight lenses.

Instructions

I needed to create an instruction booklet to help the consumers understand how to assemble the pair of glasses. I studied a multitude of instruction booklets from different sources to get some inspiration to create my own.

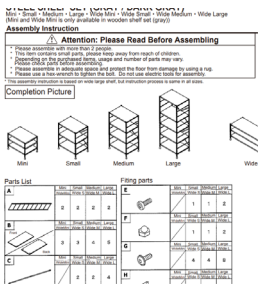
I wanted the instructions to be easy to understand for anyone using them. I created an IKEA style layout to make it, so no translation is needed.

IKEA - Furniture

Iconic instructions for flat pack furniture.
Very minimalist, few words if any on the instructions.

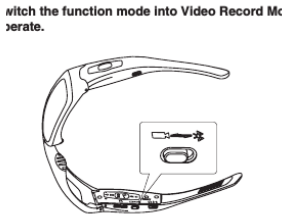
Muji - Various Goods

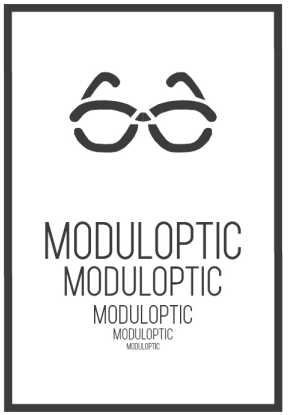
A combinations of graphics and words. Requires more work since translation need to be available.

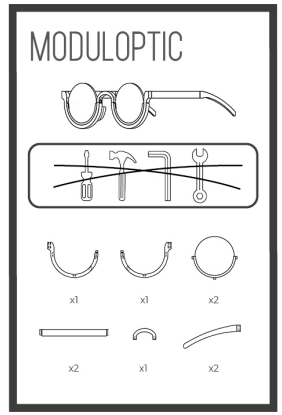


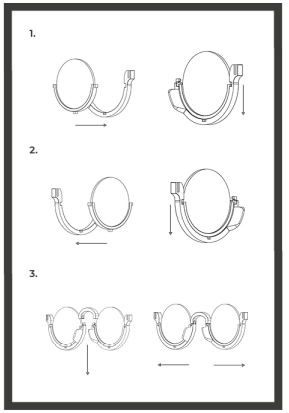
Megaview - Electronics

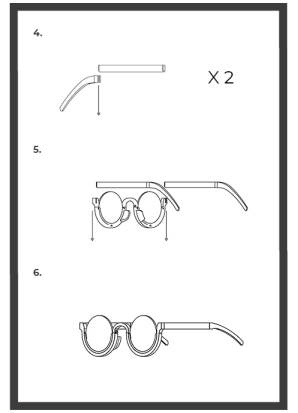
Fewer graphics and even more words than the previous two. Simple and straight to the point.











Cost Calculation

Manufacture

I had to calculate the cost of manufacture for the glasses. This involved checking the volume of the material and the price of a mould for injection moulding.

The injection moulded process would be outsourced to a subcontractor that manufactures the piece for the “sets” assembled in-house.

The twelve different pieces would have an additional cost to manufacture.
For example, the front frames (not including the initial cost of machinery or delivery) would have an estimated cost of £2.17 if 10,000 pieces were manufactured.

Material: £1574.27
Production: £672.19
Tooling: £19426.66
Total: £21673.12 (£2.17 per part)

But that is just for one piece; to calculate the cost of each piece individually is important in order to determine the cost of a pair of moduloptic glasses.

Price for 3500 manufacture pieces
Box and Lid: £48221.13 (£1.69 per Assembly)

Prices for 10,000 manufactured pieces

Left Front Frames : £21673.12 (£2.17 per part)
Right Front Frames: £21673.12 (£2.17 per part)

Small Nose Bridge: £ 17877.84 (£1.79 per part)
Medium Nose Bridge: £ 18121.26 (£1.82 per part)
Long Nose Bridge: £ 18351.16 (£1.84 per part)

Prices for 20,000 manufactured pieces

Flat Temple Tips: £22754.99 (£1.14 per part)
Standard Temple Tips: £22602.26 (£1.13 per part)
Curved Temple Tips: £22482.93 (£1.12 per part)

Small Temple : £29896.11 (£1.50 per part)
Medium Temple: £30741.71 (£1.54 per part)
Long Temple: £31129.91 (£1.56 per part)

Lenses Holder; £28097.50 (£1.41 per part)

An additional 10% cost can be added on top of each pieces for the colouring.

The cost of manufacturing 10,000 sets of Moduloptic glasses (not including the box) would cost £285401.91.

Adding the 10% for the colouring aspect makes manufacturing 10,000 sets cost £313942.11.

Each sets at this point would cost £31.39 to make but it doesn't take into account labour cost, storage, packaging, printing costs and transport.

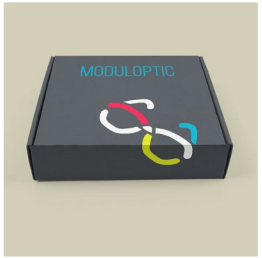
Labour

Labour cost is hard to calculate because it is hard to know how many workers are needed to run an operation such as this.

If we take it as a base of 7 minimum workers (2 Drivers, 4 packaging operative, the owner) to a more relaxed amount of workers possible, (2 Drivers, 8 packaging operative, the owner). The minimum cost is:
Driver average wage: £26,406 x 2 = £52812
Packaging operative average wage: £20,009x 4 = £80036
Owner wage: £29,187
Total yearly wage: £162035

With the more relaxed approach, the company would hire an extra 4 packaging operatives, which would total the cost to £242071 a year.

Adding on top of that between 200 and 700 a year for workers insurance.



Mockup of the packaging

Other Costs

The rental cost of a small warehouse averages £11.000 per annum. This takes care of the location and the storage of the glasses.

Each container for the glasses would cost an average of £0.30 (quoted from different websites)

Each print for the instruction booklet would cost between £0.04 and £0.08 per booklet.

Total Cost Calculations

f Moduloptics sells 20.000 frames a year and 7000 boxes a year; the total cost would be £894472.48

To make each sale cost-effective, it would require to sell each complete set for at least £45 (Not including taxes). To achieve a keystone margin, the product would have to sell for £90 pre-tax.

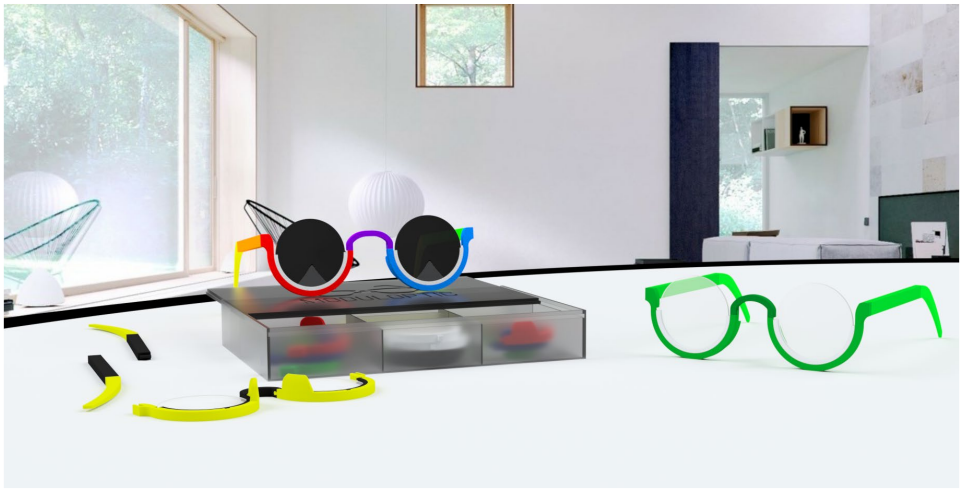
Left Front Frames : £20
Right Front Frames: £20
Lenses Holder: £10

Small Nose Bridge: £6
Medium Nose Bridge: £7
Long Nose Bridge: £8

Flat Temple Tips: £8
Standard Temple Tips: £8
Curved Temple Tips: £8

Small Temple : £8
Medium Temple: £9
Long Temple: £10

With this calculation, the cheapest single pair should cost £94 (pre-tax), and the most expensive combination is £105 (also pre-tax). Despite the Temple Tips being the cheapest item to manufacture, I did not make them the cheapest item.
The nose bridges cost more to manufacture but due to the fact that they are smaller, consumers will expect them to be cheaper.



05 Final Outcome

User Feedback

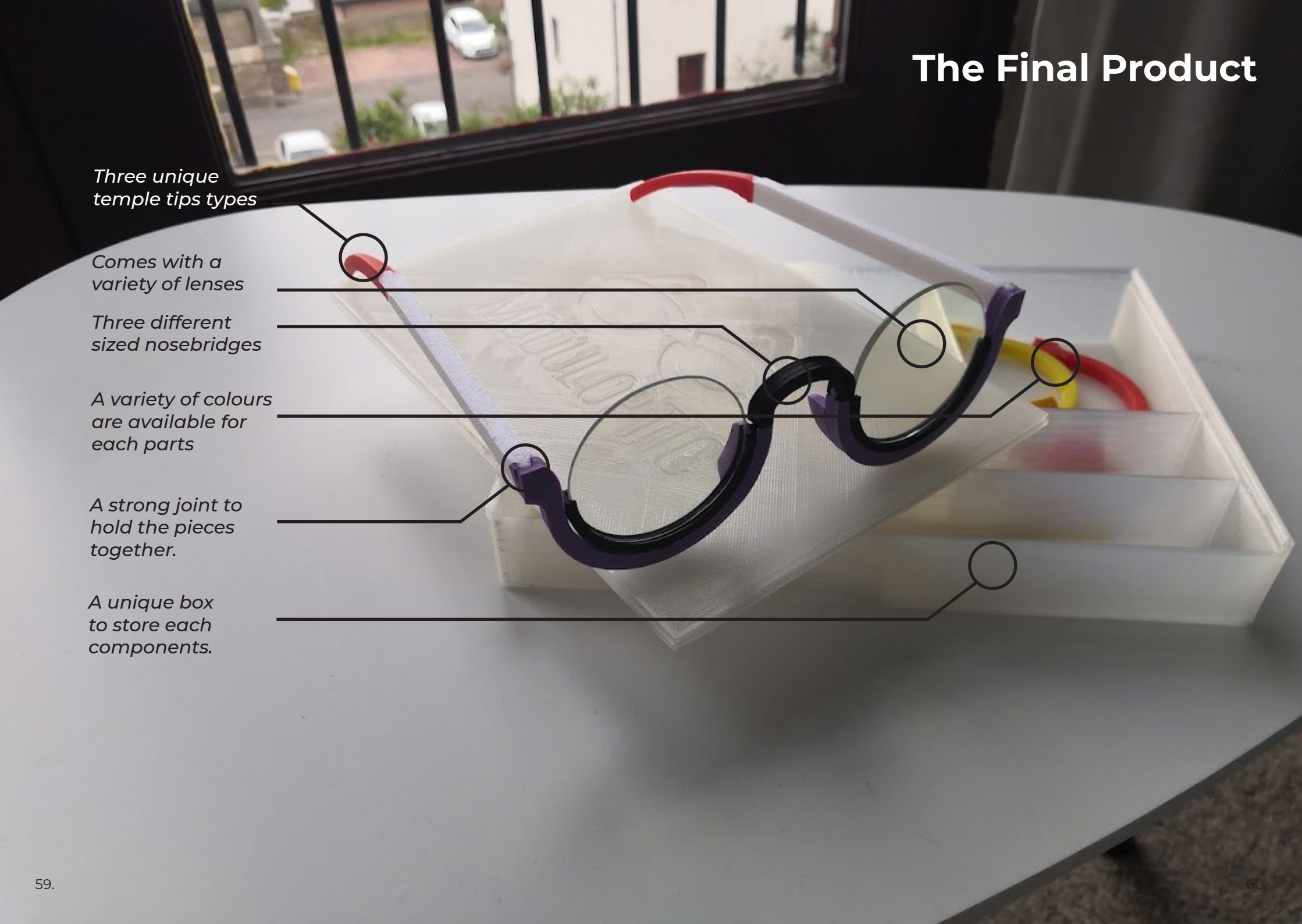
"I like the fact that they are customisable, that they fit for my head. I like the versatility, the different colours available and that I can change them according to my mood."
- Petra Otenšlégrová, Jewellery Designer, 24

As someone who is clumsy, the idea that if I break a part, I can just order a new one and not have to replace the whole frame appeals to me.
- Marie Rousseaux, Backstage Theater Manager, 54

The different colours of the frames are very fun, but I worry about the arms because I have sensitive skin.
- Alexander Stevenson, Law Student, 22

Every frame I buy has big lenses so those are perfect for me, I also really like the fact that they are a fashion statement piece.
-Gianni Caltabianno, CAD Designer, 36

The Final Product



Reflections

I am proud to wear my glasses. However, I think there are a couple of things that can be improved upon.

I spent too much time trying to make a modelling method work when deep down, I knew that it was a better idea to switch. My stubbornness is to blame. As soon as I changed to PLA from resin, the project started to develop faster.

My primary focus throughout the design process was developing and adapting the fickle nature of the small joints in conjunction with the aesthetic nature of the project. I concentrated on style and fashion over practicality. I believe this was the correct choice given the nature of the Moduloptic glasses.

Designing a pair of glasses from scratch was not an easy task. Many pairs of glasses were studied, dismantled, and broken for me to understand their design. The glasses with some components fit my head to a tee, but I know they will not fit some despite the multitude of parts available.

Overall the design process for Moduloptics was enlightening since I learnt the various methods of 3D printing from scratch, which has given me new ways to explore making.

MODULOPTICS