Ideas

SWOT Analysis

	Strengths	Weaknesses	Opportunities	Threats
	Idea 1 : Portable chair/ cushion device which helps back problems or prevents it. Strengths - Adjustable for the consumers needs, whether they have lower back pain or upper back pain. - It's portable so you can carry it to other places - If it's portable then it should be lightweight	- Dull and only serves one thing which only solves one problem - No further development s can be made that is interesting enough to solve it	- Since back pain affects people in all age groups with the over 50's being affected the most. My product will be use for those people who have back pains and also to the people who don't as it prevents them from getting it. - Almost 10 million Britons suffer pain almost daily so this chair will allow them to ease the pain wherever they are as its portable.	- There is already a product e.g. a cushion which helps out with back problem. My idea wont be innovative enough to be in the market as there are already many products out there which are successful
	Idea 2: Multi purpose chair for small confined spaces Strengths - Great for small spaces i.e. students accommodation - Multi purpose, chair turns into many different things such as a table, study desk, stool, sofa/bed, with small storage compartments	- Intricate parts/design - Probably going to be over engineered because it needs to be able to withstand all of it's the purpose.	- This product would be a great opportunity for small spaces. My main target are uni accommodations, this is because in uni accommodations there is barely space for furniture's. So my product will allow them to customise their space as well as having a useful storage/chill unit. - This product is also multi purpose so that means you can use it different ways as its designed to function as 4 other furniture's.	- There are similar products to this which are more appealing and cheap - Moreover, this existing product would be easier to use and there's no need for much improvements
	Idea 3: Foldable helmet which also serves as a bike light Strengths - Easy to store away in a bag - Additional light which can come off so that you wont have to take the helmet off and risk your own safety. - Comfort as well as protection and foldability	- Not necessary as the bike already has lights built in - Also helmets are mostly for PPE purposes and most helmets out there are well built	- Similar products are hard to store so this product with its ability to fold will be compact enough to store in any sized bag - If the built in lights suddenly don't work or are broken, with the design of the helmet there will be an extra light on the helmet to be use - It probably wont save your life for sure but will be more durable and safer than other helmets out there due to the layers of foam and all around protection.	- There is already an existing product out there so there is no need to redesign another helmet which will do the same thing and doesn't bring any innovative ideas

Next step: Find out which project you are likely to do and search more about that category

This project idea would be fairly interesting but I don't think it would be fairly easy to develop it further when it comes to investigating other successful existing products. This is because there are already so many products out there which solves this problem. If this product can solve other problems then it might be marketable and could make a very good project idea as it will be more innovative.

Challenges
There are many challenges associated with this idea. First of all, I wouldn't know where to start. This idea could be an actual chair which helps prevent back problems or just a back support to help the consumer when seating. However, I do think that this will be fairly easy to manufacture and it's not challenging enough for me to do a project on.

This project idea is quite appealing to me because I was always interested in furniture/interior designs. With this idea, it's about creating an illusion of having more space in a very minimal room. Moreover, you get more than what you pay for as there are many functions that it can serve. Buying all of these purposes separately would be more expensive and takes up space. This is because it accumulates, while the multipurpose is condensed into one piece of furniture which can be easily stored away.
This is why I am planning on pursuing this project because it is a big challenge for me and it will be a great achievement to have a multi functional furniture

Challenges
With me, the only challenging part of this idea would be the scale of the chair and how I will fit all the purpose/function in one chair all together to reach all of the core requirements. Moreover, I will need a better understanding of how all of the parts will be manufactured and how it will come together to make it multi purpose. Also, there will be a key requirements which needs to be met as it's what you're trying to sell to it should be able to achieve all of it if it's what was initiated in the first place.

This project idea could be interesting, however, my ideas are quite plain and not innovative at the moment. I have no clue what I will be doing differently to this project idea instead of replicating the existing products but making the design more aesthetic and serve as multiple purposes. Also, I feel like that this project will require a lot of work where it will actually turn out to be successful or not because it's main purpose is to help protect the consumers head. If that purpose doesn't work then this is a complete waste of a project.

Challenges
I feel like I wont be interested in this project as much because its quite simplistic and cannot be further developed because it might end up defeating it's actual purpose if I decide to make different purposes out of it too. I might end up not considering about the most important thing a helmet is served to do which is to protect the consumers head. However, there will be quite a lot of design developments which I have in mind but there are already many products which does just the same and probably are way better than what I have in mind right now.

Design Brief

Next step: Research existing products and evaluate and analyse their problems.

For my multi purpose chair I need to consider about why the user might need it, who the users are and what my product should be along with the problems of existing furniture's.

- **More than one functions** – This is what my product is all about, this is because it would be really helpful for the university students who have minimal space in their accommodations . This multi purpose furniture will enable them to use it more than once because of the other purposes it has without taking up to much space when it transforms into another piece of furniture.

- **Durable** – Durability is also important as you would want the life of a product to last for a couple of years until the end of it's life so that there's no need of buying another furniture again which will also fall apart easily. But despite it being fairly cheap the chair needs to be durable and withstand accidental impacts so that it doesn't fall apart easily. Durability will depend on what type of materials are used in the chair as this will determine whether it's designed to last and not designed for the dump.

- Able to fold in a small box (**compact**) – This ability is what's lacking in most existing furniture's so I'm going to try and corporate it with my product. So that when its not in use it can be easily stored without using up too much space. This should be small enough to be stored underneath a single bed, as this would be the average bed size in a small university accommodations.

- **Inexpensive** – Also since my target market are university students the chair needs to be fairly inexpensive so that they are more appealed into buying it because they have budgets on things they care less about. Also, it's because they only get a certain amount for their student loan, meaning that they would have less money on top of all the rent, bills food and other expenditure.

- **Size** – For the size of my product I need to consider how small university accommodations are and build around that so that it will be able to fit. In addition to this it should be small enough or able to transform into a smaller and compact furniture to be able to fit the smallest accommodation rooms there are for university students or how much space they have left for the product.

- **Withhold** the majority of the university students' **weight** - For this I will be researching what is the maximum weight university student are or the anthropometry for a chair. This will allow the majority to be able to sit on the chair without it breaking, this is because it's the average percentile. Most chairs can hold up to 250lbs according to salawow at (shttp://www.tomshardware.co.uk/answers/id-3443534/office-chairs-weight-capacity.html) as he have seen that the majority of the chair's weight capacity is 250lbs and he who is 310llbs has tried the chairs himself and felt the need to buy the 'big and tall' chairs which can hold up to 400lbs

- **Comfortable** – This is not even a requirements it's a must have because it wouldn't sell if chair's are not comfortable as the main purpose for a chair is to rest and when people rest they usually need to be comfortable. On the other hand, it can just be for postural comfort which allows the body to be comfortable and is not restricted.

- **Adjustable** – This function would allow the chair to be versatile but most importantly more comfortable to the person needs. This is because not everyone is the same, body wise and preference. This will allow them to adjust the height of the chair so that their feet is nicely resting on the ground.

Problems with Chairs and lack of multi functionality

- Some chairs are not adjustable
- Uncomfortable
- Large and Bulky
- Not suitable to everyone
- One or two functions only
- Better quality = Expensive So if people have the money and fully commit on buying a furniture which probably serves as only one function and waste space then they usually buy the better quality furniture's as they last longer than the cheaper ones
- Bad quality = Cheap This will usually fall apart within years use as its only for short term use
- In the middle = never good enough, it usually lacks of something

Other stakeholders

Manufacturer

- Materials – The materials should be easily sourced and sustainable. There should be an unlimited amount of the materials needed so that if the product is in high demand there would still be something left for the future generations.
- Method of Manufacturing – For my product will the methods to manufacture it be expensive and consume a lot of energy. Since I'm not really sure what materials I am going to use I don't know for sure if the production cost of my product will be high.

Retail

- Price – This should be moderate as people are not of the same wealth and should be lower than most of it's competitors so that it will gain popularity straight away.
- Appeal/Customer interest – If my product doesn't appeal to the customers there will be no profits made and it would just be a waste of resource, this might be because even though it's needed not a lot of consumers are actually wiling to buy/try the product.

Supplier

- Cost of distribution/ Distribution process – I think my product will be manufactured abroad, maybe somewhere in Asia. So the distribution costs will be quite high as it is international and there will be large transportation devices like airplanes or ships to transport the product all the way to the UK.
- Size of the overall product – This should be moderately small and lightweight so that it will be easier to transport. Moreover, it will allow more room for the other products to be transported therefore it will reduce the trips of going to UK from Asia. In addition to this, it will also reduce the carbon monoxide that transport emits and impact the environment and social massively.

Marketable?

Next step: Is my product really necessary? Proof of problem.

I think my product is marketable because there are already similar products out there which are popular and now consumed by consumers. However my product is different from the others as it's not the 'same old same old' and has new features that is combined with the old. This will hopefully make the consumer take notice and upgrade their space and way of living.

Who are the target market? Mass appeal?
My target market are mostly university students. They are the ones with the common problem with compacts living space. This is because not everyone can afford a bigger living space on top of paying everything else for university, or spending their money on social life. My product should have a mass appeal even though majority of university students around UK every year are looking to move into their accommodations, which already means high potential sales. However, there are also adults who have small living space and can buy this product , because it's not only for the university students as its built for anyone interested and has the problem that I'm trying to solve. This is due to the product being a piece of furniture which doesn't have limited customers as it's a necessity to most people.

How high do you think your product will be on demand?
I feel like and hopefully the demand for my product will be quite high. However, this would be only after the advertisements and the product physically on the market, where the public eye can see and try for themselves. This is because its a not a massive problem that I'm trying to solve. Also, there are already products out there that are quite similar to my product so why would people demand a product that already exists. On the other hand, after the product is released to be sold, I hope it will be popular not only for university students but everyone else too.

What makes your product different from the existing products?
My product is certainly different from the existing products because my chair will offer way more functions than the furniture's which is already in the market. Moreover, it will offer compactability which most multi-purpose furniture's don't have as it can be quite intricate specially when it's good quality. This could mean the weight which is added bulkiness.

Is it aesthetic? Or easily customisable?
Even though my product will be unique this chair is fairly simple and ordinary which would suit everyone's needs which makes the furniture highly customisable as the design and materials used wouldn't be restricting. This would be great for those who wants to be extra with their furniture and wants it to reflect their personalities.

How good will it perform?
The fittings/ fixture chosen should work effectively/smoothly otherwise they wouldn't have been chosen. They should be able to withstand pressure and wear which will make it easy to transform the furniture into its other functions. Apart from that my product will be outstanding as the right materials will be chosen to make the product perform well.

Tease, please and seize the consumer – will the product be easy to work/ understand?
The product will be fairly easy to work out, so that it doesn't waste their time trying to understand and figure out how to sit on it or perform its other functions. Some areas /parts of my product will require a little bit of strength to lock and unlock parts in depending on what fixtures/fittings I will choose for the product

Time to market. How long will the product be out for sale?
I'm not really sure but if it's highly demanded then I would expect to sell it for at least 10 years and release a new upgrade.

Consumer appeal
My product offers to solve the consumers problems so this should appeal to them as it will make their life easier. Also it will be able to suit their needs or aesthetic as it will be customisable.

Value with the right price?
People nowadays are comparing the same or similar products for a cheaper price while still getting the quality they want. I think that my product will be the right price for what it will offer as it's a 4 in 1 furniture. Also, I will make sure that we will be the only one supplying retailers so that the retailers can decide how much they are willing to sell our product.

Why should they (students) buy the product?
My multi purpose chair is very useful for most students who don't have space in their accommodations. Also for the students who don't want to have extra expenditure on coffee to study in the café. So I think they would buy it as it has the majority of the furniture they need which can be stowed away when not in use or just free up space for something else. Moreover, instead of paying for individual furniture's which will probably more expensive so they can buy my product instead and save money.

Will the students be able to pay? Finance? Parents?
I think if students invest in a good quality, multi purpose chair instead of having to frequently buy furniture's or individual one then they could save some money and be able to pay for my product. However, I think since my product is a necessity most students will ask their parents to chip in or pay for their furniture expenses.

Are they willing to pay for that amount?
I think £200 is a fair price for a chair which has 4 functions while being durable. However, I don't think modern day students will spend that much in one go for a piece of furniture as they mostly would want to use that money for their social life.

Impact on the society?
My product should positively impact the society but they are also negatives on what my product could be. I my product is not carefully designed or manufactured it could cause harm to the people. These harm/dangers could be release of toxic from the materials used or corners which could cut if not smooth enough.

What are the (fire)(safety) regulations?
My product has to be able to comply with the Furniture and Furnishings (fire)(safety) regulations 1988. This means that my product must pass the tests to comply with the regulations. Also, I would need to consider applying the risk management principles on my design before I can proceed to with the design process. These will all allow my product to be marketable and trustworthy because it complied with the regulations.

Ergonomics?
Ergonomics means that I will have to look at how easy my target market will be able to use the product. I will have to research the anthropometrics which are the average comfortable seating height to be able to have a successful chair. However, I still have to consider that there will be a few who are not average so I will have to design an adjustable chair or have adjustable features to make it easier for everyone.

What are the product drawbacks?
The only product drawback I can think of is the price. My product will be fairly expensive for a university accommodation furniture. There are vast amount of products out there either good quality or imitation of that, which will be more inexpensive than mine. Then the price is a huge drawback to my product as it might not sell as much.

Potential for new markets?
There could be a new strategy to make more people appeal in my product or a new upgraded product which will not only keep the existing consumers but hopefully outside the market.

Multi Purpose Furniture's

Problem to solve : Fairly Cheap and Space saving furniture's for small accommodations

Next step: Take a look at multi purpose chairs.

Matroshka

This piece of furniture is called **Matroshka**.
Matroshka is a collection of furniture pieces which are inspired by the Russian dolls that everyone knows about. This collection within the furniture is composed of several versatile pieces that can be combined and configured in lots of different ways. However, the best part about this furniture is that the furniture pieces can be stored in one another. The most compact version takes up just 4 square meters. Matroshka furniture is what I call a very interesting multi purpose furniture as it can function in variety of ways, the pieces can be used to make a bed, a desk, a bookshelf, a coffee table, a dining table, a wardrobe, clothing drawers and seating for 12.

The problem with this furniture is the overall **cost** of it. This is selling for a whopping 112,000 Swedish Krona which is **£9269.29**. This is a very expensive price for a piece of furniture, however, it does decorate three rooms so the price would probably accumulate to that amount when decorating the individual rooms. Moreover, the **quality is excellent** hence why its expensive. But this would be **my problem** because it wont be as marketable or **high in demand** which means that it could cost me more to manufacture the product than get profits from it. Moreover, this will be a **huge project** which would not be completed as I have a very limited time to finish it.

Multipurpose furniture Sosia by Emanuele Magini.

This piece of furniture here is called Sosia. This was made by an Italian designer called Emanuele Magini. Magini has designed this versatile furniture, Sosia Sofa for Campeggi, which is an Italian company which sells furniture. In Magini's words, "Sosia could be two chairs, but also a sofa or a small sheltered bed, but it could also represent the metaphor of a living room because of its extreme formal reduction and composition: Sosia is all this and much more. It's a dynamic object ready to adapt to the different situations that everyday life brings." Sosia might not seem like an aesthetic piece of furniture but this is a very convenient furniture as it has many purposes which functions differently and will vary as to what the consumer's prefer to use or need. Moreover, this furniture does offer comfortability which is a plus because it will be mostly used all the time and could easily become a replacement for the consumers bed if they don't have enough space for both the bed and this Sosia Sofa furniture.

Sosia Sofa is made out of Polyurethane foam and polyester padding stuffing, coloured Lycra covering.

The problem with this furniture is the **style** and the **size** of it. This piece of furniture is quite humongous which means that it will take up most of the space in my consumer's accommodation, unless they are planning to use this furniture as their primary furniture and use it mostly as their bed. However, it would take patience and resilience if they were to use this furniture as their primary bed because it would be everyday that they keep changing the furniture into what their necessity is. In all honesty, I don't think that my target market will be that resilient enough to keep changing the furniture everyday since they are quite busy and always in a rush. Furthermore, it looks just like a normal furniture, there is nothing that appealing to it and could come across ugly to some people because of the extra fabric that just lies there. Moreover, this design reminds me of a **mat or artificial grass** which could come across as not comfortable because of what the material implies. Overall, I am planning to do a multi purpose furniture but I don't think I would make it at this huge of a scale so I might build it up from a chair.

Badac multi purpose furniture.

This furniture collection is called Badac. This furniture is created by Sang A Choi, the furniture was inspired by the Korean flat pack furniture called Pyung Sang. Badac is a collection of eight pieces that can be used to create all sorts of different configurations depending on what the consumers preference. The pieces include two backrests, a coffee table, a lamp and a shelf. All the pieces are very versatile. Also, it comes with three seats which are reversible which makes it good for storing them away when it's not needed and in need of more space.

The problem with this furniture is the **comfortability that it doesn't offer**. It doesn't come with any cushions or sort of padding attached to the furniture. If I were to solve the problem and make this sort of furniture I would have to **consider the ergonomics** for it because I plan on making the furniture to be used most of the time and not just an extra piece of furniture for guests'. Moreover, I feel like this project will be **too easy to manufacture** as it doesn't necessary offer any complicated fixtures/fittings. Furthermore, this will be quite big and probably take up most of my consumers space, also it's **not** really **eye catching** for my target market because it's all made out of wood which is not necessarily their style. I should look more on contemporary style.

Multi Purpose Chairs

My project idea that I have finally made conclusions on doing is Multi purpose chairs but before I finally decide I need to look at existing products and find out their advantages and disadvantages and how my chair would be different or if I'm planning to add those features to mine.

Next step: Feasibility for the Multipurpose chair

This chair here is called the Bi Chair. This chair is designed by Elemento Diseño and it's a dual-function chair and table/shelf.

Advantages: This chair looks modern and contemporary so therefore be very appealing to my target market who are students, as they are young and all about what's on trend right now or the futuristic. Moreover, it does have multiple functions which students will likely need like the chair and table together to study on and the shelf to store their books or just their things because they have minimal space.

Disadvantages: The other functions like the table cant be achieved without using both the chair, so a table and chair cant be used together unless another Bi furniture is bought. Moreover, the table would be too high anyway if there was a way that it can function without the use of the other chair. This would be very uncomfortable to use and cause unwanted strain in the arms, however this chair would overall be uncomfortable for a long period of use because the chair is not ergonomic and there are no cushions or padding whatsoever.

My project: If I were to make this similar type of chair then I would incorporate some cushions into the design so that it's ergonomic and comfortable for when the students are studying for a long period of time. I would also make one of the chairs either higher or lower so that it can be used as another function and suit their preference. Also, when its flipped 90 degrees it can also be used as a long table. My project will have to contain quite a lot of functions to compete with the other existing products so I would need to manufacture it better than this

This design here is called the Tona Chair, this is designed by an Argentinian designer called Diego Gonzalez King. Through some clever design, he's created a singular piece that can be a chair or one of two tables with a quick, 90 degree rotation. King has a very keen understanding of the shape to create a piece which is modern, versatile and supremely functional.

Advantages: I feel like that this chair will be marketable because of it's futuristic design and easy transformability. However, that's all that is good about this chair because it doesn't really offer as much functionality which are needed for my target market. On the other hand this would make a very stylish furniture which could come in handy because of it's other functions.

Disadvantages: This design only has two main functions and that is a chair and a table. The chair could also be used as a shelf but not as storage as this means that when the chair is needed the stuff will need to be moved so that it can be used as the chair.

My project: If I were to get inspiration from this chair, I would take away simplicity and incorporate it to my project because I feel like if I over complicate it then my target market wont be as interested because they have a short attention span. Also, I shouldn't over engineer my project and only use the right amount of materials because it would then turn out heavy and expensive to manufacture, which then means that my selling price will have to go up so I don't think that my students will have enough money for.

Advantages: The design is pretty cool and would probably attract people who doesn't necessarily shop for furniture but since they see something familiar it would be a must buy. This piece of furniture also has many functions which are suitable for my target market. Having all these other pieces can mean that the consumers can decorate their space with more furniture. However, this would then defeat the idea of it being multi purpose because you are trying to save space by just using one furniture to have extra functions.

Disadvantages: To make other functions it would be necessary to buy more of the furniture pieces and these could be costly unless it comes in a bundle or comes in all 10 of the furniture pieces. If it does then this would not suit my target markets accommodation because they have minimal space to keep furniture's so there wont be any space to store them if they are not needed for that particular function as it gives a large footprint. Finally, this chair also doesn't offer any comfortability as there are no padding or cushions attach.

My project: The easy transformability of this chair is very interesting so I might incorporate modular legs for my project as they are the ones which are easy to adjust and change.

This chair here is designed by Cho Hyung Suk, Pacman is multi-purpose home furniture which can be easily transformed from one thing to another and thereby lets consumers use it their own way. It includes a table, two stools, a side table, four chairs, bookcase and lots more. The furniture set on the whole shows off your gaming fervour in a stylish way.

This chair here by Teknion is called Belize. Belize is a mobile lounge chair for use in casual meeting rooms, teaming and reception areas, and training and presentation rooms.

Advantages: This chair has three main functions which are my target market's main requirements which are a comfortable chair, desk and storage. Also, this chair offers comfortability as it's basically an armchair. The cushion is thick to give enough support to their spine and even though it might not be ergonomic, the cushion looks like it will mould to the consumers natural curves. Moreover, this chair have wheels which means that this would be fairly easy to manoeuvre and wont require any heavy lifting.

Disadvantages: This chair doesn't offer anymore functions beyond the three it has to offer and it would be good it can also function as other furniture's because the space is very minimal to have different separate furniture's. Furthermore, I don't think this would appeal as much to my target market because it does look very old fashion as arm chairs are usually associated with the older people.

My project: With this chair I will probably have to redesign the shape of the chair but keep the comfortability of an armchair. This is because my target market will be using this most of the time to study. But I will have to figure out other ways to give more function to it so that this chair wont have to compete with other existing chairs in the market.

Feasibility

MULTI PURPOSE CHAIR FOR SMALL CONFINED SPACES

MAIN TARGET MARKET : STUDENTS WITH A SMALL ACCOMMODATION

Details of my intended product.

My multi purpose chair has many different purpose, this all includes the table, study desk, stool and chair bed. My products main purpose is a chair but it will be able to fold out as a lounge chair bed which students can fully lie down on. Also, it can function as a table as well as a stool. Furthermore, the chair will then have a pull out table on the side to convert it as a study desk. This study desk will be very helpful for the students who don't have the space for a chair and desk in their accommodations because my product is then designed to be stowed away in a stool form which could fit easily under a single bed. This then frees up space which the student can decide what whatever they want to do with it. Moreover, besides being multi purpose the chair should also be ergonomic as its probably going to be used everyday so comfort is also important.

Strengths of concept/availability of resources/specialist knowledge/USP

Wood are a reliable source, however, if its to much in demand then there might not be enough for our future generation. However, trees are easy to grow, the time it takes for them to fully develop will take awhile but in the meantime wood is fairly easy to source. However, this all depends on what wood is available for me within the classroom and the workshop. On the other hand, metal is more difficult to source and is actually expensive to extract the raw metal wanted. In contrary to this, metal can be used in many manufacturing methods while wood is limited. This is because it's easier to change the shape of metal than wood as metal can take shape as a liquid molten form which is malleable.

Weaknesses of concept/availability of resources/specialist knowledge/USP

Wood are not perfect, even when its cut down to be used there would still be holes in the wood which would need an additional process to fix it. Also wood is a hygroscopic material which absorb surrounding condensable vapours and loses moisture to air below the fibre saturation point. The only problem here would be the availability of my chosen wood within the classroom. So the wood chosen shouldn't be expensive and is commonly bought as the college has a budget and cant afford to store all the varied types of wood.
Moreover. metal are very expensive to source and manufacture, you would only get your money back if the product is mass produced. Furthermore, hopefully this product will solve the space problem with university accommodations and small spaces without having to upgrade to a bigger space. This is because I lack in any furniture making knowledge and weak at picking suitable materials.

What local limitations are there/problems with implementation/ modelling/personal skills?

There are always limitations and problems with product inventions and for my product the problems will probably be not working as it should. What I mean about this is that it might be too complicated to work out and therefore won't be able to function its multi purpose and just function as one thing which is just a chair. Moreover, if my product requires materials that I can't source within the classroom and the workshop the model of my product will have limitations where I have to change parts of it will still function the way it's designed. Furthermore, my lack of personal skills with the materials such as metal will impact the way I use it within my product even though I know the properties it will be a challenge to deal with the problems in person.

What must the product do to succeed in it's role?

For my product to be able to succeed in it's role, it has to be able to fold out effortlessly or can be easily changed/transformed for a different purpose. Also the product should actually be highly demanded so that it can appeal to the consumer and outshine similar products.

How important or what weighting is there for the factors?

Important factors
- Fixture and fittings, this will make the product multi purpose as it's what will transform the chair into its other functions
- Multi purpose, allows one thing to become other useful things
- Quality, should be able to withstand long term use

What limitations are there/existing products/financial

I think my products main problem is the cost of it to manufacture and the selling price. I feel like my product will be labour intensive even though its not going to be a one-off, my product will still need a lot of workers as there are parts of my product which I think are too intricate for a machine to manufacture and I think it will require skill. Furthermore, the overall sale price will be fairly expensive to cover the manufacturing costs so I don't think the price will appeal for the students as they already have to finance everything.

What innovations/new thinking can you bring to this area?

My product will probably fold small and compact compared to others as my product has different kinds of purpose and hopefully folds away neatly despite of its size. Even though, I have a specific target market. It wont just appeal to them as it is a piece of furniture and furniture always have a mass appeal as it's a necessity in todays world.

Multi-purpose Chair : Is It Necessary?

Multi-Purpose Chair

My product is primarily supposed to be used mostly as a chair but since its multi purpose, the chair will have components within it that will be able to fold out into a lounge chair-bed which could also be used as a sofa. Moreover, the chair will also have a study desk that will pop out from the side so that the consumer can write and study, as well as turning into an actual desk/table for when more table top space is need e.g. party or food.

Is It Necessary?

My product is necessary for small university accommodations because it maximises their space instead of taking it all up. It will enable students who have minimal space left in their accommodation to freely use the space that my product creates for something else that interests them. A university student can have a choice to either spend more money on a bigger room or save money by making use of the minimal space. The smallest accommodation room is basically a cuboid which can hold a single bed, desk and a chair. A room with shared facilities consists of kitchen and living room with the bedrooms at a minimum size of 6.5m2 by 9.5m2. This type of room size where its shared with other students would be the cheapest.

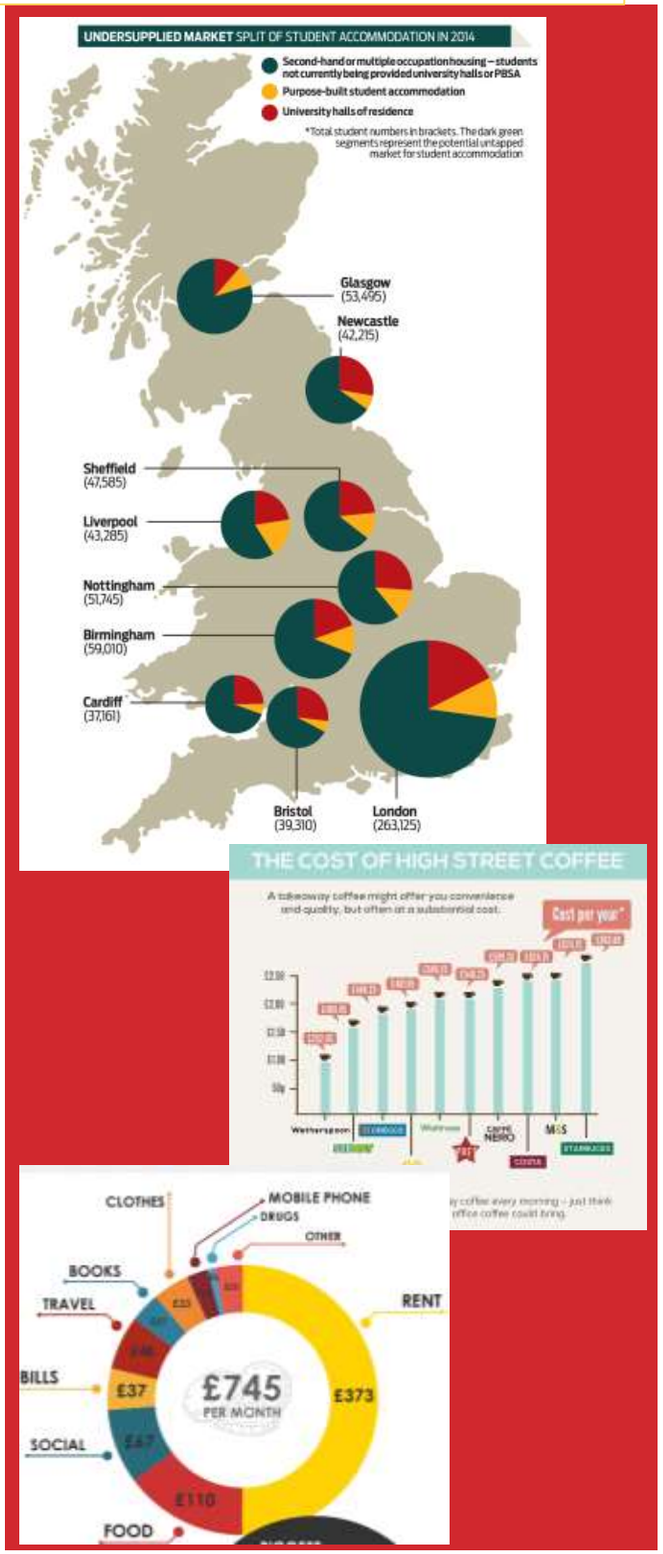
Moreover, the students most popular choice for the type of student accommodation they rent is ensuite self catered rooms. Additionally, according to The Guardian 55% of those purpose-built rooms costs an average £121.71 per week for a single room compared to a much affordable alternative which is a non ensuite cluster flats at an average £97.48 for a single room. However, this all depends on what space you have as the rents for any university accommodations are getting more expensive this is according to The Guardian which got their figures from National union of Students (NUS) that "The average rent costs for a room purpose-built student accommodation has gone up by 25% over the past three years".

Furthermore, if you have a third of a room then you should only be paying a third of your share of the rent. On the other hand, students can now save up money by renting a much smaller space rather than a big one to accommodate their much needed furniture for storage and necessities. So this is where my product comes in, my product should last them a long time compared to the single furniture's which probably wont be used again. This is because they are not multi-purpose and cant easily adapt to a new space unlike my product as it is adjustable and has many functions.

Many students nowadays are buying more furniture from the store brand Ikea, this is because Ikea is selling their products relatively cheaper than other competitors, also its easy to assemble furniture. According to costumers of Ikea and Jeff Frank in Quora, (https://www.quora.com/Why-do-people-or-just-you-buy-IKEA-furniture) that Ikea furniture's are not for long term use as they are not as durable and high quality.

Moreover, a lot of students waste their money on coffee. This is because they feel like they are required to buy a coffee or something when they go and study in cafe's. In addition to this, they feel like coffee will help them be awake and more focused A research found that Britons spend more than £2000 a year each in every high street coffee shops.

Finally, student furniture's are increasingly becoming popular as students don't want to spend as much on their rent and having to buy extra furniture to suit their needs. This is because in accommodations the furniture usually included are a bed, desk, chair and wardrobe if a furnished is rented. There is a website in the internet which solely sell furniture's for student accommodations. The website is https://www.loft-interiors.co.uk/student-furniture/

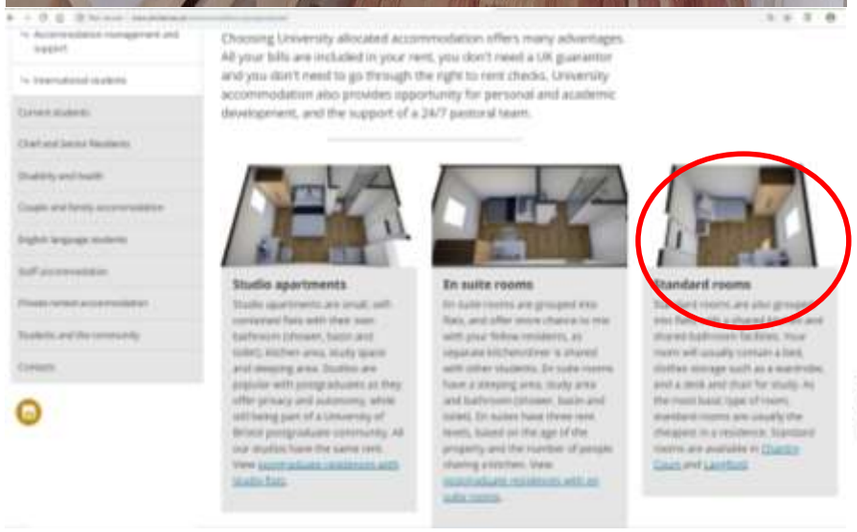


https://www.theguardian.com/money/2013/aug/15/student-accommodation-what-need-know https://www.nus.org.uk/Global/Campaigns/Accommodation%20Costs%20Survey%20V6%20WEB.pdf

Multi-purpose Chair : Is It Necessary? Continued…

Next step: Stakeholder feasibility

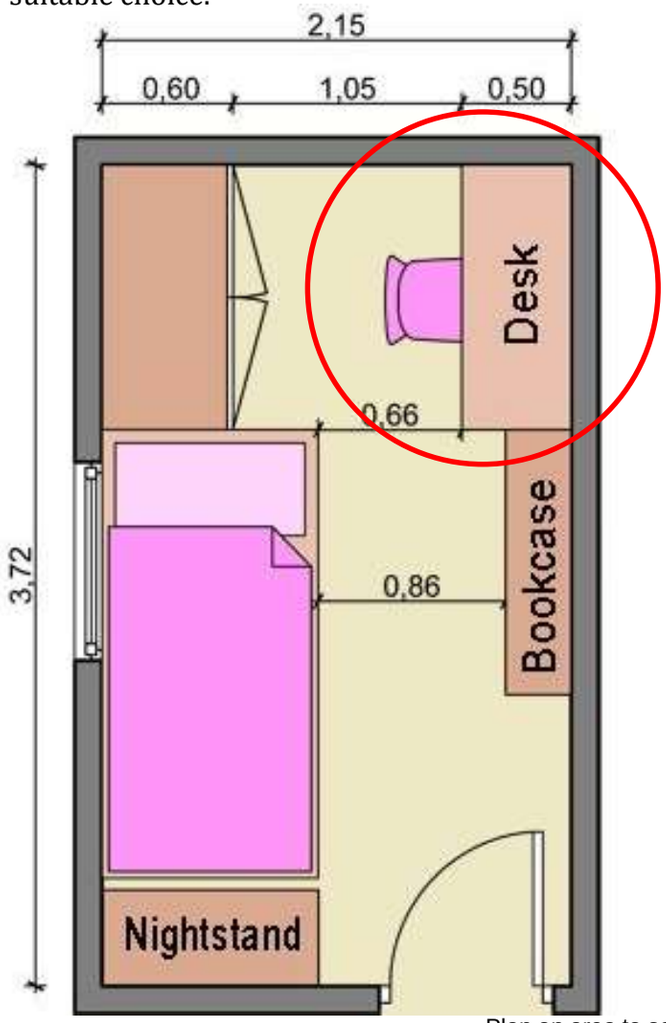
Small University accommodations are still a choice, these accommodations can be as small as a 16ft by 9ft. This has become a common problem specially for students who don't want to splurge most of their money or student loans on rent. As students would rather spend their money on social life or things that are more important to them, as this will not be their permanent living situation. So the students would be stuck with accommodations like these as it's fairly priced. However, their problem is the space that they have left when all the necessary furniture is placed. Most of the time the room is crowded with unnecessary furniture. So this is where my product comes along as it's a multi purpose chair where it can take up one place while being useful as it performs as other furniture's too, such as a desk chair, table, stool and a lounge chair/bed. Furthermore, they will only spend a large amount at once or can be financed using a student scheme for the students who cant afford my product all at once. This will allow them to spend less on furniture as buying individual furniture's can add up to be even more expensive.



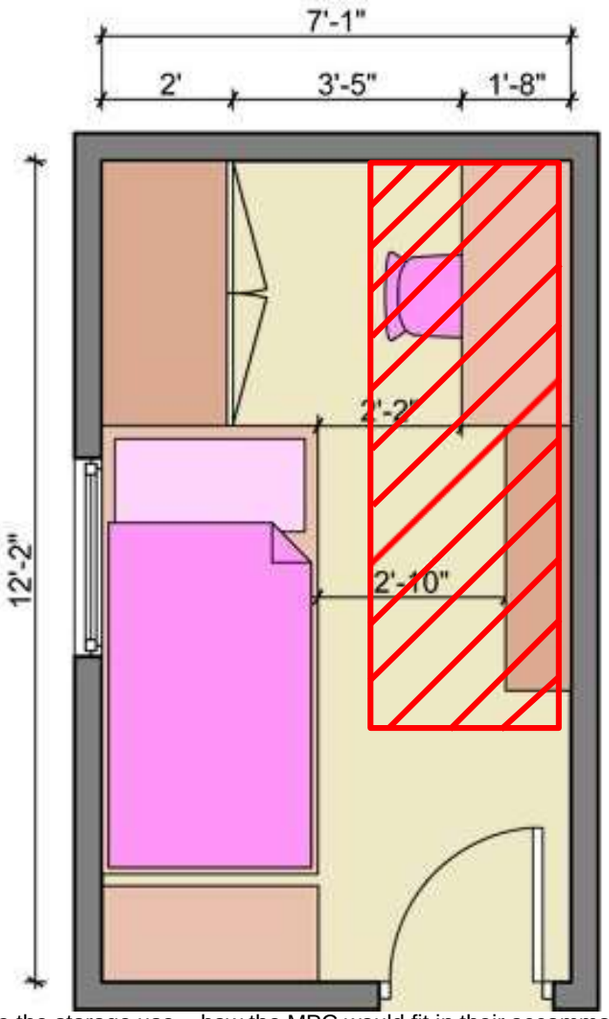
At University of Bristol a Standard Room which is basically a box will set you back at least £6865.50 for 50 weeks. This room will not come with a bathroom as that will set you back a whopping £8314.00. Its very expensive nowadays so having this piece of furniture will be very handy if you don't have space but want friends over and it wont accumulate all the space you have because it has many functions and it can be stored away when not in use

http://www.bristol.ac.uk/accommodation/media/docs/postgraduate-fees-18-19.pdf

This chair and desk here below is the necessary furniture. However, these two piece of furniture only serves two purposes and basically takes up the whole space along with the bookcase. Also, the desk and chair is two separate furniture which would have individual prices therefore could make it more expensive for the students.
Moreover, when the desk and chair is not in use it will permanently take up that space so the student knows they had to sacrifice that space just for the desk and chair, however, with my product which can be transformed into a stool, can be easily stored underneath their bed. The space it frees up is the whole footprint of the desk and chair, and bookcase. My product will allow freeing up space without having to permanently remove the products and loose all their purpose. Furthermore, more students don't like clutter or crowded rooms as having space creates open minds so I don't think having separate pieces of furniture will be a suitable choice.



Foot print
A foot print is the amount of space a particular product will occupy.
This is basically the total area that the furniture will cover, for example if it folds out to be a bed the area of space will be way bigger than just a chair, so the footprint of my product will be the bed size as that occupies more space.
Even though the footprint size is the same as the desk and chair, and bookcase. I feel like my product will be more useful as its not permanently a bed which means that it can then create free space when it's transformed into another product while the furniture's are permanent unless they are removed. This will make it have a smaller footprint, however, there will be less functions and purpose leaving just the desk and chair.



Plan an area to see the storage use – how the MPC would fit in their accommodati

Stakeholder Feasibility

MANUFACTURER

- What materials are going to be used for the product and what is the cost of those required material? I think for my product I'm mostly going to use wood and metal because I want to be eco-friendly and not affect the health of the people.
- The methods of manufacturing the product, scale of production, where its going to be held and would it need people? For my product I want it to be automated but since its quite intricate I feel like it will be labour intensive.
- Will there be any toxic materials? From what I want the product to be no, but I'm not sure what finishes or material I'm going to use yet.
- Cost of distribution? Since the place of manufacture will be abroad, highly likely in Asia. The cost of distribution would be high. However, if manufactured in UK I think the costs will be even higher because we are a first world country where everything is expensive compared to third world countries.
- How long to do you expect the product to take, the time it takes to manufacture and distribute the product? Hopefully to make one of my product which id fully finished and ready to be shipped should be no more than 2 days to manufacture.

RETAIL

- Cost to manufacture? This is so that they know the selling price and make profits besides the costs they are spending to sell the product.
- What size the product is, the weight of it and if it will fit on the shelf for display? My product should be able to fold flat so it will probably be the size of a bedside table and will fit under a single bed.
- Would the product or parts of the product be toxic to stock? The materials I'm going to use are
- For more information they also need to know what the product is made from and the quality of it.
- How the product compare to it's competitors? My product has ore than two purposes and it should be able to fold flat for storage which I haven't came across yet.
- Will it meet the need of your ideal user? It should be able to meet my ideal user as it's a furniture that will suit their space and requirements
- How many do you plan to produce and sell? At first I'm planning to sell about 500-1,000 first to see if its successful and highly demanded.

For my product to even exist I need to consider the stakeholders requirements. The stakeholders are a really important when it comes to designing a new product, this is because they are the ones which will determine if a new product is really necessary.

Group Discussion

In this group discussion we were given one specific role which we have to try and deliver. I had the users requirements, these questions were what we came up with on my first group. We then got separated with our sets of questions to try and challenge the others in the picture with their major project ideas and find out if it was actually necessary.

USER

- The cost of the overall product? My product should be fairly affordable, so my product shouldn't be more than £200 as my main target market are university students.
- Is it easy to use and self explanatory? It will be, however, there will be a small paper guide on how it works/ get the desired purpose.
- Is the material of the product durable? Having a durable material could mean a longer lifespan so that they wont have to buy another product within a year. So the materials I think I'm going to use for my product are wood and metal, they are not necessary the lightest or flexible but they are durable.
- How frequently it will be used? Since this product is purposely made as a chair with other functions, this will be used most of the time whenever the student is at their accommodations as the student can chill and work with this furniture.
- Maintenance costs and will there be any guarantees? Yes it if breaks or falls apart within 5 years there should be a guarantee. Also for maintenance the only thing needed to be done is to polish the wood if wood is used or dry wipe if it's metal.
- What is included in your product and what needs to be brought separately? Everything will be included in our product, however when the screws become loose or rusty then they will need to be brought separately.
- Is the material used recyclable? Most of the materials I'm going to use should be recyclable where it can be reused as another resource.
- What will you do with the product at the end of its life? Recycle it or send it off to a company who will be partnered with us so that they can turn it into a useful resource.

SUPPLIER

- Who will deliver the product? For this I think our own company will deliver the product
- What's the cost of delivering the stock, costs of the stock, cost of the materials required etc. I'm not definitely sure yet but the stock for each chair shouldn't be more than £200
- How much are you willing to spend on materials? No more than our budget, as long as there is an average profit which defeats the costs then it should be alright.
- Are the materials required difficult to source? I'm not quite sure yet, but it should be fairly easy to source but also sustainable.
- Are the materials needed going to be environmentally friendly? Yes, I'm planning to use materials that reduces less impacts on the environment.

Stakeholder Feasibility

Next step: Design Brief

Who are the stakeholders?	Why are they a stakeholder?	What makes the stakeholders relate to the problem you are trying to solve?	How do they influence the design of the product?	What are their requirements/needs with my product?
Sourcerer of materials	The extraction of materials are the first and important stage that the designer have to consider. This is because without the materials needed, the product wont be able to exist.	I am trying to make a good quality chair for the student so they wont have to keep buying cheap furniture's which doesn't last. So the sourcerer of the materials have to consider if the materials they are extracting is good enough to be used.	They influence the design of the product because they need to be able to know that the suited material is easy and inexpensive to source otherwise the materials will be considered.	They require the chosen materials to be easily sourced and fairly inexpensive to do so. Also, it has to be sustainable and reduces the impact on the environment because it affects everyone around the extraction place.
Manufacturer/Designer	Without a manufacturer the product wont be created, it would only be an idea on paper, therefore not a physical product.	Manufacturer's will have to manufacture my product quickly, easy and not over engineered. This is because the product has to be easy to work/figure out affordable so that my target market can buy it. They become a big part of this because of all the implications of the outcome.	The size and type of materials that are going to be used so that they know they are the right manufacturer as they might not have the right equipment to be able to manufacture the product.	The manufacturers ideal requirements for my product would be easy to make with a method that wont be expensive to run depending on the scale of production too. Also the materials used must not release toxic gas because it's a massive risk to their employees.
Supplier	They are the one who will distribute the product to retailers so that we can sell our product to a wide variety of retailers who are willing to sell our product.	Suppliers now want the best of the best to supply so that they can keep their reputation. The problem I'm solving is a good quality product at a reasonable price. So it shouldn't be a problem selling the product to the supplier.	The suppliers main worry would be the materials being used as they wouldn't want to risk their business if the product was a bad quality or release any toxic	The suppliers requirement of the product is the material used, they require the product to be made off a good quality material so that they can sell it and wont ruin their reputation if the quality is poor.
Retailer	Retailers are the one who sell the product to people. They are the ones who have to persuade the public eye to buy the product so that they can make profits, from buying our product.	The retailers relate to my problem because their requirements of the product are some of the problems that I'm trying to solve. These are the size, weight and price of the chair. The size has to be compact so that it can fit on small spaces, light weight so that it's easy to manoeuver and affordable because people are not of the same wealth.	The retailer will also influence the size of the product and the materials used. They would want the product to be marketable and made of a good quality for it to sell to their customers and no refunds if the product did suit the users needs.	Retailers would require my product to be compact, non toxic, great quality and if it has market potential and appeals to people. This is because if they plan on selling the product without any knowledge of it they will loose profits because they don't know if anyone will buy it.
User	The user is the consumer, they are the reason why you make a product. This is because they are the sole purpose of inventing a product as it benefits. Moreover, the product we have now is usually demanded by them.	They are the main reason why I'm making this product. This product is to solve their problem with small and compact living spaces. They are able to have 3-4 furniture in one which are useful to them.	The users are what will make the most of the product as they are the one we are selling it to so the design of the product should appeal to them and suit their needs/preferences.	Users will require the product to be very useful to them as well as suiting their taste. This product should be able to do the purpose its set out to do so that the consumer is fully satisfied and wont need to return it.
Transportation	The transport of my product is also very important because without it there is no other way for it to reach retailers around the country therefore not making any sales and profits because no one has the chance to buy it or probably know that it exist yet.	For the transportation, they relate to my problem because their concerns are mostly the size and weight of the product. Also, I am trying to improve heavy and bulky furniture's so that they are easier to transport and store away. This should make the transport of the product fast and efficient.	The transportation would influence the design by the size and weight of the overall product. This is because they need to be able to know how much/many they can carry in their transportation vehicles, so that they narrow down their costs on going back for more.	They would require my product to be lightweight and compact. This is because when they deliver it will be easier to handle and no other machinery is needed to manoeuvre the product from the vehicle to the place of delivery. Having another machinery or vehicle will decrease their profits.
Disposal	They are the ones who will dispose of the product at the end of it's life, because products never really last long so my product needs to be disposed off properly.	They also relate to the problem I'm trying to solve because one of my problem is the product being eco friendly so the materials being source must not affect the environment as much and the material itself should be recyclable or biodegradable.	The materials used for the product has to be disposed off easily, either recyclable or biodegradable. Basically environmentally friendly so that it can be disposed off properly.	They require my product to be easily disposed of. This means that the product has to be eco friendly, it doesn't have to be biodegradable but it should be at least recyclable so that it wont end up in a landfill site somewhere.

Existing Products

Multifunctional chair a.k.a As You Want/Couple Chair is by Bae Se Hwa

Problem : Doesn't fold down/flat, only has 3 purposes and it doesn't look comfortable.

Doesn't fold down/flat = When a piece of furniture is foldable, it gives the consumer many opportunities with the space that the furniture frees up. Foldability is common in furniture's, specially furniture's for small spaces. This is because the consumers will have to fully commit on spending their money on a piece of furniture which will probably be used or not, this would just waste their space, until they finally gets tired of it and get a new furniture.

Only has 3 purposes = It's great to have a furniture that has more than one purpose because it allows the product to function in different ways which means its more furniture for the consumer, they get more for just one thing they paid for. Having multi purpose furniture's really benefits the consumer by saving space and saving money

It doesn't look comfortable = Comfortability is also usually a main key on making a chair and for it to appeal to consumers. For the product to be comfortable or look comfortable their should be some type of cushion or curves within the furniture which would match our spine and follow it naturally to be comfortable. This multifunctional chair could have been designed like this because of the non frequent use, this chair could only be used for a few hours if a guest comes over or the desk is needed.

This product in a student accommodation will accumulate a lot of space, specially when it only has 3 purposes. Additionally, it doesn't fold down which could mean that it will need to be fixed to a certain space in the accommodation and that the space would not get freed up unless getting rid of the furniture. Moreover, this chair was meant for two person which is great for when friends come over but for student use it will be quite pointless and just makes the furniture bulkier.

User: Will this suit everyone's needs? Can it be adjustable/extendable/customisable? Can it fold down for easy storage?
Manufacturer: What type of wood is used? How difficult will it to make? Will the product come in assembly or disassembly?
Transport: How big is the overall shipping size? Does it disassemble to allow a more compact transport? How heavy is it?

Customer reviews: There are no current reviews at all that I can find on the internet with this chair. This is probably because the designer is not from UK or lives in UK therefore its not well known. However, it could also be due to it being a one off design where the manufacturer only designed it for a certain person so would only sell to them.

https://www.pinterest.com/pin/102175485270831857/

Multi Functional chair into table

Problem : Uncomfortable, not adjustable, 2 purpose and it doesn't fold down/flat.

Uncomfortable = it doesn't have cushion or any fabric that would reduce the hard flat surface of the wood. So this would not be suitable for everyday use which means that it's not the right furniture for the students.

Not Adjustable = the height or any other seating type would cause consumers not to buy the product because it doesn't suit everybody's needs. Even though the anthropometry might have been considered , there still are a few who require it to be adjustable so that its ideal for them.

2 purpose = This furniture would be great if it had more purpose so that the space wont be wasted as much. This is because the problem I'm trying to solve is the use of a small compact space

Doesn't fold down/flat = this also causes waste of space as even though they might be used frequently it doesn't fold down enough to easily store it away when not needed. Storing away a product could also free up space for something else needed.

User: What other functions can this product offer? The price? Quality? Storage?

I think this product will be useful in a university accommodation as it wont take up much space and its very convenient that it can be a chair and a table. However, it doesn't offer that much functionality and comfortability.

Manufacturer: Will the materials used be durable? Will this be a machine or labour manufactured?
Transport: Shipping size? Shipping weight? Assembled?

https://www.futuristarchitecture.com/2682-multi-functional-chairs.html/awesome-multi-functional-chair-20

Existing Products Continued…

Next step: Research possible materials you are planning to use.

Loop Chair by Boaz Mendel

Problem : Looks cheap, material used looks weak and it looks uncomfortable.

Looks cheap = this is because of the material used and the overall design of the product.
It doesn't look very appealing because it's designed to be simple and rough because it would weigh down the product compared to the thickness of the wood used.

Material used looks weak = it looks weak the wood is quite thin and the fitting/fixtures used to stable the furniture does not look reliable and can withhold some people's weight. Also it doesn't look durable and probably will fall apart within months of use.

Uncomfortable = it doesn't look ergonomically comfortable, this is because there is no cushions and the wood used is thin therefore might mean that it doesn't give any support and is viable to break any time soon. Moreover, I think this chair is not for relaxing or to be used for a long period of time as it doesn't give any support to just be able to be comfortable.

This product in a student accommodation will probably fit in any nook and crannies as its quite flexible in terms of it changing shape. This is quite small so wouldn't accumulate as much space. However, this product seems quite flimsy and not at all worth the money. This product will probably break within weeks or purchasing due to its heavy use by the students.

User: Aesthetic for me? When's the end of it's life? Are the other functions really necessary?
Manufacturer: Materials needed? Machines or labour?
Transport: Overall shipping size? Weight? How many product?

Customer Reviews: None. I think this is a one off as only Baoz Mendel has the furniture himself. I think this is just a trial and one of his many other designs that he wanted to create and showcase.

https://www.pinterest.com/pin/363807094617230 91/

Sornean Large Multi-Function Backpack Foldable Chair with Cooler.

Problem : Multi purpose but only serves one piece of furniture, uncomfortable, small and doesn't look appealing.

This Sornean chair is multipurpose. It is foldable, it turns into a backpack with a cooler and has storage. However in terms of furniture wise, it only serves as one purpose. This is because it doesn't transform into another piece of furniture.

I think that this Sornean would be just a tiny bit uncomfortable because of the small amount of space/ fabric to sit down on therefore leaving most of our thighs with no support. Moreover, there are no armrests which could have increased the comfortability as our hand can rest on something with ease.

Additionally, this chair would be too small to do practical things with it specially for a university student. I don't think this would be suitable as a student's furniture because it doesn't have enough space to work with. Moreover, this would be great as a lightweight compact chair to carry and use somewhere else but not a fixed furniture in accommodations.

Finally, this chair doesn't look that appealing for university students anyway because of the design and its comfortability as it just looks like it should only be sat on for just a short time.

This chair in a student accommodation could be ideal because of its size and compactability. This chair could be easily transported wherever the students want it as the structure of the chair can be stored in the backpack that it came with. This makes it very convenient as the students can store their other belongings in the bag but this also guarantees them a seat wherever just in their accommodations or places where they want to relax. On the other hand, for long term use I don't think its suitable because it barely offers space to sit their bottoms down let alone offer comfort. Moreover, in their accommodations it will just be a chair or storage and nothing else, this product will require the students to buy another piece of furniture such as a table to be able to use it more than it offers.

User: Will this suit everyone's needs? Will the backpack be compact enough? Can it be adjustable/customisable?
Manufacturer: What materials will be used? How difficult will it to make? Will it come in disassembly or backpack?
Transport: How big is the overall shipping size? How heavy is it? Shipped in a package or just the backpack itself?

Customer Reviews: Most customers from amazon are fairly pleased with the product because of the ease of transporting it and the weight it can withhold specially for the inexpensive price of it. However, some customers mentioned that the chair isn't as comfortable for long term use and majority questioned the durability of the product as parts of the product fell apart easily or on arrival specially the backpack function as the most common issue was the zippers and attachment to frame .

https://www.amazon.com/sornean-Detachable-Multi-Function-Backpack-Folding/dp/B07527H6SL

https://www.pinterest.co.uk/pin/355362226840925503/

Possible Materials

What is needed for the furniture?
Easy to shape, lightweight, durable, hard, non toxic, inexpensive
Any finishing's?
Make it scratch resistant, stain resistant for easy maintenance

How they can be manufactured?

Hardwood vs. Softwood
Hardwood trees are very slow growing trees compared to softwood trees, this tends to make them produce dense wood. Items made from hardwoods are more likely to withstand years of wear and tear. Also hardwood is commonly more expensive than softwood.

Softwoods are more sustainable than hardwood because softwood trees grows faster than hardwoods. Hardwoods have to be managed carefully to make them sustainable, they have to be grown and harvested in the right way. Moreover, softwoods are more popular than hardwood as it's sometimes used as a substitute because it is generally way cheaper than hardwood.

Wood Notes:

Pine(softwood) – maple and oak more durable however pine is lightweight pine also grows faster than oak so pine is more sustainable

Maple (hardwood) – stable, less expensive , harder than many other woods, heavy, resistant to splitting

Oak (hardwood) – strong, easy to work with, resistant to moisture, heavy

Ash (hardwood) – excellent bending abilities, great substitute for white oak

Birch (hardwood) – hard, inexpensive, readily available

Douglas fir wood (softwood) – very inexpensive, moderately strong and hard, resistant to abrasion, doesn't take stain very well so paint have to be used

Cedar (softwood) – highly resistant to rot, easily take stain and paint

Coast Redwood – durable, resistant to decay-(insects, fungi and fire)

MDF – very strong and dense however, it's not a solid wood

Plywood – strong, flat and smooth, resistant to warping

Pine is a coniferous wood, this means that it's a cone bearing seed plant which keeps its foliage all year round. Moreover, this wood can be used widely for different construction projects so it should be easily sourced. Also, because pine wood is a softwood it makes it very easy to work with as it's malleable, even though it has the strength to support a residential frame construction. Furthermore, I think pine could be a possible material for my multi purpose chair because it is lightweight. This would allow the furniture needing less manual handling which could result in any injuries to my marketed students. Additionally, pine is a more sustainable wood than oak as it grows faster and many at once can be harvested and used without having to take too much leaving nothing left for the future generations.

Maple is a tree or a shrub with lobed leaves, winged fruits and colourful autumn foliage. There are two types of maple wood: hard and soft maple wood. Maple wood is one of the harder hardwoods so this will make the furniture durable and take everything life throws at it through the years. This is why maple is commonly used for heavy duty flooring. However, its also widely used to make furniture if they plan to keep it their whole life such as dressers and kitchen cabinets. Maple is not only resistant to splitting but also resistant to rot as it is susceptible to an insect attack. However, if its used as indoor furniture hard maple might not be a suitable choice because it can cause skin irritation, runny nose and asthma like respiratory effects because of the acer genus which is in the wood.

Oak is a very large tree that bears acorns and typically has lobed deciduous leaves. There are around 600 species of oak both deciduous and evergreen. Oak is not only a strong hardwood but is also resistant to insects and fungi which makes oak an ideal material for making outside furniture's. Additionally, oak is in-permeability to water which makes it suitable for boatbuilding too rather than any of the hardwood as its water resistant. Also, since its water resistant the wood will be impervious to staining, fading and cracking when a clear finish or varnish is applied to the oak. This is due to its dryness.

Ash wood is mostly grown throughout North America and this species is known to produce the firmest lumber within the northern part. Moreover, Ash wood is relatively strong considering its weight and its very versatile making it suitable for making stylish furniture's. Despite ash woods advantages, it has many disadvantages such as being difficult to work with, specially with making joints and its considered as a non durable and perishable wood . This means that when it's damp or in contact with the ground then ash wood is prone to rotting. Furthermore, to achieve a fully smooth finish, ash wood has to be filled because of it's open pores . Also ash's long fibre makes it difficult to work with because it encourages splintering.

Possible Materials Continued…

Next step: Research what other materials are going to be used i.e. Fabrics, metal or even plastic.

Birch is a thin leaved deciduous hardwood tree, also the trees grow quickly in northern temperate regions and yield hard, pale, fine-grained timber. It is a major source of veneer. This is a thin layer of wood used to overlay other products such as plywood, particleboard or fibreboard. Plywood made from birch veneer is one of the most widely used of all the hardwood plywood products. Baltic birch is more expensive, but is one of the most durable plywood products on the market. Also, the texture of birch hardwood is coarser and doesn't have a finish like maple which is smooth and have a glassy appearance. Its colour is lighter and stain application may yield mixed results, this is because darker stains do not absorb into birch at an even rate and blotching can occur. Birch plywood does not have many knots or jagged edges. It is smooth and is not known to splinter or crack. This makes it a good choice for furniture as its not a danger to the consumer. Moreover, it's an abundant, fast growing species. This means that there is no destruction or disruption of biodiversity when birch is felled. So Birch is better renewable source than other options that might have a negative impact on the environment.

Douglas fir is one of the most popular and widely used species of wood. There are two varieties of Douglas fir wood and they are Coastal and Interior. This wood is one of the strongest of the softwood varieties and actually rivals with some of the hardwoods. Douglas fir wood is however, more expensive than the other softwoods. However, this wood is not suitable when making beautiful furniture even though it can be stained and finished but this wood lacks distinct grain pattern so is quite bland. On the other hand Douglas fir wood is mostly used in residential and commercial construction this is because its durable, rot resistant, flexible and has great strength to weight ratio. In conclusion, I don't think I will be using Douglas fir wood as its considered an ideal material for buildings and not necessary for furniture. This is because it will be too expensive just for a chair and it has characteristics which wouldn't do the chair justice as my product is an indoor furniture.

Cedar is a type of coniferous wood, meaning that it is classified as a softwood and its cones/needles remain all year round. The cedar tree has developed self protective qualities that allow the tree to fend off insects, rot and temperature related stresses. This makes Cedar wood a very useful material for home building where humidity, temperature and cracking are a common problem. Moreover, many clear cedar can be stained and painted on without loosing its beautiful grained appearance. Cedar wood is also hygroscopic, meaning that if it gets wet, it will absorb water quickly, then release it again just as fast, preventing cracks from forming. In conclusion, if my product was for outdoor use, the cedar would be a suitable material for it, however my chair is for indoor use and would just defeat all the advantages of using cedar wood for outdoor furniture. However Cedar is a fairly lightweight wood because its more porous than other hardwoods which are commonly used in furniture, so when cedar is used moving the furniture around the house will be easier. .

Coast Redwood trees are called sequoias, coastal redwoods and the giant trees of the forest. This is because they can grow higher than a 30-floor skyscraper which is more that 320 feet. Redwood is one of the most beautiful woods available for use in furniture because of its rich, red colour. Also, redwood is extremely durable and weather resistant but redwood's greatest quality is that its reluctant to shrink and decay as it ages, so while other woods turn brittle and crack after time, redwood retains its moisture and stays vibrant longer. On the other hand, redwood is soft, this makes it prone to denting which makes it very difficult to change as it's a very expensive wood. In addition to this, to use a fastener with these wood a high quality stainless steel fastener have to be used or if you want to use a cheaper fastener then your option is to stain the wood first. Furthermore, redwood is fibrous and rich in tannins. Tannins are what helps the wood prevent itself form insect damage.

Medium Density Fibreboard also known as MDF is a manmade wood. MDF is made from wood fibres which are tiny little pieces of hardwoods or softwoods. In addition to that, when the little pieces are mixed with some resin and wax which is then heated up and pressed together will make a fibreboard. MDF is commonly used in furniture because its an economical choice, its fairly inexpensive but being cheap has its disadvantages as once you chip it or crack it you cant repair or cover the damage easily meaning having to buy a new one.

Plywood is a manmade wood. Plywood sheets or boards are made up of three or more thin layers of real wood that are glued together. The thickness of plywood depends on how many layers it has. Also plywood is a versatile material as its used in a wide variety of applications such as moulds, wall and floor, concrete structures and designer furniture. Moreover, its resistant to warping cracking and twisting and is fairly stronger than MDF but both woods weaknesses is water. This is because water destroys them, MDF swells when its directly exposed with water and Plywood becomes heavy.

Technical Requirements

Next step : manufacturing techniques and how some of the chair's different parts are manufactured

Fixtures and fittings for it to be able to fold out?
How its going to be manufactured?
Parts/components within it?

Joints?

- Mortice and Tennon Joint?
- Matched Profile Joint?
- Dovetail Joints?
- Halving Joint
- Tongue and Groove?
- Biscuit Joint?
- Dowel Joints?
- Bridle Joint?
- Finger Joints?
- Ball Spline?

Hinges?

- Invisible spring hinge
- Butt hinge
- Wrap around non mortise inset hinge
- Barrel hinge
- H hinge
- Pivot hinges
- Flush hinge
- Gravity hinge
- Butterfly hinge
- Overlay hinge

Brackets?

- Z Cladding brackets
- Omega brackets
- L shaped corner brackets
- Stamping brackets
- Stamping brackets
- Hinge-Up brackets

Swivel ball?

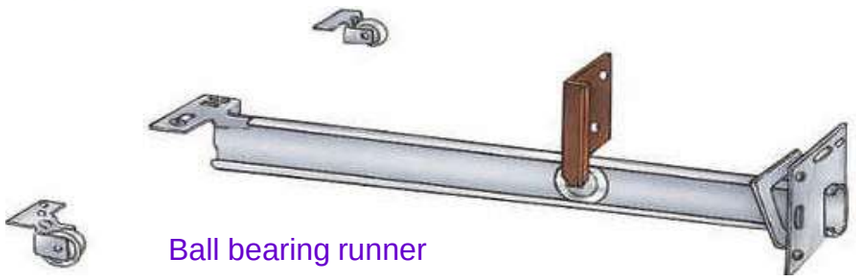
- Footing angle bracket
- Jaw Slide socket, swivel ball and socket

Splines?

- Parallel Key Spline?
- Involute Spline?
- Helical Splines?
  = equally spaced groove form a helix about the shaft, it may be parallel or involute
- **Crowned Splines?**
  = equally spaced grooves are involute but the male teeth are modified to allow misalignment
- **Serrations?**
  = where the sides of the equally spaced grooves for a V, mostly used in small diameter shafts

- Shimano Deore SL-M6000 Bracket & Fixing Bolt w/o Indicator Type - Right - Y0CR98040
- Face fix bracket with cam lock

Groove runner or ball bearing runner?



- Ball bearing runner
- Groove runner

Slip on pipe fittings?

Screw on flaps

Manufacturing Techniques

Next step: Investigate how parts of an existing product is made and what are the parts to make the product function.

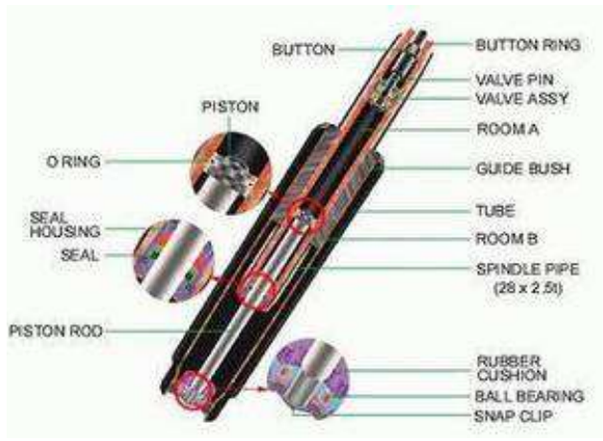
Production methods	Problems/Disadvantages to consider:	Joining techniques
Metal : ➢ Metal casting - Investment Casting , Die Casting or Sand casting ➢ Metal forming ➢ Sheet metalworking	For **metal casting** there could be problems such as porosity which is the most common one and axial shrinkage. **Investment castings** biggest disadvantage is size limitation, small castings up to 250lbs. **Die casting** needs special precautions for evacuation of air form die cavity otherwise it will cause porosity. Also this method is not economical for small quantity production. With **sand casting**, its defects are unavoidable such as surface defects, porosity and shrinkage which cause poor surface finish dimensional accuracy. For **metal forming** cross holes cannot be produced easily so this needs to be considered. Also, higher mount of force and energy is needed for this process than other methods. For **sheet metalworking** there are many different methods with different problems however there are similar defects such as cracks, wrinkling, wavy edges, tearing and alligatoring.	➢ **Welding**(Permanent Joining) = this will produce a stronger and more secure joint than the other methods. Even though it will only join the two pieces of metal together and become one rather than merely bonding the two pieces together. This is because when its properly done the finish weld is as strong as the surrounding metal. ➢ **Soldering** (Permanent Joining) = takes place with fillers, known as solders and when it melts it will solidify and bond to the other metal parts making them join together. ➢ **Bolting** (Temporary Joining) = this is secured by mating of screw threads ➢ Riveting (Permanent Joining) = rivets are bolt like devices, rivets are inserted through parallel holes drilled across. The joining members and punched from the other side to produce firm locking joints. ➢ **Brazing** (Permanent Joining) = same method with soldering with the fillers. However brazing can join dissimilar metals together and when properly joined the joints can be stronger than the metals being joined ➢ **Adhesive joining**(mostly Permanent Joining) = this joining technique will involve glues, epoxies, or various plastic agents that bond by evaporation of a solvent or by curing a bonding agent with heat, pressure or time.
Wood : ➢ Steam bending ➢ Routers ➢ Laser cutters	For **steam bending** the problems would be accurately predicting spring back, as there will be a slight spring back after the wood is released from the jig. Also, having to construct the steam box and the method itself being not as accurate at shaping than other shaping methods. For **routers** the disadvantages are that the machines are not good at cutting radial shapes. Moreover, the routers are very expensive to purchase and maintain, this method also uses a lot of electricity. For **laser cutters** it has a high energy consumption and the laser beam is very delicate to handle so its not capable in cutting thick materials.	These wood joining techniques would be even stronger with wood glue blocks or screws ➢ **Corner Bridle Joint** = is also known as a slot mortise and tenon. This joins two member at their respective ends which will then form a corner. This form of joint is commonly used as legs to hold it upright. ➢ **Tongue and groove** = one edge of a timber will consist of a slot that runs down the entire length of the wood and a tongue on the edge of a separate piece of timber which should fit into the slot. ➢ **Biscuit joint** = for this technique to be achieved you will need a tool called biscuit joiner. The biscuit joiner will cut a crescent-shaped hole in the opposite edges of wood. An oval-shaped, compressed wooden biscuit will be covered in glue or the slot is, but the biscuit is immediately placed in the slot where the two pieces of wood can then be clamped together. The wet glue will make the biscuit expand and improves the bond. ➢ **Dado Joint** = this a cut or slot into the surface of the wood . A dado is cut across or perpendicular to the grain which is differentiated from a groove which is cut or parallel to the grain.
Fabric : ➢ Knitting ➢ Weaving ➢ Crocheting ➢ Knotting ➢ Felting	Disadvantages of **knitting** are that the dimensional stability of the fabric will be lower than the woven fabric . With **weaving**, it depends with the type of machine used but its has a high power consumption which is high costs. For **crocheting** it doesn't produce fine, stretchy fabric but however does produce lacy firm textures. Also altering a mistake is very difficult so starting again or ripping back is a way to solve it. **Knotting's** main drawbacks is the size (thickness), tails and causing yarn breaks. For **felting** the process is just slow and consequently expensive.	➢ Stitching - **Hand sewn** = this method consists of using needle and thread. This joins fabric together using the thread. It is very time consuming and inefficient but can be useful as its not as restricting as a sewing machine. **Sewing machine** = this can be used instead of hand sewing because its faster and more efficient (but this can depend on skills). ➢ Fusing - **Fabric glue** = is an adhesive which is specifically for fabric, this will allow fabrics to join together without the need of stitching. This is not stronger than stitching but still last longer. ➢ Heat sealing = this is used for synthetic fabric which are made from thermoplastics. These materials could be such as polyester or nylon. Heat sealing is used to set a material into a shape and seal the seams on tents and all weather gear to make them waterproof.
Plastic : ➢ Injection moulding ➢ Compression Moulding ➢ Rotational moulding	For **injection moulding** the problems could be the part design restrictions as the product can be quite limited. Moreover, it will be very expensive as the costs of the tools and machinery is high. For **compression moulding** the moulds are pretty basic so this method would not be suited to complex designs. Moreover, its low cost effectiveness which means waste of money if the moulded object has a defect as it cant be repaired or reprocessed. For **rotational moulding** it has the same problems as compression moulding with the design limitation but also material limitation as it can only take poly-based resins. The materials used are also fairly costly.	Plastic products are often moulded so they just snap together. ➢ **Solvent bonding** = this method is traditionally only used in joining thermoplastics. Solvent bonding involves coating plastics with a solvent and clamping them together. This solvent will soften the plastics and when it evaporates, the plastics are then bonded together. ➢ **Welding** = there are different types of welding for different types of plastics as some are difficult to weld. Vibration welding is the one which is often used when other bonding methods are impractical. This is when you vibrate one of them to create fiction which will heat the plastics and weld them together. ➢ **Mechanical Fastening** = this is used when precision bonding is not required. It's the simplest way of joining plastics and it is more suited for joining stronger plastics. Mechanical fastening involves joining plastics together with simple fasteners like latches and nails.

In-depth Of An Office Chair Parts

This is part of the control plate. The control plate of an office chair is basically what will make the chair function. Depending on the chair the control plate mechanism can be multi-functional which will allow the user to adjust the chair to their preference and probably a correct ergonomical position. This particular function here is what determines the height of the chair. So when the lever is pushed down the gas lift will compress and gently bring the chair down. Also, when its pulled up the chair will gently rise up. However, it will only rise when there is no weight pressure of the chair and will only go down if there is weight pressure.

The hand like part that you see through the hole is part of the lever which is also called the control handle. This will be the one that will trigger the button when the lever is pushed or pulled. When the lever is pushed down and the user is sat on the chair (which applies pressure), the lock will be released which will then allow the piston to move. This is because the downward force exerted is now bigger than without the weight of the person which is just the nitrogen therefore making the piston rod go into the cylinder compressing the gas while it goes down. As the gas gets compressed, it's pressure increases and provides greater resistance to the net downward force. And at any time the user can release the lever to lock the height of the chair.

This a gas lift. The silver and thinner part of the gas lift is what will expand out. The black button-like circle at the top of the gas lift is called the button. This button is triggered when the lever/control handle is pushed down or pulled up. Once its triggered the nitrogen which is already in the gas lift is compressed as the piston rod reverts back to the cylinder (making a hissing sound) while the chair descends.



This picture is the back part of the chair where the backrest will be slotted in the hole. The massive knob on the right controls the height of the backrest for more a more ergonomically comfortable position. Moreover, the slant cut out of the hole allows the back rest to slot in and keep it in place.

This component here is the knob that adjusts the backrest's height. This screws in with the components below but with the knob the only one being visible. When it's screwed tight the back rest will be in fixed in place due to squeezing the nut below which will pressure the side of the hole making it tighter therefore keeps the back rest fixed.

These components on the left are the screw and nut for the adjustability of the back chair. It determines how high or low you want the backrest for your height preference and comfortability. These components will be hidden in the back arm which also hold the backrest. The nut screws in first then the knob is screwed and when tightened, the backrest will be fixed in place.

This is a video of me unscrewing the knob. When the knob is being unscrewed one side of the hole with two vertical cut outs (which you cant see here) will be released of stressed as the nut is not pressured anymore. This is because the side with the cut outs is quite flexible giving a leeway to adjust the backrest when the screw is loosened.

*insert video

Possible Materials Continued…

Next step : What other technical requirements are needed for the chair. Knock down fittings?

Stainless steel is a silver and very shiny metal. It's durable, flexible, resilient, and lightweight
It's strong because of the chromium, the chromium protects from rust and corrosion
Because it can be formed into any shape it's a common choice for manufacturing foldable chairs and tables

Iron is the second most abundant metal on the earths crust. Iron is silvery-grey in colour and oxidizes in normal air which makes the metal rust. Also, iron is flexible as the shape of it when heated it can be easily manipulated into any shapes imaginable. Additionally this metal is brittle therefore making it stronger than wood or copper.

Aluminium is the most abundant metal on the earth's crust and this is a good thing because it is widely used. Aluminium is silvery-white, soft, non-magnetic and ductile metal. Apparently aluminium is a good choice of metal because its economical, safe and ecologically sensible.

Brass is a binary alloy composed of copper and zinc. Brass is easy to work with as it can be formed into any desired shapes and forms while retaining its high strength. However, this all depends on how high or low their zinc and copper contents are. It also has aesthetic properties with colours ranging from deep red to golden yellow.

Metal Notes:
Stainless Steel - very common material used in furniture manufacturing. However gets pricy depending on the type and thickness

Iron- heavy- heavy to lift and move around? Can be good in windy days if used for outdoor furniture
Can easily rust and corrode if not waterproofed

Aluminium- lightweight – ideal for folding chairs
Strong compared its strength to weight ratio.
Tubular aluminium – flexible and hollowing
Doesn't rust but does oxidize – turns to chalky white

Brass – strong, ductile, machinability, hardness, wear resistance, corrosion resistance and has an attractive appearance

Fabric notes:

Most of the fabric I'm thinking of going to use are eco friendly and should be easy disposed of i.e. recyclable or biodegradable.

Cotton – good absorbency, colour retention, good strength, soft, machine washable, easy to handle/sew

Cotton Blend – sturdy, family friendly, stain resistant finish can be applied

Hemp – good abrasion resistance, durable, breathable, washable

Rayon – strength, great absorbance, soft, biodegradable

Wool – sturdy, durable, resistance to pilling, fading, wrinkling and soil.

Cotton comes from a cultivated plant which is from the genus Gossypium. Cotton is widely used, in fact it's the most used fabric all over the world as they are in used in our everyday lives. They are used in our clothing, household items and furniture's so should be fairly easy to source as its highly demanded.

Cotton Blend is cotton blended with some other fibre, usually half and half. This mixed fabrics makes the material more breathable and wrinkle free unlike the cotton which need special attention for maintenance. Also, cotton blends are stronger therefore making it ideal for furniture's as it needs to be able to resist wear

Hemp is a cannabis plant and it's the oldest domesticated crops known to man. The fibre extracted from the stem are used to make ropes , fibreboard and strong fabrics. Also it's a high yield crop that produces significantly more fibre per acre than either flax or cotton so can be harvested a hand full of time if it's highly demanded.

Rayon is made from regenerated cellulose some type of rayon's can also be produced from any trees as its created from a cellulose. The rayon's strength is also from the cellulose, the rayon's fibres strength is it's versatility and ability to blend with other fibres

Wool is a textile fibre which is obtained from sheep and other animals. Some people find wool unethical because of the use of animals. However, wool is a great fabric as its absorbent, lightweight , comfortable, durable and recyclable.

HDPE has a much higher density so its often used in construction e.g. drain pipe. LDPE is widely used in plastic packaging such as grocery bags this is because it's a very flexible material which has a high ductility but low tensile strength. While HDPE is strong, high density and moderately stiff.

PVC compared to other plastics is very dense and readily available. It comes in two forms which could be rigid and flexible. Flexible PVC is more amenable to bending due to the plasticizers which is why its used for electrical wires. While rigid PVC is mostly used as pipe for plumbing. This is because its very hard and has good tensile strength.

Possible plastic to be used?

Polyethylene Terephthalate – high ductility, high impact strength, low friction

Polyvinyl Chloride – strong, hard, dense, inexpensive, rigid or flexible

In-depth Of An Office Chair Parts Continued…

Next step: Make rough models and analyse them

This right here on the left is the gas lift with the telescopic cover attached to it. The gas lift is basically what acts as the leg of the chair and this will adjust the height level of the chair when its lever is released. This gas lift will compress the nitrogen gas installed within the cylinder to make the seat gently go down. I think this is the bottom end with the pin which is really a clip. This is called the gas lift clip. This end is what attaches to the base of the chair as the base also has a similar clip which should attach with each other and the other end with the button attaches to the control plate.

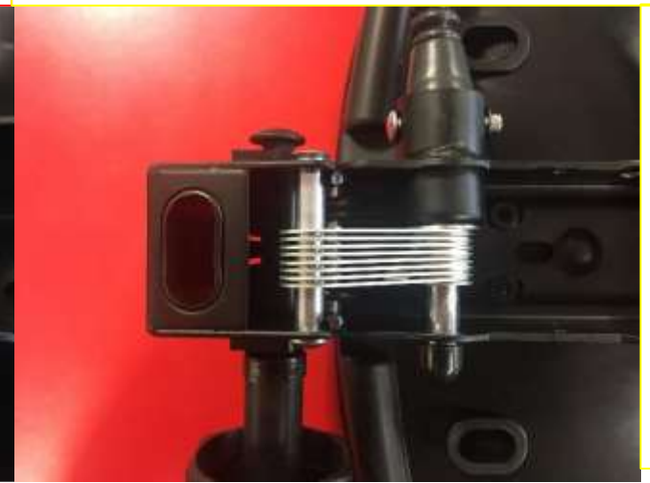
This picture here is still the gas lift but with the telescopic cover attached to it. The telescopic cover is there to hide the gas lift to make it look decent, but most importantly it protects the gas lift from the dust, dirt and damage. The telescopic cover will extend along with the piston rod when it extends, thanks to the telescopic look, the covers will stack on top of each other.

This here is the back arm which holds the backrest in place. It also holds other components within it along with the knob. There is a slant cut out as a way for the backrest rod can pass trough with the help of the ball like which retracts in when pressure is applied. This cut out means that it will be easier to insert and keep the backrest rod in place. There are also two vertical slots just below it. This small space in between the slots is somewhat flexible so that it can squeeze the rod in when tightened. This then allows you to adjust the height of the backrest as people have different torso lengths

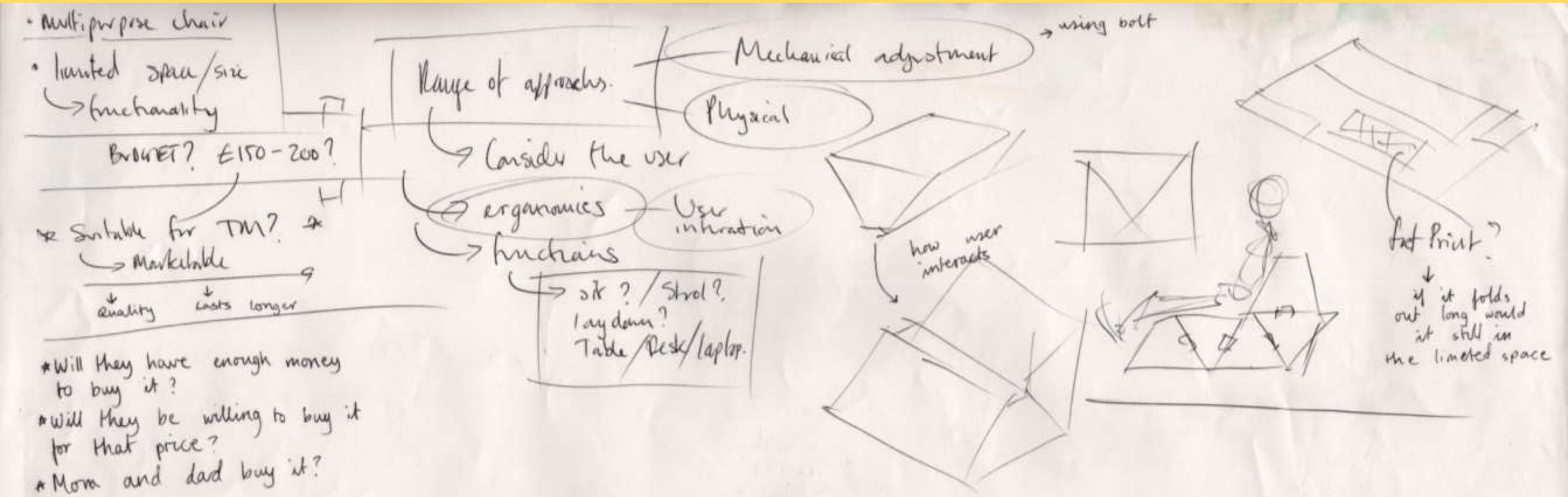
This part of the office chair is to able the person to adjust the back of the chair. This will make the chair either fall back further to a more relax posture than up straight. This mechanical part helps out back posture so that the consumer wont experience any back problems as it will not be stiff and in one position. This will give better back support because all people are different and have different preferences. Furthermore, this mechanism not only allows you to adjust it for one time use, it will also allow the consumer to adjust it whenever they like as they can just lay back and put force and it will surely automatically lock to the position.

This part of the office chair is called the back tilt mechanism. I don't specifically know what the silver spring like metal is but I think that's what controls the tilt. I think it helps the backrest to be more fixed and not fall back down straight. I think it adds tension so that the consumer can slowly adjust it to their preference.

I think the silver spring like metal is called infinite lock. This allows the consumer to freely adjust the backrest to a comfortable position when the lever is released. However, I think the infinite lock allows the backrest to automatically revert back to its upright position. Also, the consumer can lock the backrest an infinite number of positions within fixed range.



This is all because of the tension within the infinite lock, when the lever is release the tension is loosened therefore allows it to tilt back.



Stakeholder Review
- Group Discussion

In this group discussion we talked about people's proposed ideas, criticizing their product's design so that they can improve it or get a better understanding of what they need to do next with their product. We went through the list of stakeholders asking questions about each one to make the person carefully think about their design to explain what their product is and if it will actually work, with us giving ideas for any improvements needed. Moreover, the discussion was about showing what are the holes and gaps in our project specially my project. All that was discussed showed me to go more in depth detail, to show how pieces actually come together and finally decide on what materials I am going to use and why. Also, I need to consider all of the stakeholders and plan how I'm going to approach the retailers, suppliers, marketing and investors requirements.

Proposed design idea plan
- What I need to improve on

For my proposed design I need to

- Show how my chair comes together – maybe an exploded drawing
- Or draw in details or step by step how they will form
- Sketch alternatives that can be used to show which is better and why you choose it
- Show trial and errors, explain why it wouldn't work
- Show what you don't understand but give examples
- Change design ideas for development
- Make more models that's actually an improvement for

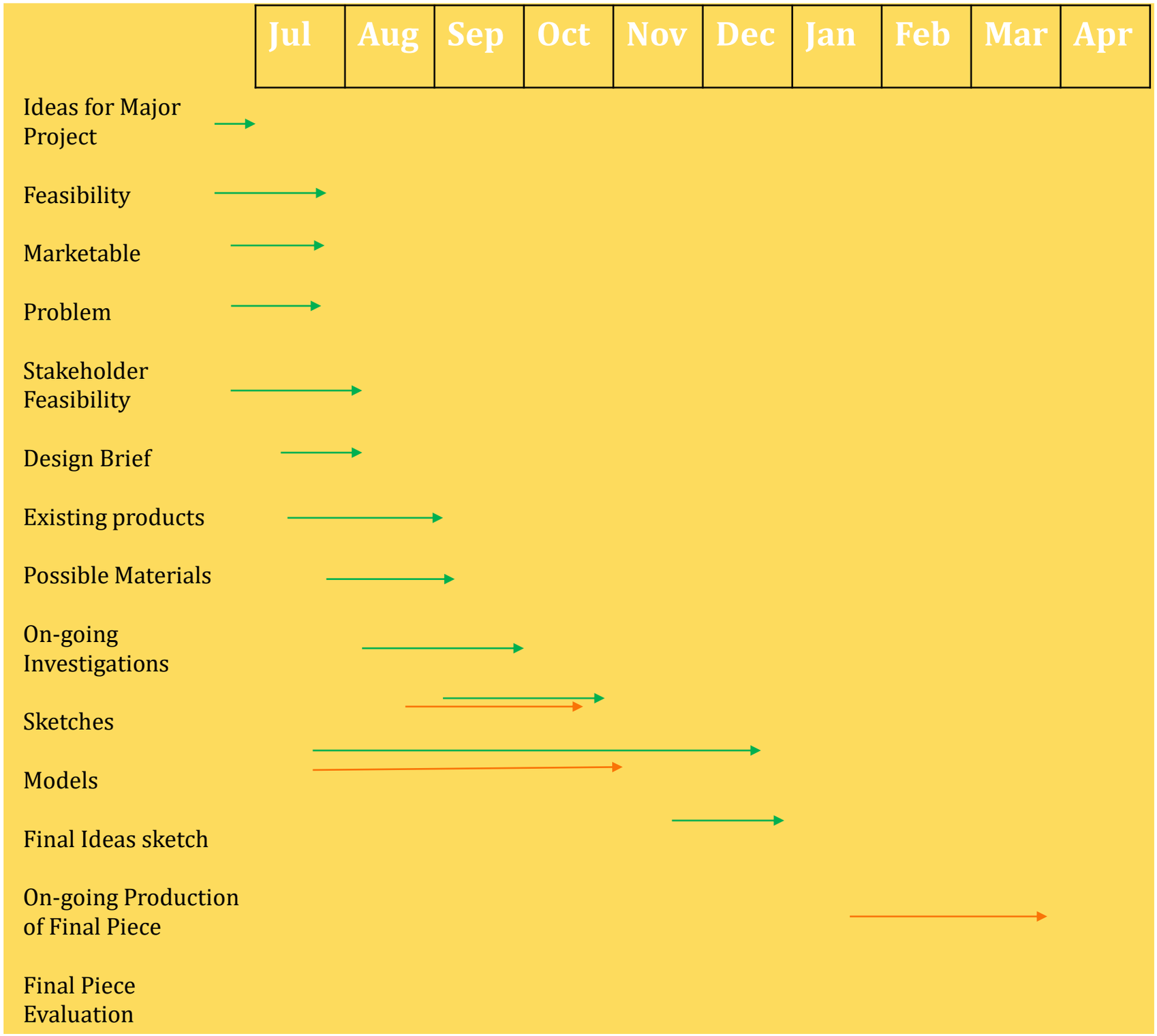
Time Management

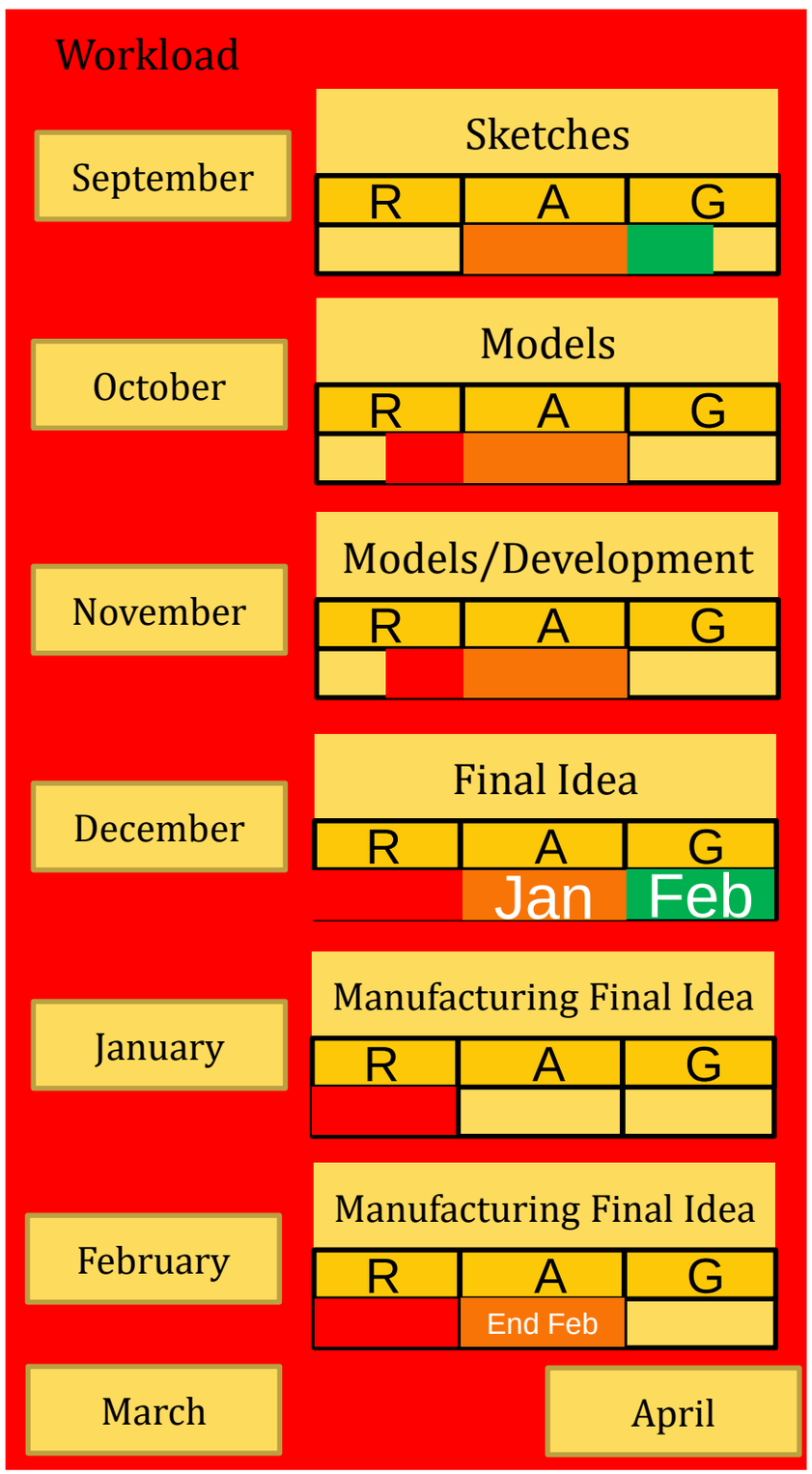
*Set goals and dates
*what you think you've finished
*where you currently at and where you need to be
*workload RAG

Targets/Goals:

- Aim to create 3-5 more models which develops from the models already created
- Write in bullet points how your models are going to be manufactured, materials used, fixtures/fittings and how it will work/ wont work together
- Research more on what materials or manufacturing techniques you are planning to use for your final idea
- Create a final sketch which solves your problem

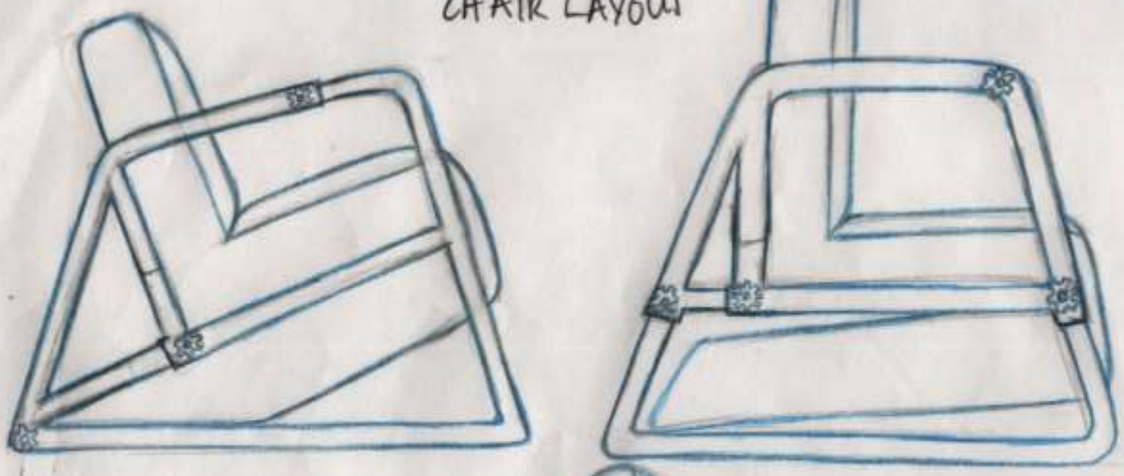
Deadlines : Models = end of October, Development = end of October, Final sketch = 1st week of November (latest is mid November)





Multi-Purpose Chair
Rough Ideas

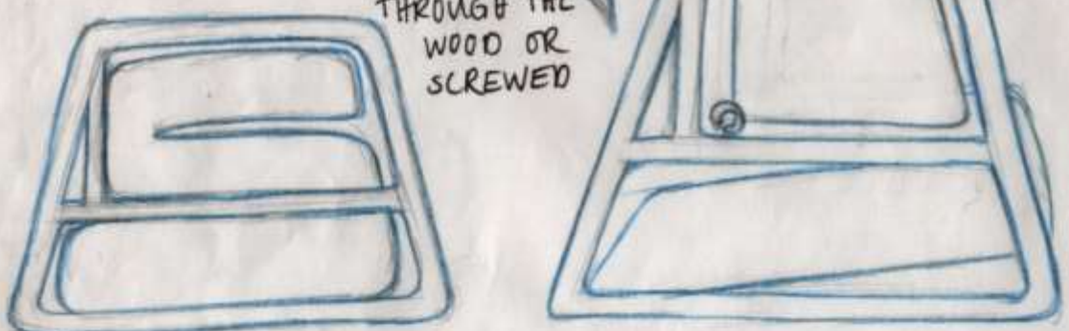
EXPANDS TO CHANGE CHAIR LAYOUT



SOME SORT OF TIGHTENING MECHANISM
↳ EXPANDS WHEN LOOSENED
↳ SHRINKS WHEN TIGHTENED

ATTACHED THROUGH THE WOOD OR SCREWED

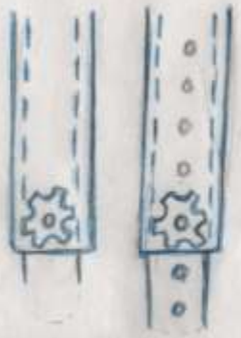
SWIVEL BALL



STOW AWAY FORMA

ATTACHED ON THE INSIDE OF THE POLE

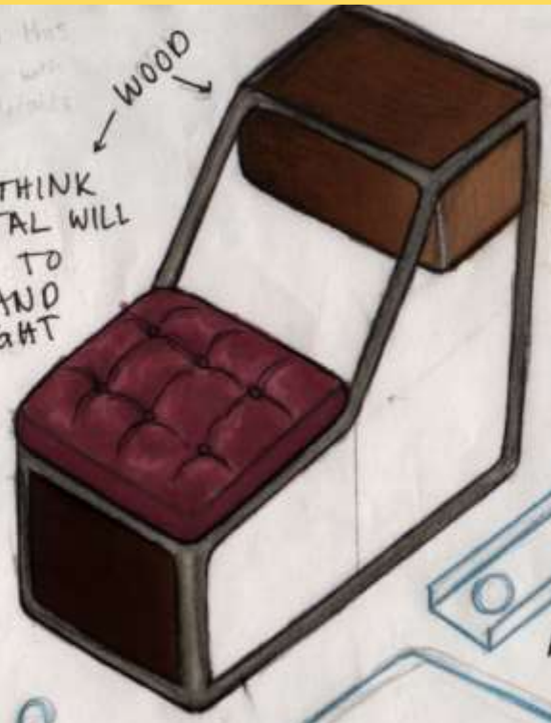
OR



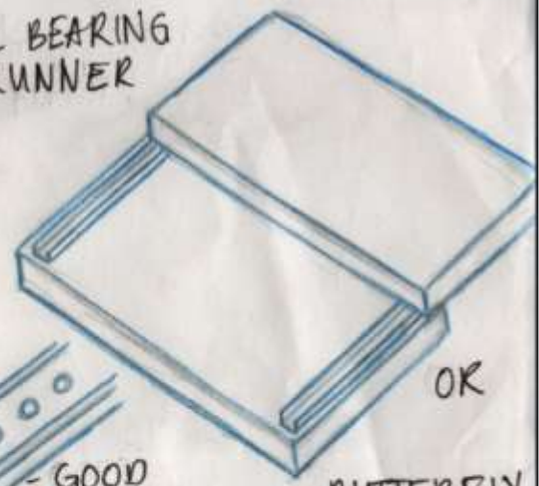
LOUNGE CHAIR FORMAT

WOOD

HEAVY
- I DONT THINK THE METAL WILL BE ABLE TO WITHSTAND THE WEIGHT



BALL BEARING RUNNER



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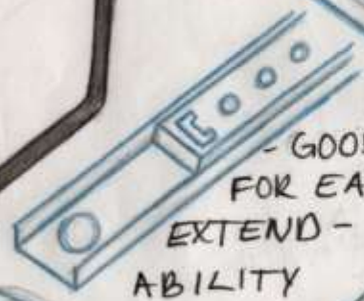
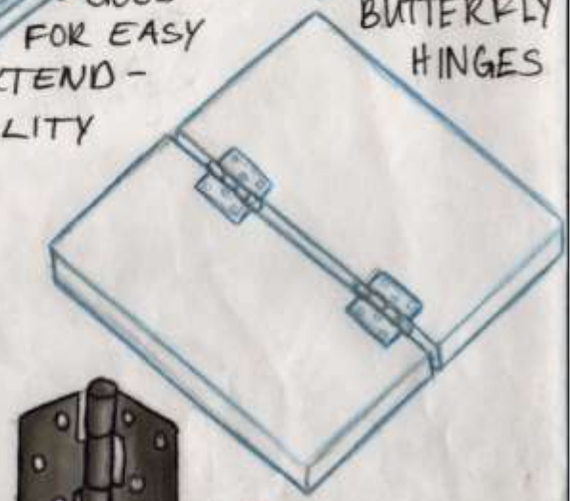
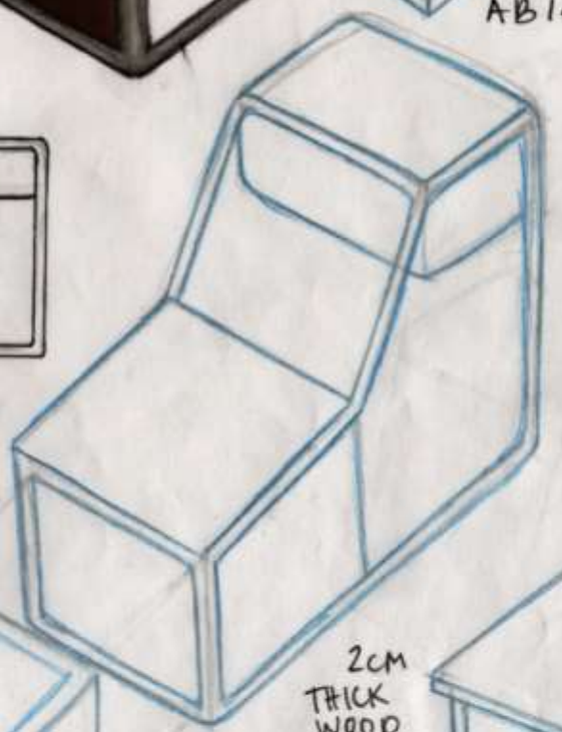


- GOOD FOR EASY EXTEND-ABILITY

BUTTERFLY HINGES



A FOOTSTOOL

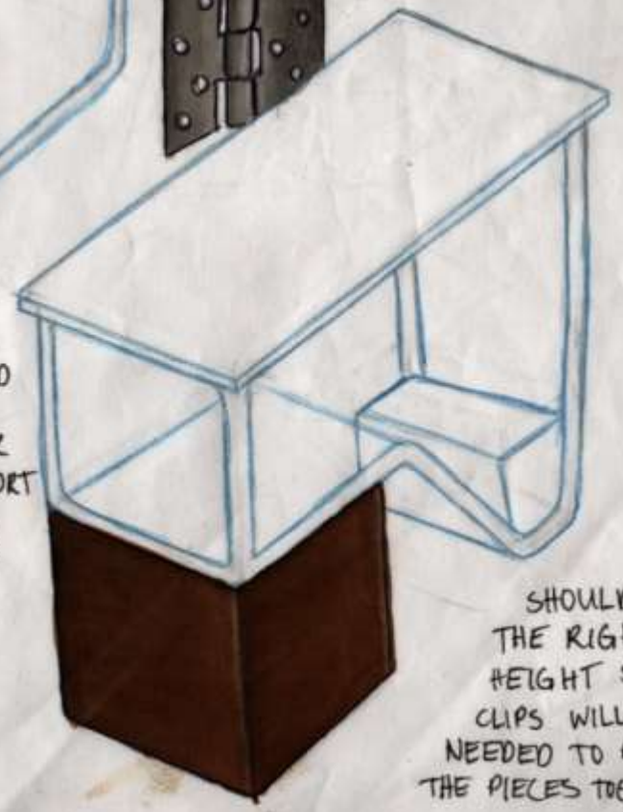


WITH STORAGE COMPART-MENT

OR JUST STOOL

TABLE FORMAT

2CM THICK WOOD ATTACHED TO THE BOTTOM FOR MORE SUPPORT BUT ALSO AS A TABLE TOP



SHOULD BE THE RIGHT HEIGHT SO NO CLIPS WILL BE NEEDED TO ATTACH THE PIECES TOGETHER

NOT ERGONOMIC
→ NOT COMFORTABLE FOR LONG TERM USE

NEED TO CONSIDER THE SHAPE OF THE BACK ↓
THIS CHAIR COULD CAUSE BACK PAIN

THIS IS PART OF THE BACKLEG

METAL ARM FOR THE DESK

ATTACHED TO THE BACK LEG

METAL ARM WILL SUPPORT THE DESK

DESK WILL ATTACH

← SWIVEL

ADJUSTABLE DESK

GO PRO DESIGN CONNECTOR

HEAVY
→ MOSTLY ALL WOOD

HAND REST FOR SUPPORT IF TABLE IS NOT NEEDED

ON THE INSIDE OF THE HANDLE
→ LESS VISIBLE

STEEL PIPE FOR STURDIER SUPPORT

STOW AWAY FORM

BACK REST CANNOT BE ADJUSTED AS THE ONLY SUPPORT IT HAS IS THE STEEL PIPE AND THE OTHER FACE

TOO SMALL
→ ITS NOT LONG ENOUGH I THINK TALL PEOPLES FEET WOULD JUST HANG ON THE END

DOESNT LOOK APPEALING

DONT OFFER MUCH SUPPORT

ROLLED OVER

ATTACHED BY TYING THE TWO STRINGS

OR

ATTACHED BY HOOK-AND-EYE

STOOL

OR

CAN BE A TABLE WHEN TURNED UPSIDE DOWN

IT'S COMPACT AS IT DETACHES

ADJUSTABLE LOCKS BY TIGHT-ENING SCREW

STRINGS WHICH ARE COILED LIKE ROPES

NOT COMFORTABLE

NEED TO CONSIDER THE ERGONOMICS

ALSO THE AVERAGE HUMAN SIZE, TO SUIT EVERYONE

VERY MINIMAL BACK SUPPORT

CLIPS WILL BE USED TO ATTACH THE PIPES TOGETHER

PLASTIC?

OR

SLAT WHERE THE WOOD WOULD BE PLACED SNUGGLY

CAN BE BOLTED ON THE SIDE WHICH IS MORE FIXED.

FIT UNDER A SINGLE BED IN THE LOUNGE

CHAIR FORM

CAN BE A FOOTREST OR A MINI STOOL

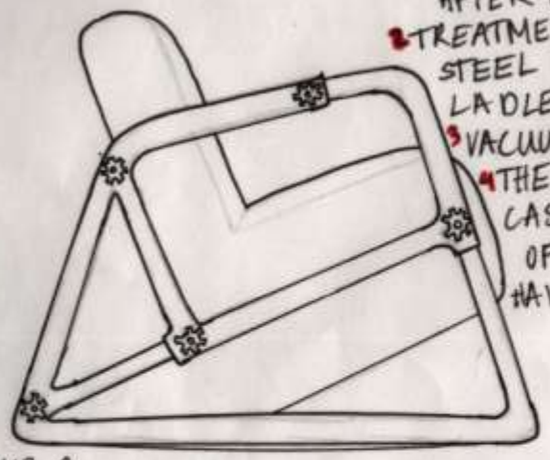
OR

A LOUNGE CHAIR

FOAM USED SHOULD BE FOLDABLE OR EASILY CHANGES SHAPE

THE BASE OF THE CHAIR UPSIDE DOWN

FLEXIBLE FOAM



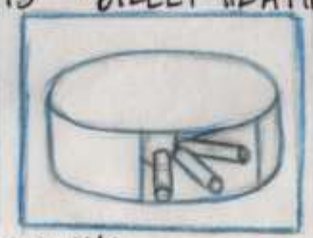
CHAIR 1

HOW STEEL PIPES ARE MANUFACTURED.

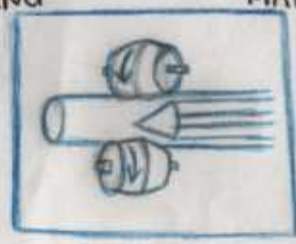
1 AFTER MELTING,
2 TREATMENT OF STEEL IN LADLE FURNACE
3 VACUUM DEGASSING,
4 THE CONTINUOUS CASTING PRODUCTION OF BILLETS HAVE STARTED.

5 CUTTING OF BILLETS

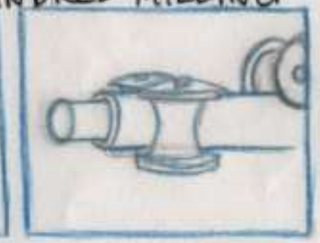
7 BILLET HEATING

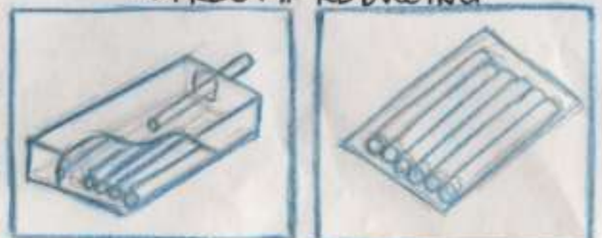


9 MANDREL MILLING



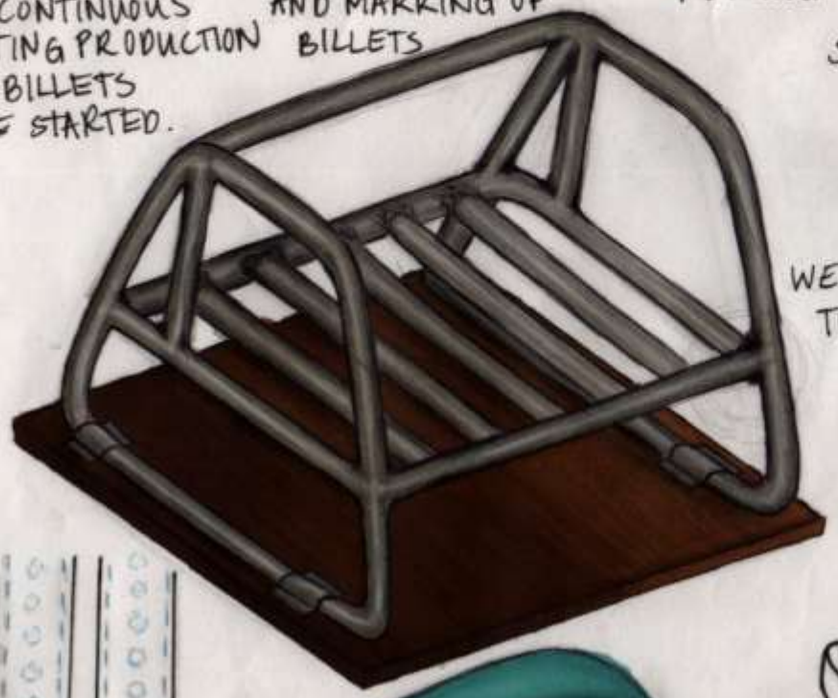
11 STRETCH REDUCING





8 PIERCING

6 THEN COOLING AND MARKING OF BILLETS



10 HEAT TREATING

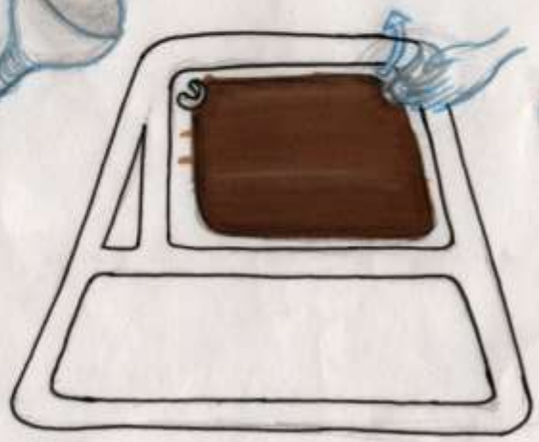
12 COOLING

OR

SWIVEL BALL

IDEA 1

WELDED TOGETHER

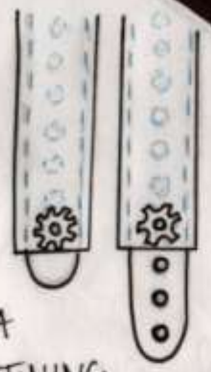


IDEA 2

CARBON STEEL PIPES

CHAIR 2

↳ EXPANDS TO CHANGE LAYOUT OF CHAIR 1



A TIGHTENING CLAMP?

OR

CURVED SCREWING PLATE?

- NOT AESTHETIC AS ITS VISIBLE

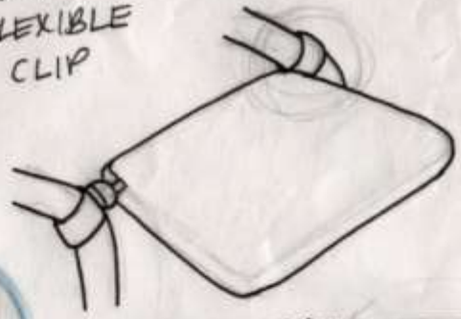
STOOL

STOW AWAY FORM

↳ SHOULD FIT UNDERNEATH SINGLE BED

BECOME LOOSE THROUGH THE YEARS

ROUND FLEXIBLE CLIP



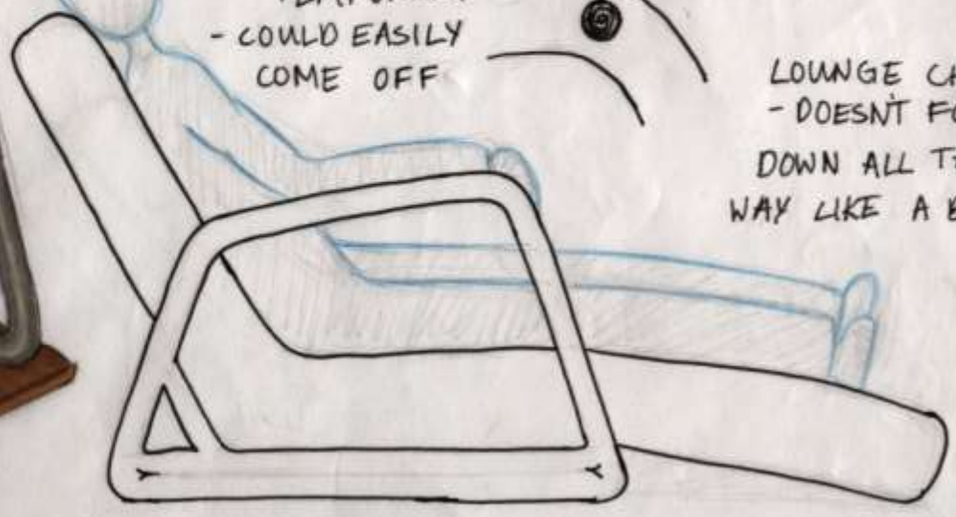
TEMPORARY

- COULD EASILY COME OFF

MIGHT NOT WORK DUE TO THE WEIGHT ALSO, ONLY ONE SIDE HAS SUPPORT

LOUNGE CHAIR

- DOESNT FOLD DOWN ALL THE WAY LIKE A BED



ZIPPERS TO OPEN THE SLOT

BUTT HINGE

SLOTTED IN FOAM

EXTRA FOAM STORED UNDER-NEATH

LOOSE TONGUE AND GROOVE

NO ADHESIVE BECAUSE ITS NOT FIXED, ITS REMOVABLE

I DONT THINK THERE WOULD BE ENOUGH ROOM FOR THE USER

SEEMS CLAUSETRO-PHOBIC WHEN DESK IS INSERTED

EXTENDABLE EXTRA PLANK OF WOOD FOR THE BENCH/SOFA TRANSFORMATION

BOLTING METAL TO WOOD

ONLY TEMPORARY → MIGHT FALL APART

SNAP FIT

WILL BE HOLLOW

PLASTIC? RUBBER?

TUBULAR ALUMINIUM
→ FLEXIBLE
→ HOLLOW
→ LIGHTWEIGHT

3 WAY PIPE FITTING CONNECTOR

CLIPS ATTACHED TO THE FOAM WHICH ATTACHES TO THE BASE STRUCTURE

EXTRA FOAM

Rough Model

Analyse and evaluate model
+ a video talking about the model

This is a very rough model which is unfinished but I knew from the start (initial ideas drawing) that this was not going to be ergonomic. This is due to the lack of comfort or following the natural curves of a human body which will support it.

I decided to make this anyway because I wanted to experiment on the design and see how I could change it to be more ergonomic. However, I stuck with the original design because it would ruin my other purpose (like the table part).

I do think this is successful for the purpose of having multiple furniture. However my intended product was offered way more than this model. Furthermore, my models intended purpose was just to be a chair, chair desk, stool and a table.

Strengths
- multiple purpose just like my intended product
- Wood frame = sturdy
- Storage space

Weaknesses
- All wood = heavy and expensive
- Uncomfortable
- Not adjustable

Materials used?
Model = cardboard, wire, tape and super glue
Real product = pine, wire or a pivot hinge and mesh wire

Suitable for the consumer?
I think this would be suitable for my target market because they probably wont have enough space for a lounge bed so this would be perfect as its all the necessity: a chair, desk, table and stool/storage.

Packaging?
If I decide that the product will come disassembled then the packaging size would be smaller than having the assembled final product. For my packaging materials I would use cardboard to transport my whole product and bubble wrap for any corners.

Aesthetics
I don't think this would suit everyone's style because people might not be a fan of wood grain . However, I am going to pick a wood which can take on paint so that they can customise it to suit their taste.

Size?
Since this model doesn't transform to an even smaller scale I'm afraid that its going to be quite big and wont be able to be stored underneath a single bed with ease.

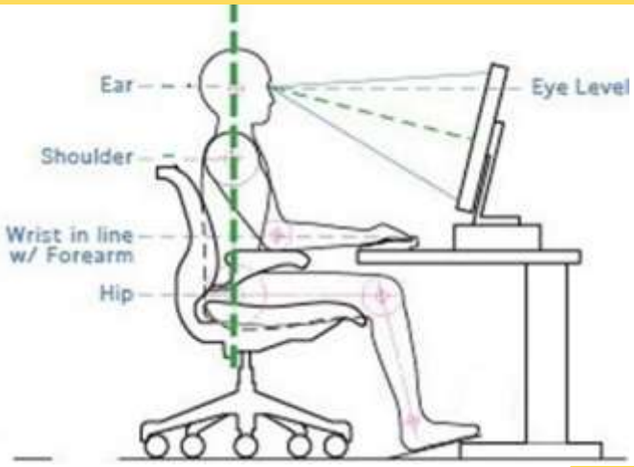
Safety?
This model is quite boxy so the real chair must have round corners and the wood used must not be toxic or easily splinter. This is because these would all result endangering the consumer.

Ease of use?
This would be pretty easy to use as it doesn't have drastic transformations that are difficult but very small ones like flipping over a table to extend it, pulling out the box for a stool or storage unit, turning the chair upside down or just turning yourself around to have the chair desk option.

Cost?
This would probably be too expensive to make and selling it for less than £200 will not be ideal. There will be no benefits as there are no profits. So I could change parts of the chair to be metal so that it wont be as heavy too.

Environment?
Timber is one of the most energy efficient materials available due to solar energy. The forest will continue to be the source of environmentally friendly products if they are sustainably managed to it being the product of. And pine is more sustainable than other woods as it grows fast an can be harvested in huge amounts while still leaving some for the future generations.

Production?
The frames and the pieces of wood and metal would need machinery. They would probably be batch made, in assembly I'm still not sure whether its going to be assembled by a worker or the consumer.



- Not **ergonomically** right for seating comfortably at a desk

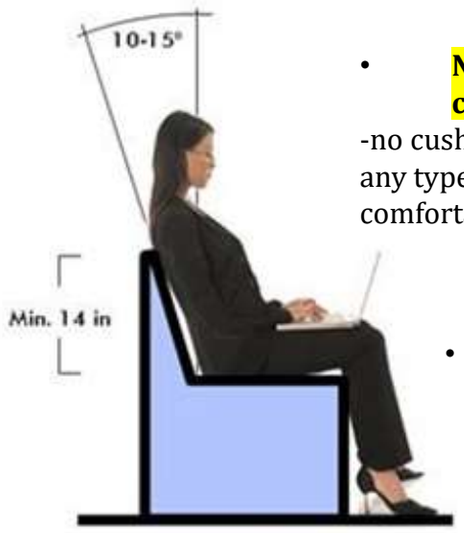
- Definitely **not suitable for everyone**. No measurements or adjustments considered through the design process.

What's wrong with this design?

- **No back support**
When the desk is needed the person needs to face the back support therefore wont be using it. This could also cause back pain for the students as there is no support for their back.

- Not **able to function** as a lounge chair/bed

- **Not compact**, this doesn't fold down into a smaller version which can be stored away



- **No comfort**
-no cushions or any type of comfortability

- However, in a **relaxed** normal seating it works well as long as the back and shoulders are **10-15 degree angle** like in this picture.

- **Limitations** when using the desk. The back rest is **on the way** and there is **not enough space** for leg room.

- Quite **restricting**, it doesn't allow you to be comfortable as its missing a lot of important objects that gives the body support which allows it to be comfortable.

- There are **no adjustments** whatsoever.

- **No seat height adjustment**
- a small variety of people will only be able to use this chair if it matches their measurements

- **Back rest adjustment**
- cause them back problems if it doesn't support it properly

- **No arm rests**
- not a necessity but might be needed when their arms get tired so its just there to rest it

- Manufacturing Techniques: For this chair it could be **CNC Machining** or a **Multi-head moulder** for the other parts of the chair. However, since my chair doesn't have intricate shapes I feel like CNC machining will be **too expensive** to use for just a small precise part. The Multi-head Moulder will do the job as it can cut various types of shapes such as V's, U's and L's.

Improvements/what need to be done?

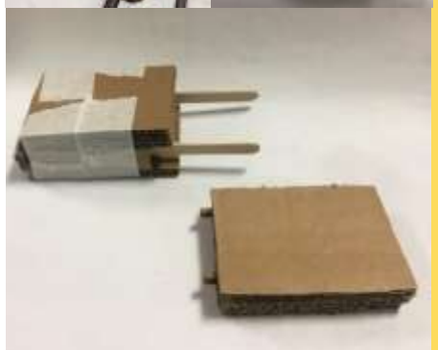
For this design, I need to change the back seat and the extendable desk. I need the back to be at least **adjustable** if there is no other way I can change the shape to **follow the natural curves** of our back. For the back seat to be adjustable and still perform the other functions it has there could be an extended piece of wood that runs at the back of the seat and have holes so that the back can be slotted in and out to change the **reclining position** of the chair. As for the extending desk, a ball bearing fixture could extend out arms of wood so that an extra piece of wood could be laid on top which slots in with the desk via slot and groove for a more fixed outlook. This would allow the extended desk to have more support and a flat surface.

- Desk extends however the table will **not** be **a flat surface**

- Don't necessarily know if it will work out in real life i.e. if the rotating hinge or butt hinge will be **able to withstand the weight** of the extending desk as it's the only thing holding it.

OR

- Ball bearing that will slide out and an extra piece of wood will be placed on top enable it as a flat surface.



- Could also be used as storage for the extra piece of wood for the extendable desk

- Tongue and groove so that it's levelled and won't slip off.

- Temporarily attached so that it can be removed and stored if not needed.

What Makes A Good Ergonomic Chair?

What is ergonomics?

Ergonomics is the study of how **efficient** people are in their **working environment**. It's also the process of **designing** or arranging **workplaces, products and systems** so that they **fit the people** who will use them.

Why is it important?

It's very important because its economically costly and a social problem. According to Safe Work Australia work related injuries and illnesses is estimated to be $60 billion dollars and the Recent research has shown that lower back pain is the most common work related disability.
So having an ergonomically product is to create a safe, comfortable and productive workplaces which should prevent these problems.

Fig 1

Fig 2

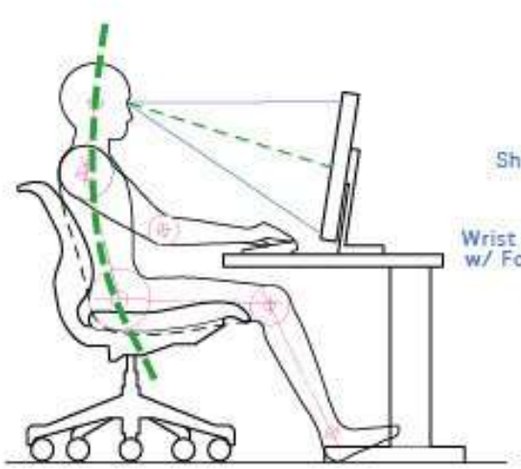
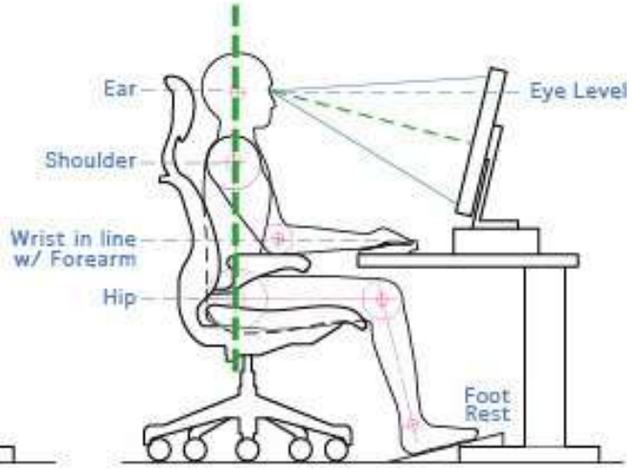


Fig 3



How does ergonomics work?

Ergonomics is a relatively new branch of science which celebrates its 50th anniversary in 1999, but relies on research carried out in many other older, established scientific areas, such as engineering, physiology and psychology.

To achieve best practice design, Ergonomists use the data and techniques of several disciplines:
anthropometry: body sizes, shapes; populations and variations
biomechanics: muscles, levers, forces, strength
environmental physics: noise, light, heat, cold, radiation,
vibration body systems: hearing, vision, sensations
applied psychology: skill, learning, errors, differences
social psychology: groups, communication, learning, behaviours.

What are the symptoms of a non ergonomic chair?

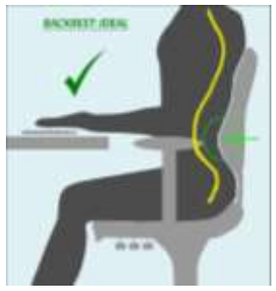
- Pain, tingling or numbness in the hands or feet
- Back or neck pain
- Stabbing pains in the arms or legs
- Weakness or clumsiness on the hands

The features of a good chair according to https://www.ccohs.ca/oshanswers/ergonomics/office/chair.html are:

- Adjustability
- Seat height range
- Backrest
- Seat depth
- Stability

I have not considered ergonomics as much in any of my designs and models, this is due to me trying to achieve all of the purposes of my intended product all at once in one model. I have modelled the chair without trialling to achieve two functions that are actually successful, if I do this then I can incorporate it to the other model. Moreover, I need to focus on what actually makes chairs successful and do its purpose which is more on ergonomics and anthropometry. Finally, I haven't further researched what ergonomics is and how I could incorporate it to my drawings and models. Now I know, I will need to experiment with other existing products that are ergonomic and incorporate it to my chair without loosing it's other functions. Also, I will need to collect more data on people's comfortable posture .

Encourages Posture Changes - You'll be more comfortable over a long work day if you change positions occasionally. Movement helps increase blood flow and alertness and prevents deep vein thrombosis. This can be as simple as getting up and taking 5 minute mini-breaks during the day, but rocking or changing your back angle every so often can also help.



Adjustability = being adjustable means that it can suit the persons body type or preference

Seat height range = If the range can suit a short or tall person

Backrest = actually having a back rest and being adjustable enables it to give a firm lumbar support

Seat depth = this is the length of the seat this will suit the shortest an talle.st users, the optimum seat depth in Europe is 35cm

Stability = it should be able to withstand most people's weight.

Rough Model

With this model I wanted to create a modular furniture where you have to manually transform the pieces of furniture's with each other. This has more functions to offer but I thought I would roughly make the necessities except the desk chair.

Aesthetics?
Just like model 2 this is quite simple so it should be able to suit everyone's taste as this one offers more texture and complexity. The wood chosen should also be forgiving so that the consumer can customise the colour or pattern themselves to suit their décor.

Cost?
Again, I think this would be too expensive to make if I use the same type of wood. However, instead of having wooden legs I could make the legs with metal wire/pipe. This would then allow me to sell it less than £200 and still generate profits.

Safety?
Just like the last two models the corners must be rounded off for a smooth finish as this is still boxy. However to make it modular the shape must have straight edges, for easy transformation

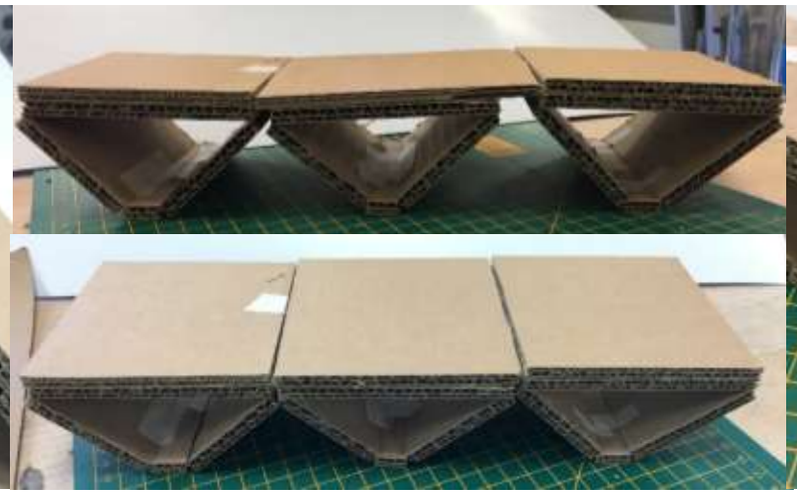
Function?
As I said this is a rough model and in my drawings this offers way more function than what I created here. There should also be a piece of wood that slides out of the seat to be a desk which is a necessity for my target market.

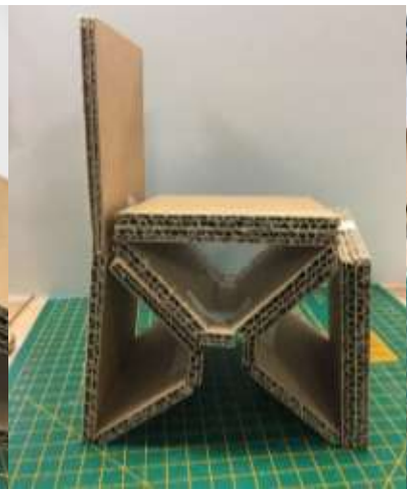
Ease of use?
My furniture's function will depend on what fitting/fixtures I am going to use. These fittings will determine whether its easy or difficult to use my furniture. However, it should be easy either way if it's fixed or removing and attaching any thing back. This is because its going to be quick and easy to do so.

Packaging?
With the packaging I am going to stick with the other two's packing materials which is cardboard and bubble wrap even though the cardboard shrinks when exposed to water. Also the packaging will be smaller than model one because its modular and in a stool form.

These last 3 images are the first model of this design I made, I started to alter parts of the model because I didn't like the design and it wasn't functioning well. What I mean about this is that it wasn't standing well and therefore would collapse as its not fixed or a way for the pieces to be sturdy. Also there are gaps.








I feel like in the end it was successful because I tried to hide the ugly gap peeking through so I made the seat more longer . Its still visible but not as noticeable now, and hopefully it adds more comfort to the ends of the thigh. Even though not all the functions are there it came out just like I expected it to, its just deciding what fittings/fixtures I'm going to use is a challenge.

Suitability for consumer?
If I think about the potential this model could be, then it really could be suitable for the consumer as the missing functions would be what makes it perfect as its all the necessities. This would offer an extra feature if it accomplished my intended product as this model also becomes a three seater bench or two seater with the table as a separator/ arm rest.

Environment?
As I said, wood is the most eco friendly source for building/creating products, this is because if forests are regenerated then it doesn't only benefit us but also the future generations and the world. Also aluminium is the most eco friendly metals on the planet as its base is the most recycled industrial metal.

Size?
The footprint size of this would be smaller than the length of a single bed but should be as long as an average person. However, the stools version is the smallest it could be and should be able to fit underneath the single bed, if not it can be stored like a bench. And with the size like that it shouldn't be heavy because of the chosen wood.

Materials?
Model: cardboard, tape and super glue

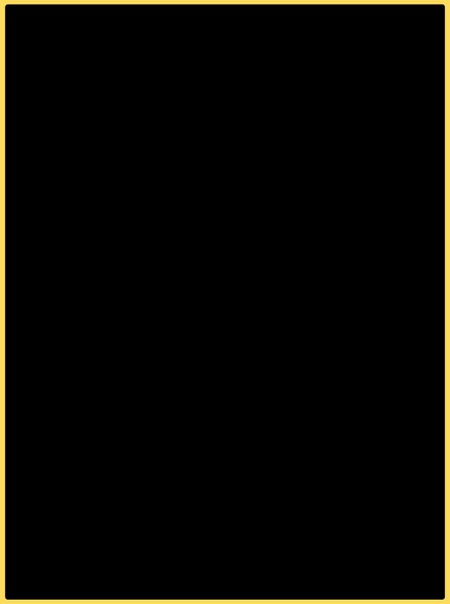
Product: soft maple, aluminium wire or pipe and fixtures/fittings

Production?
This furniture would be manufactured by machines as its not complicated or require any skills to do the parts. Also since this is going to be assembled manually by the consumer it only requires the machine to shape it into the design.

I was also trying to figure out how I could attach the legs together so it would look like a straight up chair instead of it slanting. With the model I just fixed it with tape but for the product I was thinking of a metal bar. To join them together it would slot into the holes which should be carved out on the side of the legs.

Improvements/what can be done?

For this design I could have made the seat depth shorter or added some sort of cushions/padding to the back and seat of the chair so that it would look less uncomfortable.



Insert pic of improvement i.e. add cushions and make the seat shorter

Manufacturing Techniques:

For this I was planning to use mostly wood and metal.

The wood would be **pine**, this will cause my chair to not be heavy as pine is **lightweight**. So when manually handling it, it wouldn't cause any strain or injury to my consumer because of it's weight and since this product is modular it needs to be lightweight. Furthermore, pine is malleable which mean it would be easy to work with and get the desired shape of the chair. Even though my chair doesn't require any intricate shapes I am planning to round of the edges so that its safer and looks more appealing.

The metal would be **aluminium** as its lightweight and cheaper than stainless steel. Also since I will only need it as a fixture to support my product even more and keep it from falling apart. Moreover, its fairly easy to fabricate so it can achieve the shape I want, this would be a flat long U bar. Firstly, the aluminium would have to be extruded and cut into shape and in able to create the shape I would need to use the sheet metal bending process to get that desired bend. However, this product will only be hand size and I think sheet metal bending is too large to work with small products.

- Non adjustable back support

This is because the back reclines 180 degrees to be a supporting leg or part of the table.

- **No arm rests**

- Even though its not a necessity it is advisable to have them as it gives stability to the hands

- Doesn't actually show any detail whatsoever on how the chair can function

- There should be holes on the side of the triangles so that the metal 'U' bar can be inserted and keep the chair together

- Not all of the core requirements are considered

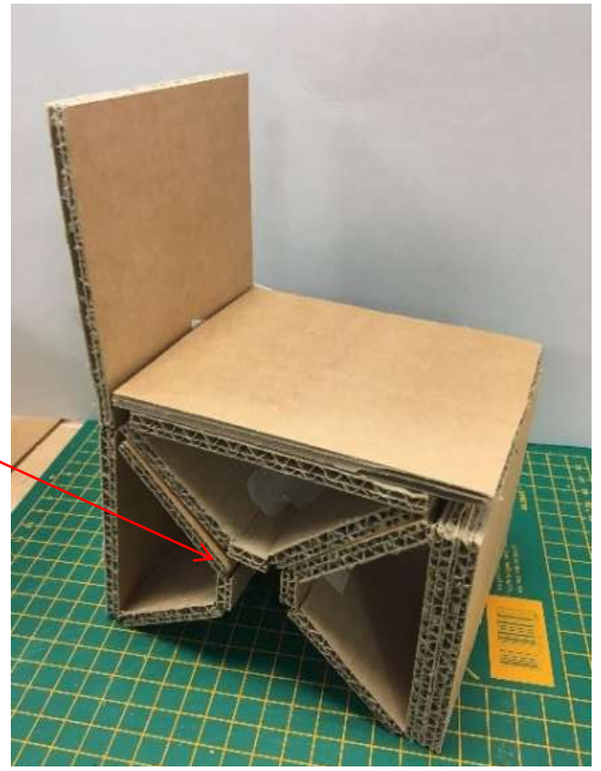
- I also didn't consider the back rest angle. This is because I was trying to achieve the table/bench and since tables need a flat surface the back of my chair is also flat.

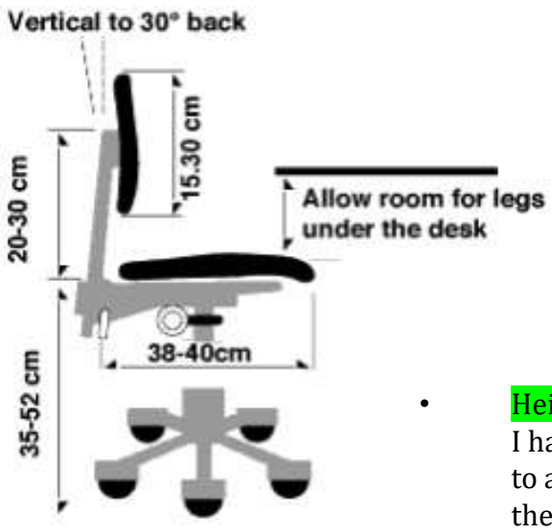
- This could cause back problems because it doesn't support the spine whatsoever and since it's at a 90 degree angle the back is not at a relaxed position where it can be supported and not having strain on the lower back.

- Does not look comfortable

The backrest is at a 90 degree angle so to make it less uncomfortable I could have added some cushions or padding to support the spine.

What's wrong with this design?





- No adjustability

There is no room for any adjusting back, seat height

- Its very **straight**

There are no curves that will follow the structure of our spine

- Heavy

This chair is mostly all wood which means that it will be quite heavy to manual handle

- Expensive

Wood is pretty expensive even when its cheap. This is because when its all wood the cost will build up so therefore the final products price would probably be expensive along with the metal fixtures.

- Would not pass the safety regulations

- In this design I have not considered about the seat depth because I was trying to make it aesthetic and try to conceal what

- Height adjustment is also a big issue that I have not yet solved, this is due to trying to achieve my core requirements all at the same time.

Rough Model

In this model here I tried to create a gravity chair but after trying to make it stand on its own, I finally decided to add stilts for more support.

I feel like this model is quite successful in terms of being able to transform it without difficulty and extra knowledge due to it being self explainable. However, its missing two functions.

I think this model is very simple and could easily be customised however, it doesn't fulfil my intended product. This is because its missing the table function and most importantly the chair desk which allows the consumer to study without needing a separate piece of table.

Strengths
- Can be easily transformed
- Sturdy
- Simple/ not complicated
- Customisable

Weaknesses
- Only 3 functions
- Uncomfortable
- Doesn't look appealing
- Manually adjustable

Aesthetics?
I feel like this could be highly customisable as its quite simple and doesn't require any additional materials for fixings/fittings which could be distracting. So it should suit everyone's style as its quite sleek and small

Suitability for consumer?
I don't think this would suit my target market if their aim was to have a multi purpose furniture for studying as well as relaxing. This is because there is no desk for them to study so it would be quite pointless to buy this furniture.

Cost?
Since this is mostly all wood I would expect the manufacturing process to be quite expensive but since it's a smaller scale I think there would still be profits for selling it less than £200

Environment?
Wood is a very eco friendly material as wood products require much less energy to produce, its recyclable or renewed as shavings or pulp for producing paper. Cedar wood is sustainable as it is maintained and harvested well as they grow in regenerated forests

Safety?
The corners needs to be rounded so it wont cut or splinter the consumers. Also the furniture's fixtures/fittings need to be secure so that it wont collapse by itself and cause harm.

Size?
This furniture would be fairly compact, small enough to fit under a single bed when its in its stool form. The footprint, however, will mean that it will need to occupy more space.

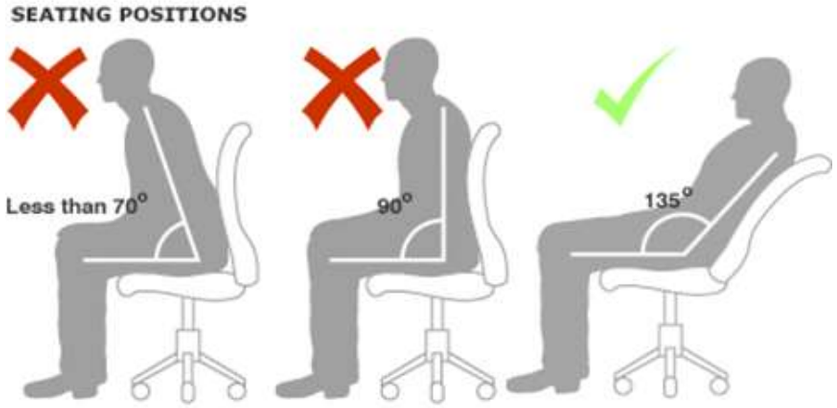
Materials?
Model: cardboard, tape and bamboo skewer sticks
Product: Cedar wood, brass and metal fixtures and fittings (rotating screw?)

Ease of use?
This will be very easy to use specially if they are not keen on instructions as it is self explanatory

Production?
This is all going to be machine made and will come assembled as a stool as it's the smallest scale it can go and because the fittings/fixtures are fixed within the chair.

Packaging?
The packaging will be the same as model 1 but just in a smaller scale.

Next Step : Remodel this design in solidworks to see if it can be improved even more.



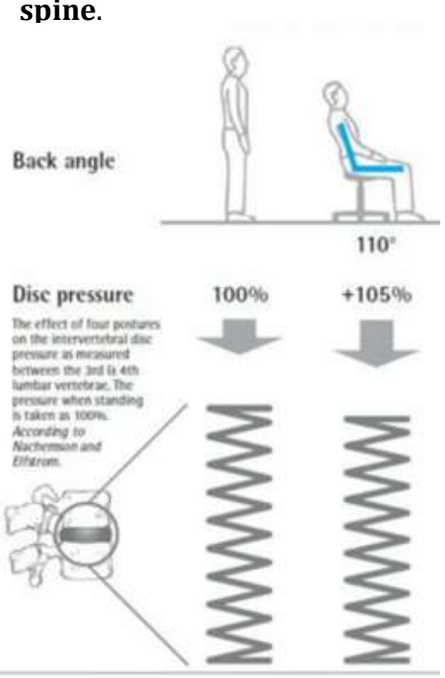
- Looks **unstable**

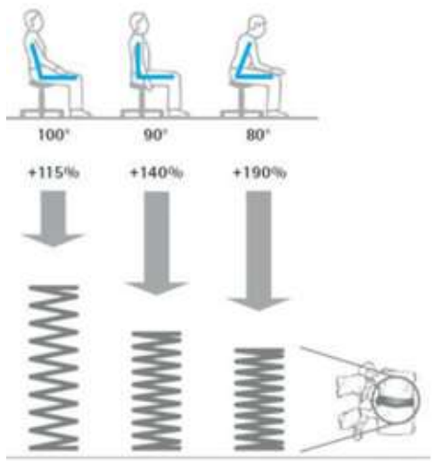
-Minimal support base

- Looks very **plain** and **simple**

- **No arm rests** and should consist one for the user to rest their arm

- This design's back support is **straight** at a **90 degree angle** therefore it would not be ideal for a good lumbar support as it does **not follow the curvatures of the spine**.





- **No back support**

- No other functions

- It only fulfils the chair, stool and lounge chair. It's **missing the desk and table.**

- Looks uncomfortable

- **No padding** or **cushions** for ease/comfy seating at a **long period of time.**

- Looks **unsafe**

-No **rounded corners** or **strong base support**

- No in-depth idea of what fixtures/fitting ill work with the chair model.

- **Heavy**

-Since it's going to be **mostly** made out of **all wood**, it can bring some weight specially if the wood chosen is to be **sturdy**.

What's wrong with this design?

- Also, it cant be adjusted to a reclined position which means there is **more pressure on the spine** and the spine muscles are more fatigued.

Manufacturing Techniques : For this model I am planning to use a Double End Tenoner machine as it cuts smooth edges for sized panels. Also, it can cut wood at a thicker rate than most machines so I think this will do the job. As for the back leg the metal will be extruded to that exact shape as I think welding two pipes together will be a weaker bond that the actual curved shape. However, I don't think that it will hold up properly, at the curved area I think there will be too much stress therefore will break easily upon mass everyday use.

Improvements/what need to be done?

For this design I need to change the whole structure so that it can offer more adjustability. The base could be more stable if I used a thicker stick or used another cardboard which would act as an extra wood to support the chair instead or using the sticks, I also need to model the backrest so that it's not at a 90 degree angle, as this is very uncomfortable specially is there are no cushions that support the spine.

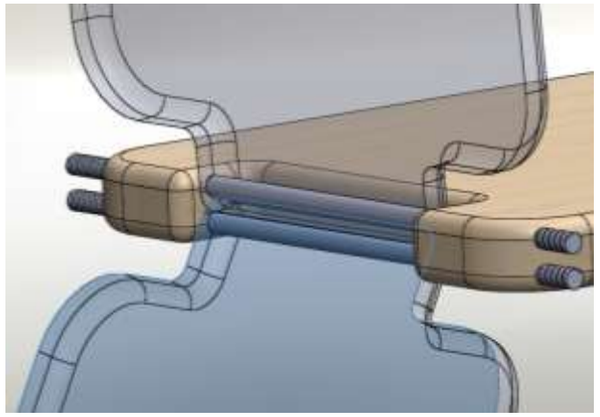
The problem I had with this model is that whenever I try to model it so that the back can be adjustable, the mechanism just wouldn't fit right and therefore wouldn't move at all. The extended tongue like wood would either overlapped with the slot and therefore making it stuck or a massive gap so that it can fold down.

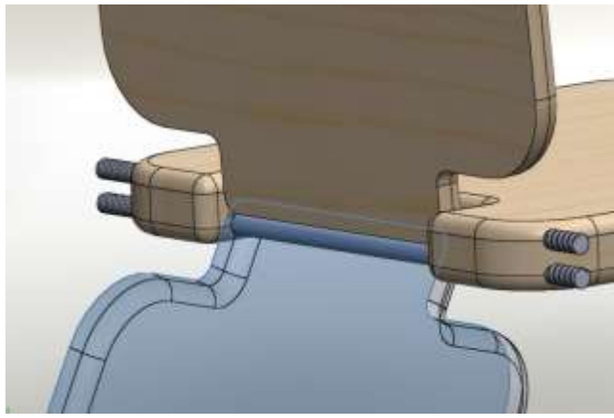
I decided to leave this model as I cant physically improve the design so I am going to use Solidworks to do a computer model. However, the design itself would not be successful in the market. This is because its very simple and doesn't have any characteristic that would be eye catching. Moreover, deciding on what technical requirements needed to make this type of chair is quite difficult because if I choose one it doesn't work out but when its successful it defeats one of my core requirements. They are a must have within this design because it wouldn't gain as much profit in the market industry because there are already so many chairs out there that does the same if it doesn't have all the combined requirements.

Remodelling in Solidworks

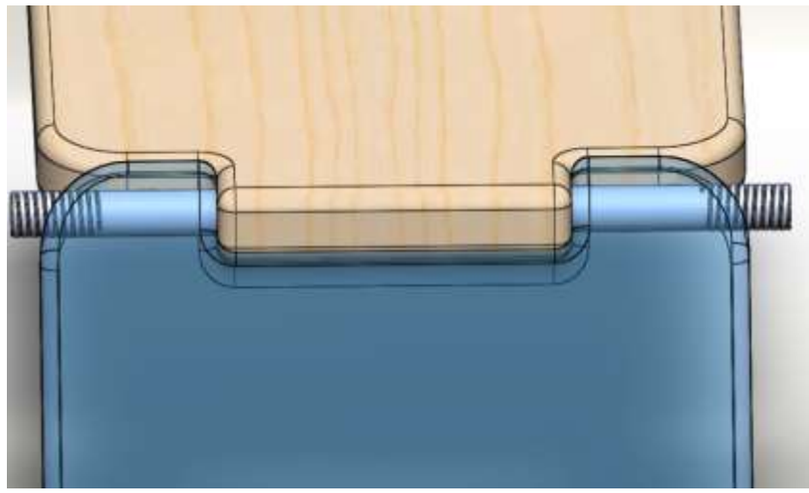
Problem

- The back leg base is longer than the front, therefore since its **not levelled** it would not be able to function as a chair because it cant be sat on.





- The two pieces of wood **overlaps with each other**, therefore it wouldn't work in real life. The screws need to be on either side and not parallel with each other, this would therefore allow them to not collide and have separate pathways but still join together to form as one.
- Also for this, I could have rounded the bottom half of the tongue so that when it comes together they wont overlap and will have a smooth connection when flipped up or down.

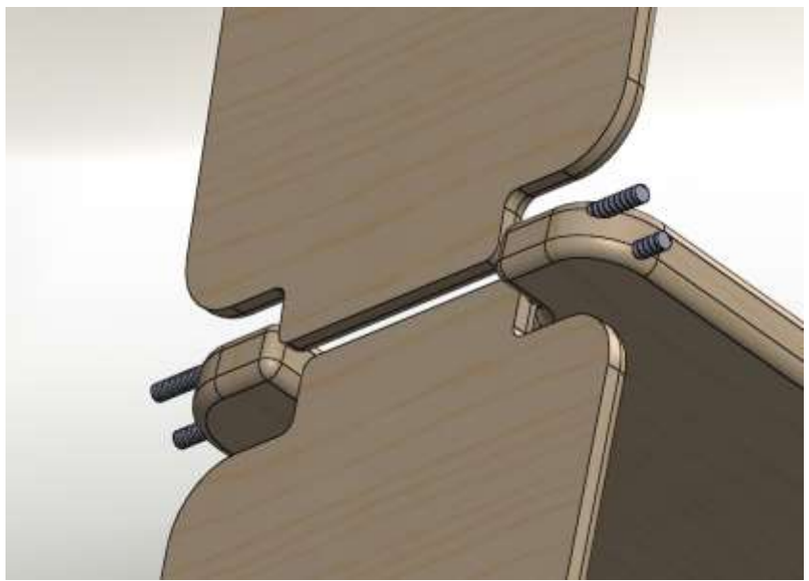


Solution

Since there was no way of making the back ergonomic without loosing the foldable function I could add…

- A **removable cushion.** This would be ideal to support the lumbar or padding to the back and seat of the chair.
- **Lock reclining mechanism**. This would allow the back to be adjusted at an angle to which could be used for more of a comfortable posture.
- This still would need **adjustments** for the back and the height of the chair so that its ergonomic and will be suitable for mostly everyone.
- I have changed the parallel screws so that they are **diagonal** from each other and that the two pieces of wood wont overlap and comes together to make a stool or a small side table .

Overall, I have decided to abandon this design because I have approached various types of ways on remodelling this but it has not been successful, in terms of how it will actually function with the fixtures and fittings that I chose for the design. Finally, this design is too simple and barely has any of my core requirements that's why I am leaving it.



Different Approach

Problem? - I just recreated an existing product

- If I was going to make this product, the wood chosen would need to be lightweight or hollow and since this is going to be all wood it wont be as heavy when manual handling it.

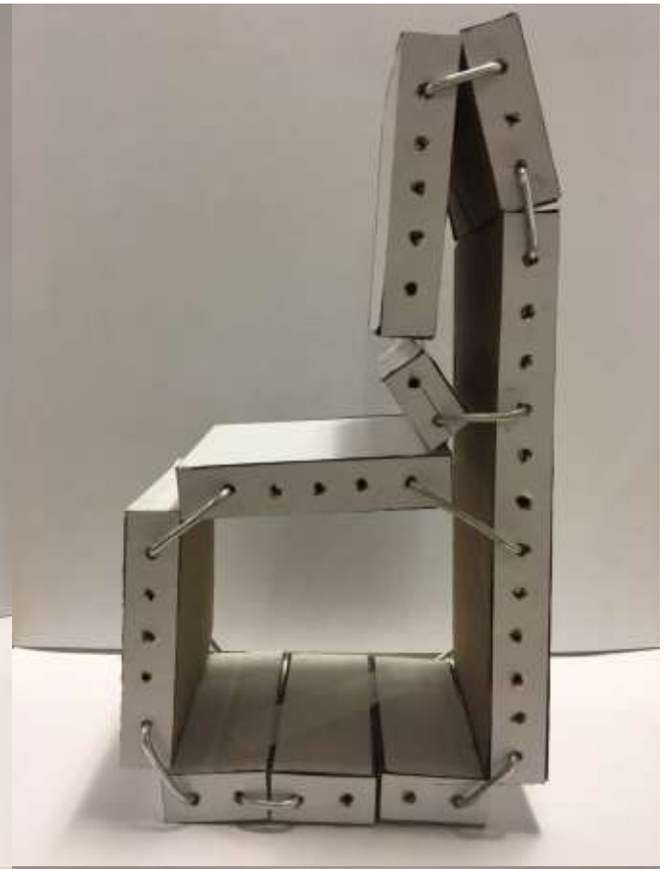
- The chair would be a **modular** furniture because you have to physically move it around to get the desired position wanted. However, to change the shape, all of the pins would need to be removed first and back on again to make the position stay.

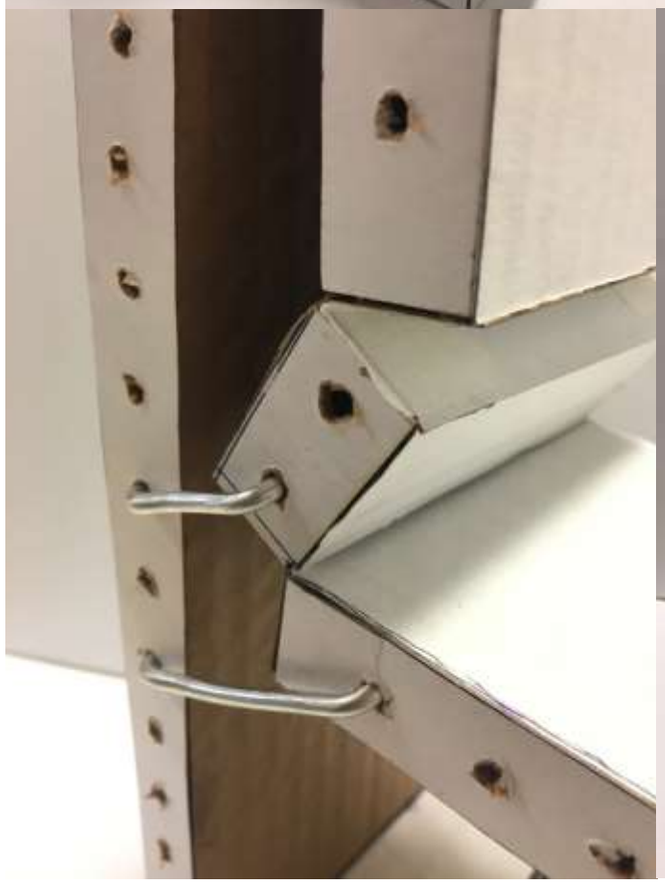
- I don't think this would **withstand** the **weight** of my target markets. This is because it can't even barely support itself that's why I had to tape the bottom to make it stand upright. However when there are enough of the pins it will stay in that position until weight is applied.

- Each of the wood slabs will be attached together by **self locking butt hinges.** These hinges will allow it to fold out and enable it to change shape easily. However these might fall apart after many uses as it will constantly have stress on it so a moulded hinge might be better.

- Since this chair is modular, the fixtures, which are the 'U' shaped pins are detachable. This is so that you can transform the shape of the chair into it's other purpose and can also be adjusted to their preference.

- **Problem:** The 'U' shaped pins have certain lengths so therefore which cant be adjusted so the issue would be finding the right size for that particular function. It will be time consuming, hassle and confusing unless its colour coded.





- This will be fairly **easy to manufacture** because it's not an intricate shape. The shapes are basically squares and rectangles of wood. There will be no need of huge large and expensive machines to manufacture this product.

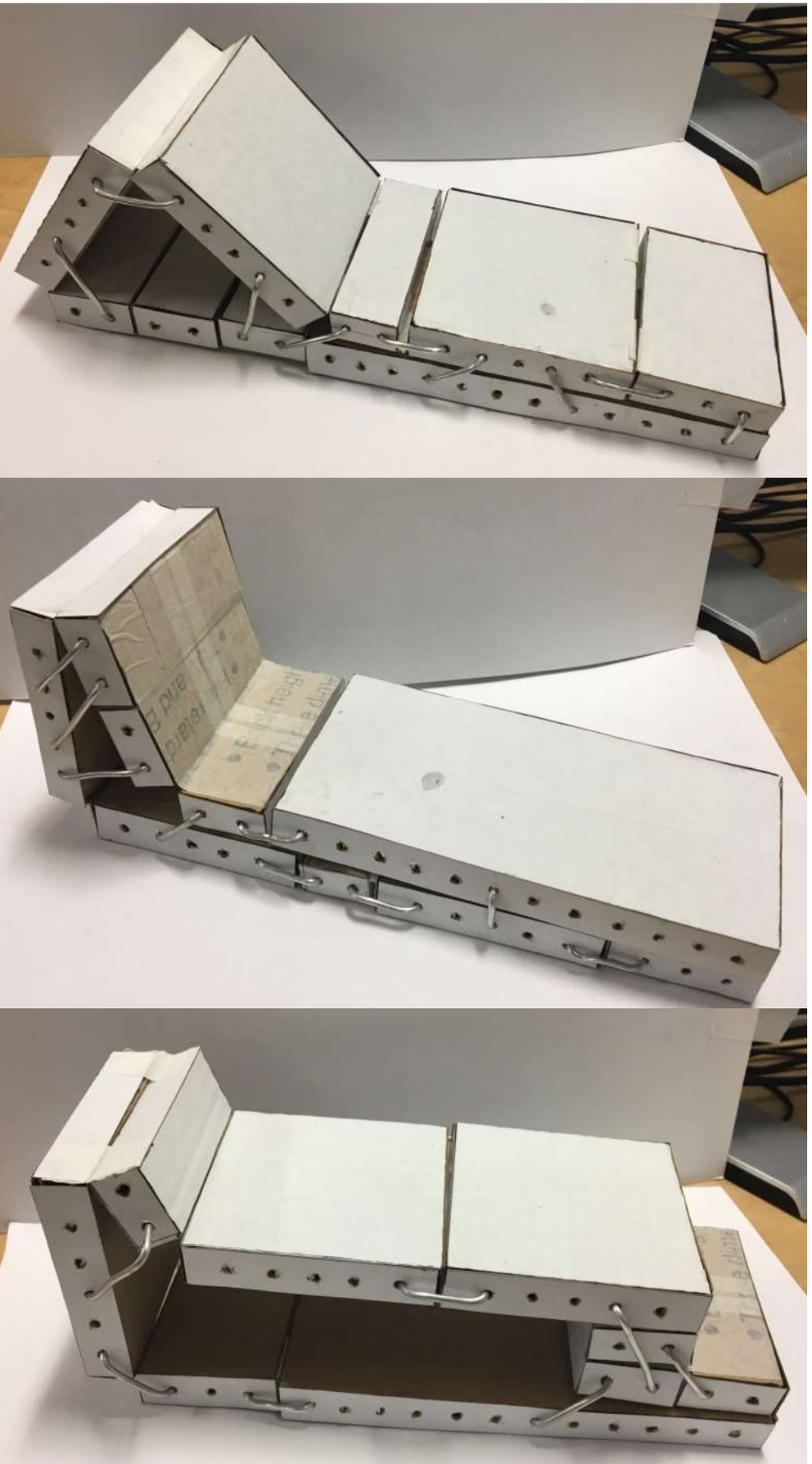
- This chair **doesn't look** very **appealing** at all. It has a very **industrial look** to it because its quite **chunky** and because of the use of metal pins.

- Also, it doesn't look **safe**. This is due to the **sharp corners** and very little support for the 'legs'. The legs would be hanging on from the hinge I am planning to use which is corner to corner with the bottom wood.

- To make this chair comfy a **built in cushion** would be one solution, So instead of having the wood at the front it can be **replaced by foam** so that it will also result in the pieces being lighter. The foam will then be covered by a **mesh breathable fabric** and attached to the pieces by stapling it on the inner sides of the wood so that it cant be seen.

- Also when sat on the chair, there is a gap just under the person's knee. This itself looks and would be very uncomfortable for a long period of time. It's because of the sharp edge which could also imprint a line on the persons leg.

- With this model I have no clue if in real life this chair would be stable, this is because the edges are attached edge to edge with the other pieces. If enough pressure is applied when sat on then there is a great chance that the hinges can come off and break the structure.



- This is more of a relaxed lounge chair as the back is reclined and at an obtuse angle. This would allow their body to a sleeping position or can just lay it flat to a full sleeping position.

- When in this position someone on the taller height range would not be able to fit their whole legs with this chair. This is not long enough for them and their legs would just hang which therefore wouldn't be comfortable and cause inconvenient pain when used for a long period of time e.g. sleeping.

- This position is more of a raised lounge chair where the back is quite straight, this is so that they can stretch their legs out while still writing or reading whereas it will be difficult to do so at an obtuse angle. This position is mostly for when you want to relax and read a book or play on your phone.

- This position might be more comfortable than the other one because its allowing a bit for room for the legs however, its still short for the tall range of people. But in this position there will be a need of cushion for the back because this cause back pain as there is nothing supporting the spine or improve posture.

- This is suppose to be a table. However it just looks odd and I don't think it will be able to support the table on the left because it will be held together just by butt hinges which acquires less support than having wood under it for support.

- This design could be better but this is just complicated and doesn't really do it's purpose justice. It doesn't look appealing either and either ends of the table can't be used because of the layout. It will be difficult to get around it or lay anything on it.

- This Loop Chair by Boaz Mendel is what I tried to I create but his chair is more successful than mine as he achieved more functions and I haven't achieved all of my core requirements.

- This kind of design needed a lot of planning and recreating and I kind of just started it off by just making the chair and focusing on how it will be able to stand. I didn't really consider how it will fold out for other purposes and I played around with it to see what I could make. Overall, next time I try and recreate this I need a plan and make models so that I can adjust how many pieces I need to be able to achieve different functions.

- This resulted in me making different sized metal pins because I didn't plan it very well and I made them just to fit that exact spot which will make it difficult for the consumers because the length are not all the same size.

- However I wanted to try his style to improve my similar design further as it was very simple but now I think this will be too complicated for my consumers, specially when it is a time consuming process to set up the function needed.

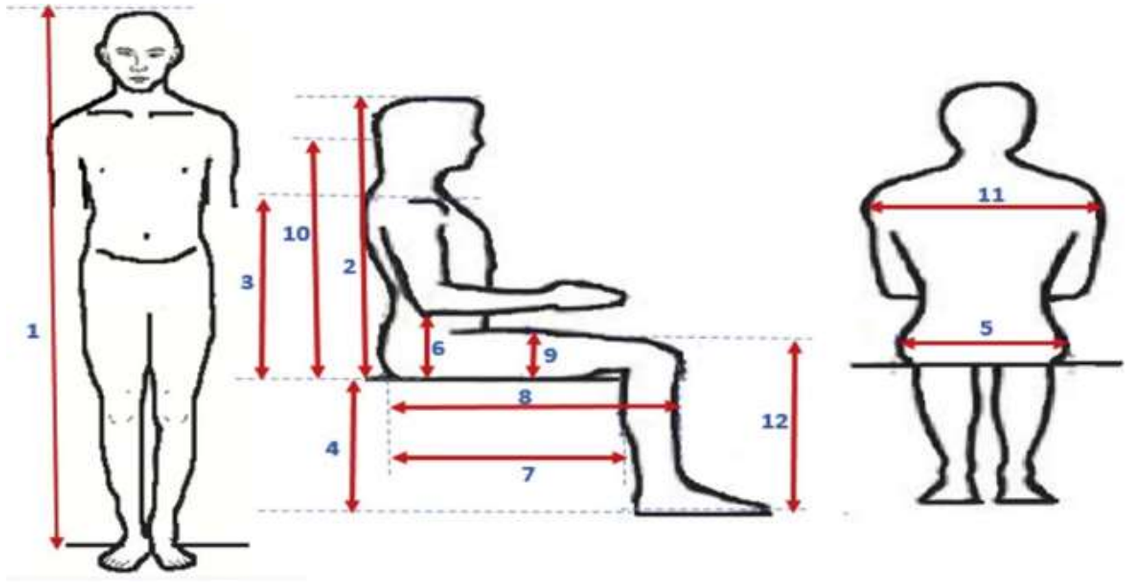
In most of my models I have not considered any insight on anthropometrics data. I have made very rough models without considering any measurements. My models aren't real life size so therefore it's hard to give it any measurements and test the functions.

What is Anthropometric data?

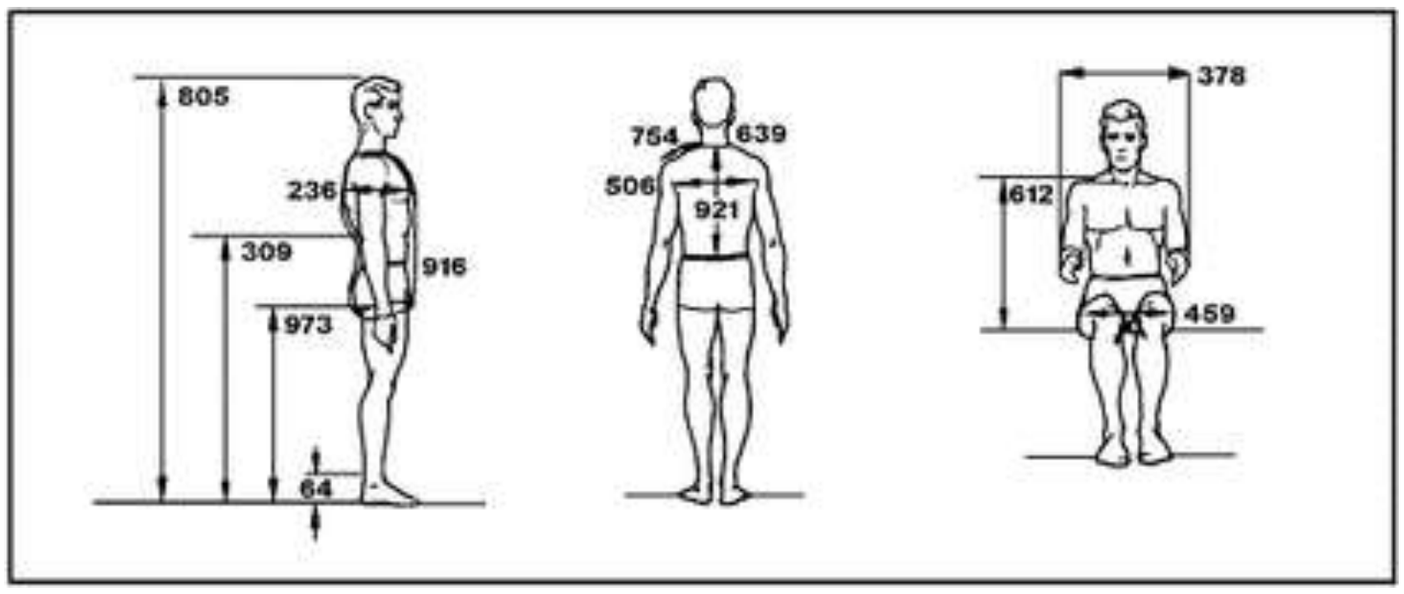
Anthropometric data is the study of the human body and its movement. This often involves researching into measurements relating to people. Moreover, it involves collecting statistics or measurements relevant to the human body. This is so that designers can base something when they are producing a product that requires the human body's measurements.

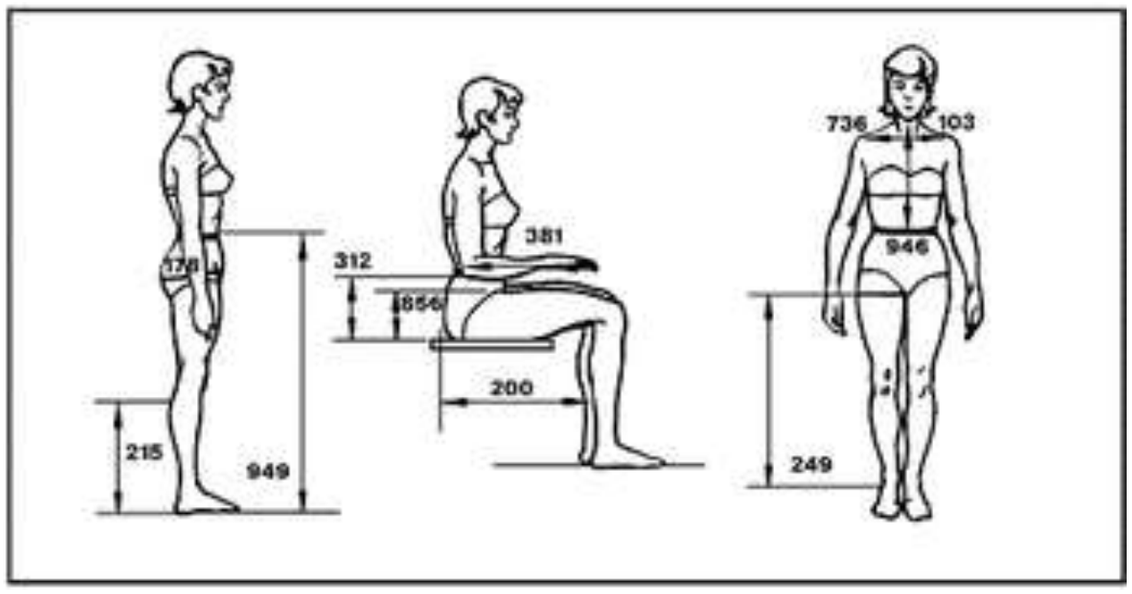
Why is it important?

An agronomist is concerned with many aspects such as strengths of various muscles and ranges of movements. A designer is required to ensure the following two things while utilizing the anthropometric data. Firstly, all persons should be able to operate particular equipment because personnel are essentially an inter-changeable component of any system.

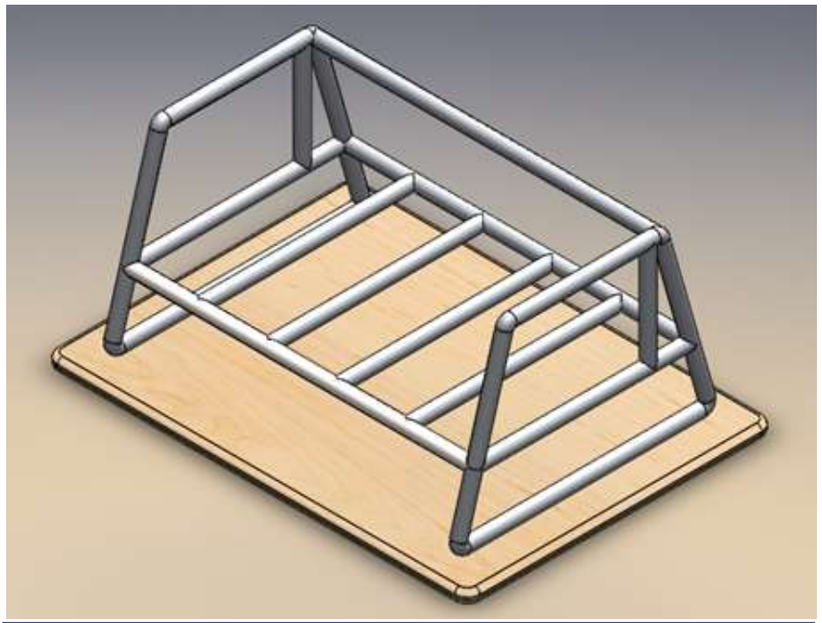


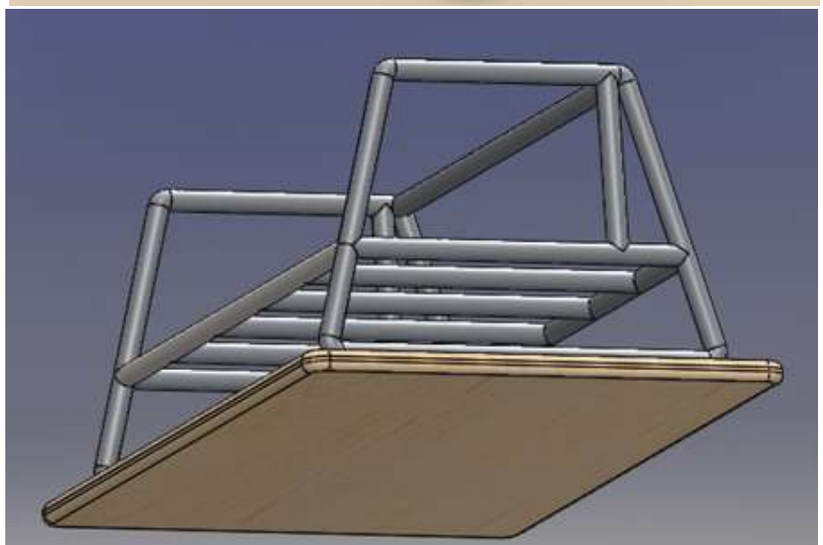
1) stature (body height),
2) sitting height (erect)
3) shoulder height, sitting
4) lower leg length (popliteal height)
5) hip breadth, sitting
6) elbow height, sitting
7) buttock-popliteal length (seat depth)
8) buttock-knee length
9) thigh clearance
10) Eye height, sitting
11) shoulder (bdelloid) breadth
12) knee height
13) body mass (weight)

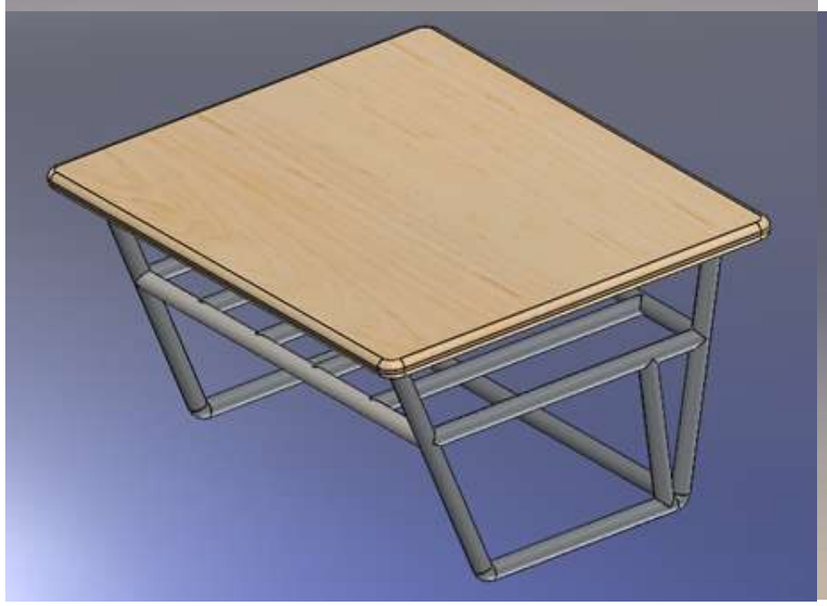




Rough Model







I am thinking of making this structure out of steel, probably carbon steel because its cheaper that the other steels. This means that I can sell it for a lower price which my target market can then afford. Carbon steel is also durable .Also, the wood is going to be maple or was it pine because its lightweight but sturdy.

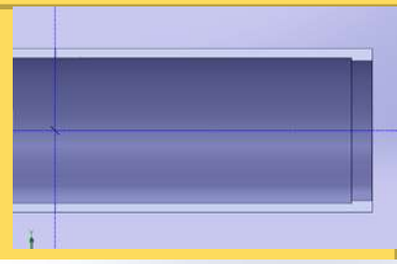
Aesthetics
I think this chair would actually sell as it is very modern and its not all wood. This is because not all people like wood so the metal pipes compliment it.

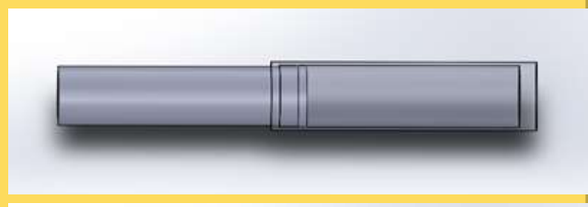
Safety
I think this would be fairly safe, there are no dangers that are foreseeable but the issue might be, not welded properly or the fixtures/fittings break causing the whole structure to collapse.

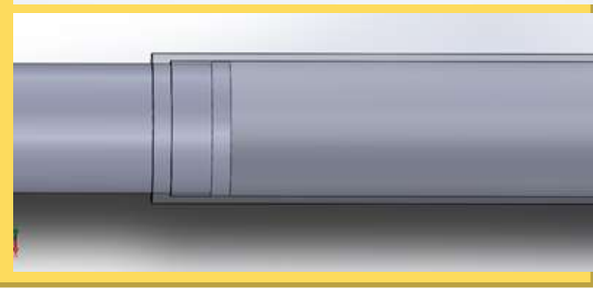
Cost
This would probably cost around my selling price as it doesn't require much expensive materials. However, there might be extra fixtures/fittings

Function
There would be knobs that will adjust and extend the pipes so that you can change the position/function of the chair. It should be easy to adjust it as all you need to do is turn or pull the knobs.

I created this to show how the pipes will extend in able for the chair to change position. There is no locking mechanism as this is only for the bottom base. It wouldn't fully come apart as at the end of the pipe it is thicker so that it becomes as a stopper when extended. The extended pole would have a smaller diameter so that it can slide in and out with ease, however this would cause unevenness when extended and therefore wont be as sturdy.

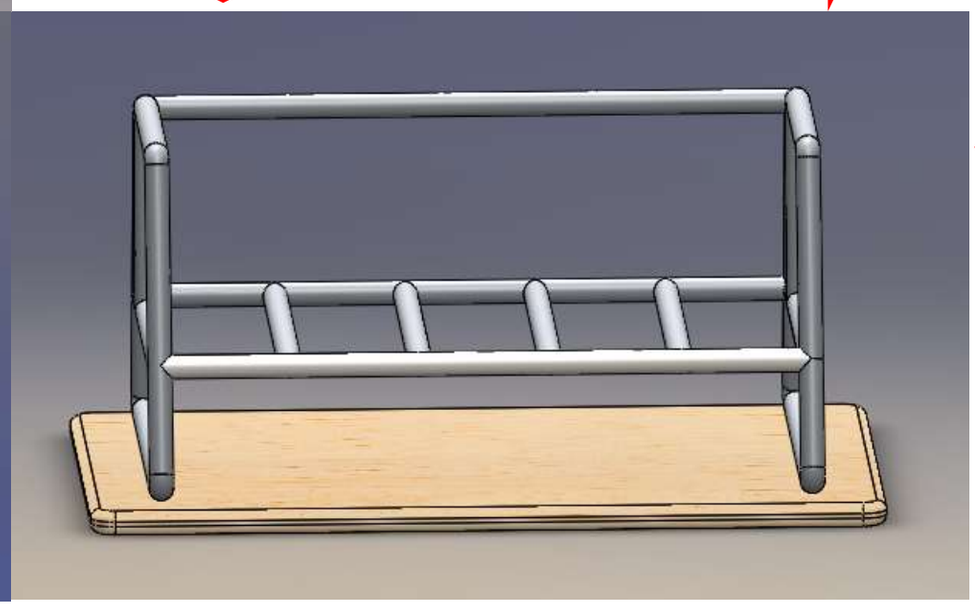






Ease of Use
This chair would be easy to use as the difficult part of the chair is when adjusting the position of the chai as each and everyone of the knobs one by one which could be time consuming.

Packaging
There is no way that this chair can fold down even more because it is a fixed structure where connected parts are welded together, so therefore cant be disassembled.



Environment
The materials chosen should be sustainable and environmentally friendly. If not it should at-least not impact the environment hugely.

Size
This is heavily influenced by armchairs and should be the same size as a small one. However, this model here is not modelled with accurate dimensions as the seat height should be higher.

Any improvements?

To improve this design further I could extend the legs so that the measurements will suit the anthropometrics of my target market. Also, since it was designed to be adjustable, just make sure it fits the average anthropometric measurement as the taller range of my consumers can adjust the height of the seat to suit their needs.

- Design all of the parts that was drawn in Solidworks to see how they would all work together and if they could work together so that when it doesn't you can change the design so that the function will be able work out.

- Make the tubular structure have a bigger diameter so that I wont need to add as much structural support to the main tubes.

- Moreover, I could make the design a bit more contemporary or futuristic as it looks quite simple and boxy right now. Maybe I could round the back so that it's more comfortable and ergonomics.

Materials and Manufacturing techniques?

- For the rectangular wood at the bottom which is for the table, it will be cut to size using the circular saw because it wont be able to fit in the bandsaws. Then the corners and edges will be sanded down either using the Grinder and using sanding paper for the hard to sand areas like the corners.

- As for the structure of the chair it will be attached together by cross welding the metal tubes for extra strength than just welding them together. For the rectangular structure the metal tube will have to bent into shape to achieve round corners and avoiding having to used multiple tubes to weld together which has a weaker bond than bending.

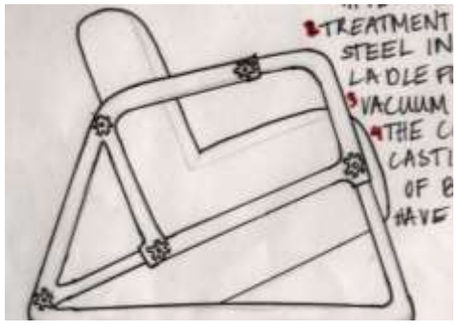
- For the foam, to shape it the way I want it I would have to use a carving knife or electric knife. This all depends on what's available. However, I am not sure if I am going to use a whole cube of foam which I will just bend/carve in shape of use different separate parts which will be joined together by the foam cover.

- The fabric foam cover will be made out of mesh fabric because it's a breathable fabric and is commonly used in furniture. I will cut this into shape and join them to fit the foam by stitching them together.

- It doesn't necessarily show how the adjustability is suppose to work because there are no screws attached to the design or inner components shown.

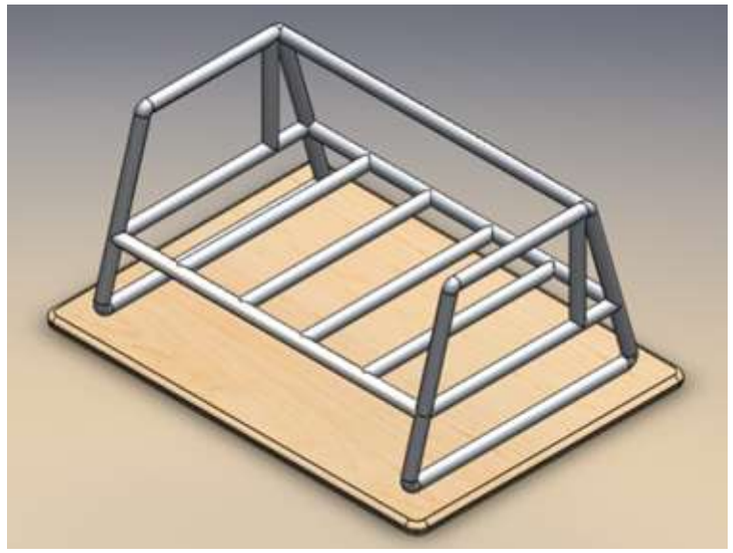
- Adjustability

This chair would offer a lot of adjustability if the design was finished, however with these you can adjust the back of the chair at a more comfortable relaxed position instead of at an upright 90 degree position. The structure of this can also become smaller so that it can fit under a single bed, however one thing that it doesn't do is adjust the height of the chair.



- Core Requirements

This chair mostly have my core requirements if finished but at the moment this design only serves two purposes of my requirements. These are a chair and a table. If it was finished it can also offer a study desk, lounge chair and a small bed.



- Will it be able to hold the weight?

The cross structure allows the chair to withhold more weight and it also acts as a support so that the foam wont fall through. Moreover, it will be more comfortable to sit on as it creates a flat surface for the foam to be placed on. So, overall I think it will hold most people's weight but I don't know whether the welding will be strong enough.

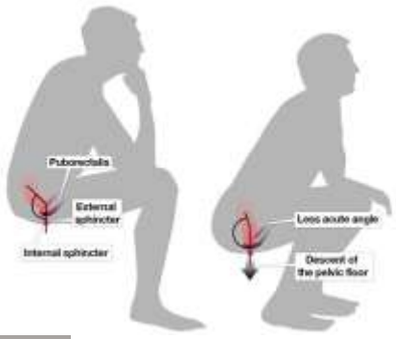
- Simple

Even though this structure is simple it is minimalistic and I think it will sell to my target market because it wont be complicated to use.

- Is it sturdy enough?

The structure seems like it would hold most of my target market's weight, however, I feel like that the tubes are too thin which therefore would result into a weaker but lightweight structure.

What's wrong with this design?



- Size

This chair looks too small and since the height of the chair is not adjustable, tall people would find it very uncomfortable to sit on this chair over long period of use because their legs will be strained as they are not sat ergono0mically where their legs are straight at a 90-120 degree angle touching the floor. With this chair they would look like they are crouching because its too low that their knees are higher than their waist.

Rough Model

Suitability for consum
Size
Environment

Aesthetics

This chair was inspired by an arm chair hence the boxed like shape. This is more modern and has a geometric feel to it as everything is very straight. However, I feel like my consumers aesthetics would not be wood as it is very hard to style around it.

Costs

This chair would mostly be made out of wood so it would be quite expensive even though some timbers are quite cheap. However, that would make the product lessen the quality because the wood is not of a high standard and wont withstand the basic impacts.

Safety

With this chair it is quite back heavy so when weight is applied towards the back end of the chair the chair tips back and the legs in real life might not be able to support it so therefore collapses back. Even when the back rest is inserted, it instantly reclines back.

Packaging

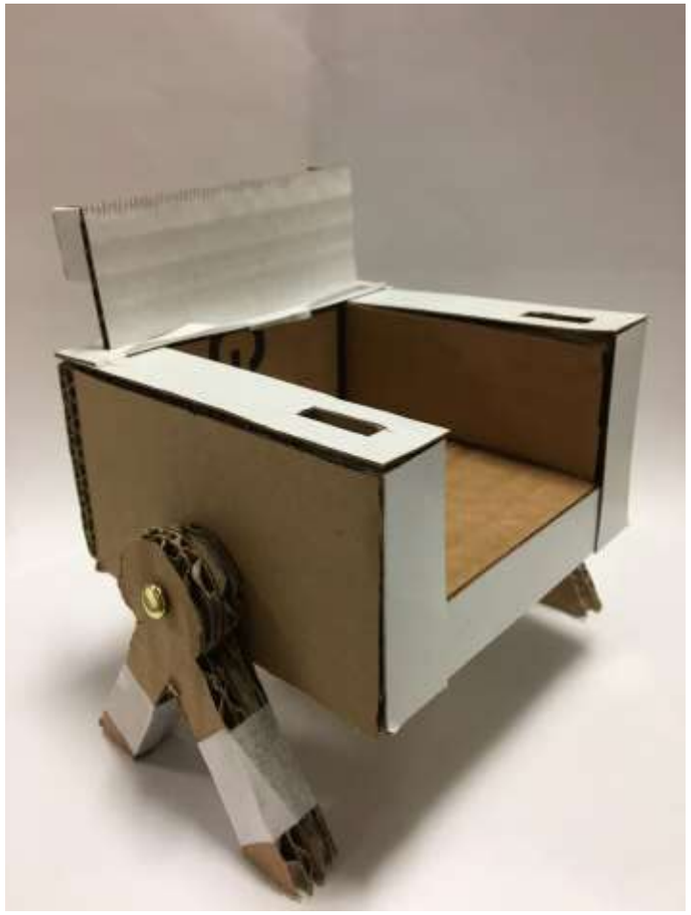
The smallest it can go is the actual chair as the legs of the chair can fold up so therefore minimize the height of the chair when packaged. Also, this chair will come assembled because it's not a flat pack where consumers can build it themselves.

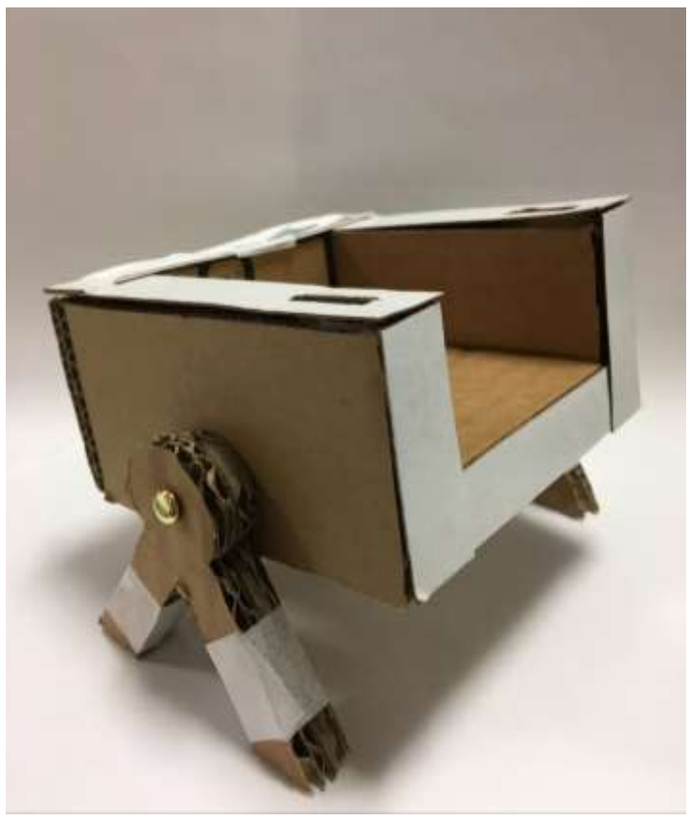
Consumer

This chair will totally be suitable for the consumer as their necessity would be the desk chair. And since this is inspired by an armchair it has the potential to be as comfy as one where they can sit and relax.

Size

This will be just a little bit smaller than an armchair and probably be the height of an office chair when the backrest is added. It will take up at-least the corner of the room but not big enough that there wont be enough space for other furniture's.





Ease of Use

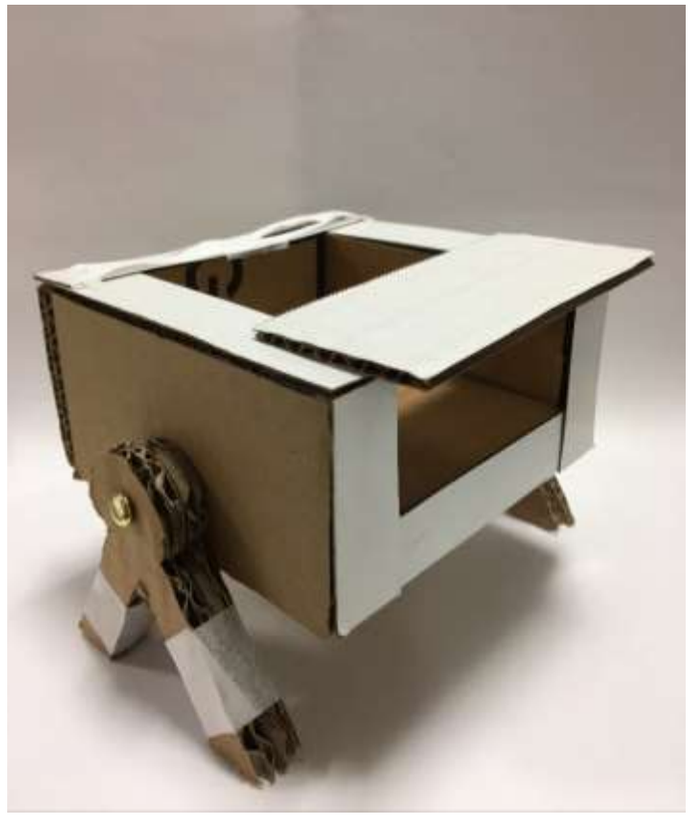
It would be fairly easy to use because all you do is sit on it, physically lift and remove the back rest to be used as a desk when needed and slot into the two holes, like tongue and groove.

Environment

The material used is going to be environmentally friendly. If not it should be reusable or has lesser impacts on the environments than the rest of the materials out there. Also the wood chosen is going to be sustainable so that there will be wood left for our future generation.

Function

This might have been the easiest chair that I have modelled, this is because I have tried to only achieve one or two functions at a time. Here, I have focused more on the rotating leg and the removable/reusable desk. All it needs is just to put it together like a jigsaw.



What's wrong with this design?

- **Heavy**

-This chair will be mostly made out of wood and unless a lightweight but durable wood is used then this chair would be fairly heavy to manual handle.

- **Unappealing design**

-The holes are revealing which makes the design unattractive and degrades the quality of the chair.

- **Unsafe**

-This chair design will become very unsafe quite quick because the legs are quite unstable so when someone sits on it and lean back, the chair will go back because the leg doesn't offer as much support or rotates itself back if there is no locking mechanism.

- **Unstable chair leg**

- No support when the chair falls back at a reclined position

- **Uncomfortable**

-There are no cushions attached. This tiny adjustment would make the chair less uncomfortable and lessen the possibility of back pains

- **Sharp** arm rest **corners**

-This could become very dangerous and cause injuries to my target market if enough pressure was accidentally put against it. Even when walking past it and accidentally hit it, it would be painful

- **Seat width** is way too **small**

- This chair would not fit the average or the upper percentile in anthropometric data. It's quite claustrophobic and I think a small child would be the only one which will fit in this chair.

- **Core Requirements**

-This chair hasn't achieved all of my core requirements. This is my biggest concern so far as it is very hard to combine them all together because it turns out not successful e.g. ruining the other purpose

- **Expensive**

-As I have noted already that the material for this chair would be wood. It will get very expensive quickly because of all the components needed and the possibility of needing more. Moreover, the concern is what type of wood is going to be used and the quality of that wood as this determines how expensive it will be to make.

- **Heavy weighted on the back**

-When more weight is added at the back the chair e.g. the extended back rest have a tendency to fall back and not at the upright 90 degree position.

Improvements

To improve this chair further I would need to change the legs into something more stable. I could do this by expanding the top design so that it covers the whole width of the chair and not just the middle. So, this piece of thing would be a metal tube which runs along the width of the chair and not only this would add some style into this all wood chair but also give it it's strength.

- Also, I could round the sharp edges so that it looks smooth or add curved shapes which will make this chair appear less boxy and bulky. I could round the edges by using a grinder as this would never fit in the disk sander.

- Make the seat width wider so that someone on the bigger side of my consumers can fit comfortably in the chair without feeling claustrophobic or like they cant fit and having to squeeze through. This could be simply done just by using a bigger sheet of wood and then building from that again making sure to add the same amount of measurements to the parts so that it will look on scale.

Manufacturing method

- This chair would be mostly made out of wood and the only non wood pieces in this chair would be the metal fixtures and fittings. The pieces would be all joined together by either gluing them together using dowels or using mortise and Tennon joints. This would all depends on what's cheapest to manufacture it because wood can get quite expensive.
- To cut all the shapes I need to assemble the chair I would need to use the bandsaws, however in this case I think I would need the help of a teacher to use the circular saw because my parts are quite large.
- Once all the pieces are cut to size I will need to sand them all down to avoid sharp edges that will harm or endanger my consumers. I will do this by either using the Sand Disk if it can fit in the bed or the Grinder for more of a accurate and smooth edges for large pieces of the chair.
- When that is done, all there is left to do is assemble the pieces together, making sure to attach the legs first before closing it in with the seat.

This chair would probably be the easiest and cheapest one to manufacture. This is because it doesn't need extra materials or materials that could be expensive. Moreover, the manufacturing technique used doesn't require large expenditure on running the machine and it's not intricate to use.

Development

Group Discussion

In this group discussion we briefly talked about what our product is from the beginning. This is so that the others in the group can understand what your product is in able for them to give feedback and criticisms along with next steps and improvements. So, we would start each discussions by asking what problem they are trying to solve along with some advise on how they can solve is further. Moreover, we would ask if they knew what their core requirements were and if they have approached it during their model making or have achieved any and analysed it. If not we would write it down as their next steps. However, in each others discussions it was fairly similar because we had quite similar stuff that we were missing from our PowerPoint so we discussed how we could all approach it and when we are planning to approach that, also if there will be any problems we would give some solutions to help out. We picked holes for

For the Half Term coming up I am planning to make more models so my plan of action will be:

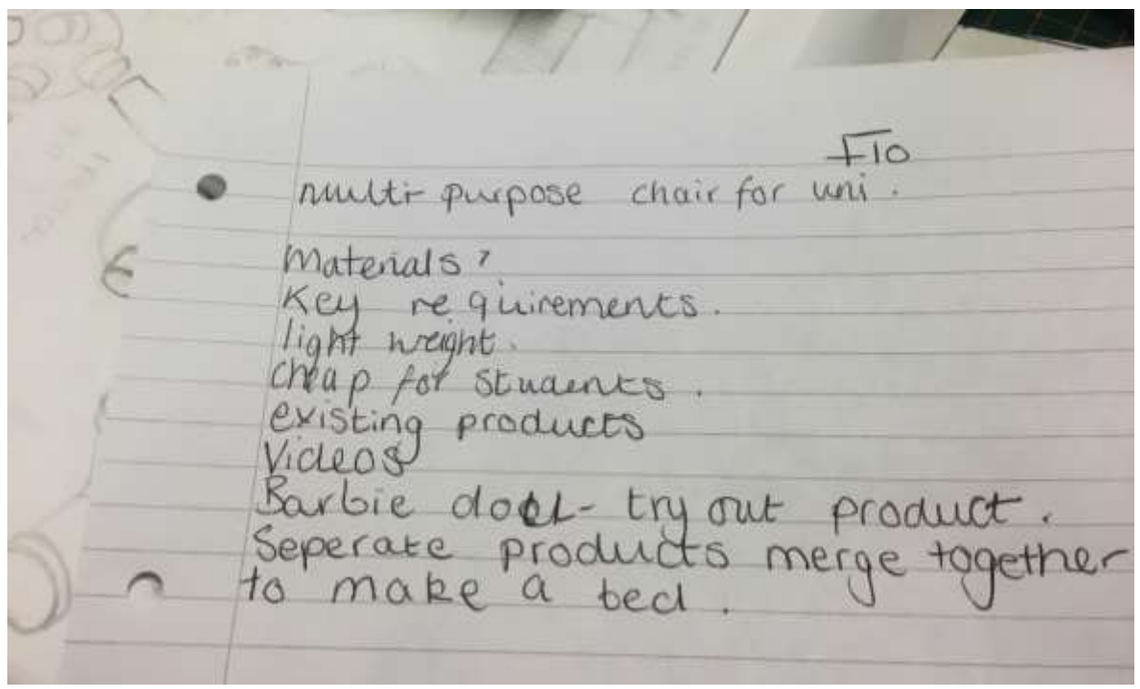
- Take some blue foam home before Thursday 25th
- Cardboard
- Metal rods
- Dowels
- Take Models home

For the Half Term I'm also planning on designing a final idea, but I still need to investigate on what materials and technical requirements I'm going to use and if it will successfully work. Moreover, I haven't achieved all of my core requirements in one model so I will need to do that and if not I will have to get rid of one of my core requirements if it cant be achieved. This requirement would have to the stool as its not as necessary as the others.

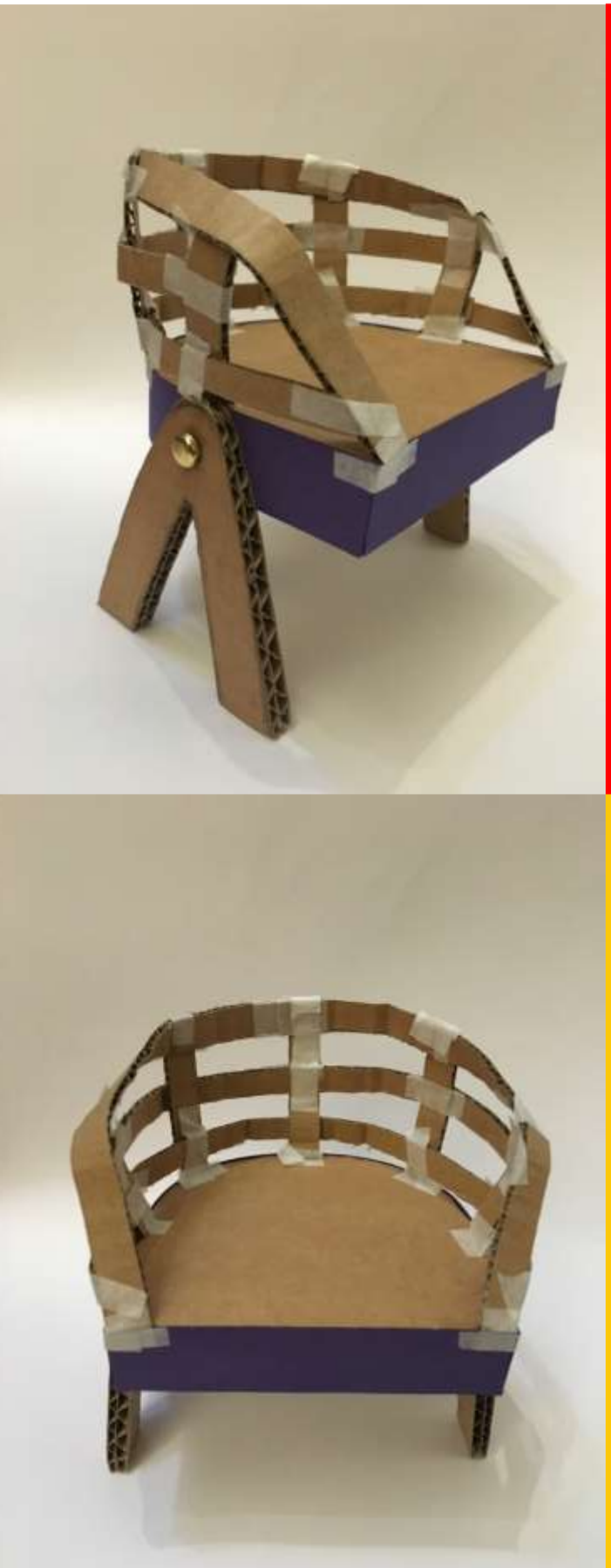
This note was written by Caitlin, one of my peer in the group discussion. She has written down my next steps and what she thinks is missing from my PowerPoint. She has briefly written down what I need to do. For the materials I need to analyse my models and suggest what materials are going to be used to manufacture it and the techniques it will need to make that specific shape. Moreover, she wrote down key requirements to remind me to keep recalling about them when I analyse my models as I have, but forgotten in the others or simply because none was achieved. Also, I need to make short videos of other people and see that they think about my product.

To make my PowerPoint even better and develop my product further they suggested that I compare my models with existing products and see what technical requirements I could use by comparing what the existing products use to what I was planning to use. Furthermore, I will need to investigate how much the existing products for university accommodations are and base the price for my product on that, along with how much the cost of materials are.

Also, they have given me some advise on how I could approach achieving all of my core requirements, the scale of my final model and how to test my models and see if it will actually work or not. To achieve all of my core requirements for my product they suggested that I should model one core requirement at a time and merge them into one model or apply that successful requirement into a model that achieved most of the core requirements.



Model 6



AESTHETIC

I feel like that this chair would be popular in terms of its style. This is because of the curved structure as it adds a bit more texture to something quite bland and plain. However, I think this would only sell to older consumers as its quite dated.

COST

This chair would be manufactured within my budget. This is due to not over designing the product so there should be enough wood **to** make this as most of it would be out of wood.

SAFETY

I don't think that this chair is fairly safe due to the legs. The way that the legs are attached gives no support when it comes to the consumer leaning back. This would cause injuries if I don't change the design and make sure that it doesn't roll back.

FUNCTION

This is very easy to work with and wouldn't need any instructions. However, it didn't reach my target requirements on the functions needed. This has only achieved two which is why it's easy to figure out, however when finished it should still be easy.

EASE OF USE

This chair will require some manual handling to change the position and function of the chair. However, it wont be too difficult to do so. This chair will also not come with instructions as it's common sense as everything is on display.

PACKAGING

This chair will be packaged in the table position where the legs are stowed away. This is because it the smallest it can get and it will come assembled because the back rest will be too intricate to DIY as a flat pack.

Suitability for Consumer

This chair would be suitable for the consumer, however it's use is to be sat on because the table function doesn't work. Moreover, This would only be suitable for a short period of time because it's quite dangerous.

Size

The size of this chair would be very similar to a size of a small armchair. The seat width would be the one similar except the height. The height would be around the average height of an office chair which should suit everyone.

Environment

This chair would be very environmentally friendly because all wood is going to be used to manufacture it. The wood is going to be Pine, this is because it has excellent bending abilities and sustainable.

Production

This chair should be fairly easy to manufacture because it doesn't have intricate shapes to manufacture. The only challenge would probably be the weave part because the bent shapes not be able to hold up the shape.

Materials

The materials needed just for the chair would be Pine, Metal fixtures and fittings, wood glue, foam and mesh fabric. To manufacture it, I would need the steam box, band saws, sand disk or grinder and other hand tools.

Expectations

It didn't exactly turn out the way I imagine it. This is due to the other functions not being able to be made because of the complications it would give to the chair. So I would need a design which fits all the requirements.

Improvements

When modelling this I did not consider about the measurements for the leg of the chair. I just estimated what the height would be. I should have measured at least the height of the seat so that it can function as a table too. To do this I could always take off the split pin and make another leg but this time it will be measured. This would be able to solve the problem but since the split pin is already in place and I have glued the seat sealed, there is no way I can take out the existing leg unless I rip it apart and re glue it all back together. Moreover, the chair's leg is not actually flat on the ground, there is a little slant because of the legs' design. This could be a problem because the chair wouldn't be sturdy or stationary which means that it could endanger my consumers as it can't keep them in place like what a chair should do. So when cutting out the legs I need to make sure that bottom parts are flat straight to the ground

At first I decided to make a longer leg but I didn't like how it turned out so I decided if there was an adjustable mechanic that will make the legs extend and retract so that it can suit everyone's chair height preference. Then this part of the chair will make it more ergonomic, however, I don't know how I will incorporate this into the design unless it's modular. But having a modular piece would make the chair have a weaker point because when its been over used for long time them those would eventually get weaker and the whole structure could fall apart. So for now I am going to just replace the legs with a longer one so that the table function can work too. However I would need to change the design of the legs if I were to use as my final design because it would be unstable specially when enough pressure is put against the back of the chair the legs could give off and rock backwards as there is not enough coverage for this chair to be stable

- Core Requirements

This chair has only just about successfully achieved one requirement and that is a chair. The table function would have worked if measured the height of the back rest so that it can lay flat and function as a table. The other requirements that I haven't achieved are the bed, desk, possibly a foot stool or stool and some storage space.

- Design is very 60's/70s

This design is very outdated and I feel like it would only appeal to older consumers which are not my target market. However, someone could still prefer the style but it just wouldn't make enough profit to go to the trouble and producing it, knowing that it wouldn't sell as much.

- Weave basket chair is very unappealing

This design was outdated for a reason, but I though it would add something unique to my furniture instead of having a block wood as the back rest.

What's wrong with this design?

- Size

I have come into terms that the size of this chair is out of proportion. The back rest would be fine, considering that someone on the bigger size would not be able to fit as seems quite tight. Also the height is good but would need to consider the height for it to fold flat with the backrest.

- Uncomfortable

Even though this chair has a curve back this is still not enough to make it comfortable to be used at a long period of time. This chair would need cushions and not just blocked cushions but ergonomic one. Ergonomic cushions would help support the spine and wouldn't cause as much strain as a normal cushion.

- Stable?

Legs roll back, not enough support when someone rocks back which therefore makes this chair unsuitable not only for my consumers but for the market too

- Cause harm to my target market

This could either be because of the legs rolling back or the back rest as the screws can come undone and the wood spring backs which could harm the back of my consumers.

Design Process

Plan for tomorrow:

What am I doing?
- Model analysis/evaluation

Where am I going?
- More models – developed, advanced, ergonomic - CAD
- Final idea sketches
- Choose specific materials for the final idea

Missing –Gaps/Holes?
- Video Analysis
- Further development analysis i.e. materials, manufacturing techniques, fixtures and fittings
- Research into prices – will it be cheap for students?

What I should focus on:

Key Requirements
-Chair
-Chair desk
-Table
-Lounge chair/bed
-Stool

Focus on making each requirements without having to build the actual chair and see if it will be a success
Try different approach of making them

Feedback
TO DO:

- Intricate model – develop this idea (Model 7) iterative
- Styling – try to look into contemporary design – what is contemporary furniture? 15/11/18
- Utilising each purposes e.g. table could also be something else, foam comes out as a footstool
- How pieces come together i.e. moulded hinge instead of a normal hinge
- – draw – model – cad – but vary/different approach
- Think about each purposes in their actual functionality – bed should have enough space for leg
- Scale of model – Use art dude to make model
- Price of everything: materials, manufacturing techniques
- Structure is flat – curve the seat

Research

What is contemporary furniture?
Contemporary furniture which is also known as modern furniture is what's built after the 19th century. Contemporary furniture invoke the styles and trends that has the best designs and characteristics. It acquires the furniture to have elements from all styles and generation. Contemporary furniture is all about neutrals, blacks and whites.







Model 7

Cad 4-6 weeks
Workshop 7th January

Aesthetics

I don't think that this chair is very appealing in this generation because the style is very old fashioned. It has a 60'/70s feel to it as well as the weaved basket chair as the wood structure of the tub is visible.

Cost

The overall cost for this chair will be fairly high. This is due to it not being simple. It has many different parts which would be costly to make, so the overall price would be higher than my £200 maximum budget to gain a reasonable profit while paying off the expenses to manufacture it.

Materials

I don't know what wood to use for this chair yet because I am debating whether to use all the same type of wood and use different ones for different purpose. However, I will use Pine for the supporting U shape. And for the cushion , a memory foam.

Safety

With this chair the danger it could possibly cause for the consumer is back aches or sore bottoms. Also it could possibly collapse if the knock down fittings used are not chosen properly. Moreover, this entire chair could collapse because the structure are stacked on top of another so an additional support will be required so that it is more stable.

Suitability for consumer

This chair is totally suitable for the consumer, it's safe to sit on and the functions are fairly workable. However, the bed function might be too short for an average adult and would probably only fit a child or someone under the height of 5ft. But this can still function as a lounge chair their whole height is not needed.

Packaging

The size for packaging this would be fairly big. This is due to it coming as an assembled product. Moreover, this would overall be heavy either way because of wood as the material being used.

Size

The size of this chair is comparable to an armchair because it basically looks like one. However, the height of this would be slightly taller than an armchair because it's going to be used for work.

Function

To use it, a lot of manual handling will be required, this is because you actually have to lift up the whole chair to enable the lounge chair/bed feature. The back rest is also removable if not needed or act as cushion as it will be made out of *thin foam*

Ease of Use

This will not come with a set of instructions because it will be fairly easy to use as all you would ned to do to achieve the other functions is manual handle the top layer and the bottom layer should fold out without any trouble. If not it's common sense to just play around with it to see how it works.

Expectations

I didn't expect that this chair would achieve most of my core requirements but the design seems to be successful as the other functions can be added without any complications. This is due to the fact that most of the surfaces are flat so that other features can be redesigned and easily attached.

Environment

This chair is quite environmentally friendly and the only bad impact it will have on the environment is the disposal of the foam when its ruined or need replacing. However, wood is the main material for this chair so it shouldn't effect the environment as its reusable. The only thing that would is probably deforestation if the wood used is not sustainable.

Production

The design is not overly complicated but to manufacture it I feel like it would take a lot of work and skill to make this chair. Most of the wood would need to be cut to size by either the bandsaws or the circular saw. I feel like the only challenging part of this design is the steam bending of the supporting U shape for the backrest. This is because the bend is quite deep and I don't know if it can be achieved even with predicting the spring backs.

- Key Requirements met?

With this model this is the closest I have met all of my requirements, the only thing that I haven't met is the table. This is because it would require me to change the upper shape to an even more block shape to be able to keep it flat to be able to function like a table.

- Feasible?

I think that this chair is feasible, however, I have not considered how the rest is going to be manufactured e.g. the backrest and the desk. I don't think that the way I made it here would work in real life as it would need more support to keep it together.

- Style is very outdated

I feel like this style is fairly normal but since I added the colourful 'cushions' for the back rest it suddenly made this chair very outdated. Moreover, the slats for the back support also made this old fashioned where it reminds me of the wooden uncomfortable chairs. I think that if it was solid with no gaps in between, it would have made this chair more contemporary and modern.

- Easy to work out?

This chair is easy to work out, all there needs to be done is to pull the seat up and it should just unfold with some manual help to keep it in place. Other than that, it should be fairly easy as the fixtures/fittings used should be self locking

Improvements

- To improve this chair further, I could have added a table function even if it's just using the bottom structure and leaving the top structure as a very small stool. I could have added a lock which allows the bottom and top layer to attach and detach easily so that they can be used differently at the same time.

- For the backrest I could have just joined it onto the U structure so that it wont be a separate part which will need to consider how it's going to be attached to the chair. This will also add more complications and time consuming to manufacture because there are different things that need to be attached and manufactured so that they can be pieced together.

- Moreover, there should be another structure which lays flat so that it would be able to fit someone in the taller range because most of my target markets are young adults which are fairly tall. So I don't think that this will fit them as there legs would be dangling over the bed.

Manufacturing Techniques

For this chair the manufacturing techniques used wont be expensive, this is because the parts need to manufacture this are not intricate or needs professional/very skilled workers to make it.
The machines that will be needed are most likely to be the band saws or the circular saw for the bigger parts of the wood. Also, a steam box might be used for the U structure being held up by the slats
The cushions will be cut to shape and covered with a breathable fabric. This cushion will also be stapled to the wood before its covered by the fabric so that it is fixed and wont mover around when used.
Moreover, hinges will be attached on the ends so that it can function properly and transform to its other functions. These could be either attached by screwing it on the wood or using adhesive which would be a very bad idea as glue will get weaker easily specially when it comes in contact with water or moisture.

- Size

This chair is quite big and bulky which would probably make it heavy too. This looks very heavy because the top structure where it curves out further to allow more space for the consumer. This is what makes it bulky as the bottom structure is not as wide as the top. However, this shouldn't be too heavy to manual handle because I will choose a wood that is lightweight and I will use a thin sheet for some of the parts.

- Expensive?

I feel like that the overall cost for this chair would be quite expensive due to the small parts of wood needed and the cushions. This is because it will take more time for smaller pieces to manufacture and there are many cushions that are going to be used her

- Long term use

The fixtures and fittings, hinges etc will fall apart overtime as it's a temporary fix and if it's in constant use then there's a high chance that they will become weaker/looser which therefore results in buying new screws or the furniture if it can't be fixed. This will add to the consumers cost and if it keeps happening then the consumer will likely get rid of the product all together and buy a new and better product.

- Comfortable?

I would say that this chair is going to be comfortable because of all the cushions that I have added, this should provide enough comfort to be able to sit in it for a long period of time specially when studying or sleeping

Unfinished Model

I decided to leave this model because it doesn't look aesthetic. Moreover, the design is very basic and the way its made makes it look uncomfortable as there are no rounded edges and curves. Furthermore, this chair is just a chair as it was hard for me to design a modular one, I lack of Solidworks skill and tend to make things simpler but it doesn't do my product any justice because all the parts are complicated and needs explaining through design and with this one it barely reached any of my core requirements which is why I decided to leave it alone and move on.

- **Expensive?**

If I were to finish and make this chair design I don't think it will be that costly, this is because all of the materials that are going to be used are fairly inexpensive and the manufacturing techniques used wouldn't be expensive to run because the parts are not intricate to manufacture.

- **All core requirements reached?**

The only thing that this model achieved is the chair and desk function and possibly the table too. This would be if I finished it because the metal structure does detach from the chair and perform as a table if I added an extra piece of wood which would go on the bottom of the structure and this can be flipped to be used.

- **Style**

This chair does look very simple but ugly, this is due to the top of the chair structure because it looks quite awkward and out of place. Also, it just doesn't have an appeal to it which could attract the market.

- **Unsafe**

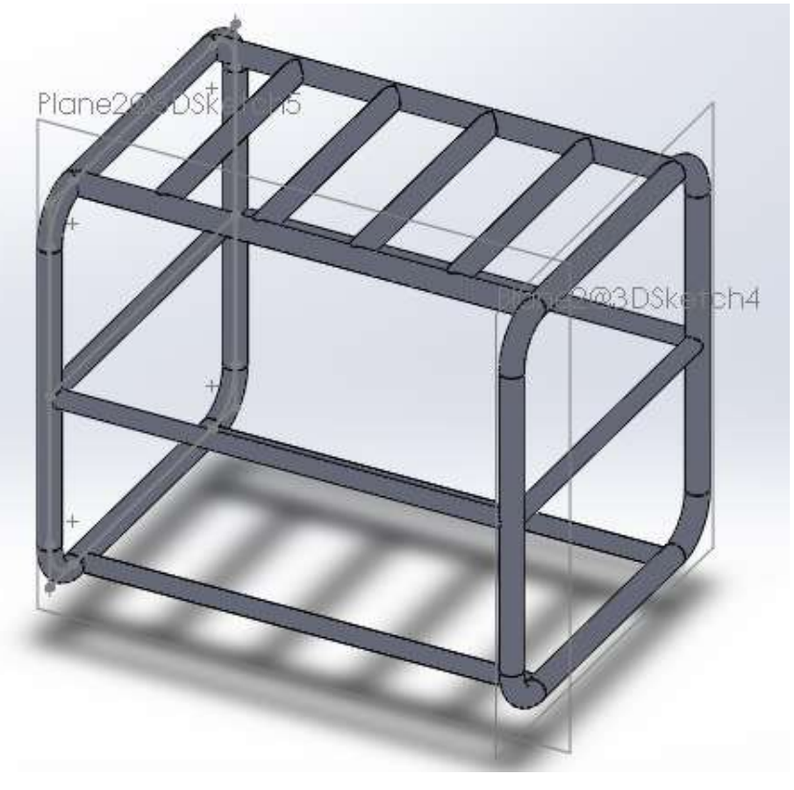
I know that I didn't round any of the edges which will therefore make this an unsafe product because it can cause bodily harm to my consumers.

- **Feasible?**

I feel like this chair could work, however, I don't think that the desk function is quite stable, this is due to it probably being one sided heavy and there is barely no support from the chair when it's flipped. Furthermore, this could potentially break over time because the fixtures/fittings will get weaker when it's in constant use and could loosen the hole which therefore slants the desk and make it non usable.

- Easy to use?

This chair should be easy to use once it's finished, this is because there are no complicated fixtures and fittings that needs to be fitted or attached. The functions should be very self explanatory, if not then there will be simple image instructions on the packaging on how to make use of the product.

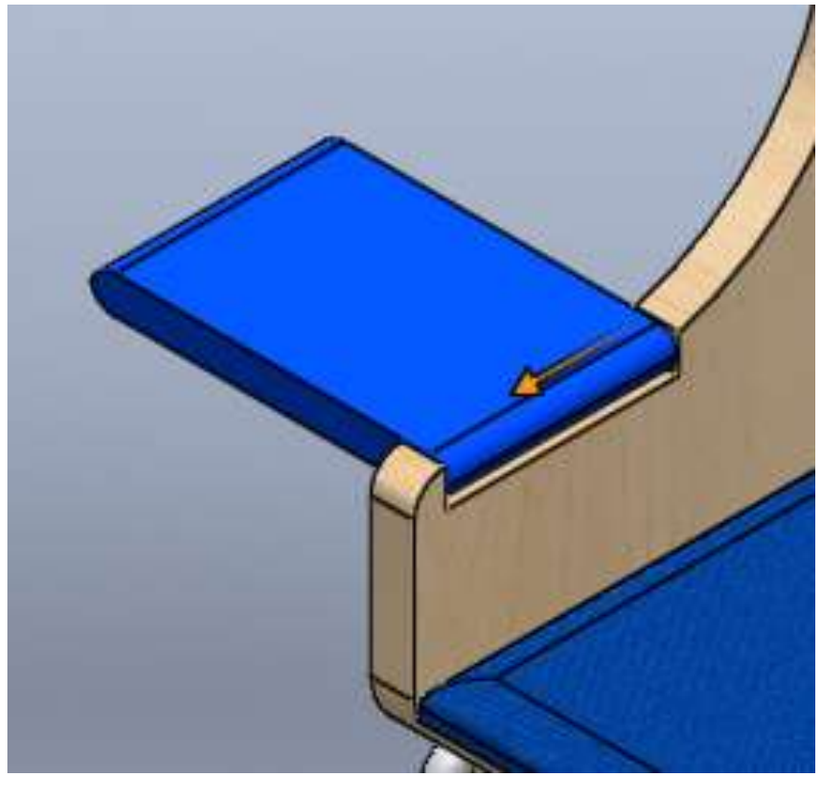


- **Uncomfortable**

The backrest with this design is very straight which makes it not ergonomic and uncomfortable. This could also be because of the lack use of cushions, specially for the back. Without correct padding this could lead to my consumers having back problems because there is nothing that will support their spine. Moreover, the cushion here is not ergonomic as it doesn't have a shape which should follow the human bodies natural curves and it's also too thin which barely adds any comfort at all.

- **Durability**

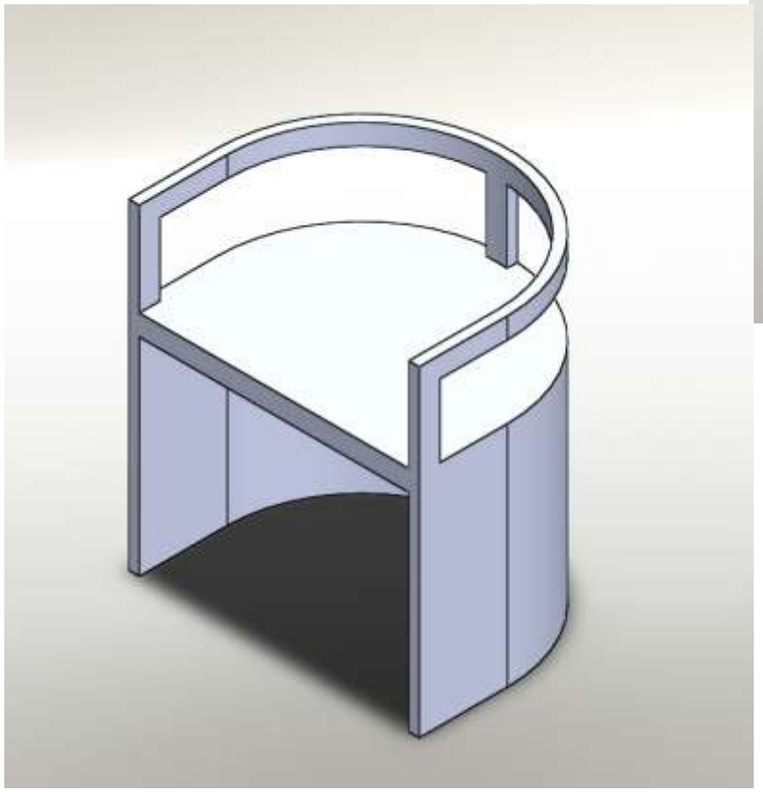
I would say that this metal structure here on the left would be durable but I don't think that the chair structure would be. This is because the metal structure would be cross welded for strength and there are many support tubes that will hold the structure together. On the other hand, the chair structure will be manufactured in part which therefore would have breaks/weak point where the wood parts came together.

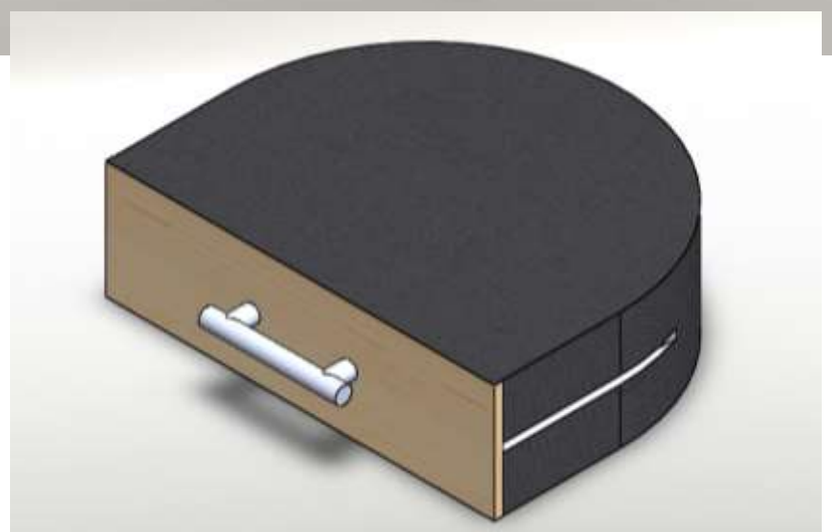


Unfinished Model

- This chair had potential, however, due to me not completing it, it didn't really reach any core requirements.
    - This chair is however, aesthetic and has a good sense of style to it. It's fairly simple and has no intricate parts which would be difficult to manufacture.
- On the other hand, it does look uncomfortable because even when there's a cushion the cushion made here wont offer enough support anyway. This is due to it not following the requirements of an ergonomic cushion when it follows the natural curves of out back
    - When manufacturing this a steam box will need to be used, this is due to the shape of the structure being curved in a U shape. However, I don't think it will achieve the desired shape this is because there will be spring backs when dealing with a steam bending process as it cools down. This due to the surface tension which causes the shape to naturally try to change back to its shape.

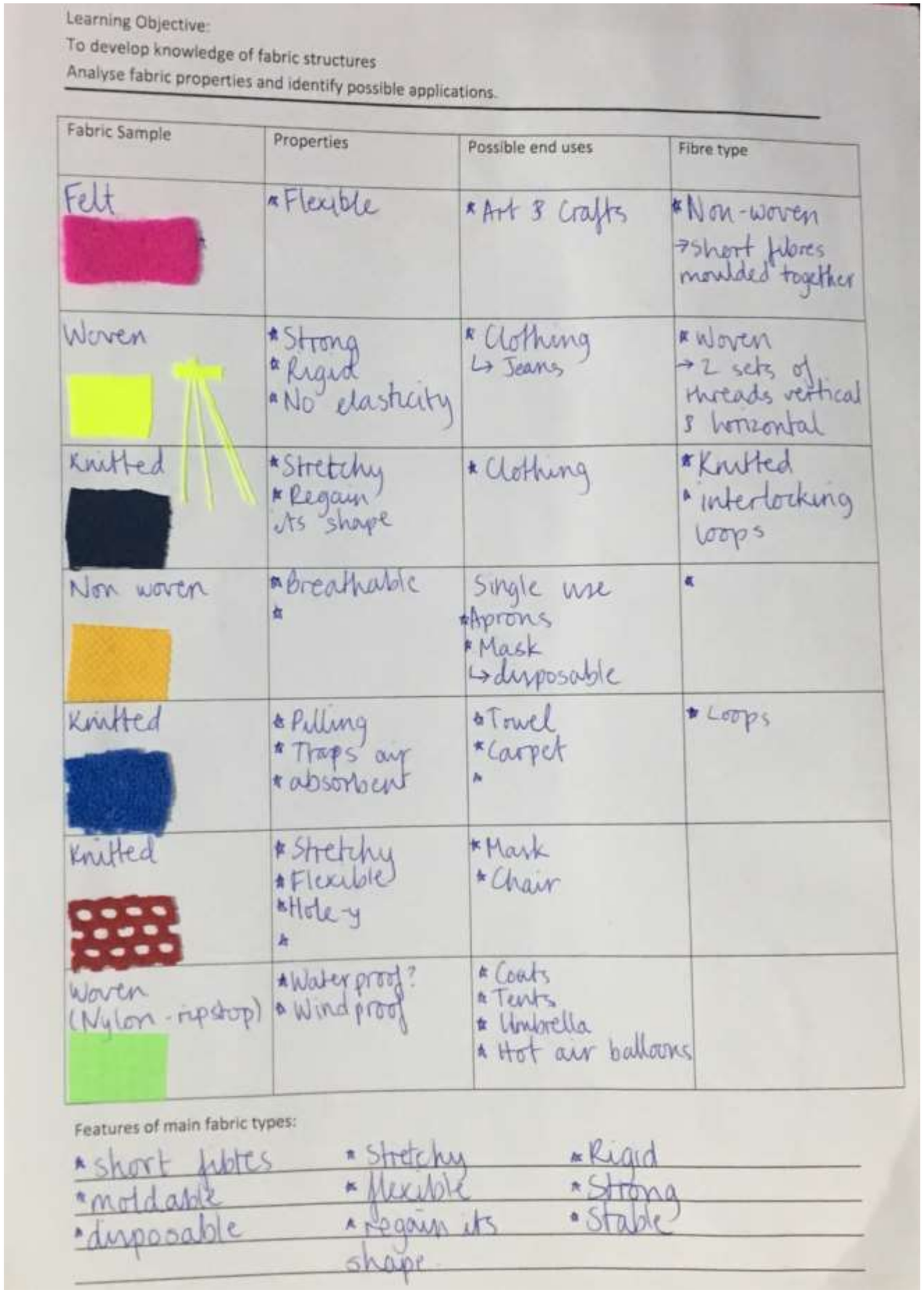
I decided to leave this model because it was taking forever to make and I needed to move on, this was due to parts not matching up and because all the measurements were wrong which made it very difficult to mate in Solidworks. This is how far I have gotten which will turn into a bed, however, I didn't really consider how it's going to turn into a bed or it's other functions.





- Moreover, the arm rests looks way too small for a child, let alone my consumers who are generally quite tall with long arms.
- This structure is not manufactured how it's designed, this chair is supposed to be modular where parts of it would come apart so that it can be made into it's other functions.
    - This chair is quite big too which therefore impacts on the way its going to be packaged and exported. Also, it will be very heavy to manual handle because the product is one big load and is not separated into parts which could lessen the weight impact when handling.
- Furthermore, I don't have a clue on how I will attach this fabric seat onto the wood structure. This will be another process in manufacturing this chair and it might be quite intricate because the structure that it's going to be attach to has a small surface. Moreover, if it's attach by screws of showy fixtures it would ruin the aesthetics of the chair.

Lesson on Fabrics



Learning Objective:
To develop knowledge of fabric structures
Analyse fabric properties and identify possible applications.

Fabric Sample	Properties	Possible end uses	Fibre type
Felt	* Flexible	* Art & Crafts	* Non-woven → short fibres moulded together
Woven	* Strong * Rigid * No elasticity	* Clothing ↳ Jeans	* Woven → 2 sets of threads vertical & horizontal
Knitted	* Stretchy * Regain its shape	* Clothing	* Knitted * interlocking loops
Non woven	* Breathable *	Single use * Aprons * Mask ↳ disposable	*
Knitted	* Pilling * Traps air * absorbent	* Towel * Carpet *	* Loops
Knitted	* Stretchy * Flexible * Hole-y *	* Mask * Chair	
Woven (Nylon - ripstop)	* Water proof? * Wind proof	* Coats * Tents * Umbrella * Hot air balloons	

Features of main fabric types:

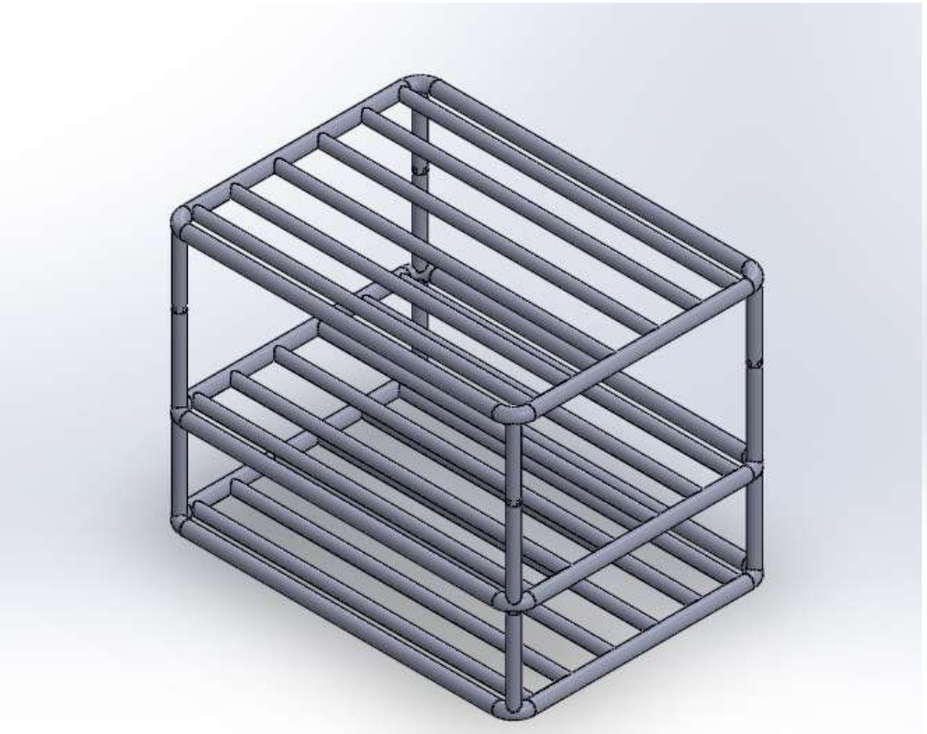
* short fibres	* Stretchy	* Rigid
* moldable	* Flexible	* Strong
* disposable	* Regain its shape	* Stable

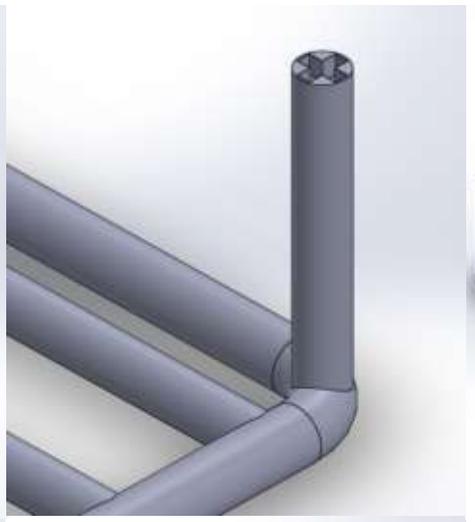
In this lesson, we had Sharon who is also a DT and Textiles teacher. During the lesson she thought us about the different types of fabrics, how they are made and the products that could be made from them.

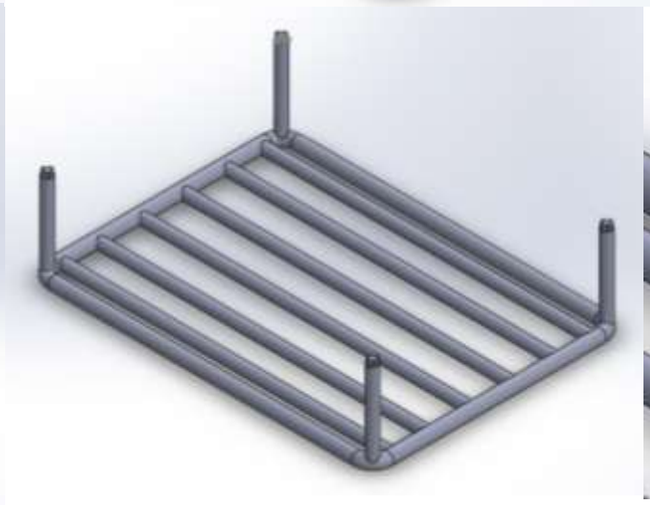
First of all, she showed us a slideshow which had pictures of products and we had to know what the products are made out of by either guessing it or using our common sense by eliminating the obvious and picking out the necessities for that product. Sharon also showed us how the fabric itself is manufactured, if they are either woven, non woven or knitted. She gave fabric examples to us so that we can investigate and guess the structure or fibre type of the fabric. After observing the fabric examples that were given to us we also had to give its properties/characteristics and visualising what products could be suitable to be manufactured using that fabric. This was very helpful because it helped me understand all the different fibre types and what is suitable for my chair.

My chair's only use of fabric will be the cover for the foam that I'm using for the seat as the rest of materials will be wood and metal for an eco friendly furniture. The only plastic that I will also be using is for the connections. However, metal ones can be made too but this would be too expensive which therefore would raise the cost of my chair and might not be able to sell because it's overly priced for students. But, the fabric that I require is to be breathable, soft, durable, good resistance to wear and easy to clean. This is because it should be able to absorb moisture and be comfortable as this will be used for a long period of time. Moreover, it also needs to last for a long time so that it wont need to be replaced quickly which will be costly for the consumers, and resistant to soil or at least can be easily maintained because I would say that my target market are lazy or wouldn't spend much of their time cleaning. So if the fabric needs to be breathable and flexible I would need to choose a fabric that is knitted as it has interlocking loops which should allow air to flow through and absorbs sweat and any moisture instead of pilling on top and bathing in you own fluids.

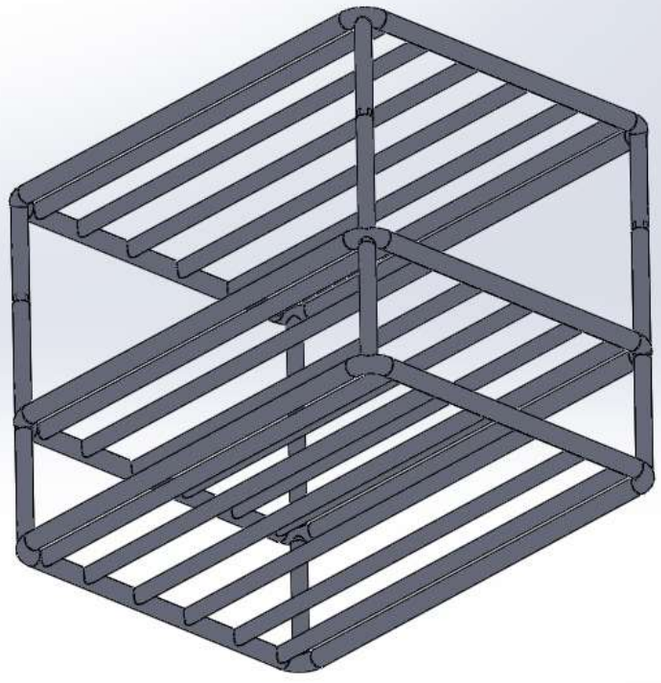
Final Proposed Design Idea







Base Structure



Possible Materials which could be available in the workshop

- Metal base – Carbon Steel
- Chair –Birch or Pine
- Fabric –
- Filler - foam

List of materials and manufacturing techniques

Materials

- Carbon Steel
- Pine
- Birch
- Tubular connections i.e. 3 way 90 degree elbow tube
- Grub screws
- Karabiner Round Clips
- Split Ring Pipe Clip
- Foam
- Mesh fabric
- Cotton Blend

Manufacturing Techniques

- Router Mill
- Cross Welding
- Heat Bending
- Spray Painting?

Rough Cutting List

Button Clips for attaching and detaching the structure

MDF

My original plan was to have pine or birch for my chair but the MDF will be a substitute for making my model. I am planning to use MDF for my prototype as it can be easily machined.

Length (cm) :	Width (cm) :	Depth (cm) :	Component :	Quantity :
42	160	2.5	Back rest	X1
55	55	3	Seat base	X1
45	30	2	Desk	X1
50	55	2	Pull out table	X1

Foam

Retain the shape after pressure is applied so it will be a good cushion when sat on or laid on.

Length (cm) : 55	55	
Width (cm) : 55	55	
Depth (cm) : 5	2.5	
Quantity :	X1	X2

Component : Seat Cushions and Extra foam for extending bed

Length (mm) :	Diameter (mm) :		Component :	Quantity :
57	2		Length of my square bases	X6
42	2		Width of my square bases	X6
55	1.75		Tubular structure for additional support	X18
15	1.75		The height of my square bases	X8
16	1.75		The height of my middle square base	X4

Tubing

My original plan was to use carbon steel for my tubular base. If it's not available or too expensive then I would probably just use dowels to appear like carbon steel by spray painting it silver.

	3 way elbow tube	Split Ring Pipe Clip
Length (cm)	N/A	N/A
Diameter (cm)	2	1.75
Quantity :	X12	X4
Component :	Connect the corners of my square bases	Connect the desk to tubes arm desk

Extra Tubular Connections

- Split Ring Pipe Clip
- Tubular Elbow connections – 90 degree 3 way tube

Fabric

Mesh fabric will be the fabric that goes on top of the cotton blend fabric. This will only be done on the 'right' side of the seat where it has ergonomically curves. I would like to use cotton blend for the bottom layers and the other cushion covers.

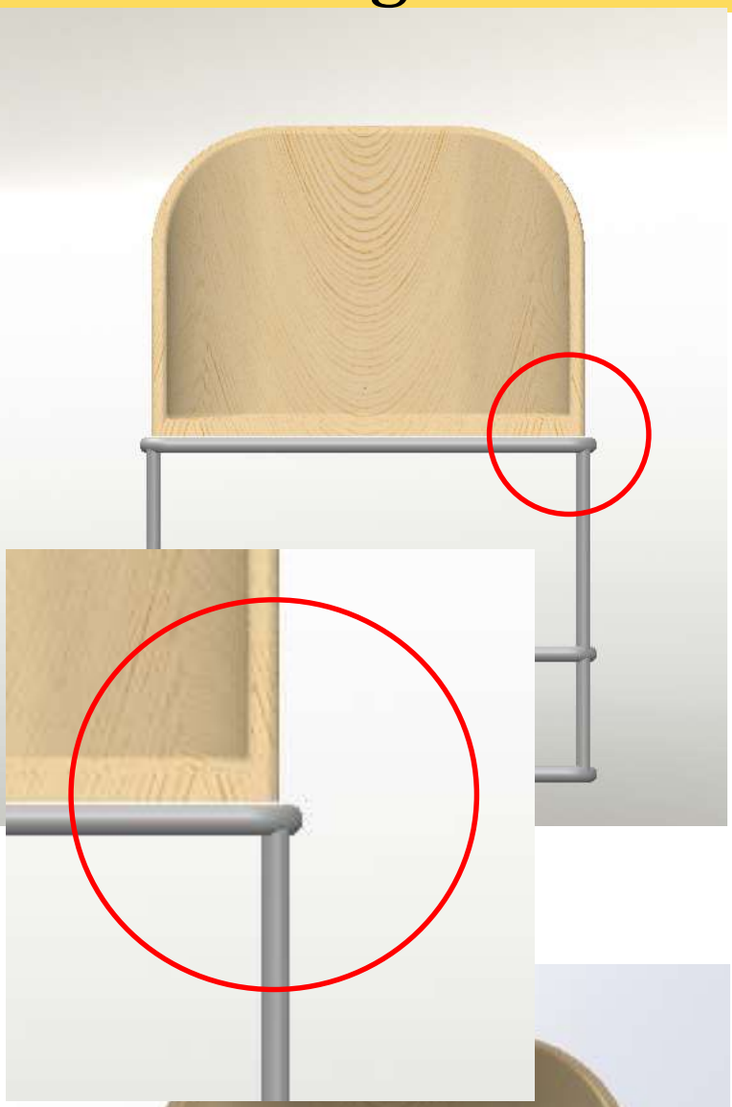
Length (cm) :	Width (cm) :	Depth (cm) :	Component :	Quantity :
55	55	N/A	Seat Cushion	X2
60	60	N/A	Foam Covers	X4
55	55	N/A	Mesh fabric for top layer of seat	X1

Metal Bolts

- Grub screws
- Karabiner Round Rings

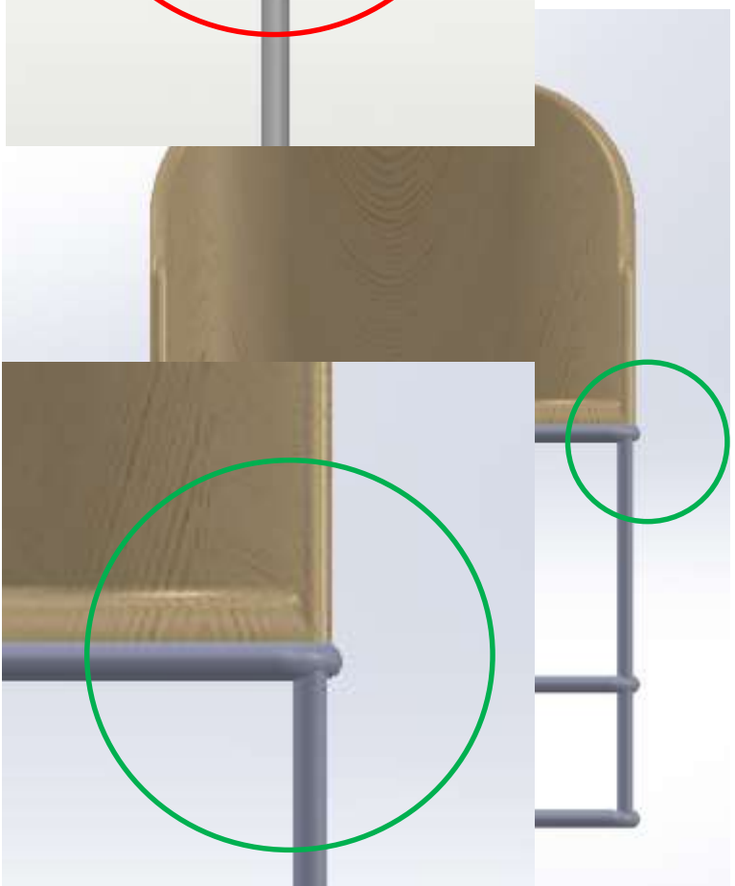
	Grub screws	Karabiner
Length (cm) :	1.5	5
Diameter outer (cm)	1	4
Quantity :	X36	X4
Component :	Screws for the elbow tubes	To attach the foam cushions together

Final Design - Development



What's wrong with his design here is that there is a small gap in between the metal structure and the chair structure. This could be due to not mating the two together properly. Moreover, it's probably because I didn't design the small spindle which attaches the two together by screwing it onto the chair structures base.

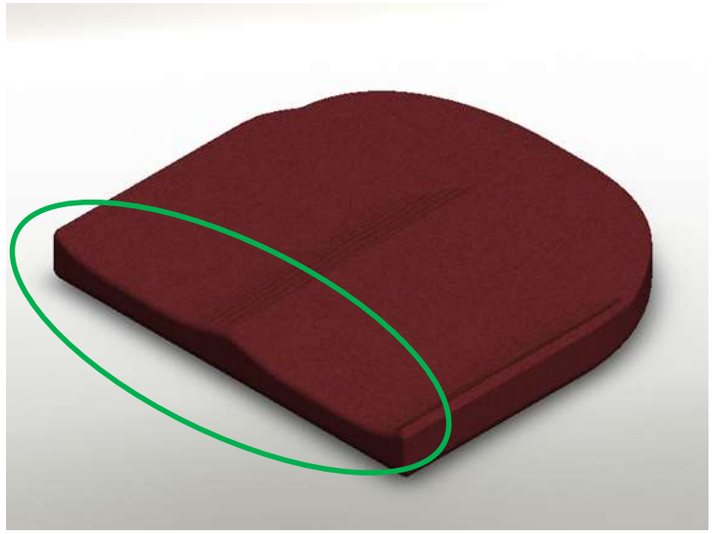
Furthermore, the metal structure is slightly longer than the chair structure. This is because I didn't really measure properly how long the chair structure was and I also didn't consider that when I made the metal structure that it will add a small cm when it's bent. This can be seen in the image here where the curve is quite protruding and adds a small cm to the structure.



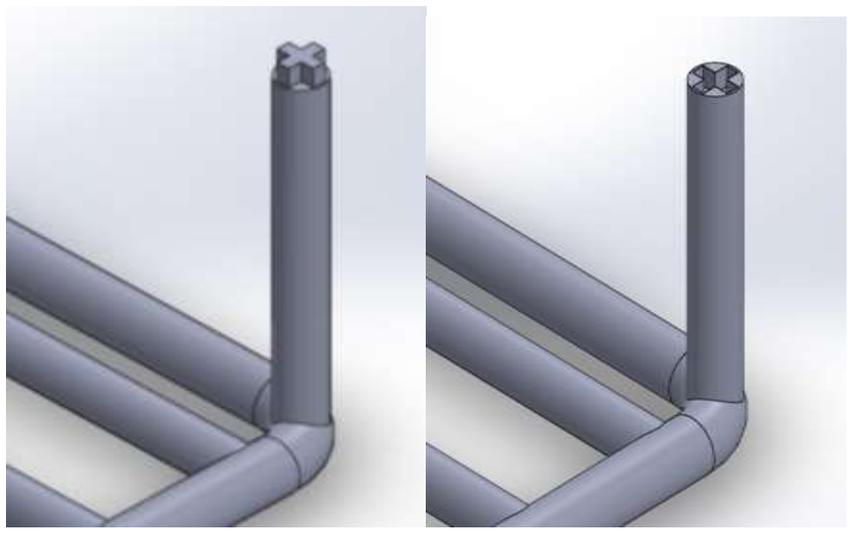
To correct these I had to try the other mating functions to see it will mate properly however, it was the same issue so instead I drew a line just right on top of the metal tube and converted that same line to the base of the chair structure so that it can align properly and mate together therefore not leaving anymore small gaps.

I also changed the dimensions of the chair structure to make it wider so that the metal structure is not that noticeably bigger. I did this instead of reducing the size of the metal structure so that the bigger side of my consumers will be able to fit on the chair, if not there will be plenty of room for my other consumers and not as claustrophobic.

I think that this design would be okay if I were to make it out of memory because it shapes the human's natural curves anyway. However, over time with constant use the memory foam will get flatter and therefore wont be as comfortable as it was before. So in conclusion I think that changing the design would be the better option than using a different foam for this design.



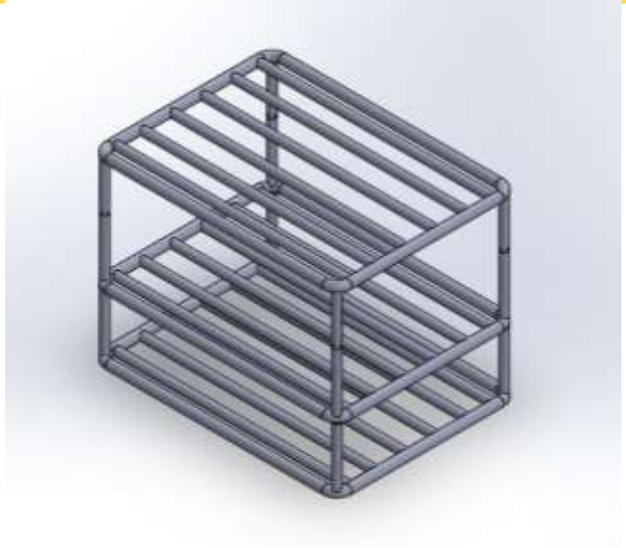
This has probably been the most challenging thing I have tried to create. This is why this cushion manufactured is very simple. Moreover, it's due to me not knowing what the cushion was going to look like. Furthermore, I had no clue how I would design it on Solidworks because it's quite an intricate design which requires sweeps, lofts etc. which I have tried and failed as I did not like the end result.



I don't think that this structure is feasible, however, it depends on the diameter of the tubes that I'm going to use. It might be able to hold the weight since it's a cross structure. However, this would be challenging to manufacture because you can't really carve out metal without difficulty. So to be able to achieve this structure I would need to extrude it to that shape, which wouldn't be an option for me as it would be too expensive.

Due to so many technical difficulties and lack of challenging skills in Solidworks I manufactured the chair to look like it has been joined together by wood adhesive. My initial plan was to have either a biscuit joint or a Mortise and Tenon joint.

After many foam design ideas, I have finally decide to use a plain design and use memory foam instead of foam fillings. This is because memory foam has the ability to follow your shape and will retract back to its normal size once pressure is not applied.



I'm still sceptical whether this base structure will work because I feel like that the diameter that I have used here is too small which therefore would probably make my cross section connection not work as it will be too small and thin to be able to join together.

This desk here would be the easiest to manufacture, however, its very simple and plain. Also, I don't think it will be able to fit on the arm rest as the arm rest is quite small and is already close to the back of the chair which will lessen the space for the person and defeats the purpose of the chair.

Risk Assessment - In The Workshop

Necessary : | Safety goggles are always worn in the workshop | Tie hair back | No dangling accessories i.e. lanyard | Be aware of surroundings and people

LOW

HAND TOOLS
There are going to be various of hand tools that I am going to be using. However, I still don't know which, but since there are low risks that can occur I will just have to be cautious when using them. Hand tools will only be used on small things, to attach the fixtures and fittings.

SAFETY
- Space awareness
- Put it back where it belongs
- Don't mess around with it
- Don't use if broken/blunt

SAFETY
- Local Extraction
- Check that abrasive disk is in good condition before use.
- Space awareness
- Take care and focus on the work

GRINDER
This will probably be used more than anticipated because the disk sander might not be able to get difficult corners or either the wood will be too large to sand down. I feel like this tool will be easier to use than the disk sander because its not restricting and as risky.

MEDIUM

DISK SANDER
The disk sander will be used a handful of times because my wooden parts are required to be smooth. This is because it comes in contact with its consumers daily. However, for large shapes I might not be able to fit it on the disk sander table, so I will probably use the grinder tool.

SAFETY
- Local extraction
- Space awareness
- Clean the dust after use or when full
- Keep fingers close to body

SAFETY
- Space awareness
- Clean the dust after use or when full
- Keep fingers close to body

BANDSAWS
This machine might or might not be used, it all depends on how large the wood that I'm planning to cut is. However, even though the wood might be too big for the bandsaw, if I only need to cut a few inches of then I might ask someone to hold the other end for me and use the bandsaw.

HIGH

The circular saw in college can only be used by teachers who have had professional training. This is due to the high risks. These risks can be serious and probably fatal cut injuries.

In this risk assessment I have only highlighted the risks of the machines I am planning to use. This is so that I can remind myself of what production methods I am going to use and the dangers that come with it.

SAFETY
- Staff has sufficient space to work in
- Watch from the distance
- Do not distract the staff
- Guard inspected and maintained

CIRCULAR SAW
This machine will only be the machine that I cant use but is planning to use. I will have to ask a trained staff politely to use it to cut the pieces of wood for me. This is because its highly dangerous and you have to be professionally trained first.

Production Plan - Desk

True scale desk model

Material: MDF

START

First I will need to measure out the available woods in the workshop before I could cut out the shape.

Make sure that the MDF wood has the correct dimensions, specially the thickness which will be 1mm thick.

If the shape required for my desk is too big for the **bandsaw** then I will have to ask my teacher to cut it out with the **circular saw**.

When the rectangle is cut, cut the corners too so that it will be easier to sand as there would be less material.

When that is finished and cut I will either use the **disk sander or the grinder** to smooth out the edges and surface

Check against your chair model to see if it's the right size and that the consumer have enough space when they are sat down. If not, make adjustments by cutting it down and sanding it again.

FINISH

Production Plan – Foam Seat

True scale seat model

Material: Mesh Fabric

- Foam inserts
- Memory Foam

Memory Foam x2. These will be for the lounge chair bed.

START

There are other ways of producing this seat, it all depends on what materials are available in the workshop ad the orders

1

Measure and draw the parts needed
Cut out the fabric parts, when that's done sow all of them accordingly so that it has a shape.

Use a sewing machine and make sure to use a strong stitch so that it wont fall apart.

When sown all together, turn it inside out and start filling it with foam fillers.

Make sure that when your sowing the parts together that you leave a small hole for inserting the foam fillers.

Once filled, sow the hole back together. Test out the product so see it its firm enough or comfortable.

2

Measure the fabric needed for the cover of the memory foam.

Cut the fabric and sow them all together, making sure that this will be smaller than the memory foam.

Measure the size needed for the seat. Add a few mm for allowance.

Carve out the shape using an electric carving knife or a razor knife.

When the shape is carved out, insert it inside the fabric sleeve cover which was made earlier. Close the gap using the zipper attached.

FINISH

As for the 2 extra foam I will be using memory foam, because its more comfortable to sleep on.

Measure individual fabric parts making sure to leave a seam allowance.

Make sure to cut two of each.

Sow all the right parts together and stitch a zipper on the side turn it inside out.

Measure and cut memory foam to size.

Make sure that both foam are the same size.

Insert the foams into their fabric cover.

Production Plan – Chair

Seat Base

Steam /Heat bending

START

Gather the wood needed for the chair.

Measure the wood and draw out the net shape of the chair.

Cut out the shapes using either the bandsaws or the circle saw which I will need to ask for a teacher to do it as the risk for me using it is extremely high.

Once it is all cut out, use the disk sander or a grinder tool to sand the edges down. This will hopefully smoothen out rough edges and pointy corners.

Make sure that you don't sand down the wood entirely because the edges will become uneven and not flat.

After that, cut out rectangular holes so that the back rest can be secured in place.

The hole can either be cut so that a biscuit joint can be put in place, finished off with some wood glue.

The hole can be cut so that it's a mortise and tenon joint with a hole for a dowel to go through for extra support.

FINISH

After the backrest is cut out in shape.

Gather the equipment's needed for heat bending. This includes a clamp and the heat box

Place the wood that needs to be steam bent onto the heat box and wait for it to heat up and loosens it fibres.

Once the wood is at the right heat, placed it on a jig and clamped it down around the jig to get the shape desired.

Make sure not to over bend it because the outside of the wood tends split, but there should be and outside jig supporting the whole length of the wood.

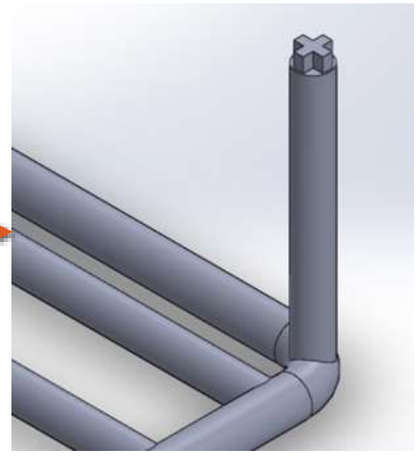
When that is done make sure to leave it until its fully cooled down. Then it can be unclamped and removed from the jig.

You should expect to be a small amount of spring backs which is natural in this process because when you change the shape of something it will naturally try to back to it's shape.

FINISH

Production Plan – Leg/Base Structure

Material : whatever is available - tubes or dowels or broom stick handles



START

First, I have to decide whether I will use dowels, broom stick or the metal tubes.

1

If I use the dowels, I don't think that my structure will hold up. However this will all depend on the thickness of the dowel used.

2

The broom sticks will be a better choice than the dowels. This is because the thicker it is the sturdier it will be because it will be able to withstand more weight.

3

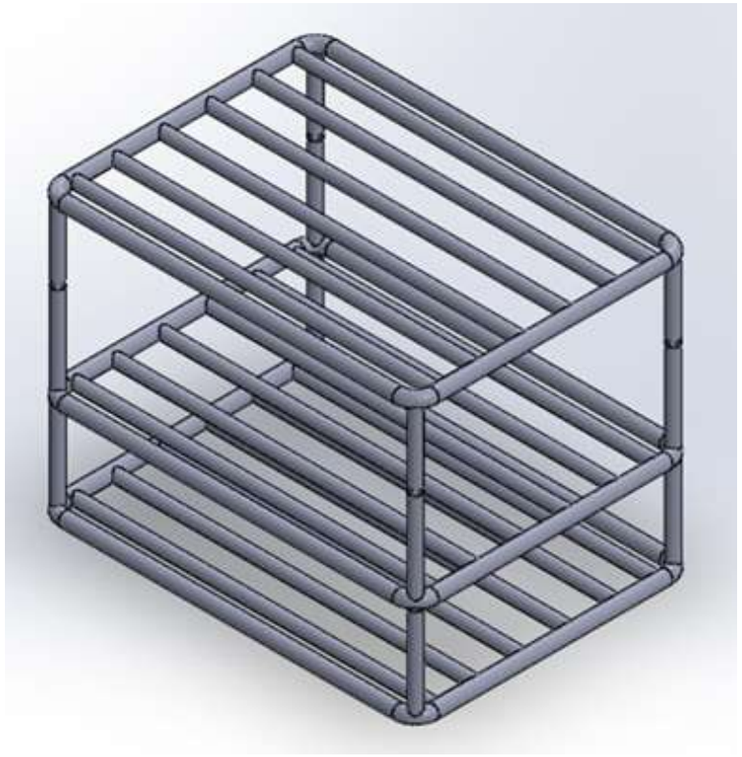
I feel like that it will be very expensive and tricky to work with the metal tubes. This is due to either carving out a shape. However if I used the tubes I will use friction fit with lock as the modular attachments and welding with the fixed ones.

Measure the longest size and make sure that all is cut the same size to prevent uneven structure.

Leave some allowance so that it can be cross welded in the corners

Use hollow tubes for the height of the structure for friction fit

Make sure to only weld the right parts because this structure is modular and comes apart in three parts.



1 Measure the longest size, measure the dowels and cut to desired length. Now put it aside and do the same for the other lengths

Keep note of each and every dowels even though they have the same dimensions because the structure comes apart into 3.

2 Measure the longest size, measure the broom stick and cut to desired length. Now put it aside and do the same for the other lengths. Make sure to smooth out the end of each broom stick.

Make sure that the holes are a tiny bit bigger so that the dowels can be inserted and glued together with wood glue

Cut out the holes for the dowels .

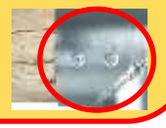
When that is finished assemble the parts together by inserting them through the right holes.

Be sure to put wood glue first before inserting the dowels

Once everything is manufactured, assemble the sticks using the connectors and bolt them in place

Make sure you assemble the right sticks together

Either do the same production method as the dowels or buy/make tube connections out of metal to join all of the sticks together. These connections will be bolted with screws onto the wood.



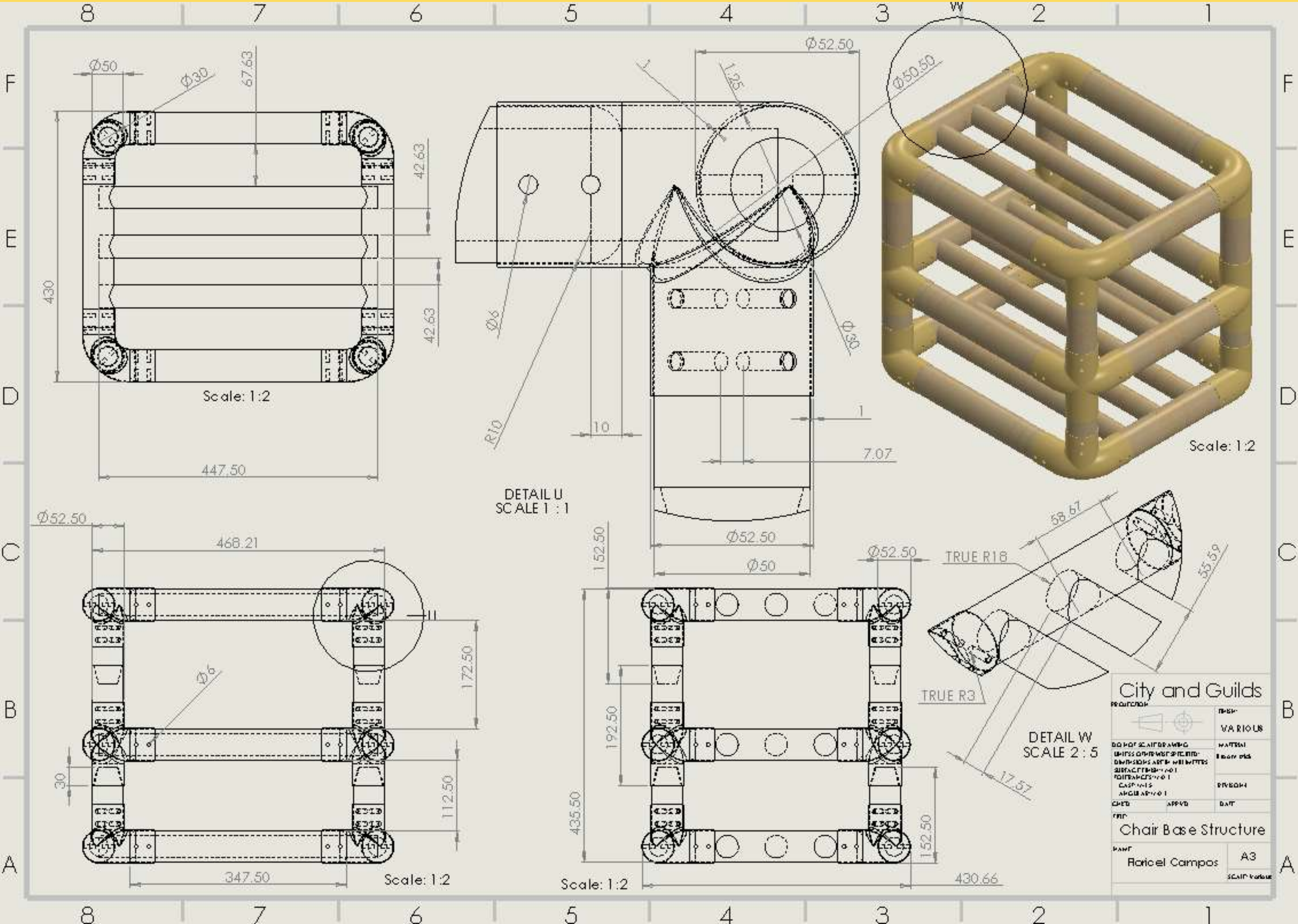
Button clips

Check that the wood are evenly coated and smooth, if not then re coat it.

Finally, spray paint the wood silver to finish it off and give it a metal look which was my initial idea.

When the structure of the bases are finished, lay them on top of each other and test if it will handle someone's weight.

FINISH



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Ø30
67.63
42.63
42.63
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Scale: 1:2
447.50
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55.59
TRUE R18
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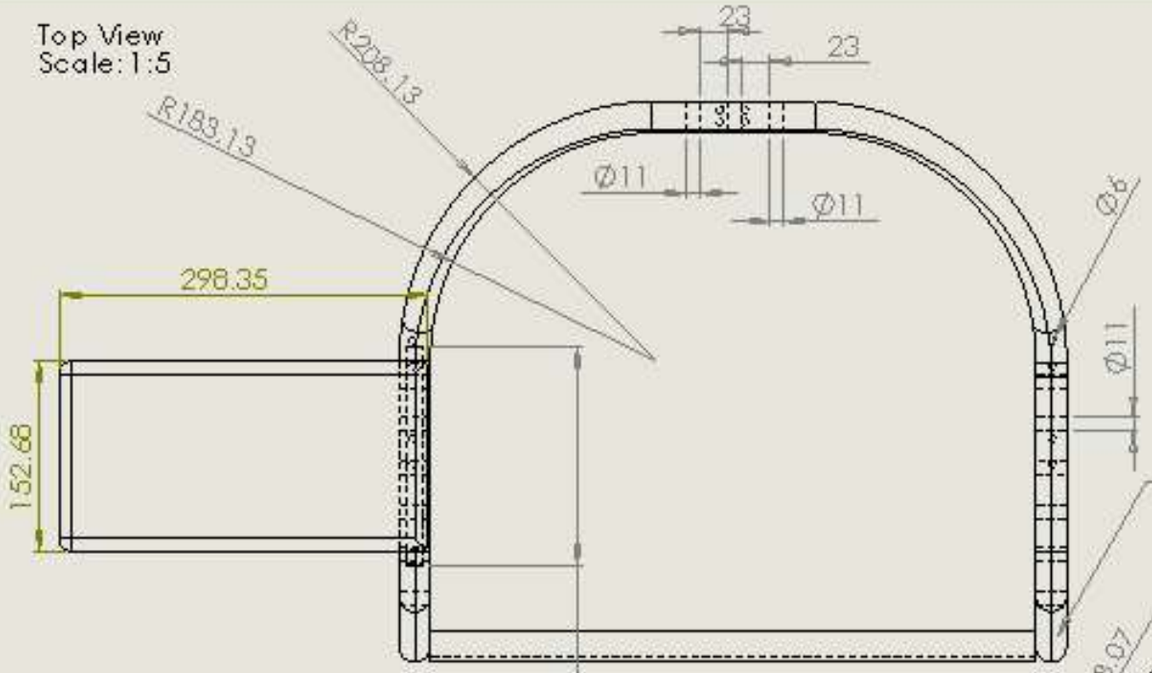
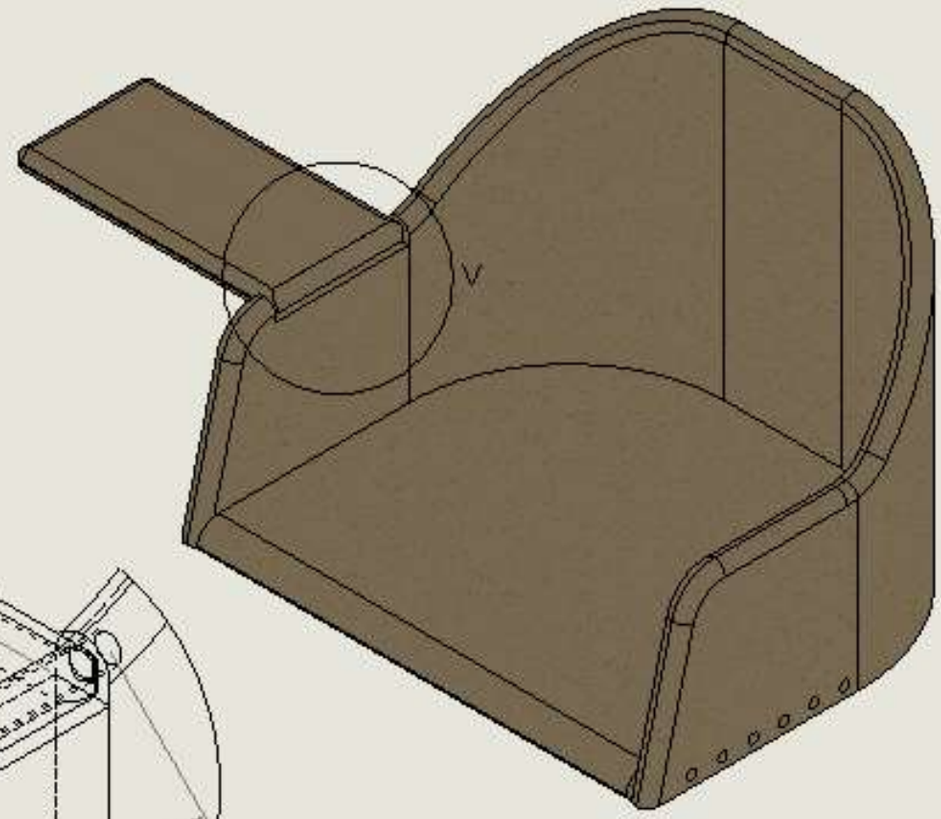
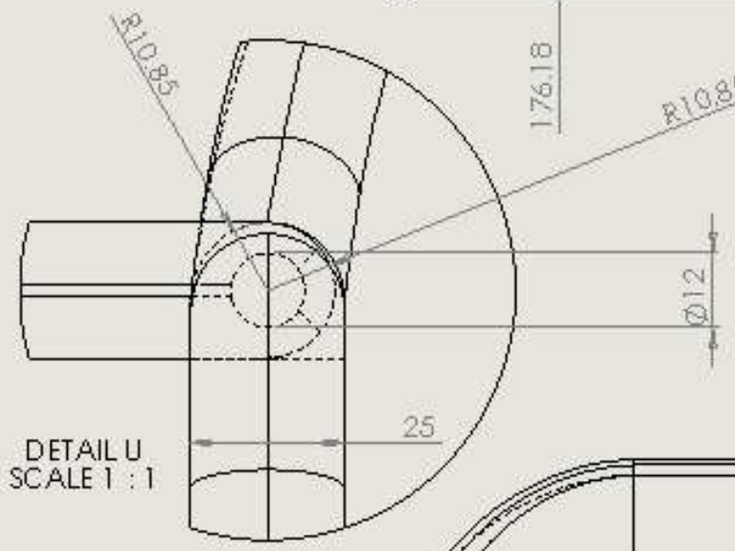
DETAIL W
SCALE 2 : 5
City and Guilds
VARIOUS
Chair Base Structure
Raricel Campos
A3

Top View
Scale: 1:5

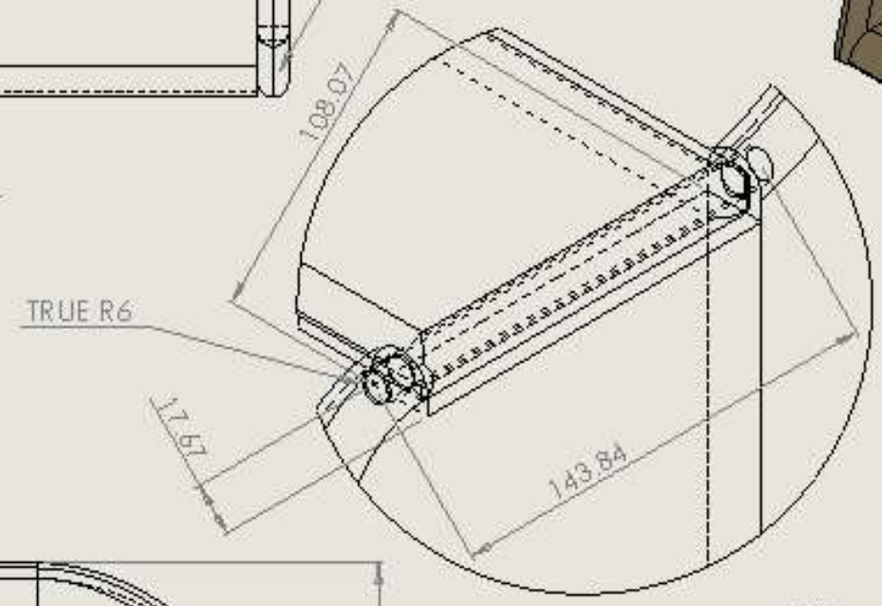


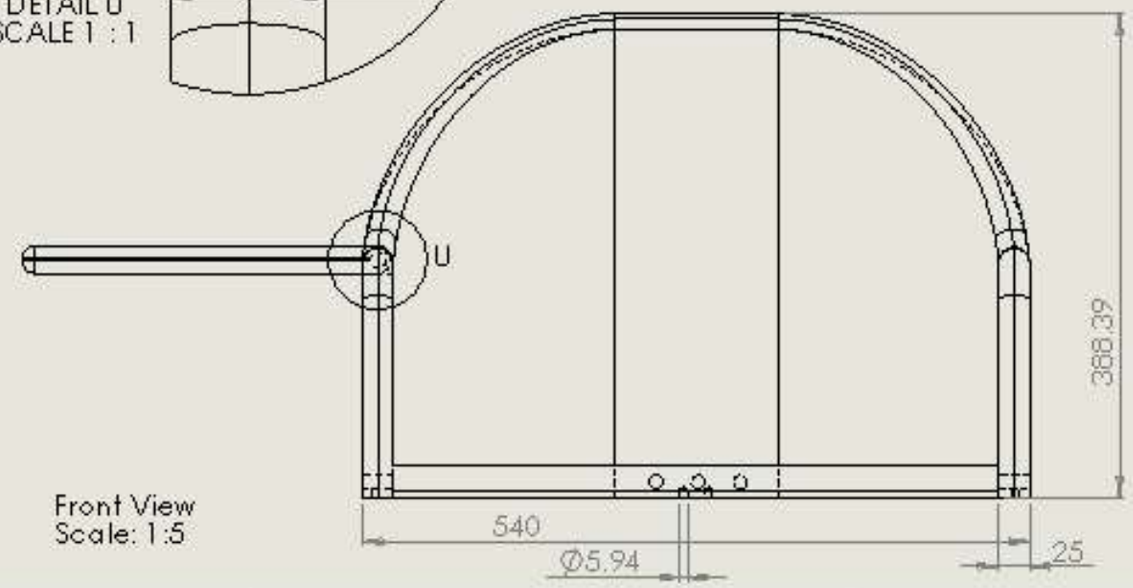


Isometric View
Scale: 1:5

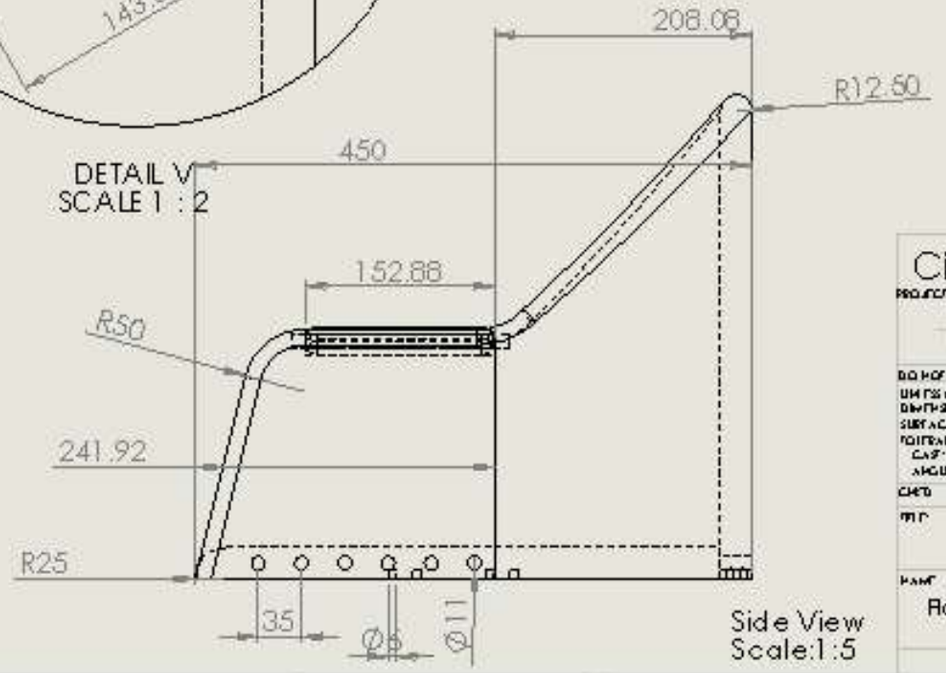


DETAIL U
SCALE 1 : 1





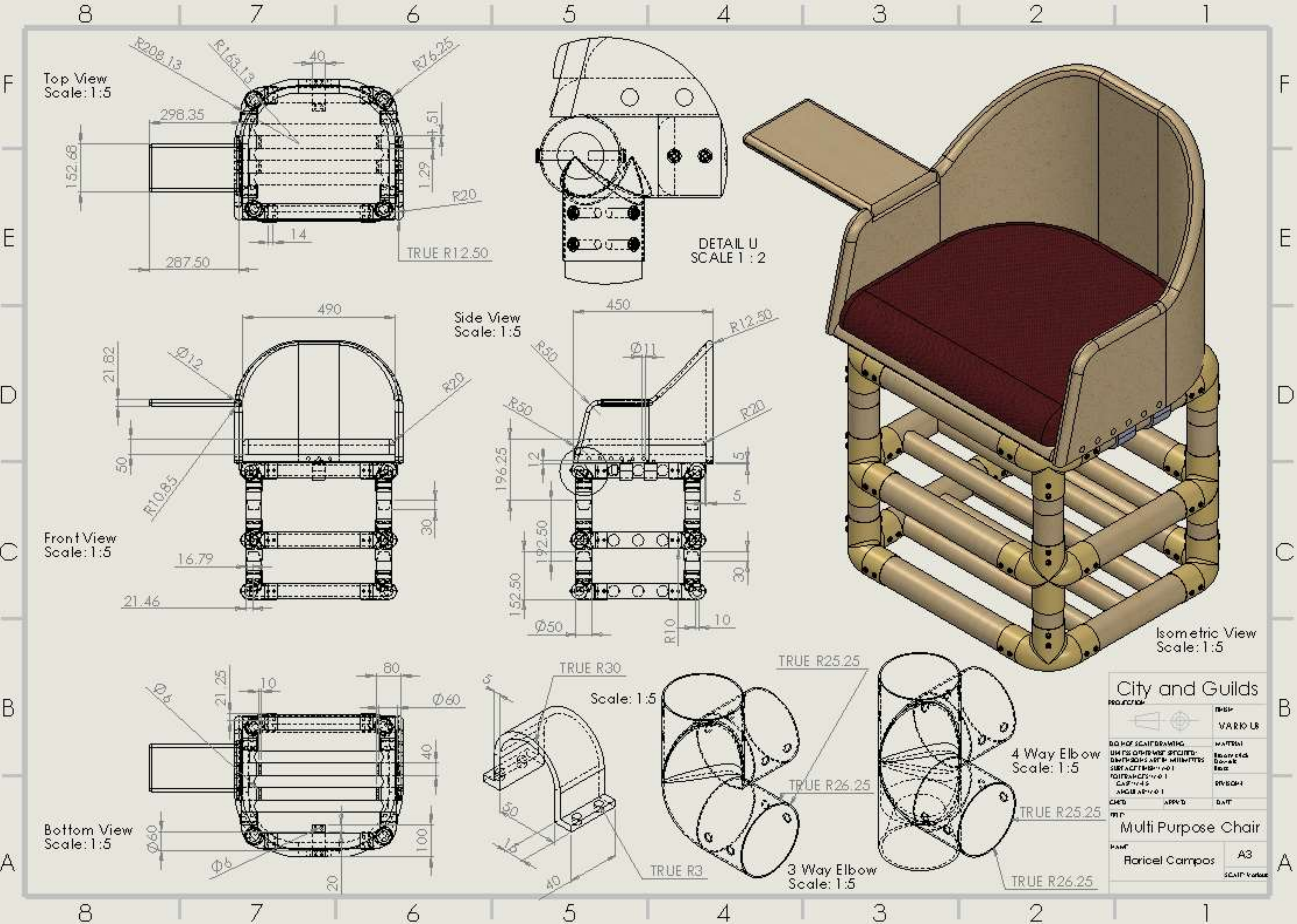
Front View
Scale: 1:5



DETAIL V
SCALE 1 : 2

Side View
Scale:1:5

City and Guilds	
PROJECTION	FINISH: VARIOUS
DO NOT SCALE DRAWING	MATERIAL
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETRES SURFACE FINISH TOLERANCES CASTINGS ANGLES	WOOD
	DIVISION
CHKD APPVD	DATE
TITLE: Chair	
NAME: Raricel Campos	A3
	SCALE: Various



Top View
Scale: 1:5
R208.13
R163.13
40
R76.25
298.35
152.68
51
1.29
R20
14
TRUE R12.50
287.50
DETAIL U
SCALE 1 : 2
490
Ø12
21.82
R20
50
R10.85
30
Front View
Scale: 1:5
16.79
21.46
Side View
Scale: 1:5
450
R12.50
R50
Ø11
R50
R20
196.25
12
5
5
192.50
30
152.50
Ø50
R10
10
Isometric View
Scale: 1:5
Ø6
21.25
10
80
Ø60
40
Bottom View
Scale: 1:5
Ø60
100
Ø6
20
TRUE R30
5
Scale: 1:5
50
15
40
TRUE R3
TRUE R25.25
TRUE R26.25
3 Way Elbow
Scale: 1:5
4 Way Elbow
Scale: 1:5
TRUE R25.25
TRUE R26.25
City and Guilds
VARIOUS
Multi Purpose Chair
Raricel Campos
A3

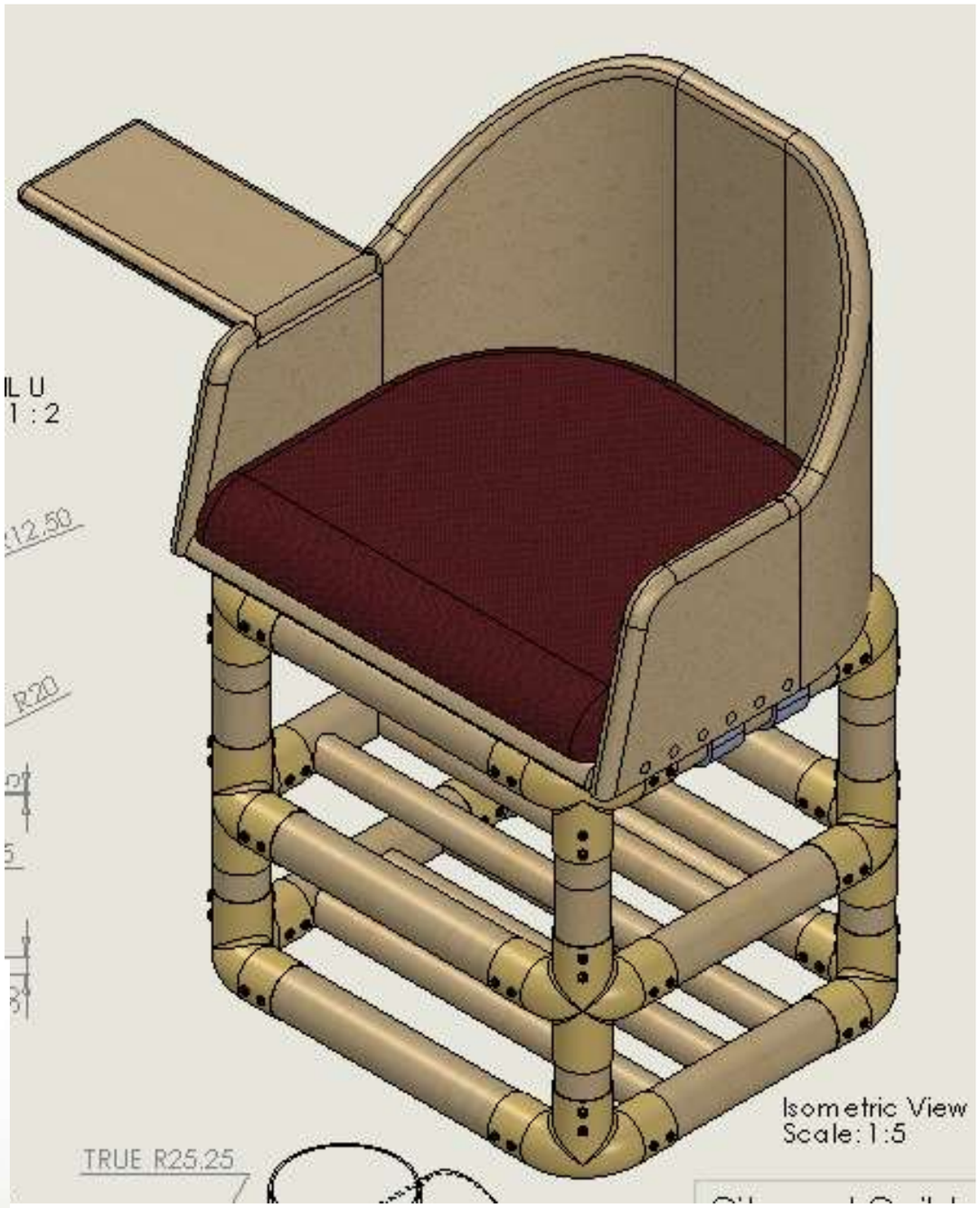
What's wrong with this design?

- Bed structure would be too small

There are not enough layers for the base structure on this chair, which means that the bed structure layout would be too short. This would cause my consumers to not fit as most of my consumers are young adults and nowadays they tend to be at the taller range of the spectrum. My consumers legs would hang out of the structure making it not comfortable to be a bed.
To solve this problem I should add another layer, but keeping the height the same. This is because the height already looks tall enough for someone on the shorter range to sit on it. I would have to make the legs of each layer structure shorter to fit another structure.

- Seat is not ergonomic

The seat that I chose to put on my design would be too uncomfortable as there are no bumps which should fit with the natural curves of our legs and bottom. However, I chose this design so that it would be comfier to sleep in. But this cushion would lead to having a back problem or just sore bottom, this is because all the pressure is against the spine. This cushion here at the bottom would be more comfortable and since we need more or less a flat surface to sleep in, I designed this cushion so that it can be flipped over to a flat surface. This will be flat and not uneven because I made the sides to be equal and flat.



- Difficult to store away

The base structure would be fairly easy to store away because it's modular, however, the top chair structure wont be because it's fixed and there is no solution which can make is modular or smaller.
On the other hand, this would still be fairly useful to have it lying around as they can just sit on it whenever instead of using the floor which could be more uncomfortable.

- Legs are too chunky

For this chair, I didn't realise that I made the tubular legs slightly bigger than anticipated. The legs' diameter was supposed to be 40mm but in this case it was bigger by 10mm at 50mm. My original plan was to use a radius of 20mm tube but I don't know how it ended to be a 25mm radius. I probably changed it last minute because I thought that the structure looked too thin so I added 5 more millimetres. However, now looking at it I should have kept it at 40mm diameter because it doesn't look very appealing at all. Anyway, the size of the tubing really depends on what stock I can get my hands on as the stock in the workshop is quite limited. I could also, order some tubing, however, this would be very expensive. So overall I would just have to work with what I have and then change the deign of my chair on Solidworks.

- Desk is too small and basic

This desk designed here for the chair is way too small to do any study work on it. I don't think it can barely fit an A4 piece of paper which is the ideal size for books and laptops. I feel like it's not going to be a workable desk so in this case would be pointless to even include it in the chair. However, this can hold a drink, maybe food etc but it's not used for it's actual purpose so I would need to make the desk bigger without making it claustrophobic for the consumer when using it as there is barely space for them to sit as mostly half of

- No back cushion support

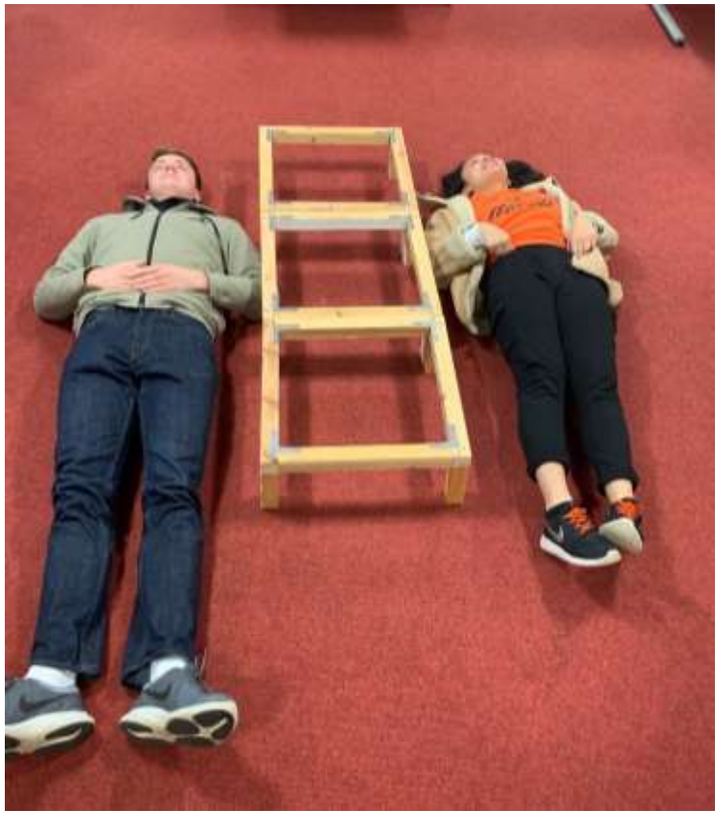
The back is very flat and straight, this would be very uncomfortable to lean on as no human's back is perfectly straight. I have tried many designs to curve the back chair but there was no success, so to simply solve this I could add another cushion which follows the curves of our spine. This cushion would have the same material of foam and fabric as the seat cushion so that it adds to the aesthetic appeal and wont be as expensive because I could reuse the material that's not used up yet.

Rough Prototype

I made this prototype just to see if my measurements were right instead of making it straight with the deign I created without testing it out first. As expected the height was too tall resulting at a height about 63cm which is 13cm higher than what I designed. I might have been confused when making the design and didn't consider the thickness of the wood into the height of the chair, and just followed my measurements when making it and dint make any adjustments.

The chair turned out to be higher than I expected, my plan was originally 47cm-50cm with 50cm as the maximum height which includes the foam. As you can see on the left, I have Caitlin who is 5ft 4 sat on top and her feet just about touches the ground leaving at least the length of her foot for her to actually have her feet flat on the ground. On the right I have also compared it to an existing chair which I was sat on and its way taller, measuring at about 63cm.

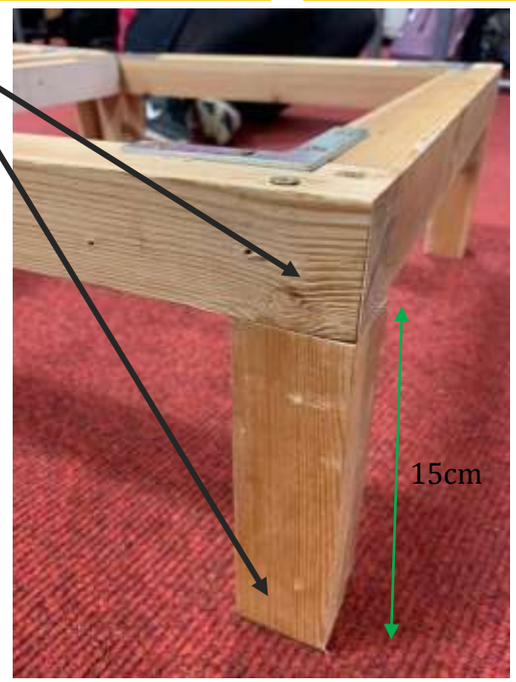
Here I have my classmate Zac, who is 6 ft 3. I made him lie down next to my bed structure to show the size of it and how unrealistic it would be to sell it for my target market. My bed structure turns out to be way too short and would probably only fit a child under 5ft. My measurements were way off or I just didn't take notice of the length because I was also focusing on the height. However, that didn't end up well too because I didn't take off the thickness of the wood for the quadrilateral structure which added 2 inches x3 to the height of my structure.



I also compared it against myself to see the difference. I could just get away with it but with my legs sticking out would still be uncomfortable. And since someone on the shorter range cant' fit on my structure I need to consider researching more in depth into anthropometry and apply the measurements to each aspects of my design because the size of the chair would differ to a bed.

My solution to this is to either add an extra layer so that it will be just about long enough for someone on the taller range like Zac here. Or I could extend the width of the chair, however, the chair might be too wide to sit on, but extra space is better than having little/tight space specially when using it for a long period of time. Also this might fit someone on the bigger side of my target market.

This is the part that I will be cutting off. Size is 15cm when the whole height of this structure should be 15cm.



I also compared my bed structure against Caitlin and we have the same problem where our legs are hanging out. This would cause discomfort and pain in the morning if its not supported by another structure. If I add another layer to support the legs I need to take off more wood from the legs so that the height of the chair is about 47cm and not 63cm. I might also consider making my chair wider. This might be either making the structure wider or just the chair part, where it will be bigger than the structure as it can still easily withhold the chair even if its slightly bigger.

Next Step :

Next I would need to make another layer, but first I need to unscrew the legs from the quadrilateral structure so that it will be easier for me to cut down the legs. I will need to measure how much I need to take off first and label which leg goes to which side of the quadrilateral as the holes wont be the same when screwing it back together. However, I need to consider on either changing the size of each layer. This is to take advantage of another purpose or keep them all the same and just change the size of the quadrilateral structure to make it wider and withhold someone of a bigger size or just for extra space.

COMPARE THE TWO IMAGES WITH THE NEW IMPROVEMENTS

Improvements

Since I finally added a 4th layer, the structure now fits for Zac who is 6ft 3. However, for someone taller, this would be an issue because this will me the maximum height as the legs of the chair are already shorter than I'd like them to be. This is because I was planning to make stools or footrests out of them too if the chair is not in use so that other purposes can be made functional without having to buy separate parts to be able to use it to it's potential. This extra structure however, will make it more difficult for customers because there is 1 more that they have to manual handle and figure out. But this will allow more room for storage.

In this image above I have Caitlin sit on my chair again but with the improvements I have changed. This time her feet are flat on the ground and not tip toeing to keep her feet on the floor. With the improvements I have to consider what's the average height of a chair so I had to remove a couple centimetres off the legs so be able to create another structure.

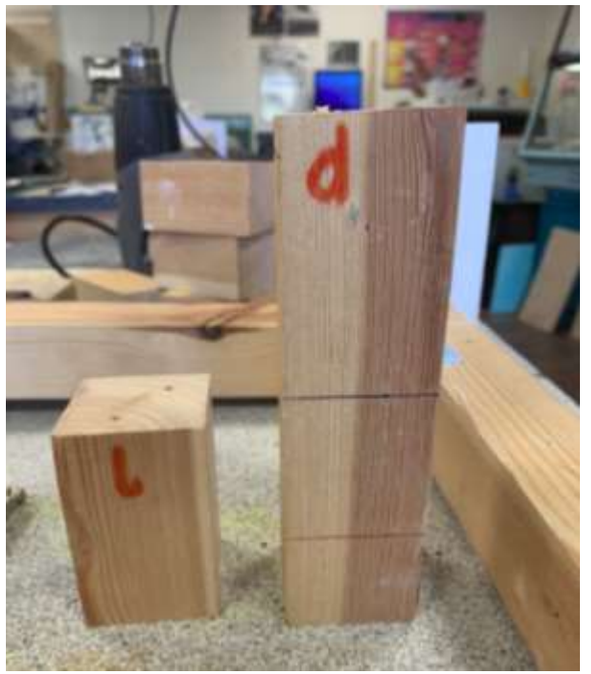
Before, with the 3 structure layer, the height of it was way too tall that Caitlin who is 5ft3 had to stretch her feet to be able to touch the floor, more of a tip toe position. But since I cut off a little bit more off from the legs and added another structure I had to cut the legs so that its at 7cm tall. For this I had to consider the height of each structure and make sure that all of them would make the height of 50cm all together which is the height of this office chair pictured here. The first structure with the layer was at 63cm height which as you can see is a significant difference as to the one pictured on the right which is now slightly lower than the office chair, this is because I have to make room for the seat cushion.

To achieve this end result I had to unscrew the legs from the top layer, but before doing so I had to label each of the legs to the top layer because the holes would differ from each side. Hence why there is a d at the top of the wood picture here below. After that, I went into the workshop and used the screw drill to take out the screws, using this tool makes my life easier as it's faster than manually using a hand tool screw to unscrew the screw. When all of the screw is taken out, I had to measure each of the legs making sure that the length was 7cm long. Once that is done, I then had to cut the excess off, doing so, I used the bandsaw for quicker and efficient way to cut it rather than a tenor saw. To get them fairly straight I used the fence which came with the band saw to guide me through the blade. However, not all of the legs came out straight because at one point it gets stuck for a little bit probably because of the grain of the wood which made me wiggle it a bit and it slightly moved the wood while I was at it. When I have finally finished cutting off 12 of the legs, I matched each of the side starting with the first structure with alphabetically to it's rightful place matching with A a, B b, C c etc. To screw them back I used the same screw drill to screw it back on, but first I had to fully screw one at a time because it would be quite challenging to screw all of them at the same time because it doesn't stay in the place.

By adding 1 more layer, it could make the structure of the chair sturdier but also make it heavier. These could either make or break the chair structure because it really depends on the materials I am going to use. However, since I am using a 15mm steel metal tube, I don't think it would be a big problem. This is because hollow steel tubes are lightweight but strong. The 15mm metal tube that I am going to be using sounds small to be a chair base however, it's made out of steel so I think it would be sturdy enough to hold my consumers weight. While adding 1 more layer to the structure I had to consider what the overall height was going to be because the first structure that I made was too tall and since the height is not designed to be adjustable I had to change the height measurement while trying to make another structure. This is why the legs of the first structure is basically the half of the improvements I have made. However, the end results was all good as the structure wasn't too low, it's still perfect for a footstool and for a bed as now it will be longer and can actually fit the taller range of my consumers. Moreover, when its at a chair structure it can also fit my other consumers who are not at the taller range of the spectrum. The consumers should now finally reach the ground and wont have uncomfortable straining pain on their legs because they cant reach the ground as the chair is too high for them. This will also be a deal breaker if not solved because a chair can't do it's purpose if it cant serve as a chair which is suitable for the consumer. It should be ergonomic and highly comfortable it it's going to be used for a long period of time.

Another way?

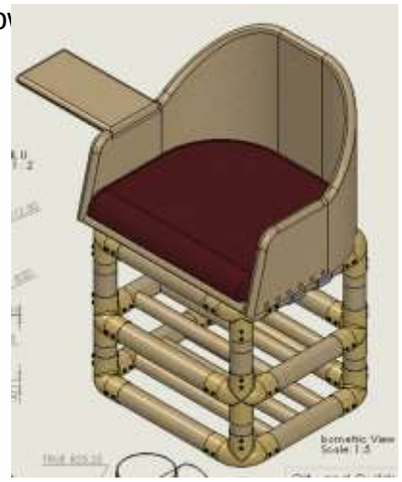
For this problem, I could have also made the structure's length longer if I didn't want to shorten the legs. However, this would have caused the chair to have an even deeper depth of seat. This could then lead to the shorter range of my consumers being 'shallowed' by the chair because their legs wont be perpendicular to the ground but probably parallel instead. Moreover, I could have made some of the structure's at different height and serves as a different purpose i.e. stool, footrest or a table . On the other hand, this would have made my bed purpose not to function because the structures are all of different heights unless there was a way where that product is modular too so that the bed structure can be made.

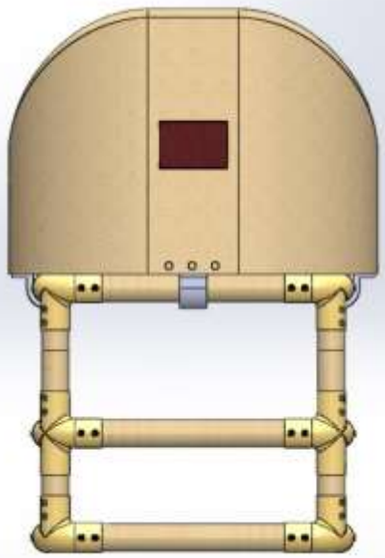


Final Design idea

*Talk about the changes you've made and why they needed to be changed
*Key Requirements reached
*Show

Any more improvements?
The cushions designed here should be more curved but I could always make these changes on my actual physical model because it will be down to preference as there wont be enough foam if it's too curved and therefore be more uncomfortable. I can always trim down the foam later on before I'll cover it with the fabric.





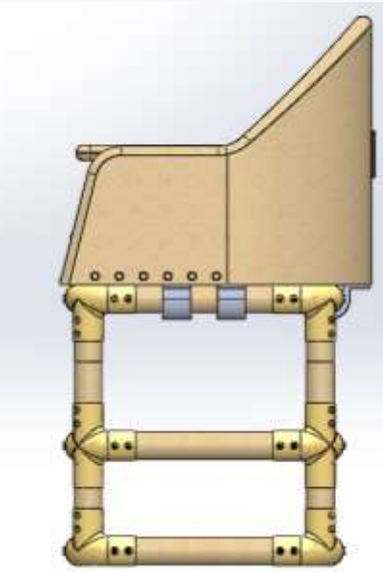
Changes

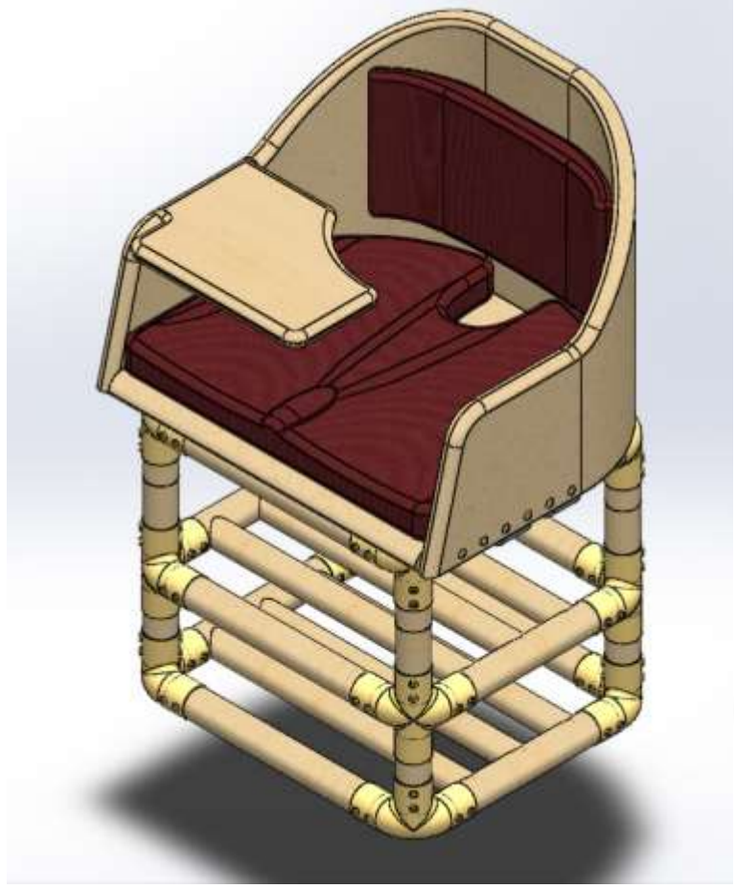
This chair have been developed massively from this model here to the one down below. I have changed the plain flat cushion to ergonomic by curving the edges so that it follows the human curvature. I did this so that it will be more comfortable for my consumers specially when it's being used for a long period of time. This is why I also added a back cushion but it's also because it will help with reducing back pain or the chance of getting back problem. The cushions or paddings should support my consumers spine and reduce the strain from their tailbone as not much pressure is then applied because there is a cushion holding some of the weight.

Mistakes?

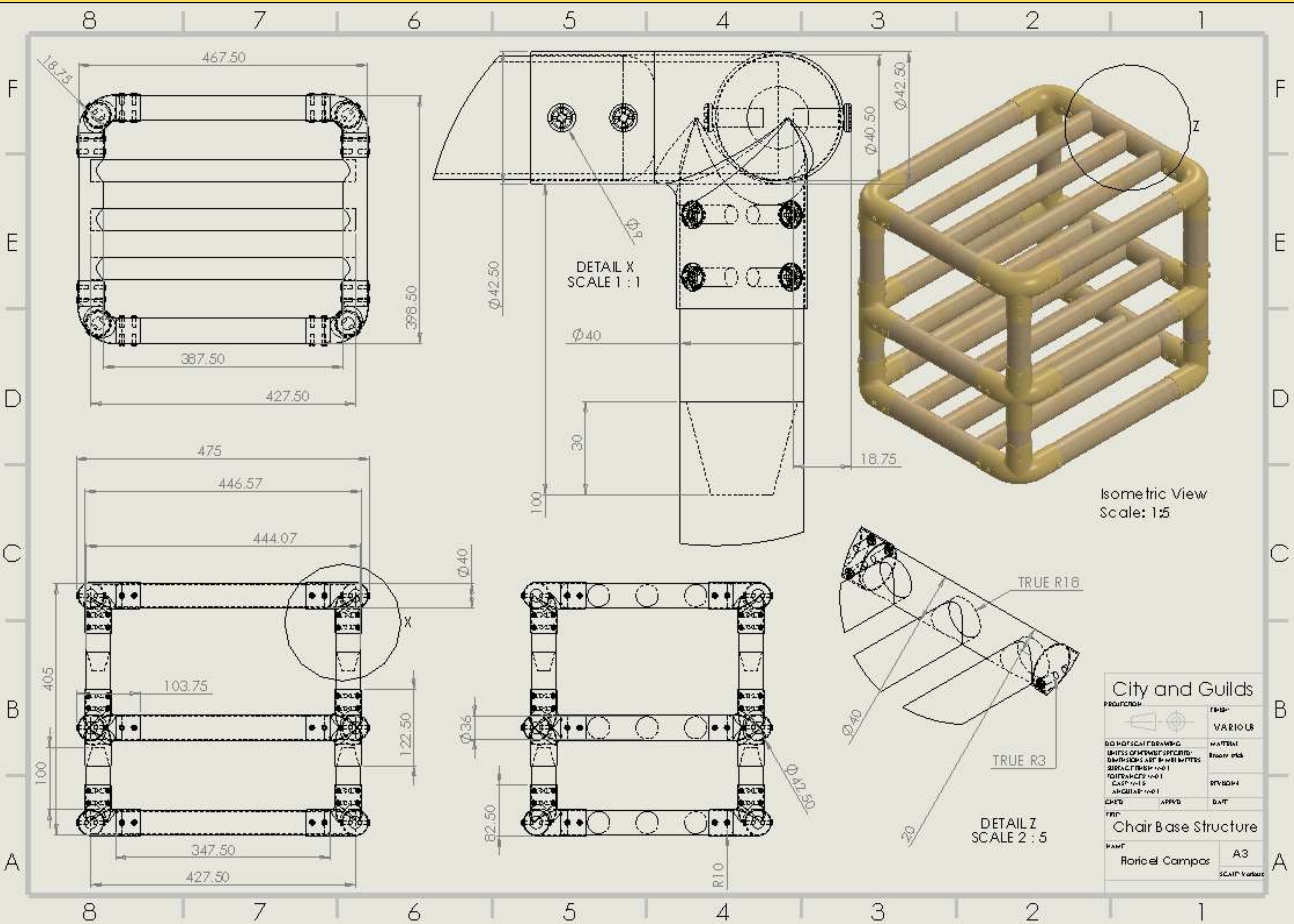
The only mistake that I have made with this model is the way I mated the table to the seat structure. So this model it therefore inaccurate, I have made the mistake by mating the table to the wrong side of the seat, which has caused this extra extended wood to be on the way when it needs to be flipped and used as a desk. This wouldn't work whatsoever as the wood will be restricting it from being flipped. If I mated it to the right side, where the longer side of the table is not facing towards the consumer and the curves is facing towards them then it would look like these images here down below which I have corrected and mated properly. Therefore, this table can now perform accurately when it's necessary.

Moreover, I have changed the shape of the table because looking at it and considering how big an A4 piece of paper is I know that it wouldn't fit and 2 thirds of the paper would just fall off the table. This is why I have made the table wider, I was going to leave it as a square but I decided to curve the left corner because I had a feeling that my consumers would feel claustrophobic or just wouldn't fit at all so I added a leeway to break it apart from that.





Any more improvements?
It would be ideal if there was another inexpensive way to attach the tubular structure with the seat because the saddle tube clip are very prominent and ugly to look at. It's not very appealing because they are quite big too.



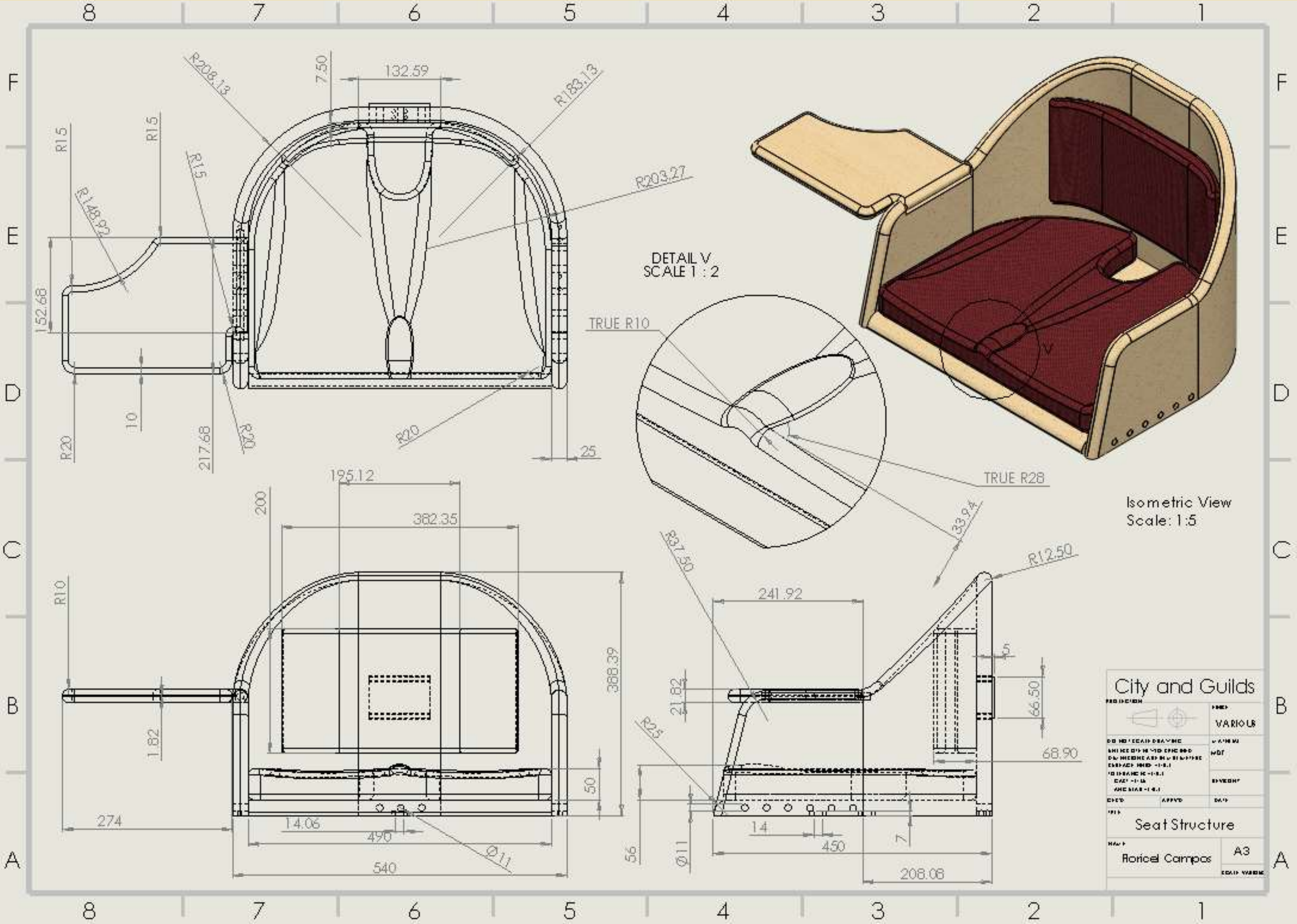
City and Guilds

VARIOUS

Chair Base Structure

Floricel Campos

A3


DETAIL V
SCALE 1 : 2
TRUE R10
TRUE R28
Isometric View
Scale: 1:5
R208.13
7.50
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R183.13
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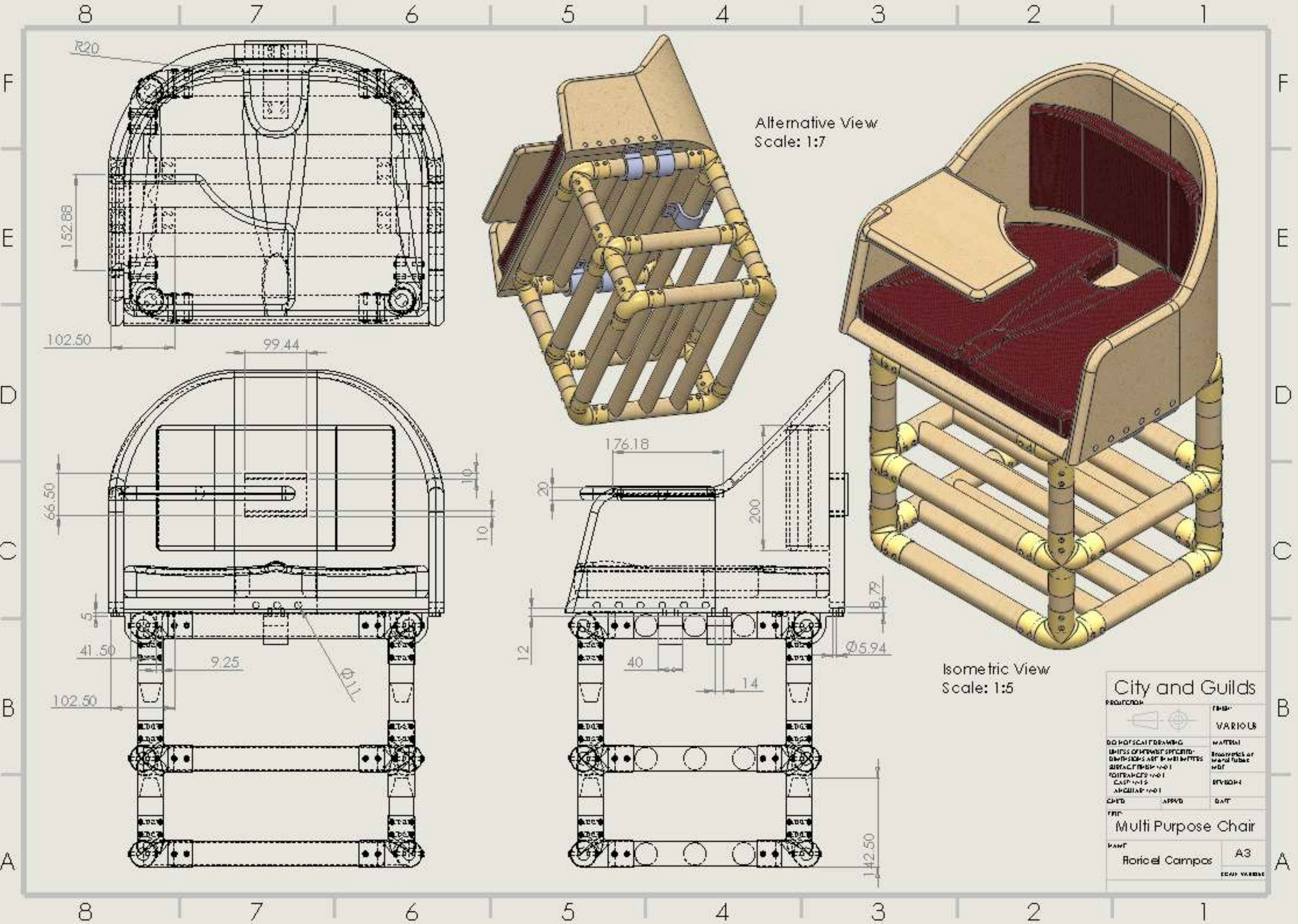
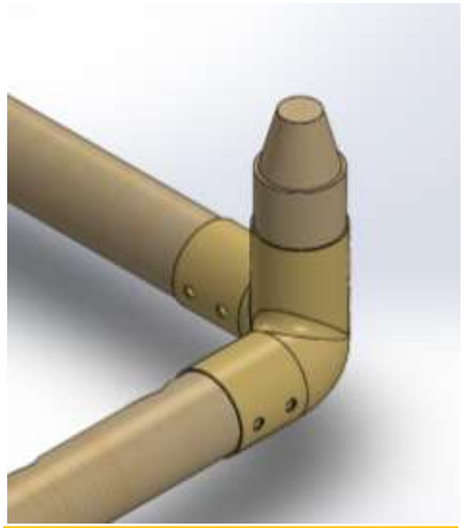
City and Guilds
VARIOUS
Seat Structure
Floricel Campos
A3

Next step : Do an updated production plan because of design change

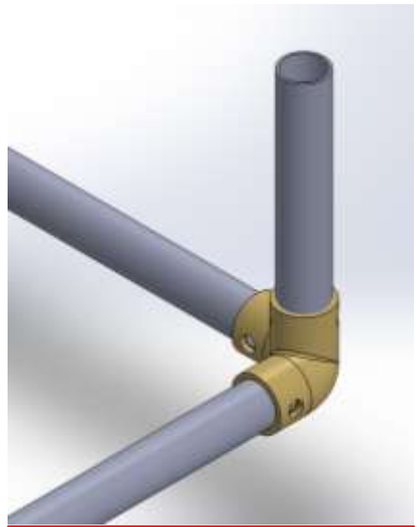


Final Design - Development

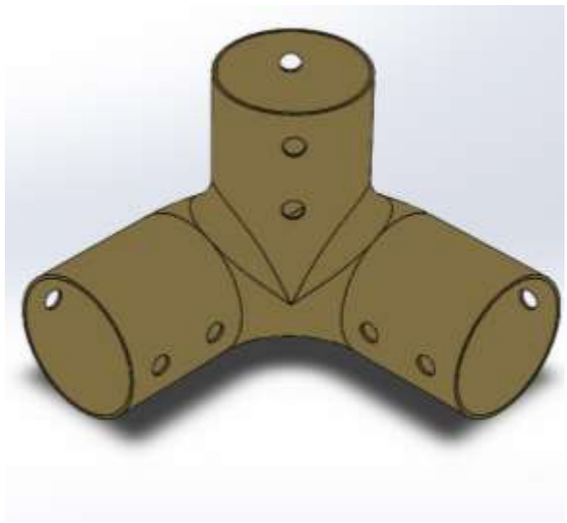
I had to change this design because it will be very difficult and expensive to manufacture because we have limited machines in the workshop and having to extrude your own tubular shape is not an option



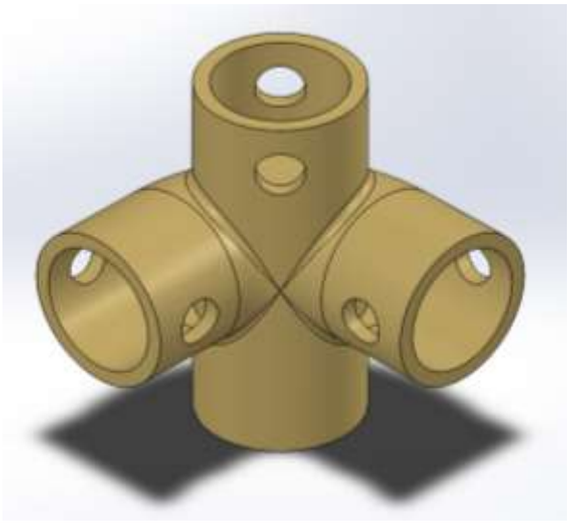
I also had to change this design here because using wood would be heavier than using the hollow tubes. Moreover, the tubes will be easier to work with and be structurally stronger with the connections.



I finally decide on this design because I only sourced out these 15mm diameter mild steel tubes because the 40mm extruded mild steel tubes were too expensive.



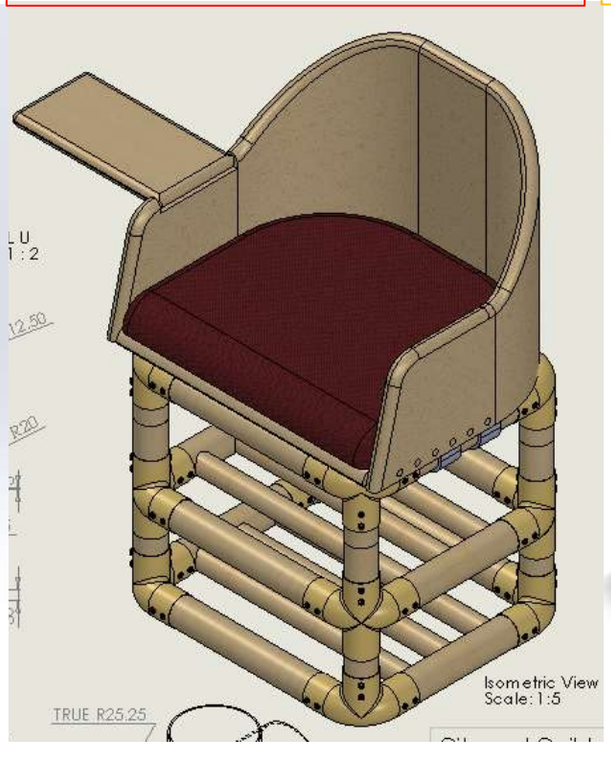
This was the first three way connection I've made for the wood. This would have been made out of metal and I think I would have brought these instead of making them because it would be difficult for me to manufacture it because I am limited.



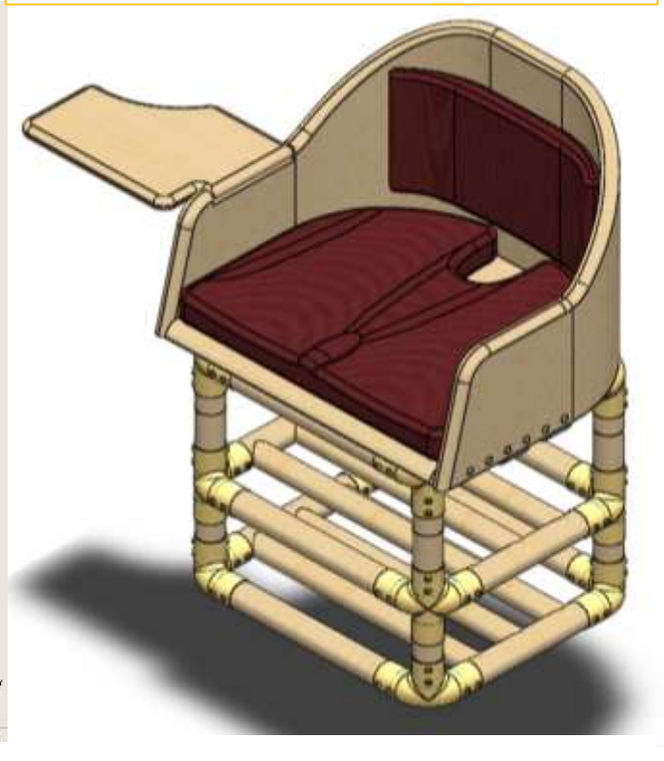
I then changed the connection to this design so that it suits the 15mm tubes. Moreover, I made the connections thicker because they were too thin and could easily break, also I made them smaller so that it can fit in the 3D printer bed as I am planning to manufacture it than buying it.

This was my first design attempt for this chair. This was inspired by my other models and wasn't really considered of properly as I didn't sketch it first and see how all the other functions would fit together so I basically had to build it up.

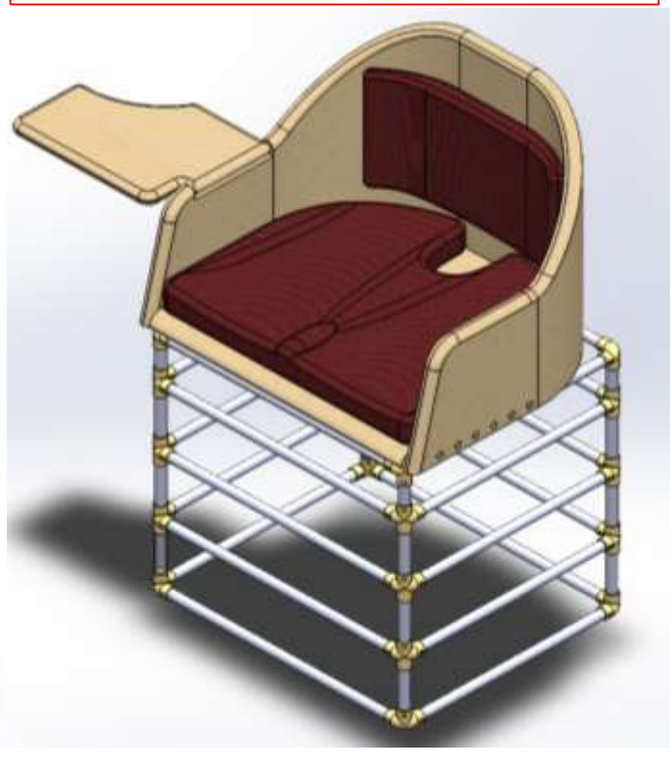
With this design, I made the wood thicker and made the seat separate because wood cannot be bent two different ways with ease. I also added a desk which adds as another function and made the legs out of wood and modular.



From then on, I made the chair more ergonomic buy shaping the seat, adding back cushion and changing the shape of the desk so that it wont be as claustrophobic. Moreover, I made the wooden legs thinner by 5mm as it was looking too chunky and heavy.



From gathering all the materials that I have, I had to redesign my final initial idea to this design as I only had 15mm tubes available. Moreover, I had to add an extra layer of the structure so that it fit my consumers as I have mentioned in slide 66 that it was too short.



Updated Production Plan

With this back cushion I am planning to use two foam which I could cut slits into so that I can achieve the curve look without having to actually carve the curve in a big block of foam because it will get very fiddly when doing so.

First, I would need to find a 2.5cm thick foam

Using a rough guide of the back seat structure, outline the shape and cut the foam in half using the band saw.

See slide 57 for the Health and Safety rules of the bandsaw

When that is done cut out the slits so that when you attach the two foam together it would make a permanent curve.

After, the slits are cut, glue the two pieces of foam together and wait for at least 2 hours to dry

When the foam is dry, carve out the design of the cushion using a knife or an electrical knife.

Next, make the net of the shape onto the fabric and cut it out.

Once the fabric pieces are cut out, sew them right sides together and make sure to leave a hole for the zipper to be attached.

FINISH

For this cushion I decided to revert it back to the original plain shape instead of the ergonomic version because there were not enough foam for me to carve out this ergonomic shape as i only sourced a thin piece of foam in the workshop.

I found a sheet of foam and I cut out rectangles from it because it wasn't big enough for the whole shape of my seat.

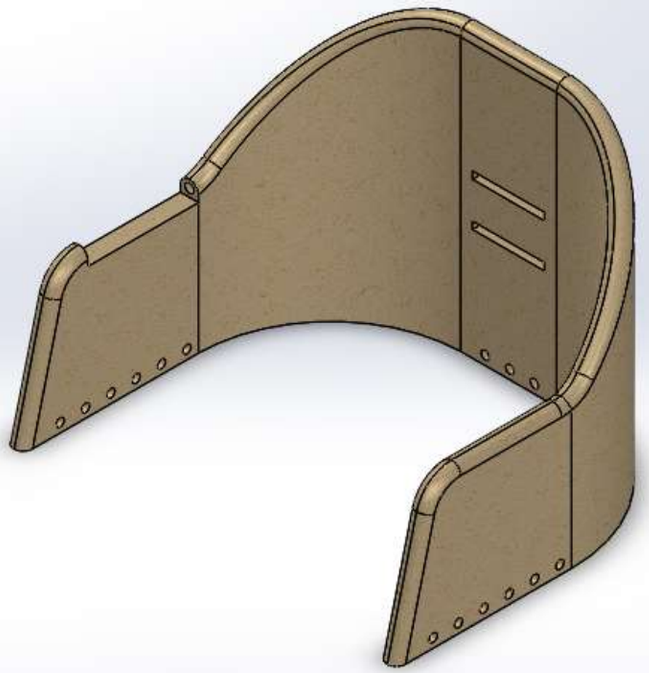
I then traced my stencil of the seat on the foam and then cut the bit I don't need using the band saw

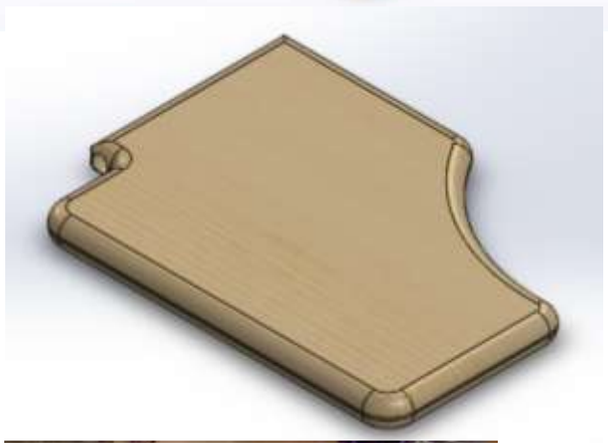
See slide 57 for the Health and Safety rules of the bandsaw

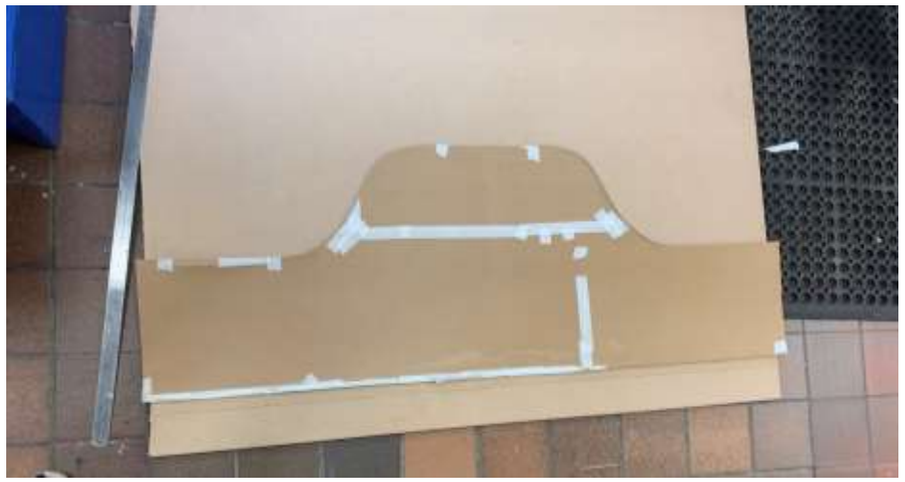
When that is cut out stick the two part of the foam together, while that is drying stick the other half of the second layer too.

After they are both dried, glue the layers together to make a slightly thicker piece of foam

Finally, cut two pieces of fabric using the seat stencil and then sew the two pieces of fabric right sides together making sure to leave a gap for the zipper to be attached. Once the zipper is sown on then you are finished.

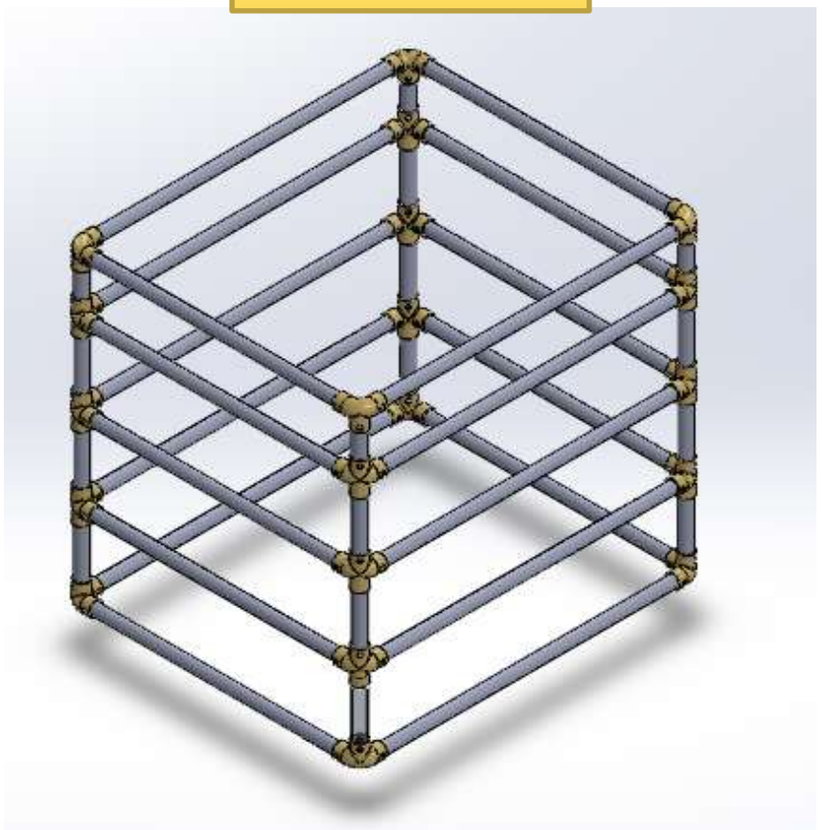


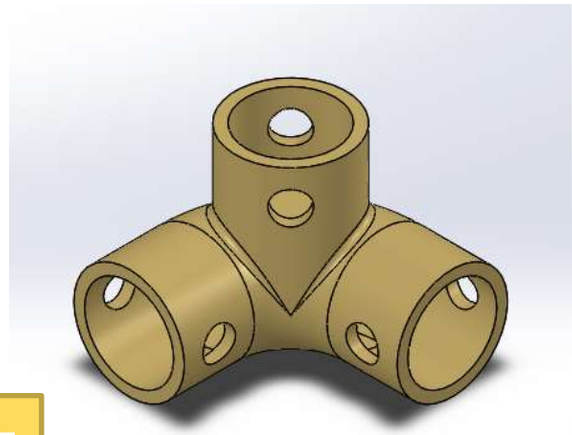


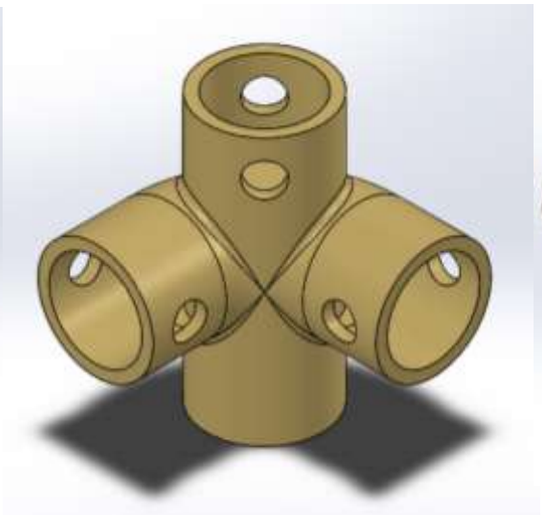



DO NOT
MOVE

Finish







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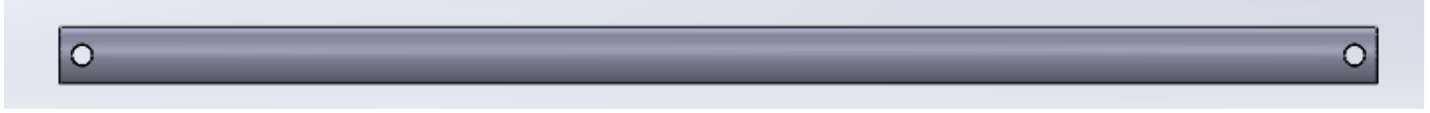
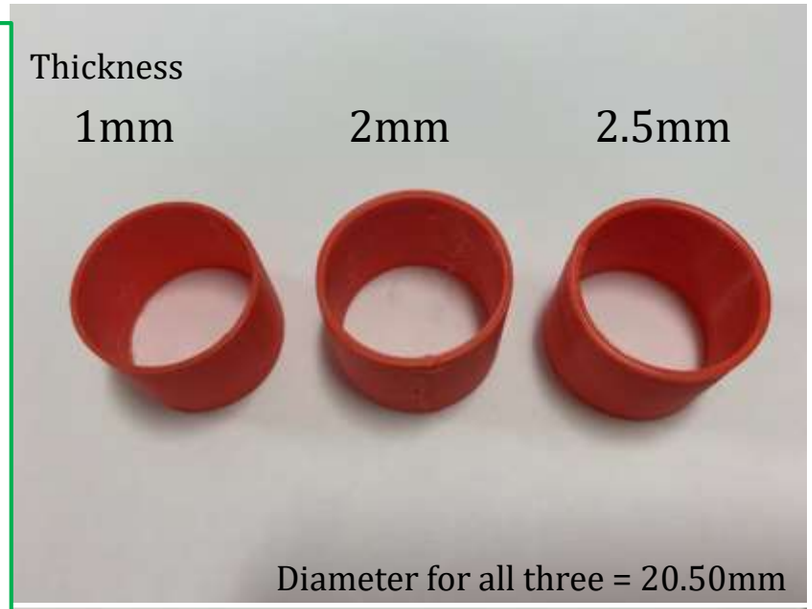


3D Printing

For my tubular connections I had to 3D print it out to fit the size of my chosen tubes diameter. There have been many complications into what size I was going to use due to the size needed which was 40mm diameter. This was too expensive to order and since we don't have sufficient stock in the workshop of over 8m worth of metal tubes I had to find a way to get metal tubes without having to buy the expensive product. I have been advised that a Zimmer frame would be suitable for my structure because its made from mild steel and is built to hold someone's weight. However, I was too late in asking the care homes if they had any left which will end up in the skip anyway but apparently they already have disregarded it. On the other hand, luckily there were bed frames that I found in the skip which should be strong enough to hold the structure together and my consumers weight. However, the diameter of these tubes were 15mm which I fear would look small against the seat and make the chair less aesthetic and obviously if it would be durable.

Since, it took a while for me to find any metal tubes, I had to experiment on the Zimmer frame which was in the workshop to see how I was going to 3D print it. The diameter of the Zimmer frame was 20mm so I made it slightly bigger by adding a leeway so that the tubes can be easily slotted in. However the first connection tube I made was way too thin and the rest of the two can still also be bent. Moreover, this wont be thick enough to drill holes through it and inserting a screw, this would easily break and snap in half because its still quite thin.

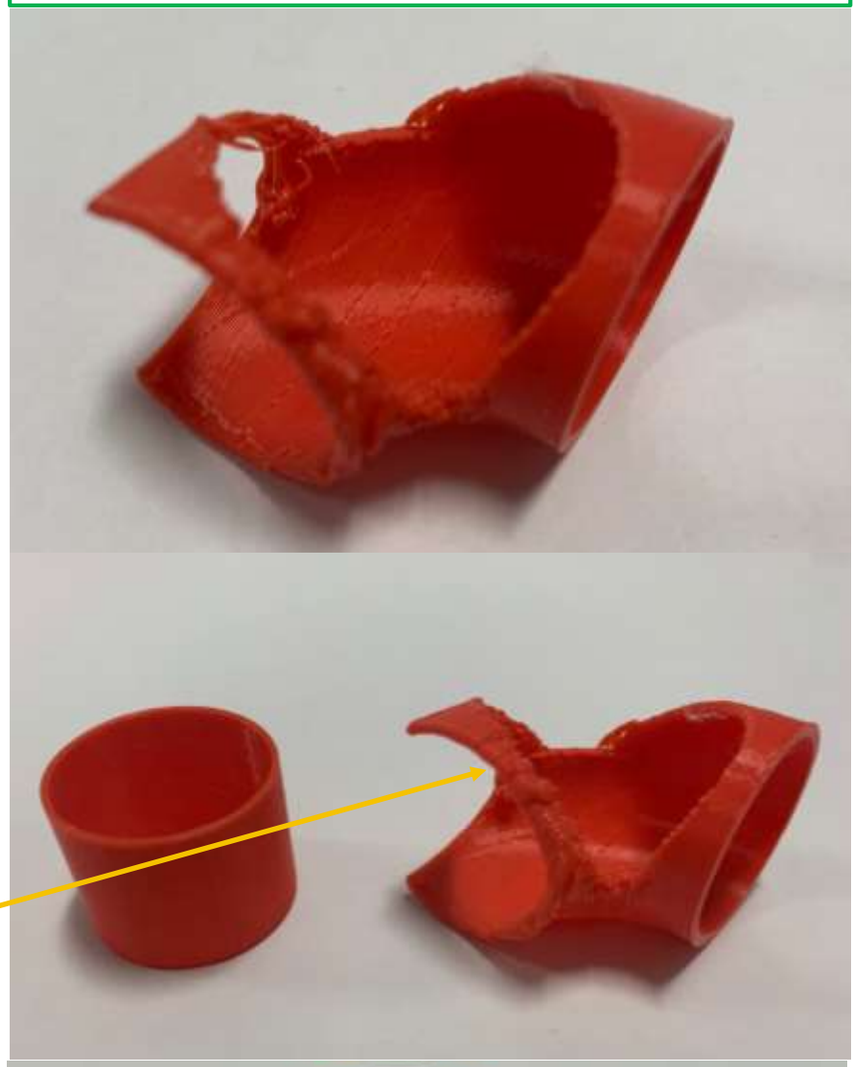
First, I had to create a Solidworks file of the pipe connection so that I can convert it to an STL file which can then be altered into G code file in Slicer so that it can be printed on the 3D printers as you can only upload G files. In slicer this is where you can rotate, slice or split on however you want to print your product as it gives the bed are of the 3D printer.

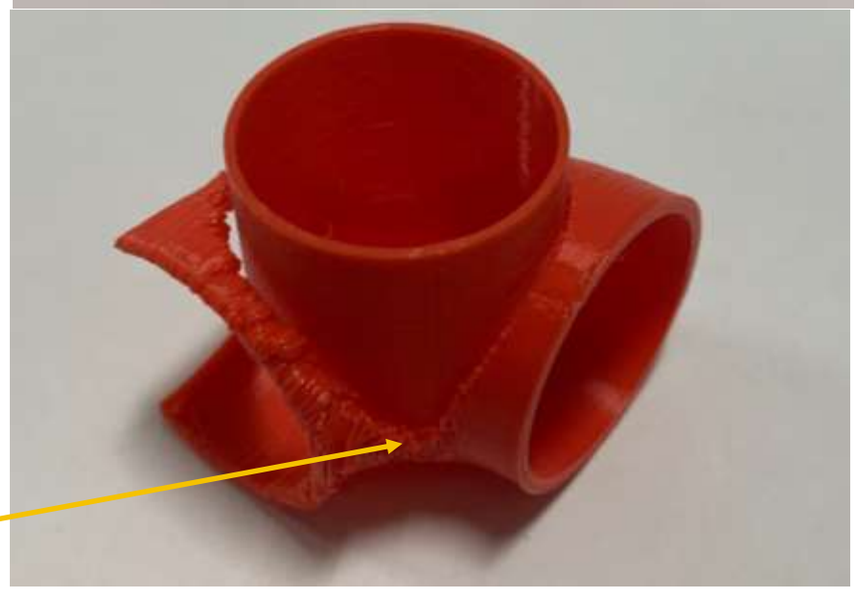


After I was satisfied with the size and thickness of the tubes I created another piece which the tube will slot into make the 3 way connection. However, the design of this part didn't print properly in the 3D printer as it's quite a sudden curve which slightly over hangs in the air when it's being printed. The 3D Printer will only print properly when there's no overhangs, the bottom surface is flat and the hole is not big than 1cm. Moreover, this structure would be weak anyway. This is because when the tubes are attached it to this structure it would easily snap because the ends are too thin that it wont be able to hold the tubes in place.

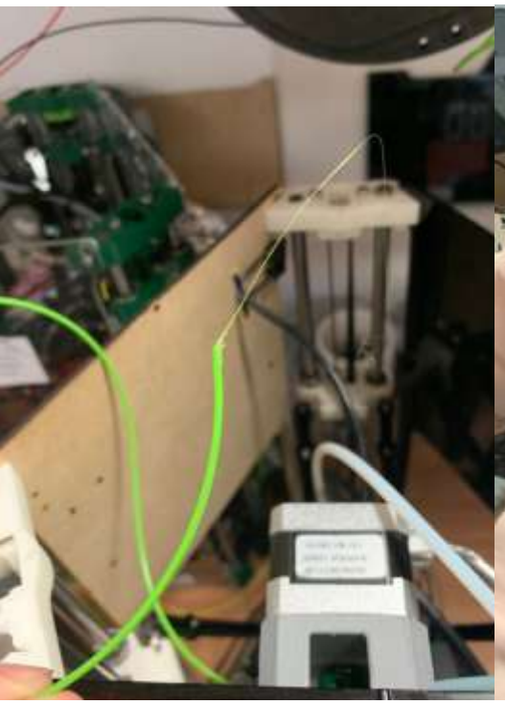
Furthermore, this structure will not work or be usable to me because I will need to drill holes into the ends of the connection but since there is barely space I wouldn't be able to attach the pipes in to this structure unless I use adhesive. Using adhesive will be a temporary fix which will probably fall apart within days because the bond will eventually get weaker over time specially when it's frequently used. However, I don't think that the tubes will be able to fit in this structure anyway as the tube is blocking the way for the tubes to go in. Overall I will need to find a different way to 3D print the connections without making the structure weak where there is a chance that it can break.

Secondly, I tried to print out the second part of the tube connection but it failed to print properly and the entire product. I don't know whether it was the structure of my connection or the 3D printer but it turned out like this.



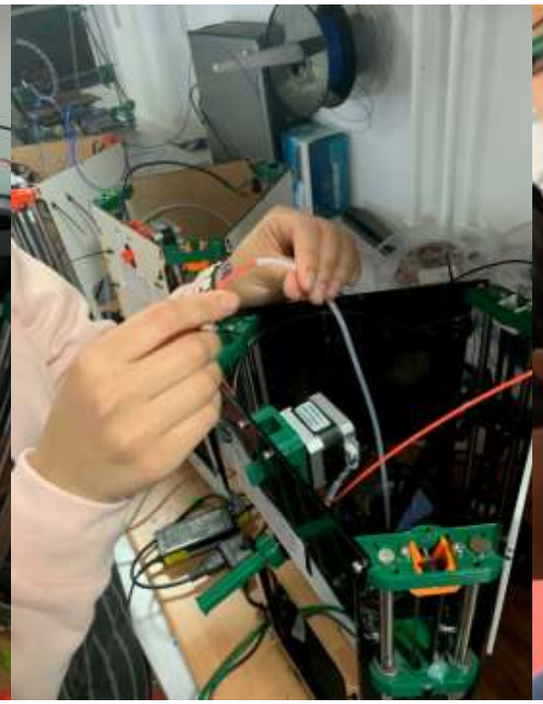


At this point I have had many problems using the 3D printer and this problem here was the most common one. However, this one could be solved very easily and this was the solution.



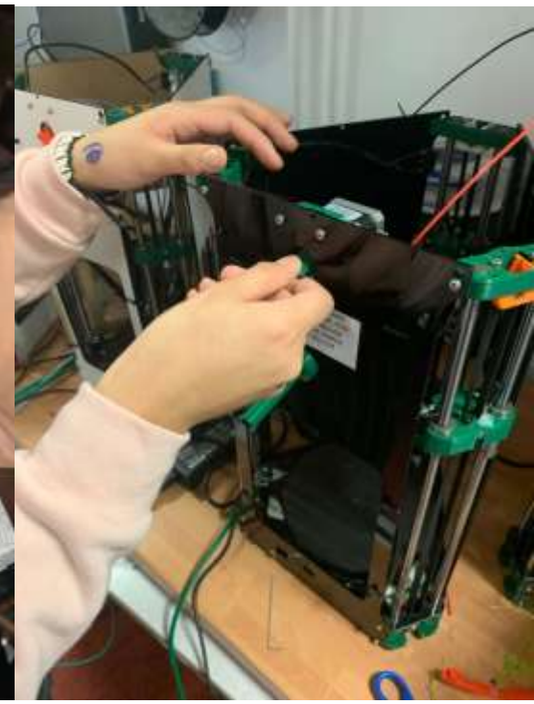
First, I had to take out the filament and see what the problem is. A small bump or a melted end could cause the 3D printer to stop extruding the PLA.

So, after taking the PLA off from the housing tube which is attached to the extruder body. I then cut it off making sure to cut it at a slight angle so that it can feed through better.

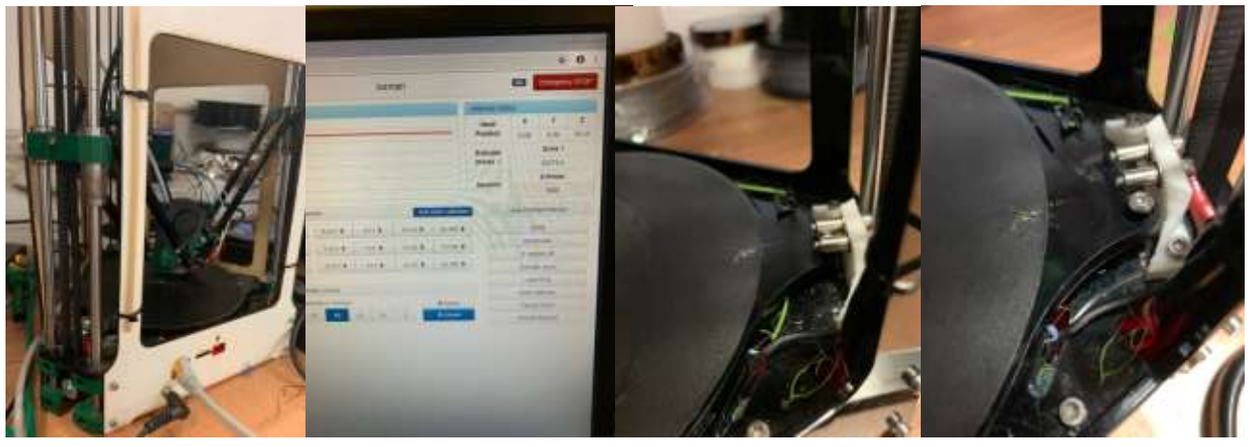


After that, I then inserted the PLA back to its housing tube making sure that there is enough PLA along the tube all the way to the extruder. To check that it is, this can be done by the next step.

Before I can turn the knob which extends the PLA , I have to place the stopper first before I turn it as it keeps the PLA in place and then make sure it loads the PLA properly.



Finally, turn the knob anti clockwise to feed the PLA through the drive block. Once PLA is melted down, check that your temperature is at 220 degrees, cut off the excess and start printing.



There were many other problems with the 3D printer that occurred while I was using it such as the arms being at a lower angle which means that when calibrating the arms the arms are likely to get stuck to that one side. Moreover, the next most popular occurrence is that the bed keeps moving which therefore prints out blobs or print in the air with stringy PLA. To solve these problems I had to aligned the arms back together and home it. I also had to make a connection with the bed to the printer because it keep loosing the connection which therefore comes up with 1000 probe which is not good because it needs to be at 0.

What's acceptable and what's not?

Not Acceptable

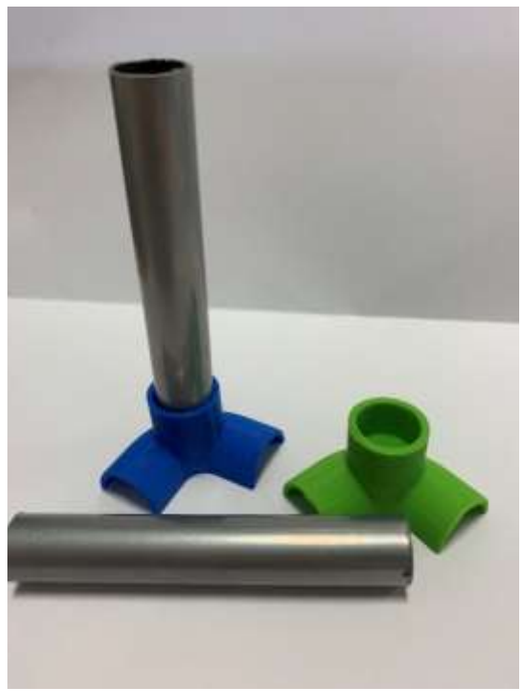
I printed out several connections already but most of these are failures. When it does print out the whole thing I have to decide whether it's acceptable or not because sometimes the bed is moved which therefore causes it to slightly print on the side which could mean that the bond is now weaker and that the tube might not be able to fit anymore. But if the connections is slightly bent aqt the bottom because it cooled too quickly, that is acceptable because the gap can be sealed when I glue them together.

Acceptable

Here, I have printed out 20 pieces out of 40 of the connections. It was a very challenging achievement as this has been on going for 4 weeks now with barely any success. Achieving at least two to three pieces being printed each week. This is due to the 3D printers either breaking down, not printing properly or the computer just wouldn't connect to the 3D printers. Even though the 3D printer is inconsistent, I am going to have to keep printing as this I the only option for these parts as I have already printed out half of the connections. I just need to print out 4 more 4 way connections which is two part so this will be 8 pieces together. I also need to print out 4 more 2 part 3 way connections with 4 more bottom connections for the 4 way elbow.

These are a few of many that went wrong with the design, these two (red and green) I feel like I can salvage, however, the two blue ones on the far right cant be. This is because of how the tube is going to sit. The tubes wouldn't be able to fit all the way through as the slight movement would block it from standing straight. The red and green pieces however, is still usable, it might now look aesthetic of be a bit weaker than the rest that is printed out but it's still usable. The gap in the green could be filled and the red is really not a big issue as the bed or the axes of the 3D printers have slightly moved causing it to slip off and print a layer slightly off the object which was already printed. On the other hand, the green was a different problem, with the PLA not extruding properly which meant it started printing in the air which have caused this gap as I didn't realise sooner.

However, if I have time left as the 3D printers have become more efficient, I might reprint these again because it looks unappealing and could incorporate to my structure being weaker.



I also had a difficulty in printing out the right size for the tubes, this is because I don't know how much of a leeway I needed so that it can easily slot into the elbow connection. At first, I added a 0.25mm leeway but this turned out to be quite tight and barely fits the tube. So, I had to change my Solidworks design's dimensions and start 3D printing again. It wasn't difficult to change the design's dimensions so this didn't add to my time. However, before actually getting the right size I have printed at least 4 of these tight tubes, this is due to altering it slightly and not adding a big difference as the one I printed out with a gradual 0.75 leeway was too loose. On the other hand, these are still usable because it's only the top part that is tight, the left and right elbow is fine when I connect the other part with it.

I decided to keep them because it took quite a while for them to print and it printed out perfectly, so since I have limited time I am planning to sand them down so that it will easily fit the tubes. Doing this however, might weaken the tube as the diameter width of the tube will be thinner. I have tried to sand down one tube with a sand paper attach to a round sand file, but this took time and more effort so I decide to use my nail buffer as it's quicker and more efficient as its an electric one and there are many sizes which could get the inner edges.

Manufacturing Diary

Parts	Challenges	Any Changes	Completed
3D PRINT connection to fit tubing - 8 of 3way connections - 12 of 4 way connections Note: These will be printed in halves because there will be too much stress to 3D print the whole thing and will instantly fail. So after 3D printing glue them together with 2 part Araldite epoxy glue.	The main problem I had with manufacturing these parts is the 3D printer itself because it inefficient as they keep breaking down. Moreover, I had difficulty at the start with what diameter I was going to use as I didn't have my tubing materials yet.		27.3. 2019
CUT measured 15mm MILD STEEL TUBING - 55cm x10 - 45cm x10 - 11cm x12 - 6cm x4			18.3. 2019
Cut 25mm MDF for the seat base - Use the template made for the card model earlier Note: Make sure that the curve is fairly similar to each side so that it looks aesthetic. Also, make sure that it's not too pointy or curved because it will add for stress for the flexi MDF			29.3. 2019
Cut Flexi MDF wood for the back rest - Use the card model as the template for the shape x2 Note: Make sure to add 25mm and 50mm to the height of the back rest because the arm rest will be too low as the card model has no sense of thickness			4.4. 2019
Cut 15mm MDF wood for the desk -Use the measurements used in Solidworks and test it on the card model made earlier -If it's too small then make configurations to suit the real scale model			1.4. 2019
Cut grey foam for the seat cushion and back cushion - 5cm thick 50 x 30 cm - 5cm thick, use the template for the seat base Note: make sure to carve out the shape of the ergonomic cushion before covering it with the fabric.			16.4. 19

Technical Specification

Purpose

The product being redesigned must be comfortable to sit on, usable, works efficiently and serves all the purposes it was required to. If it doesn't the this product wouldn't be as popular compared to other existing products out in the market if it doesn't do what it says.

Function

When being used, it should be able to function as it should with all those requirements that are listed which the product promised the consumers. If it doesn't the consumer will be very disappointed because what will the purpose of the product when it can't function properly to suit what they bought it for.

Performance

The desk must be easy to flip/rotate when it's in use, this is so that it will eliminate having to spend more time on something that will be used occasionally if it will be difficult to use.

The modular structure should also be easy to move around

Size

It should be an average size chair if it is not adjustable so that it will fit the average range of my consumers

Weight

Ease of Use

Materials and components

Production Methods

Assembly

Finish

Health and Safety Risk Assessments

Quality: testing standards

Maintenance

Target market requirements

Ergonomics and anthropometric

Aesthetics, shape colour style and texture

Competition

Value Issues: Environmental, Social, Moral and Cultural

Product Life span

Cost of Product

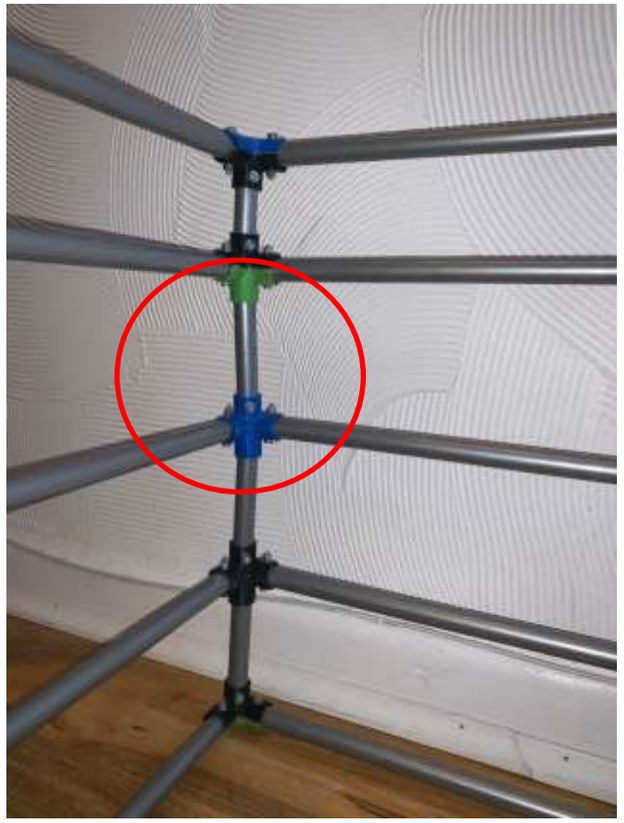
Final Design

Evaluation

Throughout these slide you can see the final design of my multi purpose chair. It has drastically changed to what I have designed in Solidworks due to limited supply of materials and late production which have caused me to change the design and how I manufactured my chair.

I do like how this structure turned out because I didn't expect that it would actually come together let alone withhold me and my brother's weight. I thought this because the connections are made out of plastic which are quite brittle and it's also manufactured in two parts which is attached together by two part Araldite epoxy glue which should have a strong hold but every time I put quite a lot of pressure on it I could hear a cracking sound which could be the glue being too dry that just cracks off.

One of the structure's leg with the connection is bent, this is due to a misalignment with the drilling of the holes which has therefore cause this slight bent which has to be forced into the other structures slot. Now one side of the structure has a longer length than the rest. Even though the structure is still strong enough to withhold my brothers weight who is at around 75kg. However, this slight bent does affect the chair's strength because it will make it slightly weaker as it's at diagonal point which could therefore give way as there is not that much support covered by the tubes surface area which puts more stress on the sides of the tube.



https://www.youtube.com/watch?v=gAd8jps8w1w#action=share

In this video, you can see me trying to assemble the structure. This should have been done with ease but since my measurements and alignment are slightly off, each of the structure then meant that they are not the same which could lead to a bit of force and fiddling around to make the each of the structure fit each other. This would then defeat my core requirement of the product as being a modular product it should be easy to take apart and assemble. Towards the end the structure was sturdy but a bit wobbly because of the structure with the blue connections.

This is what the whole structure is supposed to look like. This side of the structure is what I wanted to achieve so that it is more stronger and durable as all the tubes align at one point which gives it enough support to withhold an average adults weight. However, misaligning the holes or measuring incorrectly meant that each layer of the structure is the exact same length or have holes drilled in the same place. This could be due to me rushing the manufacturing process but it's also because of the difficulty in drilling holes on the mild steel making sure to puncture a small hole first so that the pillar drill can easily go through it with the help of a metal coolant.

Improvements? What would you change and could have you done differently?

There are many different ways I could have done this structure but since my time was constricted and limited materials I had to improvise and manufacture it this way. If I were to manufacture it differently I would make the tubes have a bigger diameter to that it doesn't looks flimsy like my model. Moreover, I would make the connections out of metal instead of this PLA plastic because then it would actually hold the tubes in place and would be stronger than the two part manufacture plastic connections. Furthermore, If I were to get rid of the connections as the metal one could be only bought as there was no other way to manufacture it in the workshop then I would weld the structure together and use button clips so that It can still be modular and adjustable.

Improvements? What would you change and could have you done differently?
For this structure I wouldn't change anything because in this structure it works perfectly fine. However, I would add more structural support going along each of the rectangular base because when the cushion is added there is barely nothing there that will support it and might fall through when sat on unless I use a hard base for the cushion but this then means that the cushion is not reversible and can only be used at one side. Furthermore, having a hard base for the cushion, such as wood would then make the cushion heavier but then again the piece of wood can then be used for something else useful like a table top when a table is needed and not a chair.

The structure on the left is longer than the right structure so that when the consumer is taller than me who is 5ft 2 then it would still fit them. This structure would still be comfortable for them as their legs wont stick out. However, keeping it as this structure means that the bed will be thinner leaving only a small amount of space for a whole person to lie down fully. This would mean that some of my consumers who are slightly on the bigger scale wont be able to fit.

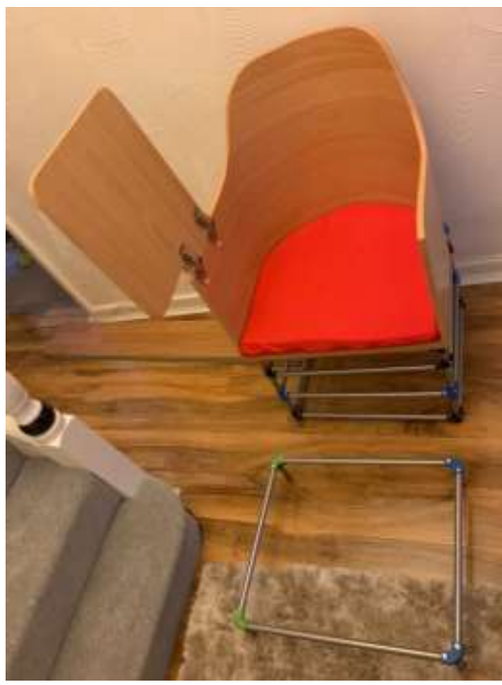
This structure here on the right is the main structure, the left can be an alternative when a consumer is on the taller range and needs more leg room. This structure can just about fit my body built so I don't particularly think that someone bigger than me will be able to fit comfortably on this structure let alone the structure on the left.

I don't mind this structure because it looks more appealing than the chair, I think this is because when the whole structure is all together the shape to me is just a box and there is nothing special to it because it just looks very structured with all the tubes going on but when they are separate and individual they seen more unique and interesting. Moreover, when this structure is wholly finished this could turn out to be more successful than the chair itself because the stress and weight of the person is evenly distributed along the structure which means that it wont have a lot of stress on the bottom of the structure, while with the bed structure the stress is evenly spaced out because the weight would have been distributed along.

Since I started late on manufacturing my product, this has led me to not finishing the bed structure and the rest of the chair which I initially planned to do. I ended up deciding to not finish the bed structure because I can then improvise how I could test it out. I decided to finish the rest of my chair because it's the most important function as it's my main project.







The outcome of this chair is actually quite surprising because I have imagined it to be different from this. I do like some aspects of this chair but overall I don't find it aesthetic or marketable. Also, since the structure is not sturdy enough this would not be able to be out for sale because it would endanger my consumers greatly. This is due to the structure not exactly aligned to each other and the connections not being able to withhold a lot of weight or overtime use because the thickness of it is quite thin.

The biggest change I have made is the shape and thickness of the seat structure. I have manufactured using Flexi MDF instead of Flexi Plywood because Flexi Plywood is more expensive. Moreover, there was no way I can steam bend the wood because we don't have a heat box in the workshop and this would be a very lengthy process which I didn't have time for because of late production. Moreover, I had to get rid of the back cushion because there was no way I could attach it to the back as the seat structure was changed. The change within the seat structure was quite drastic that it lead to me having to eliminate the back cushion because the seat structure was too thin and challenging to cut the rectangular holes for the back cushion to lay.

I have also changed the shape of the table because the original shape that I designed in Solidworks didn't work out as it was not big enough to hold A4 paper. This was vital to change because most of my students work would be on A4 which therefore means there should be enough space to lay their work on, otherwise my consumer would consider this function pointless which therefore causes them to not buy the product because the desk it important.

Finally, I reverted back to my original cushion design where it's not ergonomic because the foam is too thin for me to carve out any curves which should follow the ergonomic design of a seat cushion. The foam I have used are quite dense anyway which makes it comfortable to sit on as it's not firm and will malleable the natural curves of the consumer.

Improvements? What would you change and could have you done differently?

I would change the whole structure of this chair because it looks very uncomfortable and it's not aesthetically pleasing. I feel like if I rounded the edges and gave them more of a deeper curve then this chair would look more appealing because right now the finished product looks boxy and claustrophobic. Moreover, the structure where the arms would be is quite high which leaves the arms to strain after a long period of use.

Testing

In this video, I tested if it will be able to hold my weight with just using half of the tubular structure. Surprisingly enough this was the right height for me to sit down as both my feet are firm flat on the ground and doesn't feel uncomfortable at all whatsoever.

In this video, I interviewed my brother who is 20 years old and in 2nd year of University. He is currently not living in a small University accommodation but he is staying in a small accommodation which fits a single bed and a small wardrobe. I asked him a few general question about the chair like what he likes about the design, what could he improve, would he buy it with his own money and why.

In this video, I tested if the desk was actually functioning properly because without it the chair would be very pointless. It started off fine putting the desk down but when putting the desk up the screws suddenly gave way. This is due to the screws used and the lack of thickness of the wood, which cant hold the screws in and doesn't offer enough strength when flipping the desk up.

Problems? What are the modifications needed to solve the problems?