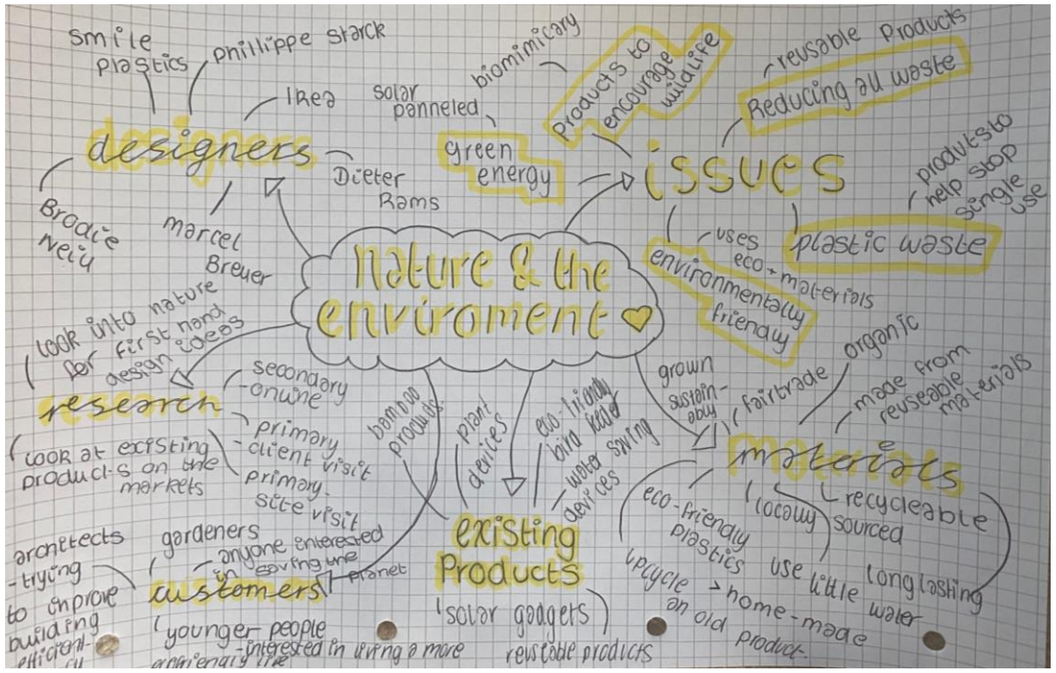
Summary and initial design brief ideas:

I intend to design and create a product that will be covered by the design area 'Nature and the Environment'. It will be a device that will allow the client to support all three themes green energy, reducing waste and encouraging wildlife. The materials used will be organic and grown sustainably if natural, or they will be made from reusable materials and be biodegradable. For example, I have the idea of creating the product using biodegradable plastic that I have made myself. The product will be suitable for the chosen client and I must ensure that it is safe for them to use. From researching into my chosen context some designers, I will investigate the works of are Phillippe stack and the brand Ikea. Both have done collects that have a focused on the environment. This could be useful when looking into design ideas or existing products.

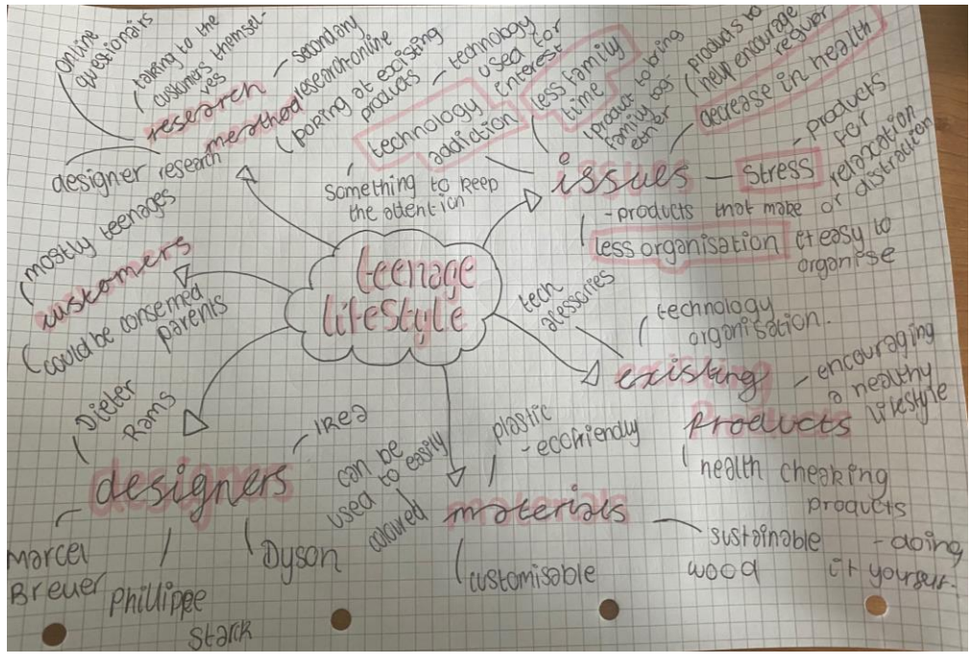
Exploring the contexts

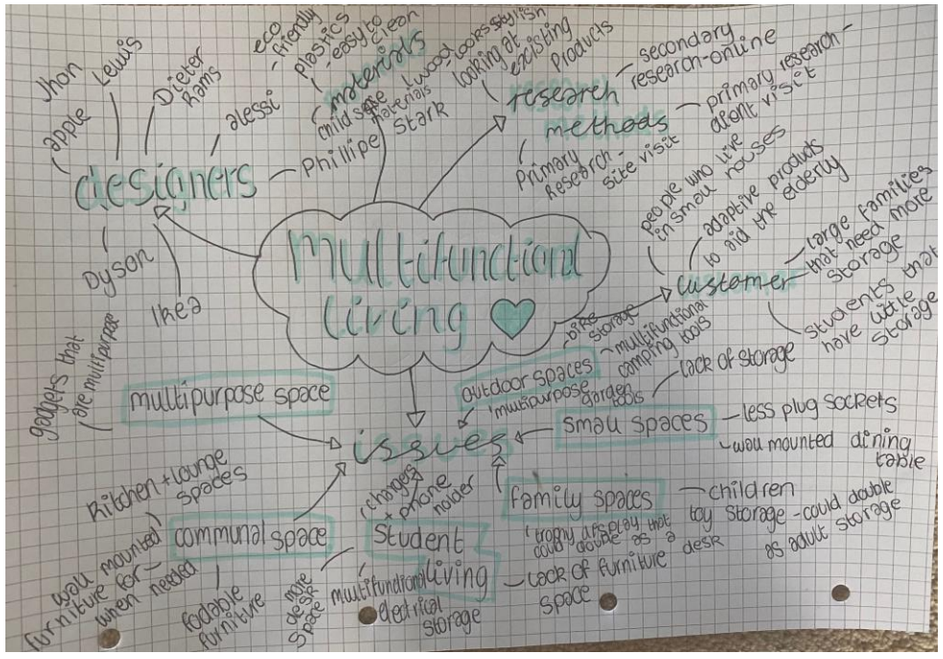


Introduction: For this page I hope to choose a design area. Within this design area I wish to create a design brief, which includes which issues I want to address and shows what area of the product that will need to address them. In the chosen context I will investigate materials, designers and research ideas which could be used.

After creating three mind maps for each possible design context, I decided on 'Nature and the Environment' as it is not only the area, I am most interested in but also it posed the most opportunities for me to develop a product in this area. I investigated categories such as green energy , reducing waste and encouraging wildlife. I have concluded that I want to create a product that is not only eco-friendly, but also includes aspects from all topics discovered. For example, I am looking for my product to include biomimicry, use renewable energy if needed and to be made including upcycled products.

I investigated multiple sections within this design area such as: technology addiction, health issues, stress, organisation and family time.





I created a mind map with the context of multifunctional living to explore the themes of small, communal or multipurpose spaces to find a product that could be used in these areas to support, one of the issues I had discovered. The

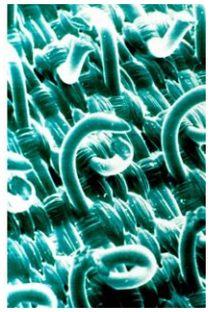
These ideas helped me to produce product ideas such as products for relaxation or products to encourage teenagers to have regular health checks and to encourage a healthy lifestyle as a main issue for this client age range is obesity. I produced several ideas that could address the needs of teenage lifestyle, however I decided against it as it reduced my clientele to a small range of customers who may not use the product for a long period of time as intended.

However, I decided against this context as it does not fully for fill these needs of my client and I believe this is a heavily worked in area where many of these same products I had ideas for were already available. Within this design area I investigated many different issues, which mainly are covered by a multi-use tool or storage area that could be appealing to multiple clients and be adapted by them for their preferred purpose. Designers that I found who have created products with this context include: Jhon Lewis, Dyson, Ikea and Phillipe Stark.

Analytical research – mood board

Introduction:

For this page I hope to gather more ideas on products I could create with the theme of 'Nature and the Environment'. I would like to use this page as a useful research tool to look at product that are already on the market. This insight will give me ideas on what themes my client is drawn to and how I can incorporate the materials or colour schemes into my product. However this mood board will also show me how I can make my product stand out against existing ones.



Here shows examples of biomimicry, where designs from nature have been taken and used to create the shape of a specific product. For example, Velcro, has been taken from plants that use this method to attach to animals' fur, for them to be reseeded. Another example is this bullet train, which has used the shape of this bird's beak to encourage it to be more streamline, and therefore go faster. I would like to use the method of biomimicry in my design, as it not only goes along with the theme of 'Nature and the Environment', but also may help me with ideas of my products shape and will therefore draw in more of an audience, who may be interested in my design.

A common colour scheme that I have found amongst these eco-friendly products is a natural but contrasting one. The colours can mimic those presented in nature whilst also representing modern trends such as monochromatic or 'dark mode' themes.

An example of a designer using this design context is the IKEA company. They have taken an interest in recycling polymers and released a collection of chairs, made of recycled wood and plastic. The products are available in several colours, following a natural, monochromatic or nude colour scheme.

IKEA have also released a kitchen made from recycled plastic bottles. This modern, stylish and consistent design follows the trends of today, wilts caring about the needs of the future.

Many materials used in these products are from natural sources such as bamboo or cotton, however for my design I hope to include a material that will stand out amongst these, whilst still being full eco-friendly. I would like to do more research into homemade biodegradable plastics.

Here shows another product which is covered by the context of 'Nature and the Environment'. It is a compost bin, which helps reduce waste as it allows the customer to decompose of some of their waste themselves instead of it being put into landfill. However, what is unique about this design is that it is made from bamboo. Bamboo is fully biodegradable; therefore, this product does not only reduce food waste, but it reduces plastic waste as itself is made from bamboo. The sleek and stylish design may catch the eyes of more customers and therefore can help encourage more people to reduce waste.

This bench and sofa are from the collection 'Fenc-e Nature' designed by Philippe Starck.

The collection is inspired by and extremely respectful of the environment. The style of the collection is to use avant-garde style materials and solutions.
Philippe Starck wanted to include harmony and osmosis with nature within this collection. The products are made from organic cottons .

I will be taking inspiration from this collection and others Philippe Starck has created to include in the design process of my product. One design feature that stands out to me in this collection is the usage of naturalistic elements and materials from the environment whilst still being ecofriendly and respectful to the environment; this collection allows people to enjoy nature. This is something that is important to include in my design brief.

This chair is also from the Fenc-e Nature seating collection designed by Phillippe Starck. It uses organic, almost primitive, forms and tactile elements. The backrests of the chairs are able to convert into two positions. This is a simple mechanism, which is designed to emulate nature itself.
Taking inspiration from nature is something that I believe that will make my design unique and will be included in the design brief itself.

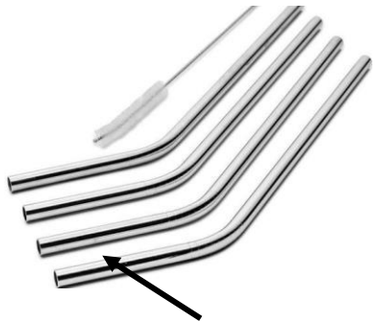
Summary:

To conclude on this page I have done research into products, design and shape ideas, biomimicry, research into materials I could use and colours to attract a customer basis.

From the research I have gathered from this page I can take it a step further and see what I would like to include from these ideas into my own product. This includes key areas for further research such as – nature, For the next pages I intend to continue this research, to gather more information, to make the best version of my product.

Analytical research – Existing product research

Introduction: From looking at reusable food packaging in my research mood board, I have identified the issue with plastic pollution with non-reusable plastic cutlery, therefore for this page I will be looking at existing reusable cutlery products. I hope to gather a viewpoint on the wide range of reusable cutlery products made to help reduce plastic pollution that are already on the market. I would like to use this page as a useful research tool to get an insight into materials, design features, size, weight, shape etc. By looking into what already exists I can use the information to adapt the design of my product, with the good features I have found but also examine problems with the existing products and adapt the design of mine to improve upon them.



Sipwell Drinking straws

What are the interesting features or functions ?
These metal straws are helping to solve the extreme problem of plastic pollution, by getting customers to use these metal straws when out and about or even at home, when they might be forced to use a single use plastic straw. According to the National Park Service, you could fill over 125 school buses with the straws Americans use every single day (500 million in all).

What does my target market think about the product?
My potential customer does not like the materials used in the product as she doesn't like the feeling of using the metal as a straw. This design flaw is something I would like to take into consideration for my product and would change and improve upon.

What materials have been used in its construction and why?
Stainless Steel has been used to manufacture these drinking straws as it is durable making the product a long-term solution. At the 'end' of this products lifespan the material can be easily recycled helping to reduce the pollution of plastic in landfills or oceans.

Is the cost of this product a factor in its success?
This product is retailed at $7.88 for a set of four with a cleaning brush, making it affordable for most people, meaning they have an incentive to purchase and help the environment

Client feedback: I like how easy to clean these products seem, as I would be using them on an everyday basis. However, for me personally I would not like for the product to be made from stainless steel.

Is the size, weight and shape important?
For this product, the size does matter as it must be small enough for people to want to carry this around with them. The opening must allow for room for the customer to drink through it comfortably also. This set of drinking straws is the 'long' version – this may be to ensure they can be used with different sized cups. The weight of this product may be an issue as it is made from metal, causing it to be heavier, however there is a positive to this being that they are more likely to last much longer, therefore helping to reduce more waste. The shape of the straw is allowing customer to drink from it comfortable, this being a design feature I hope to include in my product

Summary:
To conclude this product, I now have a new design brief on what my product must involve: It must be made from a material which is helping solve the issue of plastic pollution but must not be metal. It must be the correct shape to allow it to adapt to any drink or person using. Finally, it must be made from a material which is both hard wearing and easy to clean.

My Little Panda Bamboo Lunch Set

What are the interesting features or functions ?
This product is a reusable lunch cutlery set. An interesting feature about the set is that it is a Japanese-style flatware set. The product is made from bamboo, meaning it is also helping to solve the issue of plastic pollution as it allows the customer to use the reusable cutlery rather than a single use plastic one. An interesting function that is has is that it comes with a pouch to carry the tools in, making it extremely compact and giving the customer a product, which will encourage them to bring it around with them. However, the issue I see with the pouch is that is may not be strong enough to last a long time, it can get stained and dirty easily and may not be as easy to clean, which could cause bacteria to come in context with the cutlery. This issue which I have identified is one which I would like to fix in my product's design.

What does my target market think about the product?
My potential customer likes the feature of the pouch and wishes it to be used in my product's design, however they do not like the bamboo that has been used as they believe it may be too brittle and not sharp enough therefore making it difficult to use as cutlery.

Is the cost of this product a factor in its success?
This product is retailed at £13.19 on Amazon, making it affordable for most people, meaning they have an incentive to purchase and help the environment

Is the size, weight and shape important?
For this product, the size may need to vary as it depends on the meal being eaten with the product, and the person using the product. The weight of this product may be an issue and bamboo is very light causing the whole set to be very light. This may be good in some cases, for example it makes it very portable and easy to carry around. However, when being used as actual cutlery it may be too brittle and therefore hard to actually use as its intended purpose. The shape of the product is not that important, it just has to be the correct shape for the cutlery to be useable and it must be sharp enough to cut through food. For this product it is very important that it works well every time as the customer has to want to bring it with them. If this is not the case it is not helping solve plastic pollution.

What materials have been used in its construction and why?
The product is made from bamboo, which is biodegradable, environmentally gentle and sustainably sourced, chemical free, BPA free with no glue making it entirely natural. The pouch is made from organic hemp, also and dyed with plant extracts. The values of the materials used is what I wish to use in my product.

Summary:
To conclude I have realised that my product must be made from a fully eco-friendly material that is very durable but also light weight and easy to use with its intended purpose. The client also wishes for the product to have the ability to be cleaned and transported easily.

Client Feedback:
I like how lightweight this product seems and I enjoy the storage that comes along with the utensils as they would be easy to travel. However, I think they might not be that comfortable to hold and seem like they are not durable enough.

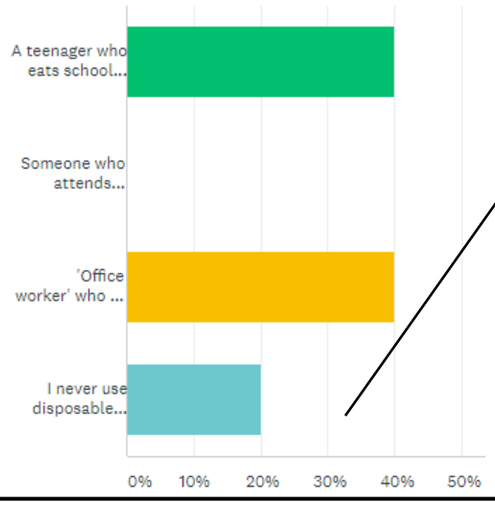
Analytical research - Client research

Introduction: For this page I will be finding my potential users and primary user/client, this will be done with the use of a survey which I will make. This will not only allow me to get a more detailed viewpoint on the type of client that my product attracts, but also allow me to prove that there is an actual ned for my product and a client that will find the product useful. I will have got an insight into what the client would like to see in the product, using this information that I gather from the survey, I will be able to improve my product as to suit the primary user better.

List of Potential users

- **Office workers who get disposable lunches:** the reusable cutlery would allow them to have cutlery in a space where they may not or cut down on sing le use plastics which they may pick up with the disposable lunch options
- **Teenagers who eat school meals with disposable cutlery:** the client has to use disposable plastic forks with their school meals. Having an eco-friendly set of cutlery would allow them to have easy access to a form of cutlery which is helping the environment instead of damaging it.
- **Young adults (or any client) who attends festivals, food markets and eats street food often:** food which comes from street food vans or stalls at large gathering, such as festivals will most likely come with disposable to eat it with. Not only is it very unlikely that the plastic will be recycled, but at large gatherings such as festivals lots of littering occurs, meaning the disposable cutlery will go directly into the environment.

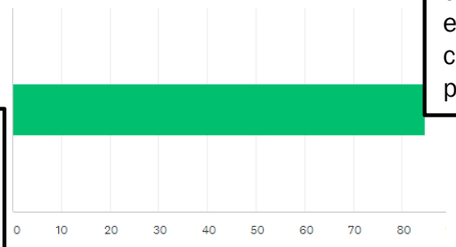
Identifying the primary user with a survey:



From my survey I have identified that there is a need for reusable cutlery as the majority of the people who answered the survey did not include themselves in the last section. From the survey I have also identified my primary user to be a teenager eating school lunches or an office worker. Both potential primary users have an obvious need for reusable cutlery to be used daily, therefore being a great choice.

How interested are you in reducing single use plastics ?

Answered: 6 Skipped: 0



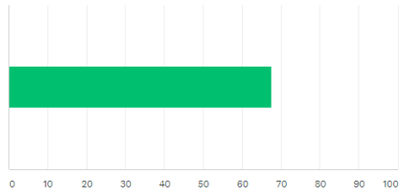
It is also important to recognise that not only does the primary user have a need for this product but that they are also interested in reducing single use plastics and therefore would be wanted their product to help do this. From the survey I can tell this factor is important to the clients and therefore would make it more appealing to the target market.

The response to this survey question again proves that there is a need for the product and therefore a wide range of potential primary users.

In the survey I also asked the potential primary users :' When going to get food how often do you have a bag with you?'. The reason I asked this question was to find out how portable my product would need to be. The response was mixed, therefore by making my product portable without a bag for example it coming with a case, but also allowing it to fit easily in most bags will satisfy the needs of all clients when it comes to the products portability.

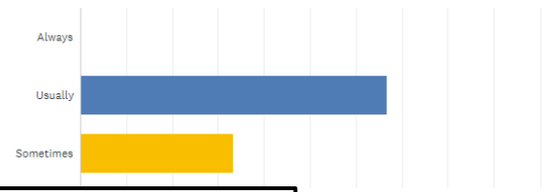
How often would you use a reusebale, eco-friendly cutlery set with a straw ?

Answered: 6 Skipped: 0



When going to get food how often do you have a bag with you ?

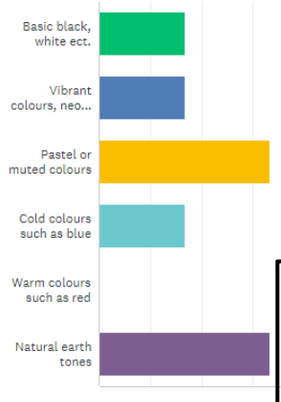
Answered: 6 Skipped: 0



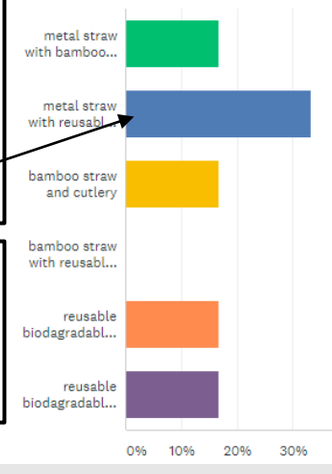
From the response to this survey question I can conclude that most people would like the product to be coloured in muted or earth tones.

What colour schemes are most appealing to you?

Answered: 6 Skipped: 0



When asking potential clients about their preferred choice of material most people picked a metal straw with reusable biodegradable cutlery. The choice of these materials will therefore be taken into consideration when choosing the final materials.

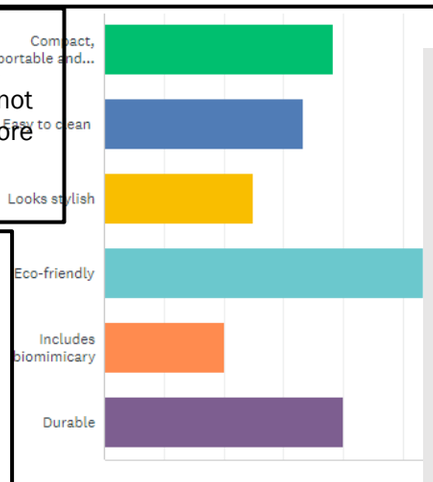


7. What features do you like about reuseable cutlery sets or straws ?

Question 7 in the survey was about existing products on the market and what my clients enjoyed from them. Some responses to this question were as followed: "Satisfies my green consciousness", "Something that is easy to clean, can pack into a lunch box and doesn't break easily like some of the plastic cutlery available with take away food.", " If it can be provided in a sealable packaging so can be carried in a bag and then when dirty safely put back into the container for washing at home.", "they're reusable". From these responses I now understand that there are a few features that would need to be taken from existing products and included in my own. For example being eco-friendly, durable and easy to clean, however all these feature can also be improved upon from already existing products.

When asking the question about what is most important for the product to include to my potential clients there was an obvious want for the product to be eco-friendly. This further implies that there is a need for my products as many people are showing a growing interest in helping reduced plastic waste and protecting the environment in general.

Although biomimicry can be good design feature it does not serve a purpose in this product. It is also not important to the client and therefore will not be included in the design brief.



6. What inprovements would you make to the reusable cutlery or reusable straws that are already on the market ?

Question 6 in the survey was about existing products on the market and what my clients would like to see improved from them in my product. Some responses to this question were as followed: "Can never find straws that a made of anything apart from stainless steel - don't like the texture of this metal", "It needs to be more robust so it can be reused more often and made to the standard cutlery size rather than being too small.", "less easily breakable and more easy to travel with" and "make them more eco-friendly and biodegradable". From these responses I now understand that all these comments should be added into my design brief as this my product must include to allow it to be better than those already available.

Other responses show that the need for the product to be durable and compact / portable are high up on their priority list for my product. One thing the potential clients were not very interested in was for the product to include biomimicry.

Summary: To conclude this page I have started to recognise what the important needs of my users are. These include a main focus on functionality and comfort whilst using the product, but also for it to be fully eco-friendly and to be helping save the planted instead of just making something biodegradable. The next steps in my client research will be to look further into my client's ideas and get feedback from them personally about what they would like to see in the product itself. By updating my design brief to include these changes it will make the product more appealing to the customer as I have included their own personal preferences.

Client research – client profile and feedback

Introduction: For this page I have taken the feedback from my survey responses to choose a specific client. On this page I will be creating a client profile which will help me to understand my client's mindset on what they wish the product to look like, how it will function etc. I will also be asking my client's opinion on both my mood bord and existing products page. This will also help me to have an idea of things they would like to see included in my product or would like to be improved upon. This will help with the design process of my product as it will allow me to make the product more appealing to the client.

My client

Name: Caroline Hall
Occupation: School business manager

My client has an issue with plastic pollution in her everyday life as she uses nonrenewable plastic cutlery. My client would like the renewable cutlery I will make to be more environmentally friendly, but also more comfortable than those already existing on the market.

What existing companies or designer's design style do you like ?

I like the design style of the company Joeseph Joeseph, because they have a clean, sleek and simple look and function to their products. They also have an aesthetic colour pallet to their designs which I enjoy. I like the company Skandium's designs, because they are classic, and the designs stand the test of time. The products are also very functional with strong design features. Finllay I like the company Anthropologie's designs, as they have slight vintage feel to their products. I also enjoy the materials used to produce these products as they feel comfortable to use, whilst also being durable and look eye catching.

What design styles or movements do you like?

Firstly, I like the minimalism movement. The simplistic designs with simple forms and clean lines give the products a unique feel that will stand the test of time and still look stylish in the future. Secondly, I like the parts of art deco style. Some elements can be too busy; however, I like the style, elegance and sophistication of most the designs. The use of simple, streamlined shapes with stylized, often geometric ornamentation give the products a unique look. Finally, I also like the elaborate use of materials in the art deco style, which could be added to this project.

What materials interest you, or that you would like to see the product made from?

I think bamboo as a material would be good as it is good for the planet and protects are environment, the product also has a nice texture, however it can slip and of your hand when using it so it may not be as function for this products purpose. One material, that I like and also think would be a great fit for this product is recycled plastics. I like the texture of this material as it is both smooth, so therefore is comfortable to use but also has a good grip. The fact that this material is recycled ensures to me that the product is sustainable, which I find very important.

What are your general interests ?

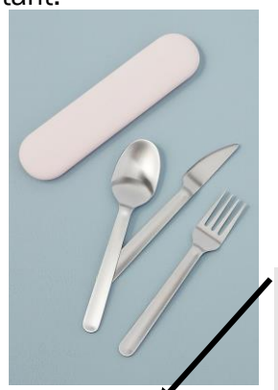
I enjoy sewing, going for walks and protecting nature.

What are your main needs that the product must have?

- made from sustainable materials
- portable
- can be stored away easily
- lightweight
- the sized specifically for the client
- comfortable to use
- function well
- unique to other existing products
- durable
- easy to clean
- must be unique to the individual client

The client likes how stylish this product is and they feel it would be more comfortable to use as it can mold to the shape of their hand. They also enjoy the feature of them slotting together, as they believe it would make the cutlery easily portable. Finally, they like the colour pallet portrayed in this product.

The client likes the simplicity of this design but feels it is not unique enough. It doesn't have a different design feature to make it stand out, however they do like that it looks user friendly and would function well.



What price would you like to see the product placed at?

I would like to see the product priced at around £15, as this would give the product value for money. The item must have longevity and therefore I would pay for the style to be still in fashion in the future not outdated.

Feedback on existing products from companies my client has identified they like

Client loves the material and natural style. The shape is user friendly and has a unique design and is attractive. It also has an environmental feel with the animal (whale) design.

For this product, the client feels the handle is too thin and therefore would not be comfortable to use. They do however like the sleek and stylish design. They also enjoy the functionality of this product with the different shapes; however, they don't feel they would be user friendly.

For this product, the client enjoys the case which all the cutlery fits into, they also like the mixture of materials and textures used. The thickness of the handle would provide comfort when using, which they enjoy. One thing that stands out to the client though is the fact the product is not unique as they feel it looks too much like regular cutlery.

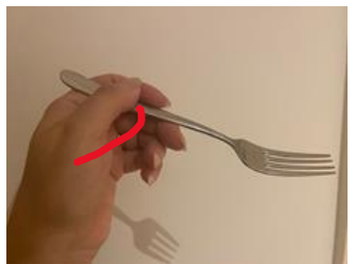
Summary: To summarise my findings on this page I have identified the key features that my client needs to see in this product. I have also learnt more about the clients likes, for example they enjoy the minimalistic movement, which I can incorporate into my design. My client has also identified some issues in existing products, such as the handles of the cutlery not being thick enough, or the designs not being unique. This will allow me to develop upon these things in the design of my product. Finally, for the next pages I wish to do some more research into material testing for recycled plastics and into the companies my client has identified that they like.

Client research – collecting anthropometric data

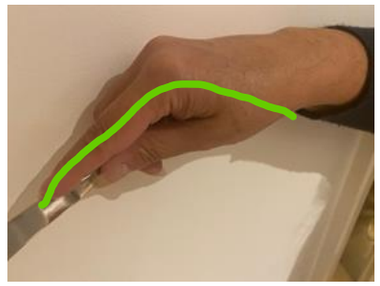
Primary data of hand measurements

Potential primary users	Red line L and R (cm)	Green line L and R (cm)	Blue line L and R (cm)	Yellow line L and R (cm)	Black line Just L (cm)	Purple line Just R (cm)
1.Office workers who get disposable lunches - male	9 , 9	16.5 ,17	7.5, 8	7,7	6	8
2.Office workers who get disposable lunches – female	9.5, 10	16.5, 16.5	7.8, 7.8	6.7, 6.8	5.4	7.5
3.Teenagers who eat school meals with disposable cutlery – male	10, 10.5	16, 17	8, 8	7.5, 7.5	6	8
4.Teenagers who eat school meals with disposable cutlery – female	10.5, 10.5	16.5, 16	8, 8	7.5, 7.5	6.5	7.5

The images on the left are the objects my potential client (2) is interacting with in the images on the right. I measured these products after seeing how the client interacted with them as to take notes on how comfortable the client felt whilst using them. It is important to improve upon the measurements of these existing products to ensure the client is comfortable when using product, I will create.
Fork whole – 20 cm
Folk handle –12 cm
Spoon whole – 19.5 cm
Spoon handle – 12cm
Knife whole – 21 cm
Knife handle – 10.5 cm



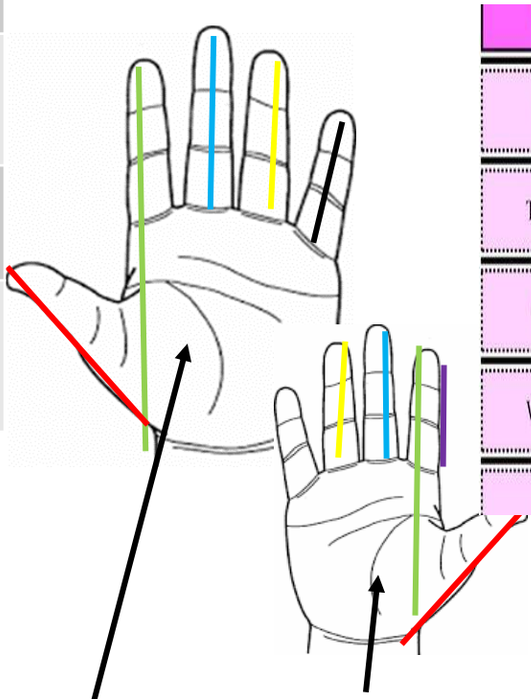
Another area to take into consideration when looking at how this client interacts with these relevant products is the red line which I measured. This area is put under stress when using the products and therefore it is important that the size of the product, I create will line up to the measurements of the clients and therefore allow the client to use the product comfortably.



From looking at these images of how the client interacts with relevant products, I can identify areas of stress which the product may put on the client, when using the product. By measuring the client and the relevant products used in these photos I am now able to correct issues which I see here, in the design of my product. One area of the client's hand which is put under pressure by these products is the centre of the palm - I will take this into consideration when designing as to make sure this area of the products has a larger surface area to make it more comfortable for the client to use. Using the green line which i measurement on my client will also help with the design of this as I will be able to ensure it fits perfectly.

Introduction: When designing a product, it is important that I carry out a comprehensive investigation into my client's needs and the needs of potential users. I will gather a collection of my primary anthropometric data. This will allow me to ensure my product can be used comfortably by my primary user. For this page I will be displaying the data I have collected from this investigation and explaining how it will aid me in creating a product which will be comfortable for my primary users to use.

Secondary data of hand measurements



Age	Circumference	Length	Thumb
Baby	4.5”	4.5”	1.5”
Toddler	5.5”	5.5””	1.75”
Child	6.5”	6.5”	2”
Woman	7.5”	7.5”	2.25”
Man	8.5”	8.5”	2.5”

These coloured lines represent the different areas on the hand of some potential primary users. I decided upon these areas for measuring by holding different pieces of cutlery and seeing which areas of the hand were used. I also considered that not everyone holds cutlery the same and therefore decided to measure some more places on the hand to ensure everyone could use my product comfortably. Another reason why I decided to carry out this research is because of a response in my client questionnaire. The question was about improvements on already existing products on the market (for reusable cutlery). One response was for the product to be ‘made to the standard cutlery size rather than being too small’ ,therefore by carrying out this research on anthropometric data I can make this improvement.

Summary: To conclude this page I have gathered anthropometric data from four potential primary users.
The utensil I create should fit the hand width of 10 cm, and length of 17cm. It should be no bigger than 210 mm and no smaller than 195cm. This will not only satisfy the needs of potential clients, but also follow the design brief I set myself for this product. By applying the correct ergonomics to the design of the product with the measurements of the user it will allow the product to maximize productivity by minimizing operator fatigue and discomfort. This ultimately will allow the product to be stylish and eye catching but an enjoyment to use for the client.

Client needs, design brief and Specification

Introduction: For this page I will compile a list of my client's needs. From this I will go on to create a design brief and specification. This will fully display every aspect of my product from the materials used to how I will make the product safe for my client.

Design brief:

I am going to design and make a set of reusable cutlery, to help manage the issue of plastic pollution. I am also going to be testing different materials to make my product out of, such as biodegradable plastic I.e. starch-based polymers that can be made at home would be a great material as it is eco-friendly and would allow me to make my product into many unique shapes or recycled HDPE could be used as it would be preventing it from potentially going to landfill.
The cutlery set is for a female office worker who eats lunches everyday with disposable cutlery. This would allow them to have a stylish cutlery set, which spread awareness of protecting the environment whilst also allowing them to protect the planet themselves as they would not be using single use plastic, every day.
My client has asked me to include biomimicry in the design of the product. I will do this by including themes of shapes or elements from nature. This will reflect through my design with the different shapes and colour schemes. The constant reminder of the environment when looking at the design will allow people to be reminded to help protect the planet.
The final overall size of the product will be based on the measurements I have taken of different areas of my client's hand and of existing products with full sized cutlery. It is important to the client that the cutlery is comfortable for them to hold, but also big enough for the cutlery to be fully functioning, therefore by making the product to their measurements it should satisfy this criteria.
The materials in the final product will be relatively in expensive to make, therefore making the wholesale and retail price accessible. However, depending on the making process the product may end up being more expensive if for example the 3D printer was used to create moulds for the plastic.
The cutlery will need to be portable, so the client can take it with them anywhere, whilst also being durable, and easy to clean, as it will be used on a regular basis.

List of client needs:

- The product needs to be made from sustainable and eco-friendly materials as the client is conscious about their carbon footprint.
- The product needs to be portable, so the client can take it with them anywhere.
- It must be able to be stored away easily.
- The product must be lightweight so can be used often.
- The product must function well, for example the knife must be as sharp as a regular knife.
- The design of the product needs to be unique, as to spark curiosity from other people and therefore cannot be like others on the market.
- The product needs to be durable, as to last for many continuous uses.
- The cutlery needs to be easy to clean, as it will be used on a regular basis.
- The product must be contoured to fit the client's own hands, using the measurements taken, it must be unique to them individually, therefore making it comfortable for them to use.

Specification:

1- materials: The material I am planning on using is biodegradable plastic that I can make myself. This will not only be cost effective as the ingredients needed are cheap and easy to get hold of, but it also allows me to test and make lots of prototypes of my product easily. As the materials for the product will be homemade this allows me to have a lower cost of production. This material is also biodegradable meaning it is good for 'nature and the environment'. Another material which I am considering using for my product is a sustainable wood or bamboo. This could be used as part of the case I will make for the cutlery and will also be a natural colour as the client wants.My chosen client would like the product to be priced at around £15, as they then know they will be getting a product that's has been thoroughly designed and tested to work at its best ability.
2- environment: This product must be sustainable for the environment. I am planning on using fully bidagradable materials meaning that the product would not be polluting the earth. However, if this does not work I wold like for the product to benefit the planet in some way other than reducing the amount of single use plastic cutlery that is used. The product could be made from recycled plastci that is preventing it from going to landfill.
3- Function: The product I am producing is going to help tackle the issue of plastic pollution which fits into my chosen context of nature and the environment. I am making a set of reusable cutlery which will be made from biodegradable plastic that I will make myself. The product will also include biomimicry, making the design more unique. To test if the product was needed and by what kind of client, I produced a survey. The response has shown that there is a wide range of people which would use and find my product helpful, therefore allowing me to choose a client and continue with the design process.
4- Ergonomics: My chosen clients is an office worker who would eat lunch with disposable cutlery every day. My client is 55, however the product would be suitable for most age ranges. An exception may be the elderly or young children as the product will have sharp edges and will be made to fit the size of my client's hands with the measurements I have taken. The client will find this product useful as they have been using mostly disposable cutlery before this or the reusable cutlery that they have used has been heavy or uncomfortable. With this is mind, one of the client's needs is for the product to be "lightweight so can be used often and must be the correct size for the client, so it fits in their hand comfortably."
5- Anthropometrics: I investigated anthropometrics by taking measurements of my client's hand and seeing them interact with cutlery, from this I have identified points on my cutlery which would need to be specific sizes to ensure my client is comfortable when using the product and to ensure the product functions well for them specifically. My client will be using this product to help them stop using single use plastic cutlery and allow them to have a comfortable cutlery that they can use often which is designed for them. Possible shapes that could be included in my design are shapes from nature. The final overall size of the product will be created using the measurements I have taken of different areas of my client's hand, as the product is being made for them individually. After getting my clients opinion of different existing products, they also would need the product to be a similar size of full-sized cutlery. This is important to the client and therefore I have taken measurements of different full-sized cutlery. These measurements will be used when creating my product.
6- Safety: For the safety of my client when using the product, I will ensure that the product is not only lightweight as they requested but also any sharp edges has been rounded, not including the 'eating end'. The material of the product will also be sanded down and sealed as to not injure the client.
7- Aesthetics: In my research I investigated biomimicry and I am planning on using this in my design to continue with the context of nature and the environment. On my survey the most popular colour choice was muted or earth tones, on speaking to my client this was the one they had selected. This theme will also tie into the chosen context. The product will have to look aesthetically pleasing, and when speaking to my client they mentioned that "The design of the product needs to be unique, as to spark curiosity from other people and therefore cannot be like others on the market."
8- social moral cultural and spiritual: The product is designed to improve the client's quality of life as it will help them in the long run with the product being lightweight, as this will not give them strain on their muscles when using the product like most reusable cutlery does. I have done research into ergonomics and how my client interacts with existing products. I have taken photos of how my client holds cutlery and studied them to fine the areas of the client's hand which needs to be supported more. This will allow the client to be more comfortable when interacting with the product. The product shouldn't need maintenance itself as it is a plastic, however the wooden or bamboo case may need another coat of a sealant. However, this is not necessary for the use of the product and will only need to be done maximum of once a year depending on usage. The product should only take a week or two in the workshop to create however the testing and prototype making stage will take much longer as the product will be made from a material I have never worked with and one I am creating myself. The production methods I will include will be prototype making. This is highly important in this project as the material, shape and measurements must be exact to the client's needs. The design of the product and the finial rptototype itself should not offend any ones sicila moral or culterual beliefs in any way. The idea of the products design is to benefit people socially by providing them with a comfortable product to use and benefir the the planet all tother as it should reduce plastic plloution.

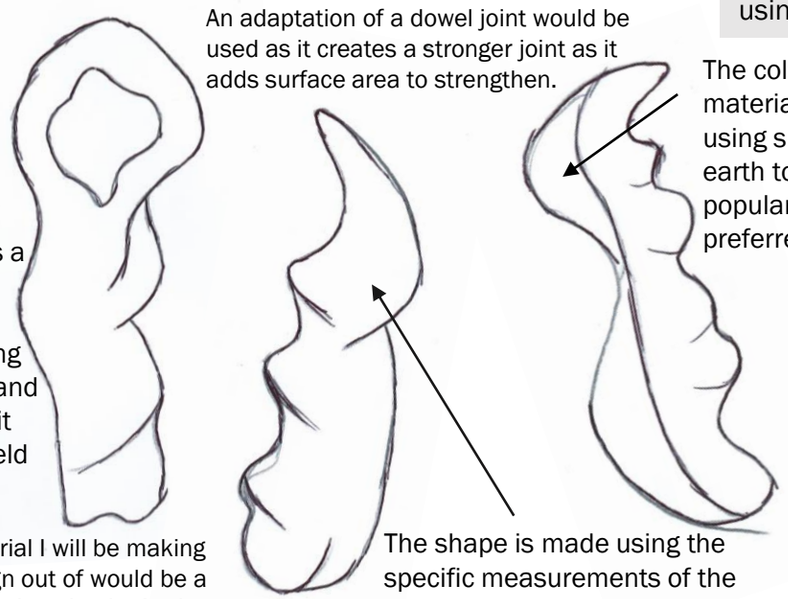
Summary: To conclude this page I have identified my client's needs by creating a list including them all. From gathering this information, I have then gone on to create my design brief, which outlines what I will be creating and what the product must include. My design brief has outlined what the important points to include are, and how I can extend my ideas, by researching these points more eg biomimicry. Finally, I created a specification, which fully detailed my whole product. I have fully explained the reasoning behind creating my product, the price it will be sold at, reasoning for materials, how I will ensure the product is comfortable for the client to use etc. In my specification I have expanded my list of client needs, by explaining how I will carry each one out. Moving on from this page I would like to do some more extensive research into material testing and the work of other designers, I will get client feedback from these pages allowing me to make my product fore fill my client's needs.

Initial design ideas

Introduction: For this page I intend to explore the design possibilities of my handles for my products. To generate ideas, I will create different shapes with materials such as cardboard and card. I will use these ideas and develop them by creating design ideas using different drawing techniques.

2

An adaptation of a dowel joint would be used as it creates a stronger joint as it adds surface area to strengthen.



Each handle is a different shape depending on the hand position it will be held in.

The colours will be kept as the material comes naturally or dyed using sustainable dyes in muted or earth tones, as they were most popular in my survey and are preferred by my client.

A positive about this design is the fact that the shape is specific to the client themselves therefore making this product comfortable to use as it is made specifically for them.

The material I will be making this design out of would be a thermosetting plastic. As the product needs to be molded to the client's hand and then set as it cools down. As noted in my specification the material would need to be sustainable also.

The shape is made using the specific measurements of the client's hand.

An issue with this design may be that it is too simple. Although my client does enjoy simple shapes, especially the minimalism movement, she still wants the product to be unique and stand out.

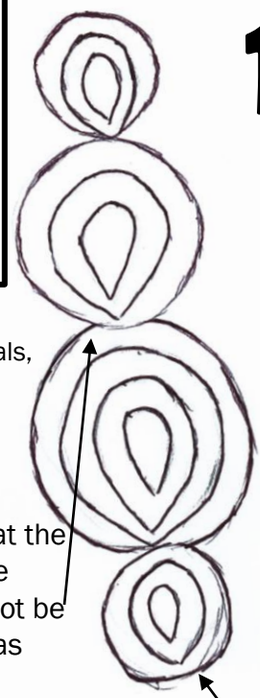
To ensure the product is safe to use by the client the thermosetting plastic would need to be cooled down entirely before using. When I join the handle to the cutlery and file the product, I would need to ensure there are no sharp edges on the final product, to make the product safe to use.

For design idea two, I took inspiration from a set of cutlery called 'transitions', which is created in collaboration with a physiotherapist by French designer Mickeal Boulay. It is a set of cutlery that helps people with impaired motor skills to be able to use cutlery by themselves. They do this through a series of tangible steps. I took inspiration from the idea that the clients hand strengthens and can eventually mold to the cutlery. For my own design I chose for the cutlery to be molded to the client's hand instead as it was important for the cutlery to be as comfortable as possible for the client to use.

Conclusion: In conclusion of this page, I have presented two of my design ideas and the inspiration behind them. My next steps are to get client feedback on these designs and choose the ones I want to develop further. By getting client feedback on these designs, I can then go on to develop them using prototype modelling and CAD to make adjustment to the design.

For design idea one I took inspiration from the Alessi 'Big Love' Heart Spoons. What caught my eye about this set of cutlery is how the cutlery was simple with regular shapes, but the eating part of the spoon was the section with a unique shape drawing our eyes towards it. This helped me to develop this design idea by bringing simple shapes together to create a more unique piece.

1



I need to carry out more material testing with the shape of this product as it may be difficult to make out of the materials, I have in mind. However, for this design I believe the best materials would be Recycled plastic from HDPE bottles or a sustainable wood.

The negative aspects of this design idea may be that the shape does not fit to the client's hand as well as the other design and that if I am to use wood it would not be as easy to clean, which is listed in my client needs as being important for the product.

Again, shown in design idea two I would use an alternative dowl joint to attach the handle, as it strengthens the joint by providing a large surface area.

The shapes included in this design are smooth meaning this product is reletivly safe to use to bein with. If I were to use wood as my material however, I would have to apply a finish too it to ensure theyre are no splinters whilst using the product.

The size and dimensions of this product will be relavent to the measurements taken of the client, presented on my anthropometrics page.

If I am to use wood as a material, I would keep it the natural colour as that is the asthetic that my client prefers. However, if I am to use recycled plastic from HDPE bottles, I would have to choose muted or earth tone coloured plastic beforehand.

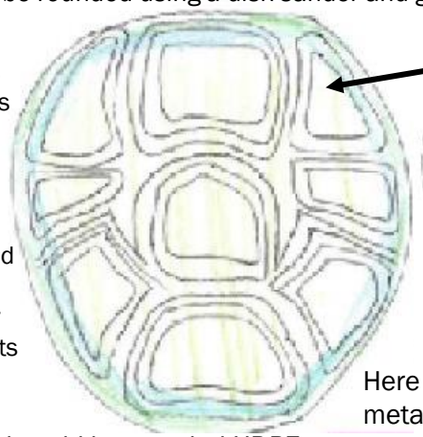
To generate design ideas, I experimented with differnet materials to create different shapes as shown in the images. After I produced the multiple circle design I testes it with card of different colours instead of cardbord with led me to the final design shown.

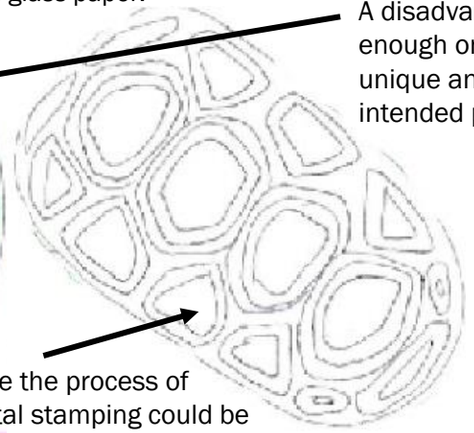
Initial design ideas

Introduction: For this page I intend to explore the design possibilities of my handles for my products. To generate ideas, I will create different shapes with materials such as cardboard and card. I will use these ideas and develop them by creating design ideas using different drawing techniques.

To ensure the product was safe it would have to be filled and the corners would need to be rounded using a disk sander and glass paper.

I will include striking colours in this design as I feel it would draw attention to the product and therefore the issue behind it, making it unique to other existing products on the market.



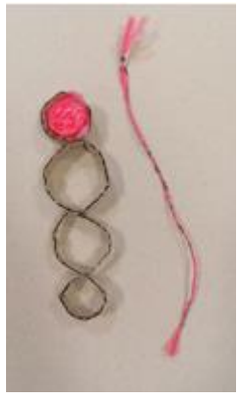


Here the process of metal stamping could be used to create the turtle shell design on the handle of metal cutlery.

Materials used could be recycled HDPE bottles or even include small pieces of microplastic that is collected from beaches which would otherwise end up in our oceans and being destructive to food chains.

A disadvantage of this design could be that it is not focusing enough on the comfort of the client. Although the product has is unique and supporting an issue it is not very practical for its intended purpose.

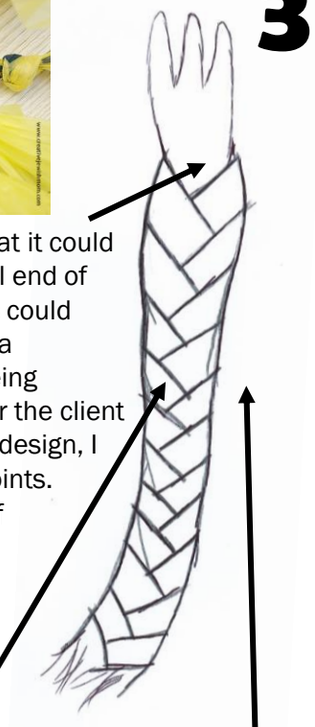
4



To create this design, I experimented by using different materials which are difficult to recycle and go to waste constantly. I discovered that plastic bags can be heated to given them strength. After trailing with different shapes, I found that strands of plastic bags could be plaited together to form a solid structure that could be built up to form a handle.

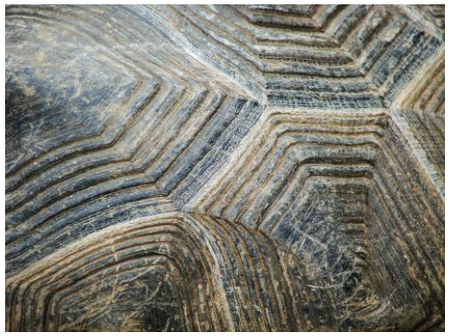
An issue with this design is that it could be difficult to attach the metal end of the cutlery to the handle. This could lead to the product not being a balanced weight, therefore being uncomfortable and difficult for the client to use. If I was to choose this design, I would need to test different joints.

3

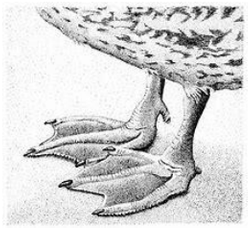


The size and dimensions of this idea will be based on the measurements I have taken of my client. As the shape of this design is easy to set into different positions, the cutlery can be shaped to fit the client's hand positions.

The colours of this handle would be based on the colour of plastic bags available. As mentioned by my client, they find products which show the natural material interesting. She enjoys how you can see how the product has been made and is helping the environment, therefore would not mind the colour, as long as you can see the material is plastic bags.



When thinking about what animals to include in my designs, I looked at what animals are most effected. Turtles are evidently affected by plastic pollution therefore by using a turtle shell design on the handle of my product it allows the client to be conscientious about their plastic waste and to understand the need for the product.



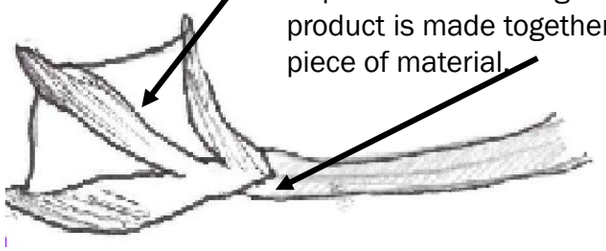
As mentioned, the material for this design is plastic bags. There are 160,000 plastic bags produced a second and less than 1 percent are recycled. Plastic bags are made from polyethylene that takes centuries to degrade. For this design I would be taking this wasteful product and upcycling it. The material is smooth and comfortable to hold, making it liked by my client.

A design feature, which I intended to use in my design ideas was biomimicry, as my product has a large focus on the environment. Therefore, by using this feature the client is instantly drawn to the product and can visually see the reasoning behind why the product was made.

I took inspiration from shapes commonly found in nature to create this design.

The shape of this design is unique to the others as the top of the cutlery is unlike standard cutlery. This may be a disadvantage for the client as more testing would need to be done to see how functional the design shape actually is. However, this could be an advantage as the product being unique was important for my client..

For this design idea, I took inspiration from these Alessi salad servers. I like the look of the product fitting together and therefore developed this idea, with the same style in mind.



No joining methods would be required for this design as the whole product is made together with one piece of material.

5

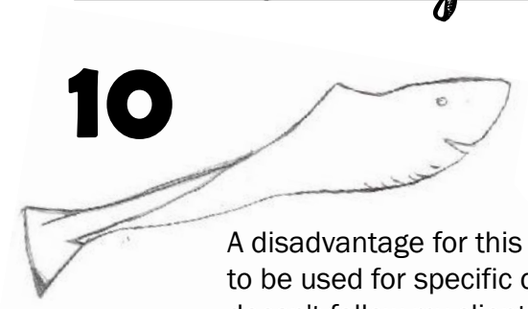
As this design would be made from recycled HDPE bottles or other forms of biodegradable plastic material, the options for coulour choices are open, however this design would mostly de created with a muted or earth tone colour scheme in mind as that is most liked by my client.

The materials used to create this design could be recycled HDPE bottles or other forms of biodegradable plastic material (e.g., Ocragela). This would allow the product to benefitting the environment, whilst allow being easy to create the unique shape with.

Conclusion: In conclusion, on this page I have shared 3 more design ideas and the inspiration behind them. From this point I will be getting client feedback on these designs, after this I can then choose which designs, I would like to develop. Developing these products would consist of testing, making models and improving the design based on the client feedback given on them.

Initial design ideas

Introduction: For this page I intend to explore the design possibilities of my handles for my products. To generate ideas, I will create different shapes with materials such as cardboard and card. I will use these ideas and develop them by creating design ideas using different drawing techniques.



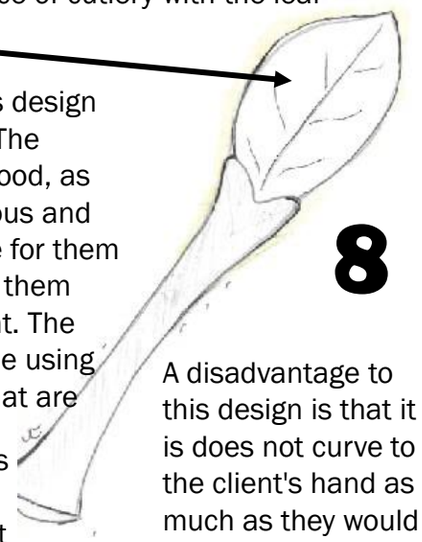
A disadvantage for this design is the fact that it is aimed to be used for specific dishes i.e., sea food, therefore it doesn't follow my client's needs for the product to be an everyday cutlery item.

For this design I took inspiration from the 'Hammered Shell Mouse Cheese Knife' from culinary concepts. Here they have taken a simple 2D shape of an animal and used the connotations of the animal to create a piece of cutlery. For example, there is a direct link between the mouse and cheese therefore making this design idea simple but unique.

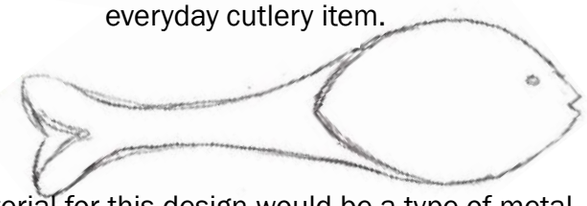
This design is a whole piece of cutlery with the leaf part being a spoon.

The material used for this design could be a combination. The handle is a type of soft wood, as this design is eco conscious and soft woods take less time for them to grow therefore making them better for the environment. The left section could be made using recycled HDPE plastics that are green or using a metal.

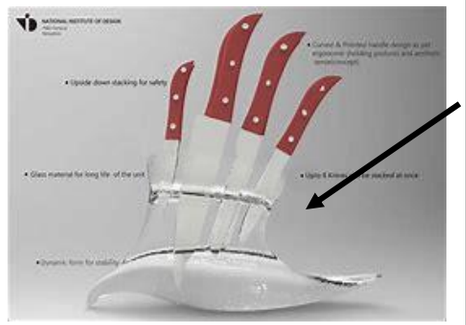
A positive to this design is that it is minimalistic. My client has mentioned that they enjoy this movement and would like the overall design to look simple and sleek.



A disadvantage to this design is that it is does not curve to the client's hand as much as they would like. They may feel the shape is too much like that of existing cutlery.

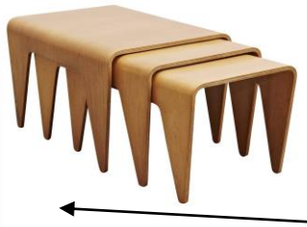


The material for this design would be a type of metal, because this is a whole price of cutlery design not just a handle and would therefore need to be strong enough to be functional.

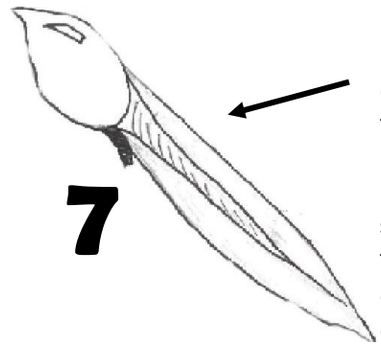


For this design I also took inspiration from this fish shaped knife rack, this design idea leads me on to think about how using animal shapes in the design for cutlery could be a used to easily show what each piece of cutlery for. However as mentioned this is a disadvantage to this design because it does not fully follow my client's requirements.

The idea of the product looking like the use it was indented for, can be seen in this product. The idea can be eye-catching to a client of any age and even with disabilities as it makes cutlery accessible for everyone.



For this design I took I inspiration from this Marcel Breuer table set. I like the aspect of the table set betting smaller and fitting together. I took this 3D design aspect and turned it into a simpler look. The rings going smaller as they get together on a peacock feather reminded me of this therefore, I used the design to create this piece of cutlery.

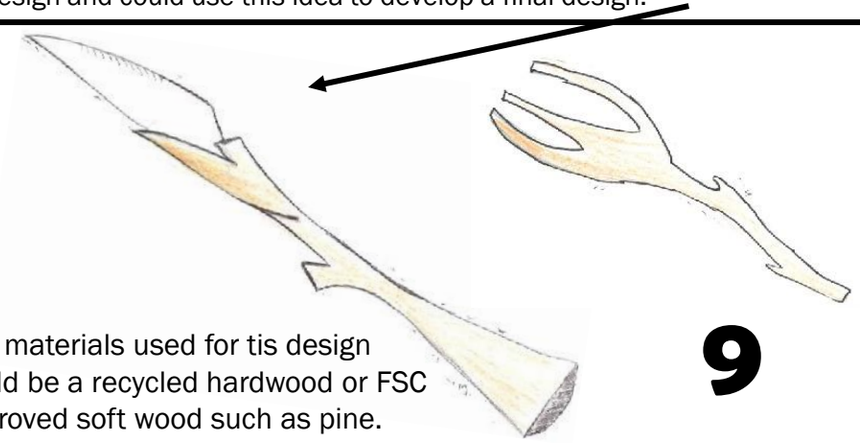


For this design I took inspiration from the 'transitions set of cutlery'. My thoughts for this designs was that a piece in the set could follow the life cycle of a frog. Each piece having a different design and being a different piece of cutlery e.g., the finial frog being a big spoon. My client may like this product as it fits their need for the product to represent nature and the environment however, it may be too animal like and outgoing for the minimalistic design style that they enjoy.

An advantage from this design is the focus on animals. I believe my client will enjoy the eye-catching design, as mentioned in my specification they want the product to stand out to other already on the market. However, an issue with the design may be that may be too creative looking and not organic and minimalistic. This is important to my client as they want the product to stand out to others already on the market. However, an issue with the design may be that may be too creative looking and not organic and minimalistic. This is important to my client as they enjoy the minimalistic movement. My client has also stated that they enjoy muted or earth tones, therefore this design may be too bright for their liking .

The materials used for this design could be a biodegradable or recycled plastic, as the bright coulours would be difficult to get from other materials if paint was not used. Paint or colourings may not be safe or suitable to use for a product that is intended to eat with.

I took inspiration for this wooden design idea from an existing product and would therefore develop it more if my client were to choose this design, as it would need to be adapted to suit the client. I enjoy the contrast of shapes in the design as seen in these chairs by Philipe Starck. Therefore, I can develop these taking inspiration from the chair designs. I also like the mix of materials in the design and could use this idea to develop a final design.



The materials used for tis design could be a recycled hardwood or FSC approved soft wood such as pine.

Conclusion: To conclude this page I have presented my finial page of design ideas, where I have taken inspiration from products within the minimalism design movement as per client feedback, focussing on simple but unique designs. From here I will get client feedback on all my design ideas. By getting client feedback on these designs, I can then go on to develop them into a final design using the feedback given. I will make models and prototypes of my designs for my client to test and give feedback on.

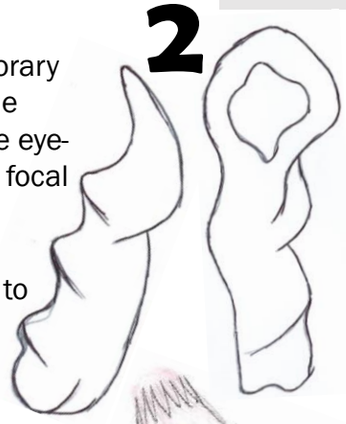
Client feedback and needs

Introduction: For this page I will be getting feedback from my client on my design ideas. This will help me to decide the ideas I will develop further using different modelling techniques and CAD.

1

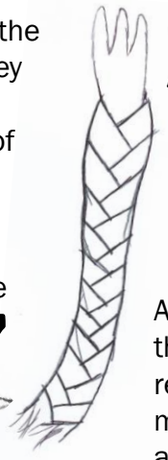
For this design, the client enjoys the unique shape and modern, contemporary style. They believe the elements of the design that are taken from nature are eye-catching and would like them to be a focal point of the design.
'An improvement of this design could be the comfort'. The client would like to see this 2D shaped design to be thicker and for the handle to have a more ergonomic shape. They would like to see the design be more of an extension of their own hand.

2



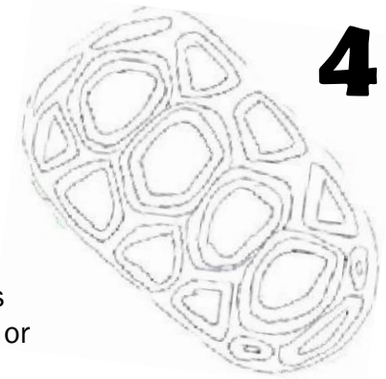
The main attraction to this design for the client is the comfort of the design. They like how it is smooth and easy to use. The client also enjoys the aesthetics of the design as they like minimalism.
An improvement of the design for the client would be for it to include more elements from nature, as they believe this design is too futuristic.

3



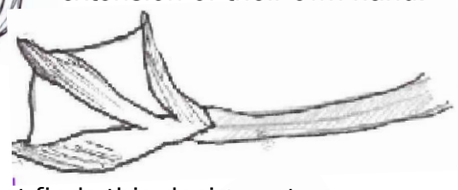
My client likes the unique material of this design and enjoys that you can see the reused materials. They also like the fact that each handle would be unique as, it would be made from different bags each time.
A major disadvantage to the client is that this product is difficult to reuse or recycle at the end of its use, as the material has already been upcycled and cannot be melted into another product. An aspect about this design that the client does enjoy is the use of different plastic bags giving the handle unique colours each time.

4



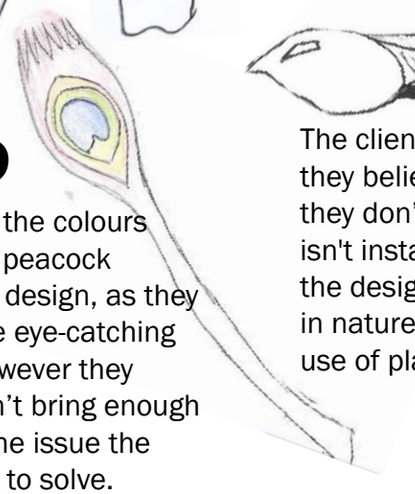
The client likes that this design looks stylish and expensive, however they feel as if this is too much about nature and less about the problem of protecting the environment. They would like to see colour in the final design but feel as though this design would be overwhelmed with colour added.

5



The client finds this design not as appealing because it reminds them of chicken feet, however they enjoy that the design is simple and minimalistic

6



The client likes the colours included in the peacock feathers in this design, as they believe they are eye-catching and unique, however they believe it doesn't bring enough awareness to the issue the cutlery is trying to solve.

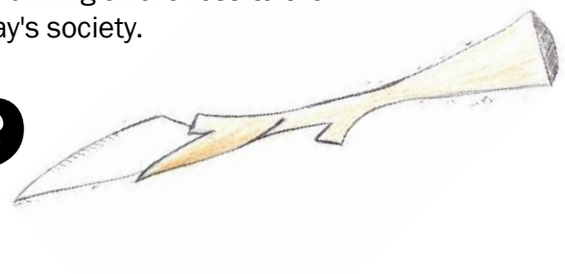
7

The client likes the shape of this design as they believe it looks comfortable, however they don't like the fact that the design isn't instantly recognizable. They would like the design to look more like something found in nature whilst also brining awareness to the use of plastic in today's society.

8

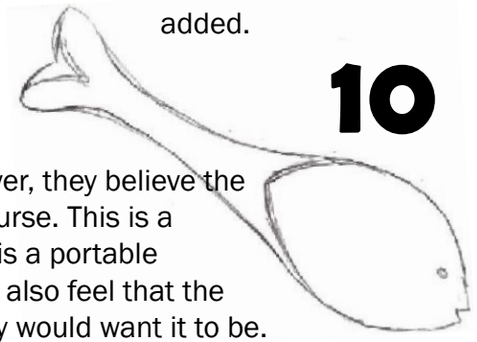
The client likes that this design is nature based and has a traditional shape. They think the handle looks smooth and comfortable. An improvement for this design would be for the handle to bend around the client's hand more, as it is too similar to ordinary cutlery. But they like the mix of materials in the design.

9



The client really enjoys the traditional shape of this design and how it links to nature. They like how unique and natural the shape feels as if the cutlery is emerging from the wood. A disadvantage they have on this design is that it would not be as easy to recycle at the end of its lifespan, which is important to the client. An improvement they have is for the cutlery to use different types of woods.

10



The client likes the upmarket feel to this design. However, they believe the cutlery looks like it would be used for a specific fish course. This is a disadvantage to the client as they want a product that is a portable everyday item and is benefitting the environment. They also feel that the metal would not make the design as lightweight as they would want it to be.

Design ideas	Client need 1: sustainable and eco-friendly materials	Client need 2: portable	Client need 3: stored away easily.	Client need 4: lightweight	Client need 5: easy to clean	Client need 6: function well	Client need 7: durable	Client need 8: contoured to fit the client's own hands	Overall score
Idea 1	9/10	10/10	8/10	9/10	9/10	10/10	8/10	9/10	72/80
Idea 2	8/10	10/10	9/10	10/10	10/10	10/10	6/10	10/10	73/80
Idea 3	7/10	10/10	9/10	9/10	6/10	9/10	6/10	8/10	64/80
Idea 6	6/10	8/10	7/10	8/10	8/10	8/10	7/10	6/10	58/80
Idea 8	6/10	7/10	8/10	6/10	7/10	7/10	9/10	5/10	55/80
Idea 9	6/10	6/10	7/10	5/10	7/10	9/10	10/10	6/10	56/80

Conclusion: On this page I have got client feedback on my designs and then evaluated the best 6 designs against my clients need as to see which should be evaluated and devloped more. From this table we can see that the best three designs are the ideas 1, 2 and 3. I will now be evalting these designs against my specification points to see which I should go on to develop more.

Evaluation of design ideas against the specification

Introduction: For this page I will be evaluating my three of my chosen design ideas against my specification. This will help me to determine the designs which follow my specification the best and that I can therefore go on to develop.

	Materials Biodegradable/ecofriendly	Environment what happens at the end of its life cycle?	Function Does the does the limit its ability to function well?	Ergonomics Lightweight and comfortable to use	Anthropometrics Designed to fit around the client's measurements	Safety No sharp edges/ smooth	Aesthetics Follows a design movement or company the client likes	Social, moral, culture & spiritual Can help improve client's mental health and does not offend any beliefs	Overall
1	This design can easily be made from biodegradable plastic, however an area to develop would be the strength and mouldability of the material as it need to be bent into many different shapes whilst keeping its strength. **8/10**	This design is extremely ecofriendly as it is made from biodegradable plastics, not only is it helping reduce plastic waste by being a reusable product and replacing single use plastics but also being biodegradable itself. **10/10**	The function of this product should work well, as the design is easy to use. However, one factor that may cause an issue is the unusual shape of the handle, although this will be designed to be comfortable to use it may take the client some time to get use to using the product. **8/10**	The client needs the product to be lightweight and therefore comfortable to use. From the material testing I have carried out, the biodegradable plastic should be lightweight, however some more product testing would be needed to ensure the shape ensure this. **9/10**	The circle shape of this design may make it difficult to fully create it to the client's measurements exactly. However, a mould can be created for the plastic to be set in. This mould would be made using the client's measurements and judgments taken from seeing them interact with existing products. **7/10**	This design has rounded edges and no sharp points apart from the cutlery making it safe to use. The biodegradable plastic would still need more testing to ensure it is food wear safe. **8/10**	The design is unique and unlike any existing products. The colours and shapes are also based of those from nature as the client highlighted, they enjoyed. The overall design fits the client's aesthetic. **10/10**	This design does not harm anyone's moral or spiritual beliefs and is not offensive in anyway. It is designed using elements from nature which can help benefit the clients metal health. **9/10**	**69/80** Overall, this is the best design idea, as it scored highly against all areas in the specification.
2	The material which I originally used to create this design idea was a thermosoftening plastic. This material is ecofriendly and has the original properties of plastic that the client enjoys. **10/10**	This product is great for the environment as it made from a type of plastic that melts down as it is put into hot water, making it easy to remould. This means that after the client decides the product is no longer useful for them it can be recycled to make something else. **8/10**	The shape of this design is purpose made to be contoured to fit the client's hands, therefore the functionality should be perfect. The only issue would be the way in which the client holds the cutlery, however this can be resolved by seeing the client use existing cutlery. **7/10**	The thermosetting plastic is light weight, whilst aliso robust enough to be durable and functional, therefore comfortable for the client to use. **9/10**	The shape of this handle is mouded around the client's own hand therefore making it only for them. By seeing them interact with exiting products the position the material is set in must be how they will use the final product. On the other hand, as this product can be heated and remouled it can easily be changed to suit the client's measurements. **10/10**	During the moudling of this shape, the corners would need to be smoothed to ensure it is safe to use. One disadvantage of the material used is that it cannot be filed or adapted after it has been mouled making it difficult to make any safety adjustments. **6/10**	Although this design is unique it does not contain many of the clients aesthetic wants. The design does follow the minimalist movement which the client enjoy but is not contain any creative design features. **6/10**	This design does not harm anyone's moral or spiritual beliefs and is not offensive in anyway. However the product is not designed with the thought of benefiting the clients mental health as oppose to the environment and it being a fluid and clean design.**7/10**	**63/80** This is the second-best idea as it scored highly against most of my criteria.
3	For this product, the material I have used is plastic bags, they are unique however the problems they pose are not being strong enough. **5/10**	This design is made from a single use plastic that has been upcycled to create a new product. Although this is helping to reduce these single use plastics from entering our oceans or landfills, it does not override the fact that it cannot be recycled easily and are not biodegradable. **5/10**	The material for the handle of this design may be too light, and therefore it may not function as well, although more material testing is needed to explore the strength of the material when heated. The design shape is functionable as it creates grip for the client's hand. **5/10**	A single use plastic bag as the material makes this design extremely lightweight, which fits the clients need. The shape of the design can be shaped around the client's hand ensuring it will be comfortable for them individually to use. **9/10**	This design shape makes it difficult for the handle to be fully designed around the client's specific measurements. Therefore, this design does not meet this specification point completely. **4/10**	This design does not have any feature which could be harmful for the client to use. The product is made from plastic bags which could be harmful to small children. However the durability of the material is being adjusted in the making of the product and the chosen client is an adult so therefore this should not be a risk factor. **8/10**	The design is unique and includes plastic bags which is a major issue to the environment at the moment. The factor of the product being a talking point about the environment was important to the client. However, the design does not folly many of the design movement or companies design styles that the client highlighted	This design does not harm anyone's moral or spiritual beliefs and is not offensive in anyway. On the other hand, there are no unique design features which would help improve the client's mental health. One factor which could make the client quirky is the fact that the product is made from a single use plastic which the client was trying to avoid completely **3/10**	**50/80** This idea had the lowest rating against the specification, therefore I will not be choosing to develop this

Justifying the ideas to be taken forward: Going forward I am going to be developing the first and second design ideas more. I believe these ideas have the best potential to be developed more into an actual product as they match my specification requirements the best and are most liked by my client. Design idea one was the best for the environment and had the shape and aesthetics that my client was looking for. However, design idea two was made from the most unique and easy to work with material and scored the best in anthropometrics which is what my client found important. I will now develop these ideas using CAD and making model prototypes of these designs. This will allow me to identify any flaws in my designs and therefore to choose the idea I will go on to develop into my product.

Conclusion: To conclude this page I have assesed three of my design ideas against my specification. This has helped me to decide that I will dvelop design ideas 1 and 2, as these as mentioned fit my specification best and are most liked by my client. From here I shall go on to develop these design ideas. I will do this using CAD, drawing techniques and making model prototypes. I will gther client feedback and do futher research to develop these designs into my finial design.

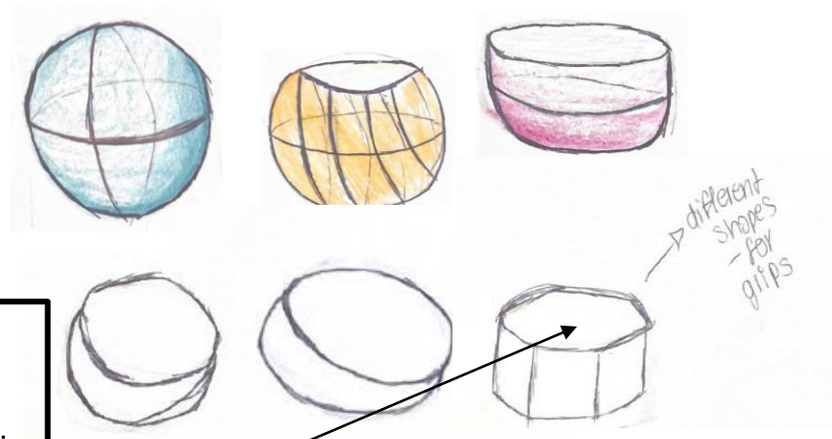
Design development

Introduction: For this page I plan to develop design ideas 1 and 2 as they were my client's favourite designs that also scored the highest against the specification. I will use CAD models and drawing techniques along with my client's feedback to develop these designs further, into products that's I can create prototypes of.

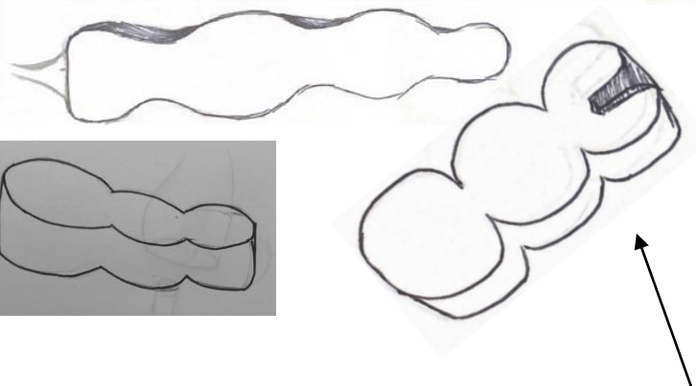
1

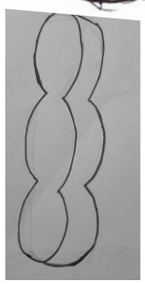
Design idea 1 is one of my client's favorite designs, however they said an improvement for the design would be for it to be 'thicker and for the handle to have a more ergonomic shape'. Using this information, I have gone on to develop the handle by experimenting with different 3D shapes to see which would fit best in the client's hand and which would look the most aesthetically pleasing to them.

I have created development drawings for different shapes to include. I have looked at their aesthetics along with how functional and comfortable they would be in the client's hands.

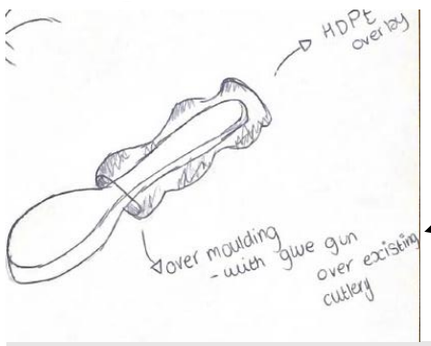


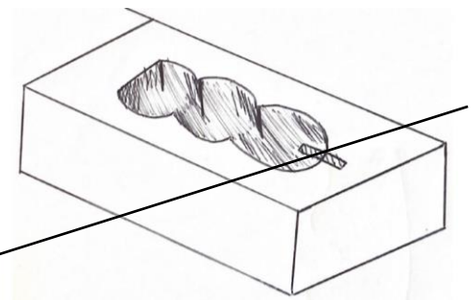
The shapes I investigated are ovals, hexagons and spheres. To conclude I have found that an oval shape would look the most aesthetically pleasing to the client, but a hexagon would give the best grip although it wouldn't be the most comfortable to hold.



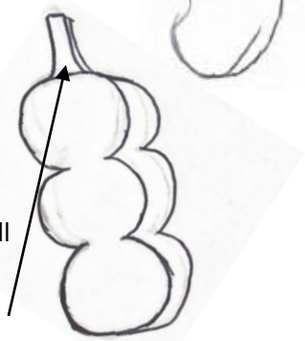


Above are development drawing of design idea 1. I have used the testing of different shapes to create a design that will suit the client's needs as much as possible. I have also developed this design idea to make the handle flow along with the client's hand much better, as mentioned in the client feedback. I have also used aspects of the design idea 2 and included them into this design idea.

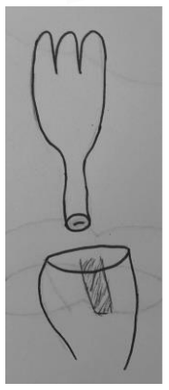




Another joining method for these designs would be for the handle to screw into cutlery piece. For whichever joining method it may not be strong enough to screw into the cutlery and function well. This is important to my client, as in their client needs they have mentioned it must function as well as original cutlery. Finally, I would need to do further testing into how the screw would fit into existing cutlery if I am to use this joining method.



Here I am I looking at manufacturing techniques to create the handle's shape. I could use a metal or silicone mold and pour in the melted recycled HDPE plastic bottles to set in the shape of my handle. Another technique is over molding where I can create prototypes of my handles shape using a hot glue gun over existing cutlery.

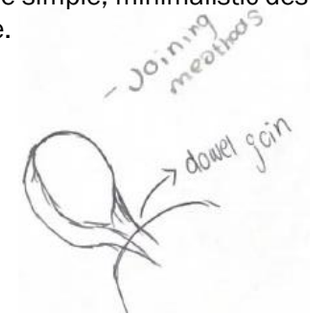


Design idea 2 was also one of my client's favorite designs. I have developed this design to make it more accommodating to include existing cutlery with a dowl joint. I have also included aspects from design idea 1 as that was also one of my client's favorite designs.

Design idea 2 but developed to include an area for a dowel joint.

Design idea 2 but developed to include aspects from nature as mentioned in my client feedback. It is also taking inspiration from design idea 1.

In my initial design idea, I had not accounted for the joining meathods I would use. In my developments I have concluded that a dowel joint would allow for the top of an existing piece of cutlery to fit into the handle. However, I need to do further research and testing into how strong this joint would be for these developed designs and how they would look aesthetically. As I would want to ensure that the joint does not overpower the overall look of the handle and ruin it. It should follow the same simple, minimalistic design tyle.

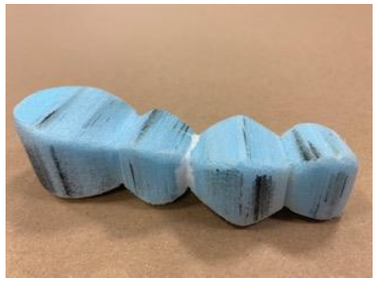


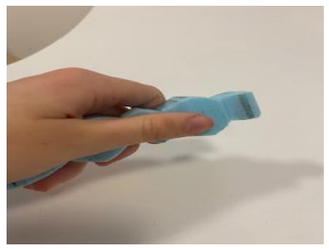
Conclusion: In conclusion, I will be taking the design developments of design one from this page and creating models including the adjustments I have made on this page. I will be doing this because it scored best against my client's need and specification and they like this design the best. From there I can identify any weakness in the design and do further developments if necessary. I will be creating CAD models with theses design development and 3D printing some for my client to test.

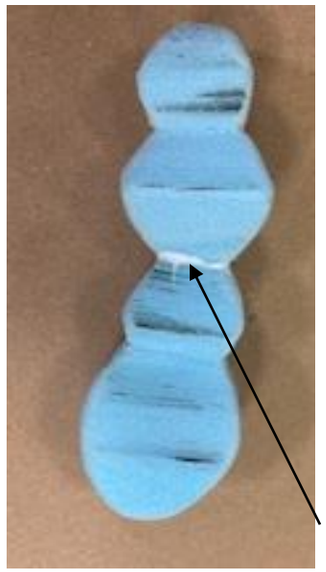
Design development and prototype testing

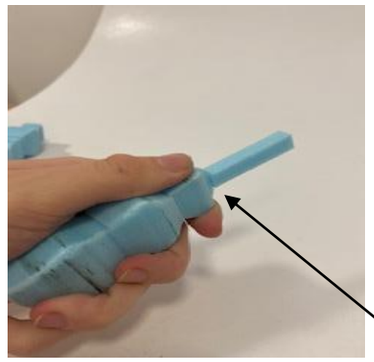
Introduction: For this page I intend to take my design developments from the page before and create models from then. I will evaluate and get client feedback on them. I can then go on to create CAD model from the evaluation of these models to see any adjustments I can make from my models.

Design idea 1 development model









When testing the second type of screw joining method I designed I noticed it was quite weak. I also identified that a lot of the pressure when using the cutlery would be in this area causing it to break easily. To conclude I have decided a dowel joint would work best for this design as it gives the cutlery strength when being used.

I an issue I noticed when creating this model was the areas of weakness when testing. The handle snapped easily in the middle. To improve this I will gradually decrease the size of shape as it goes up the handle instead of having a smaller shape in the middle, as this area experiences the most pressure so therefore needs to be strong.

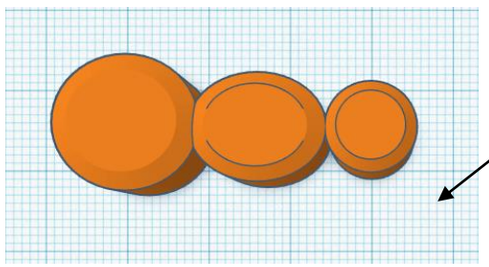
Client feedback on this design: They enjoy the overall minimalistic and simple look of this design. My client however agrees with my evaluation of the weakness of this design and would be happy to see the improvements, as they believe it follows a simple and minimalistic design style.

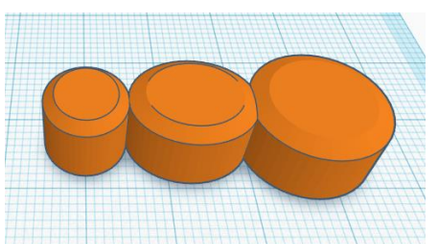
Design idea 2 development model

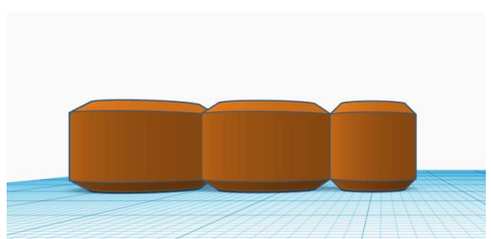
For the modeling of design idea 2 I used polymorph. This allowed me to use my own hand as the mold for this model. An advantage I have discovered of this design is how well it fits to you hand and gives comfort to the client when using this handle. However, this is also an issue I identified when modeling this design idea. It would be difficult to directly create the final design to fit the client's measurements as well as this model does as polymorph may be too weak as a finial material to use. For this design I would have to crate of mold of my client's hand before pouring the plastic into it. Three are inaccuracies that could come along with this, meaning this design idea could be too unrealistic.

Client feedback on this design: They enjoy the fact that this model shows how well it can mold to the client's hand and would therefore be comfortable to use, however they do believe if the handle is too suited to their hand's shape it could not give them the best grip and therefore not the best functionality.

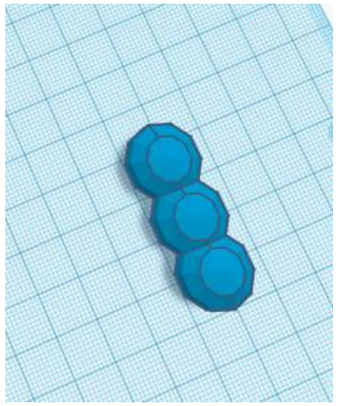
CAD models of designs developments.

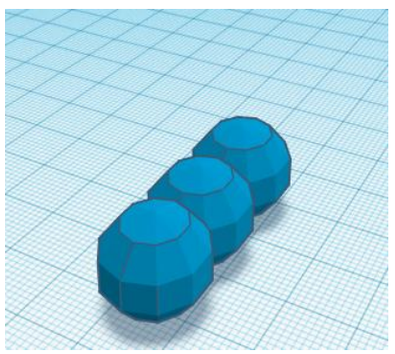


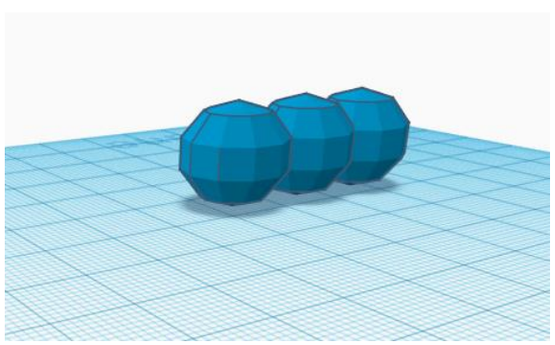




From here I will 3D print these CAD design developments and give them to my client to test. I can also identify any issues with the design form here and therefore create adjustments and develop the design further.







Conclusion: To conclude this page, I have created models of my design ideas developed. From here I have identified any issues with the designs, such as the joint screw being too weak and the unrealistic approach to design 2. Improvements that I can make to these design would be to make the handle thicker on design one, as to make the design stronger. I have also gathered client feedback on these designs and will go on to create more CAD models before I 3D print a model for my client to assess.

Further research - materials and joints

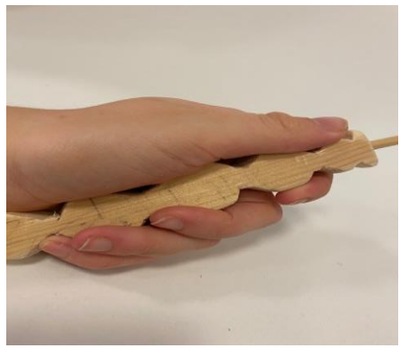
Introduction: For this page I will research different materials which suit my client needs and specification which could be used to create my product. I will also carry out material testing to see if the material has the correct properties for the use of my product. Joints will be tested on different shapes to test their suitability.

Starch based polymers

When researching biodegradable materials, I came across starch-based polymers which can be made at home and are biodegradable. For this material I used a combination of corn flour, oil and water. I tested it at a range of temperatures and found both problems and advantages with the material. I discovered that the material is very moldable meaning for intricate designs it can be useful. However, the issue with this is for my product this material would be to flexible and not hold much durability like my client had mentioned in their list of client needs. However, one main strength of this material is that it is biodegradable, which is majorly important to my client.

Joint testing

To test the best joint for my handle to attach to cutlery, I used wood. I decided to test a dowel joint as I believed that would be the strangest and what would work best with my product. To test if the joint would be strong enough, I shaped recycled cut offs of wood into different shapes and added a dowel joint.



From my findings I can conclude that a dowel joint does provided added strength to a regular butt joint, as there is more surface area to hold the parts together. It also kept its strength through testing different shaped handles. However, one improvement would be to ensure there is a wide surface where you are creating the joint. This will keep its strength.

Recycled plastic from HDPE bottles

This material is made from recycled HDPE bottles. HDPE plastic would be a good choice as I melts at low temperatures and doesn't release any toxic fumes. They are melted down as poured into a mould where they set into a new shape. Many plastics are unrecyclable and therefore go to landfill, meaning that HDPE plastic is commonly thrown away. By upcycling them in this way I would be preventing them from going to landfill. At the end of its life the HDPE bottles can be melted again to form a new object that fits the needs of the client at that time.

Ocragela

Ocragela is a material made from ochre, gelatin, glycerin, and water, making it fully biodegradable as it is derived from natural ingredients. It was created by designer Soowon Chae. He wanted to show the positive possibilities of human's intuitive creativity, as gelatin is seen as a waste product and has little value. The material is entirely renewable and would therefore be a great option to use for my product. The only downside is it may be difficult to make on a small scale and get it the material to be the correct strength for my project.

Potatoe pak - material

Potatopak is a company that creates biodegradable products, such as plates. The biodegradable material of the products consists of potato starch, cellulose and water. These ingredients are mixed, and heat pressed into the specific shape needed. The water and heat cause the Potatoe starch to expand, which creates a honeycomb formation.
These high temperatures set the mixture in place and creates an impermeable outer layer. The cellulose in the mixture strengthens the material. Therefore, making this material not only very functionable but also extremely kind on the environment.

Conclusion: To conclude this page, I have thoroughly researched different material options which fit my client needs and specification. Therefore, I have decided that recycled HDPE plastic would be best suited for my final design. I have also tested a dowel joint and concluded that it works well for my product. From here I will continue researching existing products and materials for use in my product to see which is appropriate for manufacturer in the workshop environment and elements I can use to inspire my design further, before manufacturing.

Further research

Introduction: For this page I will be doing further reserch different into companies, products and making techniques that relate to my project. Some companies my client has shown interest in their designs and other design processes can help me to create the most acurate product. With the research I can go ahead and use the information to develop my designs and plan of manufactures.

Joeseph Joeseph – company research

My client has shown interest into the company Joeseph Joeseph and their designs; therefore, I have decided to do further research into their company as to use in developing my finial design.

The main focus of the company: "We identify everyday problems and solve them through intelligent design to create distinctive, functional products that are a pleasure to own and use."

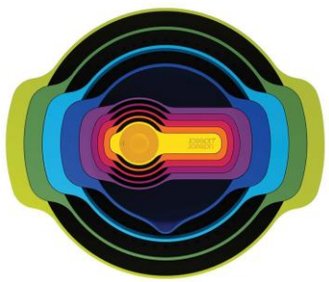
ANTONY & RICHARD JOSEPH

A main focus of this companies' designs are for them to be functionable products. Although they look aesthetically pleasing the main focus is on the ease of use for the client. This is an area which I will focus on during my finial design and ensure that my design is simple yet effective.

Since 2003, Joseph Joseph has launched over 1000 products in more than 100 countries and have won awards for their innovative designs . Some of their most popular products are below:

Chop2Pot™ is one of Joseph Joeseph's most popular designs. It is the world's first folding chopping board. When it is flat, it is a durable everyday cutting board, that has a 'knife-friendly' surface and can be used to prepare all time of food. But when you squeeze the handle the sides of the chopping board fold up to form a chute in which the chopped food or waste can fall down, without falling down. From this design I can gather that Joseph Joseph combines contemporary style with highly functioning products.

Another popular Joseph Joeseph product is the Index™; a set of food-specific chopping boards to prevent cross-contamination when preparing foods. They all organized in a slim container and have durable tabs to indicate the type of board. One thing that catches my client's eye about their designs is the use of colour. As they seamlessly blend their innovative design style with this distinctive use of colour.



Finally, one of the most popular Joseph Joseph products is the Nest™ 9. It is a food preparation set, that interlocks with one another to save space. From looking at these products I can conclude that this company strives for their products to be highly functional, but to include a contemporary style with a distinctive use of colour.

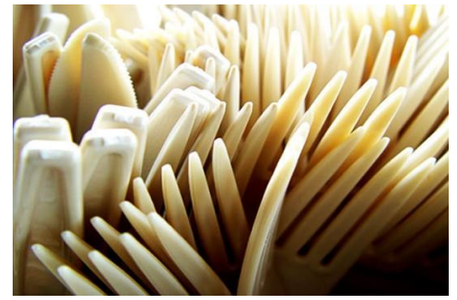
Mould making research

I would use the 3D print of my design with the correct dimensions to make the mould. I will use air drying clay, as it will be solid before putting in the oven and is heat resistant therefore will keep its shape when put in the oven. The 3D print can be placed into a block of clay to create the shape for the mould. The print will be taken out and the clay is left to dry. Then I can put my HDPE plastic into the mould wich will then go into the oven at 150 C for around 10 minuites or untill fully melted. The mould can be left to cool before being taken off to reveal the handle. Once the HDPE plastic handle has cool down it can be filed and smoothed to the correct shape. This will also ensure there are no sharp edges, wich woukld be dangerous when the client is using it.

HDPE plastic - will be broken down into smaller pieces.
This increases the surface area meaning it will melt faster.

Spud ware cutlery research

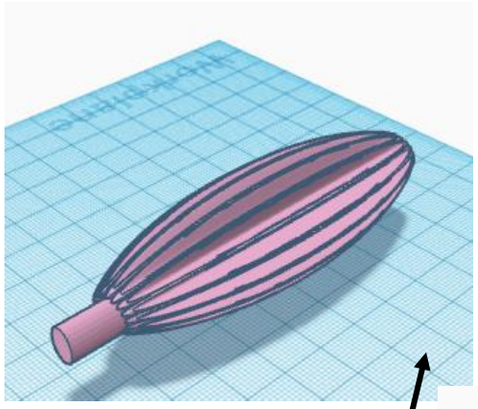
Spud ware was one of the first bioplastic cutleries brought to market. It is biodagradable as made from bioplastic resin and will breakdown in 180 days when it is disposed of correctly. The product is also unique as it can stand up to 266°F and will not melt; it holds its shape and stays cool. The mission for this product was to reduce petroleum dependency and using bioplastic resin made from plants instead of fossil fuels. They suceeded in this as the Original SpudWare cutlery was able to replace up to 100% of petroleum-based ingredients with biobased alternatives.
The only issue with the biodagradable based products it that excesss waste can be created when you dispose of the products in landfills. Therefore, to help save the planet from this excess waste disposing of the product in a compost pile required.



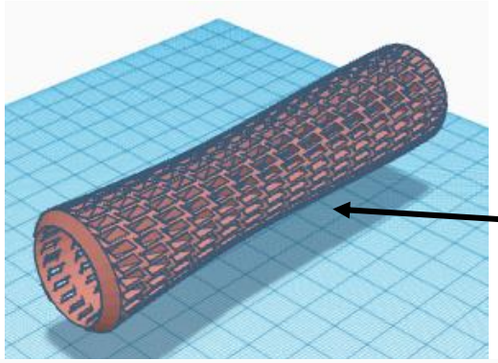
Conclusion: To conclude from this page I have researched both companies and products which can aid in my design process. From looking at Joseph Joseph products I have learnt that they use a simple but innovative design style which my clinet enjoys. I have also identified their focus of the products being highly functional and for them to have a distinctive use of colour. I will therefore go on to develop my design with a main focus of functionality and innovation moving forward. I will also be aware of my use of colour when looking at the HDPE plastic. From looking at the spudware product I have identified that it is important to be aware of the products life cycle and what will happen to it when the client no longer needs it. Although the design and materials are environmentaly friendly, they can create acess waste when disposed of. I will ensure that my client fully understands how my product can be recycled easily. Finally, by looking at the mould making process I now have a clear understanding of how the product will be produced. I xan thereforwe go on to outline any prolems that may occur during this process In my plan of making.

Design development – CAD / CAM– exploring form

Introduction: For this page I will be exploring different forms and shapes of handles using my orignal design idea which my client chose. I will be using tikercad to create different shapes and then get client feedback on them, which I can develop into my finial design.

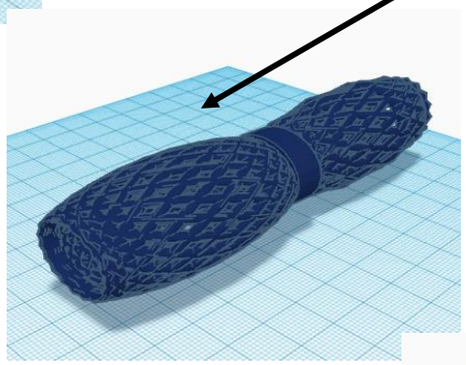


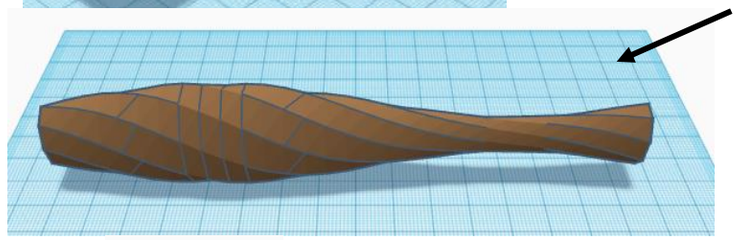
Client feedback: My client likes the unique texture of this design and believes it will add grip to the handle. However, they believe it may be too rough and could be uncomfortable to hold. They do like the shape of the design and think it will fit to the shape of their hand well.



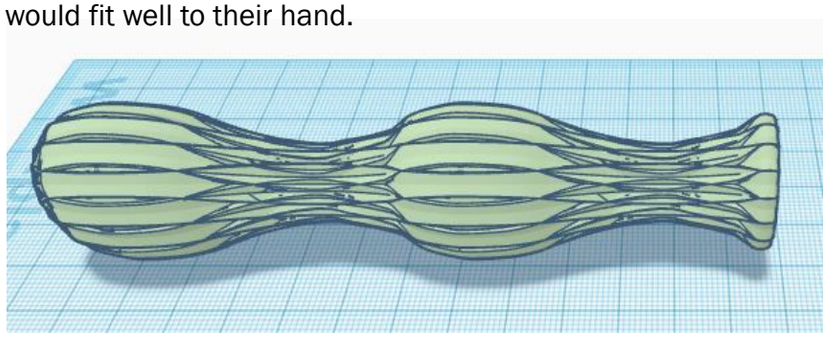
Client feedback: My client finds this design a bit basic and simple The design also reminds them of a tennis racket handle and is not an organic naturistic desig which they were looking for. My client thinks the handle will be too thick and not comfortable to use. However, one area of the design that my client enjoys is the flo of the handle and would like to see this idea in the final design.

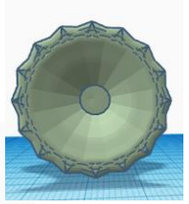
Client feedback: My client enjoys this design as it reminds them of a seed pod or closed flower head. They enjoy the organic design. They feel it would be easy to hold but the handle may be too short to use. My client believes this handle would have a nice feel and would fit well to their hand.

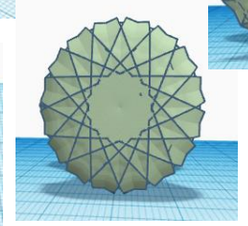




Client feedback: My client feels like this design would fit well with the cutlery that will be attached as the handle gets smaller towards the end, causing it to flow well. My clients thinks this design has a traditional shape which they enjoy, however they would like to see the final design to have a more natural shape.



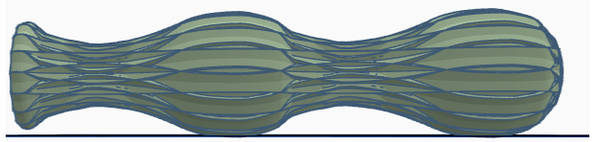


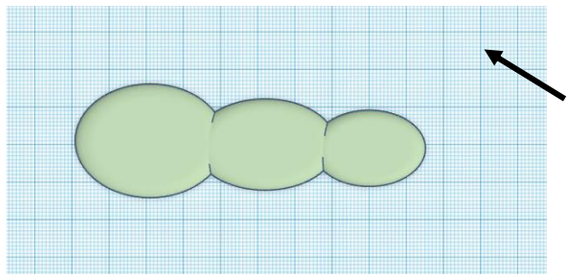


Client feedback on the 3D printed model of this design
As this design was one of my client favorites, I chose to print a 3D version of t for them to test and feedback on. My client enjoyed the feel of this design and felt like it fit their hand better than the other 3D print did. They felt as if it would be easy to use and their finger could hold the handle easily. They found the design comfy to hold and said that the pattern provided they with grip. An advantage to this design over the other 3D print was that the measurements and sizing were more accurate to their hand, as they felt it was long enough for them to hold comfortably.

Client feedback on the 3D printed model of this design
I chose to 3D print a second design, as it would help my client to compare and give improvements on their preferred model. The feedback my client gave on this 3D print was that the measurements were complimentary to their own hand. They felt it was too short and the shape of model did not fit the shape of their hand comfortably. However, they said the measurements and shape would suit a smaller set of cutlery for a child's cutlery or a set of teaspoons.

Client feedback: My client likes the shape of this design and feels it gives off an expensive feel. They enjoy the organic and natural design style. My client believes this design resembles a seed pod or flower, which they like as it follows the design brief and context of nature and the environment better than the other designs do. Another aspect of this design which they enjoy is the grooves and indents which are good as they would add grip. The flow of the design also fits to hand well.



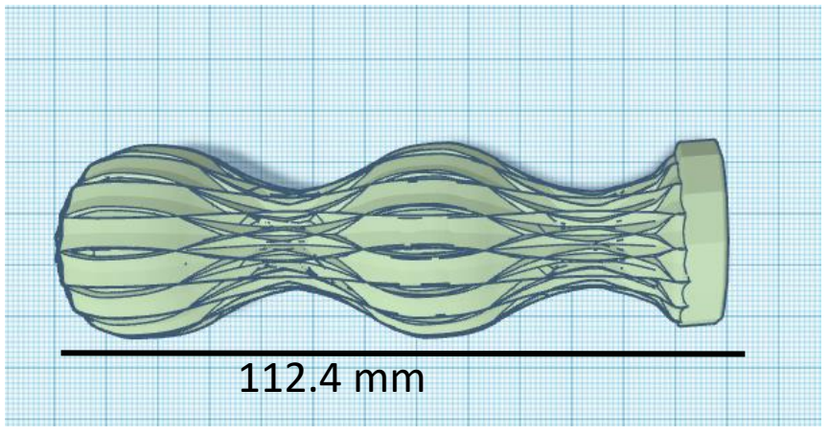


Client feedback: My client likes the simple shape of this design and its futuristic style. They think it would be comfortable to hold and use, therefore they feel it is a functional design. However, one issue they have with this design is that it is too plain and not organic enough. They would like for the deign to hold more of a natural shape. They also feel this design doesn't give them the 'wow' factor like other designs have, they want it to stand out more.

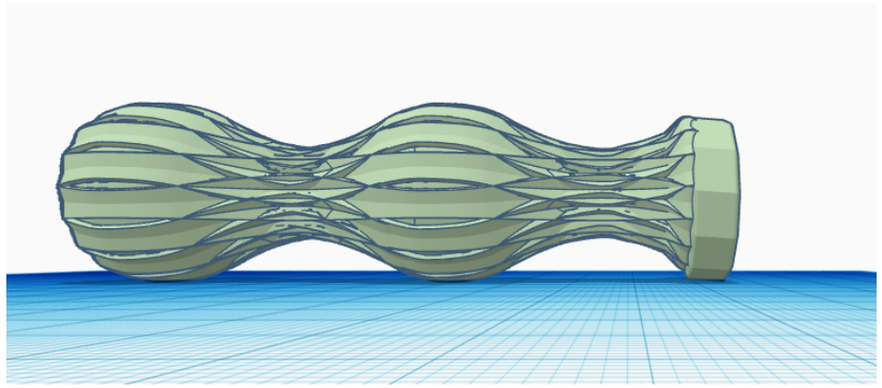
Conclusion: To conclude this page I have explored different forms and shapes of handles through CAD. I have got client feedback on my designs and my client highlighted two designs as their favourite. I then went on to 3d print these designs and get client feedback on them. The flower print design handle is my client's favourite, therefore from here I will develop this design using their feedback into the final design.

Final design

Introduction: For this page I will be presenting my finial design for this project. On this page I will be displaying the materials I will use along with feedback from my client and how the product will be created. I will present the cad images for my model including different viewpoints. I will also be assessing how this product fits along with my specification.

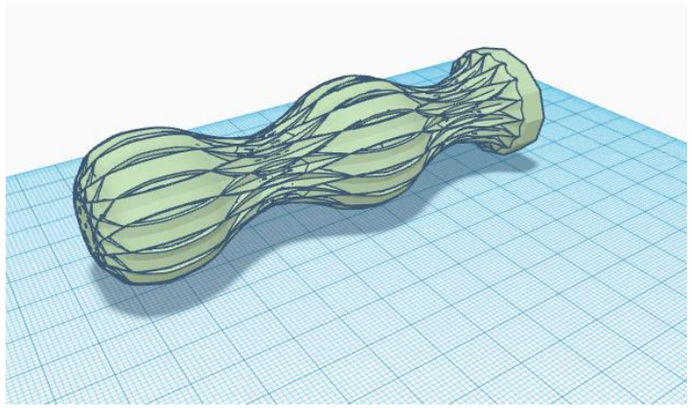


For my finial design I used ideas from my exploring form through CAD page to develop my design idea even more. My client enjoyed the CAD design developments but found they were not organic enough. They believed they had lacked the original idea as they enjoyed of elements from nature. I incorporated the unique flower shape from a vase design on Tinkercad and developed it into a handle. I used the shape of the client's favorite original design but incorporated in the new flower shape. I hope that this will provide the organic design that the client is looking for whilst also feeling comfortable in their hands and adding grip for improved functionality.

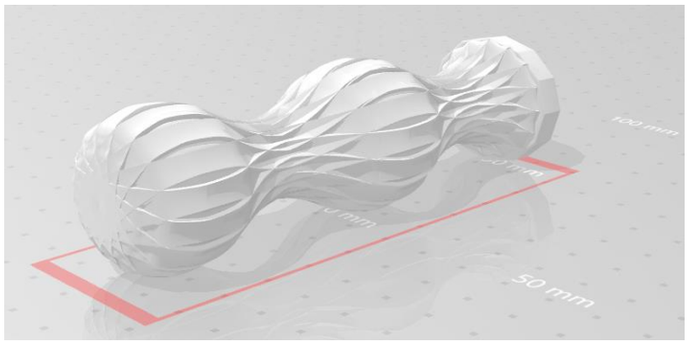


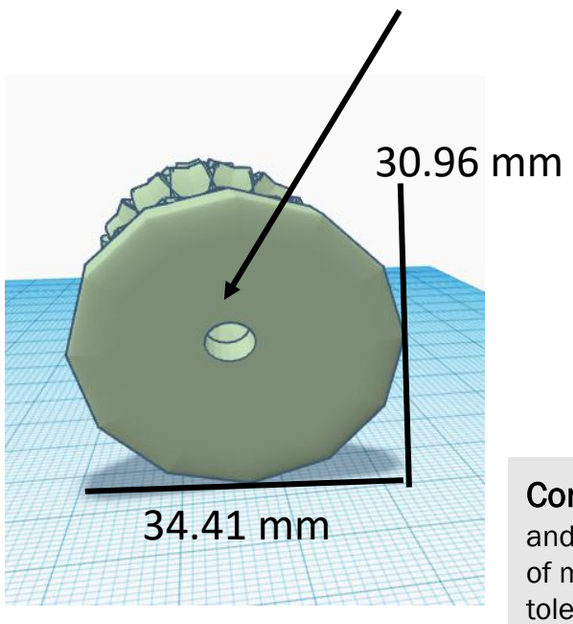
Client feedback on this design: They enjoy the new organic design and how it has been improved through the developments. They also like how the overall shape of the design is still the same and how it can fit to their hand. They believe the new organic shape will give the design more grip but hope it will still be comfortable for them. From here they would like to see a prototype of this design as they want to feel how the new flowerer design shape feels in their hands.

After researching different materials and manufacturing techniques I have decided that using recycled HDPE plastic will be the best option for this design as it is detailed and cannot easily be shaped by hand. It also is able to be recycled again after the client has finished with the product. By using this material, I will be preventing it from most likely going to landfill which can damage the environment greatly. This is the main focus of the design idea to begin with as my client was concious about the wastage from non-reusable plastic cutlery. The manufacturing technique that I will use is, to create a mold from a 3D printed version of this product, then pour melted HDPE plastic into the mold and let it set. The product can then be taken out of the mold and filed to ensure the product is safe for the client to use. A hole for a dowel joint has also been added to the design. The cutlery will screw into the joint as shown on my devlopement pages and will be secured with extra melted HDPE plastic or glue if necessary. This is to increase strength of the joint, however I would prefer to use the HDPE plastic as glue is not always sustainable.



The finial colour of the design will be dependent on the HDPE bottles that are used. I will choose colours that are glues greens and browns as my client chose earth tones as her preferred choice.





Material	Environment	Function	Ergonomics	Anthropometrics	Safety	Aesthetics	Social, moral, spiritual and cultural
HDPE plastic - it is renewable and is saving more plastic from going to landfill.	It is made from a material which can be remelted and is taking plastic which is usually not recycled out of landfills.	3D printed model needs to be made with this design, but client the found prototypes so far easy to use, the new design provides more grip.	It will be lightweight because of the material being used. It is an ergonomic as it has been designed around the client's hand.	Measurements used are from the client's measurements taken. It is designed around them.	The product should be filed before being given to the client but is made from plastic so there is not risk of splinters.	The aesthetics are based on an organic feel whilst incorporating the client's favorite design movements.	This design does not harm anyone's moral or spiritual beliefs and is not offensive in anyway. It is designed using elements from nature which can help benefit the clients metal health.

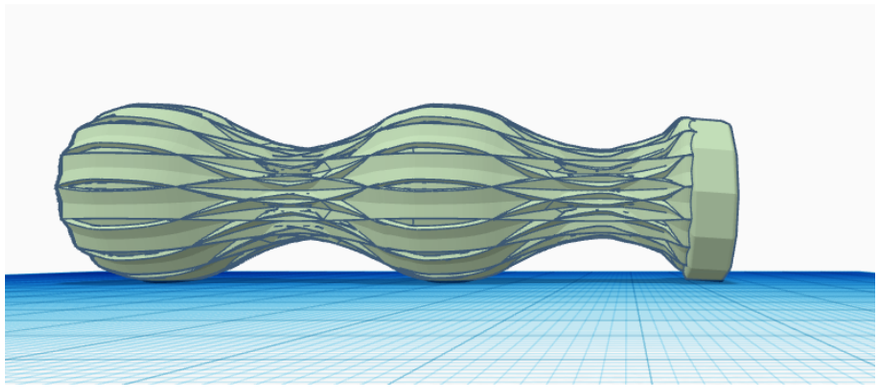
Conclusion: To conclude this page I have presented my finial design for this project. From here I will go on to explain how the product will be created and ultimately make my product. From this page I have gathered feedback from my client and assessed the important factors I must highlight in my plan of making. These are to ensure the detailed organic shape of the design is preserved when using the mould and to make sure I stick to the allowable tolerances when making the products as the joints will not be strong enough if I don't. I will go on to highlight this in my manufacturing specification.

Manufacturing specification

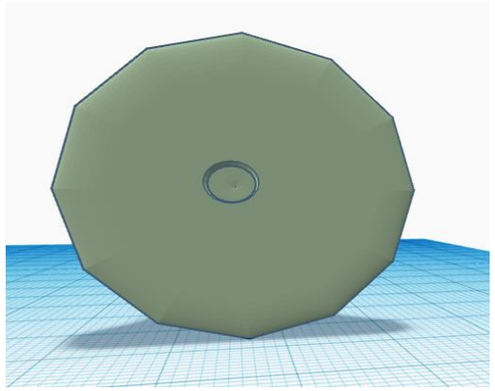
My product is an eco-friendly handle with detachable cutlery heads. The product is designed to prevent single use cutlery from entering the oceans and landfills sites, whilst proving a comfortable, lightweight alternative which can be stored away easily and therefore be used whenever it is needed. My client had experienced issues with plastic cutlery being to damaging for the environment, but metal cutlery not being as comfortable to use and not as lightweight or compact for traveling.

Quality assurance

As this product is being produced using a mold the accuracy of the mold design is what can produce a good product outcome. If the product is being commercially manufactured, then the accuracy of the product would be greater including the set tolerances. The produced products would be almost identical as the same mold design is being used. As I am creating this product on its own, it may not be as accurate. The overall quality of the product though can be increased when I file and sand it down, after taking it out of the mold. This will ensure this sole product looks of better quality, however it would not be able to be done if it is produced commercially.



Introduction: For this page I will be creating a manufacturing specification This will hold all the information and details that are required to make my product. I will be outlining the details such as scale of production, materials, quality assurance, allowable tolerances and standardized parts. These will inform a manufacturer of details to be considered when producing the product.



Scale of production

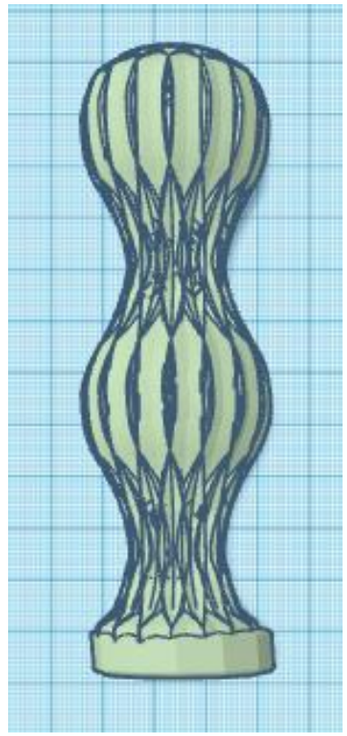
This product can be made in batch or mass production process, however the size of the product is based around the client's measurements, although not precise. It would best be made in a few different sizes, using a few moulds. This would allow clients to mesure their hands and using a given guide choose the correct size for them. It would also be suitable for mass or batch production as there are very little steps in the process, meaning on a large scale it could be fast and simple to make. However, making this as a one of product, can be done relatively easy and within given allowable tolerances. It would also ensure the measurements of the specific client are correct and can be accounted for, throughout the whole making process.

Materials

As mentioned previously the chosen material for my product is recycled HDPE plastic that I will melt down to form my product. Not only is this material lightweight it is also helping the environment drastically. For HDPE, 12% of all plastic bags are recycled and 28% of water bottles and milk jugs are recycled. As HDPE is mostly lightweight it tends to blow away from landfill sites, meaning that is it damaging fragile ecosystems even more.
If someone was to recycle one HDPE plastic bottle out of ten, it would be saving 200 million pounds of plastic from going to landfill sites. Therefore, even by choosing this material I am helping nature from becoming even more damaged. This is an important factor to my client, ultimately making me chose this material to form my product.

Joint material

For the joint of my handle, it will be made using metal. The choice of metal will be dependent on the cutlery head attached to the handle, therefore most likely stainless steel. This will not only provide the joint with strength but also is a material that can be continuously used. It will be an upcycled material therefore not damaging the environment, which as mentioned previously is important for my client. Metals are finite resources and have to be mined from cores in rocks to get access to them. This process of mining is greatly damaging, so by taking the material from a product which already exists and upcycling it is preventing further damage.



Allowable tolerances

For the main body of the handle, made from the mould the allowerable tolerances will be 5mm. Although this may seem like a lot, the main section of the handle that the client will hold when using does not attach to anything or have to fit together. This area is solely based around the client's measurements and will be determined by the mould used, so does not have to be exact to measurements given. For the dowel joint section of the handle the allowerable tolerances will be 1mm. This area has to be extrememly accurate as the dowel joint will not work if this area is too big or too small. If after leaving the mould the area is too small, it can be made bigger with a file, however it cannot be too big after leaving the mould.

Standardized parts

The only standardized part I will be using for this product is a metal screw in dowel joint. This will allow the client to attach their cutlery head of choice to the handle. As shown in my research a dowel joint has proved the strongest joint to use for this handle. However as mentioned in my allowable tolerances, the area of the handle where the dowel joint will screw, I should be precise as if it is too loose the joint will be too weak.

Conclusion: To conclude, in completeing my manufacturing specification my product is now suitible for third party production. From this page I have evaluated the important details that I must consider as they may need more research. These areas consist of the standardized parts as the joints may need to be altered to suit the specific size of handle. I will continue research into this and detail any changes that need to be highlighted in my future pages.I will now produduce a plan of manufacture taking into considerationm quality control and health and safety.

Plan of making

Introduction: For this page I will be present the process of making my product. I will outline the eiptment needed at each stage along with the quality control and health and safety mesures that will be place. I will also be explaining any problems that could occur at each stage. This will allow me to look out for these issues when making my product and therefore prevent them from happening.

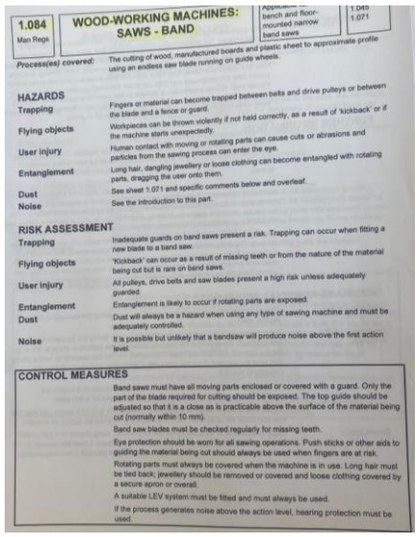
Plan of making	Process	Quality control	Equipment / materials	Health and safety	Problems that could occur
1. Mould making	I will use the 3D printed prototype of my product that has the correct dimensions of my finial product. Then I will use air dry clay to surround the product . The clay can then be left to set, and the 3D print can be removed.	As this stage it is important that the mould correctly resembles the products design and is within the given tolerances, as if the mould is not accurate the final product will not be. I will test a mould with a smaller 3D print to ensure the moulding technique works well.	- air dry clay - 3D printed prototype	There is no health and safety issues at this stage.	An issue that could occur in this stage is that the mould will not accurately show the details in the prototype. To solve this problem, I will test the mould using a smaller prototype and I doing ongoing research to find the best moulding technique.
2. Melting and pouring plastic.	I will cut the HDPE plastic into smaller piece then melt it whilst in the set mould, in an oven at 150 degrees C, as this is the optimum temperature for melting this type of plastic. The HDPE will then be poured into the mould and left to settle.	Air bubbles could build up in the plastic to fix this I will cut the HDPE into small pieces before melting. After it is melted, I will twist and fold the plastic then remelt it to remove air bubbles.	- Mould - HDPE plastic - Gloves - oven with tray	The plastic will be too hot to touch, therefore I will wear heat resistant gloves when touching the plastic.	An issue that may occur is the plastic not being liquid enough to pour into the mould. To resolve this problem, I will reheat the plastic for a longer period of time at an increased temperature.
3. Releasing from mould and cooling	After the HDPE plastic has been left to cool, the plastic should be set in place. To release the product from the mould the silicone will easily bend away from the plastic. If am using clay mould it will need to be prized open.	The shape of the product may be altered if the product is taken out of the mould or touched too soon. To ensure the product will not be damaged it should be left to cool.	- Gloves - plastic in mould	As mentioned above gloves will need to be used when touching the warm plastic.	An issue that may occur is the small details of the product may not show up when the product is released from the mould. To fix this I will file the product and heat the plastic as mentioned above.
4. Finishing	A band saw will then be used to cut off any excess plastic that does not fit the shape needed. I will then file the product using the disc sander, a hand file and sandpaper to ensure the shape of the product resembles the prototype and is in the allowable tolerances. This step in the making process may take the longest as it is an intricate design.	I will keep in the allowable tolerances as mentioned in my manufacturing specification. This will ensure the product functions well for the client.	- disc sander - band saw - hand file - glass paper - plastic removed from mould	An experienced adult will use the band saw to ensure there are no injuries and I will use goggles and tie back my hair when using the disc sander.	An issue at this stage could be that the shape of the product does not resemble the prototype as well. To fix this issue I will stick to client measurements as this is an individual piece suited to them. This will allow the product to function well for my specific client.
5. Joint attachment	For my dowel joint I will use a standardized part as mentioned in my manufacturing specification with will be attached into the handle using the hole created by the mould. This join will allow the client to add different cutlery heads to the handle.	The allowable tolerances will ensure the dowel joint is strong enough and functions well. I will also test the joint before allowing the client to use the product.	- standardized dowel joint - hand file - HDPE plastic product	There is little health and safety issues at this stage of making, however the testing of the product will be done before allowing the product to be used.	An issue at this stage could be the joint not being strong enough. To fix this issue I will stick to the tolerances allowed. This will ensure there are no gapes in the joint therefore making it function well.

Conclusion: To conclude, from this page I have presented a plan of making for my desierd product. This outlines each stage of making my product and the considerations that are needed to be taken into acount whilst making the product. From here I can produce my product whilst following this plan. This plan of making will help me to create the best functioning product possible and to correct any possible problems that may occur.

Risk assessments and record of making

Introduction: For this page I will be presenting the risk assessments for the tools I planned to use to produce my product. I also will be presenting my record of making which includes the changes along the way that differ from my plan of manufacture, along with problems that occurred and their solutions.

Risk assessments for processes and tool I planned to use



1.084 Man Regs

WOOD-WORKING MACHINES: SAWS - BAND

Applicable to bench and floor-mounted narrow band saws

1.040 1.071

Process(es) covered: The cutting of wood, manufactured boards and plastic sheet to approximate profile using an endless saw blade running on guide wheels.

HAZARDS

Trapping Fingers or material can become trapped between belts and drive pulleys or between the blade and a fence or guard.

Flying objects Workpieces can be thrown violently if not held correctly, as a result of 'kickback' or if the machine starts unexpectedly.

User injury Human contact with moving or rotating parts can cause cuts or abrasions and particles from the sawing process can enter the eye.

Entanglement Long hair, dangling jewellery or loose clothing can become entangled with rotating parts, dragging the user onto them.

Dust See sheet 1.071 and specific comments below and overleaf.

Noise See the introduction to this part.

RISK ASSESSMENT

Trapping Inadequate guards on band saws present a risk. Trapping can occur when fitting a new blade to a band saw.

Flying objects 'Kickback' can occur as a result of missing teeth or from the nature of the material being cut but is rare on band saws.

User injury All pulleys, drive belts and saw blades present a high risk unless adequately guarded.

Entanglement Entanglement is likely to occur if rotating parts are exposed.

Dust Dust will always be a hazard when using any type of sawing machine and must be adequately controlled.

Noise It is possible but unlikely that a bandsaw will produce noise above the first action level.

CONTROL MEASURES

Band saws must have all moving parts enclosed or covered with a guard. Only the part of the blade required for cutting should be exposed. The top guide should be adjusted so that it is a close as is practicable above the surface of the material being cut (normally within 10 mm).

Band saw blades must be checked regularly for missing teeth.

Eye protection should be worn for all sawing operations. Push sticks or other aids to guiding the material being cut should always be used when fingers are at risk.

Rotating parts must always be covered when the machine is in use. Long hair must be tied back; jewellery should be removed or covered and loose clothing covered by a secure apron or overall.

A suitable LEV system must be fitted and must always be used.

If the process generates noise above the action level, hearing protection must be used.

1 of 1

Using the Hot Air Gun

1. Wear the protective equipment including ear defenders and goggles.
2. Removing paint and varnish with a hot air gun will produce toxic fumes. Wear a facemask, keep others away from the fumes.
3. Do no point the hot air gun at people. It will cause burns.
4. Do not direct hot air on to glass it will crack. Some plastics will crack and splinter before melting.
5. Remember material that has been worked on will remain hot for some time. Make sure no-one touches it.
6. Switch off the hot air gun and unplug before making any adjustments. Remember the nozzle will be hot.
7. Take care not to accidentally pull the plug from the socket.
8. Switch off and remove the plug then put the machine down in a safe place to cool before leaving unattended.
9. Keep the cable out of the way.
10. If it is suspected that the cable may be cut or damaged in any way, switch off and unplug at the mains before inspecting it. If the cable attached to the hot air gun is damaged, stop using the machine. Contact the hire company. If an extension cable has been damaged do not use it again.
11. If the equipment does not work properly do not attempt to repair it. Contact the hire company.

Please keep this leaflet safely as it may be required for future reference

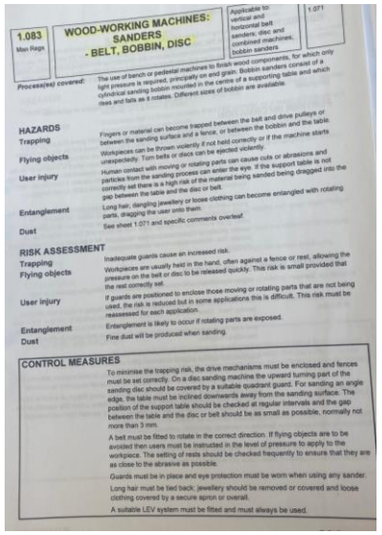
0904 Hot air gun - 110/230v

Hot Air Gun

The rules and procedures in force where people are at work may require the person responsible for this equipment to carry out a specific risk assessment.

It is important to read this entire leaflet BEFORE using the Hot Air Gun

1. Electricity is dangerous and must always be used with great care.
2. Removing paint, especially lead paint, is hazardous. Wear a facemask. Do not allow others to breathe the fumes.
3. This hot air gun is designed for paint stripping, moulding special plastics, thawing frozen water pipes and similar tasks.
4. The action of this hot air gun can cause injury if not used in a careful and controlled way.
5. If the operator has not used a hot air gun before, they should familiarise themselves with the machine on some straightforward work before starting the main task.
6. The work should be thought out and planned ahead to ensure that it is carried out safely.
7. The following items of personal protective equipment must be worn as a minimum:
   Goggles - EN166 or BS2092;
   Ear muffs or plugs giving protection for levels up to 101 dB(A);
   Facemask – a minimum of EN149 ffp2(a) protection;
   Gloves;
   Rcd if using a 230v (mains) supply.
8. This machine must not be used by minors, or by anyone under the influence of drugs or alcohol.
9. This hot air gun is designed for operation by an able-bodied adult. Anyone with either temporary or permanent disability must seek expert advice before using it.



1.083 Man Regs

WOOD-WORKING MACHINES: SANDERS - BELT, BOBBIN, DISC

Applicable to vertical and horizontal belt sanders; disc and combined machines; bobbin sanders

1.071

Process(es) covered: The use of bench or pedestal machines to finish wood components, for which only light pressure is required, principally on end grain. Bobbin sanders consist of a cylindrical sanding bobbin mounted in the centre of a supporting table and which rises and falls as it rotates. Different sizes of bobbin are available.

HAZARDS

Trapping Fingers or material can become trapped between the belt and drive pulleys or between the sanding surface and a fence, or between the bobbin and the table.

Flying objects Workpieces can be thrown violently if not held correctly or if the machine starts unexpectedly. Torn belts or discs can be ejected violently.

User injury Human contact with moving or rotating parts can cause cuts or abrasions and particles from the sanding process can enter the eye. If the support table is not correctly set there is a high risk of the material being sanded being dragged into the gap between the table and the disc or belt.

Entanglement Long hair, dangling jewellery or loose clothing can become entangled with rotating parts, dragging the user onto them.

Dust See sheet 1.071 and specific comments overleaf.

RISK ASSESSMENT

Trapping Inadequate guards cause an increased risk.

Flying objects Workpieces are used held in the hand, often against a fence or rest, allowing the pressure on the belt or disc to be released quickly. This risk is small provided that the rest correctly set.

User injury If guards are positioned to enclose those moving or rotating parts that are not being used, the risk is reduced but in some applications this is difficult. This risk must be reassessed for each application.

Entanglement Entanglement is likely to occur if rotating parts are exposed.

Dust Fine dust will be produced when sanding.

CONTROL MEASURES

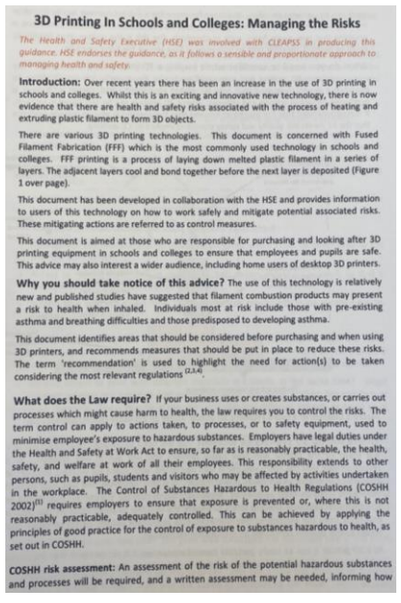
To minimise the trapping risk, the drive mechanisms must be enclosed and fences must be set correctly. On a disc sanding machine the upward turning part of the sanding disc should be covered by a suitable quadrant guard. For sanding an angle edge, the table must be inclined downwards away from the sanding surface. The position of the support table should be checked at regular intervals and the gap between the table and the disc or belt should be as small as possible, normally not more than 3 mm.

A belt must be fitted to rotate in the correct direction. If flying objects are to be avoided then users must be instructed in the level of pressure to apply to the workpiece. The setting of rests should be checked frequently to ensure that they are as close to the abrasive as possible.

Guards must be in place and eye protection must be worn when using any sander.

Long hair must be tied back; jewellery should be removed or covered and loose clothing covered by a secure apron or overall.

A suitable LEV system must be fitted and must always be used.



3D Printing In Schools and Colleges: Managing the Risks

The Health and Safety Executive (HSE) was involved with CLEAPSS in producing this guidance. HSE endorses the guidance, as it follows a sensible and proportionate approach to managing health and safety.

Introduction: Over recent years there has been an increase in the use of 3D printing in schools and colleges. Whilst this is an exciting and innovative new technology, there is now evidence that there are health and safety risks associated with the process of heating and extruding plastic filament to form 3D objects.

There are various 3D printing technologies. This document is concerned with Fused Filament Fabrication (FFF) which is the most commonly used technology in schools and colleges. FFF printing is a process of laying down melted plastic filament in a series of layers. The adjacent layers cool and bond together before the next layer is deposited (Figure 1 over page).

This document has been developed in collaboration with the HSE and provides information to users of this technology on how to work safely and mitigate potential associated risks. These mitigating actions are referred to as control measures.

This document is aimed at those who are responsible for purchasing and looking after 3D printing equipment in schools and colleges to ensure that employees and pupils are safe. This advice may also interest a wider audience, including home users of desktop 3D printers.

Why you should take notice of this advice? The use of this technology is relatively new and published studies have suggested that filament combustion products may present a risk to health when inhaled. Individuals most at risk include those with pre-existing asthma and breathing difficulties and those predisposed to developing asthma.

This document identifies areas that should be considered before purchasing and when using 3D printers, and recommends measures that should be put in place to reduce these risks. The term 'recommendation' is used to highlight the need for action(s) to be taken considering the most relevant regulations [2,3,4].

What does the Law require? If your business uses or creates substances, or carries out processes which might cause harm to health, the law requires you to control the risks. The term control can apply to actions taken, to processes, or to safety equipment, used to minimise employee's exposure to hazardous substances. Employers have legal duties under the Health and Safety at Work Act to ensure, so far as is reasonably practicable, the health, safety, and welfare at work of all their employees. This responsibility extends to other persons, such as pupils, students and visitors who may be affected by activities undertaken in the workplace. The Control of Substances Hazardous to Health Regulations (COSHH 2002)[1] requires employers to ensure that exposure is prevented or, where this is not reasonably practicable, adequately controlled. This can be achieved by applying the principles of good practice for the control of exposure to substances hazardous to health, as set out in COSHH.

COSHH risk assessment: An assessment of the risk of the potential hazardous substances and processes will be required, and a written assessment may be needed, informing how work can be undertaken safely. Guidance for preparing a risk assessment can be found on the HSE website [5]. When thinking about your risk assessment, remember: a **hazard** is anything that may cause harm, such as chemicals, the **risk** is the chance, that somebody could be harmed, together with an indication of how serious the harm could be.

What do you need to consider when buying a 3D printer and filaments? Prior to purchasing a 3D printer and associated materials, there are a number of things to consider. It is recommended that only 3D printer equipment which carries a CE mark is purchased for use in schools and colleges. Where 3D printers can be purchased in kit form, it is recommended that the purchaser ensures that the supplier is able to provide evidence that the kit meets the quality and safety standards implied by CE marking.

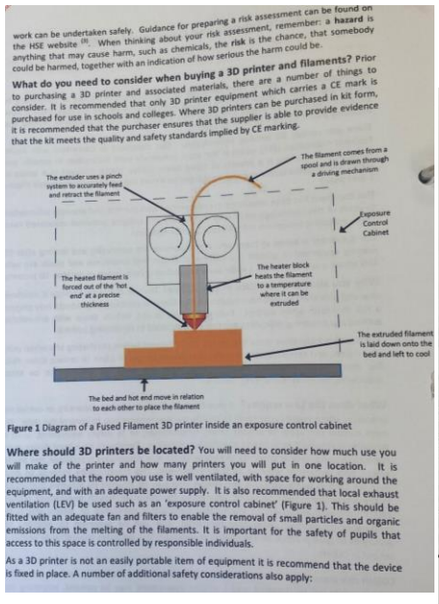


Figure 1 Diagram of a Fused Filament 3D printer inside an exposure control cabinet

Where should 3D printers be located? You will need to consider how much use you will make of the printer and how many printers you will put in one location. It is recommended that the room you use is well ventilated, with space for working around the equipment, and with an adequate power supply. It is also recommended that local exhaust ventilation (LEV) be used such as an 'exposure control cabinet' (Figure 1). This should be fitted with an adequate fan and filters to enable the removal of small particles and organic emissions from the melting of the filaments. It is important for the safety of pupils that access to this space is controlled by responsible individuals.

As a 3D printer is not an easily portable item of equipment it is recommend that the device is fixed in place. A number of additional safety considerations also apply:

- Some print runs can take many hours, so the ability to pause the print or to split the print job into smaller components may be necessary.
- In a school workshop, the power supplies to equipment should be controlled via a key-controlled electrical shut off. This switch should be lockable, accessible and checked regularly to establish that it is working at all times. This is an essential requirement for workshops, and other rooms, where machines are used; such as graphics rooms; rooms used for systems and control work and preparation rooms where machines are located.
- A 3D printer and any associated LEV may need to be on the same circuit as PCs and other equipment that does not get switched off if the emergency stop button is activated.
- The electrical supply to the machine will need to be fed via a conduit from a fused, labelled switch, which allows the machine to be isolated from the supply when maintenance or servicing is to be carried out. This should not be a standard stand-alone 13A plug which could be accidentally plugged in restoring power to the machine during maintenance.
- Additional stop switches which provide 'no voltage release' capacity may need to be provided.
- Third limb switches, such as foot stops, may need to be added.
- Appropriate and effective guards should be provided, which could be interlocked to the machine start system.
- Access to moving parts such as gearbox or belt covers should be secured, so that a specialist tool must be used to open the cover(s).
- Subject to a local risk assessment, the machine may require LEV to be installed e.g. an exposure control cabinet.

What Features of a 3D Printer Do You Need to Consider? There are many different types of 3D printers in use but typically the affordable 3D desktop printer market is dominated by FFF printers. When making your purchasing decisions you need to consider:

- Do you expect to print with different materials or colours at the same time? Single filament printers are common and more affordable, but some printers can use two or more filaments. These may be of the same material and different colours, or could be of different materials.
- What type of printing applications are you considering? Will the 3D printer be used for construction projects, for design and art work, or for electronics projects? This can influence the type of filament material you purchase.
- What is the best temperature range for the print head? The temperature range will influence the types of filament materials you can use because different materials melt at different temperatures. Some 3D printers also have the facility to heat the bed of the machine and this helps the first few layers of the print to adhere.

What is the best print bed size? The print area constrains the maximum size of the print. The larger the print, the longer the print time.

What size (diameter) filament do you require? This can affect the amount of material that is laid down in each layer and the speed of completing the build. Most desktop machines use 1.75mm filament, which is extruded at 0.2mm. Some printers use 3mm filament, which also extrudes at 0.2mm. There are no significant differences in using the different sizes, but machines can usually only use one size.

- Should the desktop printer be enclosed? It is recommended that desktop 3D printers are purchased with an exposure control cabinet already fitted to reduce emissions, prevent injuries from moving and hot parts, and to add security. Exposure control cabinets can also help to maintain the temperature environment of the printing space and improve the quality and success of printing. Desktop printers can be purchased as complete machines or constructed from kits which include air extraction and filtration units. You should always check carefully that this is the case as some printers have openings at the top which will allow particles and gases to escape. Some desktop 3D printers are of an open frame design. It is recommended that if other LEV systems are not available, exposure control cabinets are placed over open frame printers.
- What do you need to do to maintain this equipment safely? 3D printers should be maintained by competent individuals. Some printers have no user serviceable parts.
- What software do you require to run the machine and to design the objects you want to build? All 3D printers need to be linked to computer aided design (CAD) software and some additional software applications may also be required to set up and run the printer. Prior to purchasing a 3D printer it is prudent to check what sort of software is most appropriate for the printer, taking into consideration the platform you use and operating system. Setting secure passwords to prevent misuse of the CAD software is something that you may need to consider.

Choosing Suitable Consumables: There are many different types of filament material and you may be tempted to save costs by purchasing these more cheaply over the internet. However, it is important to know what the filament is made from, and that the company supplying it has provided you with good information and technical support. A good sign is that the supplier of filaments can provide you with a Safety Data Sheet (SDS) that provides clear and specific information about the constituents of the filaments and the products produced when the filament is used in the printer.

What Types Of Filament Are Suitable In An Educational Setting? It is recommended that wherever possible you use PLA to reduce the risk from fumes and particulate emissions. Filaments can be affected by the temperature, humidity (some absorb moisture) and light (some are light sensitive), so should be stored in sealed, dry and dark containers. Most filament waste can be placed into your recycling system but non-recyclable materials should be disposed of in small amounts via your normal waste carrier. Any hazardous waste produced through the printing process will need to be removed by a licenced carrier

What do you need to consider when preparing your risk assessment?

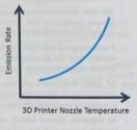
Hazards: The following are possible hazards a school/college should consider when carrying out a risk assessment:

- Moving components
- Heated components

- Ultrafine particle emissions
- Chemical emissions
- Electricity
- Heavy equipment
- Hazardous waste
- Cleaning chemicals

Relevant risks:

Inhaling emissions from the 3D printer: Standing close to the printer and spending long periods near the printer during its operation will increase the risk of inhalation of particulate and chemical emissions. More emissions are produced by higher printer nozzle temperatures (Figure 2). For some individuals, brief exposure to these emissions may trigger symptoms but there may also be longer-term health risks for individuals who spend long periods using 3D printers.



Contact with moving and heated parts of the printer: Body parts, hair and clothing could become trapped in the moving printer parts and skin could become pinched between belts and drive wheels. The nozzle of the 3D printer can reach high temperatures of between 200 - 300°C. Some 3D printers have a heated print bed reaching to between 50 - 100°C. The skin could be severely burnt if it comes in to contact with these heated parts. Printed components, immediately after the printing finishes, may also be hot enough to burn.

Electrical burns and shocks: Any equipment connected to the mains supply can possibly give an electric shock to the user, causing fatalities or injuries and burns. Poor installation and maintenance can also lead to damage of the equipment.

Musculoskeletal injuries caused by lifting and moving 3D printers: Some printers are heavy. Poorly conducted manual handlings tasks increase the risk for musculoskeletal injuries.

Control Measures:

Minimising exposure to hazardous substances: To minimise exposure to hazardous substances, COSHH sets out important principles that need to be addressed in the risk assessment. In summary when applying these principles the following is recommended.

i) Minimise the use of hazardous processes and materials:

- If you are unsure about which types of printers are safer by design, and which types of filament materials are least hazardous, seek advice from CLEAPSS[7] or from suppliers that conform to EU and GB Health and Safety and Equipment Safety Legislation.
- Choose PLA as your main type of filament material and avoid using more hazardous filaments such as ABS.

Reduce the printer nozzle temperature to the lower melt range specified by the filament supplier. This information should be in the product information sheet but if in doubt contact your supplier.

- Consider how many printers you are running in a room and whether the room has adequate ventilation. If possible do not place many printers in one room particularly if the room is small and/or poorly ventilated.

ii) Containment for 3D Printers:

- The best solution is to purchase a 3D printer that is fully enclosed including filters to remove particulate and chemical emissions. Alternatively use a bespoke exposure control cabinet to cover each printer.
- A well-designed exposure control cabinet should include a fan to draw the air through a suitable filter for ultrafine particulates e.g. HEPA filter, and a carbon filter for capturing volatile organic chemicals (termed VOC).
- All types of enclosed printers, or exposure control cabinets, will take time to clear emissions once the printing has finished, so allow an appropriate clearance time before opening the enclosure after printing. Follow the enclosure manufacturer's guidance.
- An exposure control cabinet will prevent access to the working area, and therefore prevent contact with hot and moving components.
- Properly installed and maintained equipment will prevent access to electrical components and therefore reduce the risk of electric shock injuries or burns.
- An exposure control cabinet fixed securely in place will prevent movement and unauthorised removal of the equipment.
- To minimise the risk of musculoskeletal injury caused by lifting and moving printers, suitable lifting equipment and trolleys should be used.

Cleaning and Maintenance: Injuries from the equipment and exposure to contaminants on the printer surfaces can occur, as well as from chemical products used to clean printers. Chemicals or materials used for cleaning may interact with other materials increasing the risk of chemical emissions.

- Prior to use, the operator should carry out a visual check of all electrical connections
- The machine must be switched off and isolated from the mains before cleaning or carrying out maintenance.
- The person cleaning or maintaining the machine should be competent. When accessing the interior build space of the machine ensure that all components have had time to cool.
- Take care to ensure that belts, pulleys, bearings and other mechanical components are identified and the operator avoids touching them, unless carrying out maintenance on those parts.
- Follow the manufacturer's instructions for suitable cleaning processes and chemicals, and with regard to user serviceable components. Avoid using harsh or hazardous chemicals and strong organic solvents for cleaning work. Alcohol based wet wipes containing suitable detergent and disinfectants are suitable for this purpose but avoid cloths soaked in water in order to protect the electronics.
- Use disposable paper towel to dry and clean the equipment, not rags.
- Filaments should be replaced by a competent individual ensuring care with respect to moving and heated parts.
- Guards and enclosures must be replaced when cleaning and maintenance work is completed.
- Where an exposure control cabinet is used, the filters should be checked and changed regularly as this qualifies as an LEV system. A *"Thorough Examination and Test' (TExT) is required and must be carried out by a competent person"*. Further advice can be found G225 – Local Exhaust Ventilation in D&T available on the CLEAPSS website [7].

Manual handling: Use a dedicated location for the printers and fix them in place. If the 3D printer needs to be moved, use best practice for manual handling as described on the HSE website[8].

Electrical safety: Before switching on the 3D printer, visually check that all electrical connections are in a good condition. Ensure that the machine is correctly installed, and run the power cable via a conduit from a fused, labelled isolating switch. Advice on safe working with electrical equipment can be found on the HSE website[9].

Further Information

HSE Guidance

1) Control of Substances Hazardous to Health (COSHH): http://www.hse.gov.uk/coshh/
2) Provision and Use of Work Equipment (PUWER): http://www.hse.gov.uk/work-equipment-machinery/puwer.htm
3) How to carry out a COSHH risk assessment?: http://www.hse.gov.uk/toolbox/harmful/coshh.htm
4) Management of Health and Safety at Work Approved Code of Practice: http://www.hse.gov.uk/pubns/books/l21.htm
5) Manual Handling and Musculoskeletal Disorders: http://www.hse.gov.uk/msd/manualhandling.htm
6) Electrical safety at work: http://www.hse.gov.uk/electricity/index.ht

Other Sources of Guidance

7) Consortium of Local Education Authorities for the Provision of Science Equipment (CLEAPSS): http://www.cleapss.org.uk/
8) Building Bulletin 101 (GOV.UK): https://www.gov.uk/government/publications/building-bulletin-101-ventilation-for-school-buildings
9) Scottish Schools Education Research Centre: https://www.sserc.org.uk/

Record of making with photos from the process

Record of making

1. Firstly, I used a 3D printer to create a model of with correct CAD shape of my prototype.
2. Using this printed model, I created a mould using air dry clay and my 3D print. I made a half mould so that I would end up with two half of my handle.
3. I then left the clay mould to fully dry for a few days, before removing the 3D print, which was harder than I had anticipated as the mould was fully dry and the print was difficult to get out, this led to some of the mould being damaged in the process, which ultimately altered the detail of the finial design.
4. After this I cut up recycled HDPE milk bottles into strips before placing them in the mould in the oven to melt. Here an issue occurred as the larger strips meant that the plastic didn't melt as easily and there were large gaps in the handle. Therefore, I repeated this process again but this time I cut the bottles into much smaller pieces and built up the handle in layers as the plastic melted. This meant that there were less air gaps and the plastic melted quicker.
5. From here I left the plastic to set.
6. Then I removed the plastic from the mould, which was extremely difficult and meant that I had to destroy the mould to get the handle out.
7. To create the other half of the handle I then had to create a new mould out of clay and repeat this process again.
8. I attached the 2 halves together and inserted the handle between them by using a heat gun. This helped me to melt the plastic which then meant i could stick the halves together. However, an issue here was that the heat gun warmed the whole handle up meaning that some of the design was lost.

Conclusion: To conclude, from this page I have presented the risk assessments and my record of making. I have learnt from creating this page that there are changes that could be made to prevent the problems that occurred if I were to make this product again in the future. I will now go on to evaluate my finial prototype in more detail over the next few pages.

Manufacture in industry

Introduction: For this page I will be discussing the manufacturing methods that would be used if my product were to be made in industry. I will also research and asses the commercial viability of my product to see if it would be worth producing in industry.

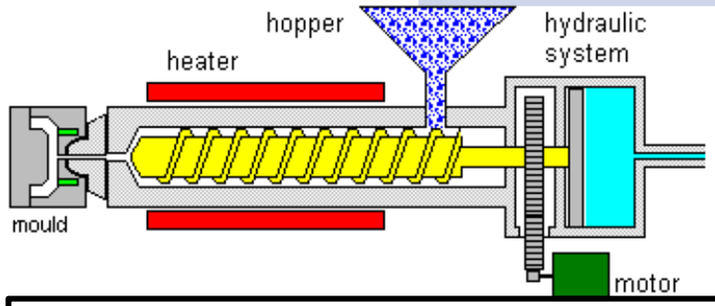
Level of production

If my product were be made in industry it would most likely be made in batch or mass production. This is because the product is for consumers who are eco conscious and do not like the existing ecofriendly cutlery available on the market. This may be due to the material existing products are made from. Due to this the market for my client constantly expanding and therefore the product could be made to order in batches or as the product gains popularity it could be mass produced. This is as a result of the fast production techniques used to make this product in industry.

Part of the product	Technique used in industry	Why would this work?
Main handle	Injection Moulding	The handle is comprised of one solid structure and does not include lots of small parts. This would make it suitable for injection moulding as it is a stong and therefore can be produced quickly.

Commercial viability

The concept of my product being commercially viable is possible as there is a continuously widening market for eco-friendly products. As my product is built from a recyclable plastic the price for the materials can vairy. My product had no cost to produce as I used the plastic from recycled milk bottles, which would have been thrown away otherwise. The spoon head also had no cost as I recycled a spoon that was no longer in use at home. However, in industry the spoon head cutlery would need to be bought. The average cost for silver household cutlery is 0.45€/g . This changes depending on the silver content of the cutlery. An average piece of cutlery weighs 48g, ,meaning the average cost for one cutlery head would be 21.6€. However, this price is for high quality silver cutlery therefore my product would need to be made with a lower quality stainless steel cutlery head to make it commercially viable. Recycled HDPE plastic can be bought in mass for as cheap as £110 per tonne. This would mean that the plastic for one piece of cutlery would be around 0.0528p. This is extremely cheap, meaning that the cost for producing my product in industry would be very low, therefore making it commercially viable. The manufacturing method of injection moulding also requires little clean up after, making the manufacture of the product cheap. The overall cost for the consumer would be around £10 as this would still produce a profit whilst being under the price my client said she would pay and therefore attracting more sales.

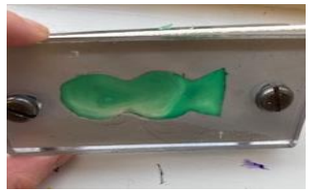


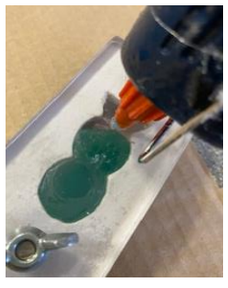
Production line

My product would need to be made through the method of production line, as a production line is ' arrangement in a factory in which a thing being manufactured is passed through a set linear sequence of mechanical or manual operations'. This means that each step in making my product would be done mostly by hand. As the product only has a few steps, this process would be quick, but it would ensure good quality each time. A production line also includes quality control check, this would ensure there is no issues with the product after it has been manufactured and would check its safety for the client to use.

Method of production

The manufacturing technique of injection moulding would be used to produce my product in industry. Injection moulding works by putting granulated plastic into the hopper. If my product was still going to be eco-conscious and use recycled HDPE plastic, then this would be broken down into smaller pieces and put into the hopper. From here, the granulated plastic is moved into the heating chamber by an Archimedean screw. In the heating chamber the granulated plastic becomes molten. Then it is pushed into the mould, which would be in the shape of my product using a hydraulic ram. This ensures that there is the right amount of the plastic being injected into the mould every time. After the plastic has cooled in the mould it can be removed. The advantages of using this manufacturing technique for my product in industry are that it is very efficient, meaning it can meet the demand for product production as quickly as possible. This process also has little waste; therefore, it is good for the environment as this may go to landfill. Finally, there is flexibility in the designs of products that can be made through injection moulding. My products intricate design could therefore be made easily with this technique.





I carried out a small-scale testing of injection moulding for the shape of my product to investigate the accuracy of this technique. To do this I used cut a 2d shape of my design out of plastic, which resembles the simple shape of my product. I then used WD40 to lubricate the press and the cut plastic so that the hot glue could be easily removed when cooled. I pot the cut plastic in between a press, which had a hole for the hot glue to be placed into. For this practice I used green hot glue as it resembled the one closest to my product. I injected the hot glue into the press and tapped the press on the desk to ensure the hot glue got to all sides of the mould. In an industrial process this would not be necessary as the hydraulic ram is powerful enough for the polymer to get to all parts of the mould. For this practice technique I did not need a hopper or a heating chamber as the hot glue gun resembled this. After the glue had cooled, I unscrewed the press and removed the product. The overall technique worked efficiently, however an improvement could be that I had to file the product to make it smooth at the end. This would not be as necessary in the industrial process as there shouldn't be air gaps the mould.

Conclusion: To conclude, from this page I have researched the technique of injection moulding and how it could be used to manufacture parts of my product in industry. From here I have gone on to complete an investigation of injection moulding to test the accuracy of this technique in producing my product. I have also looked at if my product was to be produced In industry would it be commercially viable, where I have concluded it would be. After this page I will evaluate and test my finial prototype of my product. Using the information on this page I can assess the changes that would need to be made to it, that would make it suitable to produce in industry and attract a wide range of consumers.

Evaluation page 1

Introduction: On this page I will be evaluating the process of making my product and state any changes that have been made towards it. I will also be getting feedback on the product from someone in my target market.

Changes made during the production process

The first change made during the production process was when I was melting the HDPE plastic into the moulds. Firstly, I cut the plastic bottles into long strands and put them in my mould in the oven to melt. An issue I came across in this process was the large pieces of plastic created air bubbles when melting and they took a high temperature and hours to melt. From here I changed my method to cut the HDPE plastic into much smaller pieces before melting it. This reduced the number air bubbles in the mould and allowed for the plastic to be melted much quicker. Another change made during the production process was when I had to release the plastic from the mould. I originally thought I would just prize the plastic away from the clay however, once everything had cooled down it was much more difficult to get out. I ultimately had to break the mould to release the plastic. This meant that when it came time to make the other side of the handle, I had to create another mould to do this. This led to clay being stuck on the plastic of the finial product, altering its finial look. After creating the product, I was going to use a disc sander to remove acsess plastic, however I ended up using sanding paper and a file, as the disc sander would have ultimately melted the plastic on my design. Finially, for my joint I planned to use a standerdized part to attched the cutlery head, however I inserted the whole cutlery inbetween the two halfs of the handle and attached it together when I used the heat gun. If I was to make this agin with a larger piece of cutlery it would need to be trimmed to fit in between the handle parts.

Smaller pieces of the recycled HDPE plastic

Clay residue from mould

Breaking clay mould to release the plastic

Materials Biodegradable /ecofriendly	Environment what happens at the end of its life cycle?	Function Does the does the lim it its ability to function well?	Ergonomics Lightweight and comfortable to use	Anthropometrics Designed to fit around the client's measurements	Safety No sharp edges/ smooth	Aesthetics Follows a design movement or company the client likes	Social, moral, culture & spiritual Can help improve client's mental health and does not offend any beliefs
For my finial design I used recycled HDPE from milk bottles. This fulfills my spec point for the material of my product being ecofriendly. Although the plastic is not biodegradable it can be melted down and reused. The plastic s being recycled which is preventing going from landfill.	At the end of its life cycle this product can be melted down again and the plastic can be made to use a different product. This process can be repeated again and again. Therefore, making this product sustainable.	The required function of this product is met overall, however the sizing could be altered to suit different functions. Such as the length and width of the handle changing depending on the cutlery being used along with it.	The product is very lightweight, and the shape ensures the product is comfortable to hold. However, the plastic has a slight rough texture to it, which means it can be uncomfortable to use at some angles for longer periods of time. To improve this, I would use a different moulding technique such as injection moudling and heat the plastic to much higher temperature ensuring it is fully	The measurements of the product fit to the clients hand very well. As the size of the originally 3D print that was used to make the mould was made using the clients' measurements.	This product is safe overall however if it were to go out on the market, I would adjust production techniques to make the edges of the handle less rough, therefore meaning it would be safer.	My client originally liked the minimalistic design movement and particularly liked the company Joeseph Joeseph's designs. I believe my product does sit well in this design movement, however next time I would use more colorful recycled HDPE bottles to make the design more eye-catching like those seen designed by Joeseph Joeseph.	This design does not harm anyone's moral or spiritual beliefs and is not offensive in anyway. The fact that the design is made from HDPE pling more waste from landfill could however benefit the clients metal health or wellbeing, as they know there are no damaging the environment more by purchasing the product.

Interviewing someone from my target market:

I interviewed someone from my target market of office workers who use disposable cutlery, who wasn't my client to get their opinion of my finial product prototype.

Do you like the product and what features do you like about it ?

" I like how sturdy and durable the product is, the thick handle gives me the impression that it would not break easily." This client like the unique design and feels it is different to those already on the market. "I like how it is made from recycled materials, as sustainability is becoming more important to me" This lcint also likes how the product feels in comfortable in their hand.

Is there any features that you don't like about the product or anything that could be added?

"I feel as though it may be difficult to clean, as there are small gaps in the plastic, this could be fixed in the manufacturing process though" This client feels the surface should be smoother and by using a single colour of plastic it would improve the design. "I feel as though the handle could be slimmer and less bulky, as a teaspoon is used for this product."

Is it easy to use?

"Yes, it fits in my hand well and is very ergonomic, I also find it doesn't slip out of my hand as easily as normal or bamboo cutlery does."

Would you like it to be available in other colours if so which ones?

" Yes, I think it could be sold in a range of colours" This client would personally like brighter colours, but thinks it could be alter depending on the target market, for example primary colours for children.

Would you buy this product and how much would you pay for it?

"Yes, with the improvement added I would pay £15."

Do you think this will be a successful product?

This client thinks if improvements were made it could be a very successful product. However, they also think the handle design could be adapted to suit different products such as garden or other kitchen tools. The handle design could make the product easier to use, but also make it more sustainable, as they are made using recycled plastic.

Conclusion: To conclude, on this page I have evaluated my products production process and got feedback on the product from my target market. From here I can take the suggested improvements and create new potential designs with these improvements.

Evaluation page 2

Introduction: On this page I will be evaluating my finial product prototype, by giving a general evaluation of the overall outcome of the product and what I would do next time if I were to make the product again. I will also be getting feedback from my client on the final product and receive any improvements they may have on the design.

Final client interview

Do you like the product and what features do you like about it ?

"Yes, I like how quirky the product is and how it is different to those already on the market" My client enjoys the mix of colours in the product and feel the material is a talking point. "I like how it could be made into different sets of cutlery, changing the colour of plastic." My client likes how durable the product is.

Is there any features that you don't like about the product or anything that could be added?

"For this product, as it has been made using a teaspoon the handle could be made slimmer." My client also feels the surfce is a bit rough and therefore if the product were to be made in industry this should be improved upon. " The joint could be smoother and although I like the multicoloredplastic, it lost the flower design, when in the mould." My client feels if a solid colour was to be used the flower design would show up more.

How easy is the product to use?

"It is very easy to use and not too bulky" My client feels and improvement on this though could be to have different size of handle for different cutlery types. "I think the shape may need to be changed depending on the cutlery used as well" My client likes how the design and materials used provide grip. "The cutlery is not slippy to hold like some original cutlery is and therefore I am less likely to drop it."

Do you feel the product fixes the issue of plastic pollution and is an improvement on existing cutlery?

" I love how the product is completely recyclable and how it takes plastic that is likely to be going to landfill" "I think it is an improvement on exisiting sustainable cutlery as babmboo can be too light and not durable enough."

Would it be a successful product moving forward taking these improvements into account?

" I think it could be more sucesfull moving forward if it was advertised as a quirky design cutlery set, which is sustainable" My client thinks if I were to adapt the design and manufacture for the product to look more like Joeseph Joesph product with different colours and shapes, it would be more successful.

Pictures of my finial product and my client using the product

General evaluation

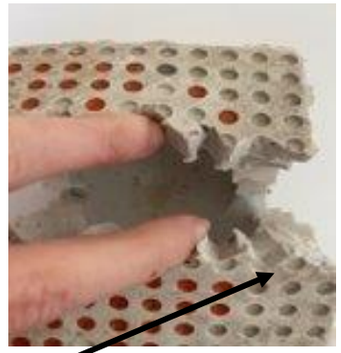
Overall, I am happy with how my product turned out, as the developments and model testing along the way resulted in a product which fixes the main issue of plastic pollution, when it comes to reusable and sustainable cutlery. However, one main area which has resulted in the product not looking the best is the finishing of the plastic. Multiple steps and alterrations, during the production process has led to it being an uneven texture, which has lost its original flower design. Firstly, the use of the clay mould resulted in the flower shape being lost a little to begin with. Then I should have let the plastic melt fully and melted it in many layers to prevent air gaps, which resulted in the unven texture. Finally, when using the heat gun to attch the two halfs togther the plastci melted, which again lost more of the original flower shape and reinforced the rough surface of the plastic. Looking back, now I woud have done more research on the use of HDPE plastic and I should have tested the accuracy of it being melted in a clay mould. This may have led to me using a differnet moulding technique o to alter the design of the handle. My client is happy overall with the product and feels it fully meets their needs. Thy find the design of the product to be unique and love the material that was used. Even though the finish of the plastic was not done to a high standard it meets the needs of my client, which was to have an everyday piece of cutlery that was sustainable but comfortable to use. However, an issue my client has is that they wished for the product to have an oraganic design, which as mentioned the flower design has been lost in the production process. Next time I would use a design with less detail or change how I used the clay mould to melt the plastic. Finally, moving on from the production of this single product, I only created a handle for a teaspoon. I would like to produce a set of cutlery with different coloured HDPE plastic handles, taking into account the changes in the the manufacturing process to create a more seamline smooth handle, with an organic design.

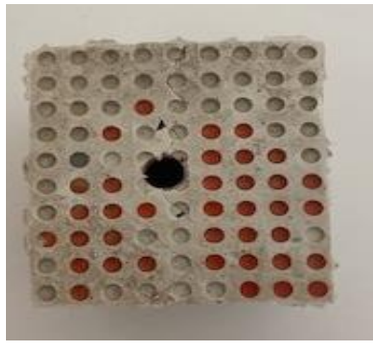
Conclusion: To conclude, on this page I have evaluated both the process of making my product and the outcome. Throughout the two pages of evaluation, I have gathered improvement that could be made to the design of the product and ways in which I would produce it differently next time, these include using one colour of plastic, making the design less bulky and improving the surface texture of the product through the design and manufacture. I will present these improvements with potential new designs on the next page.

Potential design changes and improvements

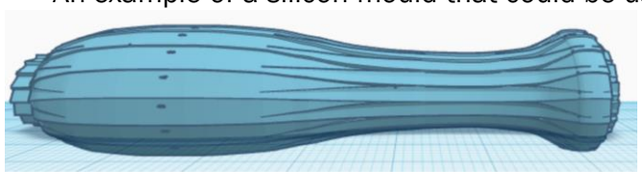
Introduction: On this page I will be developing on my evaluation pages by adding to my original designs including some improvements given by my target market, finial client and from my own evaluation.

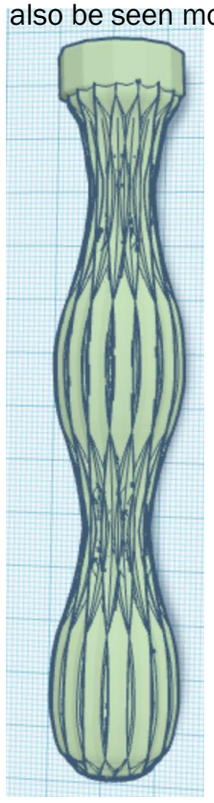
Firstly, a change I could make in the production process to improve my product, could be to use a different type of mould. A silicon mold for example may allow me to melt the HDPE plastic quicker. The clay mould I used was thicker and therefore took much longer for the plastic to heat up and melt. This resulted in air bubbles as the plastic was not hot enough and therefore didn't melt fully. A silicon mould would also allow the design of my mould to show up much better. This would allow for the organic flower design to be more visible, which is an improvement my client wanted to see. Along with this by using smaller pieces of HDPE plastic and one colour/type the design could also be seen more.

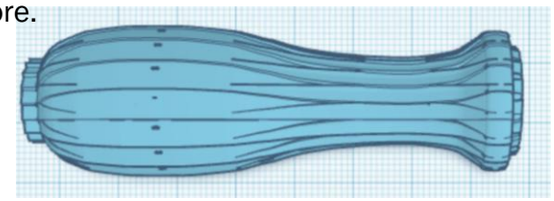




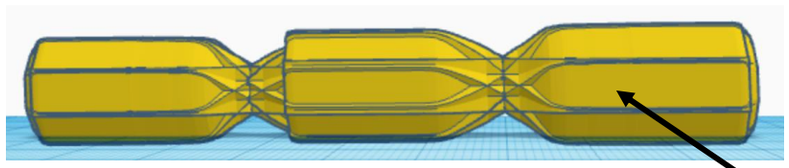
An example of a silicon mould that could be used.



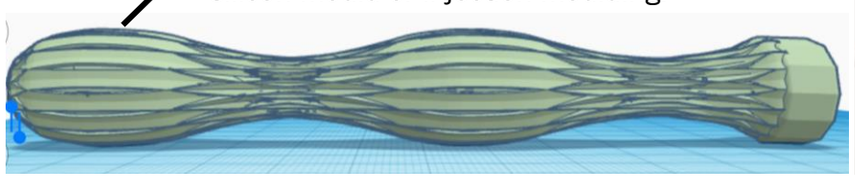




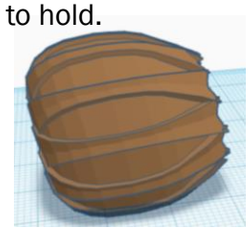
This design is also similar to the original flower design; however, the grooves are further apart making it easier to get an accurate shape from the plastic after moulding.

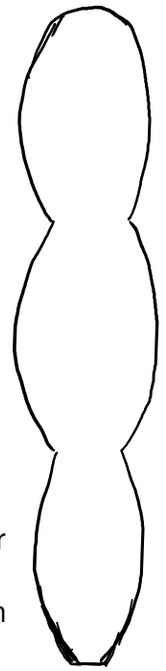


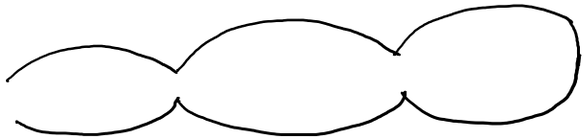
This is my finial design that was used to create the finial prototype. My client really enjoyed the details and organic feel to this design as it kept with the context of nature and the environment. I have altered the CAD design to meet the clients recommended improvements. By extending the length of the handle and making it thinner overall, it should be easier to use, more comfortable to hold and should also accommodate different sizes of cutlery better. One area of suggested improvement by my client was the lack of detail from the original CAD design to the finial prototype. This was caused by the mould therefore the design can be kept just as detailed as long as the manufacturing process is changed such as using a silicon mould or injection moulding.



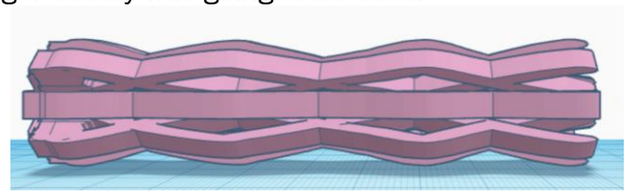
This design also has a simple shape, and the size has been adjusted to make it thinner and longer, as to make it easier to use. However, this design is less ergonomic as it is straighter and less curved. This makes the design less organic, but more similar the original cutlery, therefore the client may feel it is comfier to hold.



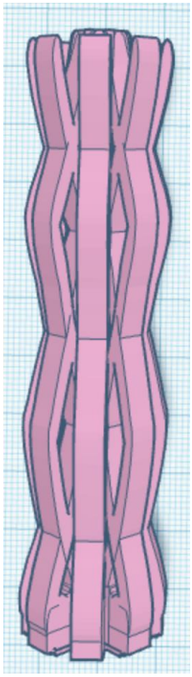




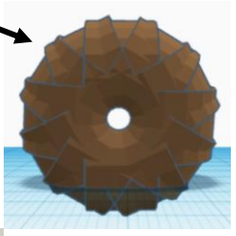
Here is an example of the altered design shape of the handle. Both my client and target market commented that the handle felt too thick and wide in their hand. This made it much more difficult for them to use. Therefore, in these designs the handle has been made thinner to accommodate for this change. I have also made the designs longer, as my client suggested they felt too short and would need to be altered if longer cutlery was going to be used.



Here is an alternative design, which still incorporates a natural look and has added grip. The difference between this and my original design is that this has fewer small details, meaning the overall design may show up better after being moulded. It still has the original look of the first design, but the sections are wider, meaning they may be easier to mould. However, a disadvantage to this design is the gaps. These areas may be difficult to mould around and therefore the design would need to be adjusted before it can be moulded accurately.



This is an alternative to my original design; it is still overall the same design piece however an adjustment has been made to how detailed the flower design is. The spaces between the design has been made bigger and simpler. By making this adjustment the mould will pick up on the design better and therefore the end product will look more uniform.



Here are some examples of existing cutlery products, one spoon is made from wood and the other is ergonomically designed to help ween babies. By looking at these products it can help me to devlop my deisgn, for example by taking the ergomic design of the Dip spoon and adapting it to help improve my product would improve its ease of use. By taking inspiration from the wooden spoon, I can look at alternative materials that are both sustainable and keep the organic detail my finial prototype is missing.

Conclusion: To conclude, from this page I have looked at potential design changes, which include improvemnts suggested by my target market and client. I have also altered and created new designs which include improvemnets and changes I have identified throughout the making process and when evaluationg my finial prototype. From here I can go on to develop and test these designs and when I create the final product in the future it can fit not only the need of my one client but also suit everyone, when my product is on the market.

References

Existing products

SipWell 9.5mm Bent Wide Stainless Steel Drinking Straws, 4-Pack – Rust Proof Metal Straws w/Cleaning Brushes –Perfect forSmoothies & Cold Beverages: Amazon.co.uk: Kitchen & Home

My Little Panda 19cm Bamboo Lunch Set with Sea Green Roll-Up Organic Hemp Carry Pouch: Amazon.co.uk: Sports & Outdoors

Kitchen Accessories, Utensils & Gadgets | Joseph Joseph UK

Other information

Ocragela - MaterialDistrict