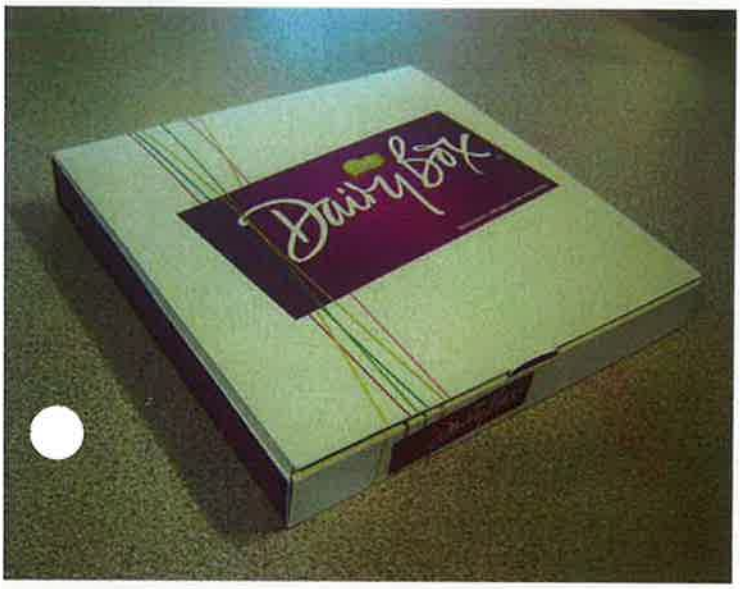
edexcel

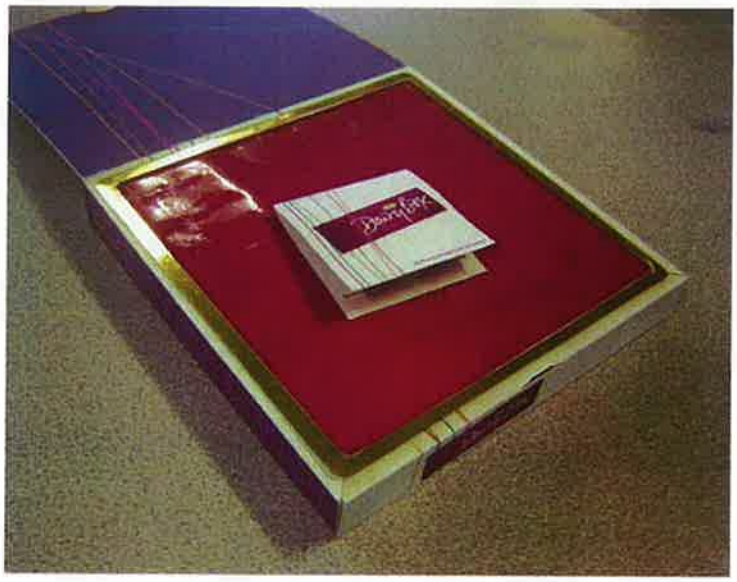
Website Exemplar

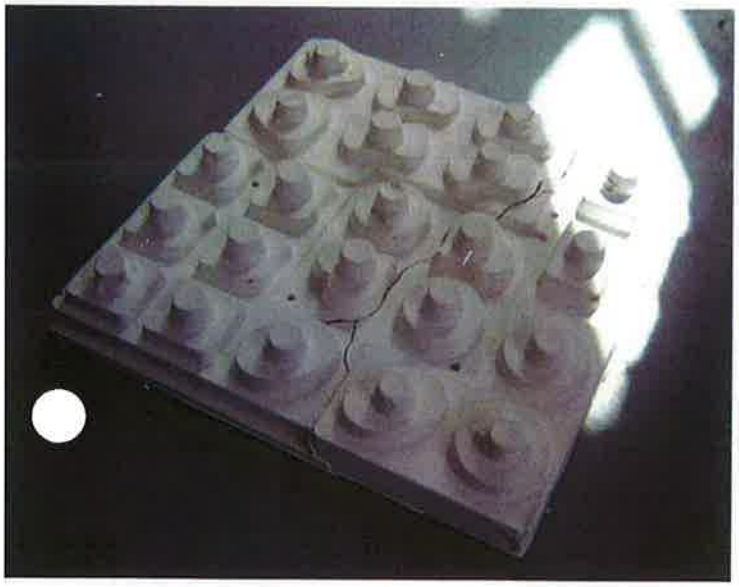
GCE D&T Graphics Product

Unit: 6GR04

Topic: The Chocolate Box.


Dairybox





Product Analysis

GRAPHICAL STUDY - COMPONENTS LIST

Exterior Packaging

- Die cut solid bleached board material.
- Offset lithography printed inks for graphical appearance.
- Spot varnishing on graphics and text to make key areas stand out.
- Glossy laminate top layer for high quality appearance.
- Positively embossed surfaces.
- Creasing lines for durable and flexible hinges

Aerosol Deodorant

- Embossed Adidas logo on the top of the lid.
- Printed graphics
- Aluminium canister to contain the chemicals
- Curved Polypropylene nozzle area.
- Dispensing mechanism for Aerosol spray.
- Removable Polypropylene cap.

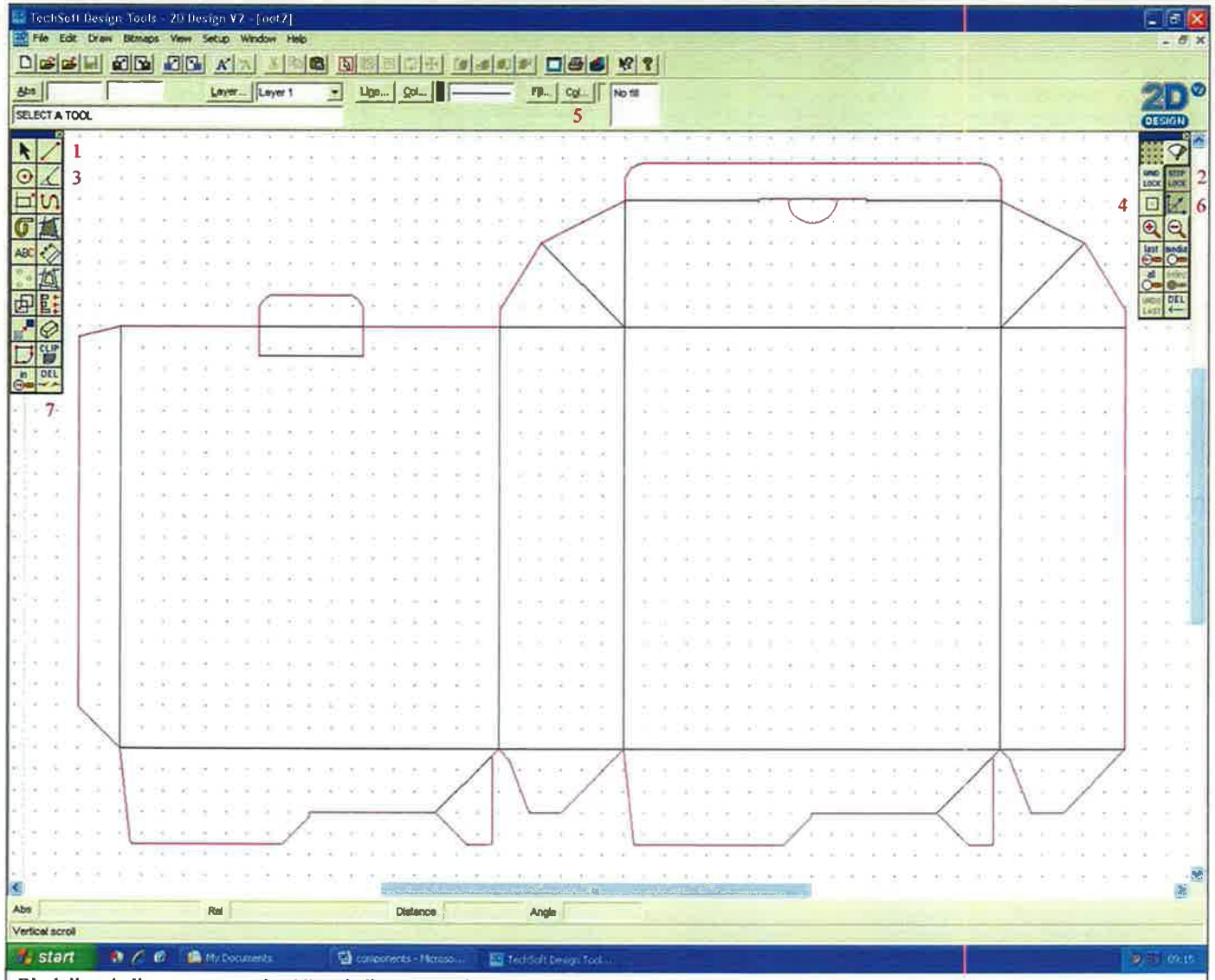
Vacuum Formed Tray

- Polystyrene rectangular shape tray with lip to span whole box interior.
- Polystyrene shower gel shaped compartment.
- Polystyrene deodorant shaped compartment.
- Polystyrene rigged air space segments to protect the products from being bashed or dropped.

Shower Gel

- Polypropylene shaped body.
- Curved Polypropylene top half.
- Hinged Polypropylene cap lid.
- Transparent label containing printed graphics.
- Raised bumpy textured grip.
- Inset smooth groove.

GRAPHICAL STUDY - 2D DESIGN NET



Black lines indicate creases and red lines indicate cuts. The colour codes are then set in the output options for the vinyl cutter and the dimensions are calculated using CNC which instructs the CAM device to produce the net correctly.

TechSoft 2D Design V2 (CAD)

I remade the 'Adidas Victory League' net by measuring each length of the original using a ruler to the nearest millimetre. I then remade each section of the net on TechSoft 2D Design V2 using the line tool[1]. I used step lock[2] which confines the line tool to only move in 1mm steps. This ensured that I made the net as accurate as possible to the nearest millimetre. I also created the rounded edges by using the filleted arc tool[3] and entering the desired radius of the rounding. This enabled me to create the rounded edges from in between two straight lines. I used the attach[4] tool to ensure that the lines I drew locked onto an existing line to join it. Otherwise gaps could be present and it would not be manufactured properly when output to the vinyl cutter (CAM). I colour coded the lines to differentiate from creases and cuts by selecting an existing line and changing the colour in the colour toolbar[5]. To create the desired angle for certain areas I used the radial lock tool[6] to lock the line to a specific angle. This was useful for creating accurate angles. Because of the complexity of the net I sometimes had to intersect two lines and then remove the unwanted excess from the intersection to achieve the desired shape using the delete part tool[7].

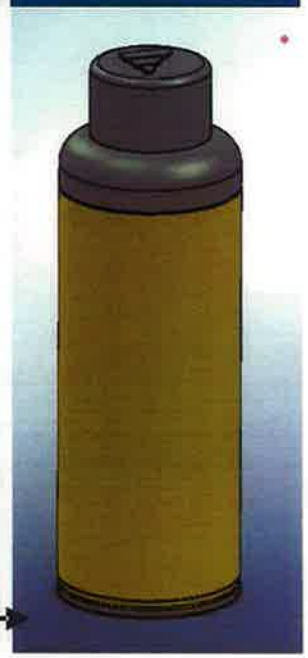
The fully constructed net alongside the original.

GRAPHICAL STUDY - SOLIDWORKS 3D MODEL

2D Sketch

Revolve Profile

Coloured Model



First of all I created one half of the deodorant can using the line tools from the sketch tab. I measured the original canister and input the lengths when creating the dimensions. I used the spline tool to create the rounded edges and created a centre line which defined the centre axis, to use when performing the revolve profile command from the features tab. The revolve profile command revolves the 2D path 360 degrees around the centre line axis which creates the 3D solid mesh. I then rounded the desired edges using the fillet command to eliminate harsh edges. After this I created the raised Adidas logo on the top of the lid by creating a new sketch on the lid's work plane. I then drew the three bars and then extruded them to the correct height.

After the mesh was complete I applied materials to the model to differentiate between each component of the model. The yellow represents the metal canister whilst the high gloss plastic colour is representative of the lid and lower rim.

I am pleased with the accuracy of the 3D model as measurements are very precise although at this stage of the rendering it adopts a cartoon style and appearance.

I took photographs of the deodorant canister from multiple sides and then loaded them onto the computer. Using a graphics package called macromedia fireworks I imported all the photographs and cropped them. Then I combined them all into one image and scaled them in to proportion so that they were relative. Following this I then tried to stitch the images together subtly using the smudge tool and airbrush to hide the joins. This proved difficult as the images have cylindrical lighting and distortion. I did this to a reasonable standard as it was only to aid representation. This image file was going to be used for my texture that would be wrapped around the 3D mesh of the canister in solid works. After this I opened the canister model in solid works and in the tools menu went into add-ins and selected photo works. This loaded the add-on and I then applied a decal material texture to the mesh but browsed for my texture file. I then scaled it and positioned the texture in the correct orientation. This wrapped the deodorant canister texture from my photos and created the labels and graphical information.

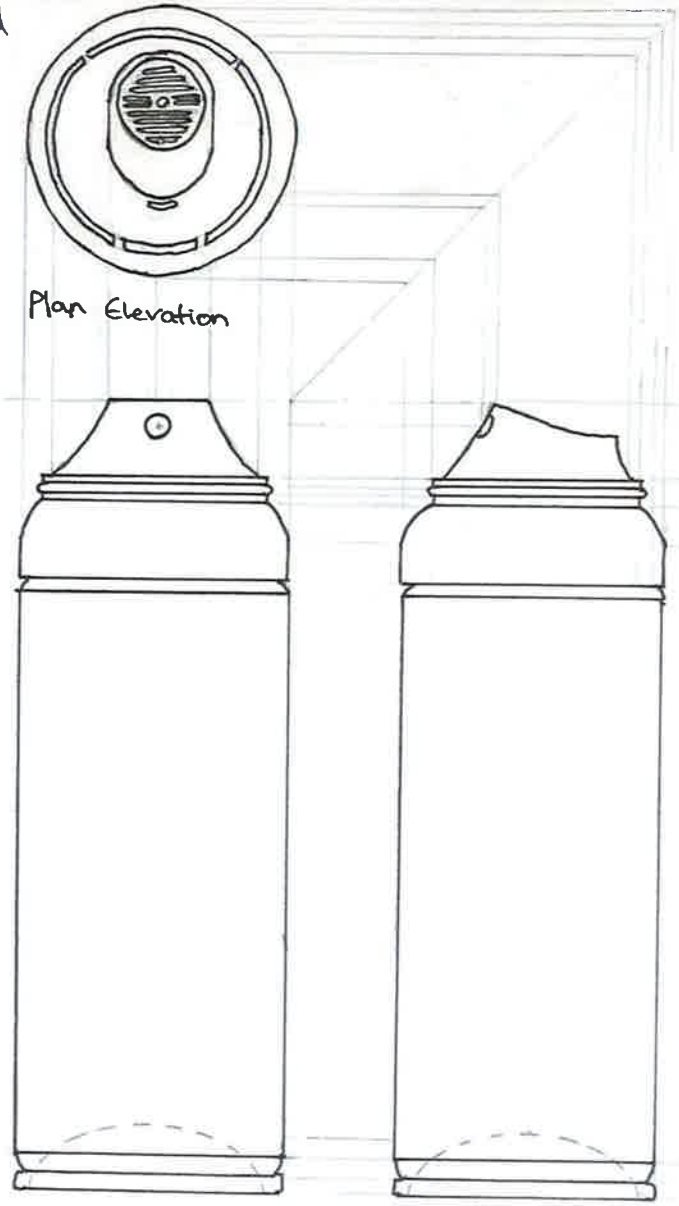
Deodorant canister

Final Render (front/back)

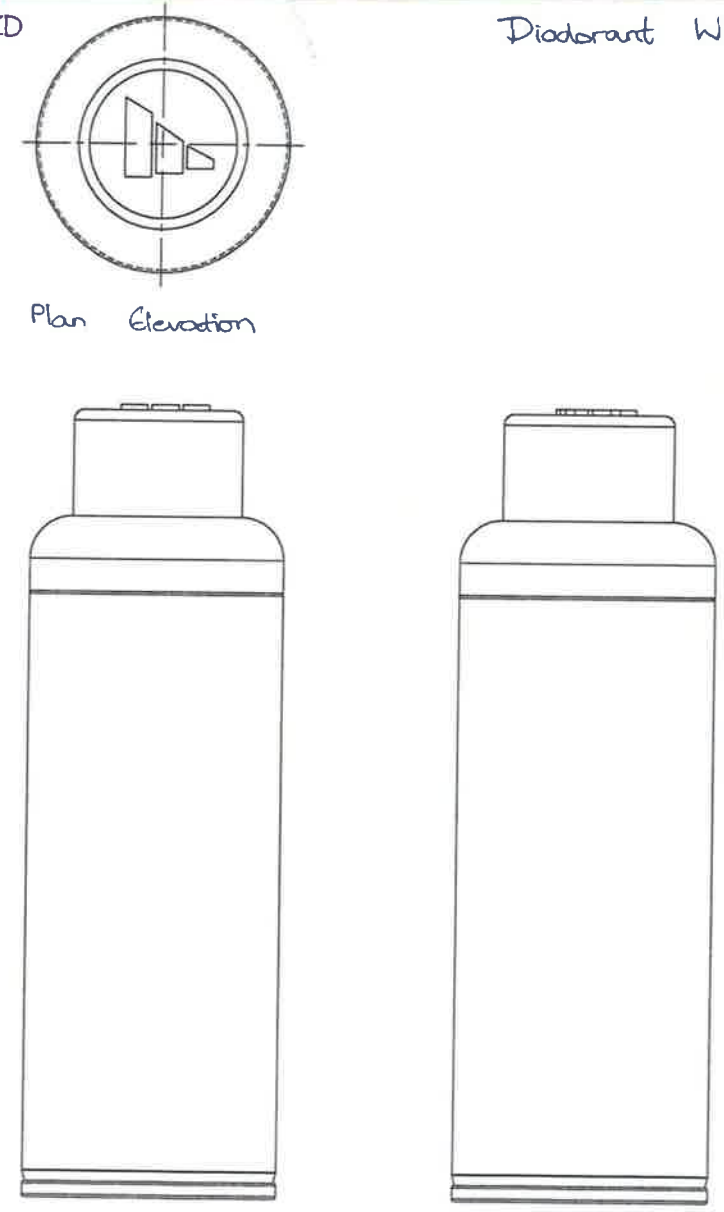
I then rendered the model with the applied texture to create the following outcome. The result is a high quality realistic illustration of the Adidas deodorant canister. I am very pleased with the glossy appearance of the metallic finish and accuracy of the images. This final rendering using textures has a high detail look and provides a stronger representational aid than the initial coloured stage*.

GRAPHICAL STUDY - ORTHOGRAPHIC DRAWINGS

By Hand - Without Lid



CAD Diodorant With Lid



3rd Angle Projection of Diodorant canister

TECHNICAL SPECIFICATION

Component	Form	Function	User Requirements	Performance Requirements
Outer Packaging	The box is rectangular to reduce transportation costs as they tessellate together effectively when stacked. This means they occupy efficient palette space per unit. The style of the packaging is luxurious and elite which is enforced by the gold and black colour scheme. This has been done to reflect on the products high quality and make it look very high-class. This suitably presents the product and advertises it attractively.	The purpose of the packaging is to advertise the product and inform the user of relevant product information. This includes the brand name, logo, ingredients, and barcode. The packaging must grab the customer's attention in the store and make them interested in the product. It must also be able to protect the contents from taking sufficient damage when transported from being dropped/knocked accidently.	The graphical layout and high quality of the materials used for the packaging make it attractive to the potential users. The gold and black colours make it desirable for the target audience as it reinforces high value and extravagance. The box must be a convenient size and feel comfortable to carry. Also it is necessary to be a reasonable price for the customer to purchase otherwise it could discourage attention.	The packaging requires bold attractive colours and an eye-catching graphical appearance for it to advertise the product successfully and grab the customer's attention. It needs to make it stand out from other similar products and display the contents in an appealing manner. The product information must present its certificates to assure it conforms to European standards. The material used needs to be sturdy enough to keeps the box's shape and cushion it from potential damage.
Vacuum Formed Tray	The black tray has been vacuum formed into the correct shape of the deodorant and shower gel, to securely contain them within. There are ridges on the underneath with large airspaces to cushion any damage sustained. The tray has a smart style due to the clean black colour and concise, accurate shape. This is to ensure it looks clean and adequate, to match the rest of the products high standards.	The vacuum formed tray must not only protect the deodorant and shower gel from damage but attractively present them in an organised arrangement. This keeps them secured into place and prevents them from coming loose within the box during transportation. This is vital because presentation plays a large part in how a customer views the product. The tray must also not distract attention from the products and this is achieved by using a contrasting dark colour.	The vacuum formed tray is attractive to the user because it is flexible and has a defined lip around the edge, which makes it easier to slide the whole tray in and out of the box. This is an added convenience which saves time and effort when using, which is a positive experience for the customer. It is also attractive as it neatly displays the products and provides a reliable, tough resistance to everyday damage.	The vacuum formed tray must cushion the shower gel and deodorant by padding them away from the interior packaging walls so that they don't sustain damage when dropped or bashed. The contents should be evenly distributed throughout the space so that they don't rub together. Also the tray must spread the products apart to make the pack look bigger than it actually is.
Deodorant	The deodorant is a smooth cylindrical profile with a curved cap and nozzle area. This has been done to achieve a slick finish and ensure the curved nozzle mount fits the users hand comfortably when in use. The shiny golden metallic finish defines the products clean and pristine style, which is appealing to the target audience. This provides a good appearance which presents the product attractively.	The function of the deodorant is to keep the pressure of the canister within and prevent the chemicals from leaking into the environment. It must be able to do this for its entire shelf life to certify that it is a reliable quality. The nozzle must release the gas at a high velocity when pushed to disperse the fragrance. And the actual content needs to smell attractive and pleasant to appeal to the sporty target market.	The deodorant is appealing to the target audience because it conveys the high quality appearance due to the shiny metallic golden surface. It is extremely relevant to their needs because it is aimed at sporty people, who need deodorant after exercise. It is a suitable size and comfortable to use. Another feature such as the removable lid adds desirability as it prevents dirt from coming in contact with the nozzle, when not being used.	For the deodorant canister to keep the high pressure within it must be made of a strong, cheap and reliable material. This is to ensure it protects the product form everyday wear and tear and also when stored for long periods of time. For the nozzle to release the gas at a high velocity the nozzle hole has to be the right size. The actual deodorant needs to mask body odour as it is aimed at people who are very athletic.
Shower Gel	The shower gel is a smoothly curved shape which resembles the appearance of a hands clench. This has been made to feel comfortable and secure when held. The shape is also very unique and individual style to the product, which makes it stand out from other competing brands. The bumpy textured surface located on the sides of the container ensures there is a superior grip, which is crucial in wet conditions.	The shower gel needs to restrict the liquid from escaping the container and release it when required. It must be easy to use and handle in a wet environment and be waterproof to avoid it leaking or being diluted by the water. When applied it should clean the user's body and smell attractive over a long period of time. This is necessary for quality assurance to make certain the product performs correctly.	The most attractive quality of the shower gel for the potential user is its unique shape that makes it stand out from other brands. Its interesting form and textured surface gives it an unusual profile and the curves appeal to sporty individuals because it's modern and more exciting than a conventional shape. The hinged lid design means it's quicker to remove and less awkward as apposed to a traditional screwed one.	The shower gel has been ergonomically designed to ensure it fits in the human hand comfortably. The nozzle is a one way rubber seal which ensures the liquid only comes out when pushed; this prevents it from leaking when upside down. Also the grip has been tested to ensure it is sufficient in wet conditions. The chemicals used for the Shower Gel have to be safe and comply with European standards.

PERFORMANCE ANALYSIS - TECHNICAL SPECIFICATION

Component	Materials and Component Requirements	Scale of Production and Cost
Outer Packaging	The material used for the outer packaging is folding boxboard because it is strong so that it provides reasonable protection to the internal products contained. This type of carton board can be scored, bent and creased easily which is required for the assembly of the net. Folding boxboard can also be embossed, laminated and spot varnished. These components are necessary to make key areas of the packaging stand out to the viewer and give the product a high quality appearance.	The nets for the outer packaging would require large-batch or mass production so that the promotional pack can be altered to suit the current market. In this scale of production the nets are produces using die cutting, once setup this process is fast and very efficient. The nets are folded and glued in a highly automated gluing line to enable fast production time and lower labour costs. This makes the individual cost of the packaging lower as they can be produced in high volumes to gain more gross profit.
Vacuum Formed Tray	The material used is polystyrene because it has a high impact strength, which is required to prevent damage being sustained to the shower gel and deodorant. Polystyrene can be easily moulded when vacuum formed which is essential so that it can be shaped to secure the products in place. It is available in a range of colours, although black has been used to give a modern and high quality feel to the product. Rigged air space segments are used to protect the products from being bashed or dropped.	The tray is produced using vacuum forming which is ideal for large-batch and mass production, in order to produce enough of them to meet customer demand. Multi moulds are used to create a small batch in each forming. The tray is cheap and light weight which reduces the overall price of producing the pack, as the transportation costs are lower due to the decreased total net weight of the promotional pack. This means it can be sold for a more appealing price and makes it more suitable for disposable packaging.
Deodorant	The materials used for the canister is tinplate because it is very strong, rigid and has high impact resistance which is required to maintain the high internal pressure and prevent it from escaping when knocked or bashed. The actuator component must dispense the gas at an even rate and disperse when the valve is open. The lid and top half of the body have been made from polypropylene as it is very strong and rigid. Both materials have high chemical resistance to protect them from corrosion/decay.	The canister is produced by crimping multiple sheets of shaped tinplate which is done on a highly automated production line. The top half and lid is produced using injection moulding. Both of these are done on a continuous scale of production because the Adidas deodorant is sold separately and needs to be constantly produced to meet customer demand. Production costs such as labour have been kept as low as possible so that the product provides value for money.
Shower Gel	The shower gel body, cap and top half have been made from polypropylene as it is tough, has strong impact resistance and can be easily moulded. It has excellent chemical resistance which is required to prevent the chemicals from corroding the bottle. This material has also been used because it can be coloured using granules. Black and gold have been used correspond to the rest of the packs colour scheme and present a high quality luxurious product.	The body is produced using blow moulding, whilst the top half and cap is produced using injection moulding, both suitable for continuous production. This is because the Adidas product is also sold separately so it needs to be created 24/7 to meet everyday mass market demand. This scale of production is highly automated and uses machinery that can run continuously for long periods of time with only breaks for routine maintenance, reducing production time.

Adidas – Victory League Shower-gel and Deodorant Set

Ben Sherman – Great British Grooming Gear

PERFORMANCE ANALYSIS - PRODUCT COMPARISON

Form

Ben Sherman has always been closely linked to British music and fashion. This has been communicated through the styling of the products and packaging as the colour scheme involves the use of red, white and blue which relate to the GB flag. The RAF roundel logo has been used as it is an iconic symbol of Great Britain's identity, which was frequently used in British pop culture. These design considerations have been made to make the pack appeal to a young target audience that are at the forefront of style. The product's style gives it a high quality appearance and makes it stand out through the use of bold contrasting colours. The Ben Sherman 'Grooming gear' pack is very different from the Adidas 'victory league' set due to the dissimilar colour schemes and styles, which have been adapted for their contrasting target audiences. The Ben Sherman pack is focused on fashion whilst the Adidas has been developed to correspond with sport and fitness. However I think that the Ben Sherman products portray a higher quality as the materials and styling has been adapter for a higher price tag.

Function

The Ben Sherman gift set's purpose is to advertise the products attractively and interest potential customers. The transparent window on the front does this by presenting the pack's contents in an interesting way to grab the buyer's eye and catch their attention. The packaging is much stronger and thicker than the Adidas one which not only protects it more sufficiently, but portrays a higher quality. This decision has also been considered so that the box can support the transparent window and withstand the weight of the top lid on the rotating pivot. The shower gel must restrict the liquid from escaping the container and also provide a firm grip in wet conditions, whilst the socks should fit a range of sizes from the target audience and be a reasonable strength to cope with the wear and tear of everyday use. Both the brand's products have been adapter for different functions to satisfy the target audience. The Ben Sherman pack includes socks as the brand is focused on style and clothing, whilst Adidas includes deodorant to appeal to a sporty and active lifestyle.

User Requirements

The Ben Sherman packaging has a pivoting hinge lid which has been used because it is a unique selling feature which is desirable for the target market as it is fashionable. The pins have been made from metal which displays a higher quality appearance and more luxurious function. When unfolding the box it makes the products inside look more important and glamorous, as it is similar to how a treasure chest opens. This makes the box look less like packaging and more expensive, unlike the Adidas box which is flimsy and opens conventionally using folding tabs. The shower gel is a different shape from the Adidas bottle design as it comes in a squeezy tube. This is a user requirement because it is more stylish and sleek design which is attractive to the target audience. The material used has also got a smooth and high gloss surface, which corresponds to a higher quality. The socks have been embroidered with the Ben Sherman logo and are cotton rich, which gives them a soft, silky feel which is luxurious and comfortable. These features make the products attractive to the user and meet their standard requirements.

Performance Requirements

The packaging must perform to a high standard by being reliable and consistent. It should hold its structure and not flex or warp under the weight of the products inside. Also the pins that are used for the pivoting hinge should perform adequately and not get jammed or stiff when used over a long period of time. The packaging contains bold colours and attractive graphics which make it perform by standing out and grabbing the potential buyer's eye. The shower gel has to dispense the liquid when squeezed and prevent it from coming out unintentionally. This means the seal shouldn't allow it to leak easily or allow water to get within the container whilst being used. Technical considerations have been made to prevent this by using an air tight and one-way valve. The socks should perform to a reasonable standard and last a suitable lifetime for them to be of a satisfactory standard. When comparing the Ben Sherman and Adidas products they both have to perform to equally high standards to satisfy the customer and be reliable over their entire lifespan.

Material and Components Requirements

The outer packaging of the Ben Sherman pack is thicker and more rigid than the Adidas box which suggests the material used is solid bleached board. This has been used because it has a high quality printing surface and can be laminated to give it a high glossy protective finish. This material has also been used as it has high dimensional stability and excellent compression strength which is required to minimize damage sustained when transported or stacked. The shower gel tube has been made from polyvinyl chloride because it has good chemical resistance so that it doesn't corrode. It has a good abrasive resistance and is tough which is ideal as it will be used daily. Also the tube must be flexible, which PVC can be, so that it can be easily squeezed to dispense the liquid contents. When comparing the Ben Sherman and Adidas products it is clear that they have been produced to satisfy different retail prices, as the Ben Sherman pack utilises stronger high quality materials which improve its extravagant style and high quality appearance.

Scale of Production and Cost

Equally the Ben Sherman nets will have been produced the same way as the Adidas ones, utilising large-batch or mass production for the outer packaging so that the promotional pack can be altered to suit the current market. This is important so that it can be modified quickly to contend with competing merchandise and be a leading product. Ben Sherman sells a huge variety of socks separately in many different designs. This shows that the scale of manufacturing is continuous production to generate a constant supply to meet with customer demand. They should be able to switch between different designs though to create a range of unique products, which can be adapted for different purposes like this pack. The Ben Sherman pack has been designed in mind for a middle price range as it presents high quality through the use of luxurious materials. The main reason its price is higher than the Adidas' one is due to the designer label/brand name which communicates style and fashion. This means it has to be expensive enough to look upper class and privileged, but still be affordable to a wide range of people.

MATERIALS AND COMPONENTS

Exterior Packaging Materials

Carton boards are commonly used in the retail packaging industry because they offer specific properties that are required. In this product's outer packaging folding boxboard has been used because it has high dimensional stability and reasonable compression strength. These properties are required for the packaging to protect the products contained and prevent damage. This material has an excellent high quality printing surface which is suitable for offset lithography, which offers affordable high speed printing. It is also suitable for cutting, creasing and gluing using high speed automated packaging equipment that can run continuously for long periods of time with only breaks for routine maintenance, reducing production time.

Other advantages of using folding boxboard include:

- Can be easily embossed, laminated and spot varnished
- Good protection once packaging net is constructed
- Smooth surface offering high quality glossy finish
- Excellent surface strength
- Relatively inexpensive to produce and process
- Can be recycled.

Alternatively the packaging could have been made from solid bleached board which has high tear resistance and very strong and rigid properties. It also has an excellent printing surface and high whiteness, which give it a sophisticated and high quality image. Other useful properties of using solid bleached board include:

- Can be easily embossed, laminated and spot varnished
- High tensile strength
- Relatively high tear resistance
- High dimensional stability
- Excellent compression strength
- Can be recycled.

When comparing the two materials folding boxboard is the preferred choice for use in the manufacturing of the exterior packaging over the solid bleached board for the following reasons:

- Both materials have good compression strength which is required when stacking the boxes on top of each other when in storage, transportation or being displayed in the store although solid bleached board is stronger than is required.
- Both materials have an excellent smooth surface and finish although the folding boxboard is less expensive and more suitable for use in disposable packaging.

The folding box board material has been made from the raw material wood. If the harvesting of this is not sustainable then less CO2 can be absorbed because of the lower population of trees. This increase in C02 would contribute to green house gas effect. Also the transportation of these resources to the consumer uses depleting fossil fuels which contribute to greenhouse gasses. If the carton board is recycled then the material can be eventually turned into wood pulp which can be used to make paper and board. Otherwise it will be buried in a landfill site where it will litter the country side and environment until it degrades. The printing inks used are oil based which is a depleting resource, water based inks should be used instead.

Vacuum-formed Tray Materials

The material used in the manufacturing of the vacuum formed tray is high impact polystyrene (HIPS) because it has high impact strength which is required to cushion any impacting damage during its lifetime and to protect the products held in place. The quality of this material is ideal for its purpose as it has a smooth and shiny attractive surface which corresponds with the other products in terms of quality and appearance. This material is a thermoplastic which enables it to be easily shaped during vacuum forming when it is heated. This offers high volume manufacture at an affordable price due to the inexpensive cost of this material.

Other advantages of using high impact polystyrene (HIPS):

- Comes in a variety of different colours
- Stronger than normal polystyrene
- Good dimensional stability
- Excellent aesthetic qualities
- Can be easily shaped to fit a mould when vacuum formed
- Very inexpensive cost
- Light weight which reduces transportation costs
- Recyclable

There are some disadvantages of this material which include:

- Has poor chemical and odour resistance
- It is susceptible to UV degradation (will fade in sunlight)
- Offers a poor barrier against moisture vapour.

A suitable alternative material for the vacuum formed tray could be polypropylene which has the following useful properties:

- Recyclable
- Very strong and rigid
- Excellent chemical resistance in case shower gel leaks
- Can be Versatile
- High impact strength

When comparing the two materials polystyrene is the preferred choice for use in the manufacturing of the vacuum formed tray over the polypropylene for the following reasons:

- Both materials have good impact strength although polypropylene is stronger than is required.
- Both materials have a good smooth surface but polystyrene is lighter and less expensive making it more suitable for disposable packaging.

High impact polystyrene is created using oil which is a depleting resource which is not sustainable. If this is recycled then the material can be processed into fuels such as diesel or new products made using oil. If the polystyrene was not recycled then it takes up large volumes of storage space and would take hundreds of years to degrade in a landfill site which would pollute the environment. Also the running costs of disposal lorries are very high and they use fossil fuels to operate which contribute to green house gasses.

MATERIALS AND COMPONENTS

Deodorant Canister Materials

The material used in the manufacturing of the deodorant canister is tinplate (steel with a layer of tin). This material has been used because it is corrosion resistant which prevents it from reacting with the chemical fragrance inside. Tinplate can be formed into interesting and complex shapes using rolling, crimping, welding and embossing/de-bossing. These processes which can be applied can give it a unique appearance and make key areas of the canister stand out to the user. Tinplate is light weight which is necessary for it to be a comfortable weight to hold and which lowers the cost of transportation. It is strong enough to contain the inner pressure and has a high impact strength which allows it to sustain reasonable everyday damage. It is also odourless and impermeable which gives it high quality functionality as it won't contaminate or have a contrasting odour from the fragrance of the deodorant.

Other advantages of using tinplate include:

- Very strong and rigid
- High quality surface finish
- Can maintain internal pressure
- Cheap, inexpensive cost
- Tinplate is an eco-friendly material which is fully biodegradable
- It can be recyclable infinite times without changing its properties

A suitable alternative material for the deodorant canister could be aluminum which has the following properties:

- Light weight
- Very good impact resistance
- Very strong and rigid structure
- Strong in compression and tension
- Easily recyclable
- Coloured using anodising or painting
- Non-ferrous metal – cannot rust

When comparing the two materials tinplate is the preferred choice for use in the manufacturing of the deodorant canister over the aluminium because:

- The aerosol canister must withstand the internal pressure and contain the chemicals within over its entire lifespan. It must be strong enough to endure transportation and also cope with everyday use. Tinplate combines the strength and formability of steel and the corrosion resistance and good appearance of tin. This makes it a stronger and more reliable material to use than aluminium.
- Tinplate is cheaper than aluminium and would lower the overall cost of manufacturing the canister.

Tinplate production improvements have reduced the consumption of energy required by nearly half than it was 15 years ago. This makes it more environmentally sustainable as less energy is required to produce it. This energy ultimately comes from the combustion of finite fossil fuels that contribute to the green house gas effect. Its magnetic properties make it the easiest material to collect and sort for recycling. A quarter of the metal used in steel-making furnaces is scrap steel which reduces demands on natural resources. Because it is entirely degradable and eco-friendly it does not cause any environmental imbalance.

Shower-gel Bottle Materials

Polypropylene has been used for the shower gel bottle because it's tough and flexible which makes it strong but also squeezable in order to dispense the liquid. It is also versatile and can be very strong as it can resist stress cracking and retains stiffness which makes it a high quality and good functional material. It has low moisture absorption which is ideal for use in a wet environment (shower) and can be ultra sonically sealed. It has been used because it has excellent chemical resistance which is required so that it isn't corroded by the shower gel chemicals contained within. It is also resistant to staining which prevents it from being discoloured or visually spoiled. Also polypropylene has good resistance to fatigue which makes it ideal for use on the hinge as it is durable and reliable. It is also recyclable which reduces its impact on the environment.

Some negative features of polypropylene include its susceptibility to cracking when manufacturers add a high amount of colour during the cooling process, this is due to its reduced impact resistance. Its chemical resistance makes it difficult to decorate due to its reduced bonding with paint, labels and ink. The polymer can cause moulding issues if it is oxidized at high temperatures.

An alternative material that could have been used is high density polyethylene which has similar properties but is stronger than required and more expensive than polypropylene.

Aerosol Spray Components

An actuator has been used for the aerosol spray mechanism which has the following advantages:

- It is pressurised by stored gas rather than by a hand-operated atomiser pump
- Only dispenses when the container's valve is opened
- Dispenses the mist at high speed
- A technique which doesn't just use compressed gas eliminates dangerously high pressure
- The shape and size of the nozzle in the actuator can control the spread of the aerosol spray
- Chlorofluorocarbons are no longer used because of its effects on the Earths' ozone layer

There are some disadvantages of this component which include:

- Has health risks due to inhalation of dangerous particles into the respiratory tracts
- Can be used for deliberate inhalation of the contents which is life threatening
- Volatile hydrocarbons that are flammable are used instead of CFC's

A possible alternative to an actuator is an atomiser system that can dispense an amount of deodorant when a button is pressed. However this would be ineffective as it utilises a hand operated pump and would make using the deodorant very awkward and uncomfortable for the user compared to using a gas stored actuator.

Aerosols do not contain Chlorofluorocarbons (CFC's) anymore as they contributed to global warming because when released into the atmosphere they contributed to weakening of the ozone layer. Now propellants such as hydrocarbons and compressed gases like nitrous oxide are used that do not deplete the ozone layer. Although these hydrocarbons and compressed gases still contribute to global warming. Also they emit volatile organic compounds which have a negative effect on the environment.

MANUFACTURE

Component: High gloss image surfaces
Manufacture: Spot UV Varnishing

Advantages:
- Highlights and draws attention to chosen areas of the design due to contrasting surface texture
- Gives a high quality appearance and makes printed graphics more vivid and contain stronger definition.
- Ideal for mass production – the UV coating dries almost instantly when exposed to Ultra Violet light.

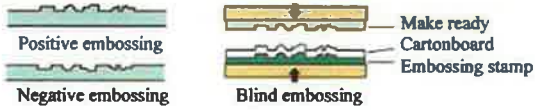
Disadvantages:
- Expensive cost making it preferred for high end magazines, catalogues and books
- Not as protective as gloss lamination.

Possible Alternative:
- Gloss lamination could be used instead but would cover the whole area of the material, not specific chosen spots.

Environmental Impacts:
- UV coating contain no volatile components that contribute to pollution as they can be produced up to 100% solid.

Outer Packaging

Component: Positively raised logo
Manufacture: Embossing



Advantages:
- Creates a high quality and sophisticated appearance by raising the material from the surface to give varying depth. This adds to visual interest.
- Ideal for mass production – converted letterpresses are used in commercial printing which enables high speed production.

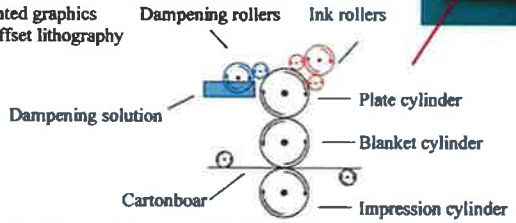
Disadvantages:
- This process is very expensive and costs as much as the printing, as a result doubling the doubling the cost to produce the products.

Possible Alternative:
- Thermography can be used to generate a raised printing surface similar in appearance to engraving by adding powder to the printing ink and heating it.

Environmental Impacts:
- Embossing has little or no environmental impact as additional products, such as ink, coating, or foil is not added to the material.

Packaging Tray

Component: Printed graphics
Manufacture: Offset lithography



Advantages:
- Produces reliable high quality image printing that is sharp and has strong clarity.
- The printing plates have a long lifetime as they do not come in contact with the printing surface.
- Lower cost in high volumes and fast printing speeds which makes it ideal for mass production.

Disadvantages:
- Inferior image quality compared to gravure and digital printing.

Possible Alternative:
- Digital printing could be used because it offers high image quality printing without the need of printing plates, but is only suitable for short production runs.
- Gravure is also suitable because it is a high speed printing process and has excellent results on lower quality paper.

Environmental Impacts:
- The printing inks are made from oil which is a finite resource and is not sustainable.

Component: Outer packaging net
Material: Folding boxboard board
Manufacture: Die cutting and folding

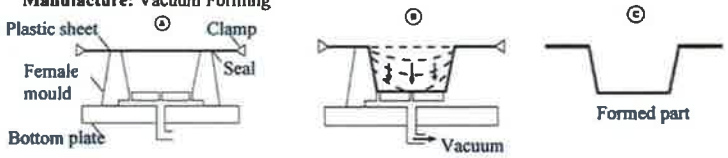
Advantages:
- The die cutting process enables high speed combination of cutting and creasing by pressing the carton board upwards against the die form.
- Ideal for mass production – the nets are folded and glued in a highly automated gluing line to enable fast production time and lower labour costs.

Disadvantages:
- The die forms require very skilled handcrafting to produce which makes the initial setup costs very high.

Possible Alternative:
- Laser cutting could be used as it flexible so that the design can be modified, offers very accurate and precise cutting, has no wear and tear of tools because of lack of contact and can cut down the waste produced by half.

Environmental Impacts:
- When constructing the box gluing maybe required. Heat glue will have been used which requires a lot of energy to heat it to the correct temperature in mass production.

Component: Packaging tray
Manufacture: Vacuum Forming



Advantages:
- Ideal for batch production – inexpensive cost to setup and produce.
- Easy to make moulds that can be modified.
- Multi moulds are used to create a small batch in each forming. This enables multiple trays to be produced at the same time to meet customer demand.

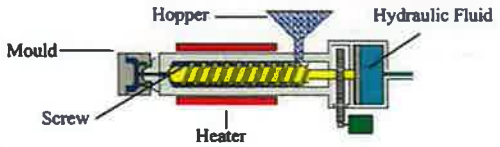
Disadvantages:
- The moulds must be accurate to prevent webbing from occurring which deforms the tray's shape.
- The process produces large amounts of waste material.

Possible Alternative:
- Injection moulding could be used although the initial setup costs are high as the mould is expensive to develop and produce.

Environmental Impacts:
- The heating of the polymers requires lots of energy. Also the waste material being produced from this process is large and the materials are mostly non biodegradable although they can be recycled.

MANUFACTURE

Component: Deodorant and shower gel lids and upper halves
Manufacture: Injection moulding



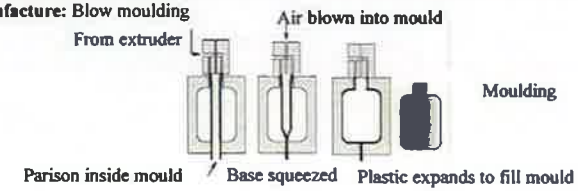
Advantages:
- Ideal for mass production – the unit cost is considerably lower for each moulding in high volumes.
- Precision moulding for the screw thread which allows the top half to screw firmly onto the bottle.

Disadvantages:
- Not economically viable for short production runs due to the high cost of running the machinery.
- Setup costs are very expensive to make the moulds.

Possible Alternative:
- Blow moulding could have been used however the screw thread would need to be replaced with a snap on closure.

Environmental Impacts:
- Lots of energy is used because it requires heating polymers however very little waste is produced.

Component: Shower gel bottle
Manufacture: Blow moulding



Advantages:
- Complex bottle shapes can be easily formed to create visual interest and make the product have a unique appearance.
- Weight and material costs are kept to a minimum due to the hollow bottle shape which has thin walls.
- Ideal for mass production – there is a low unit cost for each moulding.

Disadvantages:
- The wall thickness of the bottle is hard to control.
- This process can only produce hollow parts and there is a visible seam where the two halves have been joined.

Possible Alternative:
- There are no suitable alternative manufacturing processes to blow moulding because it is the most efficient and effective at producing polymer bottles.

Environmental Impacts:
- Lots of energy is used because it requires heating polymers however very little waste is produced.

Component: Deodorant canister printed graphics
Manufacture: Silk-screen printing

Advantages:
- This print processes can print on stocks of any shape, thickness and size making it flexible and versatile.
- Ideal for mass production – fully automated methods are available that are able to produce large volumes at lower costs.
- Matt and gloss treatments can be applied for visual appeal and a high quality finish.

Disadvantages:
- The print takes along time to dry which increases production time.
- Difficult to gain fine detail unless using photographic screens.

Possible Alternative:
- PVC shrink wrap could have been used and then printed on using flexography although it would not portray high quality and would have an inferior surface.

Environmental Impacts:
- Solvent based printing inks have been used which produce volatile organic compounds that contribute to pollution. Vegetable based printing inks could be used instead to minimise the impact on the environment.

Component: Deodorant canister body
Manufacture: Crimping and welding

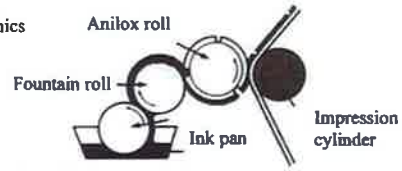
Advantages:
- Crimping and welding the tinplate body for the deodorant makes it strong enough and suitable for containing high pressure which keeps a gas-tight seal.
- Ideal for mass production – extremely fast production speeds. A can-making production line can produce up to 2400 cans per minute.

Disadvantages:
- The process is very complex and requires very specified machinery that can roll, crimp and weld the canister which makes the initial setup costs very high.

Possible Alternative:
- Crimping and welding are the only suitable processes for making canisters and there are no suitable alternative manufacturing processes because they must be made gas-tight and to cope under strong pressure.

Environmental Impacts:
- Lots of energy is used because it requires heating the metal to a high temperature so that it crimps easily into the mould shape and is manufactured under high pressure.

Component: Shower gel printed graphics
Material: PVC label
Manufacture: Flexography



Advantages:
- Ideal for mass or continuous production – high speed printing process.
- High quality printing is produced due to the fast drying ink that's used.
- Inexpensive to setup making production costs lower.

Disadvantages:
- There is an lack of industrial standards which means the quality of a press varies from machine to machine
- High costs when produced in short production runs.

Possible Alternative:
- Gravure printing could be used although it is more expensive and less suitable for this purpose.
- Digital UV flatbed printing could also have been used although it is only suitable for short production runs.

Environmental Impacts:
- Solvent based printing inks have been used which produce volatile organic compounds that contribute to pollution. Vegetable based printing inks could be used instead to minimise the impact on the environment.

QUALITY

Quality Control:

The products and components within this Adidas victory league pack have been inspected by sampling and examining them to check that they are within a specified tolerance. This is required to make certain that they are produced accurately and to an acceptable degree in order to function correctly in accordance with its specification. Quality control involves checks that achieve quality assurance by the means of the manufacturer inspecting and testing products produced to ensure they are reliable and of a high quality.

The three main levels of inspection are:

- **100% inspection** - every unit is inspected and checked to guarantee 100% quality assurance.
- **Normal inspection** – the most common sampling plan where in a large production run a sample of say every 1000th unit is checked
- **Reduced inspection** – used in smaller production runs than those in normal inspection where the quality produced is of a lower standard as an economy measure. This maybe used on continuous productions where the machinery runs 24/7 and only needs to be visually checked routinely by an operator.

Outer Packaging:

Printer marks are used during the print run to ensure quality control. Colour bars are used which provide critical information about the printing press and inks. Some tests include visual inspection by the operator or electronically using a densitometer reader. This monitors the density of the inks printed on the colour bar to ensure it is a consistent quality throughout the printing process of the outer packaging. Registration marks are required to align the four process colours (CMYK) that form the full colour image. During offset lithography all four printing plates must be lined up accurately with each other otherwise blurring can be caused which creates a low quality appearance. The inspection of the fully printed image could reveal unwanted solid colour surrounded by an unprinted halo area. This is caused by dirt, paper debris or ink skin on the printing plate/blanket cylinders. Regular washing of the blanket cylinders will prevent this from occurring. All of the checks for the offset lithography would be carried out at a normal inspection level, where samples of the products are tested against the original to ensure quality and consistency. The fully constructed packaging would be checked using 100% inspection before they leave the factory to ensure that every package includes all the components. Otherwise this would be extremely poor quality assurance if customers bought the Adidas victory league set and found that the shower gel for example was missing.

Deodorant Canister:

The finished deodorant canister would be passed through a light tester at the final stage of production which automatically rejects any cans with pinholes or fractures. This check ensures no low quality products are dispatched and sold to the customers which forms a quality assurance. Computer analysis using laser scanning systems could be utilized on a normal inspection level to determine the size and measurements of samples of canisters, and used to create a 3D model of the products to check its accuracy. Also at a normal inspection level some cans will under go tests to determine that they contain the correct amount of liquid against an agreed tolerance. If they do not then they will not be used which ensures that those sold contain a reliable amount of liquid within. Non destructive tests will have taken place within a controlled laboratory such as compressing the finished product until it shows signs of failing, i.e. cracking to determine how much force is required to deform it. Destructive tests such as monitoring the temperature, pressure or impacting force needed to destroy the product is valuable for collecting research data. This information is important to simulate possible environments that could affect the product and make certain that it is reliable and safe to use in everyday circumstances. These tests will have been carried out accordingly with all the products in the Adidas Victory league pack to ensure they meet the criteria in its specification and form a quality assurance.

Shower Gel:

The polypropylene entering the factory would be checked against manufacturing specifications to ensure the correct grade and colour of the material is being used. If this was not checked then they would be of a low quality as they could all be slightly different shades of colour when displayed on a shelf which would cause inconsistency. A sample of the products maybe tested to analyze how thick the bottle's walls are; else they could be too thin and brittle. The moulds would be visually inspected in intervals to check there is no dirt that could affect the quality of the products produced. Otherwise lots of the products could be defective which would waste a lot of money and resources. Computer analysis could be used as it is more efficient at concluding very small imperfections and faults. This would mean having to take the mould of the machine and substituting it which slows down production speeds. Sampling and testing of the two halves of blow moulded casings which form the bottle would be carried out to ensure they join together accurately and that the excess is trimmed effectively to give a smooth high quality surface. As well as this the assembly would be tested to make certain that the finished injection moulded top snaps correctly onto the blow moulded bottle body. Just like the deodorant can the manufacturer would use normal inspection to check that the bottles have the correct quantity of liquid inside, to ensure a reliable amount of shower gel is dispatched to the customer.

Vacuum-formed tray:

The high impact polystyrene (HIPS) entering the factory would be monitored to make sure it was the correct grade of colour and was of an agreed tolerance. The moulds used in the vacuum forming process maybe checked routinely to ensure they have no defects or dirt on them which could affect the quality and appearance of the finished product. Samples of the finished tray would be checked at a reduced inspection level as an economy measure as the trays are inexpensive and disposable. This would most likely be done by an operator and visually checked to measure the thickness of the plastic to ensure it wasn't too thin or to detect areas of weakness. The tray may also be checked at a reduced inspection level to determine whether it provides a firm hold on the products so that they don't come loose in the pack. Destructive testing would be vital in finding information about the vacuum formed tray to ensure it performs and functions to a reasonable quality. The manufacturer may check the affects of colour degradation on the product caused by sunlight. This would be simulated in a controlled environment using UV lights to mimic the possible conditions and gather useful information. Other tests may include testing the temperature that the tray warps or deforms at or the impacting force that it can sustain from dropping, to determine its limitations and make sure it will reliably cope under everyday situations.

QUALITY

Quality Assurance System:

To ensure that the end product (Adidas Victory League pack) fulfils all of its requirements for quality a quality assurance system is used. This is used by the manufacturer to check the quality of products throughout its design and development stage, manufacturing, end use and grade of customer satisfaction.

Preparation:

- The raw materials and components that the manufacturer buys in such as the tinplate for the deodorant canister and the polypropylene for the shower gel bottle etc… would all be sourced from reputable suppliers along with routine checks that would be made on batches of orders to determine and ensure reliable quality.
- Components such as the actuator for the aerosol or the shower gel liquid would be sourced from proficient companies that would meet Adidas's tolerances for its manufacture.

Processing:

- Quality control checks would be carried out during the manufacture of the products such as the blow moulding of the shower gel bottle.
- Quality control checks for the offset lithography printing would be used on the cartonboard packaging printed graphics.
- Sampling and inspection of batches of the components and products to ensure an agreed tolerance.

Assembly:

- Sampling and testing of sub assemblies such as the joining of the blow moulded split bottle and snapping together of deodorant components.
- Determining of the final assemblies to ensure 100% of the Adidas Victory League packs contain all of the products.

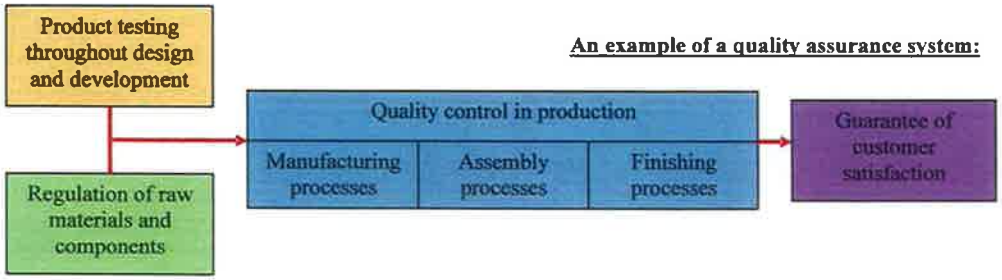
Finishing:

- Collating the final assembled Adidas Victory League packs into pallets and checking the quantities for dispatch.

Customer Satisfaction:

- Guarantee of customer satisfaction and support with after sales ensures that the Adidas Victory League pack and its contents will function under normal conditions.

An example of a quality assurance system:



Quality Standards:

The quality of manufacturing the materials, component and products has been influenced by main relevant external formal standards. If an organisation is accredited with these standards then it ensures the customer that they will receive a certain level of quality from the product and service. This has a number of benefits including; customers receiving products that conform to requirements that are reliable and maintainable, workers having better working conditions and improved health and safety and legal regulation requirements which are fulfilled. This is achieved through quality management systems which are aimed at achieving customer satisfaction through the use of quality assurance procedures at every stage of the production process.

The three main relevant standards are:

- **National Standards** – The standards produced by a countries national standards body (NSB). For example; British standards are set in place through working together with the UK government, businesses and society.
- **European Standards** – The standards produced by the European Committee for Standardisation (CEN) which are developed along side the NBSs of the European Union countries.
- **International Standards** – The standards produced by the International Organisations (ISO) which are produced by the NBSs of countries around the world. BSI is an associate of ISO and stands for the UK's consideration in the development of international standards which it chooses to adopt.

Relevant standards symbols:

The CE marking is a mandatory conformity mark that is a legal requirement which shows that the product achieves a required level of quality and ensures it can be moved freely throughout the European Single Market. This features on all the Adidas products.

The kite mark symbol certifies that the product has been tested to conform to a particular standard such as BSI. The manufacturing process is assessed regularly to ensure that the products are safe and reliable. It is now seen as a mark of quality.

FSC

The Forest Stewardship Council logo identifies products which contains wood from managed and protected forests. This certifies that the product such as the cartonboard packaging have been made from an environmentally sustainable raw materials.

The Green Dot is a symbol used on the packaging of the Adidas Victory League pack which indicates that the manufacturer has made a contribution towards the recycling of packaging. It does not definitively mean that the packaging can be recycled.

The estimated sign is a European Union mark required to ensure that the printed volume of contents displayed on the shower gel and deodorant is of an acceptable quantity. It verifies that the contents meet a specified tolerance for estimation.

Product Design

Product Design Task

Design Brief

Design a toothbrush that has a unique selling point

Your design should:

- be eye catching
- be made of suitable materials that are durable and able to cope with repeated daily use use
- be designed for mass production
- be ergonomically designed so that it is comfortable to hold and use
- have a unique selling feature

You should consider the design problem and produce a range of alternative ideas that focus on the whole or part of the problem.

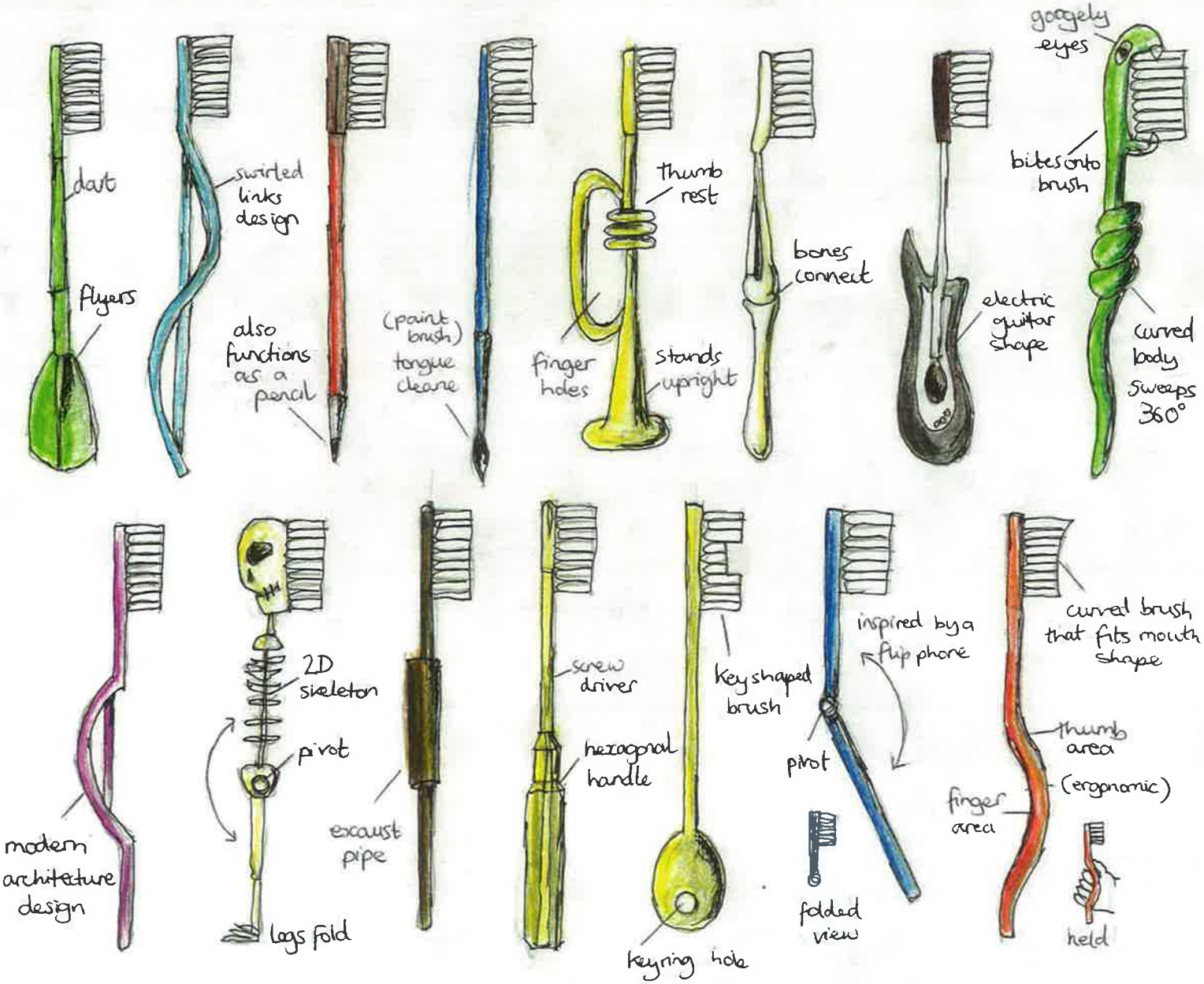
You need to produce a wide range of alternative ideas. IT is better to produce more focused work of a higher quality than a lot of lesser quality.

You should explore different design approaches in your work, applying your knowledge of materials, components, processes and techniques to produce realistic design proposals that satisfy the brief.

You should evaluate each one of your design objectively against the criteria set out in the design brief, to ensure that your designs are realistic and viable.

You should use detailed annotation as an important feature of your design development and use it to explain details of your design thinking and to offer thoughts on your design proposals.

DESIGN IDEAS

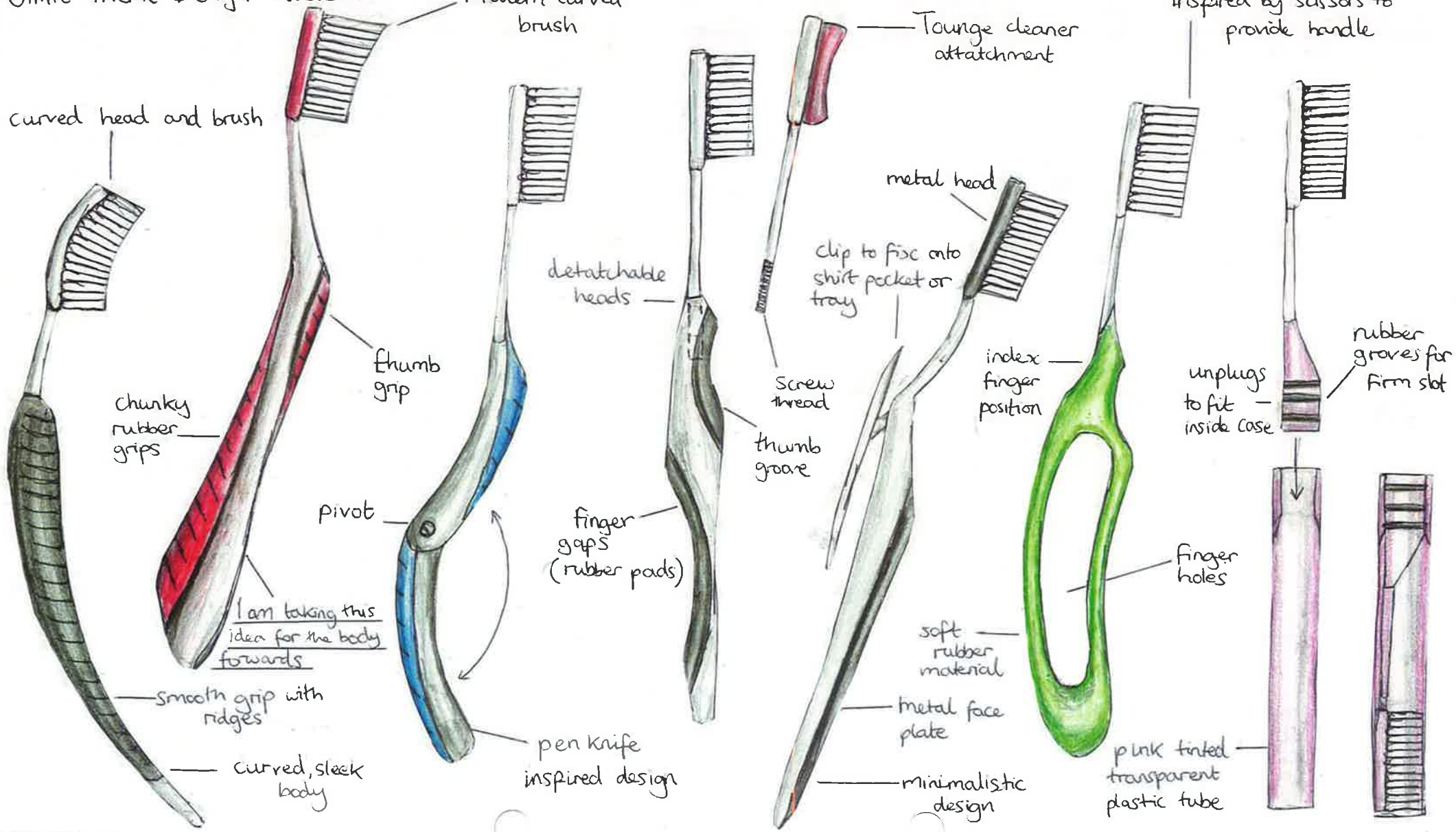


These are my initial toothbrush designs which feature a range of alternative ideas. I have produced them quickly to generate lots of different ideas to allow me to see which ones are most effective. They are all eye-catching and have unique selling features such as their interesting shapes or strong themes, which would make them stand out from conventional toothbrushes. Many of them have also been ergonomically designed to a basic level to provide comfort and better functionability for the user. These qualities mean they meet most of the design brief criteria, although at this stage they are very basic and simple.

I have decided that from these ideas that the gimics and animals theme would be the best to focus on as they offer many more unique selling features and are more eye-catching. I will explore these two themes and combine their best qualities into one.

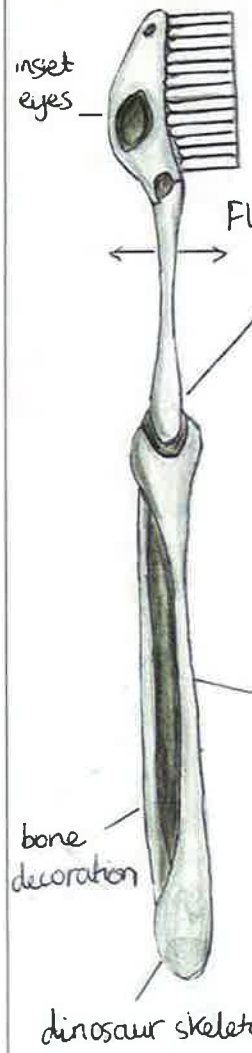
DESIGN IDEAS - TOOTHBRUSH IDEAS

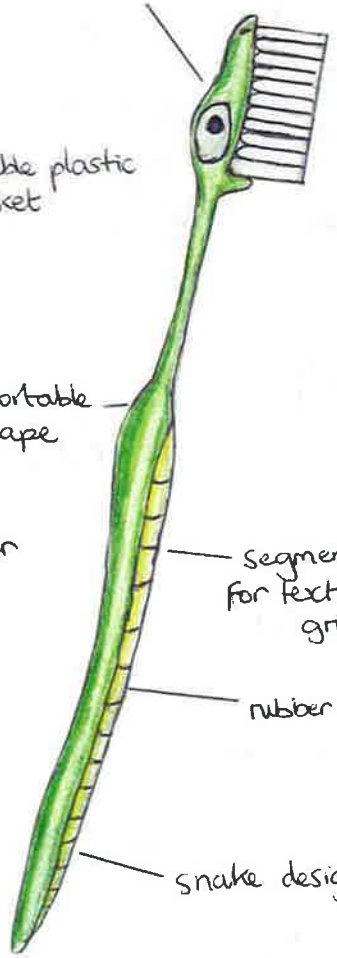
Gimic Theme Design Ideas:

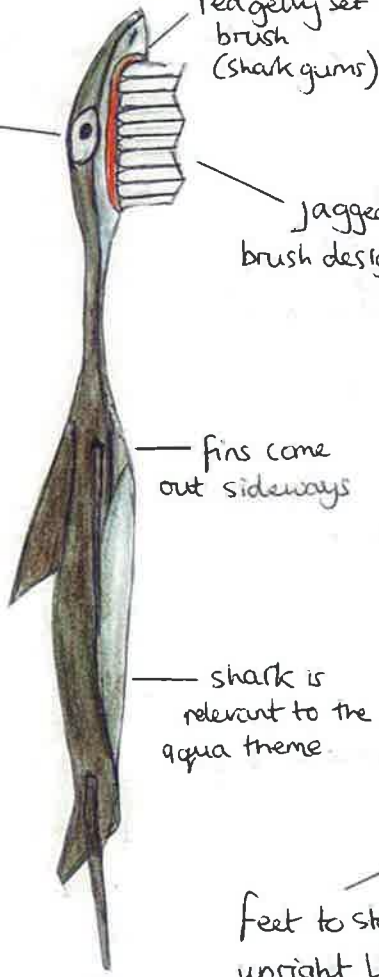


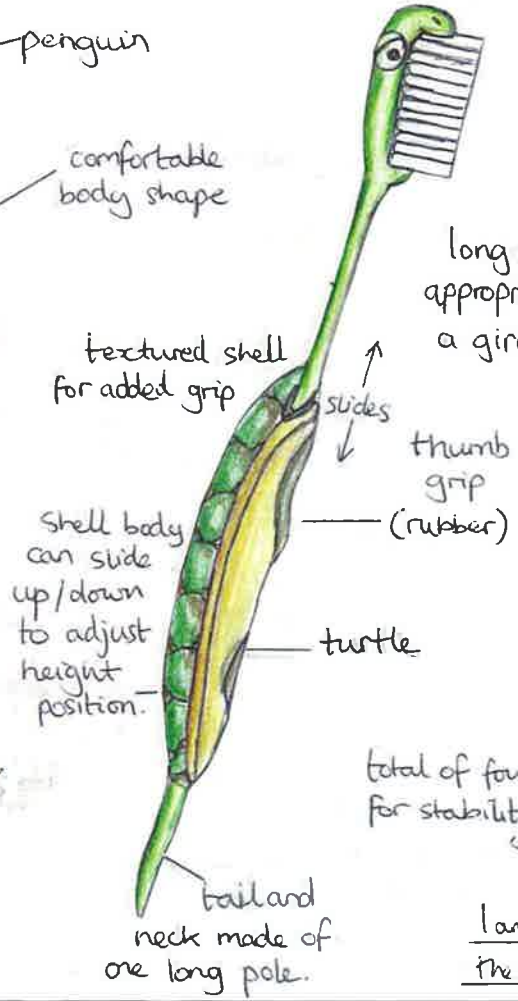
DESIGN IDEAS - TOOTHBRUSH IDEAS

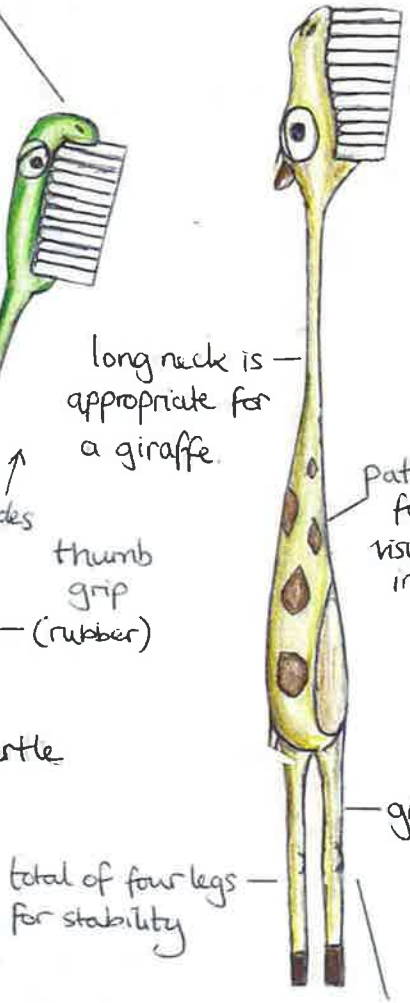
Animal Theme Design Ideas:









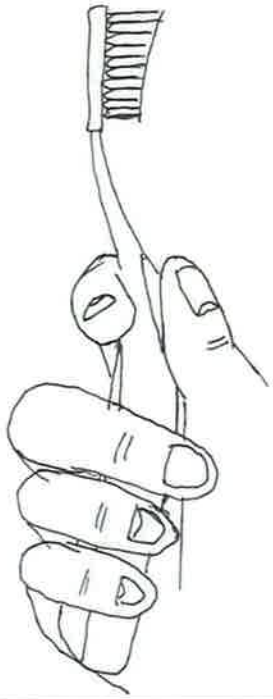


I am taking this idea for the body forwards

DESIGN IDEAS

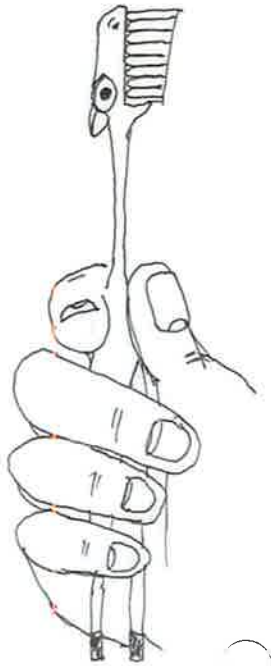
Evaluation of chosen design ideas:

These are alternative design ideas focused on gimics and animals which are workable, realistic and detailed. The quality of these toothbrushes is far greater than my initial designs as they are more attractive and eye-catching due to the interesting shapes and appearances. The unique selling features are more creative and have been considered in greater depth which has given them improved functionability.
The ergonomic features are more detailed such as rubber grip pads which would make them more comfortable to use and hold.
These designs correspond to the design brief criteria and address part of the problems due to these characteristics, which are fun and quirky which would make them stand out against other standard boring toothbrushes currently on the market.
The thumb grips used for the gimic theme toothbrush would be made out of silicone rubber as it provides a soft surface but excellent grip, which is vital as it would be used in a wet environment and needs added friction. The bodys of both these brushes would be made from Polypropeylene as it is rigid, lightweight and has excellent chemical resistance which is nessessary to prevent corrosion from toothpaste. This makes it hard wearing and suitable as it will be able to cope with everyday use. The process used for manufacturing the toothbrushes would be injection moulding because it is ideal for mass production and can be used to produce complex three dimensional structures and components quickly and effectively.
Lastly the bristles would be made out of synthetic fibres (nylon) as they are durable, hardwearing and can come in a range of colours.



Chosen Gimic theme toothbrush design:

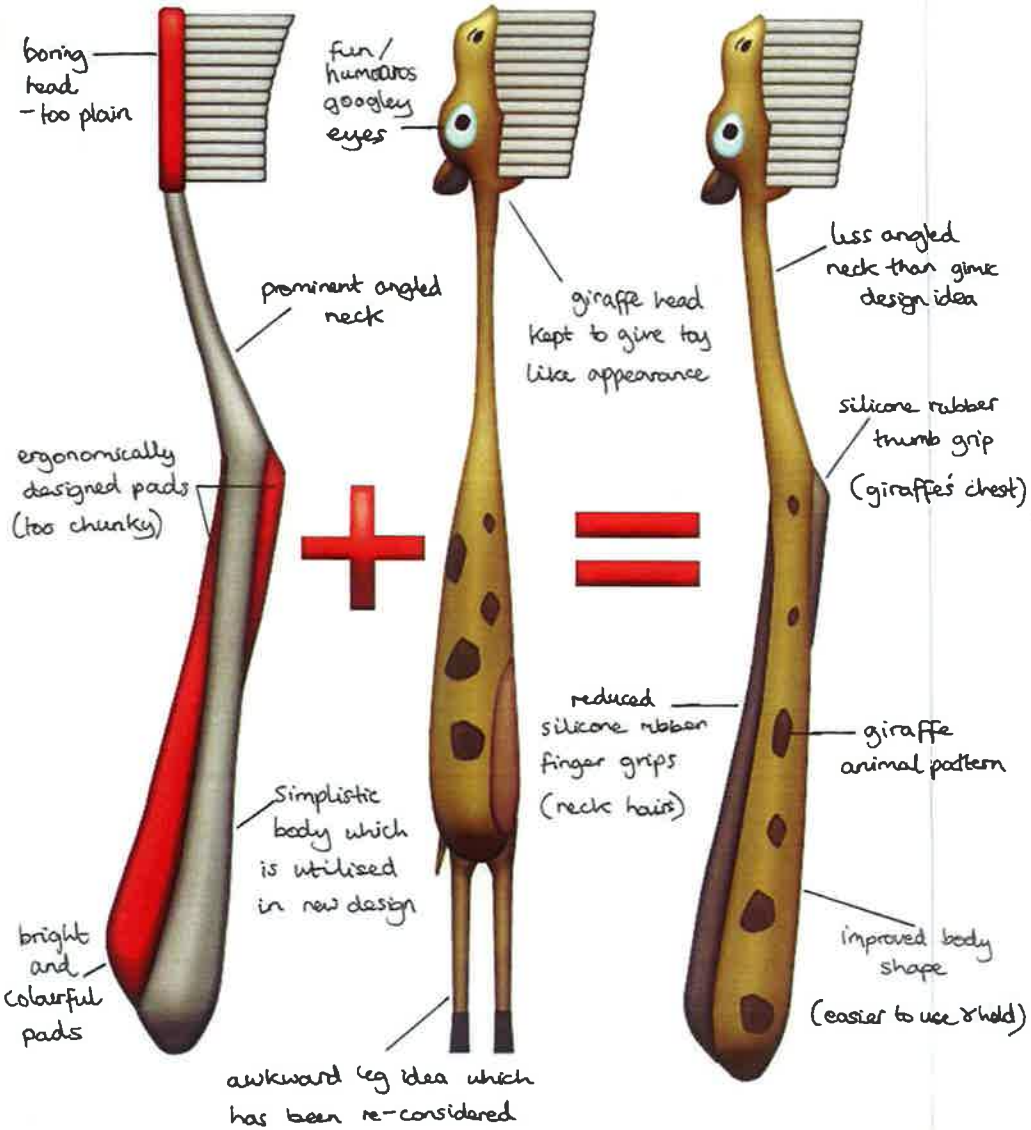
I chose this idea because I think it's more practical and workable which would make it easy to use & hold. The other designs such as the penknife inspired folding one could become dis-functional after time if the pivot got dirty, and may unfold during use which would not make them long lasting.
I like this design because it is modern, chunky and stylish through its simple shape and bold colours. The vibrant red thumb and finger grips are not only eye-catching but also gives the toothbrush a strong ergonomical aspect as they would make it comfortable to use and hold, whilst implementing a sense of luxury. This brush would also be more realistic to produce and wouldn't be too expensive.



Chosen Animal theme toothbrush design:

I chose this giraffe animal idea because it is the most eye-catching design which is very unique and would stand out considerably from normal, standard toothbrushes. It is very attractive and I could develope the idea a lot to improve its functionability and ergonomic factors.
This would be aimed at a young target audience or any age as a fun, modern accessory.
I chose to use googely eyes for the head of the brush to give it more character and to 'bring it to life', which is a creative and interesting unique selling feature. The four legs feature may not be suitable though as it could be uncomfortable to use and hold and might not balance as its top heavy.

DEVELOPING DESIGN IDEAS



Evaluation of combined design ideas:

This is a development of my two favourite design ideas which I have refined by combining the best elements of each into one workable and realistic design solution. The result is a design which combines the ergonomic features of the gimic toothbrush with the fun eye-catching appearance of the animal one.

The design problems which hindered the animal toothbrush included its awkward and uncomfortable shape, lack of ergonomical features and difficult to produce and balance legs idea. By implementing the gimic toothbrush's simplistic body shape and rubber grip pads I have now resolved these flaws and eliminated the complexity issues, making it look and function more like a toothbrush yet keeping the eye-catching appearance of the giraffe animal design. The results of these improvements is very beneficial as the new design addresses the design criteria in the brief. The design is now comfortable to use and hold and would be easier to mass produce using a less complex injection mould. The following unique selling features make the toothbrush appealing and attractive to the user.

- due to the long neck it accurately depicts the resembelance of a giraffe.
- the googely eyes makes the toothbrush more like a toy which would make cleaning teeth a fun activity for children.
- the bright vibrant colours and giraffe patern makes it stand out and more visually exciting.
- the brush which acts as the giraffes' teeth makes it more alive and adds character whilst giving it another function which is aesthetically pleasing.

The dark brown finger rubber grips in the combined design also act as the giraffe's neck hair which has horizontal groves to improve its texture and friction. The stomach has also been moved upwards to form the thumb pad which is a better position, as it has a useful function as well as making it look like a giraffe in appearance.

DEVELOPING DESIGN IDEAS

Body developments : CAD

Stage 1:

This is the body from the combined design ideas which I want to develop to make it more ergonomically viable. Already it has rubber silicone thumb and finger padding components which are placed in accordance to how the human hand grasps, which has made it comfortable to use and hold. At this stage the toothbrushes ergonomic features are quite basic and could be improved by making it more functional and detailed so that it appeals more to the target audience. I will enhance the shaping of the pads so that they are even more comfortable and fun.

Stage 2:

I decided to alter the shape of the lower half of the finger padding to make it fit in the hand better, by creating three finger groves. This is very effective because it allocates a space for the user's fingers to rest comfortably. The affect achieved is inspired by how the hand grips objects and would provide a realistic and accurate clench on the toothbrush. The gaps would be sized so that they fit the majority of people's hands from the target audience, which is young/old children from the age range of 3-12 years. This development has made it more unique & fun.

Stage 3:

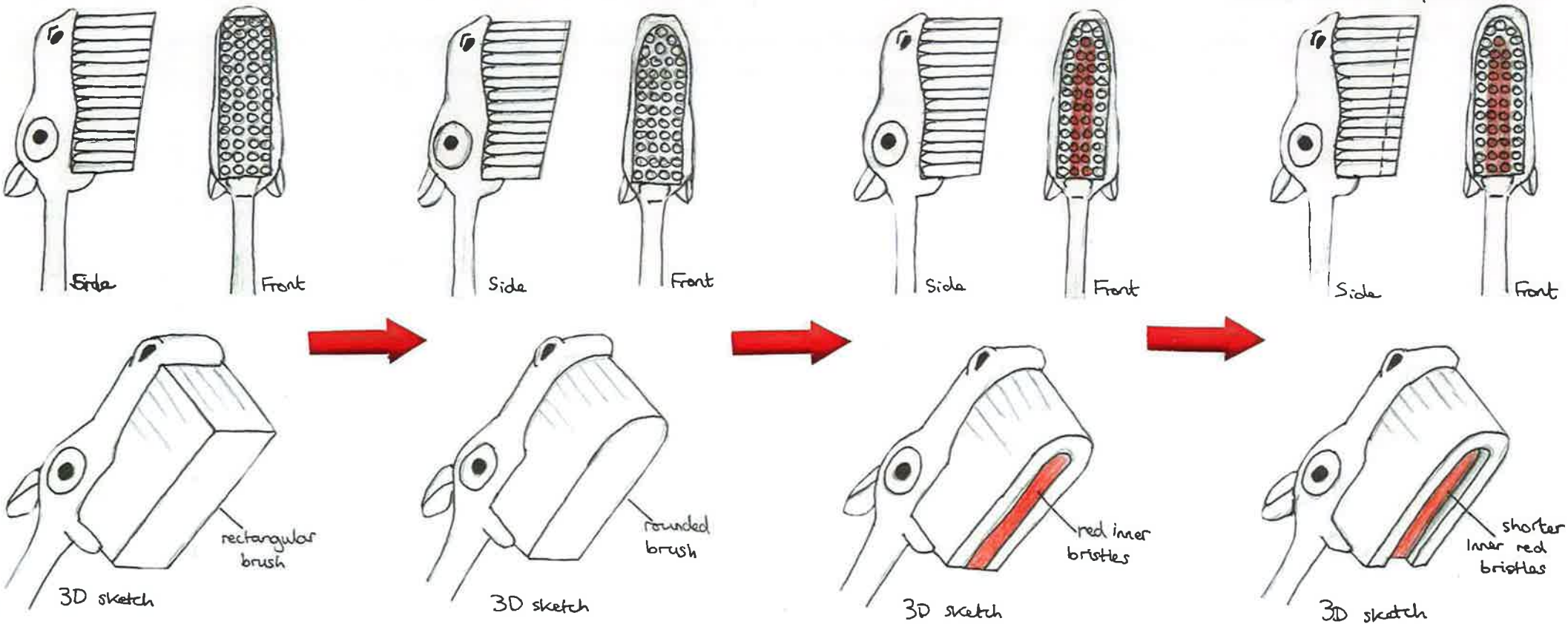
Here I have added raised ridges above the finger groves where the index finger would go when holding the tooth-brush. These ridges extruding from the rubber silicone padding would add considerably improved friction, making the grip much more sufficient which is required for a product that will get wet/slippery. This improvement now allows all the fingers to rest comfortably in positions which will not strain the hand. The design at this stage is easy to hold/use and has comfortable padding which is very luxurious as it has been ergonomically designed.

Stage 4: Finished body

I created these designs in a DTP program 'Adobe Firework' as I could modify them easily and quickly. This is the last step where I have extended the rubber finger grip up the toothbrushes neck to improve the resembelance to a giraffe and make it more visually dynamic. This subtely gets thinner to give a less harsh ending to the padding strip and makes it look more like a giraffe, emphasizing the length of the neck. This feature would not affect the ergonomic impact much but would give an improved variation in surface textures. The final body design has improved dramatically from the initial idea, as it is now very comfortable and reinforces quality & luxury.

DEVELOPING DESIGN IDEAS

Brush head developments :



Stage 1 :

This is the rectangular brush which is slanted that I want to develop because its too basic. Although the shape makes it look like the giraffe's teeth I want to refine its shape to make it more unique and eye-catching to appeal to the target audience.

Stage 2 :

Here I have rounded the top of the brush to make it follow the shape of the head. This has made it look more realistic in resembelling the giraffe's teeth and also made it more aesthetically pleasing due to the smooth edge. This also has made it more unique.

Stage 3 :

I decided to change the colour of the inner bristles to red so that they look like the giraffes gums. This is effective as it makes the white outer bristles look more like teeth and adds visual excitement due to the contrast. I like the way it seperates the brush & adds clarity

Stage 4 : Finished brush.

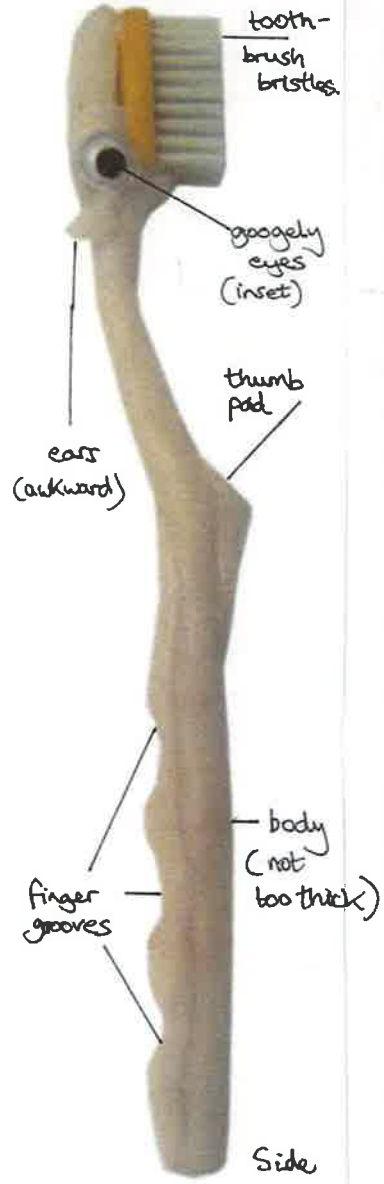
This is the final development where I made the red inner bristles shorter to add a height difference. This now makes the outer bristles look more like teeth as they protrude out further than the gum section. I am very pleased with the result as it has transformed the brushes visual impact.

PROTOTYPE MODELLING

Side held

Front held

Polymorph is a polymer that melts in hot water which can be easily moulded by hand like putty. It can be remoulded multiple times as it has a low melting point of 62°C. Once cooled it hardens and becomes very strong, rigid and durable which is why I used it for my toothbrush prototype. It was a suitable material because it is easy to mould yet it sets hard enough for a toothbrush when cooled, which allowed me to test important aspects of the design such as proportions, scale and function. This was important in order to determine any possible flaws or problems with the design proposal. These are the following processes and techniques which I used when making my prototype model; First of all I heated the polymorph by placing it in a container of hot water at 62°C, monitoring the temperature using a thermometre. I waited until it had gone transparent throughout, indicating it had melted completely. I then moulded the polymorph like putty into the shape of my toothbrush design, using referance images and a toothbrush for a visual aid in achieving the correct scale and proportions. After I had created the components like the finger padding I fused it onto the body to construct it together. Following this I cooled the polymorph under a cold tap until it was opaque to make sure it was solid. I used the nozzle of a hot glue gun to melt two eye holes in the head and placed the googely eyes in whilst hot, so that they were inset into the sockets and didn't stick out. This was required to prevent them from being knocked loose during use. Lastly I clamped a cheap toothbrush whilst I cut the head off using a mini-angle grinder, as it cuts accurately and gives a smooth finish to the cut. Once detatched I joined it to my toothbrushes head by heating the polymorph again using the hot glue gun nozzle, to only liquify a specific area for the join.



Side view

These images above show how the toothbrush fits in the hand and will be held when used by the users. From testing the prototype I discovered that it was a very comfortable shape and size, which was the correct scale and proportions. This is because I made it a similar length to most toothbrushes as there is an ergonomic standard length, which has been worked out by collecting lots of human hand sizes and working out an average measurement which is comfortable. Also because I moulded the polymorph to the shape of my hand it meant it was a perfect fit. In industry it would be sized to fit a wide range of hands. Unfortunately the head of the prototype is too big because I had to keep the cheap head on or the bristles would have fallen out, This wouldn't happen though if manufactured industrially. The problem I found was the ears stuck out awkwa so I must remove them.

DEVELOPING DESIGN IDEAS

From testing the prototype model I discovered that the giraffe's ears on the head of the toothbrush stuck out awkwardly and would have felt uncomfortable in the user's mouth even if they were made of soft rubber silicone. The problem I faced was that if I removed the ears then the resembelance to a giraffe would be less obvious to young children. The solution I came up with was to reconsider the chosen giraffe animal theme for the toothbrush and create one that didn't have ears or - awkward features, making it one hundred percent ergonomically viable and comfortable to use.

This is my design proposal featuring a unique animal toothbrush which is comfortable to use/hold, that comes in four different varieties: a blackbird, crocodile, dinosaur and seahorse. These toothbrushes are very eye-catching due to their bold colours which would make them stand out to children from the target age group. This is important in order to grab people's attention and visually attract them towards the product when displayed in a retail shop.

The most distinguishable unique selling feature of these toothbrushes is that they resemble 'cute' cartoon animals which include components such as googely eyes that make them 'come alive'. Their creative appearance makes them look more like a toy which would provoke appeal for children and make cleaning their teeth a fun activity. This is an important factor as the toothbrushes must also appeal to parents who will be buying the product for their children, which means it must be suitable and appropriate. Other unique selling features include tongue cleaners on the back of the dinosaur and seahorse heads and the fact that the toothbrushes come in a range of fun animals to chose from that are brightly coloured. Because there are four varieties it allows for personal taste, i.e. the seahorse may be more appealing to the female gender and the crocodile more so to males... Also having a choice out of four animals would be even more exciting and make picking one a fun activity for children. The body shape for the toothbrushes was deprived from the giraffe design as I had developed it so that it was ergonomically viable, comfortable to use and hold. All the toothbrushes have the same rubber silicone thumb and finger padding which provides grip and makes them very comfortable to hold. These toothbrushes would be suitable for injection moulding because they don't have sharp edges which would be brittle. Also they are block colours and do not contain any complex patterns which means they could be industrially manufactured and are realistically viable using mass production. All of the above means that the proposal fully meets the design criteria.

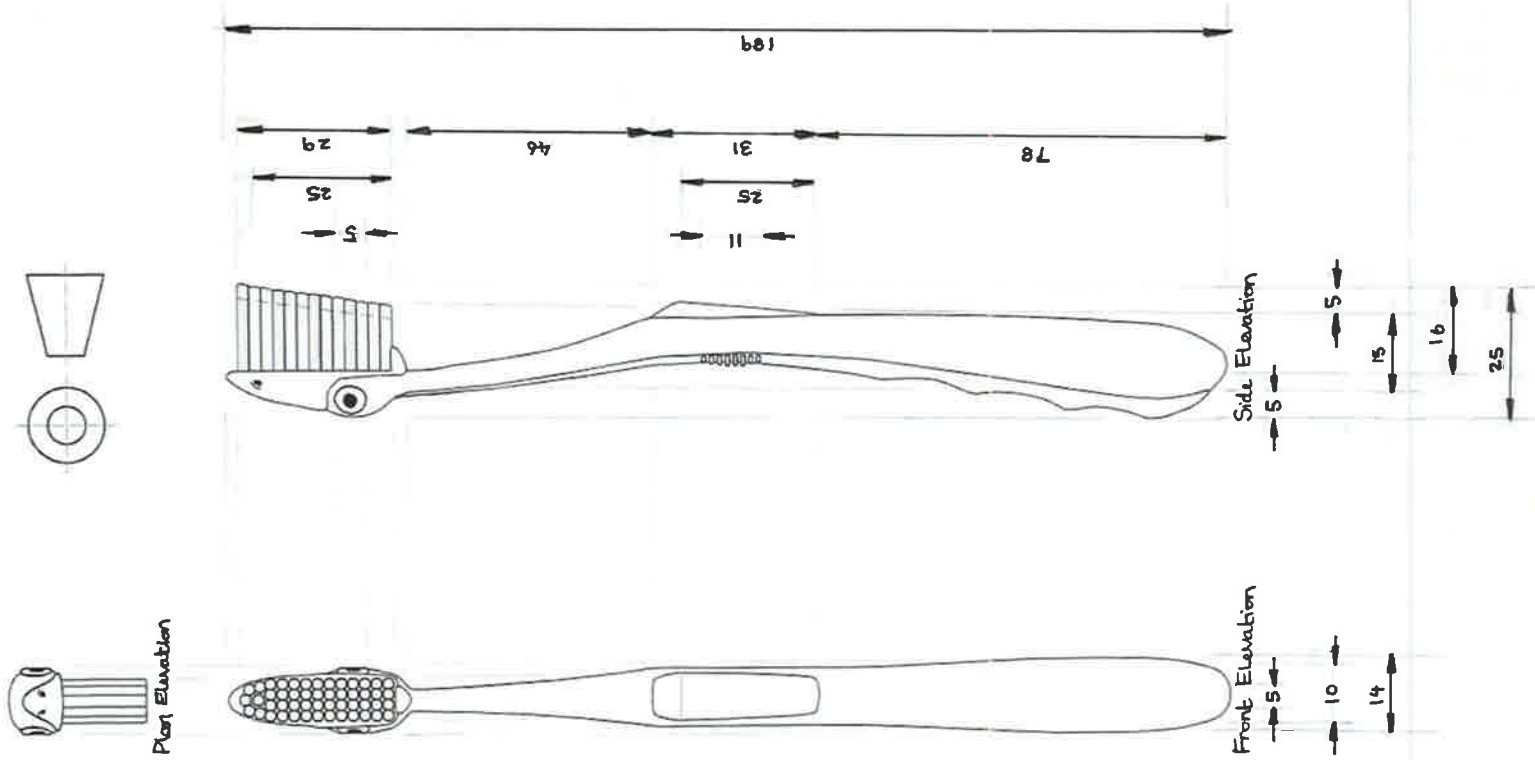
- I used watercolours to render these toothbrushes which allowed me to colour and shade them, re-creating an accurate three dimensional appearance by working ontop in stages.

TECHNICAL DRAWING

This is a 3rd angle orthographic projection that I created in order to convey enough detailed information to enable third-party manufacture of the final design proposal. I created it using ICT and CAD with desktop publishing software called 'Adobe Fireworks', because it allowed me to communicate the technical details of the design proposal with precision and accuracy. I also dimensioned the technical drawing to British Standards Institute standards by writing the measurements in milimetres on top of the dimension lines, using broken guidlines which do not touch the object and including the 3rd angle symbol. This is neccessary to allow a third-party to understand the technical details of the proposal and be able to manufacture it, as it is a nationally recognised standards body within the United Kingdom which ensures reliability and quality of products and services.

Blackbird design - 3rd Angle Orthographic projection:

Scale: 1:1



Components and manufacturing processes that would be used by a third-party manufacturer + suitable for mass production:

- Body - polypropeylene pellets would be injection moulded to form the toothbrush body using a rotating screw to force it melted into a mould.
- Bristles - The nylon bristles are positioned into the head of the brush and stapled using metal. They are then trimmed to the correct shape/length.
- Googly eyes - These would be bought from a third-party supplier and glued in place on a highly automated production run. (5mm Ø)
- Rubber grips - The silicone thumb and finger pads would be injection moulded using the same process as the toothbrush body and then assembled.

DESIGN PROPOSAL

Front Elevation :

Side Elevation :

Computer Aided Design Final Render:

This is a final render of the blackbird toothbrush to demonstrate what it would look like if it was to be industrially manufactured. This is a computer generated image that I created using desktop publishing software 'adobe fireworks' to achieve a high quality render of the front and side elevations. I used this CAD package because it contains a wide variety of filter effects to add realistic shadding to the image, such as bevels, glows, drop shadows and blurs. I made the toothbrush shapes using the pen tool to draw paths that are created using vector nodes, this is useful because I could scale the image without it pixelating as it is not a bitmap. I used CAD for this final design proposal render because I could create a high quality outcome which could be modified or altered easily without having to reproduce the image. I am very pleased with the precision of the render I have produced because it is very realistic and allows you to visualise the finished product. The toothbrush will come in the four varieties stated previously although I have only rendered the blackbird design as they are all very similar in appearance. This final design proposal is significantly different and improved compared with my initial design ideas and in particular the alternative giraffe design. It was very important that I made the prototype model otherwise I wouldn't have discovered the giraffe's ears hindered its function. I am pleased I found out this defect in the design at that stage in the developement as I could reconsider the animal theme for the toothbrush. This is why prototype models are key, otherwise if problems were found with the design after an injection mould had been set up or a production line then it would be very expensive to correct. Also I think these four designs that form my final proposal are much better and improved than the giraffe idea as they are simpler which would make them easier to manufacture. i.e, the giraffe would have been difficult to injection mould due to the different patterns which would have required more detailed and expensive moulds to produce. In conclusion my finished designs meet all of the design criteria set in the brief and have a very unique selling feature (as described on previous pages). The materials I have chosen are durable and able to cope with repeated daily use...

Product Manufacture

PRODUCTION PLAN - GANTT CHART

	Task	5 hours per week					
		Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
1	Create the packaging net on 2D design						
2	Design the packaging graphics and apply to the net.						
3	Print off the finished net onto A3 card and stitch together						
4	Emboss the front surface design						
5	Apply spray varnish to the card net						
6	Cut out the net using the vinyl cutter						
7	Construct the net and glue together						
8	Create paper divider by embossing with rollers						
9	Sandwich the layers of paper and glue						
10	Spray varnish outer surfaces of paper divider						
11	Design the mould for vacuum formed tray in solid works						
12	Manufacture the mould out of MDF using milling machine						
13	Vacuum form the tray using the mould						
14	Colour the tray with metallic gold and silver spray paint						
15	Design the chocolate selection guide graphics						
16	Print the chocolate selection guide						
17	Cut and fold the chocolate selection guide						
18	Spray varnish the surfaces of the selection guide						
19	Fully assemble the pack and apply finishing touches						
20	Wrap the fully assembled pack in cellophane						

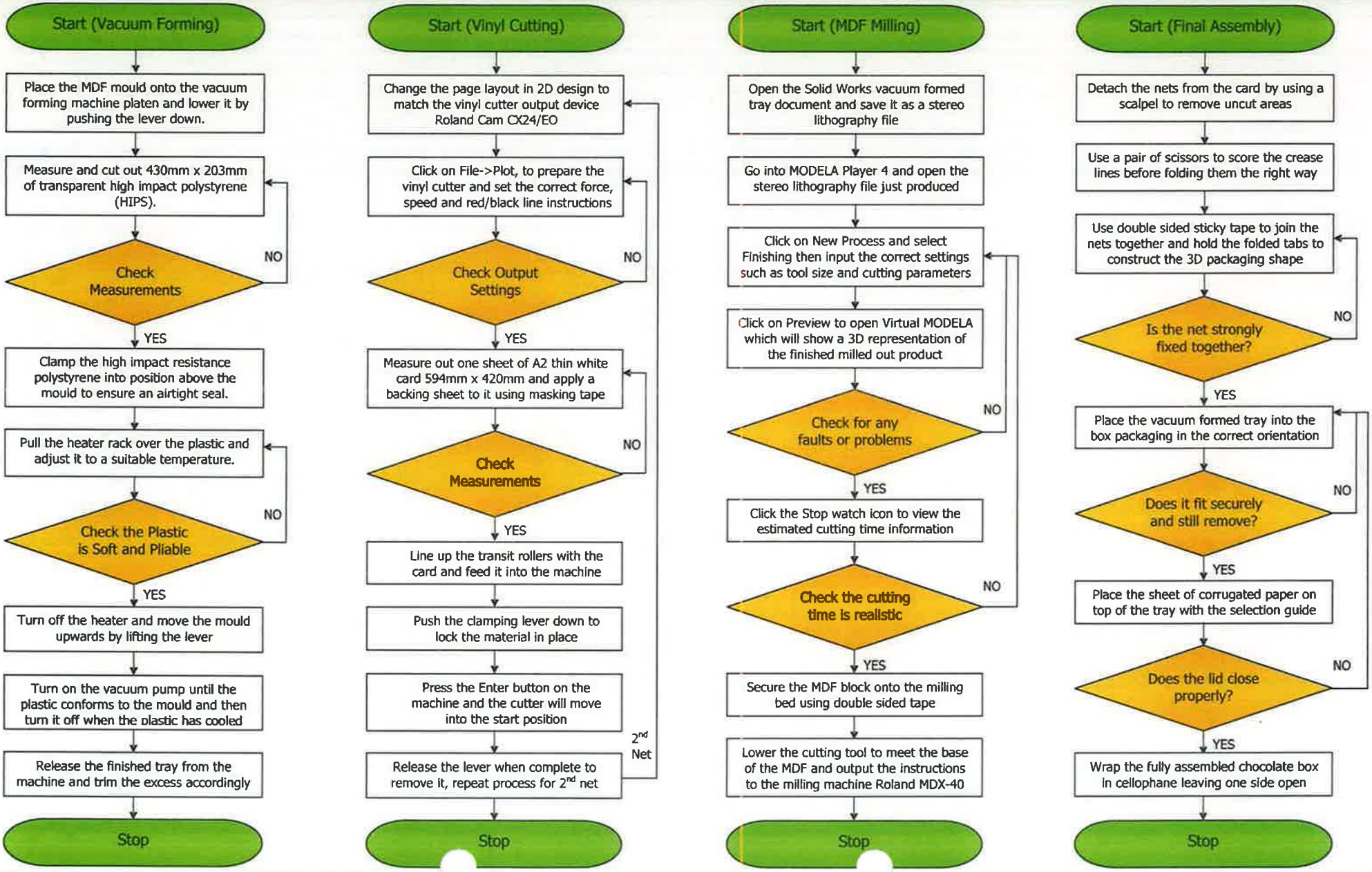
Total:	30 hours over 6 weeks

Planning Information (Gantt and Flow charts)

This is a detailed production plan which shows the correct sequence of operations I must carry out during the manufacture of each product. It has been organised into chronological order in the form of a Gantt chart which visually represents how much time has been allocated for each process. The work order includes each phase of the manufacture right through from the design stage up until the final assembly of the product. I have considered realistic timings and achievable deadlines in my Gantt chart that cover all aspects of the product manufacture. These time scales have been produced in accordance with the scale of production I am using to manufacture the products which is one off production. The consequences of this level of production is that it will take a long time to create the products as it will require a variety of skills, techniques and labour. In industry this product would be commercially manufactured at a scale of mass production which is a highly automated process that would take a considerably shorter time to produce than one off production. This Gantt chart is necessary so that I can plan my time efficiently and as a result accurately keep track of my progress throughout the making task. The total time allocation is 30 hours which is a realistic deadline as it involves many processes.

Below are flow charts which are schematic representations of the processes I will use in the manufacturing of each product. I have used these because they are a visual communication that provides easier reference to look at and understand than text. These flow charts give detailed instructions that are in a logical order of assembly of components and equipment that I will follow when producing the products. This will allow me to carry out the processes efficiently and to a high standard. The flow charts indicate the stages at which quality control checks will take place to detect faults early on that can be rectified. This is called a closed-loop control system as feedback is used to make decisions that will affect the processes. I have identified these quality control points throughout the production plan which is necessary to enable me to produce a reliable high-quality outcome.

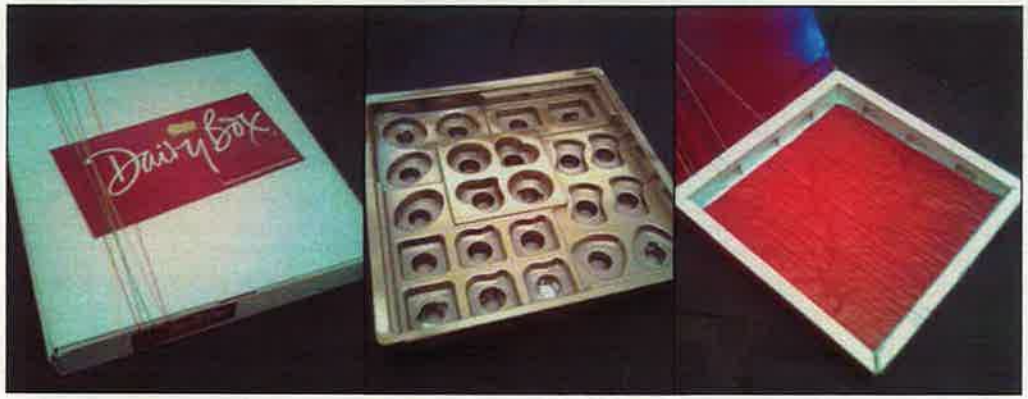
PRODUCTION PLAN - FLOW CHARTS



PRODUCTION PLAN - MATERIALS, TECHNIQUES & PROCESSES

TASK (a brief description of the process to be carried out)	TOOLS, MATERIALS & PROCESSES (this should list the resources needed for each stage, such as cutting equipment, card, plastics)	TIME NEEDED (how long each stage will take)	QUALITY CONTROL/ ASSURANCE (how you are going to check the accuracy and quality of the product and ensure mistakes are avoided.)	HEALTH & SAFETY (the hazards, if any, involved in the process/stage)	ALTERNATIVE METHODS (back up plan, different ways of making if things go wrong, perhaps using different materials or processes)
Create the packaging net on '2D design' by measuring the existing net and copying these measurements. Indicate cuts and folds by using red and black lines.	A computer with computer aided design software 'TechSoft 2D design' on it for drawing the net. An accurate ruler and pencil to measure the existing net's dimensions.	2 hours	I will measure the original net to the nearest millimeter using a precise ruler and then double check the measurements that I input into 'TechSoft 2D design'.	Computer- When sitting at the computer for long periods of time tensed muscles can result in repetitive strain injury (RSI) if the posture is poor. Also poor lighting can cause eye strain.	Drawing the nets by hand using a pencil and ruler onto A2 thin white card. Using solid bleached white board if card is unavailable.
Create the packaging graphics in a DTP and apply these to the net on '2D design'. Take images of the products as a visual guide for scales and proportions.	A computer with desktop publishing software 'Adobe Fireworks' on it for creating the graphics and 'TechSoft 2D design'. A digital camera for taking pictures of the net.	7 hours	I will use photographs as a guide for the proportions and create the graphics over the top for accuracy. I will visually inspect the graphics constantly for pixilation and compare against the original.	Computer- When sitting at the computer for long periods of time tensed muscles can result in repetitive strain injury (RSI) if the posture is poor. Also poor lighting can cause eye strain.	Printing off the graphics separately and gluing them to the hand draw nets with adhesive. Measure proportions by eye visually if no camera.
Create the design for the mould of the vacuum formed tray in 'SolidWorks' by measuring the existing tray and copying measurements.	A computer with computer aided design software 'SolidWorks' on it for creating the vacuum formed tray mould. An accurate ruler and pencil to measure the existing tray's dimensions.	5 hours	I will measure the original tray to the nearest millimeter using a precise ruler and then double check the measurements I input into 'SolidWorks'.	Computer- When sitting at the computer for long periods of time tensed muscles can result in repetitive strain injury (RSI) if the posture is poor. Also poor lighting can cause eye strain.	Spraying the existing tray with silicon and applying plaster of paris onto it so that it can be easily removed when dried.
Split the finished net into two sections on '2D design' so that it fits onto two A2 card sheets and include registration marks. Print them off using an A2 printer.	A computer with computer aided design software 'TechSoft 2D design' on it for splitting the net and creating registration marks. Two sheets of thin A2 card and an A2 colour printer for printing the graphics.	1 hours	I will do a print test to ensure the colours are precise. I will visually inspect the printed net and graphics for pixilation and then compare it against the original to check its accuracy.	Computer- Repetitive strain injury from poor posture or eye strain from lighting. A2 colour printer- Fingers getting trapped in the mechanical components or touching dangerous electrics.	Join the two finished hand drawn nets using adhesive and visually align the printed off graphics by eye. Glue graphics to the nets.
Create the chocolate selection guide on '2D design' and graphics in a DTP. Print it off using an A4 printer and cut it out/fold.	A computer with desktop publishing software 'Adobe Fireworks' on it for creating the graphics and 'TechSoft 2D design'. Plain A4 paper, a scalpel, scissors, safety mat and cutting ruler.	1 hours	I will visually inspect the chocolate selection guide printed graphics for pixilation and then cut it out with a scalpel and cutting ruler to get it straight.	A4 colour printer- Fingers getting trapped in the mechanical components or touching dangerous electrics. Scalpel- Cutting fingers.	Drawing the guide by hand using a pencil and ruler onto A4 paper. Then printing graphics separately and gluing on.
Set up the computer and vinyl cutter so that the net can be cut and creased correctly according to 2D design. Glue nets together.	The two printed A2 card nets, Roland Cam CX24/EO vinyl cutter, backing sheets taped with masking tape and double sided sticky tape for constructing/gluing the nets together.	3 hours	I will visually inspect the quality of the net after cut out to ensure it is accurate and has clean edges and that the constructed net is fixed together strongly.	Vinyl cutter- Fingers getting trapped in the mechanical components such as rollers, touching the moving blades or dangerous electrics.	Cut out the net by hand using a scalpel with a safety mat and steel cutting ruler. Score net with scissors and glue together with prit stick/PVA.
Print off the coloured paper and create the paper divider by embossing with rollers and sandwiching layers of paper together using glue.	A4 sheets of paper, A4 colour printer, embossing rollers to create corrugated ridges, a scalpel, safety mat, steel cutting ruler and double sided tape.	1 hours	I will ensure I use the correct embossing pattern and then check the paper is the correct size and colour. I will align the layers of paper precisely before gluing.	A4 colour printer- Fingers getting trapped in the mechanical components or touching dangerous electrics. Scalpel- Cutting fingers.	Use the closest grade of coloured tissue paper if unable to print it off. Emboss using a stamp and glue together with prit stick/PVA.
Set up the computer and milling machine so that the mould can be cut out of MDF correctly. Secure the MDF to the bed using adhesive tape.	A computer with computer aided manufacture software 'MODELLA Player 4' on it, MDF, double sided tape and the CNC/CAM output milling machine device Roland MDX-40.	3 hours	I will preview a 3D representation of the product to check for faults before I mill it out. I will measure the MDF correctly and sand it for a smooth finish.	Milling machine- Fingers getting trapped in the mechanical components, touching the moving drill or dangerous electrics.	Use Styrofoam if there is no MDF or it takes too long to mill or carve the tray out of MDF using a chisel and sand it to correct shape.
Vacuum form a sheet of high impact polystyrene using the milled out MDF mould to form the tray. Spray paint it gold and silver on top/base.	Vacuum forming machine, MDF mould, metallic gold and silver spray paint a sheet of transparent high impact polystyrene, a scalpel, safety mat and steel cutting ruler.	3 hours	I will visually check the vacuum formed tray for defects, spray paint it in thin coats to prevent it running and precisely trim the excess material using a scalpel.	Vacuum forming machine- Fingers getting burnt by the heater or trapped in mechanics. Spray paint- Inhaling chemicals Scalpel- Cutting fingers.	If there is no (HIPS) then use polypropylene or standard polystyrene. If unable to vacuum form then mill a shell of the tray as representation.

PRODUCT IMAGES AND SPECIFICATION



The 3D Constructed Packaging

FORM:
- The packaging must tessellate together effectively when stacked to occupy less space and reduce transportation costs.
- It must be a suitable shape and size to contain the correct amount of chocolates.
- The box must be attractive to the target audience and reflect on the products high quality.

FUNCTION:
- The packaging must contain the products inside securely and stop them coming loose.
- It must be able to protect the contents from sufficient damage when dropped/knocked accidentally.
- The packaging must grab the customer's attention in the store and make them interested in the product.
- It must be tamper proof to prevent anyone getting inside the box
- The best before date must be reliable and preserve the chocolates to a certain degree.

USER REQUIREMENTS:
- The box must be a convenient size and feel comfortable to carry for the user.
- It must be attractive to the target audience and make them want to buy the product.
- The vacuum formed tray must make the chocolates easy to remove for the user.
- The materials should be recyclable to allow the user to dispose of the packaging in an environmentally friendly way.
- The weight of the box should not be too heavy or make it difficult to transport.

COST:
- The cost must be of a reasonable price so that it is affordable for a wide range of people.
- The cost to produce the product must be low so that it is economically viable and maintains an appropriate profit margin.
- The packaging must be able to meet high demand and be cost effective to produce each item using mass production.
- The materials must be inexpensive but also of good quality so that they are reliable.

The 2D Printed Graphics

FORM:
- The graphics must use bold colours that are eye catching and make the product stand out.
- The font used must be clear and effortless to read and the information featured should be arranged in a format that makes it easy to understand.
- It must be distinctive and unique making it easily recognizable.

FUNCTION:
- The graphic must effectively advertise the product and make it sell.
- The written information must inform the user of relevant product information such as its ingredients, contents, company and legal details.
- It must notify the users of each chocolate and their relevant details
- The graphics must grab the customer's attention and interest them in the product.
- It must stand out against competing products and appeal to the customer.

USER REQUIREMENTS:
- The logo and brand name must be large and easy to read from a distance so that it is easy to find and clearly communicates the product.
- The colours used should be appealing to the user and communicate style and luxury.
- The aesthetics must be suitable for the customer and appeal to them so they purchase it.

COST:
- The cost to produce the graphics for each item must be low and cost effective, so a suitable printing process such as offset lithography could be used.

This product has a modern and stylish aesthetic appearance created by the graphics, such as the abstract coloured lines that run vertically down the net. The bold contrast of the products colour theme (cream against plum) makes it stand out and is eye catching. The product is meant to be bought as a gift for someone which is why it must look expensive and of a high quality; the gold and silver vacuum formed tray compliments this. The box's colours are also very rich and luxurious. The script lettering used for the brand name "Dairy Box" gives a personal and handmade touch which communicates quality and upper-class. The materials used are suitable for its function but are also of a good quality which makes it strong and protective.

MAKING - REPRODUCING THE GRAPHICS (CAD)

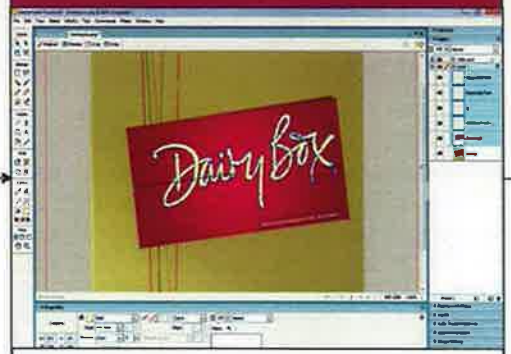
Stage 1: The photograph

This is the photograph of the dairy box front cover which I imported into the DTP Adobe Fireworks. I used it as a guide for the scale and proportions for accuracy.

Stage 2: Drawing the brand name

I then used the pen tool to create the vector path nodes of the dairy box script logo by drawing over the top and filling it in with the correct shade or cream.

Stage 3: Creating the purple box



I then added a box from the auto shapes in the correct position and rotated it. Then I changed the fill to an ellipse and entered the correct light/dark purple tones.

Stage 4: Creating the Nestle logo

I created the nestle logo using the pen tool for the yellow blob and used inner shadows and bevels to make it 3D. I also added the Nestle text in correct font.

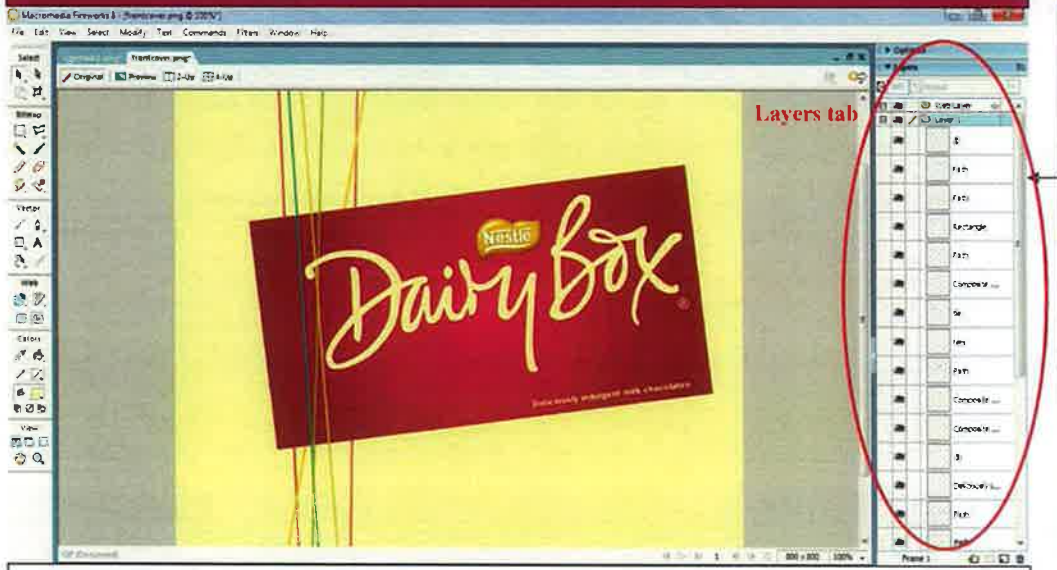
Stage 5: Adding a background

Here I added the cream background which covered over the photograph bitmap layer which I had been using to position my graphics accurately.

Stage 6: Drawing the coloured lines

Lastly I made the coloured vertical lines using the pen tool again and drew the paths in accordance with the original design. I then layered them correctly in order.

Stage 7: The finished graphics for the front of the packaging

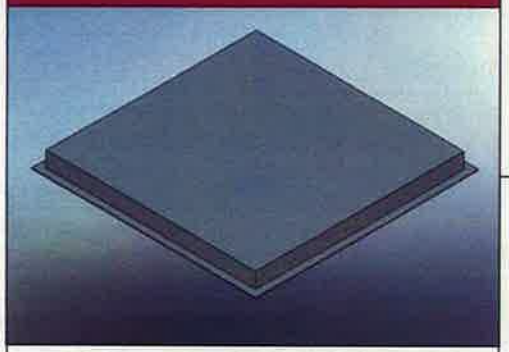


This is the end result of reproducing the front cover of the packaging. From the layers tab you can see the different components that make up the image such as paths, text and shapes which I created. Because I produced everything myself using paths the image can be resized without losing quality or pixelating as it is a vector not bitmap image.

I am pleased with the accuracy and precision to which I have replicated the graphics. Using a photograph as a guide for positioning the graphics worked really well because it allowed me to produce them accurately and to a high quality. I repeated this process for the other sides of the packaging and graphical components in the same way. For the back cover I cut out images off the internet of chocolates which were a similar shape to those used on the original packaging. Apart from this all the graphics including the logos and table I produced myself using the pen tool.

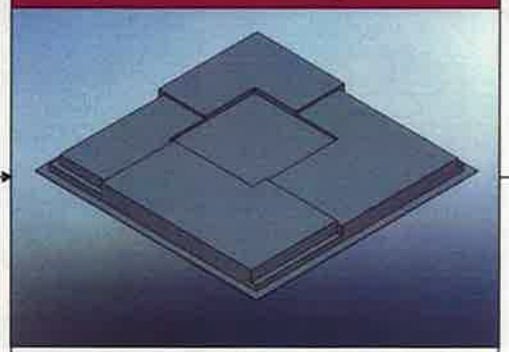
MAKING - REPRODUCING THE TRAY (CAD)

Stage 1: Extruding the base



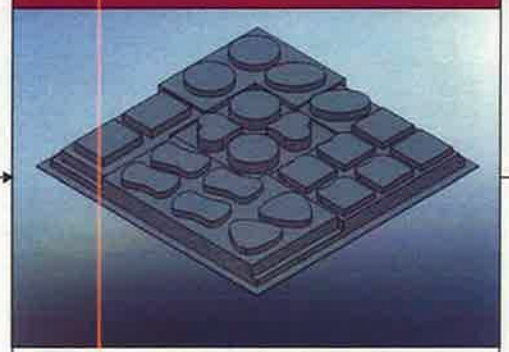
First of all I drew a new sketch of the base using the correct measurements and extruded it to the correct height. This created the main body of the tray.

Stage 2: Extrude cutting the levels



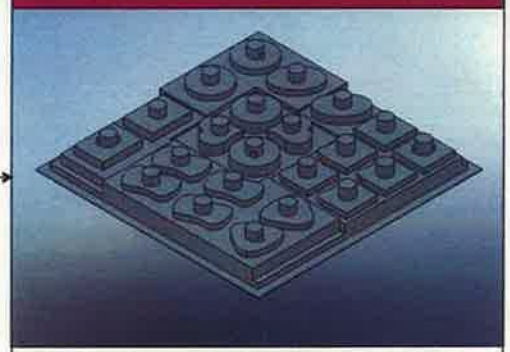
Then I created new sketches on the top surface and extrude cut blocks out at different heights to create the staggered levels that the compartments rest on.

Stage 3: Extruding the compartments



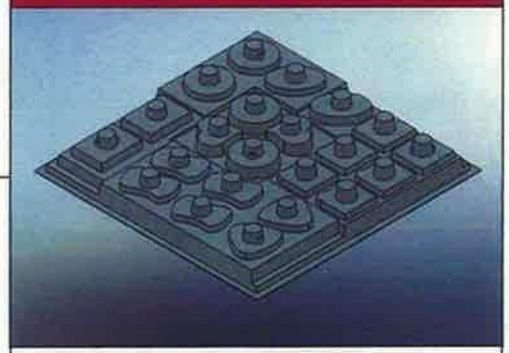
I then drew one of each of the different chocolate compartment shapes on the appropriate levels and extruded them to the correct heights, then duplicating.

Stage 4: Extruding impact supports



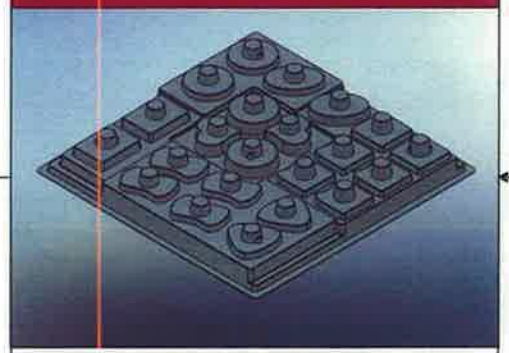
Here I drew the cylindrical impact supports on top of the chocolate compartments by creating new sketches and extruding. I then duplicated them to save time.

Stage 5: Drafting all vertical edges



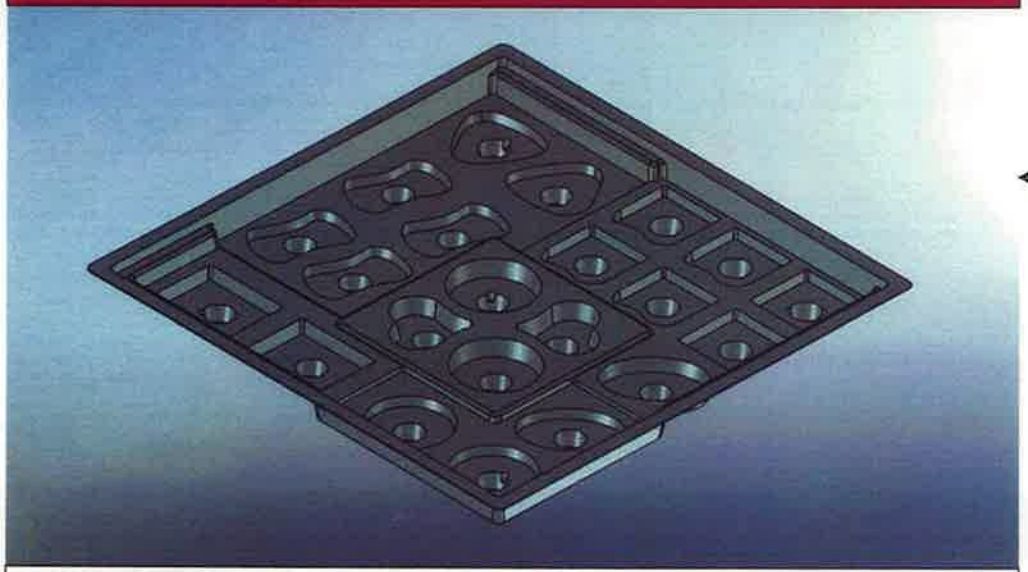
Because vacuum forming requires the mould to have slanted vertical edges so that it can be removed easily I drafted all of them at 7 degrees.

Stage 6: Rounding sharp edges



In this step I applied multiple fillets of different sizes to most of the edges to round them so they were not sharp and had a smooth high quality appearance.

Stage 7: Shelling the base (upside down)



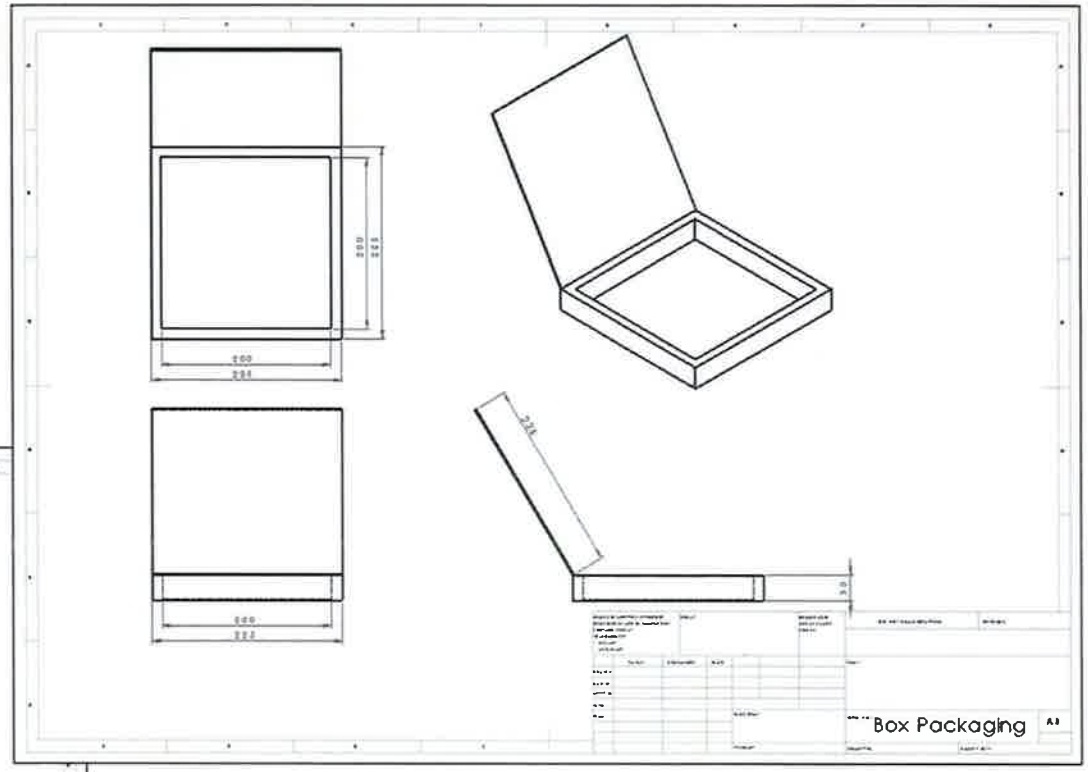
Finally I applied a 1 millimetre shell to the underside of the base in order to recreate the thickness of the plastic sheet. I then flipped the model upside down so that it was the correct orientation. The end result I have achieved is very accurate and has a high quality appearance, which is a realistic replicate of the original vacuum formed tray.

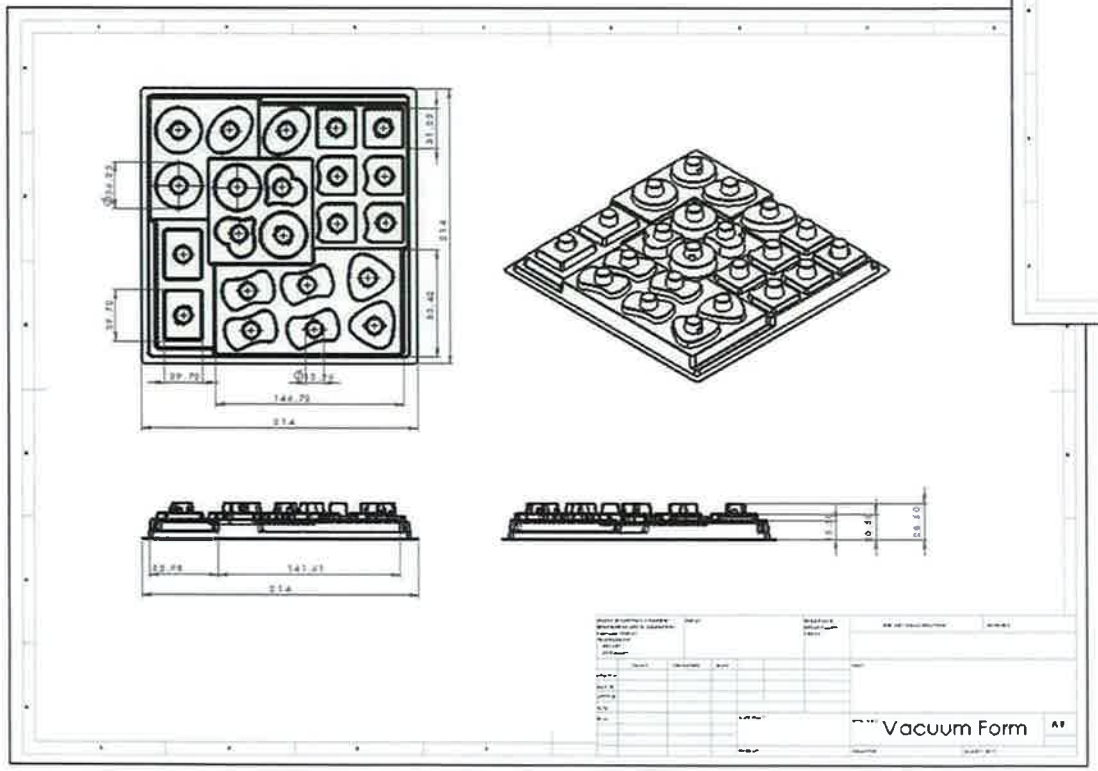
I created this model of the vacuum formed tray in SolidWorks because it is a powerful computer aided design package which allowed me to export it as a stereo lithography file. This was important as I could then use this file in a CAM/CNC program to manufacture the mould using the milling machine. When creating the model I used a ruler to measure the original tray and then used them to dimension each component so that they were accurate and precise. I used CAD/CAM to produce the tray because it ensures quality as it is more accurate than producing it by hand.

ORTHOGRAPHIC DRAWING - COMPONENTS

High Impact Polystyrene Vacuum Formed Tray

This is an orthographic drawing of the vacuum formed tray which I produced in SolidWorks. I created it by importing the 3D model of the tray I had made and then placing the correct projections onto a drawing. I placed them in the same format as a 3rd angle orthographic technical drawing with the exception of the 3D view which aids in the visual communication. I then dimensioned the most relevant and important features on the tray using the smart, horizontal and vertical dimensioning tools. This dimensioned the tray very accurately and precisely in millimetres. I dimensioned the orthographic projection to British Standards Institute (BSI) guidelines so that it was technically correct and would enable a detailed understanding of the product. Dimensioning the finished model of the vacuum formed tray before I milled it out (CAM) was important so that I could check its important aspects of the design such as size and measurements, so that I knew it would fit in the box. This quality control measure ensured it would be an accurate replicate of the original tray.



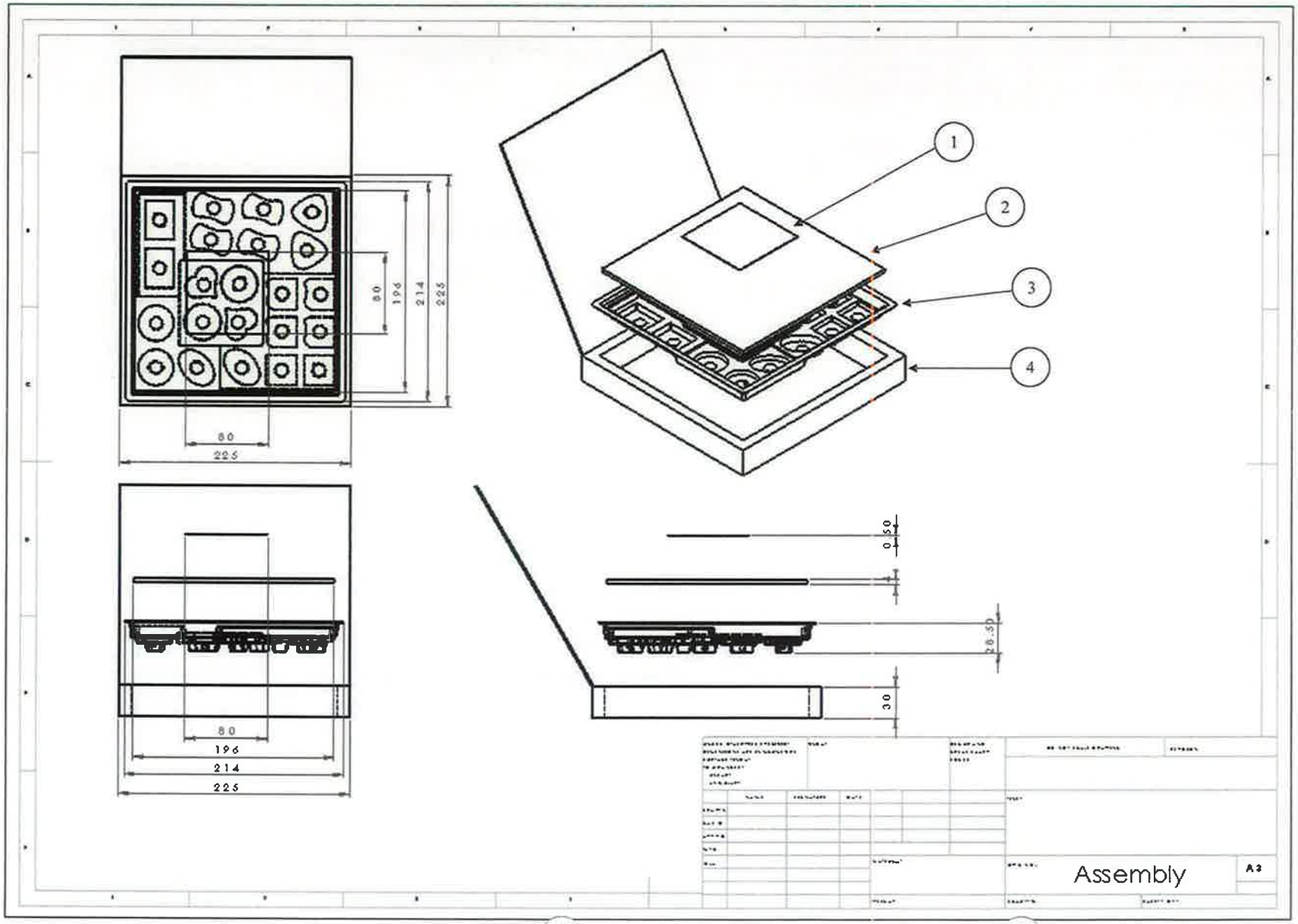


Cartonboard Exterior Packaging – Folding Boxboard

This is a reproduction of the exterior packaging that I created using the same process as the vacuum formed tray. Creating this was a quality assurance so that I could compare the measurements with the tray to ensure they would accurately fit together. Testing the tray design was vital because I couldn't afford to encounter problems as the milling machine takes hours to manufacture the product. Using CAD/CAM means it will be manufactured to a very high quality and will be very accurate. This will satisfy the design brief/criteria as I will have created an accurate replicate of the vacuum formed tray using a range of processes.

This page details the testing and quality control points that I used to ensure the vacuum formed tray would be accurate to prevent mistakes and enable a high quality outcome.

ORTHOGRAPHIC DRAWING - EXPLODED



This is an exploded view orthographic drawing of all the components that are found in the box in the order and layers they come in. I recreated the entire product in SolidWorks to test the scales and proportions to ensure they were accurate and reliable. This was also important to fully understand all the components and how they should be arranged when placed in the box so that I could manufacture it to a high quality.

Materials/Processed I will use In the manufacture:

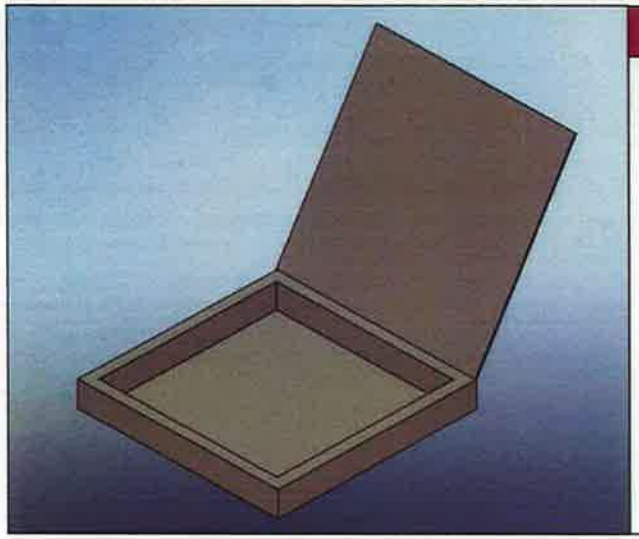
1. **Chocolate Selection Guide**
   Two printed sheets of high quality paper with a glossy finish that I will stick together to make it printed both sides.

2. **Corrugated Paper Divider**
   Multiple layers of paper embossed with a corrugated pattern sandwiched together with coloured top and bottom.

3. **Vacuum Formed Tray**
   High impact polystyrene vacuum formed into the shape of the tray using the MDF mould that I will mill out.

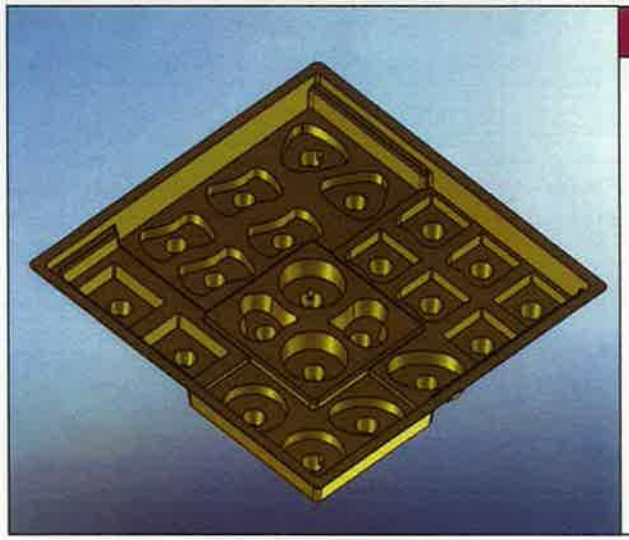
4. **Exterior Box Packaging**
   I will pint off the A2 graphics onto thin white card and then plot out using the vinyl cutter to cut and crease the net.

3D COMPONENTS LIST



Exterior Packaging

- This component is the outer packaging which contains all of the products and protects them from sustaining damage during transport.
- It has been made of folding box board and printed on using offset lithography which is suitable for mass production.
- It has been spray varnished to protect the graphics.
- The exterior measurements: 225mm x 225mm x 30mm and interior measurements: 200mm x 200mm x 29mm.

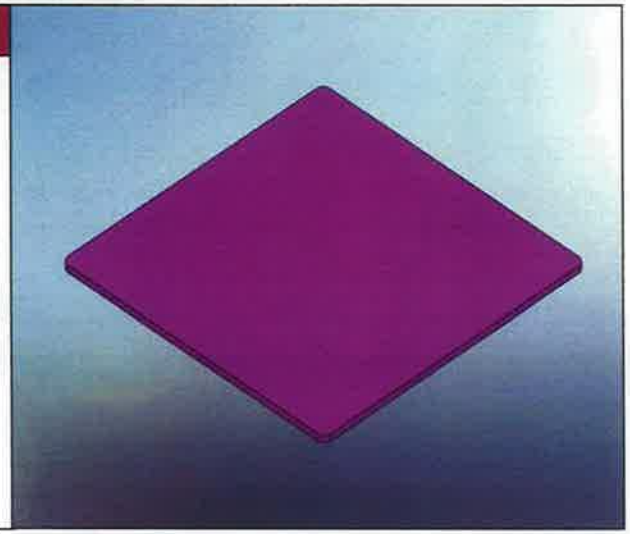


Vacuum Formed Tray

- This tray has been made from high impact polystyrene as it has added strength which is required for its function.
- It has been vacuum formed and shaped to a mould which is a fast and inexpensive process of manufacturing it.
- It has gold/silver film which has tinted the material to give a high quality and expensive appearance.
- The dimensions are aprox: 220mm x 220mm x 29mm.

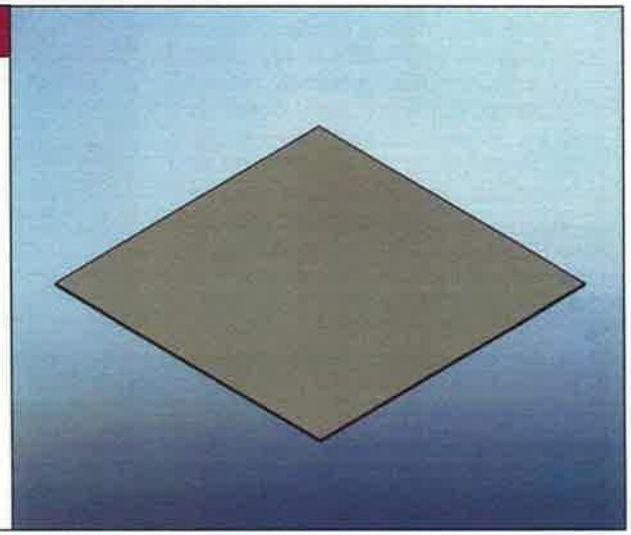
Paper Divider

- This component protects the chocolates from impacting damage and insulates the pack from damp/moisture.
- The divider is made from thin paper that has been embossed with a corrugated pattern and sandwiched in layers to make it cushion any damage to the chocolates.
- The outer surfaces are made of coloured paper that has had a glossy spray varnish applied to it to act as a barrier against moisture.
- Dimensions: 196 x 196mm.



Selection Guide

- This selection guide contains details of which chocolates are contained in the pack and what they look like.
- It visually corresponds with the graphics located on the outer packaging.
- It has been spray varnished to protect it from dirt or damp/moisture damage.
- It is double sided and been printed using offset lithography for cost effect.
- The approx measurements: 80mm x 80mm when folded, 80mm x 160mm unfolded.



These are the details of the components located in the box including the materials and processed that have been used during its commercial manufacture.

-The images used were created by me in SolidWorks and are 3D representations of the components featured in the package.

TESTING - PRINTER COLOUR CHECK

Hexadecimal Colour Chart

To ensure that the colours I printed were as accurate as possible I created a simple hexadecimal colour chart. I then printed this off and compared it visually against the original packaging to determine which shade of purple was most precise. This was an important test that I carried out as part of quality control to make sure the colours didn't differ too much from the colours on the screen to the colours when printed. As a result I found that the colours did vary quite a lot from the ones on the computer screen. I found from comparing the colour chart that the hexadecimal code: #990033 was most similar to the shade of purple featured on the original products packaging. Following this I then ensured that the shade of purple I used for the graphics was the same hexadecimal code to ensure the printed material was accurate and was of a high quality.

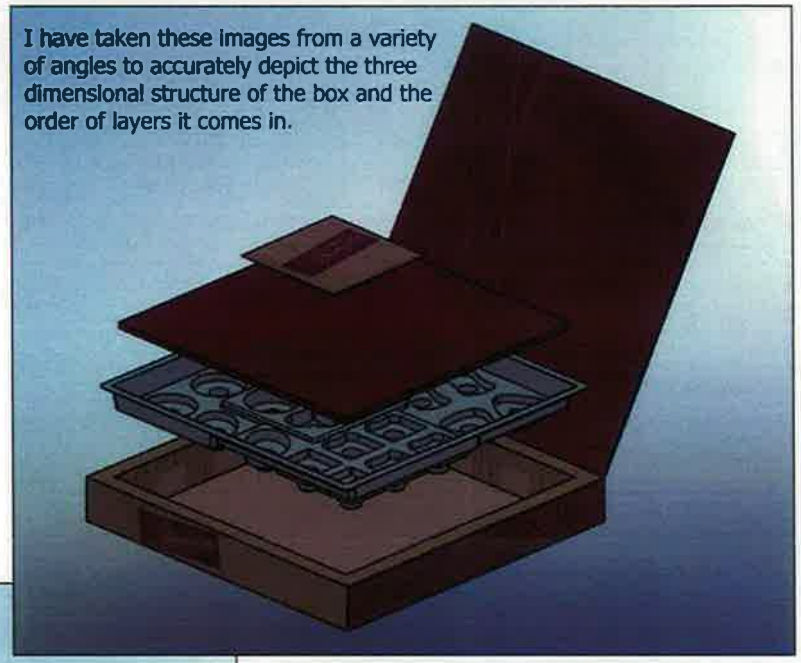
This test was important to meet the design criteria and make sure that my net was a precise replication of the original packaging. I had already designed the graphics before I did this test so I had to go back and modify the colours slightly. I am pleased that I did it before printing it out otherwise the colours could have differed hugely and it would have wasted time and resources re printing the net. This would have included the large amount of ink required to cover A2 sheets.

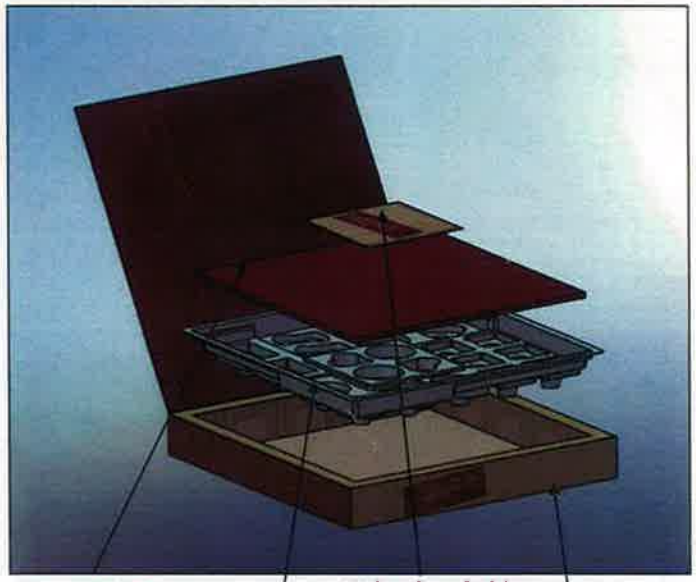
The red circle clearly indicates the colour from the printed chart which was the most accurate compared with the original products packaging. – **"#990033"**

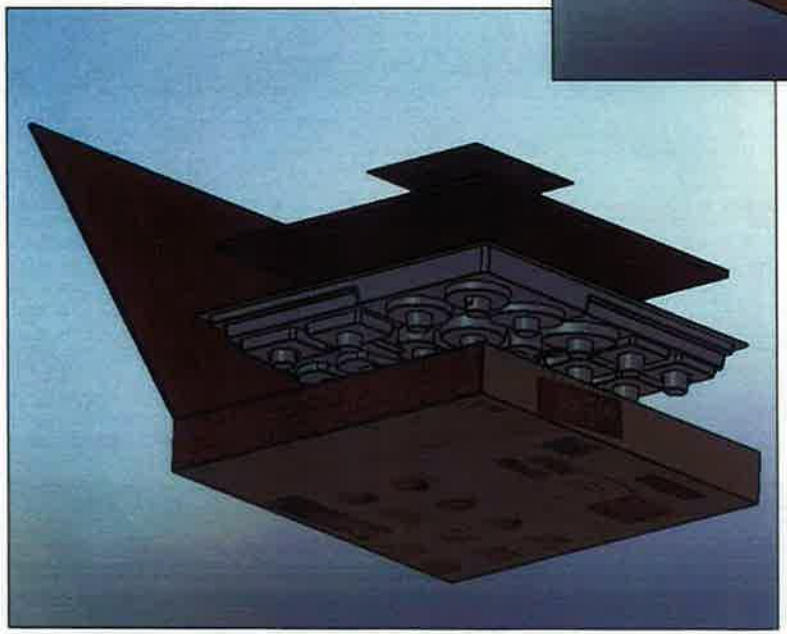
ORTHOGRAPHIC DRAWING - - EXPLODED

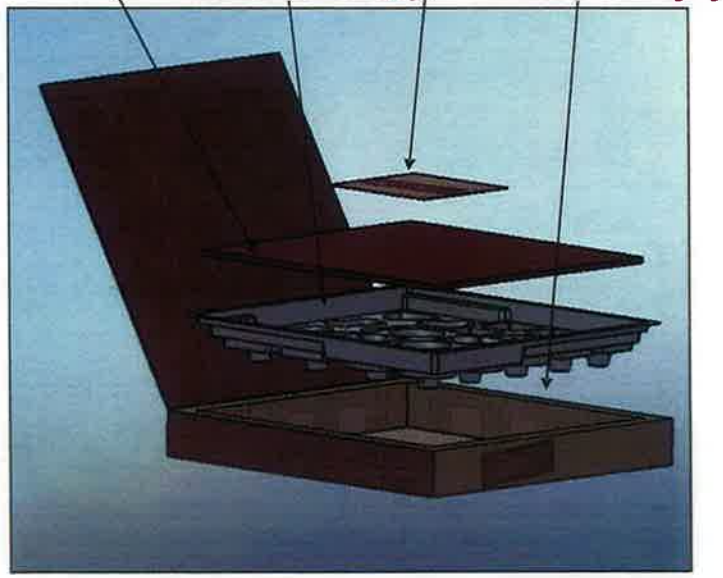
Exploded Views

This is an exploded view of the products contained in the chocolate box that I created in SolidWorks. I created an assembly and then inserted all of the components I had designed separately into the one document. This allowed me to mate edges together such as the lid to the base of the exterior packaging and then rotate it. After I had inserted all of the components I then used PhotoWorks which is an add-on to import my own textures onto the surfaces of the model such as the graphics I had made for the packaging. The result is a very realistic representation of the box in an exploded view. I also rendered the image which produced a high quality photographic like resemblance.





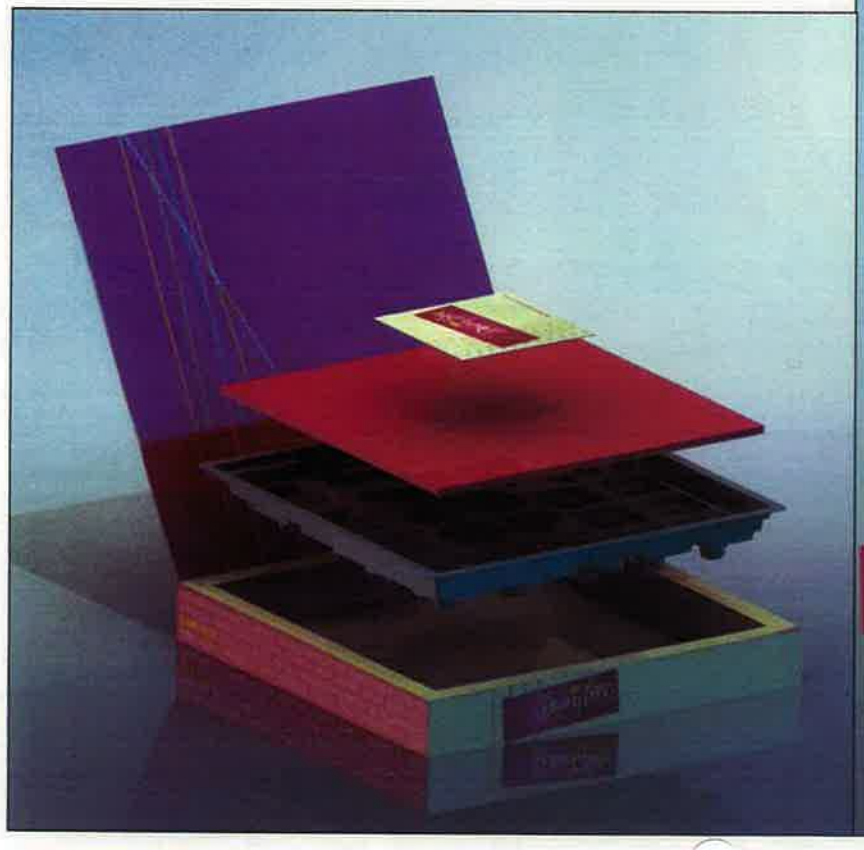




ORTHOGRAPHIC DRAWING - EXPLODED

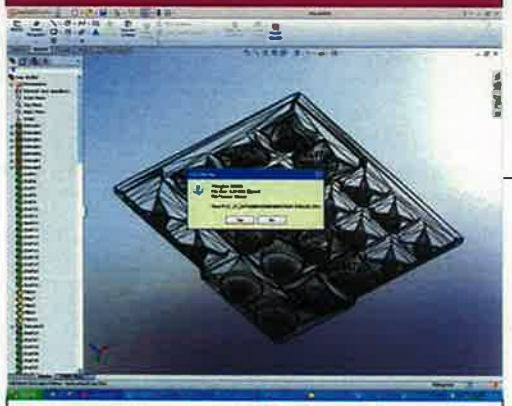
High Detail Renders

I also rendered the image in SoldiWorks which produced a high quality photographic like resemblance. This produced accurate lighting effects including shadows and highlighting. I am pleased with the results as the images are very precise and represent the real package to a high standard. I used the graphics I had created in Adobe Fireworks to apply to each surface.



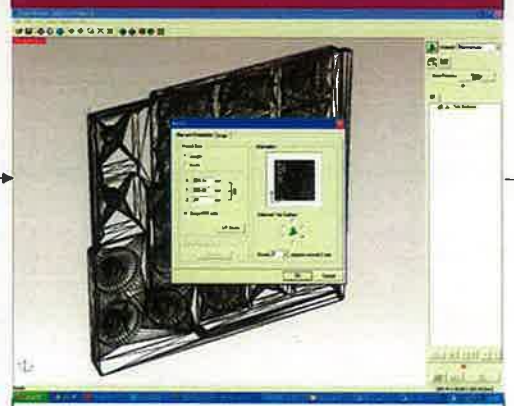
MAKING - REPRODUCING THE TRAY (CAD)

Stage 1: Stereo Lithography File



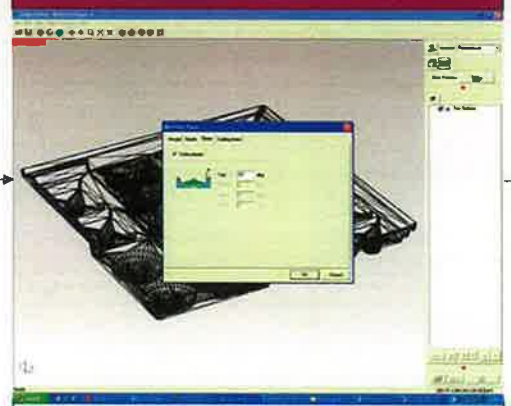
First of all I saved the model in SolidWorks as a stereo lithography file which converted it into a solid mesh (83892 triangles) to be used in another program.

Stage 2: Changing the Orientation



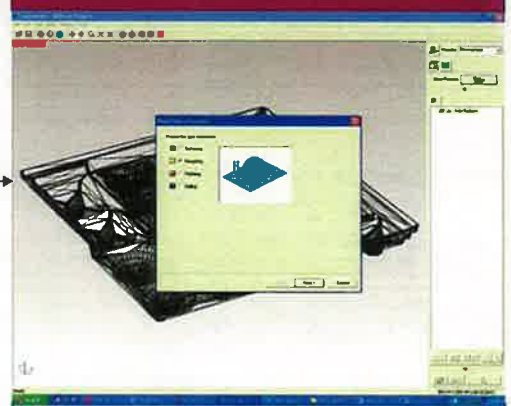
I opened the stereo lithography file in MODELLA Player 4 so I could set up the CNC output. I had to change the top surface so that it was the correct orientation.

Stage 3: Drafting at 10 degrees



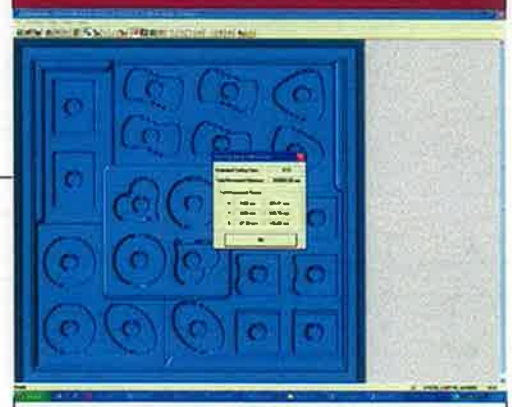
I had to change the modelling form so that the vertical edges were drafted at 10 degrees so that the mould would be easy to remove when vacuum formed.

Stage 4: Creating Rough process



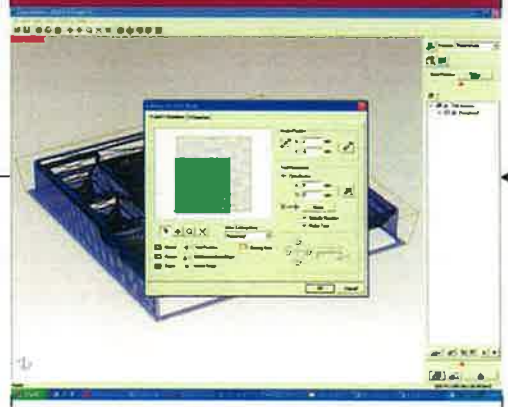
I then clicked on New Process and selected Roughing in order to set the model up, this was necessary before doing a finishing cut as it is quicker to calculate.

Stage 5: Previewing rough cut



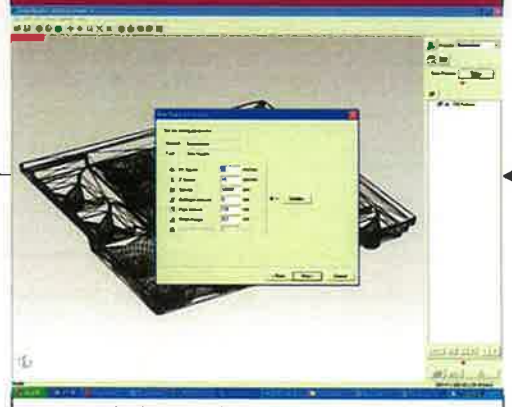
I clicked preview to open Virtual MODELA to show a 3D representation of the roughly milled out product so that I could check for mistakes and check the quality.

Stage 6: Adding a 4mm margin



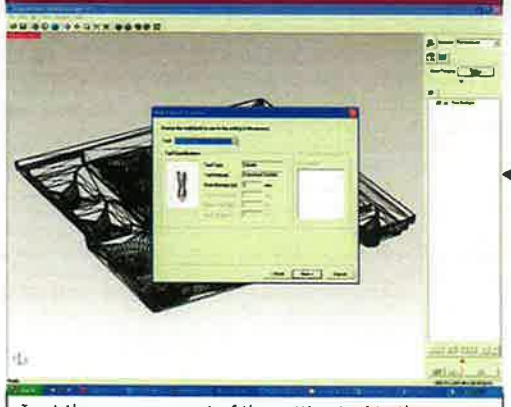
I then set the cutting position in the setup so that the model had a 4 millimetre margin. This was in order to allow additional space for the cutting.

Stage 7: The cutting parameters



Because I had previously set the material as Styrofoam the computer had the correct settings applied for that material. Here I checked the cutting parameters.

Stage 8: Setting the tool size



I set the measurement of the cutting tool to the correct size which was a 3 mm square drill. It was important it matched the one in the machine to prevent mistakes.

This is the process I used when setting up the CNC output for the milling machine using MODELA Player 4. I used previews as a control measure to check the 3D representation for faults or errors, to ensure it would be manufactured correctly as it takes hours to mill out.