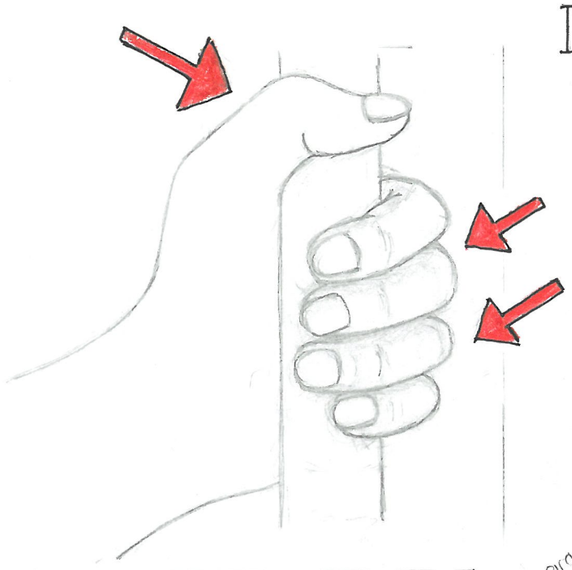
Danny Li

HAND EXPLORATION

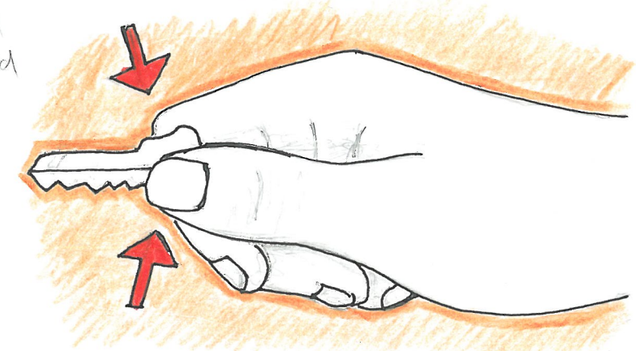


POWER GRIP

The fingers are bunched firmly around an object and overlapped by the thumb. The handle is thick enough to seperate the finger-tips from the palm. (In this situation the forearm muscles have shortened Half-way through their available range of contraction, and they are at their most efficient, because of the mechanics of the line of pull)

There should be a large area of contact, with no spots of local high pressure to prevent strength of grip being inhibited by discomfort. (This is like not being able to put your full body weight on the foot if there is a pebble in the shoe.)

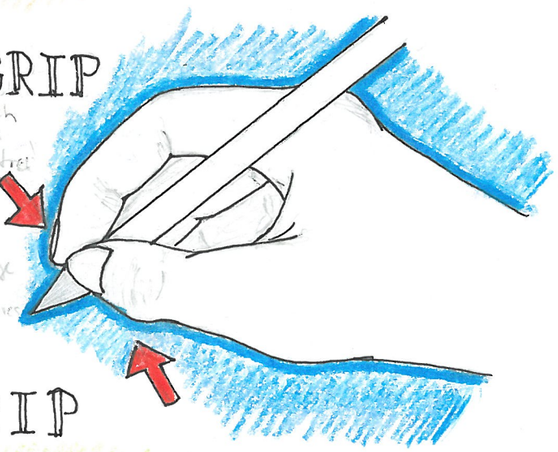
PINCH GRIP



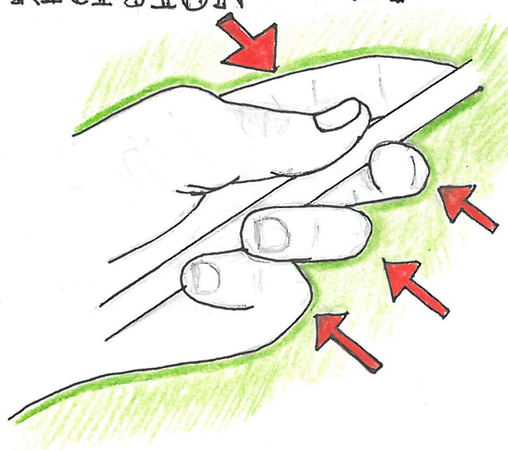
This grip between the thumb and the side of the index finger is used for picking up small objects, but not for manipulating them accurately which needs the next grip to be described. Variants of the pinch grip include a flat grip to the edge of a dinner-plate and many other finger postures, which shade into one another. Small objects have to be gripped mechanically with tweezers or forceps, or stuck onto handles such as the 'dops' used by diamond-polishers.

EXTERNAL PRECISION GRIP

This grip is for fine work such as writing. It starts off with a pinch grip, but has the two extra components of support for the instrument in the cleft of the thumb and support for the whole hand along it's medical edge. It is of special importance for microsurgery and micro-electronics

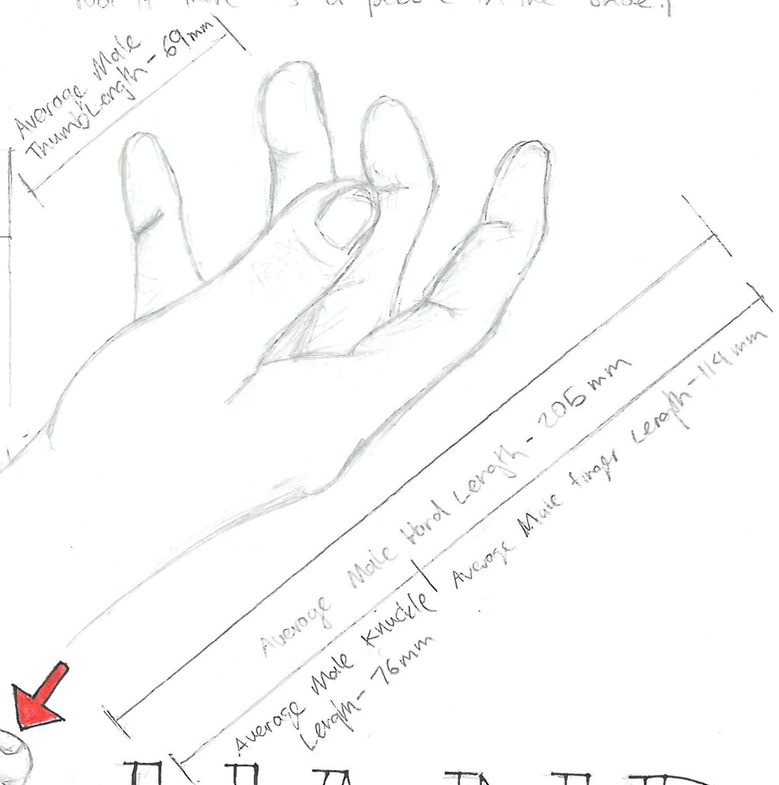


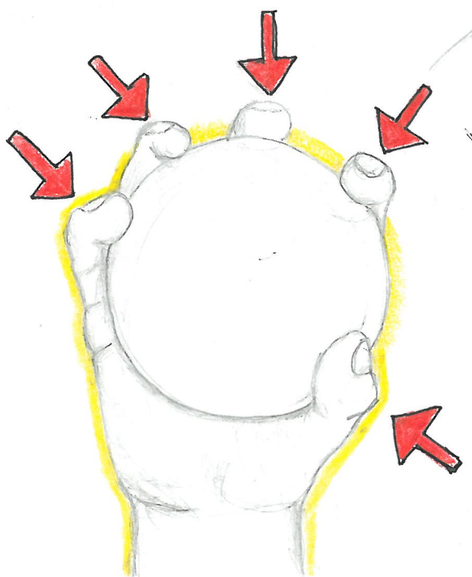
INTERNAL PRECISION GRIP



Unlike the External precision grip, here the tool handle is held parallel to the work surface rather than at an angle to it. The hand may be steadied by the knuckles resting or moving on the work surface, or against the other hand, and there is less mobility in using the tool. This grip is used in delicate wood-carving.

Average Grip Strengths (kg)		
Age	Male Normal Strength	Female Nerval Strength
20-24	36.8-56.6	21.5-35.3
25-29	37.7-57.7	23.6-41.4
30-34	36.0-55.8	21.5-34.3
34-39	35.8-55.6	20.3-34.1





HANDLE EXPLORATION

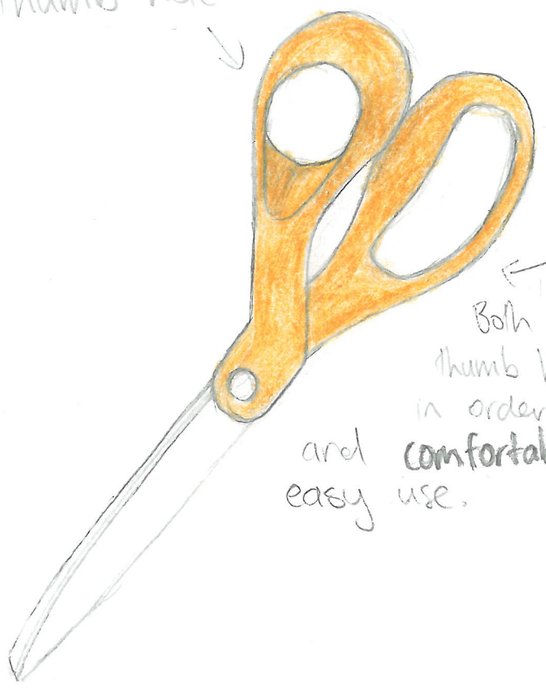
Anthropometric estimates for british adults aged 1965 (in mm, from Pheasant)

Dimensions	5th %ile		50th %ile		95th %ile	
Hand Length	173	159	189	174	205	189
Palm Length	98	89	107	97	116	105
Thumb Length	49	40	51	47	58	58
Index finger length	64	60	72	67	79	79
Hand breadth	78	69	87	76	95	83
Maximum grip diameter	45	43	52	48	59	53

173 159
Male Female

Right handed design because scissor blades are asymmetrical

Thumb hole

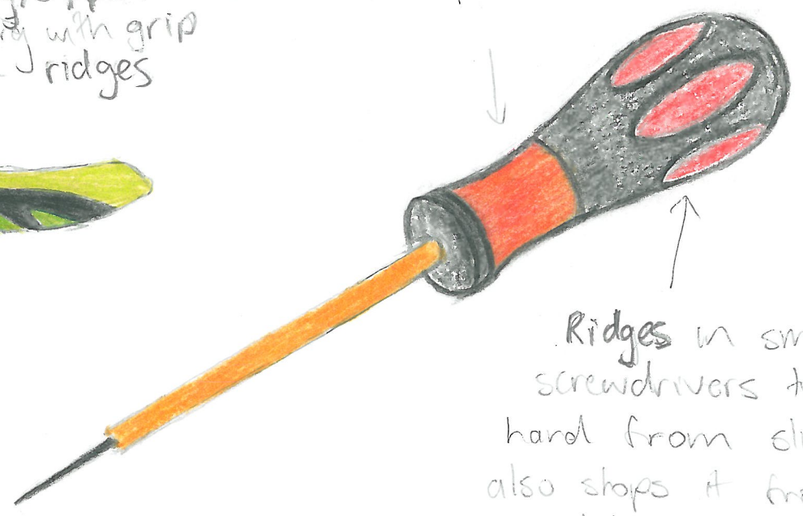


Finger hole

Both the finger and thumb holes are designed in order to be **ergonomical** and **comfortable** to allow easy use.

Special grip on wire-cutters gives **cushioning/support** while also helping with grip with the **ridges**

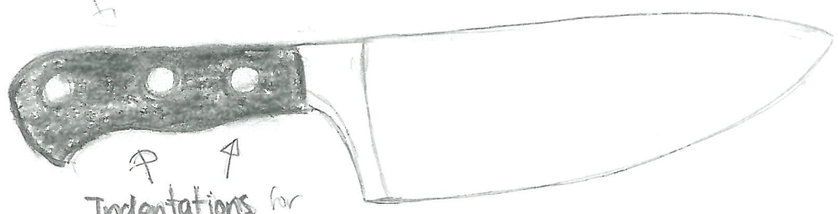
Grip handle



Ridges in smaller screwdrivers to stop hand from slipping and also stops it from rolling on tables and other flat surfaces.

Weight of handle to balance knife and make it feel nice to use

Knife butt to stop hand from slipping off.



Indentations for comfortable grip and to guide hand position.

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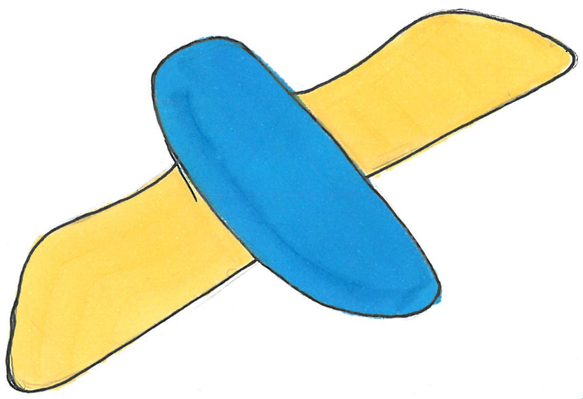
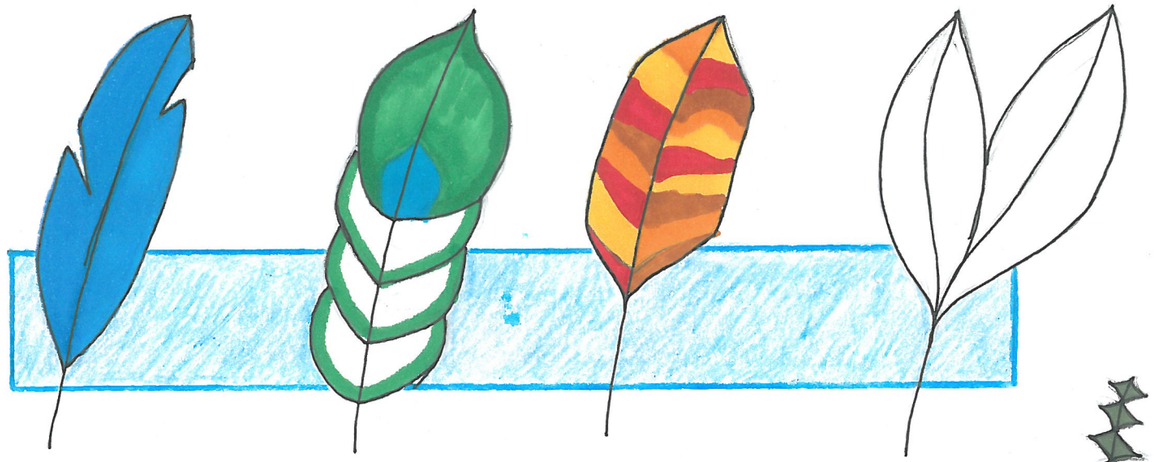
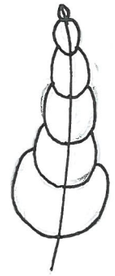
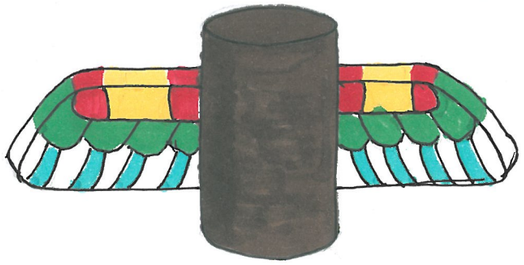
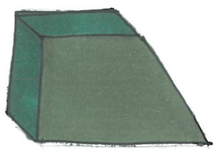
INITAL IDEAS

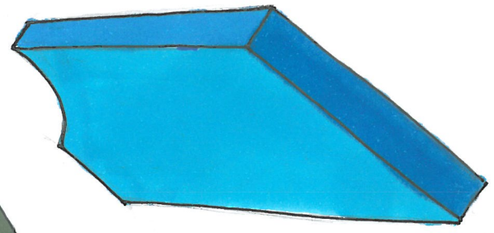


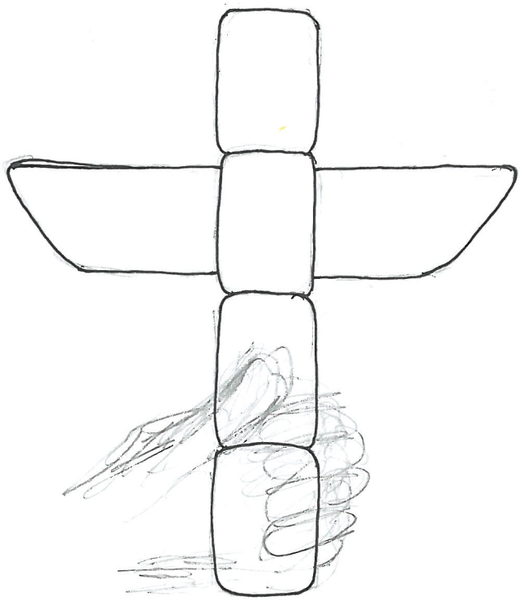


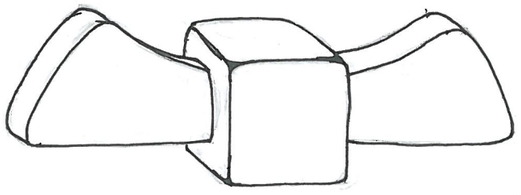


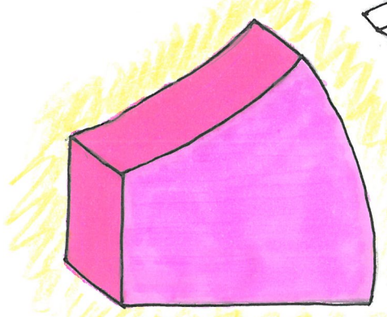


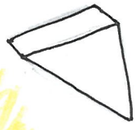


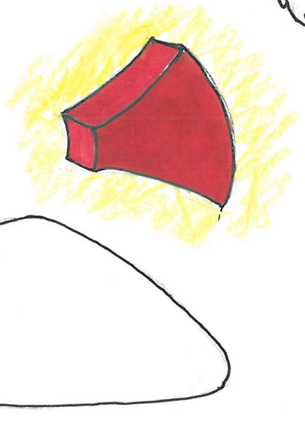


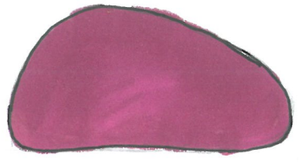












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Many ideas with fingers or holes

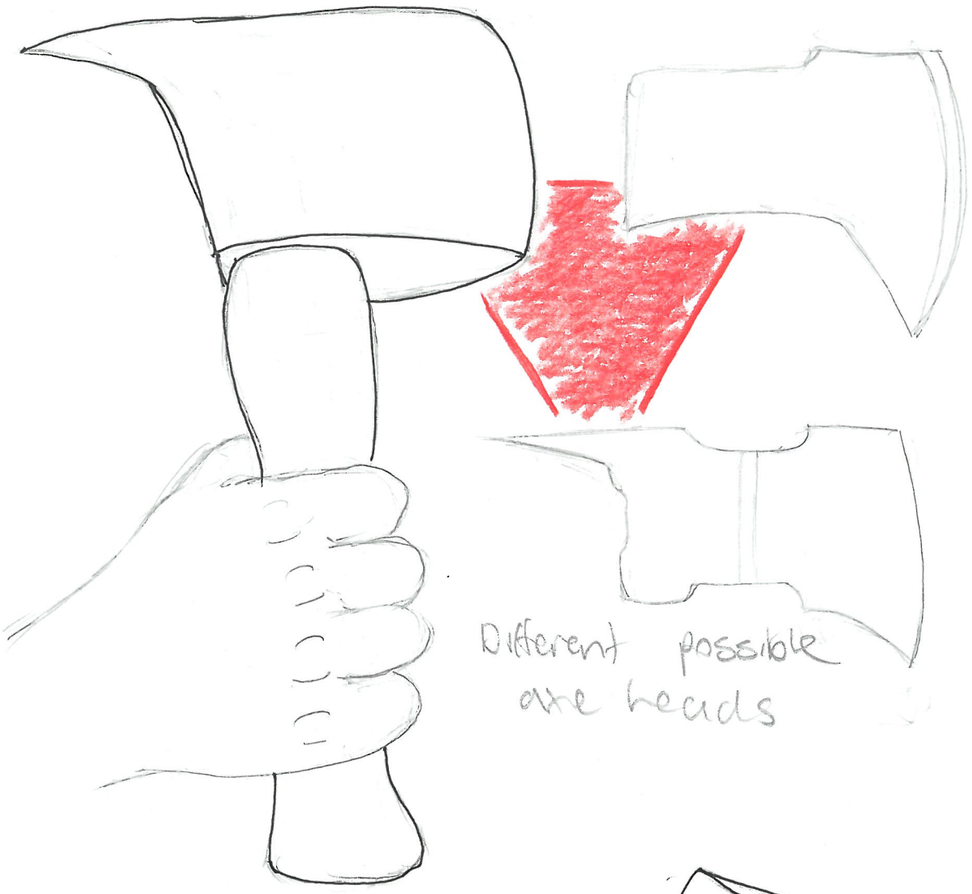
INITIAL IDEAS

Concepts

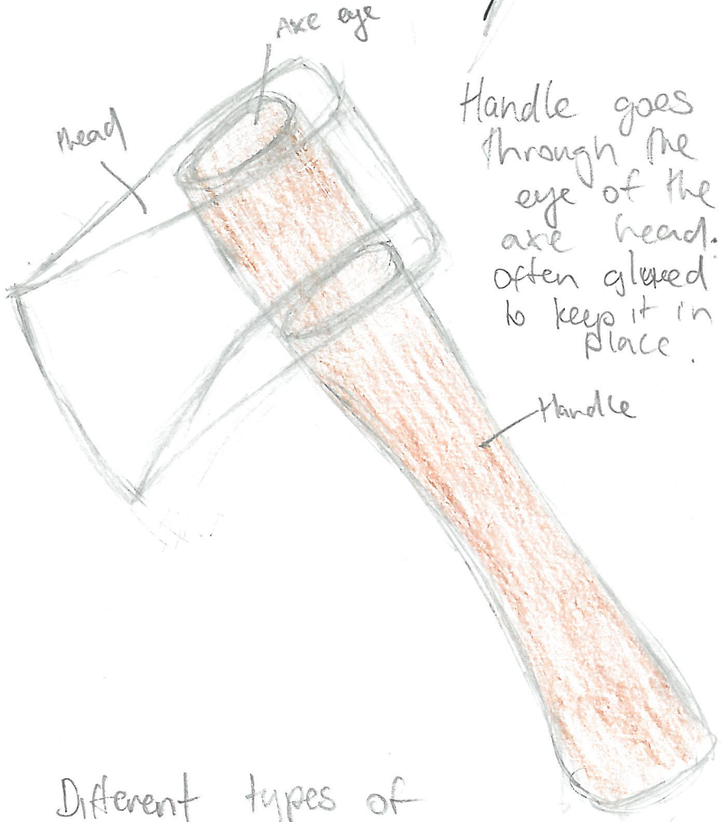
Axe sheath to cover axe head for safety and to prolong

Heel on the end to stop hand from slipping

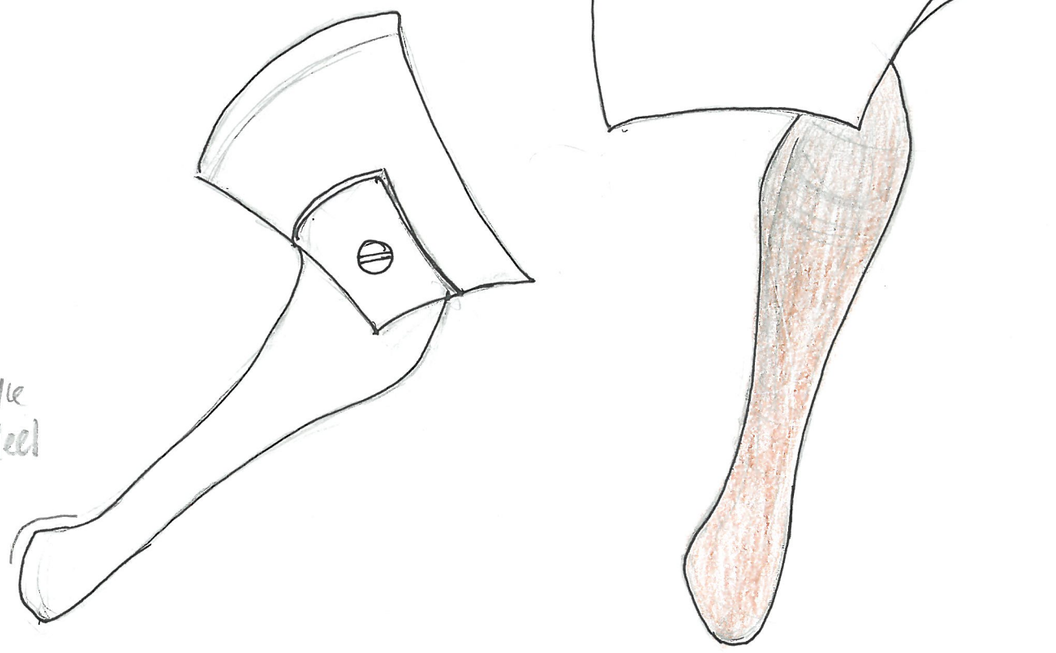
Concepts



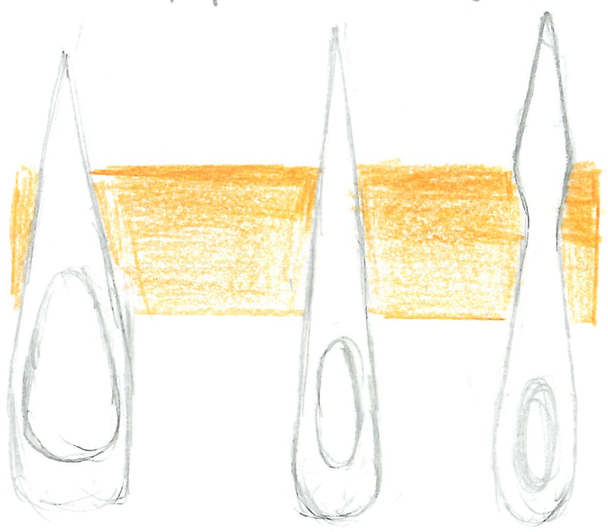
Different possible axe heads



Handle goes through the eye of the axe head. often glued to keep it in place.



Different types of axes top down view



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Model Development

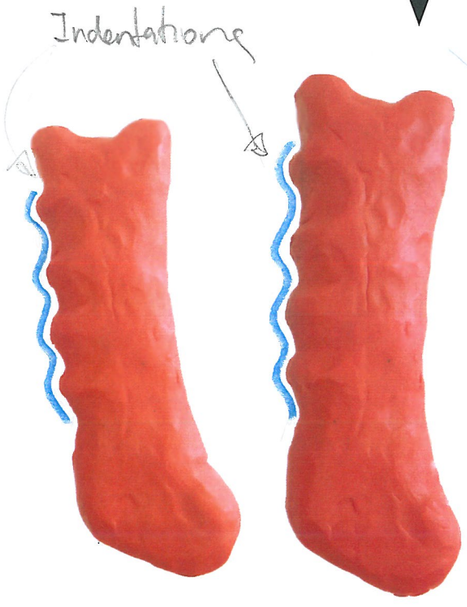
Knob, prevents hand from slipping, specifically the heel bit

For my first model of my handle, I ended up making one too big, as you can see on the left. It didn't fit properly in my hands, which meant it was uncomfortable and not that easy to use and was better suited for much larger hands. As a result, I decided to remodel the handle however, this time I ended up with a grip too small for my hand, as you can see on the right. With this handle, I didn't try it for too long, as it was far too short have any practical use for an axe. However, the diameter of the handle was a much better fit and I decided to try remodeling the handle with a similar sized diameter

After a few goes at trail and error, I finally found a handle which I think is a good fit. It's quite a basic handle with a smooth surface and a bit of curves, it creates for a strong use as a power grip. Overall, I think it is a good starting point as the size of the grip feels nice, although the handle itself may need to be longer in order to properly balance the weight of the axe head.

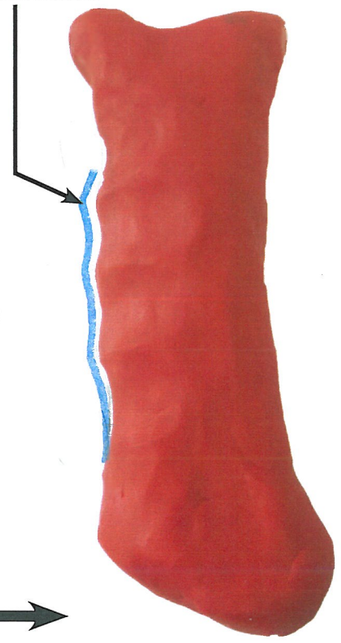
Comfort Descriptors

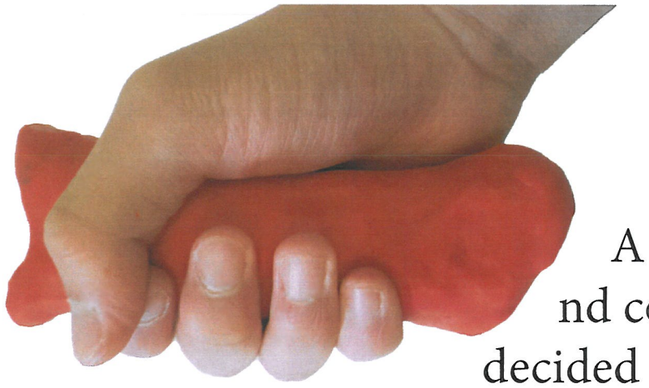
This hand tool:	Totally disagree		Disagree somewhat		Agree somewhat		Totally agree
Fits the hand	1	2	3	4	5	6	7
Is functional	1	2	3	4	5	6	7
Is easy to use	1	2	3	4	5	6	7
Has a good force transmission	1	2	3	4	5	6	7
Is a high quality tool	1	2	3	4	5	6	7
Has a nice-feeling handle	1	2	3	4	5	6	7
Offers a high task performance	1	2	3	4	5	6	7
Provides a high product quality	1	2	3	4	5	6	7
Looks professional	1	2	3	4	5	6	7
Needs low hand grip force supply	1	2	3	4	5	6	7
Has a good friction between handle and hand	1	2	3	4	5	6	7
Causes an inflamed skin on hand	1	2	3	4	5	6	7
Causes peak pressure on the hand	1	2	3	4	5	6	7
Causes blisters	1	2	3	4	5	6	7
Feels clammy	1	2	3	4	5	6	7
Causes numbness and lack of tactile feeling in hand	1	2	3	4	5	6	7
Causes cramped muscles	1	2	3	4	5	6	7



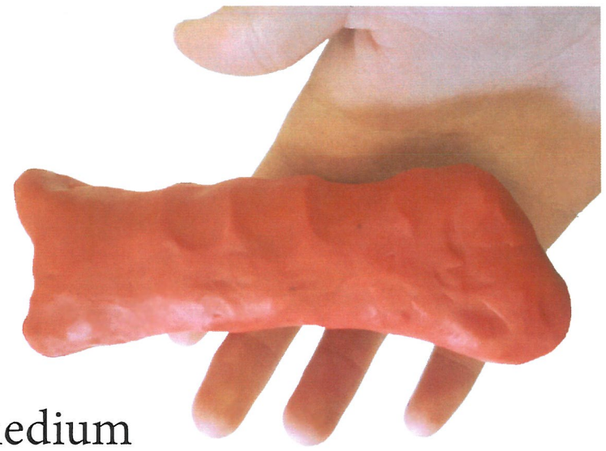
In this model on the left, I decided to test out indentations on my handle. What I found from holding it and was that in a specific hand position, it felt quite nice but in exchange for that, moving the hand around as well as trying a slightly different grip did not feel comfortable as the indentations were too deep.

For the model on the right, I decided to go for a mix between the previous handle and the one above this. I decided to keep the finger indentations but minimalise them so that it will guide the hand/ fingers to a good power grip but won't be too restricting which means it will be more functionable and fits the hand better.





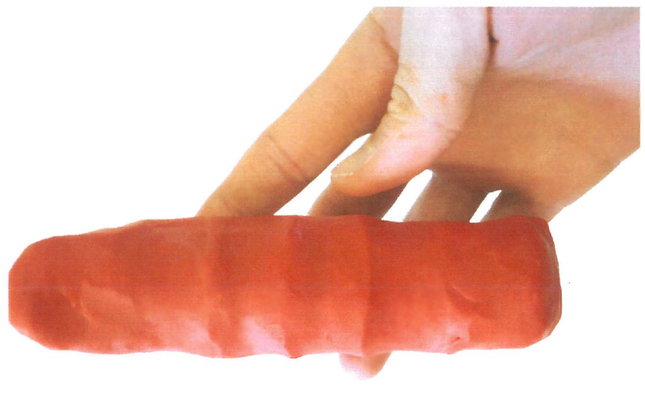
Model Development 2



A good handle needs to be easy to use and not only fit the hand comfortably but have function. I think that this model I have decided to go with encompassess all these points, and is therefore a good handle. While I was holding the handle, the overall shape and medium size felt nice to use as the minimalistic curves of the design help the fingers to easily wrap around, the circles on the hand diagram below show where pressure is mainly being applied. One thing that I may have to change however is the length of the axe as it may be too short in order to feel balanced once an axe head is attatched. The use of handle features such as the slight indentations also helps to guide the fingers and give it a nice position to sit while not completely limiting it. The use of the knob on the end of the handle is another helpful feature that stops the hand from slipping. Overall, the handle is able to allow for good and easy force transmution which very much suits as it is a power grip. From this I am able to have a good idea of what my final design will look like and where to move forward from now.

Comfort Descriptors

This hand tool:	Totally disagree		Disagree somewhat		Agree somewhat		Totally agree
Fits the hand	1	2	3	4	5	(6)	7
Is functional	1	2	3	4	(5)	6	7
Is easy to use	1	2	3	4	5	(6)	7
Has a good force transmission	1	2	3	4	5	(6)	7
Is a high quality tool	1	2	3	4	(5)	6	7
Has a nice-feeling handle	1	2	3	4	5	(6)	7
Offers a high task performance	1	2	3	4	5	(6)	7
Provides a high product quality	1	2	3	4	(5)	6	7
Looks professional	1	2	3	4	5	6	7
Needs low hand grip force supply	1	2	3	4	5	6	7
Has a good friction between handle and hand	1	2	3	4	5	(6)	7
Causes an inflamed skin on hand	1	2	3	4	(5)	6	7
Causes peak pressure on the hand	1	2	3	4	(5)	6	7
Causes blisters	1	2	3	4	(5)	6	7
Feels clammy	1	(2)	3	4	5	6	7
Causes numbness and lack of tactile feeling in hand	1	(2)	3	4	5	6	7
Causes cramped muscles	1	(2)	3	4	5	6	7



Material Development

Hickory

Ash

While choosing my handles material, I decided that I would use either hickory or ash as their the most common materials used in axe handles. Ash is most commonly used in European countries and the wood is easy to work with as it's flexible but also strong. The downside I found to ash was that it wasn't as durable outdoors. Hickory was the most common type of wood used and is well trusted due to being strong, efficient and convenient to use. Because of this I also decided to use hickory as my handles material

Some other types of woods I looked at was cherry, Maple and Pine.
Cherry I found to be too soft and flexible which wasn't ideal so I decided not to go with it.
Maple was quite a tough type of wood and could have been a suitable alternative to use but I decided hickory and ash were more fit for functionality.
Pine wood axe handles weren't as commonly used for axe handles and was mainly just if no other woods were available.

Another possible material I considered was steel due to the obvious advantage of durability and toughness. The major downsides to steel however was that it transmits most of the shock onto your hands which will cause joint problems while cutting/chopping. Shock reduction grips could be added in order to minamilise the shock but theres still the problem of weight.

Steel

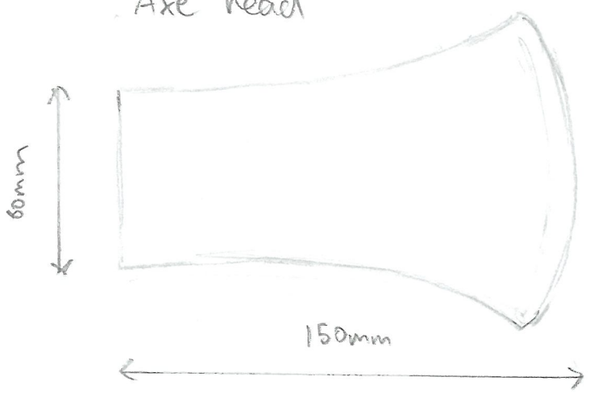
Cherry

Maple

Pine

Final Design

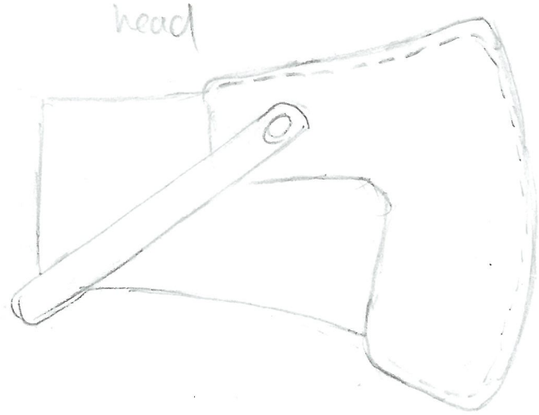
Axe head



Made from steel for maximum chopping power

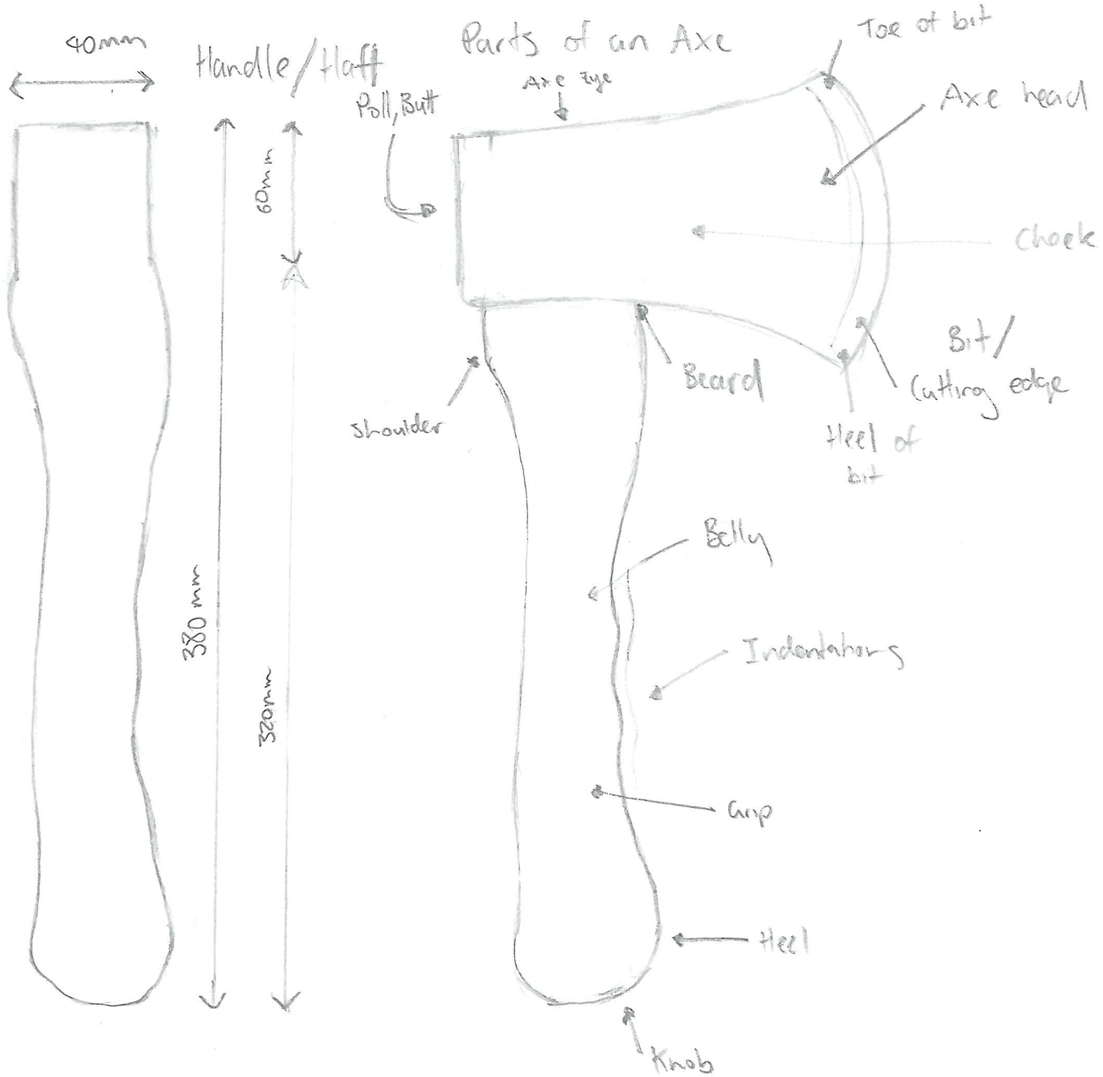
Axe head sheath

Sheath on axe head

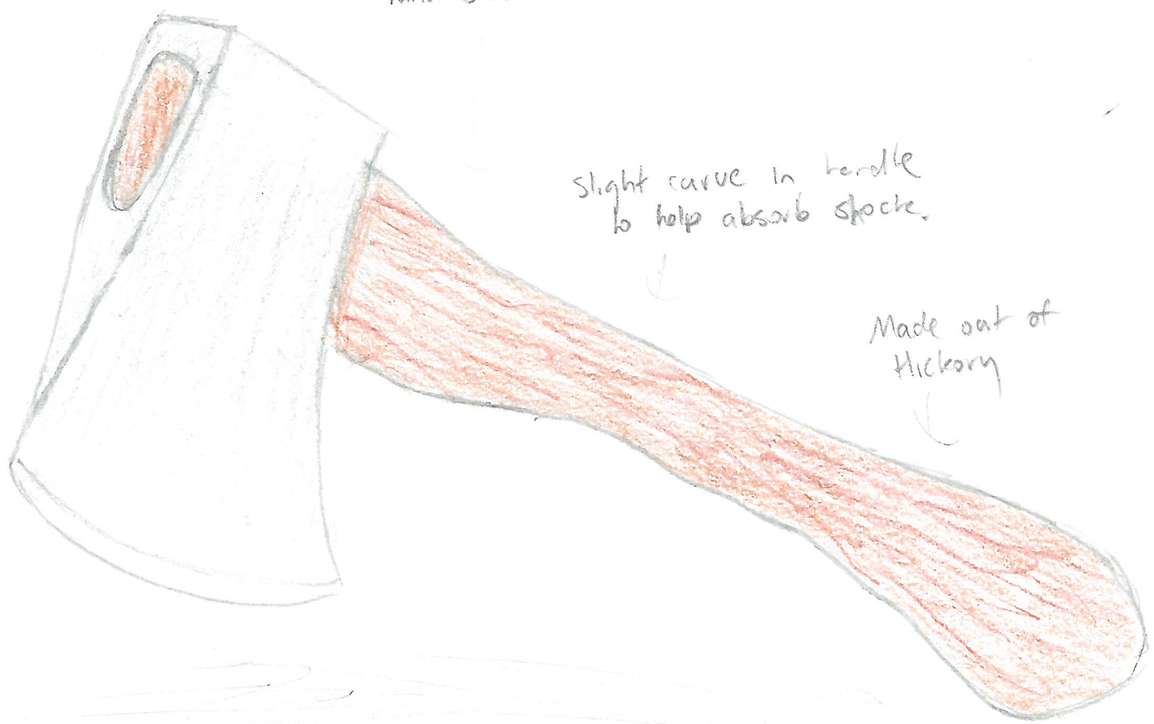


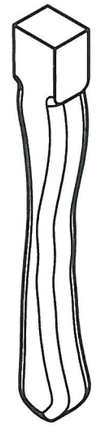
Top-down view of axe

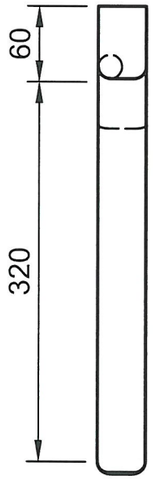
Parts of an Axe



Unfinished hickory as finished handles often cause blisters.







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		Document type	Document status
		Title: Working Drawings	DWG No.
			Rev. / Date of issue / Sheet 1/1

Assessment Schedule – 2019

Design and Visual Communication: Use visual communication techniques to generate design ideas (91337)

Achievement Criteria

Overall level of attainment for 91627	Achievement	Achievement with Merit	Achievement with Excellence
A	*Use visual communication techniques to generate design ideas.*	*Use visual communication techniques **skilfully** to generate design ideas.*	*Use visual communication techniques **effectively** to generate design ideas.*

Evidence

Not Achieved	Achievement	Merit	Excellence
Visual communication techniques (visual modes and media) are poorly applied or limited in conveying design ideas.	Use visual communication techniques to **explore functional and aesthetic qualities** means examining different design ideas (that could be variations of a single concept or a range of concepts in response to a brief). **Explore functional and aesthetic qualities** are to be viewed holistically. • **Functional qualities** may include operation, human interface, ergonomics, proxemics, circulation, environmental factors, construction, materials, components, assembly, mechanisms, dimensions, etc. • **Aesthetic qualities** may include colour, tone, texture, pattern, shape (2D), form (3D), balance, proportion, surface finish, style, etc.	Use visual communication techniques to **explore in detail** the functional and aesthetic qualities of the design. • **Explore in detail** means that design qualities (functional and aesthetic) are clarified through a range (or families) of drawings that show details from different viewpoints. This could include different levels of visual explanation (e.g. overall and closeups, external and internal information, sequence drawings for showing movement, showing design ideas in situ, etc.).	Use visual communication techniques to **comprehensively explore** the functional and aesthetic qualities of the design. • **Comprehensively explore** means that design qualities (functional and aesthetic) are highly informative and easy to follow.
Insufficient design ideas shown where aesthetic or functional qualities are not recognisable, not present, or not visually communicated.	Generated **design possibilities** are different design ideas that are simple alternatives which are predictable, obvious, superficial, or derivations of existing ideas.	Generated **divergent** design possibilities means design idea variations that are challenging, creative, unexpected, experimental, unusual and / or quirky.	**Extended** divergent design possibilities show evidence of design thinking that inspires idea regeneration and manipulation (this can be evident in the ideation that leads to the generating of divergent design ideas or the initial development of a chosen divergent design idea).

Note: **Visual communication techniques** could be digital and / or hand drawn (analogue), e.g. sketching, rendering, illustration, instrumental drawing, model making, mock-ups, 3D constructions, collage, overlays, CAD, animation, photography, etc.

Design ideas: Ideas that have functional and aesthetic qualities as opposed to shapes/forms that are essentially sculptural in nature (as is evident in the initial stages of ideation).

Achievement Exemplar 2019

Subject	Design and Visual Communication	Standard	91337	Overall grade	A
	Annotation				
	The first two pages of this submission contain evidence of research but don't contribute to this assessment.				
	On pages 3–4 shapes and forms derived from nature are explored and simplified.				
	In this case the simplification has led to predictable design ideas in pages 5–6.				
	Pages 7–10 explore some functional aspects of components of the axe in isolation through grip testing and dimensioning.				
	This submission is an Achieved. The design possibilities generated are predictable. The design work makes decisions about the functional and aesthetic qualities of components of the design. While the handle of the design has been well considered, the candidate needed to explore this in the context of the whole product rather than in isolation.				