

Coltness High School
Technical Department



craft

! REVISION
NOTES !

design

S3/4 Revision Notes
Design

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Introduction to Design

The title of this course is 'Craft and Design', but what do we actually mean by these words?

The word Craft basically means "skills in making".
"Design" is not so easy to explain.

The dictionary defines the word design in many different ways.
e.g. "to plan by drawing the outline or figure of"; "to form an idea"; "a plan or scheme formed in the mind".

These are a few of the definitions given, but basically any design process involves *solving practical problems or situations in a creative and logical way*.

Designing involves satisfying needs and/or wants and to do so this requires taking an idea which could potentially solve a problem and turning that idea into reality. Every man made object that is in existence has been manufactured but before the manufacture took place, the product was first designed.

How do we approach this design process?

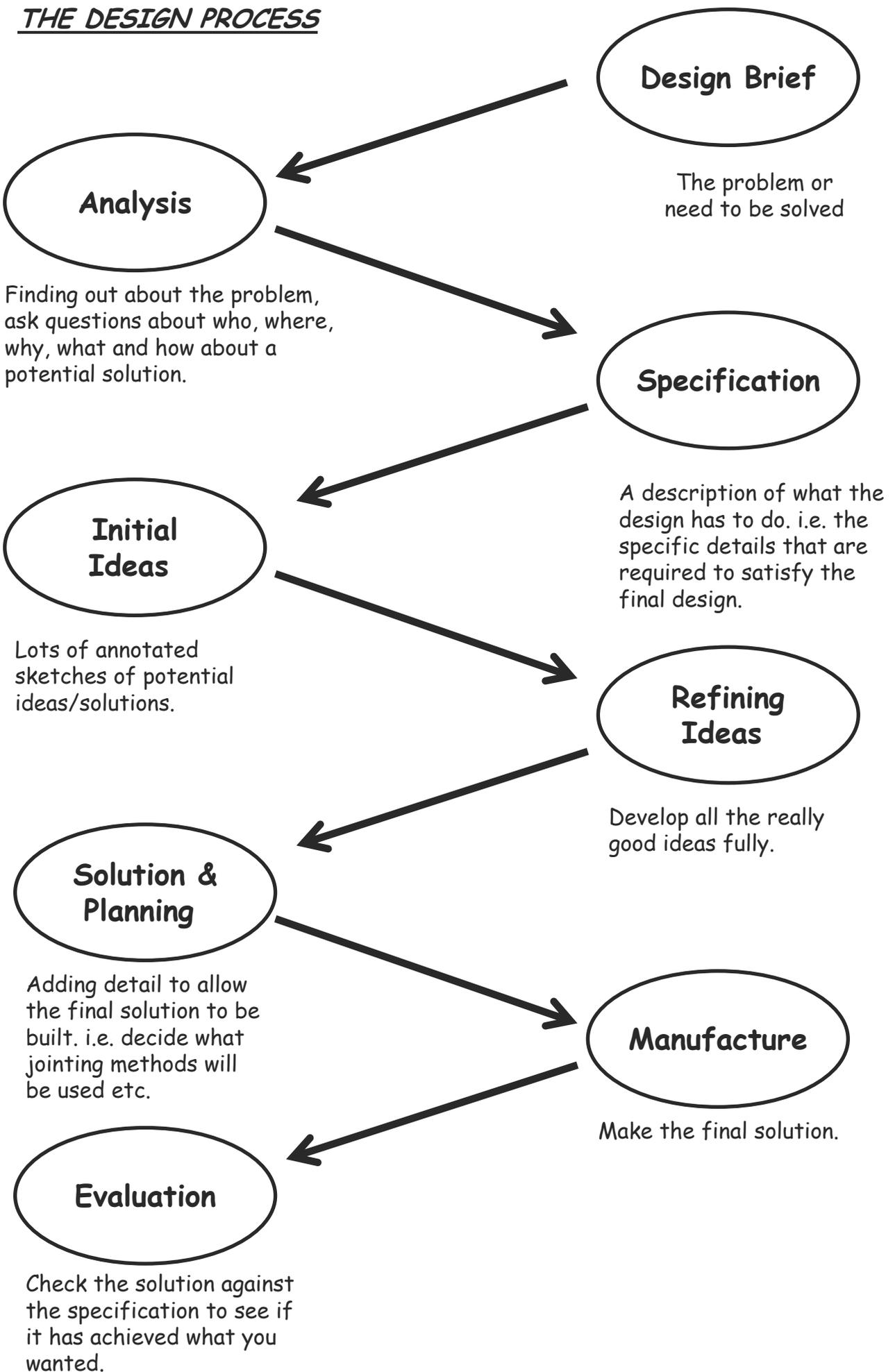
The best way is to approach it in a pre-determined logical order, i.e. in a step by step approach tackling each step at a time.

This is usually undertaken by producing a design folio which will, in S4, contribute to one third of the Standard Grade mark.

To be a successful designer you will have to carry out the design process in a logical order. The following page shows a diagram of the process.

It is important that you follow this process.

THE DESIGN PROCESS



Design Brief

Problem/Brief

As was explained in the previous page the starting point in any design assignment is the need and/or want for a particular product.

This need or want is generally put to the designer in the form of a problem or brief. It can be a short statement or a long detailed specification. The BRIEF as a starting point basically states what has to be designed to solve the need or want.

Analysis

This is where you try to fully understand the DESIGN BRIEF by researching all possible factors which may have an influence on potential solutions.

This might include looking through catalogues, talking to the client (the person who has come to you to with their brief) or looking at similar products in the market place.

Initial Research

This stage of the design process is often started by tackling the problem using a mind map (brainstorming). A mind map tries to tease out early thoughts about what factors will be required to resolve the problem. Some of the most important questions which will require to be asked are; who will use it?, What will it be used for?, What will it be used for?, How will it be used?

Detailed Research

Having carried out the mind map, the next stage is to carry out a more detailed investigation into the following aspects of design.

- | | | |
|---------------------------|---|---|
| •Function & performance | - | what exactly the product must do |
| •Location | - | where the product will be used |
| •Ergonomics | - | how the product will be used |
| •Anthropometrics | - | ensuring the correct sizes for the users |
| •Aesthetics & style | - | the image and appearance of the product |
| •Materials & construction | - | properties of the materials and methods of building |
| •Restrictions | - | limits on any factor |

Market Research

As part of the detailed research it is very important to carry out market research. This is where we need to ask people (the market) who are potential buyers. This is very important because if we want them to buy the product, we have to ensure it is what they want.

i.e. the bet's colour, texture, shape etc.

A typical survey would ask thousands of people questions of this type to try to establish what the current trend in the market is.

To carry out market research a company would use a pre-determined questionnaire which would normally not be very long to stop people losing interest. This means the questionnaire has to be carefully thought out and planned.

Design Specification

Having carried out an analysis to establish all the important factors which will have an influence in the final design of the product, the DESIGN SPECIFICATION should be a listed summary of all these important facts. What the design specification is doing is SPECIFYING what the final product must have as part of its design. i.e. a specific detail for the design of a chair could be as follows:

- *It must be comfortable to sit on as the user will require to sit on it for long periods of time.*
- *It must have four legs for stability.*

Initial Ideas

At this stage, your actual ideas of potential solutions are sketched down on paper. The quality of the sketches are not important but the quantity of different ideas is. A good habit to get into at this stage is to add notes to your sketches (annotate) to explain your thoughts on the design to the reader.

Refining Ideas

Here all your best ideas are examined in detail and improved with respect to improving the quality of the sketch, adding in sizes, exploding the views etc.

It could be that two or three idea need to be combined to create the final solution.

When the final design has been drawn, it then has to be compared to the design specification to ensure that all the specific details listed are covered in the final sketched idea .

Solution and Planning

At this stage, details such as sizes are added to allow the construction of the design. Various types of suitable joints are investigated. The final solution will be presented as a fully rendered drawing.

3D Model

Where appropriate, it is ideal to make a scaled down model of the product. The model could be made from various mediums such as card, modelling clay, to miniature versions in wood.

Doing this allows a greater insight into how the product will look with respect to proportion.

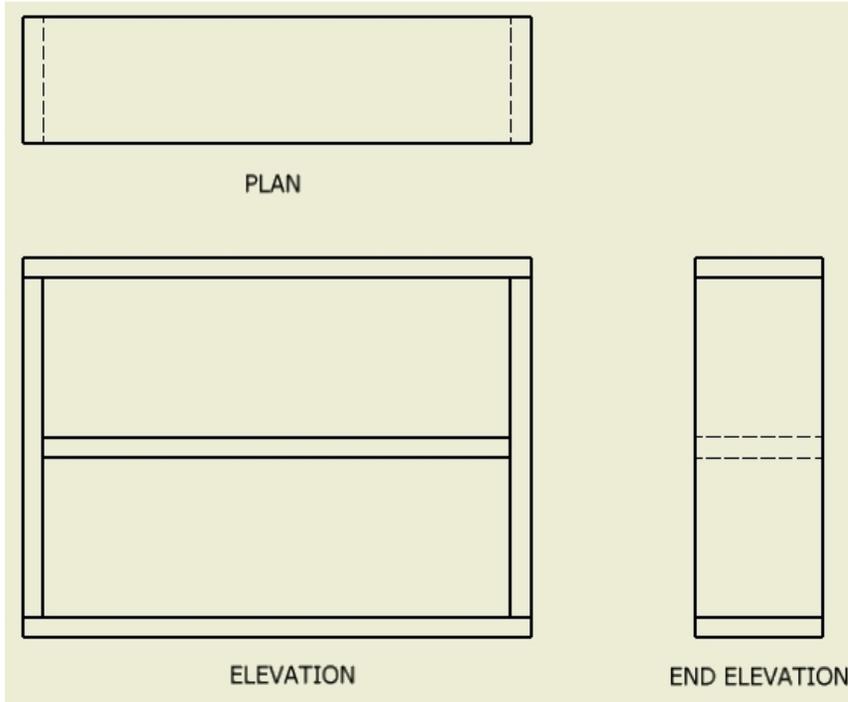
i.e. ensuring all parts of the product look good and not out of place with each other.

Working Drawing

The working drawing shows all the various sizes of the design usually in orthographic format, i.e. three views of the object.

An example of a typical orthographic drawing is shown below.

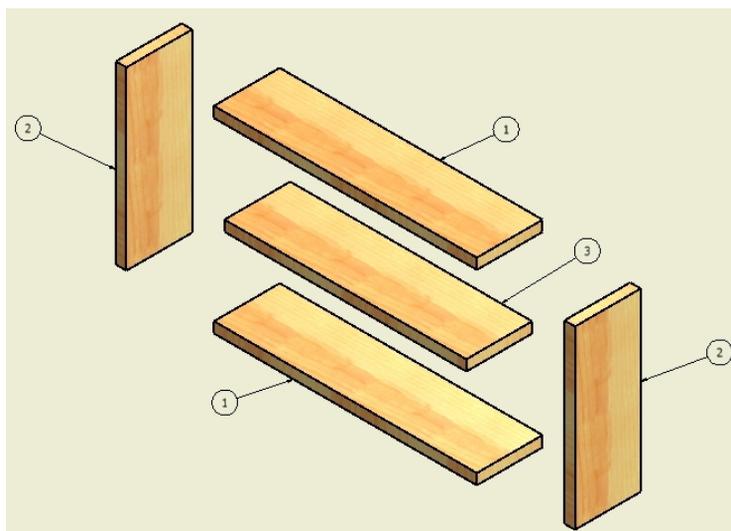
A working drawing allows the manufacture of the product as it shows all the relevant sizes.



Exploded Views

An exploded view is very important as it shows how the entire product may be assembled. Individual joints and other relevant parts may also be shown in exploded form.

The exploded view shown below is of a shelf unit showing all the component parts. It is easier to identify parts of the assembly if each part is individually labelled as shown below.



Cutting List (Parts List)

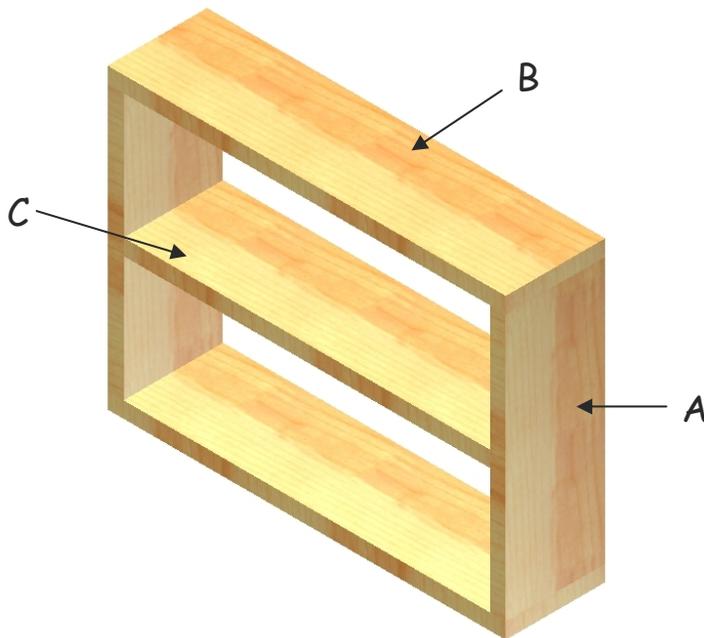
This is a list of all the parts which will be required to assemble the product.

The drawing below is a finished model of a product previously designed for a client. To enable the materials for that product to be made available a cutting list has to be produced.

Note: *If this product was to be manufactured and sold to the public it would be convenient for them to have it assembled, but the reality is, the cost involved for the manufacturer would be far greater as it would take up more space in the lorries.*

if it was bought flat pack (packed up in a cardboard box) the manufacturer would be able to deliver more units at one time thus reducing manufacturers costs, delivery costs and storage space required.

A drawing like this will help a customer to fit all the pieces in the correct way.

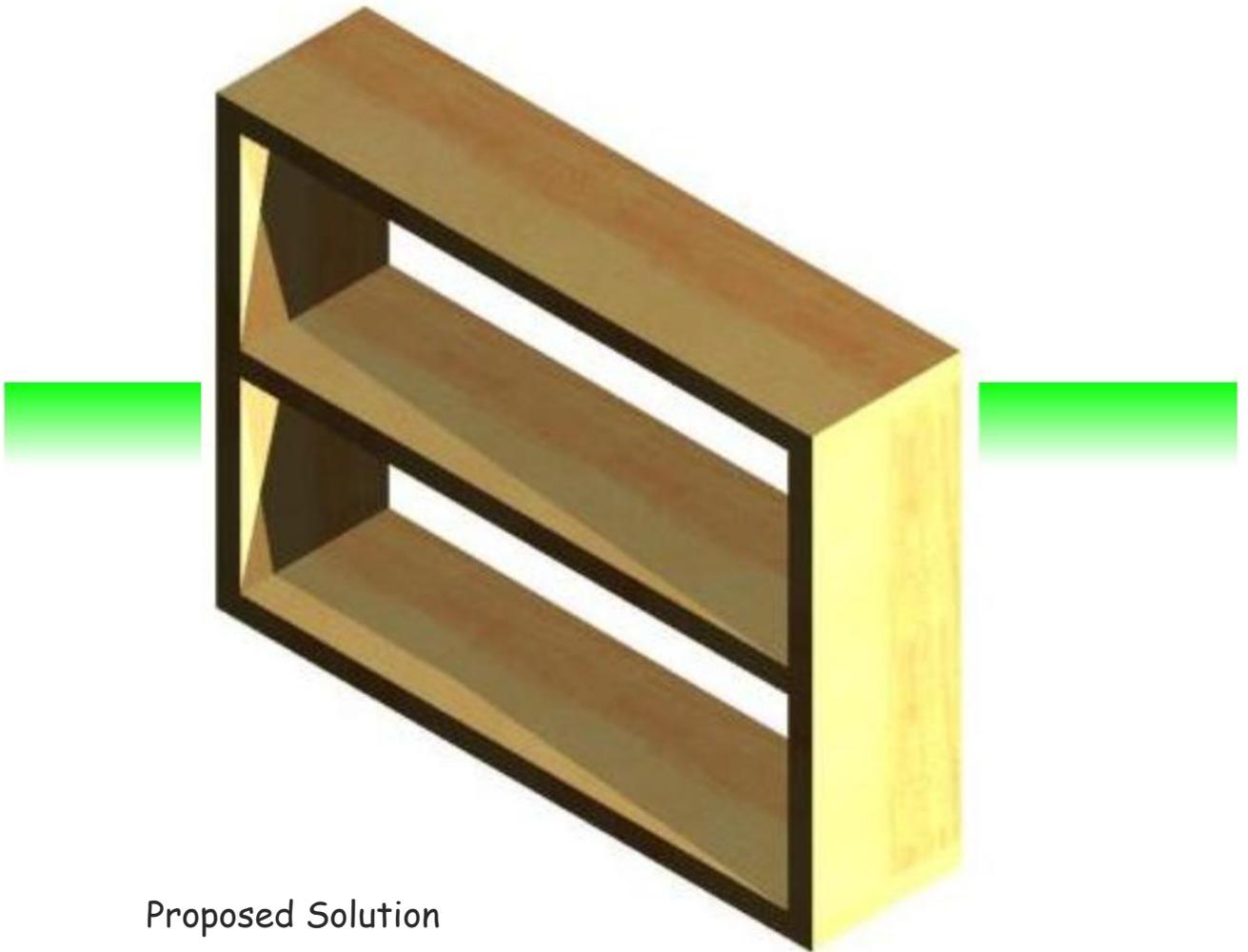


Item	Quantity	Length	Breadth	Thickness	Material
A	2	200	75	12	PINE
B	2	300	75	12	PINE
C	1	276	75	12	PINE

Presentation Drawing

The presentation drawing is a very important aspect of the design process. If the final rendered drawing is carried out accurately and as real to life as possible, this can be presented to the client for their approval before the actual manufacture of the product is carried out.

It could be that the client is not entirely satisfied with the final product and therefore it will be much easier to redo a drawing and remake the prototype model.



Sequence of Operations (manufacture)

Your sequence of operations page is just a set of instructions on how to construct your product.

This may sound easy, but it can be very difficult if you do not keep track of what you have done in the production stages.

There are four main stages in the sequence of operations:

- *Marking out*
- *Cutting, drilling and shaping*
- *Assembly*
- *Finishing*

The sequence of operations should be broken down into clear instructions for each of the stages listed above.

It is very common to hear the words "I don't know what I did!" from pupils. The simple answer to this is to keep a log of everything you do throughout the project. This log will form the basis for a sequence of operations for your folio.

Evaluation and Testing

This is the final stage of the design process and involves writing a report to summarise how well the product satisfied the BRIEF. This is achieved by comparing the final product to the DESIGN SPECIFICATION.

Some typical investigation questions used to help structure the evaluation report might include:

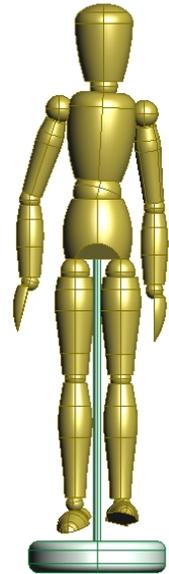
- *What tests were carried out to ensure the product does its job?*
- *What are the strengths and weaknesses of the product?*
- *How could the design be improved?*
- *Did the product solve the problem?*
- *What do other people think of the final design?*
- *Does it look good?*
- *Does the final product meet the SPECIFICATION?*

Ergonomics

Ergonomics was briefly spoken about earlier, therefore, what is ergonomics?

As far as we are concerned, it is about designing products to suit a need or want. This means we have to design products to FIT THE USER whether they are 6 months or 60 years old.

The figure opposite is called an ERGONOME and used as a scale representation of the human figure. They can be posed in various ways to reflect the human body.



You and the product - how well do you work together?

Ergonomics (human/product interface) is about making life simpler, safer or easier, by taking account of the dimensions of the relevant human body parts when we design products.



Taking the example of the ergonome sitting in the car seat.

The seat has been designed to fit our body shape taking account of leg length back support, head rest position and steering wheel position.

You can look at any product around you and work out the ways in which it has been specifically designed to accommodate the human form.

The vast majority of designing is done for the average person rather than distinguishing between tall or short, large or small.

This is because people who design products want to sell as many as possible and therefore designing for the majority will result in more product sales.

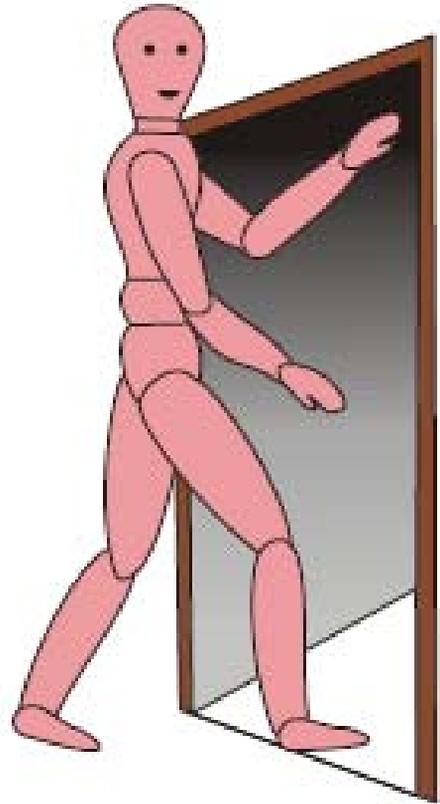
It has just been stated that ergonomics is about designing to suit the user and the user needs.

It has also been stated that we normally design for the average person. This is true for the majority of cases but there can be exceptions.

A doorway is an obvious choice to focus on.

If a doorway is designed for the average person, anyone taller would hit their head on the way through. The door frame is therefore designed with the tallest members of society in mind.

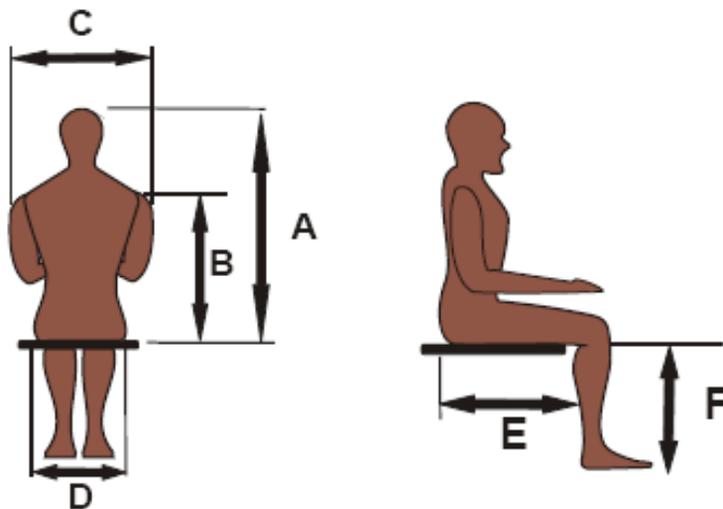
Also, a door handle would be placed to suit the majority of people with only the shortest people finding difficulty.



Anthropometry (an_thro_po_met_ry)

So far we have looked at designing to suit our needs i.e. ensuring anything which we design will fit us.

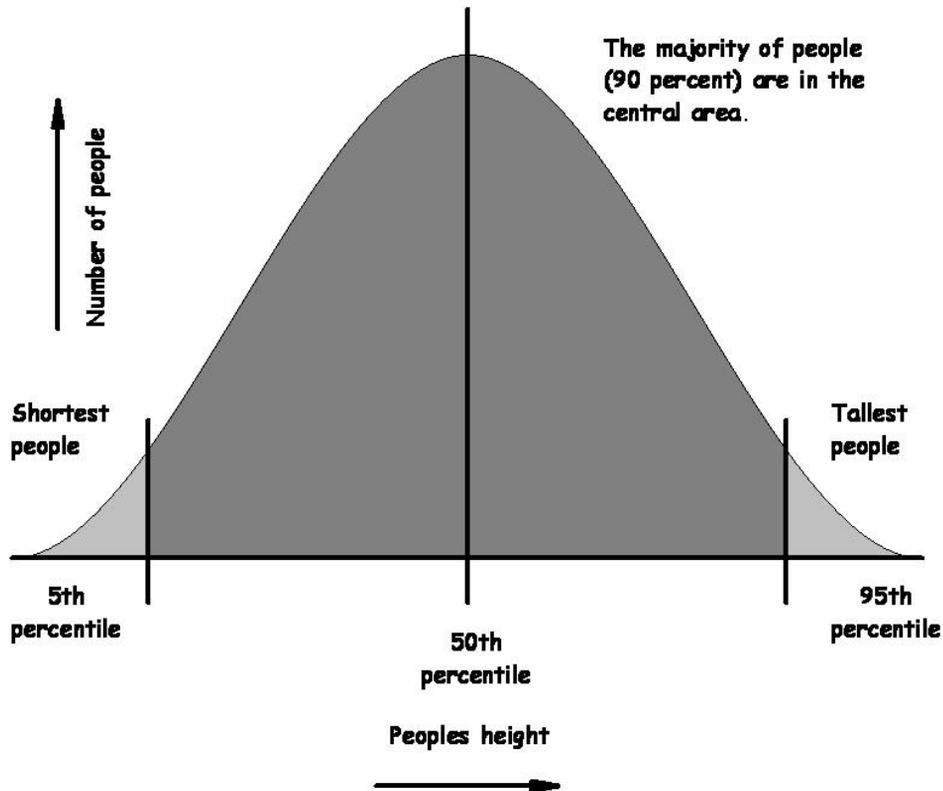
Anthropometrics is about the size of the human body. If the design brief we were given was to design a chair, the sizes of the body when sitting would be required as shown below.



Although it has been stated that these sizes will be taken, it is not as simple as that.

For a chair it would be the average sized person we would be designing for. As people come in all shapes and sizes, a large sample of the population would be required to get an accurate measurement of the average.

Regardless of where in the world we took our sample of people, the results, when produced as a graph, would always turn out to be in the form shown below.



The middle of the graph tells us that most peoples height is similar. We take this as being the average height over the sample. This average is called *The 50th Percentile*.

As designers, this would represent the majority of customers and therefore people in this group are most likely to buy the product.

The graph also shows us *The 0-5th Percentile*. This represents the minority of people who are very short.

Also shown is the *95th-100th Percentile*. This represents the other minority of people who are very tall.

Designers generally ignore these two areas when designers as they are outwith the normal deviation for designing.

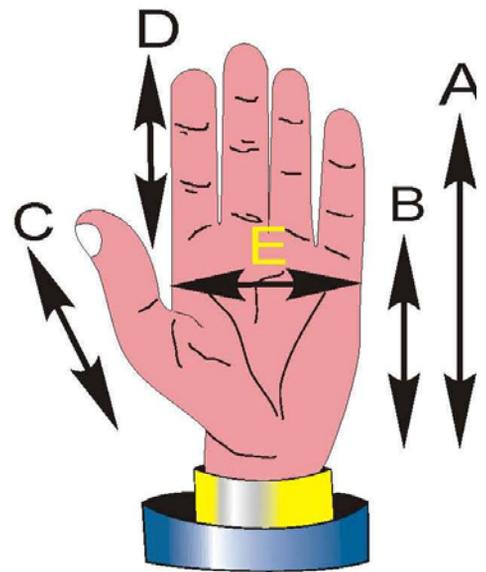
Now that we have considered that we work with the average sizes of the human body, we will look at what is required when designing a mobile phone. Factors such as finger size, finger length, hand grip etc. must be considered.

The picture opposite shows the main parts of the hand to be considered when designing a mobile phone.

The table below lists each part of the hand and also gives the 5th, 50th, and 95th percentile for both male and female hands.

The reasoning is that male and female hands are different in that a male hand is generally larger.

This means that if a telephone was to be designed it would have to be done with both men and women in mind.



Anthropometric estimates for British adults aged 19 - 65 years (in mm)

<i>Dimension</i>	<i>5th %ile</i>	<i>50th %ile</i>	<i>95th %ile</i>	
<i>A Hand Length</i>	173	189	205	MALE
	159	174	189	FEMALE
<i>B Palm length</i>	98	107	116	MALE
	89	97	105	FEMALE
<i>C Thumb length</i>	44	51	58	MALE
	40	47	53	FEMALE
<i>D Index finger length</i>	64	72	79	MALE
	60	67	74	FEMALE
<i>E Hand breadth</i>	78	87	95	MALE
	69	76	83	FEMALE

Looking at the table, the percentile that we are concerned with is the 50th.

Try adding the 5th and the 95th percentile together and dividing by two. What figure has this given you?

Each of the five dimensions relates to a particular part of the phone design. e.g. thumb length for dialling or texting while holding the phone.

Anthropometrics in Use

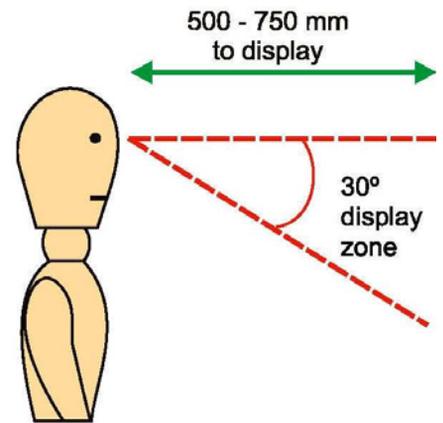
We all know supermarkets sell a great variety of products, but why are the shelves not higher or deeper than they are?

Surely they could sell a lot more if this were changed? Probably not.

First of all, if they were higher or deeper, the average person would not be able to reach the products or possibly not see what the products are.

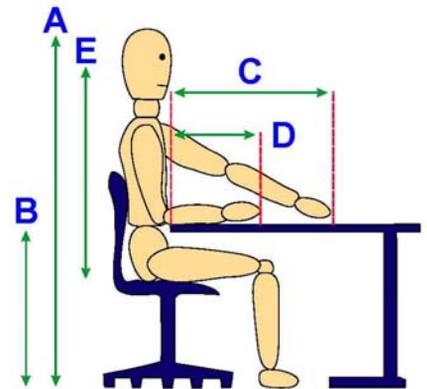
Secondly, the shelf designers have considered that people only really pay full attention to items within their visual display zone.

If a customer has to reach up too high or down really low then they will opt for a different or similar product within their own comfort zone.



In the picture opposite, factors which have to be considered when designing a table would be to ensure that the table was high enough to be comfortable when seated.

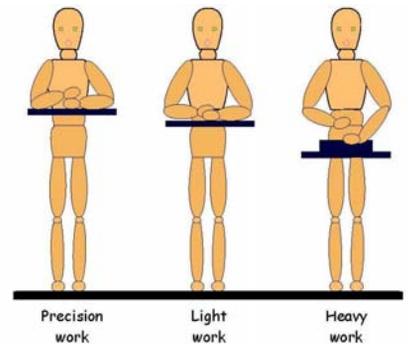
The reach of a person is also very important in determining a comfortable work area. If it was too large then the user would constantly have to stand up to reach items. (not ideal)



This picture shows three different table heights for a person standing to work.

If a person is working with heavy items then it is easier to lift it up to waste height than to elbow height.

If a person is working with light materials or needs to be very precise in the work then bringing the work to a more controlled level is better.



Ergonomics in Action

The picture opposite is a prime example of ergonomics in action. Just about every part of the bicycle has been designed with the human interface in mind.

The saddle is designed to fit our buttocks. The handle bars and grips for our hands, the pedals for our feet.

The brake levers for finger reach and strength.

The designers of bicycles have also made the handle bars and saddle adjustable to allow for the majority of users.



An ideal way to find out if a design "works" is to test it out using a full size ergonome as shown above.

This helps the designer in ensuring all body parts can comfortably reach where it should.

Aesthetics

Having discussed the ergonomic factors of various artefacts in these notes, another important aspect of design is AESTHETICS.

This is about how a product looks.

A well designed product will look attractive and possibly have a distinctive style of its own.

If a product is designed and fulfills its function yet does not look very nice, WHO WOULD BUY IT?

To the consumer, if it does not look good then they will not buy it.

What makes a product look good?

- Shape, size, and proportion
- Colour, materials and texture
- Distinctive style
- Image

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Questions on Design

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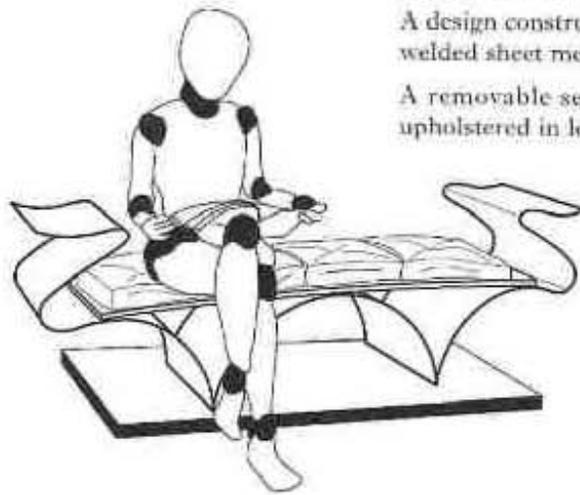
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Piers Gough

Chaise longue (outdoor bench)

A design constructed from folded and welded sheet metal.

A removable seat mattress is upholstered in leather/fabric.



1. The strange looking figure sitting on the bench above is called an ergonome. They are widely used by designers. Give two possible uses for an ergonome. (2)
2. The designer took into account Ergonomics when designing the bench.
 - (i) What is Ergonomics? (1)
 - (ii) Identify two ergonomic factors that may have influenced the design of the chaise longue shown above. (2)
3. Anthropometric data was essential in making the design comfortable.
 - (i) What is anthropometrics? (1)
 - (ii) Where would you find Anthropometric data? (1)
 - (iii) Suggest two Anthropometric considerations with regards to the design of the seat. (2)
4. Aesthetics is something that is always considered when designing a product.
 - (i) Explain what is meant by aesthetics? (1)
 - (ii) Comment on two aspects of aesthetic appeal of this design (2)
5. The bench shown above has the primary purpose of seating an adult comfortably. However it would not be suitable for all seating purposes.
 - (i) Give an example of where this type of bench would be unsuitable to be used. (1)
 - (ii) Give an example of where this type of bench would be suitable to be used. (1)

There are many words that are used when discussing design and have to be considered when working through the design process. Below is shown a picture of a standard design of a bike.



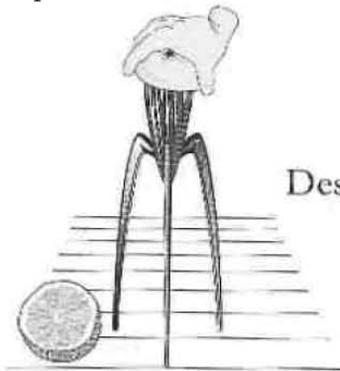
With reference to the bike,

- (i) Explain what the following words mean.
- (ii) Give an example of where the word would be used in the design of the bike.

1. Ergonomics (2)
2. Anthropometrics (2)
3. Function (2)
4. Aesthetics (2)
5. Economics (2)
6. Modelling (2)
7. 5th to 95th Percentile (2)
8. Prototype (2)
9. Safety (2)

Total 18 Marks

The “Juicy Salif” Lemon Squeezer is shown.



Designed by Philippe Starck

In the specification for the squeezer, aluminium could have been chosen as it “must be light in weight”.

1. Give two other aspects of the specification which would support aluminium as a suitable material for the project (2)

2. During the investigation and research, some factors which may have influenced the design were identified as:

<i>Function</i>	<i>Safety</i>	<i>Materials</i>	<i>Size and Weight</i>	<i>Maintenance</i>	<i>Appearance</i>
<i>Ergonomics</i>	<i>Anthropometrics</i>		<i>Cost.</i>		

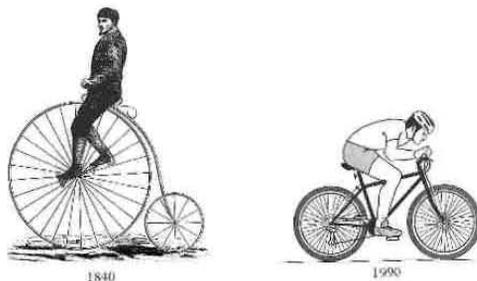
From the list, which one of these would be mainly concerned with each of the following

- (i) Sharp corners and edges. (1)
- (ii) Aesthetics effects. (1)
- (iii) Few repairs. (1)
- (iv) Fitting your hand. (1)

3. The juice squeezer is stable. What is it about the design that makes it stable? (1)

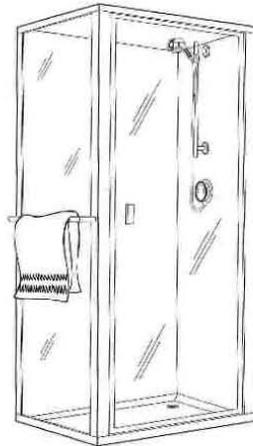
4. The juice squeezer is “tall”. Can you suggest a reason for this? (1)

5. Below shows how bike designs have changed over the last 150 years.

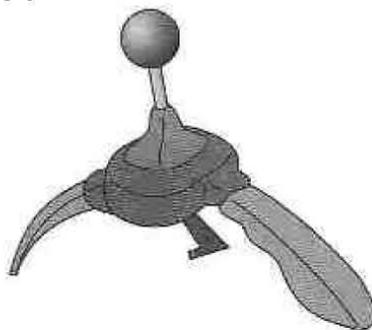


Suggest two factors that may have influenced the development of bicycle design over the past 150 years. (2)

The shower shown is designed to be used by people in the 5th to the 95th percentile range.

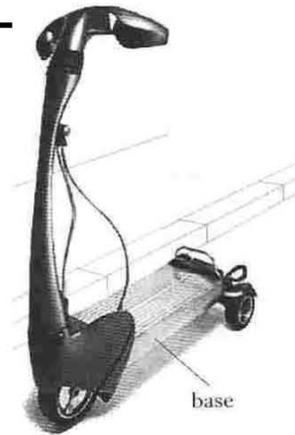


1. Explain why designers use the 5th to the 95th percentile? (1)
2. State a size or feature of the design that takes into account
 - (i) a 5th percentile consideration (1)
 - (ii) a 95th percentile consideration (2)
3. Explain how the shower can be adjusted to suit people within the 5th to the 95th percentile range. (1)
4. List two other products that are adjustable to suit human differences. (2)
5. In each case state one of these adjustments that can be made. (2)
6. A model of a computer game joystick is shown below



- (i) Models are regularly used in the early stages of the design process. Explain two benefits of doing this. (2)
- (ii) Why would plasticine be useful for modelling some of the joystick parts? (1)
- (iii) A presentation model is created before a product is mass-produced. State a benefit that the presentation model gives to the manufacturer. (1)
- (iv) Describe the meaning of the term mass produced. (1)

1. A scooter designed for city use is shown



- (i) The scooter should be suitable for a range of adults whose height is between the 5th and 95th percentile. What does this mean? (1)
- (ii) The top of the base has a grooved surface. State a reason for the grooves. (1)

2. A children's character chair is shown below.



- (i) Market research was carried out as part of the investigation. Explain the purpose of market research. (1)
- (ii) Give an example of how market research could be carried out (1)
- (iii) Primary colours were used when finishing the chair. Explain why? (1)
- (iv) State one safety consideration when choosing a finish for a child's chair (1)

3. Information taken from a booklet on ergonomics and anthropometrics is given below. Give an example of an object where a designer may have used this data

- (i) popliteal height (1)
- (ii) maximum grip diameter (1)
- (iii) stature (1)

