Student's Name: Date:

Anthropometrics & Ergonomics

Anthropometrics

Anthropometrics is the study of human measurements. Thousands of people are measured and tables of their measurements are produced which can then be used by designers to help them produce products which 'fit' their 'target users'. When taking the measurements specialist measuring equipment is used to ensure that the measurements are accurate.

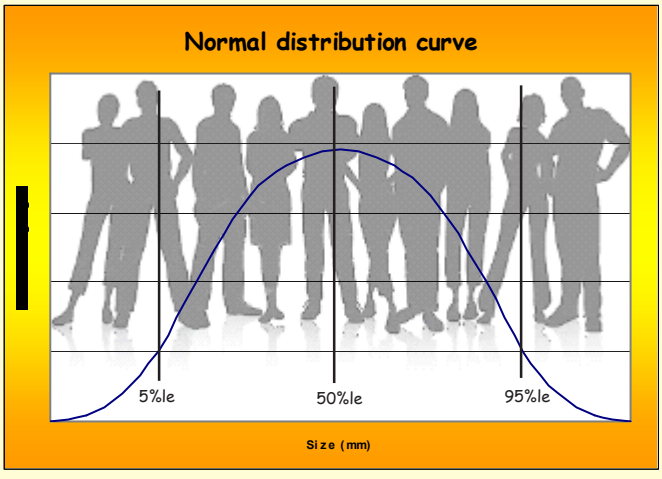
The data is arranged in tables for different 'groups' of the population for example boys aged 14-16 years or women aged 19 -65 years. This enables designers to select data which is relevant to their product.

Look at the tables below which are examples of the type of data which is generated.

Girls (14-16)			Dimension	Boys (14-16 years)		
5%le	50%le	95%le		5%le	50% le	95%le
1440	1575	1710	Arm span	1505	1685	1860
900	985	1075	Elbow height	930	1025	1130
750	830	910	Elbow span	790	890	990
385	420	455	Elbow to fingertips	400	445	495
1350	1470	1590	Eye level	1380	1530	1675
525	590	660	Fingertip height	520	595	665
590	655	720	Forward reach	610	690	765
70	75	80	Hand breadth	75	85	95
155	175	180	Hand length	160	180	200
280	330	380	Hip breadth	265	310	360
735	810	885	Hip height	790	875	965
445	495	535	Knee to floor	470	525	575
415	465	510	Seat length	410	465	520
340	385	425	Shoulder breadth	355	405	460
1180	1285	1395	Shoulder height	1215	1345	1480
170	220	270	Sitting elbow height	175	225	270
655	720	780	Sitting eye level	655	735	810
765	830	895	Sitting height	765	850	930
330	380	425	Standard seat height	355	405	460
1465	1585	1700	Standing height	1500	1645	1790
115	140	165	Thigh clearance	115	140	170
1760	1925	2095	Upward reach	1830	2010	2185

Women (19-65 years)			Dimension	Men (19-65 years)		
5%le	50%le	95%le		5%le	50%le	95%le
1460	1595	1730	Arm span	1645	1785	1925
905	980	1060	Elbow height	995	1080	1165
815	890	960	Elbow span	880	960	1040
405	440	475	Elbow to fingertips	430	470	510
1390	1490	1595	Eye level	1510	1625	1745
540	595	650	Fingertip height	580	640	705
665	725	785	Forward reach	715	780	850
70	75	85	Hand breadth	80	90	95
155	170	185	Hand length	175	190	205
320	375	430	Hip breadth	315	360	400
745	815	885	Hip height	830	910	995
455	495	535	Knee to floor	495	540	590
430	480	535	Seat length	440	495	550
370	415	460	Shoulder breadth	415	460	500
1210	1310	1410	Shoulder height	1310	1415	1525
155	225	265	Sitting elbow height	190	240	285
685	740	790	Sitting eye level	740	800	860
790	845	900	Sitting height	850	910	970
340	380	420	Standard seat height	365	415	460
1505	1610	1710	Standing height	1625	1740	1855
105	140	170	Thigh clearance	125	150	175
1880	2030	2180	Upward reach	2040	2195	2350

You will notice that some of the columns have labels containing "%le". This is short for percentile. The 5th percentile covers the bottom 5% of the population, the 50th percentile refers to the 'average' person and the 95th percentile identifies the top 5% of the population. Designers usually try to cater for at least 90% of the population which means their products should 'fit' everyone between the 5th and 95th percentiles.



The data can also be shown on graphs. All of the 'data sets' have a similar shape which is called the 'normal distribution curve'.

Look at the graph to the left which shows a normal distribution curve. The 5th, 50th and 95th percentiles have been labelled.

Ergonomics

Q4U2do.(A)

1. What are Anthropometrics?

2. Get a friend to help you measure the various body sizes listed on the table below and record them in the spaces provided.

	Yours(mm)	Ave. Boy 14-16	Ave. Girl 14-16	Grp. Ave. Boy	Grp. Ave. Girl
Standing height					
Elbow to fingertips					
Hand breadth					
Arm span					
Knee to floor					
Shoulder breadth					

3. Use the tables on the previous page to find the average sizes for 14 - 16 year old boys and girls and fill them in on the table.

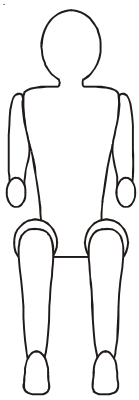
4. Share measurements with the rest of your class and use them to calculate your group's averages. Fill them in on the table.

Compare your measurements to the averages for your age / gender.

5. Which of your measurements are bigger than average?

6. Which of your measurements are smaller than average?

7. If you were asked to design a school chair, which body measurements would you use to help? Use the diagrams below to show why.





Ergonomics

Ergonomics

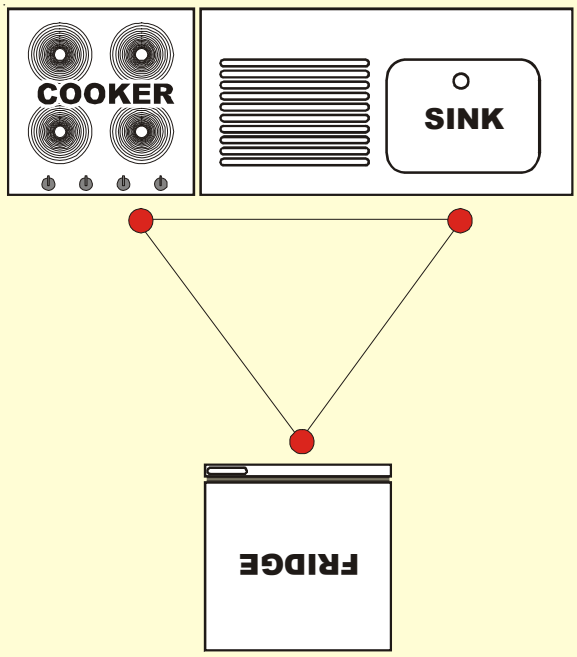
Ergonomics could be described as the study of how easy things are to use. A product is said to be ergonomic if it is easy to use and un-ergonomic if it is not. Try doing a few quick ergonomic tests of your own. For example use a pair of scissors to cut out some thick card. If the scissors are uneasy to use or are uncomfortable they are un-ergonomic. *(They might leave a ring around your finger where they were pressing too tightly).* Because people are all different it is not always possible to design for everyone. Designers may sometimes only aim to accommodate certain 'user groups' or a limited range of the total population. This is where Anthropometric data is of use.

Ergonomics is not just about things that you can touch/hold. Environments such as rooms can be made more ergonomic by considering things such as temperature, lighting, noise, colour schemes, humidity etc.

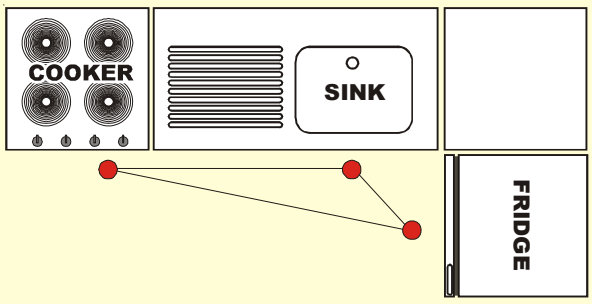
The movement of people in a space can also be studied and key pieces of equipment can be placed to minimise the distance users have to move.

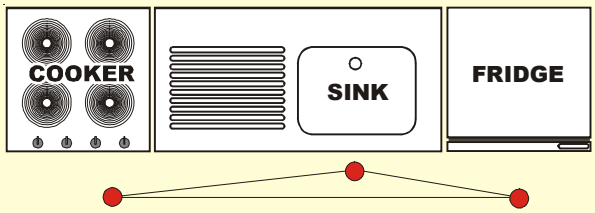
For example when designing kitchens designers often refer to the 'working triangle'.

In a kitchen three of the key elements are the sink, the fridge and the cooker. Studies have shown that the most ergonomic arrangement for these is in a triangle with the 'user' working from the middle of the triangle.

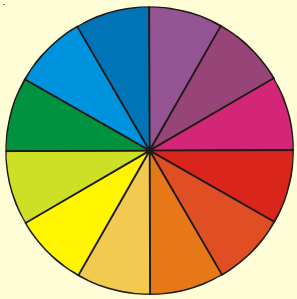


Two alternative arrangements which can be used are shown below;





Ergonomics also need to be taken into consideration when producing 2D designs. The use of different colour combinations, lettering styles etc all affect ergonomics. We shall consider the effects that colour can have in greater detail elsewhere but for now, when you are trying to make something stand out against its background you should consider using colours from opposite sides of the colour wheel. Adjacent colours do not offer sufficient contrast and can be difficult to 'pick out'.



Lettering styles (or Typefaces) can affect the readability of text. 'Comic Sans' is one of the easiest fonts to read which is why it has been used on this worksheet. Very wide columns are also difficult to read as the eye finds it difficult to find its place when it has to move from the end of one line to the start of the next.

When designing the layout for control panels / consoles it is very important to consider ergonomics. Visual displays need to be clear and easy to read. Designers should consider whether an analogue display or a digital one would be best. *(For example, which type of clock do you find easier to use - one with hands or digits?)*



The layout of a car interior is a good example of where the positioning of controls/dials is critical to the safety of the user. Drivers of all different sizes need to be able to read all of the dials and reach all of the controls accurately and easily at all times.

Below are two pictures of the Wilkinson Sword Protector Razor designed by Kenneth Grange. Ergonomics were carefully considered when generating the design.





Q4U2do. (B)

8. What are Ergonomics?

9. Why is it not always easy to produce designs which everyone will find 'ergonomic'?

Ergonomics

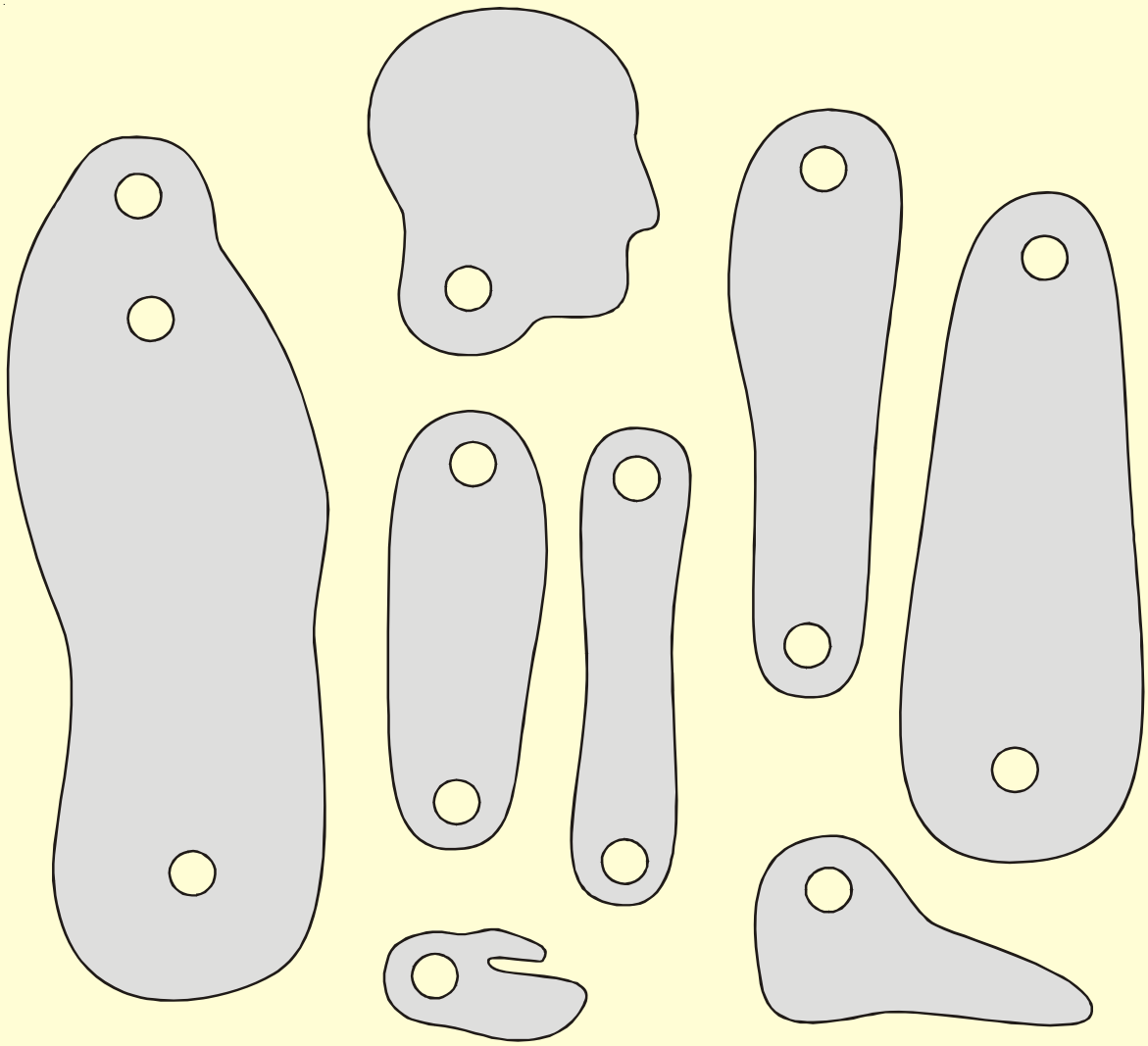
10. Choose an everyday product which you think is very 'ergonomic' to use. Draw the product in the space below and then explain what makes it so easy/comfortable to use.

When designing products/environments, designers sometimes use scale models of human beings to help them. These are called ergonomes.

On the next sheet are the body parts for a simple pin jointed 1/6th scale 50%le male adult. Build the ergonome and measure it to see how accurate it is.

Q4U2do. (C)

11. Use the Ergonome below to help you produce a design for a car inerior. Work on A3 paper - landscape orientation.



Ergonomics

AQA General Certificate of Secondary Education

Design and Technology: Product Design

Unit 1 Written Paper

To help you prepare for the written exam

Q. 1 Study the data in Table

	Age of Child		
Part of body in mm	4 years	8 years	12 years
Height	1040	1270	1480
Arm length	420	545	650
Hand width	55	60	65

Analyse and evaluate how a designer would use the anthropometric data to design some playground equipment. [4 marks]

Q. 2 Why is it important for the designer to consider ergonomics in the design of a tent? [2 marks]

Q. 3 The product below is a GPS Sports Watch worn by adult runners to monitor activity and aid training.
Specification;
- Lightweight
- Waterproof (face and strap)
- Rechargeable battery
- Battery lasts up to 3 weeks (10 hours in GPS mode)
- Watch features include; time, date, calendar, alarm, touchscreen and GPS for recording sporting data.

Evaluate the watch in terms of its:
suitability for the user [4 marks]
aesthetic quality [4 marks]
ergonomics [4 marks]

Q. 4 Explain what is meant by the term 'anthropometrics' and why it is important for designers to consider. [4 marks]

Q. 5 Name two anthropometric measures that might be used in the design of a watch. Explain why each is appropriate. [2 x 2 marks]

Exam Advice

In the exam you may well need to be able to explain the terms Ergonomics and Anthropometrics - make sure you know which is which!
You may need to analyse the ergonomics of a product and describe how they could be improved.

List of CGP Revision questions;
E2 Understanding user needs

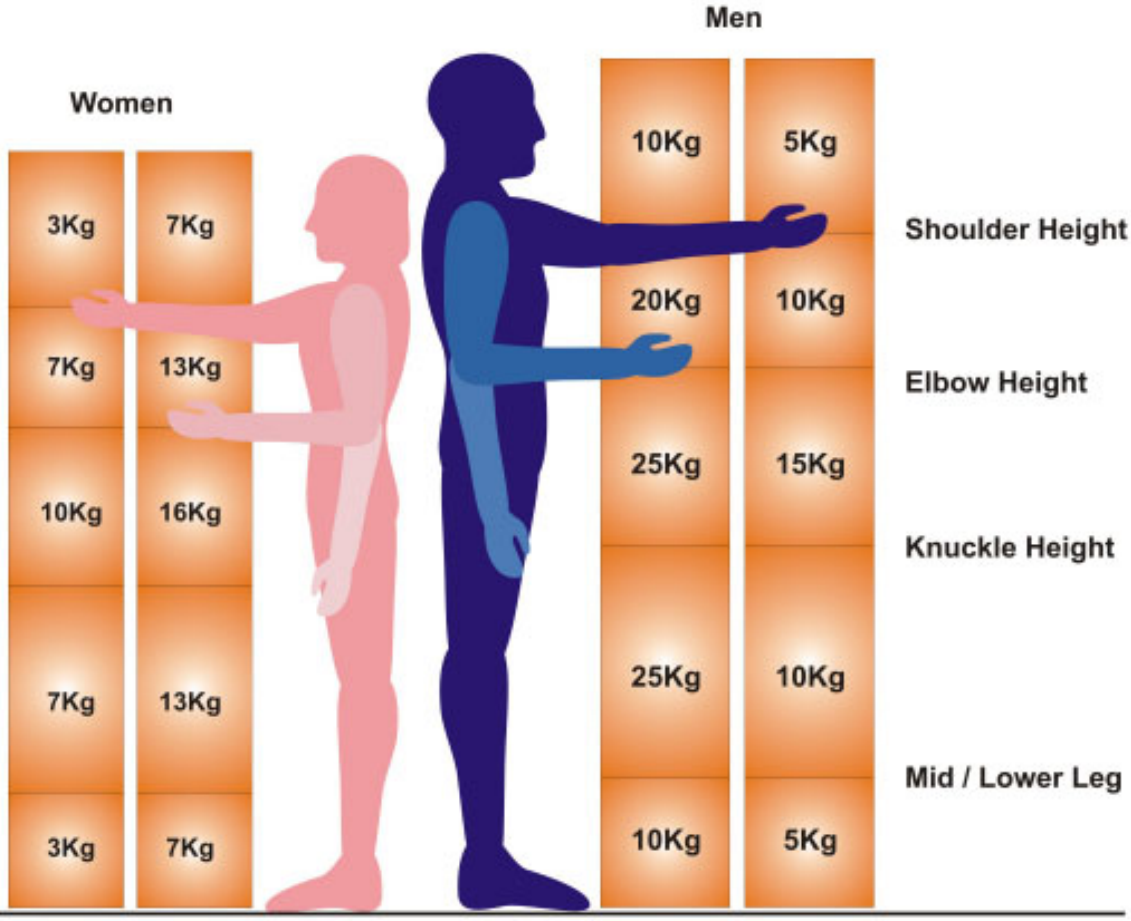
Ergonomics

St John Fisher Catholic College

Manual Handling - Lifting technique



Guideline lifting weight limits



R Milan 2012

St John Fisher Catholic College

VDU equipment usage guidelines



- Forearms should be approximately horizontal and eyes the same height as the top of the VDU.
- Make sure there is enough work space to take whatever documents are needed. -A document holder may help you avoid awkward neck and eye movements.
- Arrange your desk and VDU to avoid glare or bright reflections on the screen. This will be easiest if neither you nor the screen is directly facing windows or bright lights. Adjust curtains or blinds to prevent unwanted light. Adjust the brightness and contrast controls on the screen to suit lighting conditions in the room.
- Make sure there is space under your desk to move your legs freely. Move any obstacles such as boxes or equipment.
- Avoid excess pressure from the edge of your seat on the backs of your legs and knees. A footrest may be helpful, particularly for smaller users.
- Adjust your keyboard to get a good keying position. A space in front of the keyboard is sometimes helpful for resting the hands and wrists when not keying.
- Try to keep your wrists straight when keying. Keep a soft touch on the keys and don't overstretch your fingers. Good keyboard technique is important.
- Position the mouse within easy reach, so it can be used with the wrist straight.
- Sit upright and close to the desk, so you don't have to work with your mouse arm stretched. Move the keyboard out of the way if it is not being used.
- Support your forearm on the desk, and don't grip the mouse too tightly. Rest your fingers lightly on the buttons and do not press them hard.
- Don't sit in the same position for long periods. Make sure you change your posture as often as practicable. Some movement is desirable, but avoid repeated stretching to reach things you need.

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