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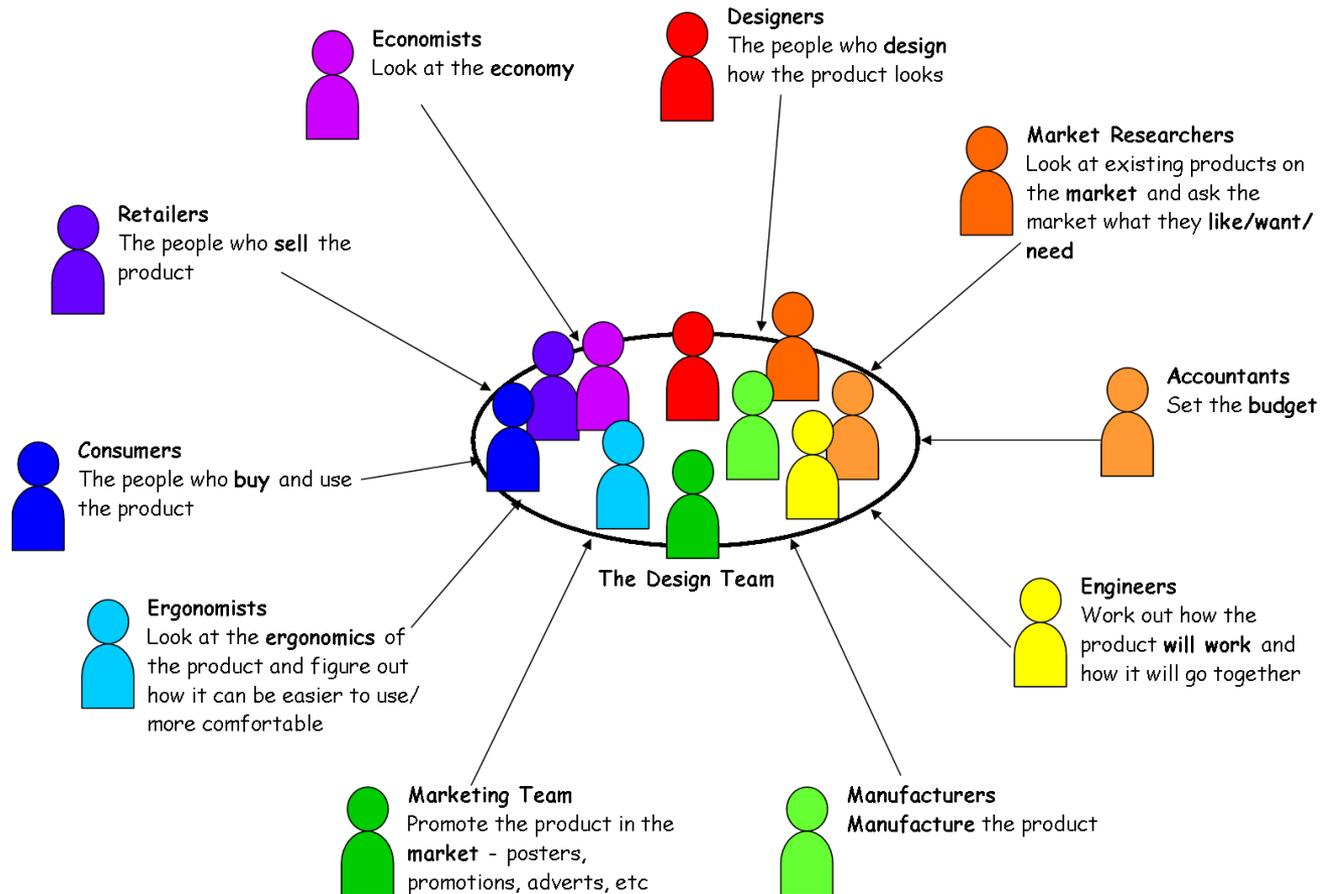
Design and manufacture

Design

Name: Class:..... Teacher:.....

Design Team

A **design team** is a group of people, brought together to design a product. Each member of the design team will have certain skills or experiences which will allow him or her to specialise in one aspect of the design. Each member of the design team will then have responsibility for a certain part of the design.



Problem Identification

Problem identification is finding opportunities to create new designs. This means finding out what needs a person, or group of people, has, in order to design a product to fulfil that need. Once a problem has been identified, a **brief** can be created to allow a designer to solve the problem.

Methods of problem identification

Situation analysis identifies problems by looking at a scene and analysing ways that the situation could be improved.

One way of doing this would be by taking a snapshot picture of a scene and using it to show problems. Describing in as much detail as possible the things that are happening in the snapshot breaks down the overall scene and suggests ways in which the whole situation could be improved.



Example of **Situation Analysis**

Situation—Messy bedroom.

Analysis—This untidy bedroom makes it difficult to find things or get to the bed. Clothes and grooming items are strewn across the room. Clothes are also piled near the heater which may be a fire hazard. There is limited floor space. There is nothing hanging on the wall.

Possible Brief—Design a storage wall mounted system that would allow a variety of items to be stored neatly.

Product Evaluation

Product evaluation tests existing products and tries to find weaknesses in the product's design. All aspects of the product will be looked at including function and performance, durability, material choice, manufacturing and assembly methods, ergonomics, aesthetics, and economics.

Once a weakness has been found, a brief can be created to allow the designer to redesign and improve the product.

Design Brief

A **design brief** indicates what task is to be undertaken by the designer or which problem is to be solved by the designer.

It is usually set by the client, and may take different forms: written or verbal.

The design brief will set out the overall design goal of the project, any major constraints (time, budget, manufacturing or material limitations) and may include some success criteria which will be used to judge how successful the design has been (sales targets).

What information should be included in a Brief?

In its simplest form, a Brief should include two pieces of information: the **Statement of Problem** and the **Target Market**.

The **Statement of Problem** is a sentence, or short paragraph explaining what the problem is that has to be solved.

The **Target Market** is an explanation of which market group the product is aimed at or who will benefit by the solving of the problem.

Examples of Design Brief

DESIGN BRIEF: *Design a pot handle that remains cool when the pot is heated. The users will be adults*

Problem: **The handle of a pot becomes too hot to hold when the pot is heated.**

Target Market: **people over 16 years of age.**

DESIGN BRIEF: *Design a game of dominoes that can be played by blind people.*

Problem: **Blind people cannot play many of the indoor games available to sighted people.**

Target Market: **Visually impaired people**

Design Analysis

Product Analysis is the process of identifying, looking at or disassembling a product and identifying its main features. The aim is to understand more about a product and improve it in the future. Many **design factors** influence the development of a product, some are listed and explained below.

Function

What the product must do. All products have a **primary function** and some also have **secondary functions**, i.e. they do something else or can be used for something else other than their primary function.

A product must do the job it was designed to do (sometimes called the **fitness for purpose**); if it fails to do this, the user may become frustrated with it.

Aesthetics

Is concerned with the appearance of a product. This is a very important factor with regards to selling a product because it is literally the first thing the consumer sees. Every product has aesthetic qualities that can be examined in depth.

- Shape Proportion Size Colour
- Contrast Harmony Texture Line

Safety

Safety means designing a product, so that it does not harm the user, others, the environment or become damaged during use so that it could cause harm.

Performance

In Performance we must consider

- Durability Ease of Maintenance Ease of use

Material

What the product is made from. The choice of material for a product will have an effect on several aspects of the design.

- The manufacturing processes that can be used.
- The cost of the product
- The strength of the product

Ergonomics

Ergonomics is the study of how humans interact with their environment and the products they use.

It can be sub-divided into three main areas:

- Anthropometrics** - the study of human body sizes
- Physiology** - the study of human body systems, like strength, eyesight or hearing.
- Psychology** - the study of how the human mind perceives the environment.

Environment

Designers must consider the environmental effects of products. The use of sustainable materials, the pollution and waste generated through manufacturing and recycling are all important issues to be considered.

Function - Fitness for Purpose

Function Task 1

A mobile phone's **primary function** is as a telephone (to make phone calls). List as many other possible **secondary functions** of a mobile phone as you can think of.



Secondary Functions of mobile phone.

Aesthetics

Colour and Shape

- The two aesthetic properties that are easiest to understand.
- Both colour and shape can be used to create **contrast** or **harmony**.
- Colour can be used to target specific markets i.e. bright colours would be used for children's toys, sophisticated colouring for high class products and so on.

Harmony

- This is where parts of a design **work well together** or the design fits in with a specific environment
- It creates a sense of peace or relaxation.
- Simple shapes and colours that work well together should be used to achieve this.

Texture

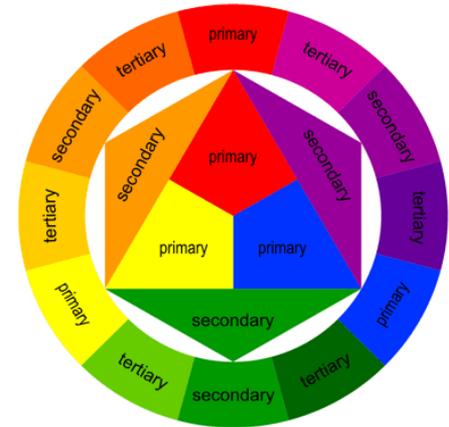
- Different textures can make designs look more stylish or interesting. Effects such as glass, concrete, wood grain, hard, soft, glossy (shine), matt (flat dull colour) and so on.

Contrast

- The **opposite of harmony** where designs are made to stand out and be bold.
- This can sometimes make a design more **eye-catching**.
- Contrast can be created using colours which are opposite each other on the colour wheel, circle and square shapes in a design, large and small, etc.

Proportion

- Small changes to the proportion of a shape can make it look more elegant, classy, stable or sleek.
- This example of a 1980's BMW 3 series and a modern 2007 BMW 3 series shows how simple changes to shape can make designs more modern, sleek and elegant.



Safety

Why is safety important?

Unsafe products have the potential to cause harm through injury and legislation forbids or restricts their sale. All products are required by law, to meet safety standards, and cannot be sold if they do not meet those standards. Products will often display symbols to show compliance with safety legislation. If, after being sold, a product is found to be unsafe, the product would be recalled and some form of compensation made to the consumer. Recalling a product is very expensive for a company to do.

Safety is also seen as a major selling point for many products. For example, cars are often advertised by highlighting their safety features. A consumer is more likely to buy a product which has additional safety features. Many products are created to fulfil a specific safety need. For example child seats for cars, or bicycle helmets are created to protect the user in the case of an accident. Designing safety products is an example of niche marketing.

How can I research and evaluate product safety?

All products sold must pass safety standards, and many will have symbols on them which show the consumer that they have been approved by the relevant organisation. These symbols are often found on a sticker or moulded onto a product, or printed in the product's instructions.

British Standards Institute (BSI)

The BSI set and check standards for all products sold in Britain. Products which meet the standards are awarded the BSI Kitemark.



BSI Kitemark.

European Community

The CE symbol indicates that the product has met European regulations and can be sold across Europe.



CE Symbol

Performance

When looking at the *Performance* of a product it is important that we consider the following issues:
Durability, Ease of maintenance, Strength, Ease of Use

Durability

Durability is the life expectancy of a product, or how long it is expected to last. This is decided by the materials that the product is made from and Planned obsolescence. **Planned obsolescence** is the usable lifespan that a product has before new advances in technology, fashion or worn parts means that it is no longer desirable to keep the product functioning.

Eg 1. A car exhaust is normally made from mild steel which will eventually rust and need replaced after several years. But the exhaust could be manufactured in Stainless steel which will last a great deal longer, but will be more expensive to purchase and will mean that the manufacturers will not sell as many spares.

Eg 2 Traditional Light bulbs are expected to last no more than six months in normal use. But new low energy light bulbs which are more expensive can last for years.

Eg 3 Washing machines are designed to be replaced after about six years, this allows the manufacturer to constantly sell new models, bringing in more business by continuing to satisfy the buyer's desire to have the latest, most fashionable model.



Performance

Ease of maintenance

Ease of Maintenance is how difficult it is for a user to keep a product in good working order throughout its life.

A cheaper product is probably intended to be thrown away after use and will need no maintenance.

A more expensive product is likely to last much longer and will require periodic maintenance to keep it in good order.

The complexity of a product will have a direct effect on the amount of maintenance required. A very complex product like a car will require a great deal of maintenance in its lifetime, from the regular servicing of the engine to ensure oil and water levels are correct to the replacement of worn parts like brake disks to prolong the life of the car.

These disposable toothbrushes are designed to be thrown away once the heads are worn out. There is no design for ease of maintenance required and their price is fairly low.



The oral-B electric toothbrush is designed to have a replaceable head, so that a consumer does not have to buy a whole new toothbrush each time the head wears out. This increases the initial cost of the product as there are additional components required to enable the head to join to the body, but allows the main body of the toothbrush to be used for a long time. Consumers would not buy the Oral-B at all if they needed to replace the whole product as often as they replace a fixed head.



Materials

Materials

When coming up with a design for a product we must consider how many are to be produced, who the target market is, what the product is going to be used for, how and where it is to be used. When we have established all of this it becomes easier to decide which materials would be most suitable for the job.

In order to decide which materials to use we must have an idea of what *properties* we wish them to have.

For instance, a car wing-mirror must be waterproof, resistant to sunlight, impact resistant, chemically resistant and corrosion resistant. On top of this, the shape of the wing mirror must be able to be formed easily as it is a 'mass produced' product.

Choice of Materials will have a direct effect on several aspects of the design, including:

The manufacturing processes that can be used

The finishes that can be applied

The disposal of a product at the end of its life

The cost of the product

The lifespan of the product

The product's performance in terms of strength, weight etc.

Cutlery made from stainless steel will be long lasting, corrosion resistant, expensive and will require costly die cast moulds to produce.



Cutlery made from HIPS will be cheap, light, easily broken, recyclable, will come in a range of colours, and will require injection moulding machinery to produce.



Ergonomics

Anthropometrics concerns the measurements of the human body. A survey is made of around 1 million people between the ages of about 19 - 65 with every relevant part of the body being recorded.

This information is then compiled to make charts called 'Anthropometric data tables' which show us what the smallest, largest and average sizes are. This information is very important when designing for people.

From the tables, designers only use information from the 5th to the 95th percentile. This is because they want to be able to cater for as many people as possible and the people from the 0 - 5 percentile and those from the 96th - 100th percentile are seen as being too extreme, i.e. too small and too big.

Physiology is concerned with the study of the systems within the human body, their responses, limitations and capabilities. Designers may have to consider strength, fatigue, muscle control, colour perception, hearing capabilities and other features when designing for people.

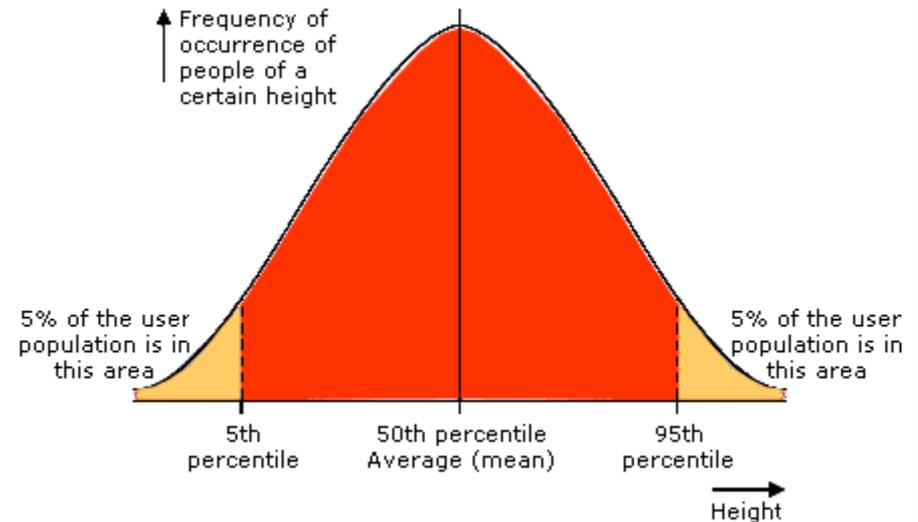
For example, when designing the braking system for a car it must be able to be operated effectively by all drivers. Anthropometric information must therefore be gathered about the strength of people's legs, as well as on lever and hydraulic systems designed to suit the forces required.

The legs are used for the repetitive tasks in driving such as applying the brakes and the clutch because they are much stronger than arms and hands, which are more nimble and better suited to finer controls like using the steering wheel or adjusting the volume on the radio.

Psychology is concerned with the human mind and the way it works. Human senses (sight, hearing, smell, touch, taste) are continually being stimulated and send messages to the brain where they are processed. Some signals are ignored while others provoke a rapid response, some are interpreted accurately whereas others may be misunderstood.

Understanding some of these processes involved in the interpretation activity proves to be vital in the development of a good design.

An example of psychology being taken into consideration at the design stage is mobile-phone buttons. When you press the button, you 'know' that you have pressed it because it makes a 'click' sound or it lights up or makes a noise. The phone does not need to do this to operate, but these features are included because it makes it easier for us to use.



Design Factors

Task 1

Before producing a specification for a computer mouse, the designer would have researched various design factors.

With reference to computer mouse design:

(a) state **four** design factors which would have been researched;

(b) explain why each of these design factors is important.



Design Factors

Task 2

Children's cutlery is shown across.

During the design of children's cutlery, the designer would consider the following areas:

Ergonomics

Safety

Aesthetics

Materials.

Explain why **each** of these areas is important in the design of children's cutlery.

