

Fibres and Fabrics Knowledge Organiser

Natural Fibre Products

Traditional fibres from plants and animals.

Wool: Fibres from sheep's wool are spun into yarn and can be woven and knitted. The fibres can also be spun into finer yarn which is turned into cloth. Absorbent, soft or coarse handle, not durable.

Used in yarn form in knitwear, scarves, gloves, bags, dresses and suits.

Cotton: Thread is spun from fibres from the cotton plant. Used widely due to its good durability and soft handle. Can be machine washed, but requires ironing as creases easily. Highly-absorbent.

Used in canvas, muslin, calico and denim, clothing, home furnishings

Silk: Natural fibre from silkworms, woven into fine fabric, which has a high sheen or lustre. Cool to wear.

Used in high-class clothing and home furnishings in Satin form.

Linen Made from fibres of the flax plant, linen is a traditional fabric. Does not cause allergies and is cool to wear. Highly absorbent.

Used in home furnishings, summer clothing.

Leather: Made from animal skins, leather is not strictly a fabric. Comfortable in both hot and cold conditions. Untreated, leather is absorbent but can be treated with a range of finishes to improve its effectiveness and durability. Tough and elastic.

Used in clothing, car upholstery, home furnishings.

Manmade Fibre Products (synthetic)

Modern fibres manufactured using polymers.

Nylon: Strong and durable manmade polymer fibre. Has a wide range of applications, as a clothing fabric and in other uses where durability is important. Warm to wear, non-absorbent and good drape. Can be made with soft or coarse handle.

Used in wide range of clothing in pure and blended form. Waterproof coats, tents.

Polyester: Very durable polymer fibre, non-absorbent and cool to wear. Often blended with cotton to produce low cost, breathable fabrics and used widely in place of pure cotton.

Used in clothing and home furnishings, industrial polyester used for ropes, seat-belts.

Organza: A lightweight, sheer fabric traditionally made from silk, although more often now made from polyester. Its decorative properties make it popular for embellishments on clothing.

Used in home furnishings, hat decorations, wedding dresses.

Lycra (brand name for spandex/elastane): A 20th century 'wonder material', Lycra is commonly found in sportswear due to its breathable and elastic qualities. Excellent shape retention. When blended with natural fibres, clothing with the feel of natural fibre, and the elasticity of Lycra can be achieved.

Used in tight-fitting sports wear, stockings and leggings, blended in denim, woollen clothing.

Photo courtesy of (@flickr) Mediatomic Hybrid Wearables - granted under creative commons licence - attribution.
Photo courtesy of (@flickr) Those Who Affected Me - granted under creative commons licence - attribution

Property	Definition	Found in
absorbent	A fabric's ability to hold moisture.	wool, cotton, linen, non-woven fabrics such as felt
blended	A fabric or yarn made from a mix of natural and manmade fibres, purposefully created to use the features of both.	
breathable	A fabric that uses specific fibres and weave that allows air to pass through the clothing, thereby preventing heat and moisture build-up.	sportswear blended fabrics, linen, cotton, wool
drape	The way a fabric looks when it is hanging down. Clothing designers must consider the drape of a fabric when choosing the material for a garment.	all fabrics
durable	Hard-wearing, stain resistant. Man-made fibres are mainly more durable, and are therefore blended with natural fibres to create more durable products.	nylon, polyester, denim, lycra
handle	What a fabric feels like to the touch, for instance: smooth, rough, stiff.	all fabrics
sheen	A smooth and slightly reflective surface finish to a fabric.	silk and synthetic satins, polyester products, some leathers
sheer	Fabrics that are flimsy and semi-transparent.	organza, voile, muslin lingerie products
shape retention	A fabric's ability to keep its shape and not become deformed through use.	lycra and lycra blends, leather, polyester, nylon
water-repellent	Non-absorbent. A fabric's natural ability, or manufactured finish, allowing water to not penetrate through the weave.	polyester, nylon, leather

Smart Fabrics

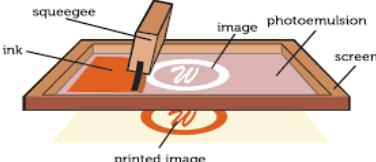
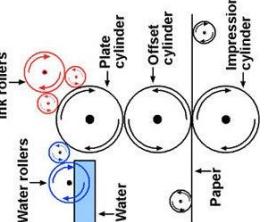
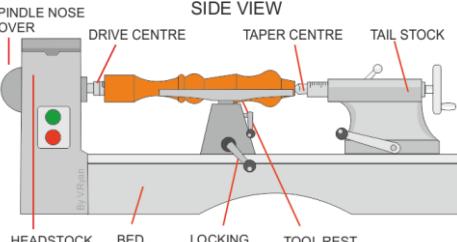
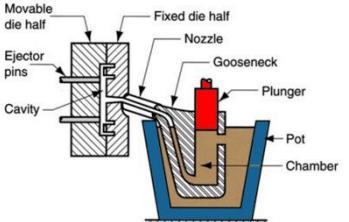
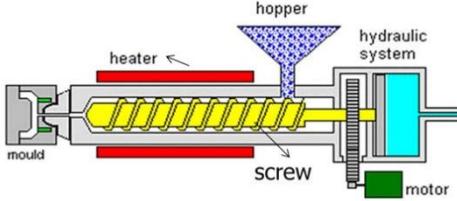
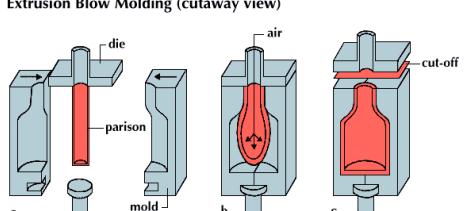
Advancements in modern technology have implications for fabrics and design. **Wearable technology** and **performance enhancing textiles** are important strands of sports and fashion design in the modern age.



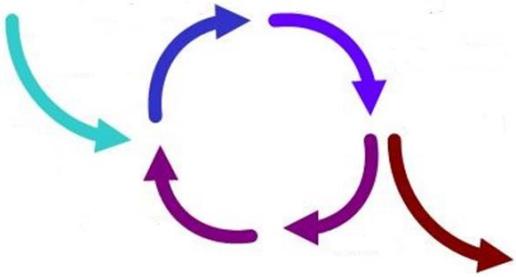
This acupuncture therapy shirt allows the wearer to receive specific therapy at the same time as getting on with their job.

This light emitting fabric is an example of how designers can use fibre-optics to create high-impact visual clothing and accessories.

Wasting	Addition	Deforming and Reforming
<p>Fabrics are a compliant material and are relatively easy to cut and shape. They are, however, an unforgiving material, and an incorrect cut will be often difficult to undo or disguise.</p> <p>Cutting: Fabric is normally cut with textile shears. The blades are 150mm long and the lower handle is always bigger. This allows for a steadier, longer cut. Rotary cutters are used for cutting non-woven fabrics such as felt.</p> <p>Shearing: Although shearing and cutting are the same force and movement, pinking shears give a zig-zag edge to their cut. This prevents woven fabric from fraying</p> <p>Wasting Fabrics with CAD/CAM</p> <p>Sections of fabric can be wasted effectively using a laser cutter. A pattern can be created using CAD software such as 2D Design and used to control the laser cutter. Identical patterns can be created very quickly using this method with a high level of accuracy.</p> <p>Seam Allowance</p> <p>Fabrics require a seam allowance; the material where the stitch joins two pieces of fabric together. This means fabric must be cut larger than the size needed by approximately 10mm on all sides where a join is required.</p>	<p>Addition by hand-stitching</p> <p>All projects will require some degree of hand-stitching. This may be to add a button, join one piece of fabric over the top of another, such as in applique, or embroidering by hand. There are a range of stitches which can be done using a needle and thread:</p> <ul style="list-style-type: none"> • Running stitch: Quickly joints two fabrics along a line • Overstitch: Loops over the edge of the fabric preventing fraying. • Blanket-stitch: Ornamental stitch effective on decorative work. • Back stitch: Stronger than a running stitch and good for seams. <p>Zips, buttons, hook and eye, press-studs and Velcro can all be added to fabrics and used to add and fasten pieces together.</p> <p>Addition by machine-sewing</p> <p>The correct method for joining fabrics is dependent on the type of fabric being used, and the loads and stresses that will act upon the join. An overlock machine is good for professional looking products as it binds the seam inside the join. Sewing machines are required to add fasteners such as zips.</p> <p>Addition by computer sewing machine</p> <p>Many jobs can be completed by a programmable CAM sewing machine.</p> <p>Some schools have embroidery machines. A design is created on a computer, before being uploaded to the embroidery machine. Decoration, detail and personalised names can be added to a panel of a product this way.</p>	<p>Deforming by tailoring</p> <p>Once the pattern and fabric pieces have been cut, the main tool for shaping an item of clothing is a tailor's dummy. Re-forming, adjustment and fitting can be done whilst seeing the overall shape of the product. Because fabrics are compliant materials, they deform as part of their nature. Imagine wearing a pair of skinny jeans which didn't deform as you moved!</p> <p>Deforming by pleating and gathering</p> <p>Shape can be created and accentuated through the use of gathering. Pleating can create a strong visual effect and allow for movement in a garment.</p> <p>Pleat: Repeated folds in a textiles product, usually stitched at the top.</p> <p>Gather: To shorten a piece of fabric by drawing it together, like the top of some curtains.</p> <p>Deforming by heat and liquids</p> <p>Heat treatment: Some specially laminated fabrics can be formed into shape using heat. This is useful where the designer needs parts of a design to hold a shape without support, such as collars.</p> <p>Blocking: Traditionally, moulded hats, for both men and women have been created by deforming felt on wooden blocks. A felt hood or cone is placed on the block and a liquid stiffener is applied. A steam iron is then used to shape the felt around the block before shaping the brim and cutting off waste material.</p>

Name of Process	Diagram	Material	Products Made	Key info
<p>Screen-printing</p>		<p>Papers and Textiles</p>	<p>Posters, signs and t-shirts</p>	<p>Screen printing places paint on top of a screen. The screen has a stencil embedded in it, so when the paint is passed across it the desired shape is printed underneath. Good process in one-off and batch production as often done by hand</p>
<p>Offset Lithography</p>		<p>Papers and card (thin, flexible plastics)</p>	<p>Posters, newspapers, plastics bags</p>	<p>Rollers containing the colours and water go onto the plate cylinder. The water stops the colours sticking to certain places, creating the shape. The shape is transferred between rollers and onto the material. Can be used at batch and mass production</p>
<p>Lathe Turning</p>		<p>Wood and metal</p>	<p>Chair legs, baseball bats (cylindrical items)</p>	<p>Material is placed between the tail stock and the headstock and spun at high speed. The material is then cut using specialist tools (either by hand or by automated machinery) to the desired shape. Can be used in one-off and batch production</p>
<p>Die Casting</p>		<p>Metal</p>	<p>Car parts, engine components, etc</p>	<p>Molten metal is poured into a chamber and a plunger forces the metal through the nozzle into the mould. Unlike sand casting, the mould is reusable. Good process for both one-off and batch production</p>
<p>Injection Moulding</p>		<p>Plastics</p>	<p>Chairs, toys, etc</p>	<p>Plastic granules are poured into the hopper and onto the screw. The screw moves the material towards the heater where it turns into a liquid. The liquid is then forced into the mould, cooled and released. Great process for mass production as it makes 100s+ of products at once, to a identical standard.</p>
<p>Blow Moulding</p>		<p>Plastics</p>	<p>Plastic bottles</p>	<p>A Plastic parison is heated and put into the mould. The parison is then filled with air (like blowing up a balloon) and is forced to fit the mould shape. It is then cooled and then released. This is a great process for mass producing bottles.</p>

Design Strategies are used to solve **Design Fixation**, and help develop creative design ideas.



Iterative Design

- A Proposal is made
- It is then planned and developed to meet the brief
- It is analysed and refined
- It is then tested and modelled

- Then evaluated against the brief – many versions fail but that then informs development to make the idea better
- The cycle then repeats and if the product is successful it is then made and sold on the market

Iterative Design	
Advantages	Disadvantages
<ul style="list-style-type: none"> • Consistent testing helps solve problems earlier <ul style="list-style-type: none"> • Constant feedback • Easy evidence of progress 	<ul style="list-style-type: none"> • Designers can lose sight of "the big picture" • Time consuming

User-Centred Design

- This is when designs are based on fulfilling the needs and wants of the Users/ Clients at every stage of the design process
- Questioning and testing is ongoing and is often found through interviews, questionnaires, surveys, etc

User-Centred	
Advantages	Disadvantages
<ul style="list-style-type: none"> • User feels listened to • Makes sure the product meets their needs 	<ul style="list-style-type: none"> • Requires extra time to get customer feedback • If focused on just one person it can limit appeal to others

Systems Approach

- Usually used for electronic products
- Often uses diagrams to show systems in a visual way
- Planning the layout for the correct sequences e.g. inputs, outputs, timings, etc
- Electronics and mechanical systems need an ordered and logical approach

Systems Approach	
Advantages	Disadvantages
<ul style="list-style-type: none"> • Does not need specialist knowledge <ul style="list-style-type: none"> • Easy to communicate stages • Easy to find errors 	<ul style="list-style-type: none"> • Sometimes over-simplifies stages • Can lead to unnecessary stages

Collaborative Approach

- Working with others to share data and solving problems and coming up with design proposals can help with creativity
- Numerous companies work in teams, and has been shown to improve the range and quality of ideas produced

Collaborative Approach	
Advantages	Disadvantages
<ul style="list-style-type: none"> • Gets multiple opinions and a range of views • Working in groups can produce more ideas 	<ul style="list-style-type: none"> • Can be difficult to design ideas with opposing views • Can be difficult to find time to communicate with multiple people

Automation

This is when machines and robotics help make products or make them for you.

Often this is done by **CAD (Computer Aided Design)** and **CAM (Computer Aided Manufacture)**

This helps products be made quicker, with more accuracy. Reducing errors humans make to products.

However, these machines are expensive to buy, need specialist training to use and need constant maintenance to keep them working properly

Virtual Marketing

This is when websites, social media and email are used to promote and sell products. This has become very popular in recent years, with big social media apps being funded by advertisers

Companies can also pay search engines to push their company further to the top of the results page, so customers are more likely to click it.

Cooperatives

A Cooperative is an Enterprise that is run by members that are part of the workforce or customers.

This means the organisation is democratic and often supports the local community. They are set-up to protect the rights of their members and ensure the same rules apply to everyone

Enterprise

This is when an idea is developed into a business and produces a viable product.

Often, one of the biggest enterprises in in apps for smartphones

To make sure ideas are protected from being copied, a **Patent** can be applied for. This legally protects your idea on invention from being stolen.

Crowdfunding

This is where ideas are funded by large groups of ordinary people.

www.Kickstarter.com is a good example of this.

Fair Trade

This is an organisation that promotes fair pay, working conditions and better trade with farmers in developing countries

You can tell when something is Fairtrade as it will often have the symbol on the product or packaging. Common Fairtrade items include; bananas, cotton and chocolate.



Non-Renewable Energy Sources	This is when certain sources of energy will run out eventually
Fossil Fuels	<ul style="list-style-type: none"> • Coal, Oil and Gas • Burned to create steam, turned in turbines to create electricity. • Burning creates CO₂ which adds to Global Warming
Nuclear Power	<ul style="list-style-type: none"> • Nuclear Fission controls the reactor (that creates the electricity). This requires Uranium which is non-renewable • Accidents and waste can severely damage the environment and cause radiation poisoning • Radiation poisoning can be fatal and cause physical deformations • Nuclear waste has to be disposed of properly and is hazardous for thousands of years.

Renewable Energy Sources	This is when certain sources of energy will not run out.
Solar	<ul style="list-style-type: none"> • Solar panels are used to collect light and convert it into electricity • There is no waste and a consistent supply • However, the panels are not effective at night or in countries where there isn't a lot of sunlight
Wind	<ul style="list-style-type: none"> • Turbines harness wind energy • Not effective on non-windy days • Some people don't like turbines as they are noisy, and not attractive to look at
Hydro-Electrical	<ul style="list-style-type: none"> • This harnesses energy from water held behind a dam • Has to be created by flooding land – damaging wildlife habitats • Tidal energy comes from using energy from waves
Biomass	<ul style="list-style-type: none"> • This is fuel from natural sources e.g. crops, scrap woods and animal waste • Growing biomass crops produces oxygen and uses up CO₂ • However, is a very expensive method

Storing Energy

Pneumatics: This is the production of energy using compressed gas or air. E.g. Pistons in an engine

Hydraulics: Like a Pneumatic system, but uses water or oil under pressure. E.g. Wheelchair lifts

Kinetic: Energy that is generated by movement. This is stored by items like springs in a "clickable" pen or balloons,

Batteries: Electrical power can be stored in batteries. Rechargeable batteries are becoming increasingly popular.

Market Pull and Technology Push

Technology Push is the development of new technology, materials and manufacturing methods to create new products or improve old ones.

Examples include; Smart Phones, Electricity, Mass Production, etc

Market pull is the demand from consumers for new products and improvements in old ones; this is often found via reviews, polls, surveys, etc

Examples include; Product **Aesthetics**, making products easier to use, etc

Cultures, Faith and Belief

Different groups of people have different interests and have to be catered for.

Different countries and cultures also react to products differently.

E.g. In India McDonalds don't sell beef burgers as it has a large Hindu population, and cows are seen as sacred – in contrast the UK sells its most amount of fish and chips on a Friday as it is a Christian tradition to not eat meat on that day.

Case Study: £5 note

Hindu, Sikh and some other faith-based communities may choose to follow a vegetarian diet, and this is part of their culture. In addition to not eating meat, many followers of these faiths, as well as vegans and vegetarians, take every opportunity to avoid using animal products in their day-to-day lives.

The revelation in 2016 that the new polymer Bank of England £5 note contained tallow, an animal fat-based substance, upset a number of communities. There was a prompt call for the Bank of England to find an alternative way to produce the note and in the first two days of an official petition well over 100,000 signatures were received.

Shortly after the Bank of England admitted that the new polymer £5 note contained the animal by-product, some establishments refused to take the notes as a method of payment. One café owner was repulsed by the idea that the note contained tallow and believed that her customers supported her view. They received no complaints.



The Bank of England say they currently have no plans to change the manufacturing process.

Fashion and Trends

Fashion and Trends will change quickly, and you can see major differences in fashions over decades.

Designers have to make sure their products meet the fashion and trends of the area they are designing and selling the product to.

The change of products over time is called **Product Evolution**. This is caused by Market Pull, Technology Push and Fashion and Trends.



Some products are seen as **timeless**. These products are called **Iconic Designs**. These products are timeless because they were innovative, set a bench mark for following products, changed their industry and are often copied.

Examples include; iPod, iPhone, Angle-Poise Lamp, Swiss Army Knife, Converse Shoes, Levi's Jeans, Classic Mini Cooper



Inclusive vs. Exclusive Design

Inclusive Design: The aim to create a product that as many people as possible can use

Examples include; Cars, Doorframes, Adjustable Products, etc

Exclusive Design: The aim to create a product for a particular group and their needs

Examples include; Car seats for babies, Wheelchairs, Stair Lifts