

FABRICS AND YARNS	MY NOTES ON SUSTAINABILITY Including positive benefits and destructive environmental concerns		Positive +
			+ and -
			Negative -
NATURAL - ANIMAL FIBRES - PROTEIN BASED			
SILK	A fiber chemically extracted from the cocoon of an adult silkworm - the Mulberry silk moth. This requires an intense heat to release the silken filament. Silk production has a large carbon and water footprint. A lot of water and vast quantities of synthetic pesticides, insecticides and chemical fertilisers are used to grow Mulberry trees and keep up with our demand for luxurious, silk products. To produce 1kg of silk, 3000 silkworms must eat 104kg of Mulberry leaves.		
Organic SILK	Where less pesticides, insecticides or harsh chemicals are used in the extraction of silken fibres. Large areas of Mulberry woodland is still required, but the silkworm emerges from the cocoon naturally, prolonging the life cycle of each Mulberry silk moth. It is extremely expensive (relative to other luxurious fabrics) as less than 0.2% of the world's silk fabric is produced organically. Demand for quantity rather than organic quality restricts this more sustainable process from becoming the norm!		
WOOL	This involves shearing the fleece from a living animal, so that its wool can be regrown. Large areas of land are required to farm the sheep for both food and textile industries. 2 million tonnes of sheep wool is produced each year, of which 60% goes into apparel (fashion and textiles), even though Wool occupies only 3% of the world's textile market.		
Organic WOOL	Where sheep are cared for on a smaller scale, vegetation is protected and smaller production runs are provided. Organic food industry is becoming more widespread. Think misshapen vegetables for example, sold loose, and not in a plastic wrapping! I believe happy sheep make softer wool?		
Regenerated WOOL	Old jumpers are grouped in similar colours. This method of recycling requires creative technologies and "mixing" to avoid re-dyeing. Knitted clothes can be unravelled and reused!		
Cashmere	Made from the hair of the Kashmir goat	Too many grazing animals can ravish the land, decimate the vegetation and cause dust clouds, as top soil has no foliage to grip on to. This is an overagricultural issue, as well as a consumer demand for cheaper quantities and an abundant plea for more choice! Animal Welfare and Rights! Think about your own ethical stance!	
Angora	Made from the hair of the Angora goat or rabbit		
Mohair	Made from the hair of the Angora goat		
Vicuna	A wild relative of the llama, inhabiting mountainous regions of South America		
Alpaca	A long-haired domesticated South American mammal related to the llama		
Yak	A large domesticated wild Ox with shaggy hair, humped shoulders, and large horns		
Camel	Made from the hair of a Camel	Where animals are cared for on a smaller scale, vegetation is protected and smaller production runs are provided. Happy animals!	
FUR	Vegetarian and Vegan ideals! However faux fur is harmful to the environment too in a different sense - see below to make your own decisions!		
LEATHER / SKIN	Think about Vegetarian and Vegan ideals! However faux leather / skin are harmful to the environment too, if they are made from an oil-based - petroleum, a non-renewable resource - see below to make your own decisions!.		There are theories that might give validity: By-products of the food industry Small scale farming Animal appreciation
FISH SKIN	A by-product of the food industry, one tonne of fish fillets 'produces' almost 40 kilograms of fish skin for apparel.		
NATURAL - PLANT FIBRES - CELLULOSE BASED			
COTTON	A thirsty crop, that relies on added synthetic pesticides and chemical fertilisers to meet the quantities of consumer demand and therefore depleting water supplies from rivers, lakes and inland seas. 26% of the world's fabrics belongs to cotton production and only 1% is organic. Shocking Fact: 50%		
Organic COTTON	Rain-fed fields, where natural pesticides are used, by planting certain things that attract the required pests to grow healthy cotton plants, "companion planting". Crop rotation also bring further nutrients to the soil, which in turn naturally fertilises the cotton fields!		
LINEN	Made from the fibers of the flax plant. Linen is laborious to manufacture, but the fiber is very strong, absorbent and dries faster than cotton. The quality of the finished linen product is often dependent upon growing conditions and harvesting techniques. To generate the longest possible fibers, flax is either hand-harvested by pulling up the entire plant or stalks are cut very close to the root.		
Organic LINEN	Same with organic cotton, flax plantations need care but with organic nurturing all parts of the flax plant are used. The linseed is used for the next flax season, as well as to feed people and animals. Linseed oil is very nutritious and is also found in soap, paint and cosmetics.		

HEMP	Fibers from stems of the <i>Cannabis sativa</i> plant. Hemp is also considered to be a carbon negative raw material, which means that it absorbs more carbon than it produces. Production of this crop requires very few pesticides, and it does not require any herbicides. On the other hand, it's been indicated that producing hemp may require more nitrogen than growing cotton. Demand raises the production runs, decreasing costs but impacts on farming and water quantities.
NETTLE "Ramie"	Made from the stalks of a flowering plant in the nettle family Urticaceae. It requires chemical processing to extract the strong natural fibers. It exhibits even greater strength when wet. Ramie fiber is known especially for its ability to hold shape, reduce wrinkling, and introduce a silky lustre to the fabric appearance. It is not as durable as other fibers, so is used as a blend with other fibers such as cotton or wool. It is similar to linen in absorbency, density, and microscopic appearance. It does not dye as well as cotton.
JUTE "Hessian"	Jute is a rain-fed crop with little need for fertiliser or pesticides, in contrast to cotton's heavy requirements. 100% bio-degradable and recyclable and thus environmentally friendly!
"PINATEX"	A leather alternative made from the leaves of Pineapples. Created by felting the long fibrous leaves together to create a non-woven substrate. The pineapple industry produces 40,000 tonnes globally of waste pineapple leaves each year, which are usually left to rot or get burned. Approximately 480 leaves (the waste from 16 pineapple plants) are needed to create 1 square metre of material. The material uses the long leaf fibres, which are separated by the pineapple farmers for additional income, the leftover biomass from the process, can be used as a fertiliser. Produced partially from a waste product that requires no additional land, water, pesticides or fertilizers. It also avoids the use of toxic chemicals and heavy metals used in animal leather production and has none of the wastage of leather caused by the shape of the animal's skin
"BANANATEX"	The world's first durable, waterproof fabric made purely from Banana plants. Cultivated in the Philippines within a natural ecosystem of sustainable forestry, the plant requires no chemical treatments. Its self-sufficiency has made it an important contributor to reforestation of areas once eroded by Palm plantations, whilst enhancing the prosperity of local farmers.
BAMBOO	Made from the pulp of "moso" bamboo grass. Bamboo fabric has been growing in popularity because it has many unique properties and is more sustainable than most textile fibres. Bamboo is an alternative to plastic, but is renewable and can be replenished at a fast rate. Bamboo planting can slow deforestation, providing an alternative source of timber for the construction industry and cellulose fibre for the textile industry.
Paper Yarn	Paper is a thin material produced by pressing together moist fibers of cellulose pulp derived from wood, rags or grasses. This comes from trees so think about deforestation!
PAPER	
NEWSPRINT PAPER	Newsprint is a low-cost, non-archival paper consisting mainly of wood pulp. This comes from trees so think about deforestation!
SUBLIMATION PRINT-OUT PAPER	Paper for an inkjet printer. This paper cannot be reused once you have printed on it as the ink might transfer. Think about reusing this for your portfolio or perhaps pattern cutting paper. Find your own way to recycle this please!
Wallpaper	
MANMADE - FROM NATURAL POLYMERS - CELLULOSE BASED	
VISCOSE / RAYON	An "artificial silk" made from mushed up tree pulp. We still need to think about preserving our forests, as they are the lungs of the world! Rayon from leading manufacturers is fully renewable, biodegradable, has reduced the use of water and chemicals (highly toxic carbon disulfide was used), and won't release microfibers that collect in waterways and oceans.
Cupro Cupron	A regenerated cellulose fiber made from cotton linter, the by-product of the industrial harvest of cotton, specifically the waste fibres that are too small to spin. Dissolved in an ammonia and copper oxide solution, Cupro fabric breathes like cotton and is similar to rayon. It is biodegradable as well as easily recycled, since it is made from 100% plant-based materials.
Lyocell – "Tencel" + "Greencel"	A cellulosic fiber obtained from wood pulp using recyclable solvents
Tencel – "Modal"	A type of rayon, a semi-synthetic cellulose fiber made by spinning reconstituted cellulose
"Lenzing – Ecovero"	Derived from certified renewable wood sources using an eco-responsible production process that generates up to 50% lower emissions and water impact compared to generic Viscose, contributing to a cleaner environment
ACETATE + TRIACETATE	Acetate is a chemical compound produced from cellulose and a source of acetate esters. It is a man-made chemical, semi-synthetic fabric. Triacetate is significantly more heat resistant than Acetate. Acetate has also shown to be biodegradable and can be composted or incinerated with no harm to the environment.
CELLOPHANE	A sheet-extruded viscose rayon
Leather ALTERNATIVES	There are lab-grown leather replacements made from apple, mushrooms, and pineapple wastes.
MANMADE - FROM NATURAL POLYMERS - PROTEIN AND BIO-BASED	
Milk / Eucalyptus casein – "eucymilk"	This process has been developed to spin raw Eucalyptus and Milk protein fibers into fine gauge yarns. These hair thin threads are carefully intertwined and woven into a soft-as-butter, lightweight fabric. Eucalyptus grows really fast!
Seaweed "seacell"	Where cellulose is mixed with seaweed to create a yarn. After much research they created a fabric that locks the properties of seaweed into a wearable fabric. Not only is the product biodegradable but the production process follows sustainable practices too.
Corn	A fairly new concept in the world of eco-friendly textile, conceptualising the idea of using fermented plant sugars derived from corn. The initial production stage involves making plant sugar from maize. The next step is to ferment the sugar, which is similar to making simple yogurt. The residue obtained after sugar fermentation is then converted into polylactide, which is a high-performance polymer. The fibre used for fabric production is extracted from

	<p>polylactide. The fermentation process goes through a chemical transformation, thus it is not 100 percent natural, but the transformation is considered renewable, as it bars the use of any fossil resources like oil etc. Another pitfall with corn fabric is that traditionally grown corn leaves an exceptionally large eco-unfriendly footprint via pesticides, water use, and land hogging. However, the use of energy is almost half as it does to make cotton or even organic cotton.</p>
Soy	<p>Considered a man-made cellulosic material, as it undergoes chemical manipulation in order to be turned from a plant into a fabric. The extensive production process involves breaking down the proteins in the soybean by exposing them to heat, alkalis or enzymes, after which they are filtered and pushed through a spinneret to separate the fibers into long strands. The fibers are then cross-linked to lengthen them using formaldehyde, which is an irritant that is mutagenic in certain bacterial and animal species and has been classified as a probable human carcinogen.</p>
Food waste source – orange peel	<p>Made of waste citrus fruit peels. The peels are processed with a patented method to extract the cellulose that is spun to form the final yarn. The fabric looks and feels like silk: soft to the touch and a shiny appearance. The biodegradable yarn can be spun with any type of existing yarn.</p>
SYNTHETIC FIBRES - FROM SYNTHETIC POLYMERS	
Virgin POLYESTER	<p>Made from crude oil – petroleum, a non-renewable resource. Production processes are energy-intensive, producing large quantities of hazardous waste and emissions that can irreversibly damage the air, soil and water. Dyeing requires high temperatures. Remember this does NOT biodegrade and 80% of the world's clothes go in landfill or get incinerated. 63% of the world's fabrics belongs to oil-based textiles production. ALL POLYESTER shed micro fibres, which is bad for the environment! Look into this further to make an informed decision regarding SUSTAINABILITY. Shocking fact: In 1980 global production of polyester was 5.2 millions tonnes but then in 2014 46.1 million tonnes was produced.</p> <p>Virgin Polyester (old clothes) CAN actually be recycled depending on recycling methods - but tends to go straight to landfill! We need to look into this further! Even if something can be recycled, that depends on us disposing / recycling it correctly!</p>
Recycled POLYESTER - RPET <i>Recycled Polyethylene Terephthalate</i> Ocean Waste Bottles – “Newlife” or “Life-recycled”	<p>Made from PET bottles – non-reusable plastic bottles found floating in the ocean! Think of this as a solution to a problem already caused, as PET comes from crude oil too (see above) to make the plastic bottles in the first place</p> <p>Still contributes to the micro fibre problems that we all know about!</p>
Faux Fur / Skin - “Fur Free Fur”	<p>Plastics – petroleum based, meaning this still sends micro fibres back into the water system</p> <p>An alternative to animal products!</p>
NYLON - POLYAMIDE (PA)	<p>A synthetic polymer, polyamide is a macromolecule with repeating units linked by amide bonds. Polyamides occur both naturally and artificially. Examples of naturally occurring polyamides are proteins, such as wool and silk. Artificially made polyamides can be made through step-growth polymerization or solid-phase synthesis yielding materials such as nylons, aramids, and sodium poly(aspartate). Synthetic polyamides are commonly used in textiles, automotive industry, carpets, kitchen utensils and sportswear due to their high durability and strength.</p>
Regenerated NYLON – “Econyl”	<p>Nylon waste from landfills and oceans around the world is transformed into “ECONYL” regenerated nylon. It's exactly the same as brand new nylon and can be recycled, recreated and remoulded again and again</p>
POLYURETHANE (PUR and PU)	<p>Polyurethane is a polymer composed of organic units joined by carbamate (urethane) links. While most polyurethanes are thermosetting polymers that do not melt when heated, thermoplastic polyurethanes are also available.</p>
ELASTANE + SPANDEX + LYCRA	<p>A synthetic fibre known for its exceptional elasticity. Today most clothes containing spandex end up as non-recyclable waste once they have been worn or worn out, as fabric blends containing spandex are difficult to recycle. This contributes to the pollution of the environment. When clothes are washed, hundreds of thousands of micro fibres are released into the wastewater, ending up in the oceans, and if clothes contain plastic then they will cause micro plastic pollution.</p>
ACRYLIC / MODACRYLIC	<p>Made with plastic threads, that originate from manmade polymer fibres created from fossil fuels (crude oil, natural gases and petroleum) through a energy-rich, chemical process. Acrylic fabric is made in a way similar to the production of nylon / polyamide fabrics and polyester too. Acrylic fabric has a short shelf life as it can pill easily, looking old and worn, however it can last up to 200 years in land fill and release toxic chemicals into the environment on its long journey to decomposition.</p>
OTHER	
GLITTER / SEQUINS	<p>WHAT ARE THEY MADE FROM? PLASTIC</p>
Biodegradable GLITTER / SEQUINS	<p>THINK ABOUT WHAT HAPPENS IN THE FUTURE? DO THEY DISSINTEGRATE?</p>

Designers have a huge responsibility in changing the industry, through material choice. Think about resources available, transportation impacts, agricultural issues, water consumption, landfill, demand,

For more information – please look at our Materials Library online resource:

<http://arts.ac.libguides.com/Materials/sustainability>