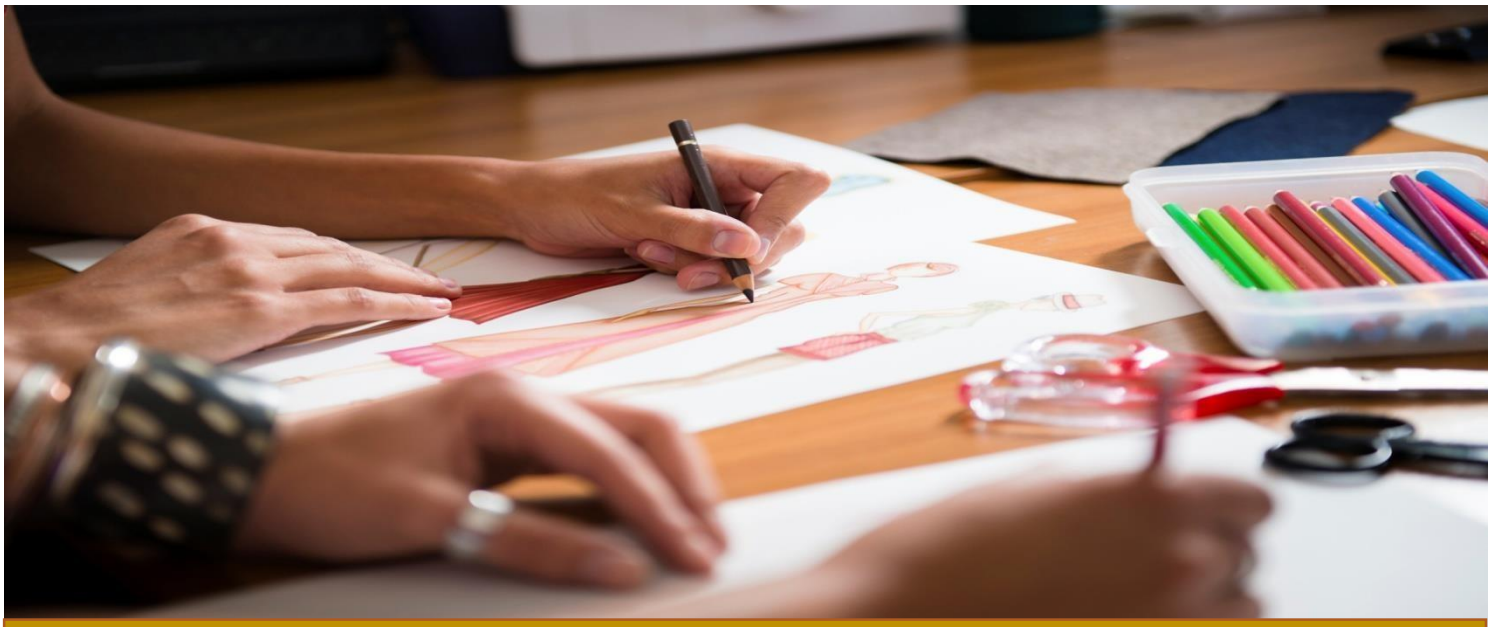


# Choosing the Right Material

## Learning Outcomes

**By the end of this unit the learner will be able to:**

- ✓ Discuss fabric construction and the kind of weaves
- ✓ Describe dyeing methods used for different types of fabrics
- ✓ Explore the printing process and techniques used in printing fabrics

# Choosing the Right Material

## Balance of Factors

For the majority of clothing items aesthetic factors provide the initial impulse of attraction and may be the only factors which influence the decision to buy. The exception is the requirement that the item should fit. But even fit may be a function of fashion and style. Such aesthetic factors as handle, drape, colour and style all interact in a complex manner and are crudely and subtly influenced by social factors – a desire to be seen to be in fashion, a desire to present an image, for example.

Aesthetic and performance factors are, of course, inextricably linked with price. The often-repeated statement that 'you get what you pay for' is generally associated with performance, but a customer's concept of what the level of performance should be, will vary considerably. It is often influenced by aesthetic considerations. Thus the concept of good quality is not a static issue operating at one level for all customers; it is influenced by aesthetics, performance and price, and is specific to an individual customer. An example of this is a silk tie. To most customers this would represent good quality, but in performance terms silk is markedly inferior to polyester. A polyester tie, however, would be considered of lower quality than a silk tie and, of course, would be cheaper. In this situation aesthetic characteristics are dominating the opinion expressed. This leads to a number of guidelines about the balance between aesthetics, performance and price:

1. For a given customer the balance required will change with the item being purchased. A woman, for example, may apply very different criteria to the purchase of a dress for a social occasion from those applied to the purchase of a pair of school trousers for her son.
2. Balance is dependent on the socio-economic position of the customer. Higher income group people will be willing to pay a high price for individuality in aesthetic terms and will be less concerned about durability, although they may expect high performance standards for the albeit short lifespan of the item. Quality is not a single definable entity; it is a statement of the balance of factors which will satisfy an individual customer.
3. Overall economic factors may radically change the behaviour of customers in terms of perceived requirements. Credit restrictions and a harsh economic climate may not only lead to reduced purchase but also to greater attention to performance details such as durability. An item of clothing is a summation of materials, starting with fibre, through yarn, fabric and trimmings which go to make it up. The complexities of balancing aesthetics, performance and cost factors therefore apply to the selection and use of these materials.

## Fibres

All textile fibres are complex long-chain polymers. The difference between them is in the chemical nature of the polymer and in the physical structure. A number are made of the same polymer, cellulose, but while they are similar in many ways, there are also considerable differences caused by the way in which the

chemical cellulose is physically arranged to produce the fibre. Examples are cotton, linen, viscose and modal.

The terms 'natural', 'regenerated' and 'synthetic' fibres- the last two being grouped together as man-made - refer to the origin of the polymer. **Natural fibres** are obtained directly from a plant or animal and, apart from cleaning processes, are used largely as they occur naturally. **Regenerated fibres** are those made from a natural polymer, almost invariably cellulose, which has either been regenerated in a fibre form (as in viscose from wood pulp) or has been subjected to some chemical modification and then spun in fibre form (as in acetate and triacetate). **Synthetic fibres** are made by industrial processes from polymers which have been built up from simple chemicals; these chemicals, almost invariably, come from oil.

**Natural Fibres**

The most important natural fibres are flax, wool, cotton, and silk. Others are ramie, jute, sisal, and hemp. All of these are derived from either animals or vegetables. Used for thousands of years, they are still considered the most luxurious fibres. For beauty, nothing can compare with natural fibres.

**Cotton**

Cotton has long been the world's major textile fibre. A vegetable fibre, it grows best in tropical and subtropical climates. Most cotton is grown in the United States, Russia, China, and India. Smaller but still important cotton producers are Brazil, Egypt, Mexico, Pakistan, Peru, Turkey, and the Sudan. The total world production is about 14 million tons.

Cotton is washable and durable, holding up well after many launderings. But because it has little elasticity or resilience, it wrinkles easily. (However, wrinkle- resistant finishes have been created that make cotton easier to care for). Cotton absorbs dyestuffs easily to produce a wide range of vivid colours.

Yet cotton is very versatile and can be made in both light weights for summer and heavier weights for winter. Cotton fabrics range from the light and sheer (such as voile and batiste) to the heavy and thick (corduroy, flannel, and chenille) to the strong and sturdy (denim).

**Wool**

After cotton, the next significant natural fibre is *wool.* It is becoming increasingly expensive, however, partly through economic manipulations of the market since production is virtually static.

**Properties of Wool**

Because of the structure of wool fibres, woollen fabrics retain body heat. Because it is warm, wool has traditionally been used for fall and winter suits and coats. Yet it can also be woven or knitted into lightweight fabrics such as challis. Wool fibres are firm, yet soft and elastic, helping wool fabrics to resist wrinkling. This elasticity also makes wool fabrics give with the body's movements, so that they are very comfortable to wear. It is truly a versatile fibre.

There are several other natural fibres derived from animal hair, the most important being mohair, alpaca and cashmere. All have high aesthetic appeal, particularly in the upper end of the market, and are used

either as substitutes for, or in blends with, wool. World production is limited, although there is no problem concerning animal rights since the animals do not need to be killed in order to obtain the fibre.

**Linen**

Linen is another natural fibre based on cellulose, although very different aesthetically from cotton. It is much more expensive to produce than cotton and does not perform as well, but the linen appearance - which can be copied by using regenerated fibres – and the handle produced by certain finishing processes, still give it an aesthetic appeal.

There are a large number of other natural fibres derived from cellulose, such as hemp, manilla and jute, but none of these has significant use in clothing. Although they are cheap, the handle is generally too harsh and unattractive for clothing; they are more suited to their use in ropes, carpets etc.

**Silk**

Silk is the protein filament spun by a silkworm to make its cocoon. The silkworm, the forerunner of the silk moth, uses the cocoon as a shell to protect itself during its transformation from caterpillar to moth. Silk harvesters unwind the filament from the cocoon onto silk reels. A typical cocoon will produce 1000 yards of continuous yarn. There are four kinds of silk fibres.

Cultivated silk comes from the domesticated silkworm. The filaments are almost even in size, their fineness indicated by a unit called the *denier.* Cultivated silk is used for the finest silk fabrics, such as crepes, taffetas, and satins.

***Wild or tussah silk*** comes from the wild silkworm. Less secure environmental conditions cause the filaments to be coarser and more uneven. Therefore, fabric made from wild silk is not as smooth as that made from domesticated silk.

***Douppioni silk*** is the filament from two or more cocoons that have grown together so that the fibres join at intervals. Yarns made from these fibres have· thick, uneven nubs from the joining. Such yarns are used in shantung (a rough textured silk made from uneven yarns).

***Waste silk*** is composed of short fibres from damaged cocoons, not strong or long enough to be used on their own. Yarn spun from waste silk also has irregular slubs (uneven yarns); it is used in rough-textured silks.

The patience and handwork necessary for silk production make silk fabric rather expensive. Japan is the largest producer of silk fibre, followed by China, India, Korea, and Italy. The most famous silk fabric mills are in Como, Italy, and Lyons, France. Silk has always been used for the finest garments. Because it takes dyes with exceptional depth and clarity and has a luxurious feel, it adds elegance to any garment. Silk drapes exceptionally well, is very strong yet lightweight, and is comfortable as well as beautiful.

**Regenerated Fibres**

The first man-made fibres were regenerated but their popularity has gradually receded. The main regenerated fibre is viscose (the former name rayon is not permissible). Its performance is markedly

inferior to cotton, particularly in wet strength, although it is cheaper. Its former market, such as linings, has gradually been lost but it is still popular for certain print fabrics for blouses and dresses, as well as in household textiles.

Two other regenerated fibres are made by chemically modifying cellulose: acetate and triacetate. Both are cheap and both have been promoted with a fashion image. Acetate was used extensively for cheap linings but is now largely superseded. Performance is markedly inferior to polyester and nylon and the price difference is not now very great. The main attraction is aesthetic. Acetate was formerly known as artificial silk but that term is now illegal. It has some of the characteristics of that natural fibre and is capable of giving bright coloured prints.

**Synthetic Fibres**

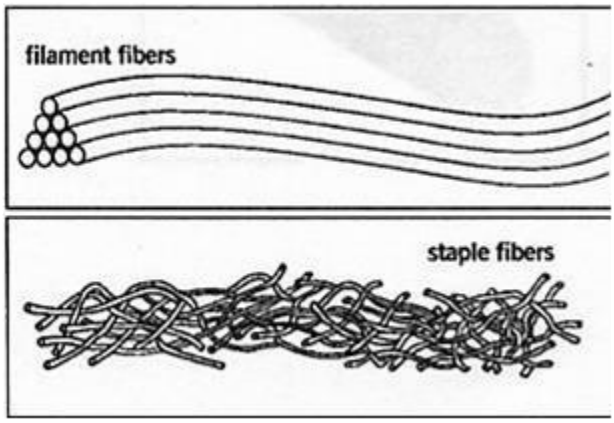
By far the most important man-made fibre, and second only to cotton in total world usage, is **polyester**. It has a high standard of performance, except in terms of moisture absorption, but its aesthetic image has suffered with the change in the social climate towards natural fibres. It is, however, cheaper than all the natural fibres, and although it is subject to oil price changes and, therefore, like all fibres subject to opportunistic pricing by the market, it is likely to retain its popularity. For clothing, **nylon** (generally now known as polyamide) has yielded the lead to polyester. Two varieties of nylon are generally used, known as 66 and 6, but from a consumer performance viewpoint these are indistinguishable.

Commercial production now is geared more towards 6 because production is cheaper. The performance of nylon is at least comparable with that of polyester. **Acrylic fibre** retains a significant market share as an alternative to wool, particularly in knitwear. It can be extremely price competitive with wool and it does have the advantage over the natural fibre that it is machine washable. This advantage has been partly eliminated by the machine washable finishes now available for wool, but the price difference remains. Essentially, the decision is based on price versus aesthetics.

Some use has been made commercially of polyethylene and polypropylene fibres, particularly the latter. The other synthetic fibre of note is a very specialised one: elastane. This is now almost universally used as a substitute for rubber, and because it does not have the same deterioration characteristics has enabled a wide variety of stretch garments to be produced. Although expensive, it is used in small quantities within the material and therefore can give marketing advantages of stretch for a relatively low price increase.

## Filament and Staple

Fibres may be available in two forms - filament or staple. The natural fibres, with the exception of silk, are all in staple form, whereas man-made fibres can, in theory, be produced in both. In practice, market considerations now mean that viscose is available generally only in staple form, with acetate and triacetate in filament. Acrylic is invariably staple but polyester and nylon are available in both.




## Blends

The balance of aesthetics, performance and price in the choice of fibres has inevitably led to the production of blends. The man-made fibres are blended with natural fibres. Blends capitalize on the best qualities of each fibre, yielding fabrics with the look and feel of natural fibres but the easy-care properties of synthetics.

## Yarns

Staple fibres generally require conversion into yarns as the first stage in the production of fabric.

**YARN PRODUCTION**

a) ***Spinning Staple Fibres***

Before being woven or knitted into cloth, fibres must first be made into yarn.

Raw white acrylic yarn

Spun yarns are made from natural and man-made staple fibres. Yarn can be made as coarse as rug yarn or even finer than sewing thread.
Natural fibres such as cotton, flax, and wool must go through a long and expensive series of processes to become yarn. First, there are several processes to clean, refine, and parallel the raw fibres. Next the fibres are drawn out into a fine strand and twisted; this keeps them together and gives them strength to withstand the spinning process. Once the fibres have been spun into yarn, they can be made into fabrics.

Man-made staple fibre is spun on the same conventional spinning system used for cotton or wool. For this reason the resulting yarns have characteristics similar to those of spun natural fibre. In fact, staple man-made fibres are often blended with natural fibres.
Filament yarns are made from long, continuous filaments. These yarns are primarily man-made. (Although silk is also a filament, it accounts for less than one percent of fibre and yarn production.) Filament may be knit or woven as is directly from the fibre producer. In this case, individual filaments are brought together, with or without a twist, to create the yarn. Generally, however, synthetic fibres are textured to provide bulk, loft, or elasticity.

## Fabric Construction

*Fabric* is material or cloth made from natural or man-made yams by any of the following methods: weaving, knitting, bonding, crocheting, felting, knotting, or laminating. Most textile fabrics are woven or knitted. Fashion preference for one or the other is cyclical.

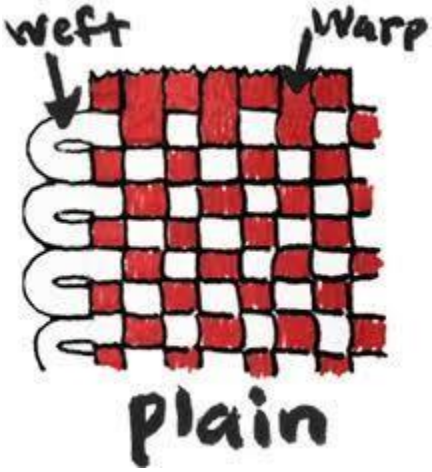
a) **Weaving**

Woven fabrics are made by interlacing warp yam (lengthwise) and filling yarn (crosswise-called *weft* in England and in hand weaving) at right angles. Weaving begins with a process called *warping:* yarns are wound onto a beam and hung lengthwise on the loom. There may be as many as 15,000 warp threads on one loom (ready-to-wear manufacturers need wide fabrics for efficient pattern layout). In the conventional method of weaving, filling yams are fed into the loom by a shuttle carrying yam wound on a bobbin. The warp yams separate alternately to allow the filling yarns to

interlace with them as the shuttle passes through the warp shed. An even faster method of weaving uses a shuttle less loom, which carries the filling yarns through the warp on steel bands. Still other types of shuttle less looms carry the filling yams on tiny *darts* or tiny jets of water or air. These looms operate at three times the speed of shuttle looms and produce seven to eight times the fabric because they weave wider widths.

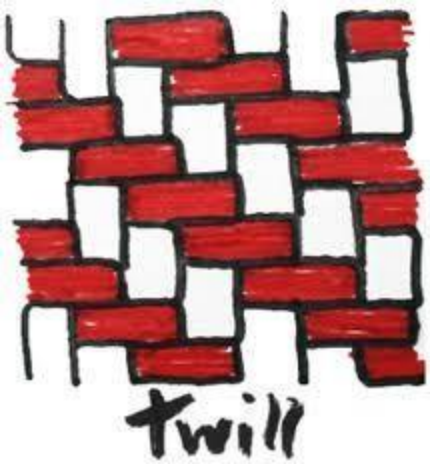
**Kinds of Weaves**

There are three basic weaves: plain, twill, and satin. A *plain weave* is the simplest, most common weave. The warp and filling yarns alternately
pass over and under each other.




In *twill weave,* the filling yarn passes over a number of warp yarns before going under one.

The same pattern is repeated row after row, but each time the repetition begins on the next warp yarn, creating a diagonal weave. The resulting fabric is very durable.




A *satin weave* is achieved by one warp yarn crossing over several filling yarns, creating *floats* on the face side of the fabric. The floats give the fabric lustre and smoothness.


But because they are caught into the fabric only at comparatively wide intervals, a satin weave does not wear as well as others. The many variations of basic weaves used to create designs or patterns in fabrics are called *novelty weaves.*

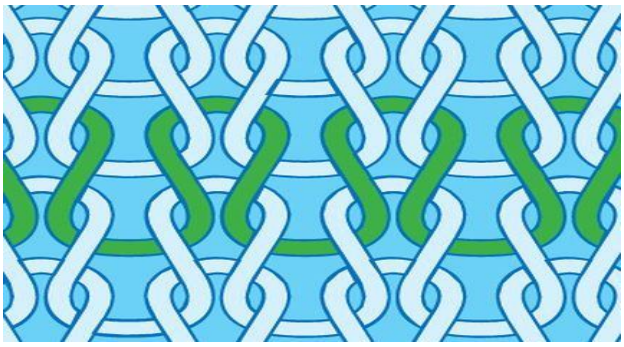
**Pattern**

Pattern can be introduced by using yarns of different colours in the warp, the filling, or both, to create plaids, checks, or stripes. These *yarn dye patterns* can be distinguished from prints because they appear the same on both sides of the fabric. Woven patterns may also be produced by reversing the direction of the weave in certain areas or in alternate rows, as in herringbones. Small figures, called *dobbies,* can be woven into the fabric by a special attachment on the loom.

Fancy woven patterns, such as brocade, damask, and tapestry, may be created on a *Jacquard* (jahkard') loom, run by computers. The pattern is programmed on a series of computer cards, which cause the individual warp yams to go up or down, creating the desired pattern.

**b) Knitting**

Knitted fabrics are made from one continuous yarn or combination of yarns formed into a series of interlocking loops to make cloth. There are two basic ways of knitting fabrics. When the loops run across or in a circle, the process is called ***weft* or *circular knitting.*** This is the least expensive method of converting yarn into fabric. Weft knits are made in a wide variety of single and double knits and generally have more stretch than warp knits.



In ***warp knitting,*** multiple yarns are used and the loops run vertically.

Warp knits include tricot and raschel. In addition, novelty or patterned knits may be produced on special machinery. In comparing one weft- or warp-knit fabric with another, people in the trade refer to the *cut* or *gauge* the number of needles per inch. The more needles there are, the finer and closer the knit loops are. On modern electronic knitting machines, sweater designs can be transferred to a computer tape, which operates the machine automatically.

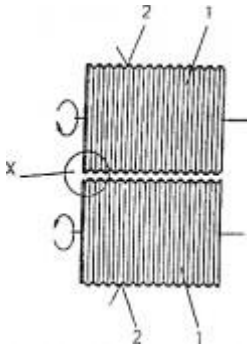
**c) Nonwoven Fabrics**

Nonwoven (or *engineered)* fabrics are made by either bonding or interlocking fibres, filaments, or yarns into a web or sheet by mechanical (pressure), chemical, thermal (heat), or solvent means. Examples of such fabrics include nonwoven interfacings such as Pelion. Felting is a process for making matted fabrics, such as nonwoven felt. Nonwoven fabric production usually includes four stages:

1. fibre preparation,
2. web formation,

Nonwoven manufacture starts by the arrangement of fibres in a sheet or web. The fibres can be staple fibres packed in bales, or filaments extruded from molten polymer granules.

3. web bonding, and




4. post treatment. Nonwoven fabrics constitute one of the fastest growing segments of the textile industry.

## Dyeing

Dyeing can be done at any stage of fibre, yarn, or fabric production. Some of the most important methods of dyeing are as follows:

- *Solution dyeing is* used for synthetic fibres.
- *Stock dyeing is* used for natural fibres.
- *Yarn dyeing* is used for multicolour effects and is generally considered the quality way to produce patterned fabrics.
- *Resist dyeing* involves treating the yarn or cloth before dyeing so that the treated portion resists the dye.
- *Piece dyeing* is done on fabric after weaving or knitting.
- *Cross dyeing* like yarn dyeing and resist dyeing is used to produce patterns. But it results mainly in a simpler, two-colour effect and is therefore considered the less expensive way to produce patterned fabrics

**Special Dyeing**

If apparel manufacturers want a fabric in a colour that is not regularly available, their order must meet a minimum yardage requirement. Yarn-dyed and solution- dyed fabrics require the largest orders (the minimums are so high for solution-dyed fabrics that special orders are rarely placed).
There is a new vogue in junior apparel for total garment dyeing *after* the garment has been sewn!

## Printing

Printing is used to apply design or pattern to fabrics. There are three basic printing techniques: engraved-roller printing, screen printing, and heat transfer printing.

a) **Engraved-Roller Printing**

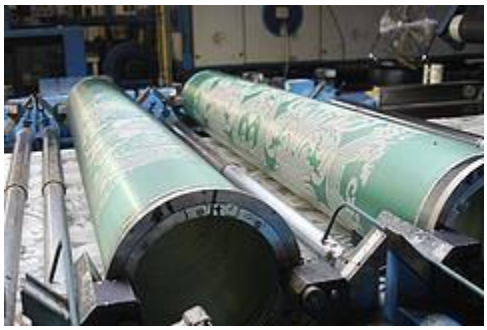
In this technique, a separate roller engraving is used for each colour in the pattern. The design is rolled onto the fabric as it passes through the printing machine.

**b) Screen Printing**

Flat-bed Screen Printing: This technique uses a screen spread over a frame. The portions of the design to be printed are made of porous nylon that allows the colour to pass through the screen. The areas that are not to be printed are covered or coated with enamel. Colour is poured into the frame shell and is forced through the nylon by means of a squeegee worked back and forth. Flat-bed screen printing is versatile but expensive.

**c) Rotary Screen Printing**

This is a mechanized version of flat-bed screen printing. In this method, the roller itself is porous in the areas to be printed. Dye is forced into the roller cylinder and through its porous screen as it rolls over the cloth. This method is faster than flat-bed screen printing and is continuous, leaving no breaks between screens. In engraved-roller printing and screen printing, dyestuffs are applied wet for optimum colour penetration. In pigment printing, another method of wet printing, the pigment is attached to the fabric surface with a resin. Other wet prints use dyestuffs that have a chemical affinity to the cloth fibre and do not require resin. With wet printing it is possible to achieve a soft, drapable hand (the feel, body, and fall of a fabric) as well as a crisp finish.



**d) Heat-Transfer Printing**

In this process, used on polyester and some nylons and acrylics, rotary screens or rollers first print dyestuffs onto paper. The paper can be kept for use at any time. To print on fabric, the paper and fabric are put through hot rollers; the dyestuffs sublimate into a gas, which moves from the paper base onto the fabric. The advantages of this method are that it gives a clean, fine line on knits, and that the paper is a smaller investment than the elaborate equipment needed for other methods. However, care must be taken that the hand of the goods does not become stiff under heat.

## Finishing

Some of the most important developments in fabric treatment are finishes. *Finishing* is a general term covering all the treatments done on fibres and fabrics. Finishes can drastically alter fibre and fabric characteristics, performance, or hand. Here are a few common finishes:

*Mercerizing* is a process by which cotton is treated with a cold, strongly caustic chemical solution to achieve a lustrous silk like finish.
*Sanforizing* preshrinks cotton cloth so that it will not shrink or stretch more than 1 percent during laundering.

*Calendering* (called *eire* in French) is a mechanical process of passing fabric between heavy rollers. By using different combinations of heat, pressure, and rollers, it is possible to produce a wide assortment of effects, such as glaze, watermark, or moire. Calendering is usually done on synthetics, because it is not permanent on fabrics made of natural fibres. *Schreinerizing,* one type of calendering, gives the cloth lustre by pounding it with steel rollers to impress miocoscopic reflective lines on the surface.
*Durable press* (also called permanent press, although it is rarely permanent) is the application of certain resins to cotton to create fabrics that require little or no ironing.

Other finishes can make fabrics flame-retardant, water-repellent, fade-resistant, mildew-resistant, bacteria-resistant, or stain-resistant. When production is completed, fabrics are measured and rolled onto tubes. Each finished roll, called a *piece,* may have 40 to 100 yards on it, depending on the weight of the goods (heavier knits and wools have fewer yardages on a piece, which makes it easier to handle).

## Testing

The most obvious way to test clothing for performance factors would appear to be a wearer or user trial. Under certain circumstances such tests are essential but, as a routine form of investigation, they have inherent problems.

a) **Durability**

Durability testing is almost entirely related to physical forces acting on fabrics. It can give good correlatable results for seam breakage and seam slippage, for example, and reasonable correlation in some other areas of durability, particularly for fabrics with particular weaknesses such as resinated cotton. However, there is a tendency to assume that the use of synthetic fibres such as polyester and nylon will guarantee durability, and while this is sometimes a mistake because of the influence of construction, it has some basis in that both these fibres provide adequate protection from chemical attack.

b) **Dimensional Stability**

Dimensional stability can be relatively easily checked. The biggest problems occur in use, particularly cleaning, but it must be remembered that dimensional stability is also critical during the making up process. Standardised test equipment, such as the Wascator machine, is used in testing laboratories but a close approximation can be given in any normal domestic washing machine.

c) **Crease Recovery**

Testers exist to measure crease recovery, such as the Shirley crease recovery tester, but these are seldom used except on a quality control basis. If specific claims are being made for easy-iron performance the usual method is to subject a sample to washing and observe its appearance

d) **Stretch and Recovery**

Testing for stretch and recovery can be carried out on load application machines of the Instron type. These are frequently used where particular claims are being made and where the end use is specifically related to stretch, as in swimwear. In other cases shape retention is based around the use of fibres or on structures which give the necessary stretch, mainly knitted.

e) **Moisture Absorption**

No specific test for moisture absorption is normally carried out.

f) **Insulation**

For insulation properties, test methods which give results in terms of 'togs' are available. This is only a measure of conduction. The results are frequently quoted for duvets and sleeping bags but not generally for clothing.

g) **Water Proofing**

The two most widely used methods for rain proof or water proof testing are the Bundesmann and the Credit rain simulators. Both give measures of water penetration and absorption but the difficulty is always in correlating the level of water dropped on to the fabric with rain in real life. Nevertheless, they are used as a guide when any claim for shower or rain resistance is being made.

h) **Colour Fastness**

Tests for colour fastness are well developed. Those for rubbing (Crockmeter), perspiration and washing correlate well with use and employ the standard grey scales operating in the range 1 to 5 for both change of shade and staining.

i) **Laboratory Testing**

Laboratory testing is extensive for flame resistance, using equipment operating to British Standards. This measures the rate of propagation or otherwise of a flame which is applied in a standard form for a set period of time. Although mainly used on furnishings because of recent legislation, the equipment is used on clothing, particularly children's wear.

**Trimmings**

In the manufacture of clothing the main fabric is supplemented by a variety of trimmings whose number and complexity will depend on the type of garment. All garments will employ sewing thread in some form but additional items may be lining, interlining, tapes, labels, buttons and various other fastening devices including zips, and shoulder pads etc. The trimming may be for aesthetic reasons, performance reasons or a combination of both and it will have a cost which must be weighed against its advantages.

Most trimmings involve both functions. Buttons for example, have a practical value but also increasingly have an aesthetic one. Zips as a means of fastening may be concealed because they are not considered aesthetically pleasing; alternatively, they may become a fashion feature.

Any trimming should not detract from the performance characteristics of the main fabric. Most trimmings are themselves textile materials, as in linings, interlinings and sewing thread. The most popular material for linings is now woven nylon or polyester, although woven viscose filament and occasionally acetate are still in use. Pockets generally include polyester or nylon for performance reasons. Interlinings are now largely fusible, often based on non-woven materials. Since these are almost inevitably concealed in the garment, their appearance is not important; they need to produce the right drape and handle, combined with a resistance to deformation. Fusible non-wovens give this at the lowest possible price both in initial cost and in manufacturing process. Traditionally, however, other types of interlining are still employed, especially in the tailoring industries.

Most sewing threads are now polyester, but they may contain small percentages of cotton. Cotton sewing thread, although used, is increasingly losing ground because of the price as well as performance advantage of polyester. Apart from a small amount of nylon and a limited amount of silk for decorative purposes, no other fibre is significant in sewing thread.

## Make-up

Manufacturing a garment from a fabric is the conversion of a flat two-dimensional form into a three-dimensional shape to fit the human body. In the majority of cases this is done by cutting pieces to defined shapes and joining them in such a way that the three-dimensional form is built up. The way in which this is done and the position of the seams are often dictated by aesthetics or, particularly in menswear, by traditional views of where these seams should be. In tailoring, some underwear manufacturing and millinery, a limited amount of shape is produced by moulding or shaping. Obviously the more seams and the more complex they are, the greater the cost, but this may be accepted for aesthetic reasons.

The final process in making up - pressing - is carried out to obtain the desired aesthetic appearance in the new garment. Indeed, pressing may take place at various stages during the garment construction in order to achieve the desired effect. Pressing may also be needed to impart pleats or creases which are required as part of the convention for that garment, for example in trousers. Again, the duration of pressing and in particular the amount of under pressing greatly adds to the cost of the garment but may be considered essential in order that the garment presents the right image at the point of sale.

### Further Reading:

- ✓ ***Fabric for Fashion: The Swatch Book ( By Clive Hallett)***
- ✓ ***Fashion A Very Short Introduction ( BY Rebecca Arnold)***