Complex Weaves

- **Complex weaves** include all weaves except "basic weaves."

- The classification and/or terminology for weaves other than basic may vary. Where possible, the terms describing a weave are mentioned for each complex weave.

- Many complex weaves are chosen to enhance appearance and durability. Some weaves are used for specific purposes; for example, uncut pile is used for terrycloth for towels because the loosely twisted loops increase a fabric's ability to absorb water.
Examples of Complex Weaves

jacquard

dobby

leno

unclipped spot weave
double weave

uncut pile
Complex Weaves

The main categories are:

- **Figure, or novelty weaves**: combinations of basic weaves that do not require extra warp or filling yarns to create a design.

- **Surface figure weaves**: require extra warp and/or filling yarns to create a design. Extra yarns are inserted during weaving.

- **Pile weaves**: require extra warp or filling yarns to form the pile created during weaving.

- **Double cloth**: requires three or more sets of yarns to form different effects on the face and back; includes double cloth, double weave, and double-faced fabrics.

- **Leno weave**: crosses two or more warp yarns to hold the filling yarn in position.

- **Crepe weave**: a texture is created by random interlacing of warp and filling yarns.

- **Slack-tension weave**: bands or stripes of slightly puckered areas are created by reducing the tension on yarns that are puckered.
Figure Weaves

- **Figure**, or novelty weave, is "a woven construction that is a variation or combination of basic weaves - plain, satin, and twill."*

- Figure weaves include **dobby, jacquard**, and **piqué**.
  - Dobby and jacquard are more common.

- **No extra warp or filling yarns are used to create a design.**

- A variety of designs and textures are created by varying the fiber or yarn.
  - Simple designs require less yarn manipulation and can be made on a standard harnessed loom with a dobbý attachment to raise and lower a limited number of yarns.
  - Complicated designs require a jacquard weaving process in which individual warp yarns can be controlled.

*Source - *Dictionary of Fiber and Textile Technology*
**Figure Weaves – Dobby**

- **Dobby weaves** have small, simple geometric designs with straight lines in at least one direction. They have fewer than 25 yarn interlacing arrangements before the design repeats.

- Dobby weaves are created with a dobby attachment that selectively raises and lowers the yarns to create the design.

- The design motif may be spaced out on a plain, twill, or satin background.

- The design motif may be an “allover design;” examples include waffle weave and huck/huckaback.
Dobby Weave – All over pattern
Figure Weaves – Jacquard

- **Jacquard** weaves are figure weaves with large repeats or non-repeating designs with curves. They contain more than 25 yarn interlacing arrangements before the design repeats.
- Each yarn is controlled independently to create intricate designs.
- Originally, punched cards were used to raise the warp yarns to create a design; making intricate designs was very labor-intensive and expensive to produce.
- Today, computer controlled jacquard systems are used to raise the warp yarns, thereby drastically reducing manufacturing costs.
  - Examples: brocade and damask.
Damask (Jacquard Weave) Tablecloth
Jacquard Weave Fabric Used as Wall Covering
Figure Weaves – Piqué

- **Piqué** fabrics have raised areas visible on the fabric face and loosely woven floats on the fabric back.

- **Stuffer yarns** make the raised areas more prominent and contribute to fabric weight and bulk. They are laid between the warp and filling yarns, but not woven into the fabric. They can be pulled without affecting the integrity of the fabric.

- Most piqués are woven with a dobby attachment. Jacquard looms are used to produce more complicated designs.
  - Examples: widewale piqué, pinwale piqué, bedford cord, birdseye piqué, and bullseye piqué.
Widewale Piqué with Raised Cords

- floats on fabric back that cover the heavy stuffer yarns
- thick 2-ply stuffer yarns
- raised wales or cords

Side View
Birdseye Piqué

Face

Back
Piqué – Crisscross pattern used for bedspreads

Note: Due to the crisscross pattern, this fabric resembles a quilted fabric.
Surface Figure Weaves

- **Surface figure weaves** require extra warp and/or filling yarns inserted during weaving to create a design. The three surface figure weaves are:
  - Spot (unclipped and clipped)
  - Swivel
  - Lappet

- Spot is the most commonly used surface figure weave.
Spot weaves require an extra set of warp or filling yarns to create a design.

- The extra yarn is inserted for the entire length or width of the fabric, floating from one motif to another, appearing on the back of the fabric when not interlaced on the front.
- The length of the floats varies depending on the design.
- The base weave of a spot weave may be plain, twill, satin, dobby, jacquard, or double weave.
- Spot weave is divided into unclipped and clipped spot.
Surface Figure Weaves - Unclipped Spot

- In unclipped spot weave, the floating yarns between the motifs are not cut.
- In some fabrics (mostly apparel), the floating yarns are very short as the motifs are close together.
- In upholstery fabrics, where the back of the fabric is coated, long floating yarns are left uncut to enhance fabric durability (uncut yarns resist snagging).
Unclipped Spot Weave

extra set of filling yarns carried from one motif to another
Unclipped Spot Weave Used for Upholstering

Note: The base weave for the unclipped spot weave fabric is jacquard. The fabric back is coated, and the long floats are not cut to enhance fabric durability (uncut floats do not pull as easily). This fabric is suitable for upholstering as the back of the fabric with long floats and coating is not visible. This type of fabric would not be suitable for an end use such as unlined drapes.
Surface Figure Weaves - Clipped Spot

- In **clipped** or **cut spot weave**, the floating yarns are cut between motifs, forming a fringe.

- Fringe generally appears on the back of the fabric; fringe can appear on the face of the fabric for design purposes.

  - Examples: eyelash fabric, dotted swiss.
Clipped Spot Weave - Extra set of yarns in the warp and filling directions used to create the design.

extra set of warp yarns used to create the design have been removed.
Clipped Spot Weave

extra filling yarn used to create the design left uncut by mistake
Clipped Spot Weave – Dotted swiss fabric with fringed edges on design face to enhance the appearance.
Note: Eyelash fabric is an example of clipped spot weave in which the fringe is created by cutting the extra set of warp yarns in between the two points where it is woven into the fabric. The technical back with the fringe is the design face in eyelash fabrics.
Pile Weaves

- **Woven pile** fabric is produced by inserting an extra set of warp or filling yarns during weaving to create a raised surface.

- The raised surface created by the loops of the extra yarns, or the pile resulting from cutting the loops, can be on one or both sides of the base fabric.

- It is defined by the direction in which the extra set of yarns is inserted to form loops or floats (warp pile or filling pile), or by the type of raised surface (loops or cut pile).

- Terrycloth and velvet are examples of warp pile fabrics.

- Velveteen and corduroy are examples of weft pile fabrics.
Warp- and Weft-Pile Fabrics

Note: In warp pile fabrics, the pile formed by an extra set of warp yarns is unraveled in the filling direction as the pile is held in place by the filling yarns. Similarly, for filling pile, the extra set of yarns is unraveled in the warp direction.
Pile Weaves - Terrycloth

- Terrycloth fabrics are uncut pile fabrics manufactured with an **extra set of warp** yarns to create the loop by slack-tension method.

- Terry toweling quality, cost, and durability depend on weave type (plain or twill), count of base cloth, and loop characteristics.

- Terrycloth has pile on both sides of the fabric. Some fabrics have pile on the face side only.

- In **velour** (e.g., towels, robes), the **loops are sheared** on one or both sides to enhance appearance and softness.
Note: Loops have been pulled to show the base fabric on side A. Notice that nothing happens to loops on side B when the loops on side A are pulled. This is because different sets of warp yarns are used to produce loops on the two sides of the fabric.
Velour Towel – Loops on one side sheared
Pile Weaves - Velvet

- Velvet fabrics are woven with an **extra set of warp** yarns to create the pile.
- Traditionally woven with silk filament yarns; now rayon, acetate, nylon, and polyester filament yarns are also used.
- Sometimes spun yarns are used (e.g., cotton velvet used for upholstery fabrics).
- Most are double cloth fabrics with two layers separated by cutting the pile down the center.
- Examples: panné, devoré, crinkle, and crushed velvets.
Cut Warp Pile Fabrics – Double cloth method

fabric # 1
extra warp yarn
filling yarn
warp yarn
extra warp yarn
filling yarn
warp yarn
fabric # 2

Source - Dictionary of Fiber and Textile Technology. Figure adapted with permission.

Note: Velvet is typically woven on a double shuttle loom. The pile is cut into half (along the orange line) by an automatic knife that traverses from one end of the loom to the other. In “W” construction the extra warp yarn interlaces with three filling yarns. In “V” construction it interlaces only once.
Velvet Upholstery Fabric

- pile tufts created by cutting extra set of warp yarns
- white warp yarns
- cross section of velvet fabric
- extra warp passes under a filling yarn
- filling yarns
- white warp yarn
Panné Velvet – Pile is pressed in one direction
Devoré Velvet – Velvet fabric with a burn-out finish
Pile Weaves - Velveteen

- **Velveteen** fabrics are woven with an **extra set of spun** yarns.
  - Traditionally an extra set of filling yarns is woven as floats. The floats are then cut to create the pile.
  - Now some fabrics sold as velveteen fabrics are produced with an extra set of spun yarns used in the warp direction.

Source - *Dictionary of Fiber and Textile Technology*. Figure adapted with permission.
Cotton Velveteen

pile created with extra set of filling yarns

face back
Comparison of Two Cotton Pile Weave Fabrics Sold as Velveteen

filling pile fabric

warp pile fabric
**Corduroy** is a filling-pile fabric where the *extra set of filling* yarns forms floats (similar to velveteen). The floats are cut to create the pile in parallel lines along the length of the fabric.

Source - *Dictionary of Fiber and Textile Technology*. Figure adapted with permission.
Pile Weaves - Corduroy

- Ridges or cords, known as **wales**, along the length of the fabric are characteristic of corduroy.
- Corduroy is described by:
  - Number of wales per inch. e.g., 8 wale, 10 wale, 16 wale. The higher the number of wales, the finer the fabric.
  - Width of the wales. e.g., widewale, pinwale, and featherwale.
Pinwale (18-Wale) Corduroy
Double Cloth Weaves

- Double cloth weaves are divided into three categories based on the number of sets of yarns used to produce the fabrics.
  - **Double cloth** requires five sets of yarns.
  - **Double weave** requires four sets of yarns.
  - **Double-faced** fabrics require three sets of yarns.

- **Double cloth fabric** is constructed with five sets of yarns.
  - Two fabrics are woven simultaneously, each with two sets of yarns; the fifth set is a binder set holding the two fabrics together.
  - If the binder yarns are removed, double cloth can be separated into two distinct fabrics.
Note: The fifth set of yarns can be pulled apart to separate the fabrics.
● **Double weave** fabric is constructed with two sets of warp and filling yarns.
  o The two fabrics are woven simultaneously and have some areas where the warp and/or filling yarns from one set are interlaced with the other.
  o The two layers cannot be separated without destroying the fabric.
    – Example: matelassé, a puckered surface, double weave fabric.
Double Weave With Two Sets of Warp and Two Sets of Filling Yarns

- Yarns interlaced such that the two layers cannot be separated in this area.
- Two separate fabrics in this area.

Face vs. Back orientation.
Matelassé

puckered look that is characteristic of matelassé fabric

two separate fabric layers
Double Cloth Weaves

- **Double-faced** fabric is constructed with three sets of yarns. The combination can be either two warp sets and one filling set, or vice versa.
  - Example: Double-sided satin ribbon, double georgette.
Double-faced Fabric Woven with Two Sets of Filling Yarns

Unraveled maroon filling yarn visible only on fabric face

Unraveled beige filling yarn visible only on fabric back

Face

Back
Leno Weave

- **Leno** weave fabrics are produced by crossing pairs of warp yarns (or sets of warp yarns) prior to inserting the filling (or set of filling yarns) through the shed during weaving.

- The warp yarns form a **figure 8** around the filling yarns as they cross over to hold the filling yarns in place.

- Leno weave is used to produce open construction fabrics.

- Leno weave is combined with other types of weaves to create interesting designs.

- Leno weave is used for curtains, apparel, vegetable sacks (onions, potatoes), carpet backing (Action Bac®), and industrial applications.
Leno Weave Fabric Used for Women’s Apparel

white warp yarns form what appears to be a figure 8 around the brown filling yarns
Vegetable Sack – Leno weave woven with tape yarns of similar width in the warp and filling directions
Casement Fabric With Leno Weave
Crepe Weave

- Crepe (momie) weave is produced with **random interlacing of warp and filling yarns** that results in an irregular surface. It is produced using a dobby attachment.

- True crepe is produced with **crepe yarns** (very high twist) in the warp and/or filling direction of plain or satin weave fabrics. Crepe weave is used instead of true crepe to reduce cost.
  - The pebbly surface of the fabric is due to distortion of the weave by the over-twisted crepe yarns that shift once tension during weaving is released.
Crepe Weave
Slack-tension Weave

- **Seersucker** fabrics are created using the slack-tension weaving process in which sections of warp yarns have reduced tension. This results in bands or stripes of slightly puckered areas.
- Since the puckering is woven into the fabric, the pucker cannot be flattened. Seersucker fabrics are relatively more expensive to produce as the fabrics are woven at a slower speed.
  - The puckered look can also be produced at a lower cost by application of chemicals such as caustic soda to shrink the stripes after the fabric has been woven (information included in the section on Finishing).
Seersucker
Seersucker Fabric Used for Drapery