In plain weave the weft travels over and under alternate warp threads on one pick, then under and over them on the next. Two "controls" (hereafter called shafts) are required, one to raise odd-numbered warp ends and one to raise even-numbered ones. When warp threads for plain weave are distributed on more than one pair of shafts, it becomes possible to produce interlacements in addition to plain weave, at which point the interlacement may become a new weave structure. It’s not just plain weave any more!

In such drafts, two (or more) pairs of shafts can each produce plain weave. The different pairs of shafts can (usually) be combined to produce plain weave across the width of the fabric, but they no longer have to. One can weave plain weave, while the other does something else. When a threading can be made to do plain weave in some areas and something else in others, the weave structure is no longer plain weave, and the threads grouped on the different pairs of shafts have become BLOCKS.

**BLOCKS:** Groups of threads (i.e., pairs of shafts and treadles, in this case) that can produce a background texture (e.g., plain weave) or a pattern texture (“something else”) independently of other groups.

In the structures reviewed here, what makes the something else are FLOATS.

**FLOATS:** Places in the cloth where a warp or weft fails to interlace in plain weave order.

Accidental floats (when a thread that you want to come up or stay down to make plain weave, doesn’t) are errors.

The floats discussed here are deliberately introduced and controlled by the loom. To prevent their being mistaken for accidents, they must be consistent, organized and short enough that the integrity of the cloth is not compromised. In other words, a weave structure that uses floats for patterning must have a means of controlling where they appear and of regulating their length. The way each structure uses floats and how they control float lengths are the factors that distinguish the weave structures surveyed here from one another.

**A Word about Weaving Drafts and Interlacement as They Relate to Structure**

Many (but not all) weave structures have a standard threading, tie-up and treadling sequence, mainly because it is easier to understand and weave a structure if the shafts that make up the different blocks are the same from one pattern to the next. However, it is important to realize that this is primarily a convenience for the weaver, and it is perfectly possible to weave the same interlacement on any number of different threadings, tie-ups and treadlings. Shadow weave has two different threadings, and huck has three (out of a total of 12!) commonly used different threadings that will yield the same interlacement.

**The interlacement of threads, not the threading, tie-up or treadling, determines a weave structure.**

Lynn Tedder, 2014
Finding Plain Weave

Many different threadings can produce plain weave when combined with the appropriate tie-up and treadling. To find plain weave on a threading with more than two shafts, circle every other thread and group the shafts with circled threads together on one treadle and the others on a second treadle. However, if a shaft contains warp threads that are both circled and uncircled, true plain weave cannot be woven all the way across that threading.

Below are the tie-ups that will weave plain weave in threadings 1, 2, and 3.

Basketweave

Basketweave contains floats, but they are not produced by blocks. Instead, the floats are produced by doubled threads arranged on 2 shafts, and woven with doubled picks in plain weave order in the weft. It is sometimes classified as a variation rather than a derivative of plain weave. However, doubled threads work differently from a single, heavier yarn. The threads in basket weave float over and under pairs of threads, so they interlace (pass between one another) less often than in plain weave. As a result, basketweave fabrics are thicker, more pliable, and drape better than a plain weave fabric. In addition they combine better with fabrics with similar float interlacements like twill. (Plain weave tends to spread the selvedges and twill to draw them in.)

Characteristics

- Balanced sett (fewer interlacements need a closer sett—more like a twill—to balance).
- Color can be used in all the same ways as plain weave (stripes, plaids, etc.).
- Basketweave's uniform texture lends itself to use with fancier yarns.
- It can be woven on many threadings, which makes it easy to combine with other weave structures like twill.
Color-and-Weave Effects
Warp rep and shadow weave are both plain weave derivatives whose effects result from a combination of color effects and interlacement. They produce plain weave within each block but two-thread floats often occur at the junctions between blocks. However, because color always dominates structure and interlacement in weaving, the floats they make are largely masked by the different colors used and in rep’s case, the dramatic difference in size between the two weft yarns. In addition, because the color that appears in a block is controlled more by the threading and tie-up than the color sequence, most rep and shadow threadings alternate dark light colors uniformly.

Warp Rep
As, we saw last month, two controls can produce warp rep. Rep on more-than-two shafts allows more complicated patterning. But it cannot weave true plain weave across the width of the warp. On 4 shafts 4 blocks can be woven, but because blocks A and C (and blocks B and D) share the same 2 shafts with the colors reversed, when one block of a pair is woven as dark, its mate with the color sequence reversed will be light. To facilitate opening sheds in its warp-faced sett, rep blocks are threaded on pairs of shafts as far away from one another on the loom as possible. On 4 shafts, blocks A and C are threaded on shafts 1 and 3, with B and D on shafts 2 and 4.

Characteristics
- Warp-faced Sett
- Alternating dark and light colors in warp
- Alternating thick and thin threads in weft.
  Thick wefts emphasize the warps passing over them, with those passing over the thin weft minimized, so that one warp color is dominant in each block.
- Plain weave is always produced within blocks.
- At the junction between blocks, however, adjacent threads may weave together, producing 2-thread floats that are structural rather than decorative. The color effects and the warp-faced sett mask the floats between the warps.

Shadow Weave
Although its pinstriped pattern resembles log cabin, shadow weave is more closely related to warp rep. The design effect is vertical and horizontal pinstripes arranged in diagonal sequences. Because shadow weave is woven on a balanced sett, the blocks can be threaded on adjacent pairs of shafts instead of the threading used in warp rep. The 4 blocks are made and the threads’ interlace exactly the same way as warp rep. Like rep, blocks A and C are threaded on the same shafts (1 and 2) with colors reversed, as are blocks B and D (on shafts 2 and 4).

Characteristics
- Balanced Plain Weave Sett
- Alternating dark and light colors in both warp and weft arranged in paired blocks (one pair weaves D/L, while the other L/D).
- Color is the dominant design element.
- Within blocks, the pattern is horizontal or vertical pinstripes in plain weave.
- At the junction between blocks, adjacent threads can weave together, producing 2-thread structural floats, which are masked by the color-and-weave effect.

Lynn Tedder, 2014
Loom-Controlled Lace Weaves

The quintessential plain weave derivatives, lace weaves produce patterns of floats on a plain weave ground. Off-loom, the floats allow the warps and wefts to relax out of the rigid vertical and horizontal alignment of plain weave creating openings in the web. Loom-controlled laces will weave plain weave across the width of the fabric.

Characteristics

• Balanced Sett (sometimes a little more open than for plain weave to encourage the floats to make openings)
• Colors are traditionally light or neutral, with the same (or close in value) warp and weft, so that contrasting textures are not overwhelmed by color. Usually plain, smooth yarns are used, again to set off the patterning.
• Alternating thick and thin threads in weft. Bright color contrasts can be used to good effect as an accent in areas that are woven without floats.
• Patterning is an arrangement of warp and/or weft floats, usually not over more than 3 or 5 threads, and often in pairs.

Atwater-Bronson Lace

Atwater-Bronson lace typically uses weft floats to make its pattern. Each block of Atwater-Bronson lace controls the length of its float within the block, which means that the same block can be threaded as many times. To create the “window pane” openings that is the characteristic of the weave, at least two adjacent blocks must be woven in floats.

In its most common threading, every other warp thread in Atwater-Bronson lace is threaded on shaft 1, so plain weave is made by alternately lifting shaft 1 against all the other shafts (2-3-4). Each pattern block contains 6 threads, 3 “ground” threads on shaft 1, alternated with 2 “pattern” threads on another shaft (either 3 or 4). A pattern shaft (e.g., 3) can be “subtracted” from the 2-3-4 treadle to make a pattern treadle that produces floats in the A blocks. (Shaded squares in the tie-ups below show which shafts have been subtracted to make floats.) Shaft 2 is used to “tie down” or control the float length and it is always raised when shaft 1 is down.

The drawdowns below show the individual blocks (outlined in orange) as they make plain weave or pattern floats, along with the places where the threads will slip to form the window pane openings (dark squares superimposed on the drawdown), once the fabric is removed from the loom.

Atwater-Bronson Lace woven in Pattern Blocks

Atwater-Bronson Lace woven in Allover Pattern

Lynn Tedder, 2014
Huck

Huck patterning consists of either “spots,” warp or weft floats in one block alternated with plain weave in the other, where once off the loom, the floats deflect around the plain weave to form little circles of plain weave, or alternating warp and weft floats, which makes huck lace, the most open loom-controlled lace possible. (See the drawdown below right.)

On this threading (the huck interlacement can be produced on 12 different threadings), plain weave is made by treadling the odd shafts against the even ones. Blocks of huck contain an odd number of threads (usually 5, but also 3 or 7), and floats pass over a whole block. Their length is controlled by the threads of the other blocks surrounding the block with floats.

The in the drafts below are composed of 5 threads. The first, third and fifth threads in each block are always on the same shaft and serve as “ground” threads, here threaded on shaft 2 for block A and shaft 1 for block B. They always rise in plain weave order: 1, then 2. The second and fourth threads in each block are the “pattern” threads. They can be subtracted from the treadle in the second or fourth pick to make weft floats or added to it to make warp floats. (Shaded squares and colored numbers in the tie-ups below show where pattern shafts have been removed or added to make floats.) Because the floats are controlled by the ground threads of adjacent blocks, the blocks cannot be repeated, and block A must alternate with block B throughout.

**Huck Textures showing floats and blocks**

**Huck Textures showing pattern effect off loom**

*Lynn Tedder, 2014*
**Supplementary Weft Weaves**

Supplementary weft weaves, overshot in particular, are usually classified as twill derivatives; however, they can also be seen as a loom-controlled way to apply a second, decorative weft to a plain weave ground just like inlay.

Supplementary weft weaves require one warp and two weft yarns: a **tabby** weft to weave the plain weave ground (and holds the fabric together) that is the same or smaller than the warp, and a **pattern** weft that is heavier and lofter enough to float over the plain weave and cover it. (The word **tabby** is **NOT** a synonym for plain weave; it should be used only to refer to plain weave when it is used as a ground for supplementary wefts.)

Within the blocks, pairs of shafts are arranged in odd-even order so that the tabby ground can be woven. To weave a pattern weft, lift the shafts of the block that you **DON’T** want covered with pattern and throw the pattern shuttle. Follow with a pick of the tabby weft in one of the plain weave sheds. Weave the same pattern shed, and alternate the tabby picks until the block is the height desired. Because the weft makes the pattern in these weaves, weft drawdowns, in which dark threads represent wefts, are used.

**Monk’s Belt**

In monks’ belt on 4 shafts, two blocks are formed by two pairs of shafts (Block A on shafts 1-2; B on shafts 3-4). The number of ends in a block is limited only by the length of the float it produces: too large a block and the float will droop and snag. The patterning is areas of supplementary weft floats alternated with plain weave background. On the back the pattern is reversed.

In the drafts, shaded squares in the tie-up indicate which blocks the pattern weft will cover when that treadle is raised.

![Monk’s Belt Weft Drawdown](image)

**Characteristics**

- Sett for a more open (looser) balanced plain weave
- Fine, usually light-colored warp, with same or finer yarn for tabby weft. Heavier, compressible contrasting color yarn for pattern weft.
- Plain weave and tabby foundation are plain weave made by raising odd shafts vs. even shafts.
- To weave pattern weft, raise the shafts for the block you want to weave as background (i.e., **lift where you DON’T want the floats**), and weave the pattern followed by a tabby pick on one of the plain weave treadles. Repeat the pattern pick, alternating tabby picks, until the pattern area is as tall as desired.

**Drafting Conventions**

**Standard Monk’s Belt Weft Drawdown (“Use Tabby”)**

Showing tabby picks in drawdowns for monk’s belt along with pattern picks distorts the pattern vertically. In the cloth the pattern picks completely hide the tabby picks.

Instead, most drafts use the drafting convention at right, which omits tabby and shows the correctly proportioned pattern. **“Use Tabby”** indicates that each pattern pick is followed by a tabby pick.
**Overshot**

The structural difference between monk’s belt and overshot is that the shafts that make up the pattern blocks are divided into four pairs instead of two. Each shaft is included in two different blocks. Thus, block A (on shafts 1-2) shares shaft 2 with block B (2-3). Block C (3-4) shares shaft 3 with block B and shaft 4 with block D (4-1), and block D and block A share shaft 1.

These shared shafts make overshot patterning different from monk’s belt. First, the threading blocks overlap, so the block widths vary depending on which block is woven in pattern. Secondly, when a block (say D on 4-1) is woven in pattern by pressing the treadle that raises shafts 2-3, the threads in block D shared by A and C will also stay down so that pattern weaves over them in a third texture called a *half tone* in addition to pattern and background.

In half-tone areas, the pattern weft does not float, but weaves over the threads of only one of the shafts in the block as for plain weave, which gives that area a speckled appearance that combines both the pattern and tabby colors. Overshot can be woven on more than 4 shafts, and then half-tone areas can be designed to weave actual patterns. (See van der Hoogt for information.)

**Characteristics**

- Sett for a more open (looser) balanced plain weave.
- Fine, traditionally light-colored warp, with same or finer yarn for tabby weft. Heavier, compressible yarn in a contrasting color for pattern weft.
- Plain weave and tabby foundation are plain weave made by raising odd shafts vs. even shafts.
- To weave pattern weft, raise the shafts for the block you want to weave as background (i.e., *lift where you DON’T want the floats*), and weave the pattern followed by a tabby pick on one of the plain weave treadles. Repeat the pattern pick, alternating tabby picks, until the pattern area is as tall as desired.

**Drafting Conventions**

Showing tabby picks in drawdowns for overshot along with pattern picks distorts the pattern vertically, as shown in the draft. In the cloth the pattern picks completely hide the tabby picks.

Instead, most drafts use the standard drafting convention at right, which omits tabby and shows the correctly proportioned pattern. “Use Tabby” indicates that each pattern pick is followed by a tabby pick.

Neither method shows half-tones accurately. In the standard draft they look like vertical pinstripes.
**Doubleweave**

Two layers of plain weave, one on top of the other, woven at the same time. Sound impossible? It's not. It's double plain weave and all you need are 4 shafts divided into 2 pairs in an unusual way and a judicious use of floats. Classifying doubleweave is tricky; on 4 shafts, it's not really a block weave or a twill, or even plain weave. It's really in a class by itself, but probably closer to a plain weave derivative than to anything else.

Because we are examining how floats, and combinations of pairs of shafts can be used to create new structures, only a basic description of how doubleweave works is used: two separate layers interchanged. Once the basic principles are clear, doubleweave can produce an amazing variety of textiles: two layers, either separate or stitched together, doublewidth fabrics twice as wide as the warp, vertical or horizontal tubes, and using pick-up techniques, two color patterns.

**Characteristics**

- Sett the warp at twice the density for balanced plain weave (a little more open, if the yarns are sticky).
- Smooth, strong yarns to facilitate opening the sheds in a close-sett warp for the 2 warps and 2 wefts.
- Depending on the product, almost any color combinations used in plain weave can be used.
- The threading is arranged so that the 2 layers each contain an odd and even shaft, and so that adjacent pairs of warp ends consist of one thread from the upper layer and one from the lower.
- In the treadling a pick of the upper layer is woven alternately with a lower layer pick, each with a separate shuttle.
- The secret to weave two layers at the same time lies in keeping the two layers separated. Basically, the wefts of the upper layer float over all the warps in the lower layer and never interlace, while the lower layer wefts always float underneath the upper layer warps. The sequence is shown in the cross section.
- Which shafts weave the upper layer and which the lower is entirely up to the weaver. In the sample at right, the layers switch positions at the middle.

**Drafting Doubleweave using Cross Sections**

Drafting programs have a hard time representing doubleweave in a drawdown because they are 2-dimensional representations of interlacements. Doubleweave's 2 layers require 3 dimensions for an accurate representation. Instead, doubleweave is sometimes rendered in a warp cross section, as if the warp is viewed end-on, with the weft wrapping over and under around them.

The draft at right shows a cross section of two threading repeats and one treadling repeat to weave two separate layers with a dark upper layer and a light lower layer.

- **Pick 1:** Lift half the warps in the upper layer (shaft 1); weave with dark weft.
- **Pick 2:** Raise the upper layer (shafts 1 and 2) out of the way, plus half the warps in the lower layer (shaft 3); weave light weft.
- **Pick 3:** Lift other half of upper layer warps (shaft 2); weave dark weft.
- **Pick 4:** Raise upper layer warps (shafts 1-2) and the other half of lower layer warps (shaft 4); weave with light weft.

*Lynn Tedder, 2014*
This program provides only the briefest survey of a few structures that are descended from or related to plain weave. For more in-depth information on these and related structures, patterns and instructions for weaving them, a few resources are listed below.

Bibliography


Keasbey, Doramay. *Pattern Techniques for Handweavers*. Eugene, OR: Doramay Keasbey, Publisher, 2005. An encyclopedic survey of weave structures organized by the number of warps and wefts used. Included is information on loom-controlled laces, shadow weave, monk's belt, overshot, and doubleweave.


Neilson, Rosalie. “A Rep Runner: Versatile and Reversible.” *Handwoven*, Issue 126, September/October 2005. pp. 44–47. Rep-themed issue with several warp rep projects. Rosalie Neilson is the current authority on warp rep. She has written a number of other articles on rep for *Handwoven* which are also worth checking out.


van der Hoogt, Madelyn. *The Complete Book of Drafting for Handweavers*. Coupeville, WA: ShuttleCraftBooks Inc., 1993. Organized a little differently from the way the information is presented here, this book is still a must-have for any weaver interested in understanding weave structures for handweaving. Includes an excellent chapter on designing half-tones in overshot, as well as information on lace weaves, and doubleweave.