



CARPETS V. FLAT-WOVEN CARPETS: TECHNIQUES AND STRUCTURES

CARPETS

v. Flat-Woven Carpets. Techniques and Structures

Most of the structures in Persian flat-woven carpets belong to the category called “interlacing” by textile specialists; the term designates the most straightforward way in which each thread of a fabric passes under or over threads that cross its path (Emery, pp. 62, 74-178). Interlacing can involve one or more sets of warps (longitudinal elements; *čella*, *tār*) and welts (transverse elements; *pūd*). Persian flat-weave structures range from simple interlacing—one set of warps and one set of wefts in various forms of plain weave (see below)—to a variety of compound weaves involving additional sets of warps or wefts or both. Patterning and decoration may also be achieved through various flat-weave techniques, including the introduction of supplementary warps, wefts, or both. Occasionally small motifs are worked in a supplementary-weft technique known as knotted and cut pile (see iii, above). The other two basic categories of woven textiles are represented in Persian flat-woven carpets by weft twining (Emery, pp. 196, 200-01) and weft wrapping (Emery, pp. 214-21, 225). A flat-woven carpet is made in either one piece or, if the loom is narrow, in two lengths, the long sides of which are then stitched



together, leaving a seam down the middle of the carpet.

The looms used for flat-woven carpets are of the same basic types as those used for pile carpets (see iii, above). Nomads have traditionally used horizontal ground looms (*rū-zamīnī*), which are easy to dismantle for the biannual migrations. Certain nomadic groups do use vertical looms (*dārī*, *dīvārī*), however; for example, weavers of the Šāhsevan, whose summer quarters are on high mountain slopes where the climate is cold, work inside tents, where space is limited and the vertical loom thus more practical. Villagers tend to use vertical looms fixed permanently in place, but recently settled nomads, including some Baktiārī, favor their traditional horizontal looms, even in village houses.

Vertical looms have also been used by urban weavers of flat-woven rugs. From the Iranian workshops that produced mainly pile carpets for the court and commerce the only flat-woven carpets known to date from the “classical” period (10-11th/16-17th centuries) are silk tapestry-woven examples with brocaded (supplementary; see below) decoration in silk threads wrapped with thin strips of silver or gold. These carpets, together with certain silk pile carpets brocaded in a similar way, were products of Kāšān, mainly during the reign of Shah ‘Abbās I (996-1038/1588-1629), and are known as “Polonaise” (Beattie, 1972, pp. 31-37 and pl. III; Dimand and Mailey, pp. 59-67; for illustrations of two tapestry-woven examples, see Bier, nos. 40, 49; see also ix, below).

A wide variety of flat-weave structures have been used by nomads and villagers throughout Persia, both in carpets and in such other items as storage bags, horse trappings, and tent decorations (see xvi, below; for discussion of techniques, diagrams of structures, and illustrations of flat weaves, see Black and Loveless; Cootner; Enderlein; Ford and Pohl-Schillings; Wertime, 1979; idem, 1981; Housego; Petsopoulos; Tanavoli).

Plain weaves. The most basic type of interlacing of warp and weft is called plain weave (for structural terminology, definitions, and diagrams, see Emery; Burnham). It is created by passing successive rows of wefts alternately under and over single warps. If the warps and wefts are equally spaced and of virtually the same thickness and flexibility, the structure is called balanced plain weave (Figure 75). If the wefts are tightly packed so that the warps are hidden or almost hidden, the structure is called weft-faced plain weave (Figure 76), or tapestry weave. In Persia this structure is called *gelīm* (Turk. *kilim*).



Conversely, if the warps are packed so closely that they completely cover the wefts, the weave structure is called warp-faced plain weave (*jājīm*; [Figure 77](#)).

In tapestry weave the wefts may be continuous (carried from edge to edge) or discontinuous (turned back around adjacent warps part way across the work as required by the pattern). Discontinuous wefts may be manipulated in various ways in order to produce different effects, sometimes in a single weaving; certain of these effects can be said to characterize particular regions or tribal groups (see xvi, below). Discontinuous wefts may either interact or not. In the latter instance, where discontinuous wefts are turned back at the boundary between two colors, the adjacent warps are not bound together and a slit is left between them; this weave structure is thus called slit-tapestry weave ([Figure 78](#); in Figures 78-82 the weft-faced tapestry weaves have been schematized in order to clarify the structures, whereas in actual weaving the wefts would be tightly packed together). The slits may be sewn up, but in Persian weaving they usually are not. The boundary between two colors can also be dovetailed ([Figure 79](#)). Dovetailing is a shared-warp technique, in which two discontinuous wefts from adjacent color areas in the pattern are wrapped around a common warp before being returned to their own color areas. A third way of handling the meeting of discontinuous wefts of different colors is single or double interlocking, in which the wefts from adjoining color areas are wrapped around each other between two adjacent warps; it produces a stronger and neater join than does slit weave or dovetailing. In single interlocking ([Figure 80](#)) each discontinuous weft is wrapped around one corresponding weft from the adjacent color area. In double interlocking the discontinuous wefts are wrapped around each other in pairs, forming an even closer join; where the two color areas meet, the face of the piece is smooth ([Figure 81](#)), but a ridge is formed on the back ([Figure 82](#)). Double interlocking is particularly characteristic of Baḵtīārī tapestry-woven pieces (see [baḵtīārī iii. carpets](#)). Tapestry-woven carpets characterized by slit weave, dovetailing, or single interlocking are reversible and will look the same on both faces, unless supplementary decoration has been woven in.

The techniques discussed so far were also used in European tapestries; the Polish Carmelite father Paul Simon thus used the words “tissues of the Arras kind” (referring to the famous Franco-Flemish tapestry-weaving center the name of which had become virtually a generic term for tapestries in Europe) to describe tapestry-woven carpets that he saw when he visited Kāšān in 1016/1608 (Dimand and Mailey, p. 59).



Float weaves. Another group of structures involving only one set of warps and one set of wefts is known as float weaves. They are characterized by warps or wefts that, instead of simply being passed alternately under one and over one of the opposite element, as in plain weave, are passed over and under more than one element at a time. The longer spans are known as floats. One type of float weave is twill weave (Emery, pp. 75, 92-107), which occurs in some Persian tribal and village pieces, sometimes in combination with other structures used for decoration; it is characterized by a diagonal alignment of floats (see [Figure 83](#)). The diagonals—forming herringbone, chevron, or lozenge patterns—result when the weft floats, instead of floating in alternate passes over the same warps (alternation), are offset one warp beyond the float in the previous row (progression). Figure 83 illustrates a plain twill weave found in some nomadic carpets, in which each weft is passed over two and under two warps (expressed as a ratio, 2:2). Different effects are achieved by different ratios of float spans. The direction of the diagonal in twill weave is characterized as either “S” or “Z” (according to the direction in which the middle section of each letter is slanted). The direction of the diagonal in Figure 83, for example, is that of S, and the twill ratio and diagonal direction can be described as 2S2 or, alternatively, 2\$ 2 (2Z2 may also be written 2/2). On the reverse face of twill weave the diagonal is in the opposite direction.

A type of warp-float weave derived from plain weave (Emery, pp. 113-21) and favored by the Šāhsevan (Tanavoli, p. 72) is based on both alternation and progression, rather than simply the latter, as in twill weave. In the example illustrated in [Figure 84](#) the wefts are passed under three warps and over one warp (3:1) in alternate rows and under one and over one (1:1) in the intervening rows (a form of alternation); in addition, the pass of the weft under three warps is offset one warp in successive rows of 3:1 (progression). The warps in this variant float on the front of the fabric (the face seen in Figure 84); the reverse side shows weft floats.

Compound weaves. In addition to weft wrapping with a ground weft and to extra-weft contour wrapping (see below), nomadic and village weavers use a number of other compound weaves, which may be either complementary or supplementary (Burnham, pp. 29, 138, 174, 184; Emery, pp. 74, 140-54; Wertime, 1981, pp. 195-96; Tanavoli, pp. 73-77). In contrast to plain weave (whether balanced, weft faced, or warp faced), in which there is only one set of warps and one set of wefts in the foundation, compound weaves consist of more than one set of either warps or wefts or both. When the additional sets



are integral to the foundation structure they are said to be complementary; the resulting fabric may or may not be reversible, and the areas of color or floats forming the pattern may be identical or reversed on the two faces. Supplementary warps and wefts are not integral to the foundation structure but are added only for purposes of design. Either supplementary or complementary warps and wefts may be used to create a pattern or enrich a ground weave. The resulting fabric is described as either warp patterned or weft patterned.

The compound weaves used in nomadic and village carpets include supplementary weft-float brocading, or patterning (Figure 85, Figure 86), which may be used on either a weft-faced plain-weave ground (*gelīm*) or a warp-faced plain-weave ground (*jājīm*). The weft floats may be continuous (from selvage to selvage) or discontinuous (used in more widely spaced areas of the piece), and they may span variable numbers of warps.

In complementary compound weaves the second set of warps or wefts can be used over the entire face of the fabric or limited to decorative stripes (vertical, in the direction of the warp) or bands (horizontal, in the direction of the weft). Threads of contrasting colors may either be substituted in pattern areas on the face (Figure 87) while the unused elements float on the back, or they may be used more equally throughout the structure. In either instance the front and back of the fabric are similar, but the colors are reciprocally reversed on each face.

Weft twining. Another type of compound structure, used to decorate ground weaves, is weft twining (Emery, pp. 196-205; Tanavoli, p. 78), in which pairs of wefts in contrasting colors are twined around each other, enclosing successive warps, to produce a row of diagonal “strokes.” Weft twining may be worked in a single direction (Figure 88) or countered (Figure 89).

Weft wrapping. Nomadic and village weavers employ a variety of weft-wrapping techniques, in which the weft encircles the warps, usually two or more at a time. Weft wrapping may cover the entire surface of a woven piece (Emery, p. 225), or it may be an added decorative feature on tapestry-woven *gelīms*. In some pieces, when weft wrapping covers the entire surface, a simple ground weft (1:1) may be passed between two rows of weft wrapping, which is then considered supplementary to the ground weft (Figure 90); such supplementary weft wrapping is also known as “extra-weft wrapping.” Persian flat weaves composed entirely of weft wrapping, with or without



ground wefts, are often called “sumak,” a word of obscure origin. Weft wrapping can be handled in such a way that it creates a horizontal, diagonal, or vertical line (Emery, pp. 214-21; Tanavoli, pp. 80-88; Wertime, 1981, pp. 175-91, 197-99; Acar, pp. 69-75). The precise wrapping sequence can be designated by the numbers of warps or paired warps the weft spans as it encircles the warps: forward over (Fo), forward under (Fu), back over (Bo), or back under (Bu). The diagram in Figure 90 shows weft wrapping in a sequence Fo4 Bu2. As wrapping progresses, a row of slightly oblique spans is produced on the front surface of the piece. They may all incline in one direction, which is known as “plain sumak” (Figure 90), or they may be countered (the direction of slant reversed) in alternate rows to produce a herringbone effect, known as “countered sumak” (Figure 91). A form of weft wrapping known as “reverse sumak,” in which the shorter spans of the weft wrapping are seen on the front of the work and the longer spans on the back (Figure 92, showing a sequence Bo2 Fu4 Bo2), is also found both as a ground weave and as a decorative feature in some Persian flat-woven pieces, particularly those of the Šāhsevan of northwestern Iran. The shorter spans tend to be less oblique than the longer spans, which lends reverse sumak a characteristic appearance distinct from that of plain or countered sumak.

Diagonal extra-weft wrapping can be used as decoration on a plain-woven ground, producing a kind of compound-weave structure. It is used particularly to outline motifs worked in a color that contrasts with that of the adjacent background. In Figure 93 this structure is illustrated in a sequence Fo4 Bu2, Fo4 Bu3, Fo4 Bu2, which creates a diagonal line on the face of a plain-woven ground.

Zilūcarpets. An entirely different type of flat-woven carpet made in Persia is an inexpensive sturdy floor covering known as *zīlū*, which is usually made of cotton, though occasionally in the past wool was also used. It is woven on a special loom called *dastgāh-e zīlū-bāfi* and is produced almost entirely for local use, rather than for export.

The structure of *zīlū* carpets is a compound weave, a particular kind of weft-faced plain weave with two sets of warps and pairs of wefts that are complementary to each other (see Figure 94). This structure (known by the commonly used French term *taqueté*) characterizes the entire carpet, rather than being limited to specific areas. Each of the two sets of warps has a different and essential function. One set of warps is known as the main, or binding, warps; it interlaces with the wefts to create the foundation of the



fabric. The other warps, called inner warps (the dark vertical threads in Figure 94), control the pattern, by determining on which side of the fabric the wefts will appear; the inner warps themselves cannot be seen on either surface. This set of inner warps distinguishes *zīlū* carpets from other Persian flat-woven carpets. The two sets of wefts, which are continuous and worked in pairs to form the pattern, are complementary to each other; they are usually of different colors. When a weft of one color appears on one surface, a weft of the other color appears in the same area on the opposite surface. *Zīlū* carpets are thus reversible (or, more precisely, counterfaced) when the wefts are of only two colors; that is, the colors are reversed in the same pattern area on each surface, though a woven inscription will appear in mirror image on the opposite surface. In the plain-weave version of this structure (see Figure 94) the wefts (on both sides of the fabric) float over three warps (one inner, one binding, one inner) and then go under (are bound by) one binding warp before the next float span over three warps.

According to literary sources, carpets known as *zīlū* were woven in Persia at least as early as the 4th/10th century (see vii, below), but it is not certain that they were woven in the same manner and materials as modern *zīlū* carpets. The earliest dated example of the latter type was woven in 807/1405 (Beattie, 1981, pp. 169-74; Wilber; Mackie). Today *zīlū* carpets are commonly found in mosques, homes, hotel rooms, offices, and shops. Some pieces, particularly those given to mosques, bear inscriptions and dates. The region around Yazd, notably the villages of Maybod and Ardakān, has long been known for the production of these carpets.

Finishing. The edges of flat-woven carpets parallel to the warp, like those of pile carpets, may be finished either by overcasting with the ground weft or by wrapping an extra weft over two or more pairs of warps either parallel or in a figure eight. If the figure eight is wrapped over more than two pairs of warps, an additional extra weft in a contrasting color may be wrapped vertically over part of the selvage as further decoration. The variety of techniques used to finish the upper and lower ends of flat-woven carpets (Tanavoli, pp. 97-102) fall into two main categories. Either a hem may be created by turning under a few centimeters of the fabric and sewing it down, or the loose warp ends may be formed into a fringe. Fringes may be formed in a variety of ways:

1. Groups of warp ends may be knotted together (Figure 95).
2. Alternate groups of warps may be knotted together in successive rows to



create a net or web (Figure 96).

3. Warp threads may be interlooped singly or in groups in a series of three to five chain-like rows (Figure 97).

4. Groups of warps may be braided in flat vertical plaits, each about 2 cm wide (Figure 98).

5. The ends of the warp threads only may be diagonally plaited in a structure like plain weave to create a band about 2 cm wide extending across the width of the carpet; the ends may then be knotted in a simple fringe (Figure 99).

6. Warp threads may be twisted together in pairs, often with the ends left as uncut loops (Figure 100).

7. Groups of warps may be twisted together (Figure 101).

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