1998

Unit Turning Blocks For Designing Tablet Weavings

Bonita R. Datta
Textile Society of America

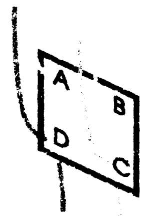
UNIT TURNING BLOCKS FOR DESIGNING TABLET WEAVINGS

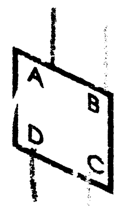
BONITA R. DATTA

This paper describes a design process for tablet weaving with four-holed tablets. It addresses the following techniques: twining; Egyptian diagonals; four-colour diagonals; 3/1 twill; and, 2/1 twill.

DEFINITIONS

Threading direction is the way in which the yarns pass through the holes in the tablets. These diagrams show the two possible threading directions. The fell line of the fabric is above, the unwoven warp is below, and the front surface of the textile faces the viewer.

S-threaded tablet: 

Z-threaded tablet: 

> This paper assumes all tablets are Z-threaded. The impact of alternating or symmetrical threading arrangements, and the operation of flipping tablets to reverse the threading, are not discussed.

The warp appears on the surface of the textile as a **float**, and floats may twine in one of two directions:

S-twined float: 

Z-twined float: 

A warp-wise column of floats is called a **wale**, and a weft-wise row of floats is called a **pick**.

A **forward turn** is the ninety-degree rotation of a Z-threaded tablet that produces an S-twined float on the surface of the textile. A **backward turn** is the ninety-degree rotation of a Z-threaded tablet that produces a Z-twined float on the surface of the textile.

> A backward turn on an S-threaded tablet produces an S-twined float on the fabric, and a forward turn on an S-threaded tablet produces a Z-twined float. Because of the symmetrical relationship between threading and turning, we can select "Z-threaded" and "forward-turning" as defaults without limiting the generality of the discussion.

Double turns are 180-degree turns in the direction indicated. The notation used to represent turns is as follows:

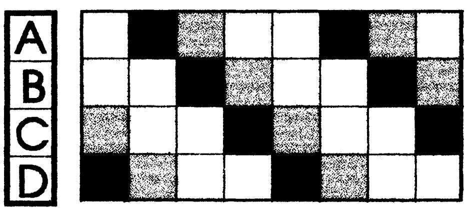
Forward F Backward B Double Forward FF Double Backward BB

A **unit turning block** is the smallest pattern of turns that produces a particular weave structure. These blocks are repeated horizontally and vertically (like tiles) to create the **design template** upon which the design will be developed.

The **fundamental weave** is the textile woven using an unaltered design template as a pattern, with the tablets arranged in a particular starting position.

The **design overlay** is a grid of light and dark cells. When it is overlaid on the design template, the turns under the dark cells are reversed – forward becomes backward and vice versa. Thus the overlaid design tamplate becomes a **pattern**.

The **colour matrix** is a graphical representation of the thread colours for each of the four holes in a tablet, labeled A, B, C, and D. The letters are assigned in a clockwise manner on the front of the tablet. When a design calls for a certain number of tablets, there will be a column for each tablet. The sample below is the matrix for eight tablets.



When all tablets have the same colours in the same sequence (as in this sample), the weaver can use a fast warping method to thread all tablets identically, then rotate them into the positions illustrated.

In the figures, the top two rows of the colour matrix represent the tablet holes that are on the side of the textile facing the weaver (the front surface), and the colour that is in the topmost row is assumed to be closest to the fell line. All diagrams assume that the weaver will be following the pattern from the top down.

DESIGN PROCESS

In general, the process consists of three steps:

1. On square grid paper, repeat the unit turning block to cover an area big enough for the envisioned design. The width (number of vertical columns) represents the number of tablets that will be used, and the length (number of horizontal rows) represents the number of picks that will be woven. This is the design template.
2. Shade the regions that will create the design, following technique-specific prescriptions that are presented below. This is the design overlay.
3. In the shaded regions, reverse the turns.

TWINING

Twining, the most basic weave, has the simplest unit turning block -- a single turn. Often the entire deck of tablets is turned forward or backward together, or in a few groups. Tablets need not be threaded with the same colours or colour arrangement, and because the woven designs are so dependent on the threading, they are referred to as "threaded-in" designs.

Smooth edges are desirable and usually the face of the textile will have them, while the back will have the barbed edges that occur when the twining direction of the float doesn't align with the colour-change angle on the image. See Figure 1(d).

Designs are based on symmetries. In Figure 1(e), the overlay is divided into quadrants by one horizontal and one vertical line of symmetry. The resultant woven design, Figure 1(f), has the anticipated symmetrical "image". The horizontal and/or the vertical axis of symmetry is often used as a starting point for designs in other techniques, to obtain the mirrored images that are so suited to this medium.

EGYPTIAN DIAGONALS

This weave is much like twining, and has the same unit turning block. Egyptian diagonal weavings are characterized by the fact that they are customarily woven in just two colours, light and dark. Here again, designs are based on symmetries. The maze-like imagery is obtained by using complex arrangements of rectangular regions in the overlay, as shown in Figure 2(a) and (c). Such an overlay can also be used for twining, but the contrast created by using just two colours accentuates the pattern.

To the two colour arrangements shown in Figure 2 might be added a third, with three light threads and one dark, which would produce a weave similar to these, but with narrow dark stripes alternating with wide light stripes.

The overlay in Figure 2(a) has steps that are multiples of two, both vertically and horizontally. Contrast with Figure 2(c), which has single steps in the image overlay, possible because the coloured threads here are alternating in the four holes of the tablet. The shape and placement of the overlay have great impact on the outcome of the design.

FOUR-COLOUR DIAGONALS

This weave creates a structure where the widths of the diagonals are varied by allowing long floats. As implied by the name, four colours are customarily used, a variation being the use of only three colours, with the repeated colour either in adjacent or opposite holes.

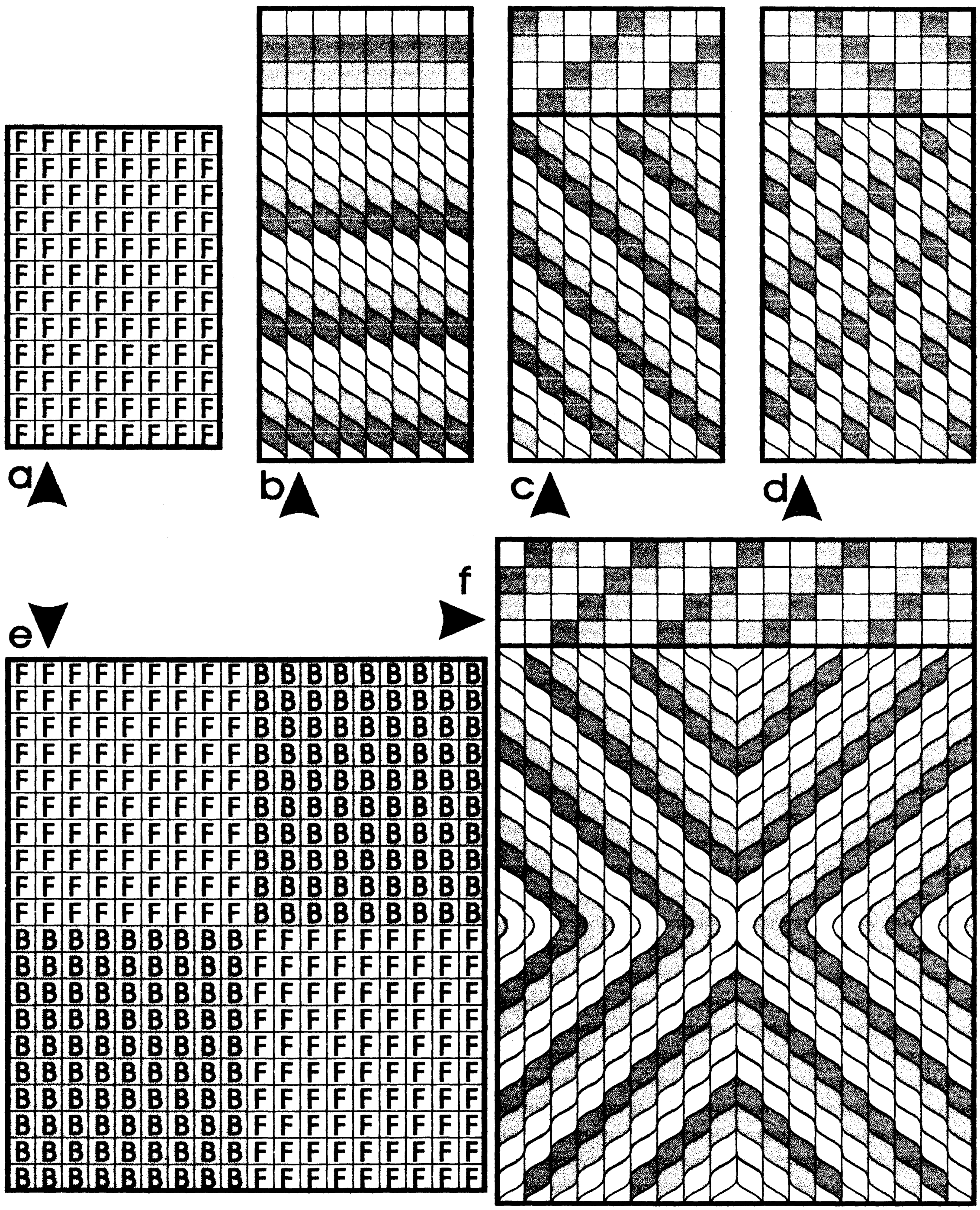
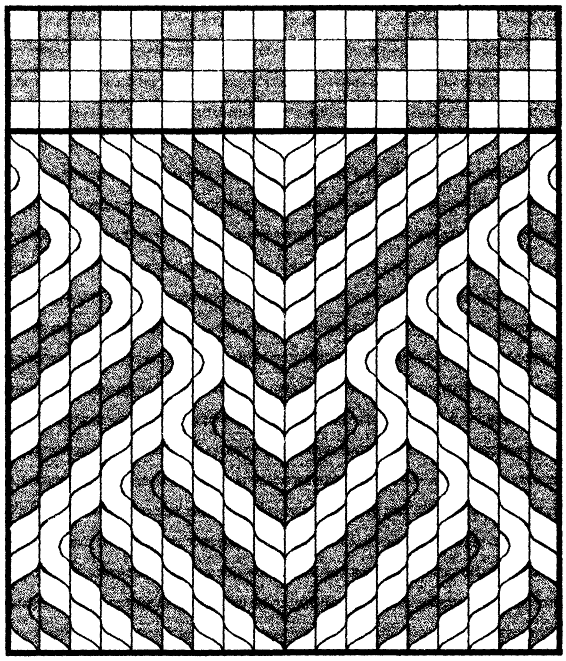


Figure 1: TWINING Unit Turning Block: $\boxed{F}$

a: Design template.
b, c, d: Fundamental weaves using the design template with three different tablet starting positions.
e, f: Pattern and resultant weaving.

F	F	F	F	F	F	F	F	F	B	B	B	B	B	B	B	B	B
B	F	F	F	F	F	F	F	F	B	B	B	B	B	B	B	B	F
B	F	F	F	F	F	F	F	F	B	B	B	B	B	B	B	B	F
B	B	B	F	F	F	F	F	F	B	B	B	B	B	B	F	F	F
B	B	B	F	F	F	F	F	F	B	B	B	B	B	B	F	F	F
B	B	B	B	B	F	F	F	F	B	B	B	B	F	F	F	F	F
B	B	B	B	B	F	F	F	F	B	B	B	B	F	F	F	F	F
B	B	B	B	B	B	B	F	F	B	B	F	F	F	F	F	F	F
B	B	B	B	B	B	B	F	F	B	B	F	F	F	F	F	F	F
B	B	B	B	B	F	F	F	F	B	B	B	B	F	F	F	F	F
B	B	B	B	B	F	F	F	F	B	B	B	B	F	F	F	F	F
B	B	B	F	F	F	F	F	F	B	B	B	B	B	B	F	F	F
B	B	B	F	F	F	F	F	F	B	B	B	B	B	B	F	F	F
B	F	F	F	F	F	F	F	F	B	B	B	B	B	B	B	B	F
B	F	F	F	F	F	F	F	F	B	B	B	B	B	B	B	B	F
F	F	F	F	F	F	F	F	F	B	B	B	B	B	B	B	B	B

a



b

c

F	F	F	F	F	F	F	F	F	B	B	B	B	B	B	B	B	B
B	F	F	F	F	F	F	F	F	B	B	B	B	B	B	B	B	F
B	B	F	F	F	F	F	F	F	B	B	B	B	B	B	B	F	F
B	B	B	F	F	F	F	F	F	B	B	B	B	B	B	F	F	F
B	B	B	B	F	F	F	F	F	B	B	B	B	B	F	F	F	F
B	B	B	B	B	F	F	F	F	B	B	B	B	F	F	F	F	F
B	B	B	B	B	B	F	F	F	B	B	B	F	F	F	F	F	F
B	B	B	B	B	B	B	F	F	B	B	F	F	F	F	F	F	F
B	B	B	B	B	B	F	F	F	B	B	B	F	F	F	F	F	F
B	B	B	B	B	F	F	F	F	B	B	B	B	F	F	F	F	F
B	B	B	B	F	F	F	F	F	B	B	B	B	B	F	F	F	F
B	B	B	F	F	F	F	F	F	B	B	B	B	B	B	F	F	F
B	B	F	F	F	F	F	F	F	B	B	B	B	B	B	B	F	F
B	F	F	F	F	F	F	F	F	B	B	B	B	B	B	B	B	F
F	F	F	F	F	F	F	F	F	B	B	B	B	B	B	B	B	B
F	F	F	F	F	F	F	F	F	B	B	B	B	B	B	B	B	B

d

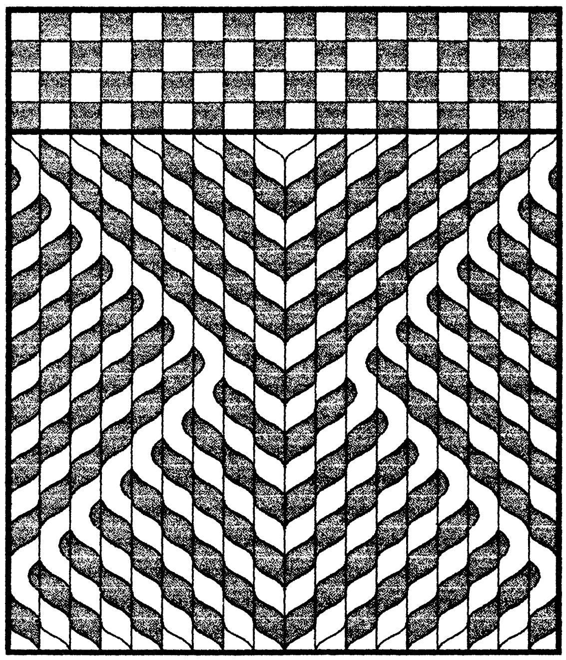


Figure 2: EGYPTIAN DIAGONALS **Unit Turning Block: F**

a, b: Pattern and resulting weave, with thread pairs in adjacent holes.
c, d: Pattern and resulting weave, with thread pairs in opposite holes.

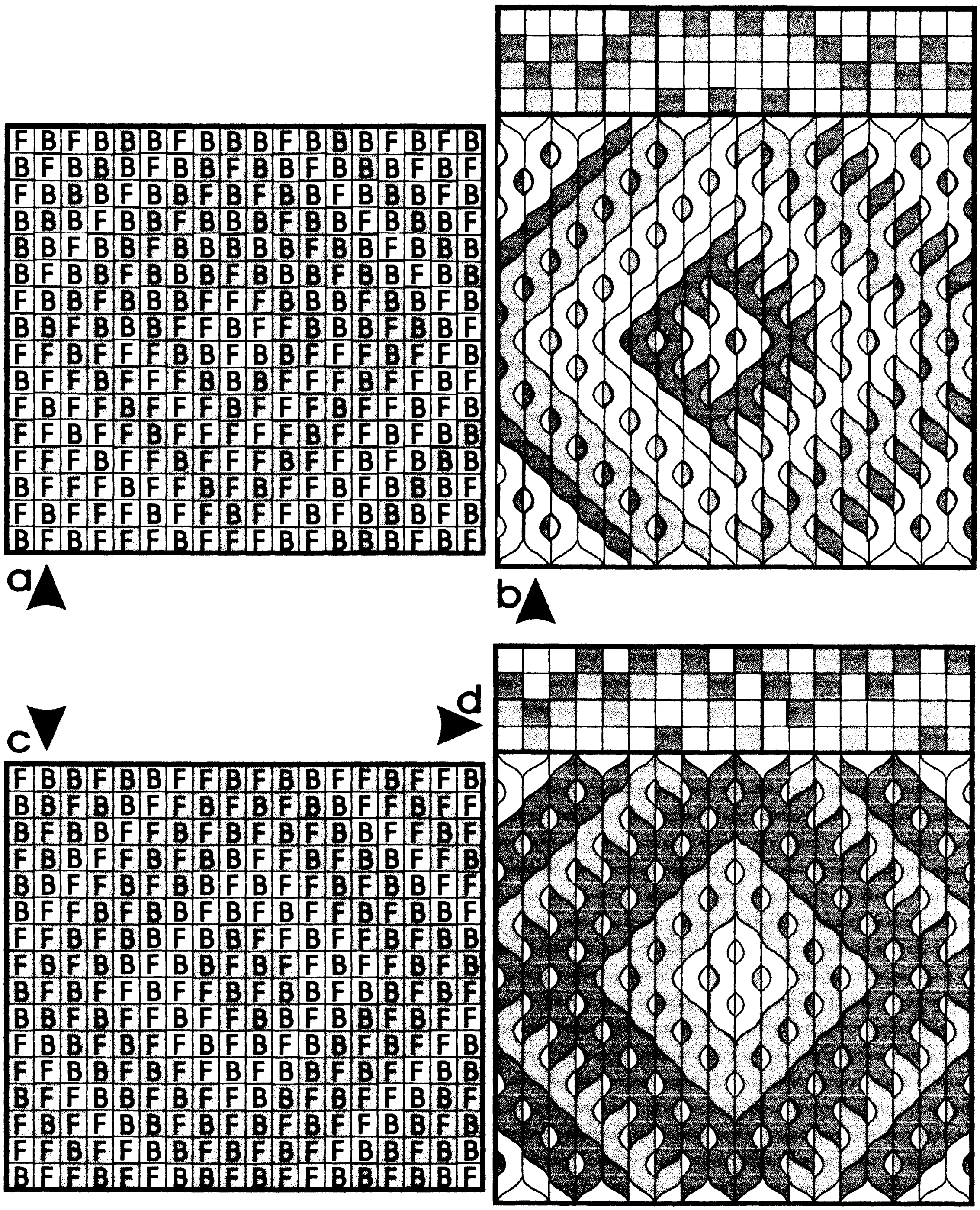


Figure 3: FOUR-COLOUR DIAGONALS Unit Turning Block:

F	B
B	F

a, b: Pattern centered on a tablet, and resulting weave.
c, d: Pattern centered between two tablets, and resulting weave.

The unit turning block for this weave is a two by two array composed of forward and backward turns in diagonal pairs. An unusual feature of this technique is that the design template is not actually weaveable. It results in a plain-woven central layer with floats on the front and back surfaces that extend the entire length of the weaving.

If the overlay consists of oblique regions that are two or four cells wide, the weaving will show just two colours on the front, and the other two will show on the back. If some of the overlay regions are an odd number of cells wide (one or three), then all four colours will be visible on each surface. See Figure 3(b).

Overlay regions wider than four cells can be used, but if the image reflects over a horizontal axis then very long floats can be expected. An overlay line even four cells wide, as illustrated in Figure 3(d), produces a float over nine wefts in the central region of the fourth wale. The width of the overlay region also impacts the smoothness of the edges of the obliques in the weaving. A region whose width is an even number of cells will always have one smooth edge and one barbed edge, whereas if it is an odd number of cells, then both edges are smooth on the surface of the textile and barbed on the reverse.

The placement of a vertical axis of symmetry also impacts the smoothness of the colour-change lines. In Figure 3(b), the vertical axis of symmetry is on one central tablet, and as a result, the right side of the weaving has barbed edges where the left side is smooth, and vice versa. By contrast, the vertical axis of symmetry in Figure 3(d) lies between two central tablets, and in this case there is true structural symmetry. However, the price paid to achieve this is that the colours in the tablets on the right are threaded differently, with two opposite holes essentially transposed. Once the decision is made to have such a vertical axis, all images woven must mirror over this axis or undesirable colour changes will result.

3/1 TWILL

With this two-colour structure, the unit turning block is a four by four array of forward and backward turns arranged in one of two possible twill layouts. The design template weaves into a textile with a visible twill texture, deriving from the twill structure of the unit turning block that is used. The fundamental weave shows one colour on the right side of the textile, and the other colour on the reverse.

With 3/1 twill, tablet weaving is able to produce two-colour weavings in which an essentially free-form image in one colour is set on a background of the other. The form of the image is limited only by the need to have an even number of floats in each colour region along the wale.

As is seen in Figure 4(b), the smoothness of the colour-change edges is erratic. Some oblique lines are smooth on both edges, others are smooth on just one edge, and others have smooth and barbed floats mixed. It is characteristic of this weave to have all smooth, and that is accomplished by refining this preliminary pattern. Wherever a barb

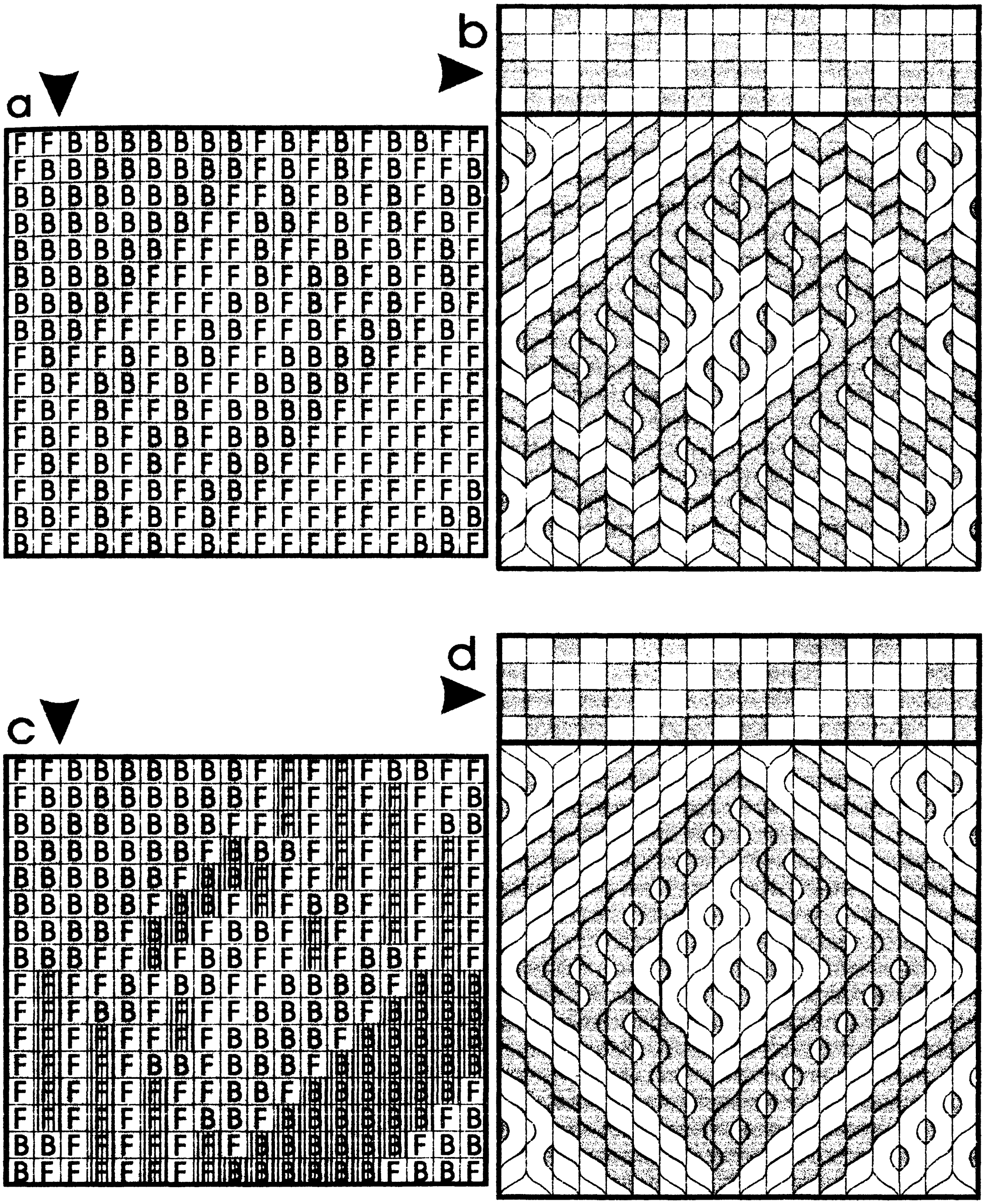


Figure 4: 3/1 TWILL **Unit Turning Blocks:**

F	F	B	B
F	B	B	F
B	B	F	F
B	F	F	B

F	B	B	F
F	F	B	B
B	F	F	B
B	B	F	F

a, b: Uncorrected pattern and resulting weave.
c, d: Pattern correcting float directions to obtain smooth edges, and resulting weave.

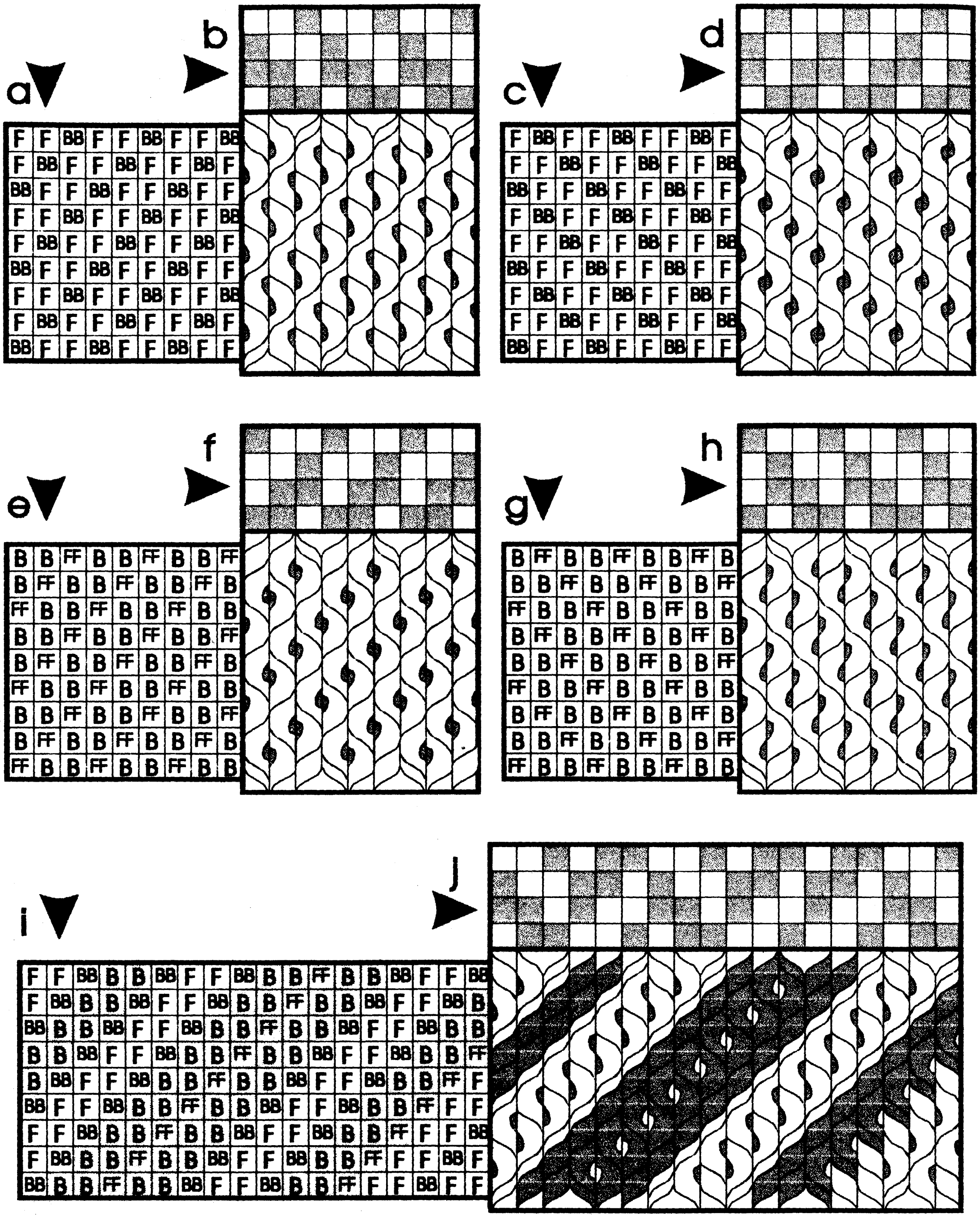


Figure 5: 2/1 TWILL Unit Turning Blocks:

F	F	BB
F	BB	F
BB	F	F

F	BB	F
F	F	BB
BB	F	F

B	B	FF
B	FF	B
FF	B	B

B	FF	B
B	B	FF
FF	B	B

a & b, c & d, e & f, g & h: Design template and fundamental weave using each of the four unit turning blocks.
i, j: Pattern and resulting weave.

occurs, the two cells (one light, one dark) that make up the barb are highlighted. These cells are shown with hatching in Figure 4(c). To eliminate the barbs, the turns under the hatching are reversed. This process makes the colour-change edges smooth, as shown in Figure 4(d).

2/1 TWILL

This weave introduces the double turn, a 180-degree rotation of the tablets. The effect of this on the structure of the weave is such that four unit turning blocks must be considered. The weaves shown in Figure 5(b), 5(d), 5(f), and 5(h) show that four textures are derived from these blocks. Comparing these weaves, it can be seen that reversing turns produces a texture that is similar to that produced by changing the twill direction in the block.

What this means to the designer is that a weaving may have regions of each of two colours overlapping regions of each of two textures -- texture and colour can be manipulated independently.

Figure 5(i) shows how an overlay for one of the four possible design templates might be constructed, with the "image" having a width of two, three, four or five cells. The resulting weave, Figure 5(j) shows how both edges of a colour change are smooth in each case except for the three cell width, which produces one barbed edge.

Designs for 2/1 twill can be generated by creating a design template with regions of some or all of the four unit turning blocks, then creating an overlay that follows the structure as has been done in Figure 5(i).

Alternatively, a free-form image can be drawn, as for 3/1 twill, constrained only by the need to have at two or more cells in each colour region along the wale, not necessarily an even number. Once such an image is created, the unit turning blocks are laid onto the image, rather than overlaying the image onto the design template as has been the method described for the other techniques. The scope of this paper precludes a discussion of the details of this method.

BIBLIOGRAPHY

Collingwood, Peter. *Techniques of Tablet Weaving*. McMinnville, Oregon, U.S.A.: Robin and Russ Handweavers, Inc., 1996.

Hansen, Egon. *Tablet Weaving*. Hojbjerg, Denmark: Hovedland Publisher, 1990.

Hendrickson, Linda. *Double-Faced Tablet Weaving: 50 Designs from Around the World*. Portland, Oregon, U.S.A.: 1996.

The author acknowledges funding assistance for the preparation and presentation of this paper, from the Canada Council for the Arts.