

## Chapter 7

# Shaded Structures

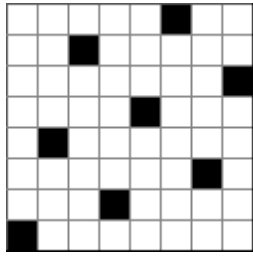
Shaded structures are any group of weaves which work seamlessly together to simulate a range of tonal values in the cloth. They are frequently satins, but may be twills or other structures. You might be familiar with a group of picture jacquards that render portraits of public figures, like Joseph-Marie Jacquard or George Washington woven with contrasting warp and weft (black warp with white weft or white warp with black weft). They look like etchings and viewers often do not realize these are woven images. Most of these portraits are examples of shaded structures.

Almost any weave structure can be used as the root to create a series of structures that range from warp-faced to weft-faced (or vice versa). The size of the weave repeat determines the number of possible steps between the weaves; a shaded 4-end twill will have only three possible steps between the most warp-faced and most weft-faced structures, and a shaded 8-end satin will have seven possible steps.

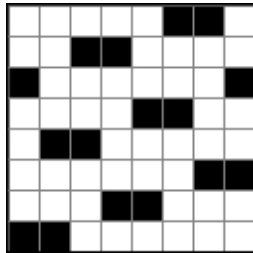
Shaded structures are sometimes referred to as *ombré* weaves. They are a simple structure—that is, they are one layer, composed of a single warp system and a single weft system. (Shaded systems can also be used in compound cloth. We discuss them in Chapter 11.)

When using a white warp and black weft, the most warp-predominant weave will be lightest in tone and the most weft-predominant weave will be the darkest, with all the steps in between exhibiting various tones of gray. However, the drafting convention we use employs black squares to indicate warp up and white to indicate warp down (or weft up); consequently, when working with a light warp and dark weft, it is important to remember that the dark/light effect in the cloth will be the inverse of what appears in the draft.

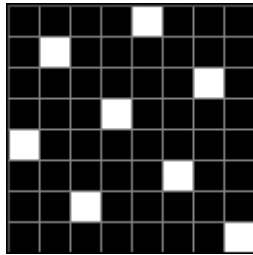
Although we are using a warp and weft of extreme value contrast in our examples, shaded structures may be woven with the same color warp and weft, like traditional damask cloth. In this case, the way light reflects off the



7-1



7-2



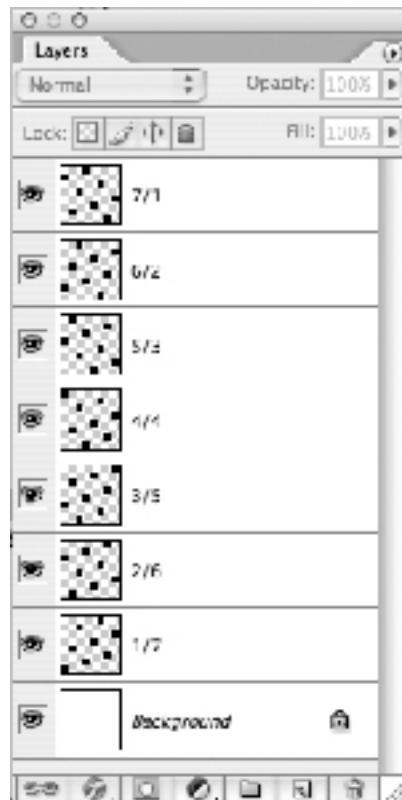
7-3

horizontal and vertical yarns is different and provides the design effect. You can also try weaving your weft as a sequence of similar but different tones of a color and see how it builds a rich look to the fabric.

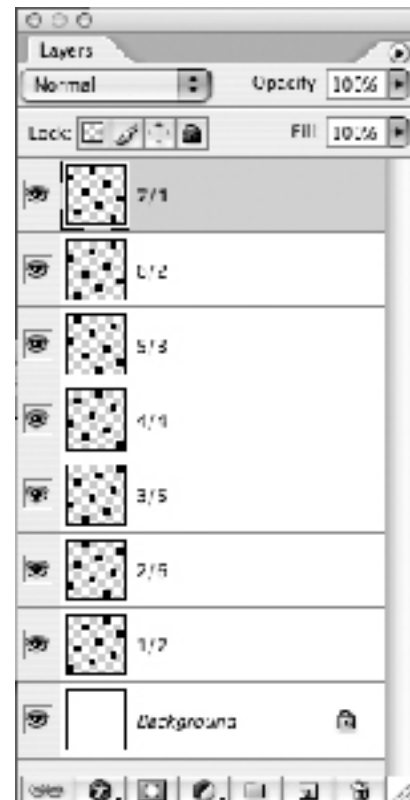
To construct a family of weave structures in Photoshop, start with a file whose pixel dimensions are the same as the size of the weave structure. For our example we will construct a shaded 8-end satin and start with an RGB file 8 pixels wide and 8 pixels high. Have the Background white, zoom to 1600%, and turn on a single-pixel grid. Add a new layer, and with the Pencil tool, color black, click in the grid to form an 8-end satin with a counter of 3 (go up three squares in each succeeding column). The basic weft-effect satin is shown in this first layer. This weave is known as a 1/7 satin, and is shown in Figure 7-1.

Now add a second layer, and with this new layer still active (so you are working on it and not modifying the layers below), add a new pixel to the right of every original pixel. The weave, known as a 2/6 satin (2 warps up and 6 warps down per pick) is now slightly more warp-emphasis than the previous example, and looks like Figure 7-2.

Continue adding layers, and in each new layer add an additional pixel to the right of the ones added in the previous layer. You might want to rename each layer to reflect the weave painted on it (1/7, 2/6, 3/5, 4/4, 5/3, 6/2, and 7/1). When seven layers are added, the weave looks like Figure 7-3. At this point the Layers Palette looks like Figure 7-4.

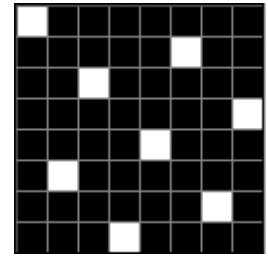


7-4



7-5

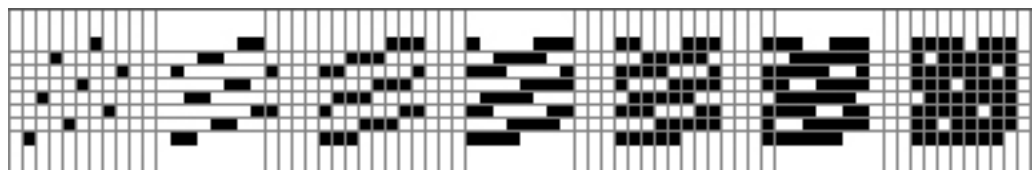
If you wish, you may build layers of the satin by adding pixels above the previous pixels, instead of to the right. The completed Layers palette would then look like Figure 7-5 (at the bottom of the previous page), and the final warp-effect satin like Figure 7-6.



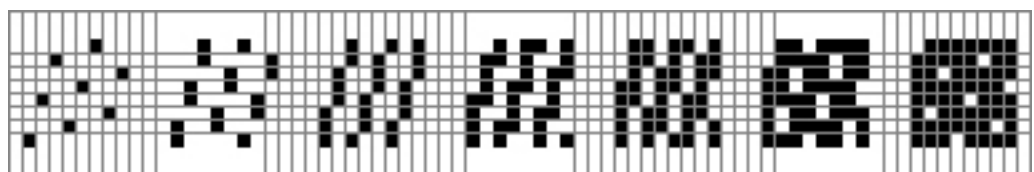
7-6

Save your weaves as Pattern Presets. In the sample file *Shaded 8-end satin.psd*, included on the accompanying CD, you would do the following: turn off the visibility of all layers except the layer named 1/7 (eye icon visible in layers palette). It doesn't matter which layer is highlighted as the active layer. **Edit>Define Pattern**. You will see in the image to the left of the name that you only see the visible layers. We saved our pattern as 1/7. Now make layer 2/6 visible also. Again go to **Edit>Define Pattern** and give it a name (2/6). Repeat these steps until you have saved all seven structures in this family. Now go to **Edit>Preset Manager**, choose the Preset Type: Patterns from the drop down box in the Preset Manager window, highlight all seven satin patterns by **Control(Command)-A**, Click on Save Set, give the set a distinctive name (we called ours *Shaded8EndSatinsWarp.pat*), save it in the directory **Applications>Adobe Photoshop>Presets>Patterns>Weave Presets**. Now go through the same process with the satins featured in Figure 7-8. We named this set *Shaded8EndSatinsWeft.pat*. Refer to Chapter 4 for more information on managing Pattern Presets.

To summarize, the seven shaded 8-end satins in the first group would look like Figure 7-7, and the second group would look like Figure 7-8.



7-7 Shaded Satins  
risers added in the weft direction



7-8 Shaded Satins  
risers added in the warp direction

## Principle of Inclusivity

If you are following the Principle of Inclusivity you may use any or all weaves from either group in a single shaded image, but you must not mix weaves from one group with weaves from the other. Notice that within each group, the pixels of the earlier weaves are contained within the pixels of each succeeding weave. Or described in another way, the pixels of a weave in a given series contain all the pixels of the preceding weaves. It is this **Principle of Inclusivity** which guarantees that all the weaves in a group of shaded

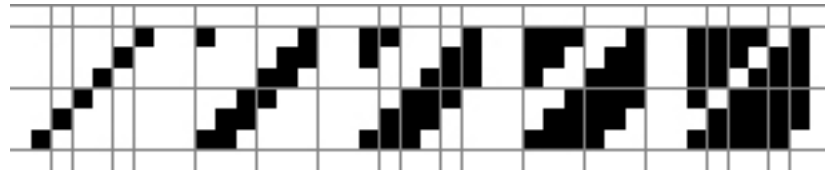
structures will work together, with no excessive floats at the edges of the design areas.

## Which Satins to Choose?

Why would you want to use one system of shading versus the other? Look at Figure 7-7. Do you see that we are shortening the length of the weft floats each time we add a riser? This system emphasizes the weft yarn. Now look at Figure 7-8. Do you see how each riser increases the length of the warp float? This series emphasizes the warp yarn. We suggest you try weaving the same image, using the same yarns, first with the satin system that shades in the weft direction, then with the system that shades in the warp direction. You will definitely see differences and will learn your preferences, and can choose accordingly in future projects.

## Other Shaded Weaves

Other single-layer weaves may be used in a shaded fashion. Straight, broken, and point twills may be used as shaded weaves. Figure 7-9 is an example of a shaded 6-end straight twill. The Principle of Inclusivity is followed here as well.

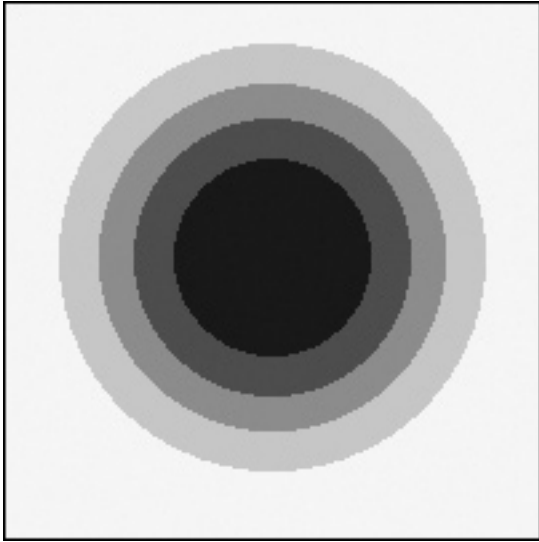


7-9 Shaded 6-end Straight Twills

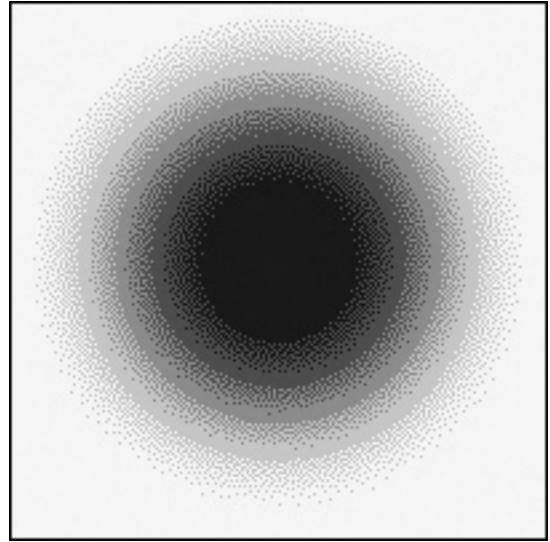
Figure 7-10 is a file indexed to five colors. It was reduced with no dithering. Figure 7-11 was reduced with dithering set at 100%. Dithering gives the illusion of smoother transitions. Putting your image into grayscale mode before you put in weaves is helpful because you can see the light to dark steps more clearly than if you are using colors. We explain this process later in this chapter.

Figure 7-12 is a 100x100 pixel image with the five shaded six-end twills applied. No dithering. Note the sharp boundaries between design areas.

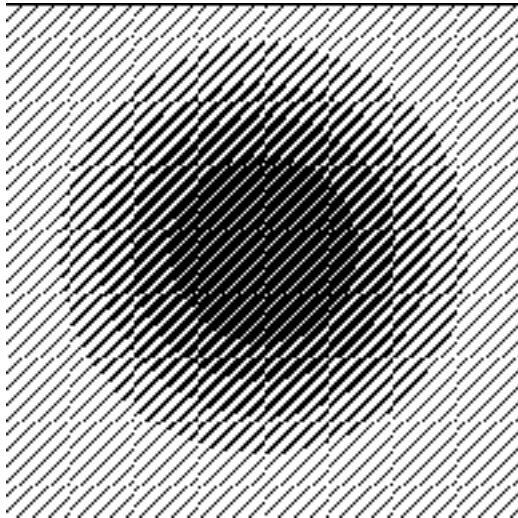
Figure 7-12b is the same 100x100 file as Figure 7-10, with the same weaves applied, except that 100% dithering was used in the reduction of the file to five colors. The boundaries between colors are blurred and the appearance of the design is smoother. There are no excessively long floats in any part of the design, because all succeeding weaves in the group are inclusive of each other and the weaves mesh together perfectly.



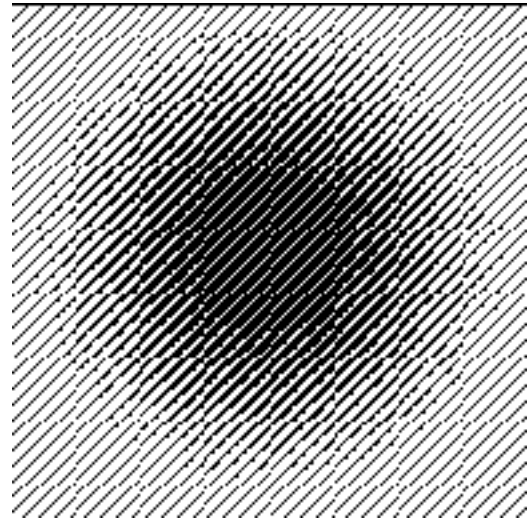
7-10



7-11



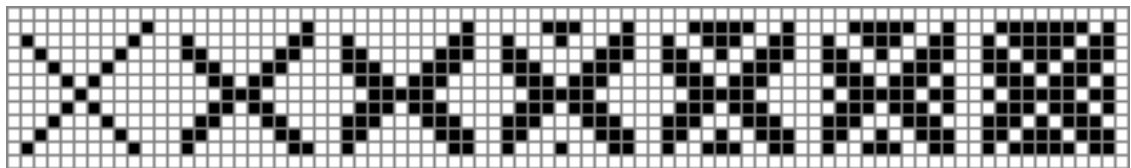
7-12



7-12b

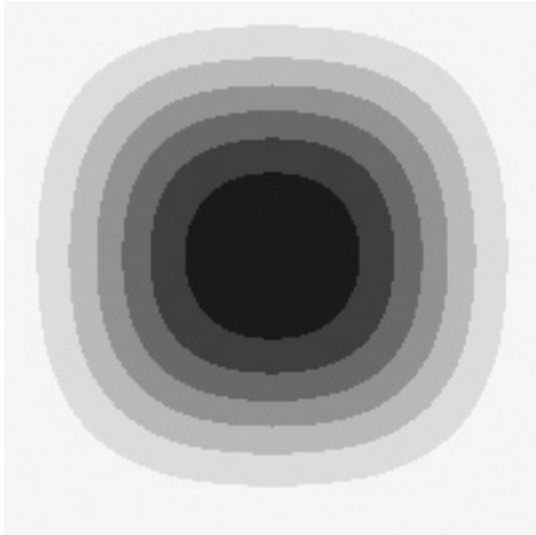
If you need a refresher on how we converted the image to weave structures, see Chapters 4 and 5.

Figure 7-13 is an example of a 10-end point twill, shaded in seven steps. Note that the steps do not follow a strict order of one step right, or one step up, but are added in arbitrary directions according to the shape of the diamonds. Each step is inclusive of all the preceding steps.

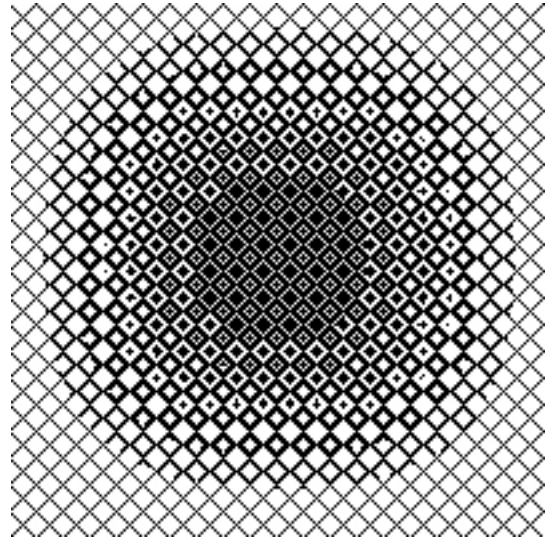


7-13

Figure 7-14 is an image indexed to seven colors (no dithering), and has the shaded point twills applied in Figure 7-15.



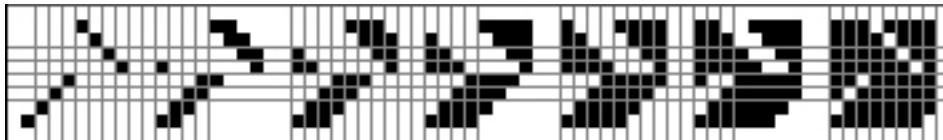
7-14



7-15

Finally, here is an example of a shaded 8-end broken twill in seven steps (Figure 7-16); an image reduced to seven grays, with dithering (Figure 7-17); and the same image with the shaded broken twills assigned (Figure 7-18).

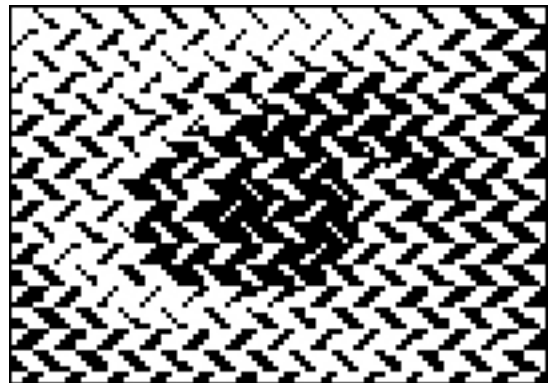
Hold Figure 7-18 at arm's length and squint, to simulate actual woven cloth with fine threads. Isn't it amazing how much detail and realism you get with only seven steps of gray!



7-16



7-17



7-18

Any of the sets of Pattern Presets may be saved as a group for recall and use in future files. The presets for the examples in this chapter were saved as *Shaded 6-End Straight Twills.pat*, *Shaded 10-end Point Twills.pat*, and *Shaded Broken 8-End Twill.pat*. When located in the directory **Applications>Adobe Photoshop CS2>Presets>Patterns>Weave Presets**, they are available for use within the program menus, and directly from the Layers palette. Refer to Chapter 4 for complete instructions on saving and using Pattern Presets.

## Pixel Aspect Ratio

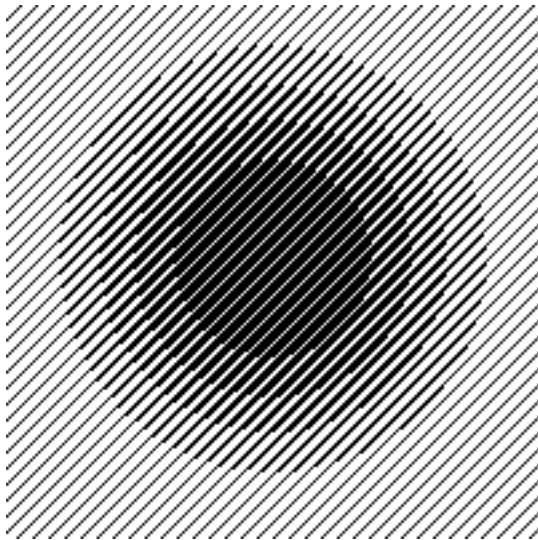
Ideally, fabrics constructed with shaded weaves should have balanced sett, that is, the same number of epi as ppi. In that way, the designs will weave at the same Pixel Aspect Ratio as the original image and with the same tonal range. Frequently the beat will not be exactly what is expected, and the Pixel Aspect Ratio will be off—the image in the cloth will come out either squashed or stretched. Sampling is necessary in this case. Especially in handwoven jacquard, a weave sample blanket will weave at a particular sett, and the actual project will beat up differently, due to differing distributions of the weaves in the file. *A file with more dithering in the original image will tend to beat up with fewer ppi than a file with less dithering.*

For all these reasons, we strongly advise weaving a sample strip of several inches of the file. Count the actual ppi of the sample strip with the tension relaxed. Count the actual epi of the sample in a relaxed state also. (We were surprised ourselves to find how much the actual epi differed from the sett on the loom.) Divide *actual ppi* by *actual epi* to get the true Pixel Aspect Ratio of the file.

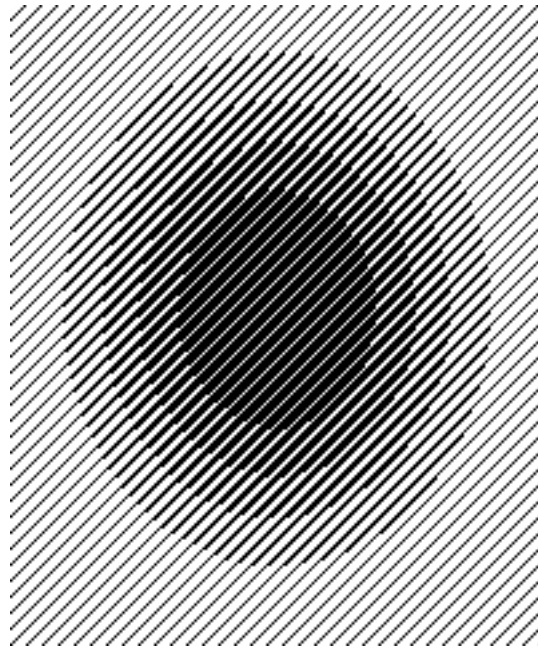
Go to the file with weaves assigned as Layer Styles, then to Menu item **Image>Image Size**. In the Image Size dialog window be sure the Constrain Proportions box is unchecked, set the Resample Image drop down box to Nearest Neighbor. Observe the height in pixels, multiply this number by your new aspect ratio, and change the height to this number. Click OK. This will resize your file to the correct Pixel Aspect Ratio and the weaves will flow in correctly to the new file. (Important reminder: in assigning weaves as Layer Styles, do not check Link With Layer and do not click Snap to Origin. If you forgot to uncheck Link With Layer or if you accidentally hit Snap to Origin when you put in your weaves, your weaves will not flow in correctly in the resized file, and you will have to reassign them.) Save the new file with a distinctive name. Before weaving, flatten this file, index it to make sure it contains only black and white, and save it as a .bmp or .tif file to send to the loom.

Keep in mind that if the design is to repeat, the resized file must have a height which is an exact multiple of the weave repeat. For instance, if the basic shaded weave is ten pixels high (say a group of 10-end satins), the final file must be a multiple of ten pixels in height, otherwise there will be a visible break in the structure at the point of repeat. Here is an example: the original file is 200x200 pixels and the actual Pixel Aspect Ratio is 1.19. Multiply the

height of 200 by 1.19 to get a new height of 238. Since 238 is not an exact multiple of ten, round up to 240. The new file is 200 pixels wide by 240 pixels high.



7-19



7-20

The original file with weaves applied looks like Figure 7-19, and adjusted to the new Pixel Aspect Ratio it looks like 7-20, but when woven it will appear correct.

If you want to see it on screen at the correct visual aspect ratio after you have modified the file, go to **Image>Pixel Aspect Ratio>Custom Pixel Aspect Ratio** and enter 1.19. Now the image will look the way it will when woven. For more complete information on Pixel Aspect Ratio and resizing files, see Chapter 4.

## Preparing Images to Accept Shaded Weaves

### Tonal Range Related to Weave

The preparation of images for shaded weaves offers special opportunities and challenges. The range of tones in a black and white weaving, with a white warp and black weft, is theoretically pure black, through several shades of gray, to pure white. But in the real world this is not the case. Even a very dense warp-dominant satin will show small amounts of the weft, and will not read as pure white, but as light gray. And similarly, a dense weft-dominant satin will not read as pure black, but as very dark gray. Therefore, the range of tones will not be as great as the range found in a black and white photograph which



has been “equalized” or adjusted so that the tonal range goes from pure black to pure white.

The first step in preparing an image for shaded weaves is to reduce it to shades of gray. Even though the final image may be woven in another range of colors (for instance, beiges through medium brown through dark brown, or shades of blue from pale blue to navy), it is easiest to work on the computer with grayscale images for the purposes of assigning structure.

### **Three Methods of Reducing to Grayscale**

There are at least three methods of reducing RGB color images to grayscale. We are doing this after we have styled our image and flattened it. Each gives a slightly different result. Try them all to see which you prefer:

1. **Image>Mode>Grayscale**. After using this method, it is important to convert back to RGB mode before indexing the file. When indexing directly from grayscale mode, you are not given a choice of how many colors you want in the final image; the image is automatically indexed to 256 shades of gray. This is usually not what you want. But if you first convert to RGB from grayscale and then index the RGB file, you are given the option of how many colors. (Just to be clear, the steps are: **RGB>Grayscale>RGB>Indexed**.)

2. **Image>Adjustments>Hue/Saturation**, and then in the Hue/Saturation window check the Preview window and move the Saturation slider all the way to the left, and click OK.

3. **Image>Adjustments>Channel Mixer**, and in the Channel Mixer window click Preview and then click Monochrome. With this window still open, experiment with the Red, Green, and Blue sliders, to see different tonal ranges in your grayscale image.

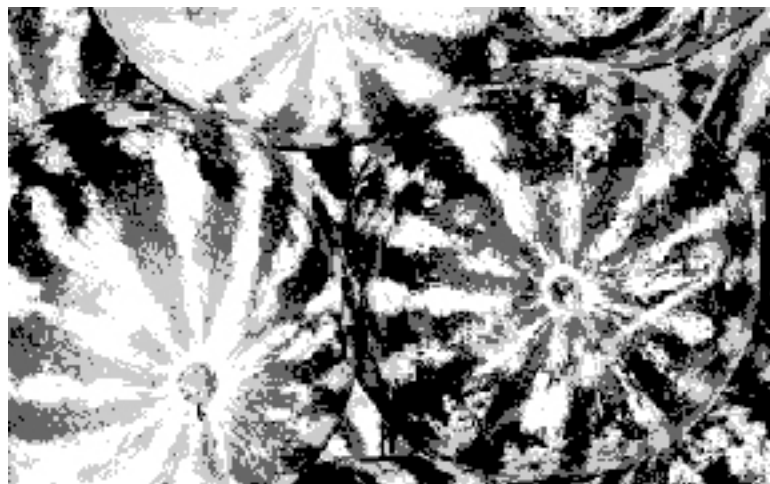
Additionally, you may wish to increase the tonal range, and thereby the contrast, by **Image>Adjustments>Equalize**.

After reducing to grayscale by one of the above methods, be sure the image is in RGB mode (if not, convert it at this time), flatten it and save as something descriptive, such as *TreesGrayscale.psd*.

Next, index the file to the desired number of colors (or shades) by **Image>Mode>Indexed Color**, choose Palette: Local (Adaptive), put in the desired number of colors, choose Forced: None. To dither or not to dither is your own choice. If you blow up the same section of your image, converted in each of these ways (be sure to compare dithering versus no dithering also) you will be amazed at the differences in the file. The best way to really learn about these differences is to weave them all in the same yarn and compare them. The differences might be moot or they might be significant for you.

## **Choice of Weaves**

Two major factors affect the choice of a group of weaves for the shaded effect. The first is the suitability of the weave for the intended project and the second the way the weave works with a given yarn and sett.



7-21



7-22



7-23

All satins (or all twills) are not alike. The number of intersections per unit of a weave determines the relative length of floats, and the optimum sett for a weave. An eight-end satin will have to be sett closer than a five-end satin for a stable cloth, and the resulting fabric will be heavier in weight. While you might like the greater range of tonal values in the eight-end satin weaves, the closer sett necessary might not be suitable for your intended end use.

If your starting point is a given yarn and sett on a loom which is already warped, that setup will determine which weaves you choose. For instance, on a loom warped in 10/2 cotton at 30 epi, five-end satins will work well but eight-end satins may be too sleazy. If you are fortunate enough to be working at a loom with adjustable sett, you may be able to increase your warp density sufficiently to accommodate the higher-order satins. If the same loom were warped with 5/2 cotton at the same 30 epi, an eight-end satin would work well, if the increased density of the fabric is suitable for the intended end use.

Putting aside issues of size of weave repeat and density of sett, the higher order satins do offer a greater range of tonal values. The contrast between the two extremes of an eight-end satin (1/7 and 7/1) with a white warp and black weft will be greater than the contrast between the two extremes of a five-end satin (1/4 and 4/1). This can be illustrated by looking at an image which has been reduced to four shades of gray (Figure 7-21).

First it has been interpreted in Figure 7-22 with five-end satins (1/4, 2/3, 3/2, and 4/1). As the drafting convention is black=warp up, imagine that in this case the warp is black and the weft white .

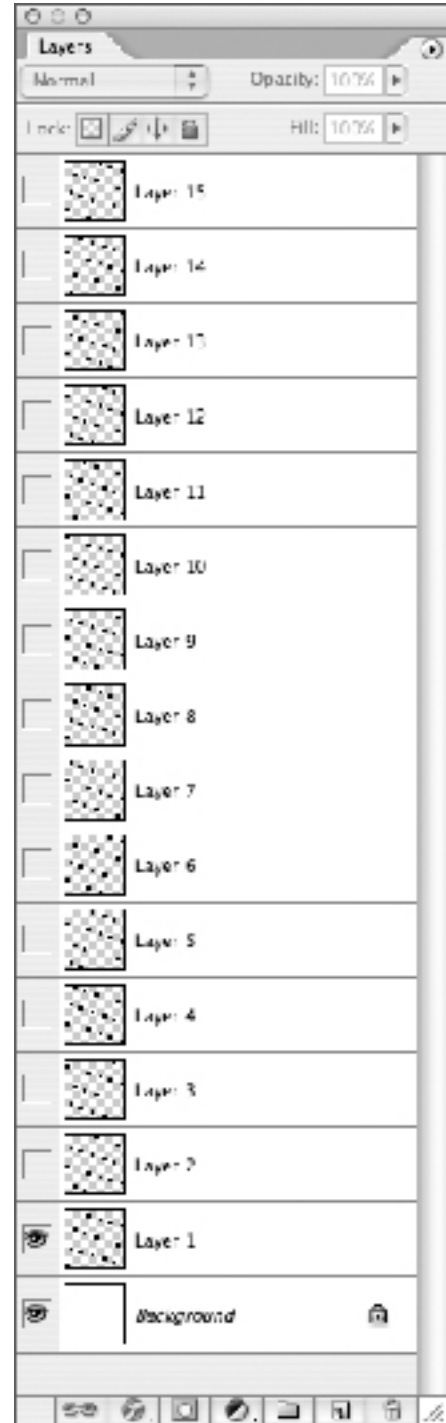
Figure 7-23 shows it interpreted in four of the eight-end satins (1/7, 3/5, 5/3, and 7/1) picked from among the seven available, with the first and last being the most warp-faced and most weft-faced of the series. Again assume black warp and white weft. Notice the increased contrast and readability.

## Granite Weaves

Granite weaves, which are built on a satin base, work well for shaded effects. They have the added attraction of being more interesting texturally than ordinary satins, and are fun to construct.

A granite weave is one in which tie points are added in some regular fashion to the basic satin ties, but not necessarily adjacent to them. In the following series of weaves, the beginning base is a 16x16 satin with a counter of five. The first layer of the Photoshop file shows a single tie in each weft row. Each succeeding layer is a copy of the previous layer with the pixels wrapped five positions to the right. There will be 15 possible layers, with the steps going from a 1/15 weft-effect satin to a 15/1 warp-effect satin. By turning the layers on one at a time (by clicking on the eye icons in the Layers palette), you may step through the series. But we will not be using these as satins—the longest floats are over 15 ends. We will construct a series of granite weaves by turning on layers one at a time, not necessarily in sequential order.

To make this file create a 16x16 file with a white ground. Make a new layer and dot in a 1/15 satin with a counter of 5 using the Pencil tool; this is *Layer 1*. *Layer 1* contains only black risers; the white pixels are what is showing through from the Background. Now drag *Layer 1* in the Layers palette onto the **Create a New Layer** icon at the bottom of that palette (this icon looks like a little page symbol); a duplicate layer is created (called Layer 1 copy). Rename this layer *Layer 2*. Be sure *Layer 2* is the active layer (highlighted in blue). We will now shift the risers five columns to the right by going to **Filter>Other>Offset**, and in the Offset window entering Horizontal: 5 pixels right, and Vertical: 0 pixels down; Undefined Areas: Wrap Around; Preview button checked. Click OK. We now repeat the process by dragging *Layer 2* to the Create a New Layer icon, renaming the duplicate as *Layer 3*, and moving the pixels of *Layer 3* five squares to the right with the Offset filter. Continue duplicating layers and offsetting them until you have all 15 layers in your palette. Figure 7-24 shows the Layers palette for all 15 layers.



7-24



7-25



7-26 (*Granite 16x16.pat*)

Figure 7-25 illustrates a series of five weaves constructed by turning on layers in this manner by clicking on the eye icons in the Layers palette (notice that each weave is inclusive of the previous ones, and none contains floats longer than seven):

The five weaves of Figure 7-25:

1. Turn on visibility of Layers 1, 9 and 15
2. Add layers 6 and 11
3. Add layers 2 and 13
4. Add layers 3, 4 and 5
5. Add layers 7 and 14

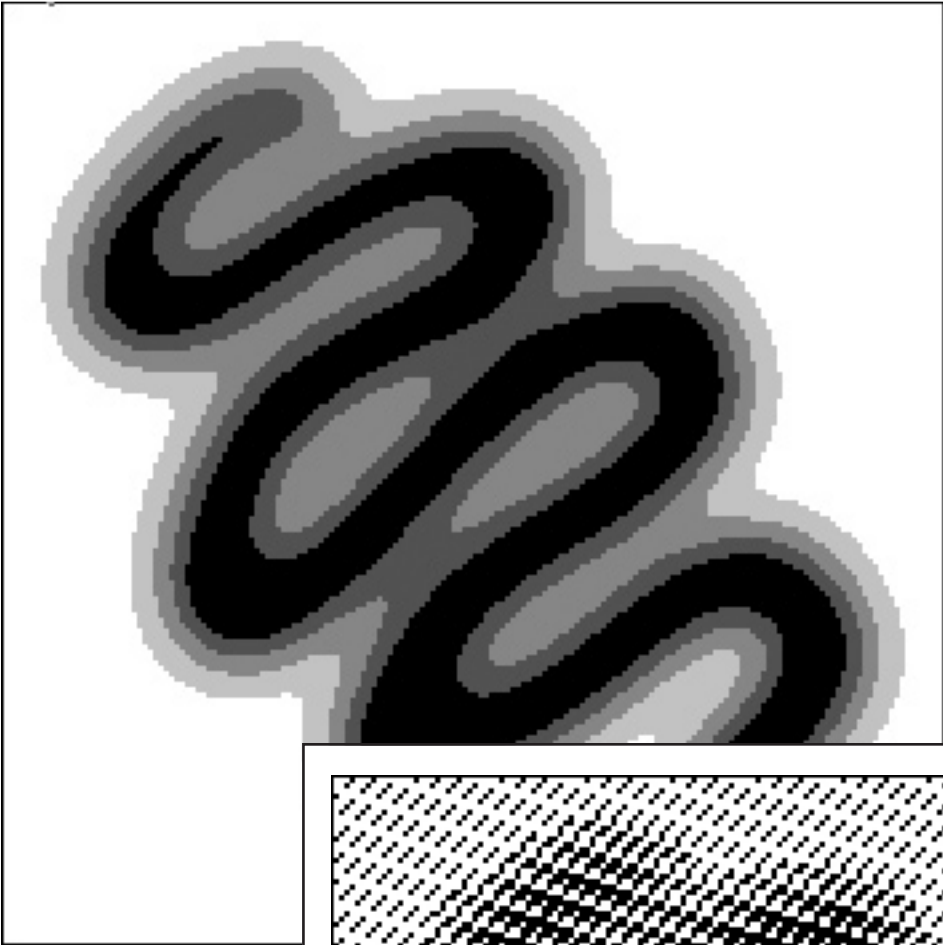
The five weaves of Figure 7-26:

1. Turn on visibility of Layers 1, 5 and 13
2. Add layers 2, 6 and 14
3. Add layers 10 and 11
4. Add layers 7 and 8
5. Add layers 3 and 15

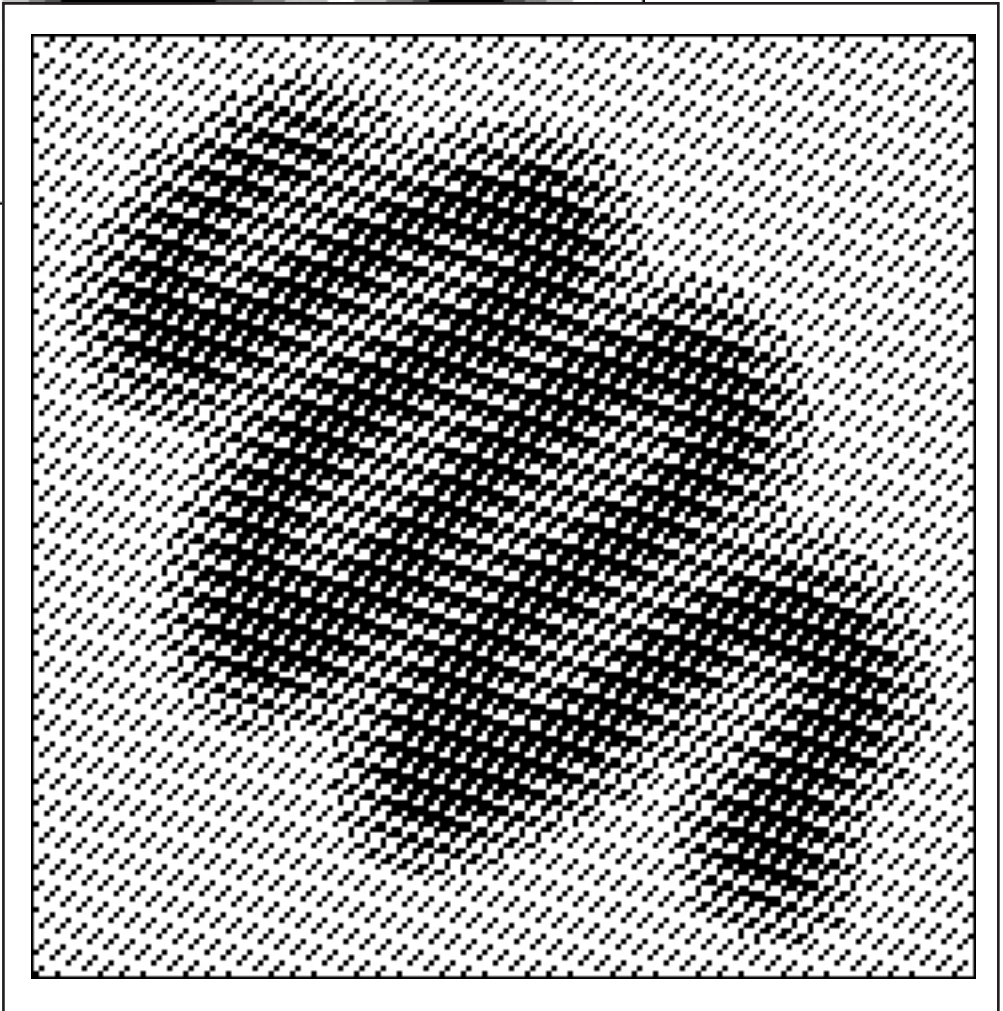
Use any or all of the weaves in a single series only to preserve the inclusivity.

We have saved all five of the weaves from Figure 7-26 as Pattern Presets and named them *Granite 16x16.pat*. You can save them as Pattern Presets this way: turn on the eye icons for only the layers you want to include; go to **Edit>Define Pattern** and give it a name.

We have then applied the Granite 16x16 weaves to a five-color image (Figure 7-27). We have chosen not to use dithering in this example (7-28).



7-27



7-28

The result of this granite exercise is a file with good contrast between the lightest and darkest weaves, and an interesting surface texture. If we had used a shaded 8-end satin for this image, the maximum float length (seven) would have been the same, but the surface texture would have been flatter. The building of granite weaves in Photoshop adds yet another great option to our bag of tricks.

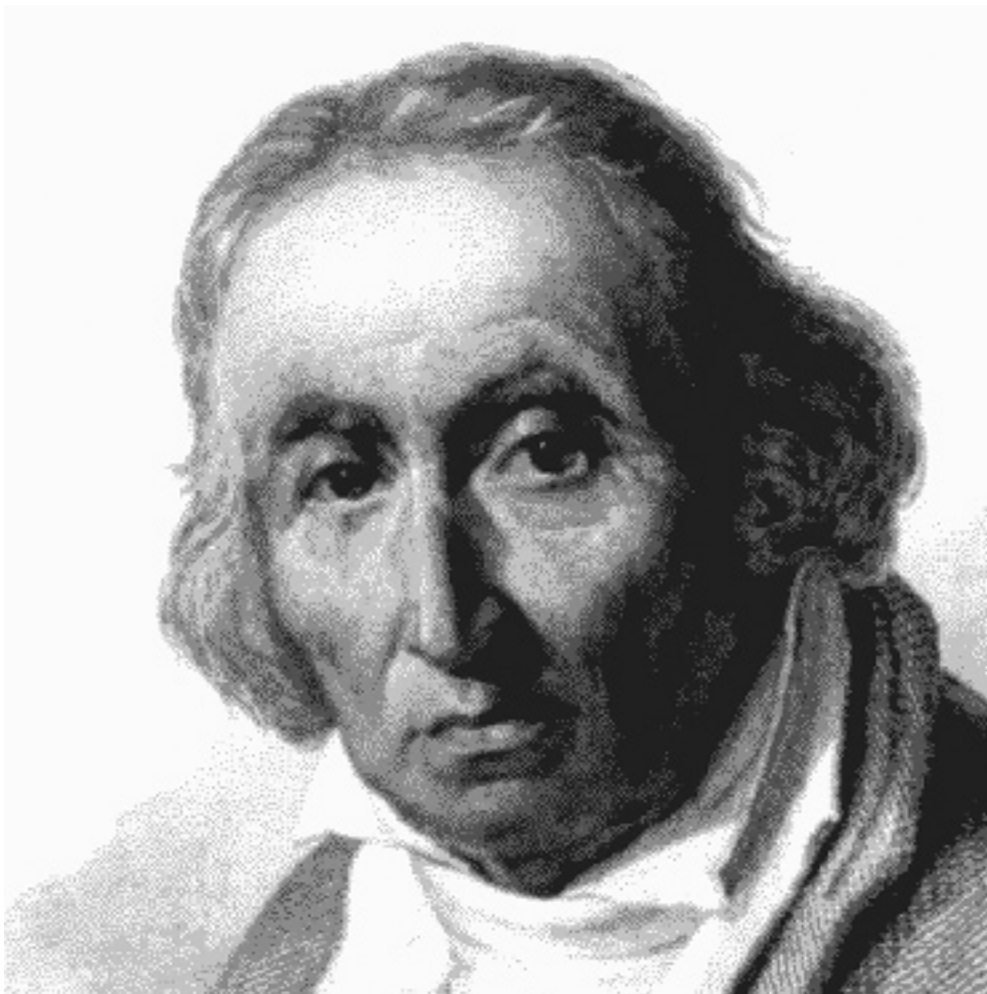
## A Woven Portrait

Let's end this chapter, appropriately enough, with an image dear to the hearts of jacquard designers, a portrait of Joseph-Marie Jacquard (you may remember that a woven portrait of Jacquard was a treasured possession of Charles Babbage, and a key link in the chain leading from the earliest jacquard looms to the modern computer). Jacquard's original woven portrait comprised 2400 picks – we will do a more modest interpretation. Our original image, cropped from a scan of an engraving, is 496x496 pixels, and when woven with a balanced sett will be square. The starting image is shown in Figure 7-29.



7-29

We reduced the image to five shades of gray, with dithering at 100% (7-30).



7-30

And voilà, Joseph-Marie Jacquard himself (Figure 7-31), with the five granite weaves of *Granite 16x16.pat* applied as Layer Styles.



7-31