BEST OF

HANDWOVEN

Technique Series

COLOR!

Everything a Weaver Needs to know

+ A DOZEN PROJECTS on Four & Eight Shafts

Whenever I ask a group of weavers what aspect of weaving they need to learn more about, they say "Color." Unless you were an Art major, chances are you received very little color theory in school. That is certainly true for me. It is embarrassing for me to remember touring a yarn shop with Michele Wipplinger, master colorist. We passed a group of green yarns, and as she paused to look at one, I said: I don't like green. She stared at me for a minute, and said, Oh, you don't like *green*! Just outside the windows near us, Nature was gloriously in Spring mode, beautifully juxtaposing every green imaginable, along with sunshine yellows and rich lavenders. I realized then that I had always looked at each cone of yarn separately, saying to myself I "like" this or "don't like" that. In weaving, it is not a single color that matters, but how colors work together. I loved putting this eBook together, because it has in it the articles I use constantly myself—for knowledge and inspiration. It is Art 101 for weavers.

Madelyn

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The language of color *by Deb Menz*

I love color in any way, shape, or form. I spend a lot of time looking at it, thinking about it, and analyzing what I see. Using color is a skill. Like any other skill, it improves with practice. If you understand a few basic concepts, designing with color is easier, less frustrating, and more predictable.

Describing a color

The first step is to describe a color accurately. If you can describe a color, then choosing yarn colors, mixing dye colors, and matching a color to what's in your mind's eye all become easier. If the desired yarn color is not available, you will be well on your way to figuring out how to use other colors to get the effect you want.

A color can be described in three ways.

Hue First, decide where the color belongs on the color wheel by identifying its hue family. The color wheel shown here consists of twelve hue families. Three of the hue families in this wheel are the primaries: red, yellow, and blue. All of the colors on the wheel are mixes of the primaries. Every color belongs somewhere on the wheel. Each hue family contains hundreds of thousands of variations of the hue.

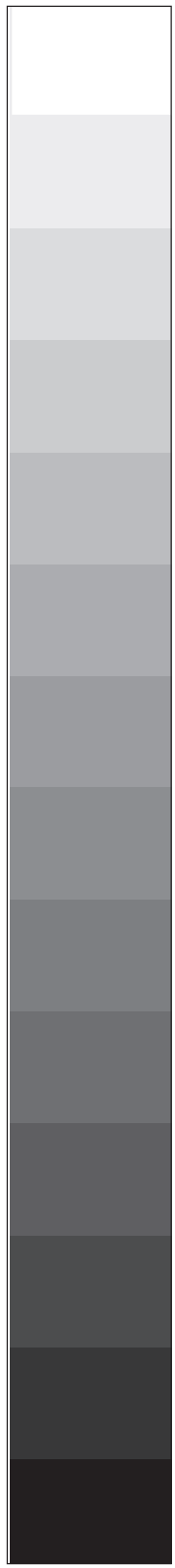
Value The second way to describe a color is its relative lightness or darkness when compared to a value scale. A value scale is a ruler with black on one end. Progressive amounts of white are added to form steps of gray until pure white is reached on the other end. The value of a color can be seen when you squint at it or look at it from a distance. A quick and easy way to tell the value of a color is by photocopying it on a black and white copy machine.

Saturation The third way to describe a color is by its brightness. Other words for this are intensity or chroma. Saturation is the amount of a pure hue in a color in comparison to a neutral gray. The most saturated colors contain only pure hue. The scale below shows a pure hue with successive amounts of gray added to reduce its saturation.

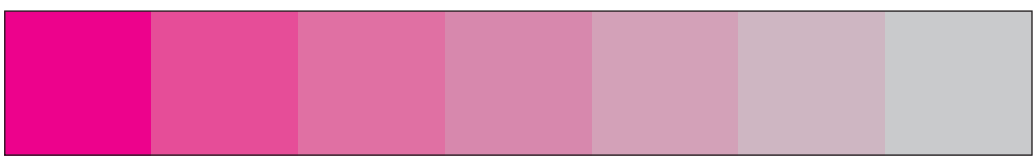
You may have noticed that the three ways to describe a color are closely interrelated. When one element is changed, another can be changed at the same time. For example, pure yellow-orange can be changed to red-orange by adding red. The hue family is changed and the value becomes slightly darker.

Colors can also have subtle underlying characteristics of warmth or coolness, sometimes called an undertone. Red can lean toward either yellow or blue, blue toward red or yellow, for example. The color chips on page 2 show warm undertones and cool undertones from the same three hue families.

Value scale



Saturation scale: from pure hue to gray



Color relationships

Because colors are not used in isolation, it is important to know how and why they react the way they do when they are placed together in a fabric. There are no strict rules, but there are principles that make it possible to predict results. Trust me, no color god will strike you if you put the "wrong" colors together!

All of these relationships are based on the color wheel. The color wheel on page 1 shows twelve hue families: yellow, yellow-orange, orange, red-orange, red, red-violet, violet, blue-violet, blue, blue-green, green, yellow-green. Using the color wheel as a reference while you read, study the relationships as they are illustrated in fabric samples, pages 3–5.

Monochromatic colors are from the same hue family but can be any value or saturation. High contrasts can occur, and color choices usually work well together, but the results are not as complex as with more than one hue; see Sample **a**, page 3.

Analogous colors are from adjacent hues on the color wheel. When using analogous colors, limit the hue-family choices to three, unless the range is between two primaries. Three hues cover one fourth of the color wheel. If the range is from one primary to another, as many as five hues can be used. Use any value or saturation of the hue families; see Sample **b**, page 3.

Warm vs cool colors Colors on the color wheel are either warm or cool. The warmest color, orange, is at the center of the warm half of the wheel, which extends from yellow-green to red-violet. The coolest color, blue, is at the center of the cool half of the wheel, which extends from red-violet to yellow-green. Red-violet and yellow-green can be either warm or cool, depending on how they are used. Why is this important? When warm colors are used in a fabric design, they tend to pop out. Cool colors tend to recede. At their most saturated, the values of most warm colors are lighter and the values of most cool colors darker. Notice that there appears to be a balance between warm and cool when there is a greater percentage of cool than warm colors; compare Samples **c**–**e**, page 3.

Complementary colors are pairs of colors that are opposite on the color wheel, such as red and green. When very small amounts of complementary colors are placed side by side and/or viewed from a distance, the perceived new color looks dull; if the amounts are small enough and/or the distance great enough, they will form gray. On the other hand, when large amounts of complementary colors are placed side by side, they intensify each other; compare Samples **f** and **g**, page 3.

Split complements are three colors of which two are on either side of the complement of the third. An example of a split complement is red, yellow-green, and blue-green. This relationship includes three hue families, which give it greater complexity in a design than complementary pairs. The effect is different in that the colors do not react as strongly, nor do they get as dull when mixed in small amounts as complementary pairs. This relationship provides a strong contrast in hue without the intensity of complements; see Sample **h**.

Warm and cool undertones

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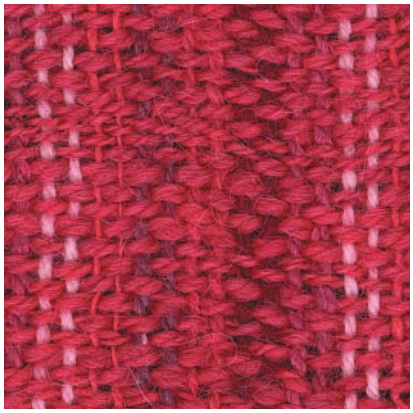
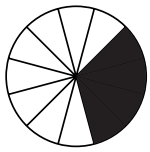
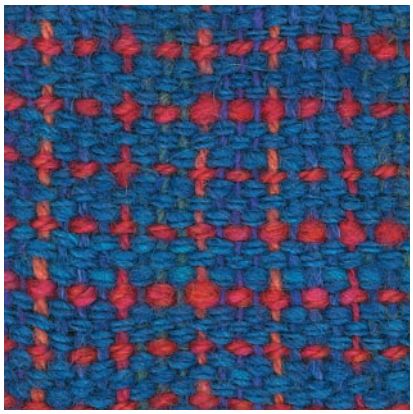


a. Monochromatic colors

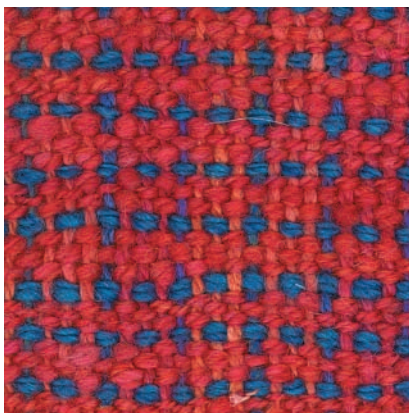
b. Analogous colors

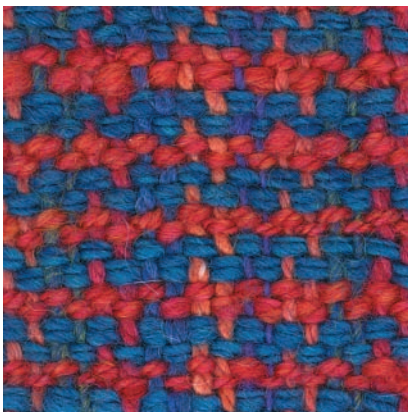


d.

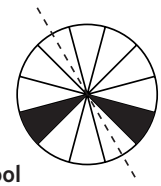


c.





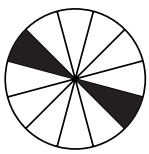
e.



warm

cool

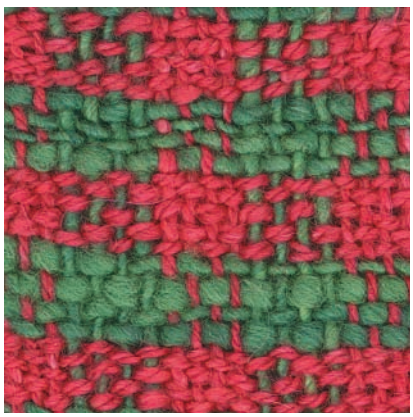
c. More cool colors
d. More warm colors
e. Equal warm and cool

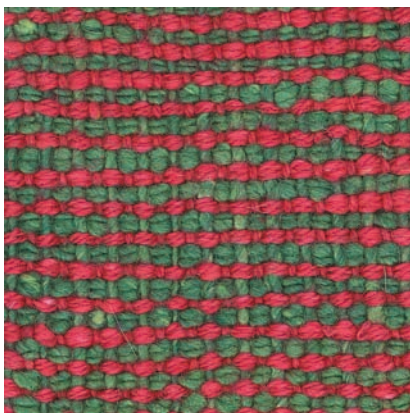


f.

g.

Complementary colors:
f. large amounts intensify colors
g. small amounts gray colors





A triad uses three hue families that are equidistant from each other on the color wheel, such as orange, violet, and green. There are four possible triads on a twelve-hue color wheel. Strong contrast occurs in this combination and the colors affect each other but do not intensify each other as in complementary relationships; see Sample **i**. Any of these six relationships can be used in a design, but there is even more to consider! Four additional elements must be kept in mind when you're choosing colors in order to be able to predict the effects you want.

Value considerations

Even more important than hue choices in a design are value choices. Values of colors are seen before the colors themselves. Very different effects are possible with different value choices. The same hue families are used for all of the fabrics in Samples **j**–**n**, but the value choices are different for each.

To obtain the most subtle results, use a limited range of values. Concentrate on one area of the value scale, keeping value contrast to a minimum. Use only very light values or only medium values, for example. Limited value ranges in a design are called minor value keys; see Samples **j**–**l**.

On the other hand, if you want the final design to be bold, use a wider range of values. The greater the contrast is between values, the bolder the design will be. To be most successful, make one of the values dominant and plan accents using a wide range of other values. Bold value ranges within a design are called major value keys; see Samples **m**–**n**, page 5.

When a dark-value color is placed next to a light-value color in a design, the dark-value color makes the light-value color look lighter and brighter and the light-value color makes the dark-value color look darker and duller. If you want to diminish this effect, add a medium-value color between them.

Warm and cool undertones

Every color has a subtle underlying characteristic of warmth or coolness. Remember that an undertone does not identify a cool or warm color on the color wheel; an undertone is much more subtle. A warm color can have a cool undertone and a cool color can have a warm undertone. For example, a red can have an undertone of either orange (leaning toward yellow) or violet (leaning toward blue).

Sometimes if a combination of colors does not work, the solution is as simple as changing the undertone of one of the colors. One design choice is to limit a palette to colors with only warm or only cool undertones.

Saturation

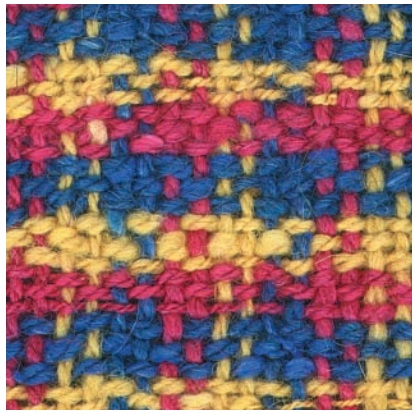
A third concept to keep in mind while making color choices is saturation. When bright colors are placed next to dull colors, bright colors make dull colors look duller, and dull colors make bright colors look even brighter. Colors can therefore be highlighted—or diminished, even to the point of being lost. For example, to minimize red, use it in small amounts, and/or choose greens that are brighter than the red and use them in larger amounts than the red; see Sample **q**, page 5.

To highlight a color in a design, make sure that all the colors that surround it are duller. If you want a color to get lost in the design, make sure it is surrounded by brighter colors. Keep the values of all the colors consistent. Notice that the brighter colors in the warp in Sample **p** dull the weft color; the same weft looks brighter in Sample **o**.

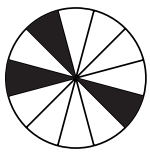
Proportion

A last consideration when making color choices is the proportions of colors. Remember, for example, that a smaller quantity of warm colors and a larger quantity of cool colors produces a balanced effect (review Samples **c**–**e**). For a color to be dominant in

h. Split complements

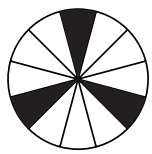


i. Triad



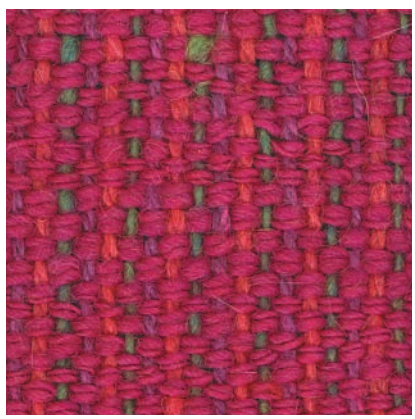
Split complements consist of three colors: two of them are at either side of the complementary color of the third.

Triads are three colors that are equidistant from each other on the color wheel.



j.

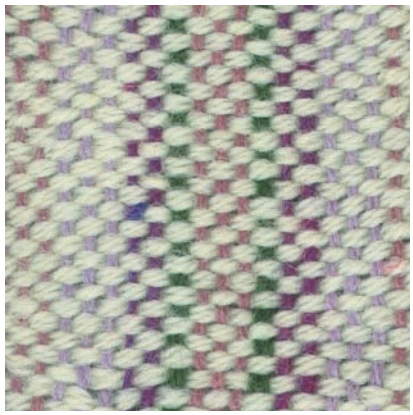
k.



l.

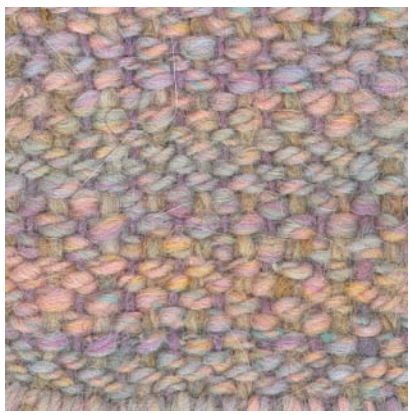
Samples j–l each use hues from the same hue families and each shows a narrow range of values: j shows a light-value range; k shows a medium-value range, and l shows a dark-value range.

m.



n.

o.

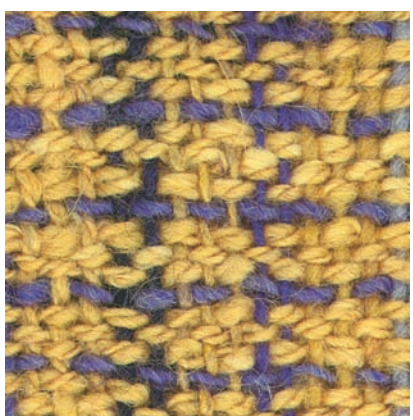


p.

q.

r.

s.



This fabric sample uses:
- **complementary colors (yellow and violet)**
- **a major value contrast**
- **a variety of saturations**

a design, choose at least half of the colors from the hue family of the dominant color. They do not all have to be the same color—the end result is richer and more complex if several variations are used instead. Notice that the same hue families are used in Sample **q** and Sample **r** but in much different proportions.

Tips for planning a fabric design

Use a color wheel as a reference to simplify making color choices. When starting a new project, ask some questions before making decisions. Write down:

- the kind of value contrast desired (major or minor)
- the kind of color relationship desired (monochromatic, split complement, analogous, etc.)
- the amount of saturation of colors desired
- a dominant hue family, if any.

A design example

Here some possible design choices:

- a major value contrast with light values dominant with medium- and dark-value accents
- a complementary relationship of yellow and violet
- a variety of saturations with yellow as the brightest
- yellow as the dominant color.

Determining these relationships and describing the colors as you work makes choosing colors easier and the results more predictable. The fabric in Sample **s** is developed from these design choices.

More to come!

Think of the color wheel as a kind of training wheel as you read the rest of this book and apply what you learn. Like any skill, once the concepts are learned, the training tools aren't needed as often. These concepts can keep you busy for quite some time, but they only touch the surface of color theory. Any one of them can be considered in more depth as well as their many variables and combinations.

Color vocabulary *by Karen Selk*

Working with color can be both exciting and overwhelming. Too many options can be paralyzing. It is hard to move forward, backward, or in any direction. The most successful things I make are the result of setting limits and working within them. Having some restrictions gives me the confidence to roam feely. They do not allow me to stray too far and help me stay focused, encouraging experimentation without trepidation.

Your personal "workshop"

Discover the rewards of working within limits by trying in your studio the same exercises that I teach in my workshops. I place in a basket many "color challenges" written on folded pieces of paper. Also in the basket are 4-shaft and 8-shaft drafts for a variety of weave structures. Participants draw a color challenge and select a draft. They then gather yarns following their color challenges and prepare wraps, twists, and needle weavings to see how a variety of proportions and combinations look in their selected structures.

Here are some color challenges for you to try. First, review the definitions in the Color Vocabulary.

Color challenges

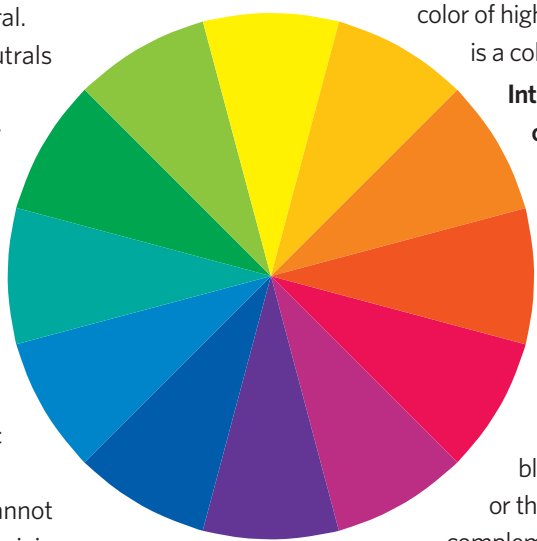
- Use any triad combination with shade as one of the unifying factors.
- Use complements of the same value and make the cool color dominate.
- Choose colors close in value only.
- Use a neutral as the unifying factor with four or more hues.

To play with yarn colors and see how they work together, use sample cards from yarn companies and/or cut small amounts of yarn from cones you have on hand.

The **color wheel** shows the chromatic spectrum (usually with twelve hues) and demonstrates color relationships.

Hue is the name of the color or color family, i.e., red or green.

Neutrals are low chroma (color) and tend to tone down the colors with which they interact and lend visual relief and a sense of quiet and serenity to complex multihued color mixes. Gray is a neutral. Chromatic neutrals include colors such as greenish gray or blue-gray.



Primary colors or pigments are red, yellow, and blue, the three basic colors of the wheel. They cannot be created by mixing any other colors.

Secondary colors are created by mixing two primaries together in equal quantities.

Intermediate colors are between adjacent primary and secondary colors. Orange (secondary) and red (primary) make red-orange (intermediate).

Complementary colors are opposite each other on the color wheel. Each complementary combination consists of one warm and one cool color.

Split complements are three colors, one plus the two that are on either side of the complement of the first. Split complements show a two to one relationship between warm and cool (or cool and warm) colors.

Triads are three hues that form an equilateral triangle on the color wheel.

Tetrads are four hues that form either a square, rectangle, or trapezoid on the color wheel.

Value is the lightness or darkness of a color. All pure colors on the color wheel are not of the same value. Yellow is the lightest hue and blue-violet is the darkest hue on the color wheel. Pink is a color of high value. Maroon is a color of low value.

Intensity (chroma or saturation) is the degree of purity of a color. Pure hues are the most intense. A color can be made less intense by adding black, gray, white, or the color's complement.

Tint of a pure hue is created by adding white, which also lightens the value and lowers the intensity.

Tone of a pure hue is created by adding gray or its complement.

Shade of a pure hue is created by adding black, which also lowers the value and the intensity.

Temperature is a hue's apparent visual warmth or coolness.

Cool colors have the shortest wavelengths: blue, green, and violet. Cool colors are passive and recessive.

Warm colors have the longest wavelengths: yellow, orange, and red. Warm colors are visually active and tend to dominate a piece. You need fewer warm colors per piece to make an impact.

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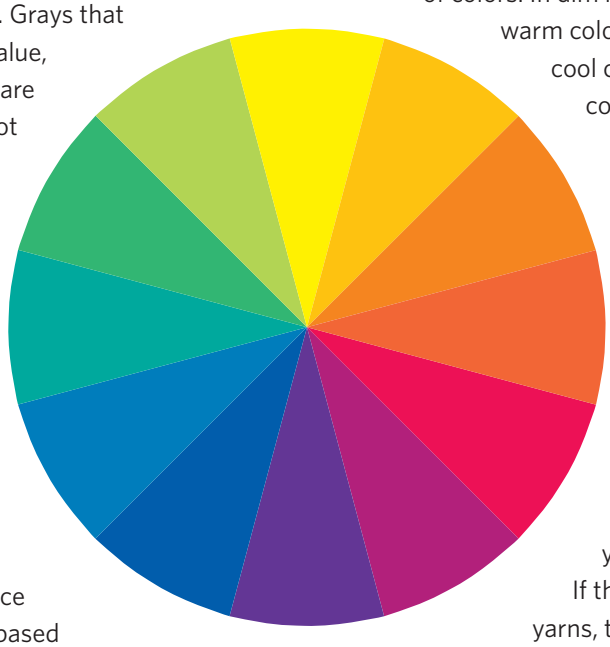
The language of value *by Deb Menz*

Working with value choices in designing a fabric is a lot like composing music. Choosing values is even more important than choosing hues, because value is the first characteristic the eye sees. Value choices greatly affect the mood created by a design.

Value

Value is the relative lightness or darkness of a color in relationship to a gray scale that includes white, black, and the gray mixtures in between. Grays that are closer to white are higher in value, and grays that are closer to black are lower in value. Someone who is not aware of value can usually detect five values between white and black. You can train your eyes to be more sensitive to differences in value.



Create a gray scale

The first step to learning about value is to create your own gray scale. It will serve two purposes: you can see firsthand the relationship of the grays, and you can use the scale as a reference tool. Acquire two tubes of water-based paints like acrylic or gouache—one in black and one in white. Paint one rectangle (approximately 1" by 2") in pure black and one in pure white. Next, mix a small amount of black into the white to match the lightest gray square in the scale at the top of page 8 and paint a rectangle. Add a little more black to approach the value of the second lightest gray square and paint another rectangle. Add a little more black and paint another to match the next square and continue until there are ten gray rectangles between white and black.

The values should be as evenly spaced as possible so the grays appear to flow from one to the next. Glue each rectangle to a piece of cardboard. With a hole punch, punch a hole in the middle of each.

Determining relative value

Place the value scale you have just made over a color you are evaluating so that the color shows through the holes. Squint, and the rectangle that blends most closely with the color is the color's relative value. Squinting helps detect value by decreasing the amount of light that reaches the eyes, thereby also decreasing color vision so that the value portion of sight becomes more dominant. The holes in the gray scale are relatively small to prevent hue and intensity from influencing your perception of value. Study this effect by placing the gray scale over a range of yarn colors.

The relative brightness of light also influences value perception. Both bright and dim lighting skew the true value of colors. In dim light, cool colors appear lighter and warm colors appear darker. In bright light, cool colors appear darker and warm colors appear lighter. In dim light, light values are more distinct and dark values tend to blend into one group, thereby reducing the number of colors that can be perceived. In bright light, dark values are more distinct and light values tend to blend together.

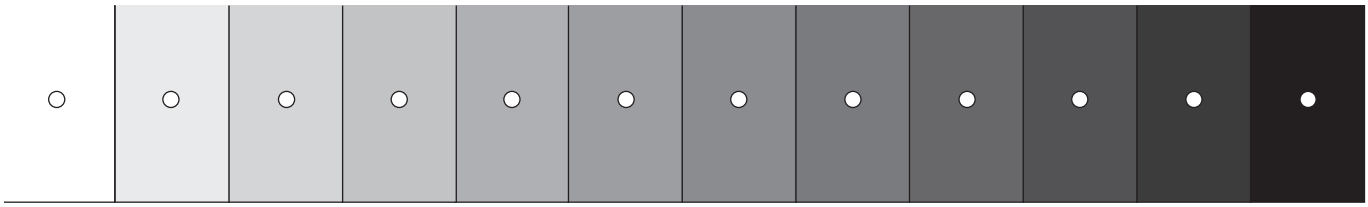
Texture also influences value perception. If the texture is smooth and reflective, as with silk yarns, the value perceived is lighter. If the texture is fuzzy, as with angora yarns, the value seems darker.

In a woven fabric, the weave structure as well as the yarns creates texture and therefore influences value perception. Smooth structures read lighter; more heavily textured weaves, such as waffle, usually read darker. The distance from which a color is viewed also influences how the value is read. The farther away an object is, the more the eye sees a medium value. The smaller and finer a woven object, the closer it needs to be viewed to distinguish its values accurately.

Value and hue

Color wheels depict colors at their most intense, but the values of the hues on the wheel are not the same even though all hues are at full intensity. Each hue comes to its full intensity at a specific value called its spectrum value. Yellow has the highest spectrum value and violet the lowest. Blue green and red orange have the same spectrum value, which is midway between that of white and black. The spectrum value of orange and yellow green falls midway between that of yellow and red orange. Red and blue fall midway between blue green and violet.

Value scale



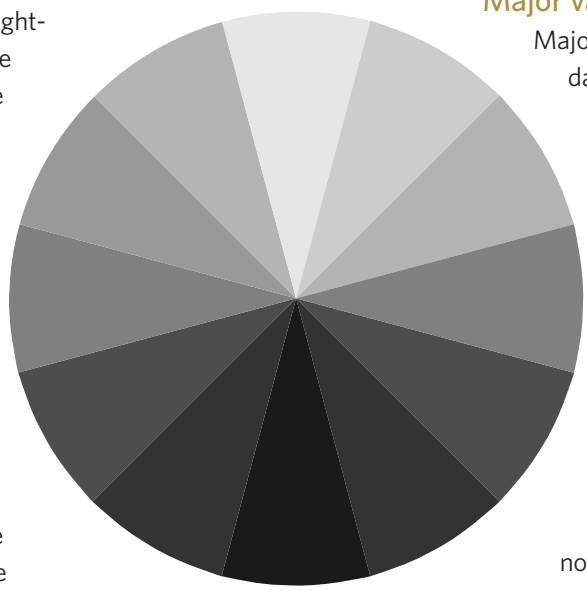
While light values are easier to distinguish from each other than dark values, warm colors (yellows, oranges, reds) appear lighter than they really are. Hue, yarn texture, weave structure, lighting, and viewing distance all influence the perception of values and must be considered for successful design.

Tints, shades, and tones

The value of a color changes with the addition of white, black, or gray. Tints are colors that have white added; a tint is higher in value than the original color. Shades are colors that have black added; a shade is lower in value than the original color. When a gray of the same value as the original color is mixed with the color itself, the intensity of the color changes but the value does not. These colors are called tones. As an example, a color, its tint, its shade, and its tone are shown in **1a–1d**.

Using value keys

Working with individual values is like composing music with single notes. Value keys are combinations of values that create a mood or a feeling—like chords or a melody. The first step in designing is to choose the values to be included that will obtain the desired effect. There are two main kinds of value keys to work with: major value keys and minor value keys.



Major value keys

Major keys combine very light and very dark values and appear direct, bold, and assertive. (Major keys in music, which have greater tonal distance between notes, create a bolder sound.) Major value keys vary from each other according to which values are dominant.

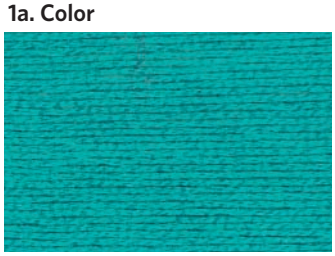
The high major key uses colors in the high or light range of the value scale with accents of medium and dark values. High major keys tend to produce luminous and happy designs; see the yarn wraps in **2a** and **2d**, page 9.

Middle major keys show most of the colors in the middle value range with accents of very light and very dark colors. This is a particularly popular key for artists because the eyes are drawn to medium value colors first. Designs in middle major keys appear strong, stable and well-balanced; see yarn wraps **2b** and **2e**, page 9.

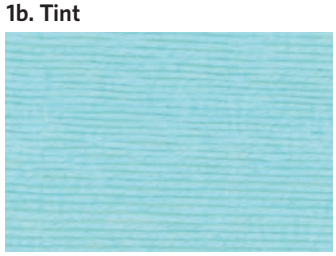
Low major keys show predominantly dark values with medium and light accents. Designs using low major keys are dramatic and work especially well in theatrical settings; see the yarn wraps in **2c** and **2f**, page 9.

Values are changed by adding white, black, or gray

1a. Color

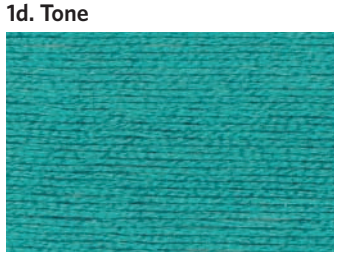


1b. Tint



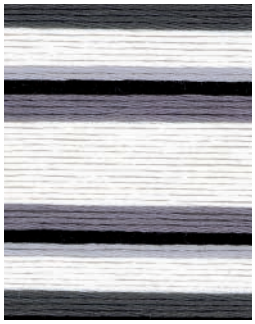
1c. Shade

1d. Tone



Originally published in *Handwoven*®, September/October 2000, pp. 60–63.

Major keys



2a. High major

2b. Middle major

2c. Low major

2d. High major

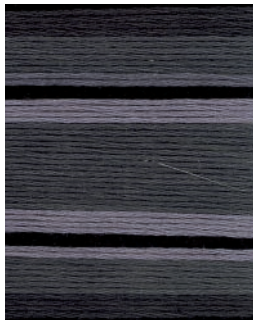
2e. Middle major

2f. Low major

Minor keys

3a. High minor

3b. Middle minor



3c. Low minor

3d. High minor

3e. Middle minor

3f. Low minor

4. Extended middle minor keys

Middle minor keys can be extended by increasing value contrast (but not enough to change them into middle major keys). Compare these wraps with the wraps in 3b and 3e.

Minor value keys

Minor value keys include only a small portion of the value scale, which means there is less value contrast in the designs. Minor keys are more subtle and evoke moods more than major keys—analogous to minor keys in music.

The high minor key uses only colors with values from the upper third or high portion of the gray scale. The results are delicate, serene, and peaceful; see the yarn wraps in **3a** and **3d**.

The middle minor key uses only values in the middle third of the scale. The results are dreamlike and subdued; see the yarn wraps in **3b** and **3e**.

Low minor keys use only values from the lowest or darkest third of the scale. Designs are very quiet and can seem gloomy and depressing; see the wraps in **3c** and **3f**.

A fourth minor key is the extended middle minor key. It uses more contrast than a middle minor key, but not as much as a middle major key; compare the wraps in **4** with **2b** and **2e** and **3b** and **3e**.

Design considerations

Designing with major and minor keys is not the only way to use values, but it is a good place to start, especially because it can provide predictable results. Being aware of contrasts in value or their absence in a design is an important prerequisite to creating a good design.

Even the placement of values within a design influences the appearance of the values used. Placing a very dark value next to the lightest value in a design makes the dark value look darker and the light value look lighter.

A middle value placed between them minimizes that effect. Small contrasts in value using small quantities of each soften

transitions; compare the yarn wraps in **5a** and **5b**. Dark values used as background can make a design appear luminous; see the yarn wrap in **6**.

Colors that are placed next to black in a design appear lighter; the same colors appear darker when placed next to white and a little brighter when placed next to a gray that is similar in value; see the yarn wraps in **7a–7c**. These different effects are the result of value contrast. Black is the darkest value and makes all other values seem lighter. White is the lightest value and makes all other values look darker. A gray of the same value makes a color look brighter because there is no value contrast to conflict with perception of the hue.

Practice new design skills by first choosing the value key and the mood you'd like to create before you choose the actual hues. Make a preliminary design in black, white, and grays to determine proportion and placement of values, then choose the hue families, saturations of colors, and undertones of those colors.

Further reading

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Lambert, Patricia. *Controlling Color*, 1991. New York: Design Press.

Lambert, Patricia, Barbara Staepelaere, and Mary Fry. *Color and Fiber*, 1986. West Chester, Pennsylvania: Schiffer Publishing Co.

Sargent, Walter. *The Enjoyment and Use of Color*, 1964. New York: Dover Publications.

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5a. Abrupt value transition

7a. Colors with white

5b. Gradual value transition

7b. Colors with gray

6. Colors appear more luminous against a dark background

7c. Colors with black

Complementary napkins *by Beth Ross Johnson*

The unusual color effect in these napkins comes from working with two pairs of complementary colors. One pair is a rose red against an olive green, and the other pair is a rusty orange against a greenish blue. In the warp, the two warm colors are used as stripes against a background of the two cool colors. In the weft, the warm and cool colors trade places. A spot Bronson interlacement accents the stripes as they cross each other (a group of warp floats alternate with with a group of weft floats in both the threading and treadling directions). Use this project to experiment with other complementary color pairs.

Fabric description Plain weave and a spot Bronson variation (warp and weft spots).

Finished dimensions
Six hemmed napkins 15" by 15" each.

Warp and weft
22/2 cottolin (60% cotton, 40% linen, Bockens) at 3,170 yd/lb, 820 yd blue (#2029), 580 yd orange (#2014), 580 yd rose (#2019), and 400 yd green (#2063).

Notions
Matching sewing thread (rose or orange).

Total warp ends 288.

Warp length
4¼ yd (allows for take-up and 30" loom waste). Allow 22" warp length for each additional napkin.

E.P.I. 16.

Width in reed 18".

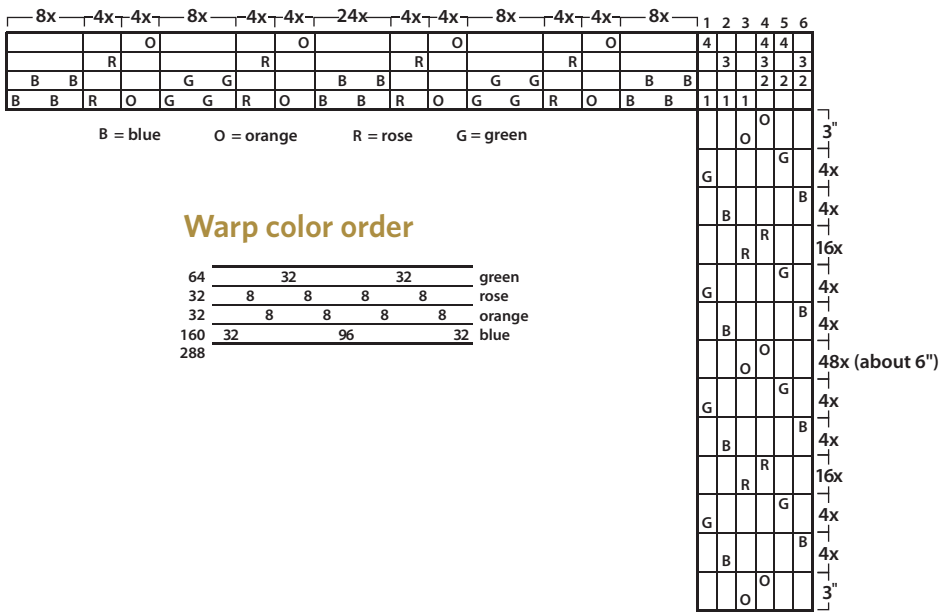
P.P.I. 16.

Take-up and shrinkage 17% in width and length.

Weaving
Weave three napkins following the treadling sequence and weft color order. Weave three additional napkins reversing the positions of the orange and rose. Separate napkins with 2 picks in a contrasting color.

Finishing
Machine zigzag the raw edges of the fabric. Machine wash in warm water and mild detergent. Tumble dry and remove from the dryer as soon as the fabric is dry. Machine zigzag on both sides of contrasting marker threads. Cut napkins apart. Turn each end under ¼" twice. Sew hems by hand. Press with the iron on a cotton setting.

Draft



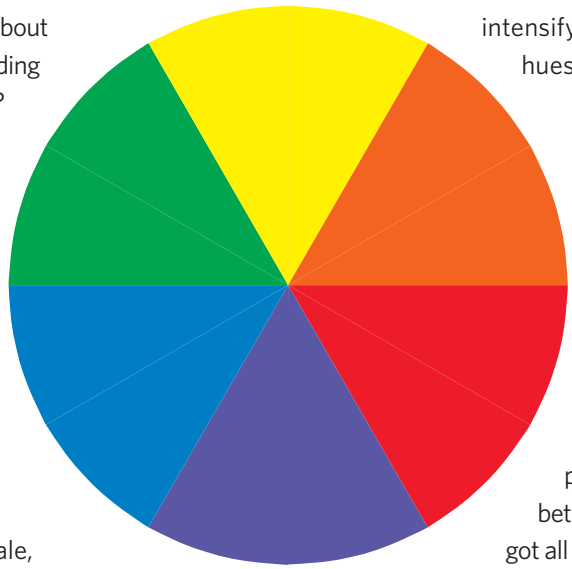
Warp color order

Originally published in *Handwoven*®, January/February 1993, pp. 50, 84–85.

Recognizing a complement *by Jean Scorgie*

Want to be knowledgeable about color theory without spending a bundle on color courses?

Try this experiment. You will need a white wall or other large surface to look at as well as large swatches of bright colors such as red, green, blue, and yellow. Each swatch should be a solid color—a brightly-colored notebook or piece of wrapping paper or fabric will do. Prop up a swatch of color at a distance and stare at it, counting slowly to 20. Then shift your eyes to stare at the white wall.



After a moment or so, look for a pale, iridescent shape matching the shape of the swatch. You may not see anything the first few times. Relax and keep staring gently at the swatch until its edges start to get blurry. Then shift your eyes to the white.

What color do you see? Surprise! It's the complementary color of the swatch. Try other bright colors, pausing to rest your eyes for a few minutes between each viewing. Each color you stare at will form its own complement against white.

What you see is an afterimage. The cones in your eyes' retinas become saturated looking at a bright color. They become fatigued and project the complementary color to neutralize themselves. This phenomenon happens all the time, though we may not be aware of it until it's pointed out to us.

Complementary colors

The word complement means "to complete." We can see how the eye tries to "complete" a color with its opposite. According to one color theory, complementary colors are satisfying to the eye because they balance each other visually, giving the eye a "complete" color experience rather than leaving the eye "wanting" to see another color.

Knowing that your eyes instinctively recognize complementary colors gives new meaning to color study. The same color sets that your eye recognizes are organized directly across from one another on the color wheel.

Think of complements as two extremes—colors as different as they can possibly be. One complement is warm; the other is cool. Whatever hue one complement contains is completely lacking in the other. Placed side by side, complements enhance each other with afterimages which intensify their hues. Mixed together, their hues cancel each other to make gray.

How can we remember the sets of complementary colors? It's easier than you think. Start by placing the three primary colors on a color wheel, with yellow at the top, red at the lower right, and blue at the lower left. Next, mix two primary colors to form a secondary color and place it between them—orange between yellow and red, purple between red and blue, green between blue and yellow. Now you've got all the information you need to identify any complementary color accurately.

The color directly opposite a primary is the secondary color mixed from the remaining two primaries. For example, the complement of yellow is a mixture of red and blue—purple. The complement of red is a mixture of blue and yellow—green. While each of the primaries is the complement of the secondary opposite it, each of the secondaries is the complement of the primary not contained in it.

Are you ready for a quiz? What's the complement of blue? (Blue is a primary; the other primaries are yellow and red, which make orange.) What's the complement of purple? (Purple is a mixture of red and blue; the remaining primary is yellow.) Let's work with more subtle colors. Choose a color and identify the primary or secondary color closest to it. Let's say it's a color close to orange. The complement of orange is blue. But the color isn't just orange, it's red-orange. The complement of red is green, so the complement of our chosen color is blue-green.

Here's another example—purplish navy. Navy is dark blue and its complement is orange. The navy has a purple cast, and purple's complement is yellow, so the complement of purplish navy is yellowish orange. We're still using the sets of complementary colors on the basic six-color wheel even though we're choosing colors that lie between the primaries and secondaries.

Try this with other colors, first identifying the closest primary or secondary color, finding its complement, placing it more specifically to one side or the other, and finding another complement. You'll find yourself combining colors in new and effective ways.

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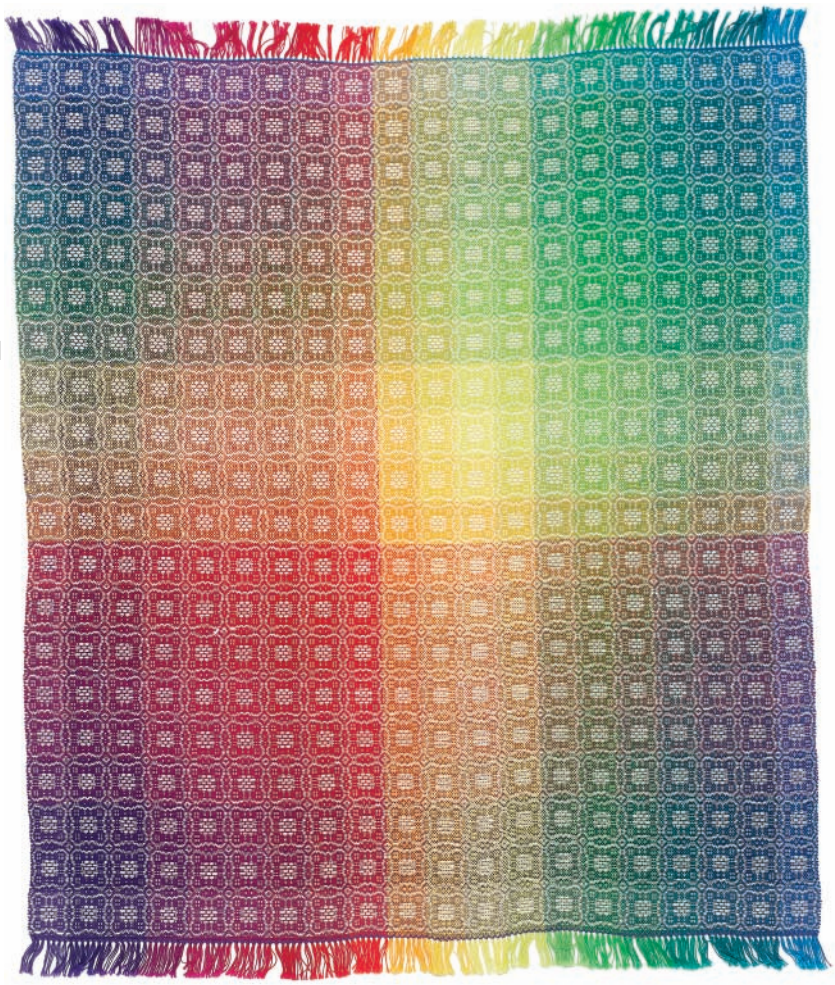
Color gamp in overshot *by Vicki Tardy*

Last summer I wove color gamps in a variety of weave structures using the Tubular Spectrum from the Lunatic Fringe. It was great fun! This wall hanging is one result. Each repeat of an overshot draft is threaded in a different color. The pattern weft is off-white; the tabby weft uses the same color order as in the warp. Notice that the light pattern weft casts a bright wash over the rainbow ground cloth, as if a burst of light were coming from the lightest (yellow) area. Try the gamp with a black pattern weft, and the color-wheel colors will intensify.



Fabric description
Overshot.

Finished dimensions
25⅝" by 29".

Warp and weft
Warp and tabby weft: 10/2 pearl cotton at 4,200 yd/lb; the Tubular Spectrum Color Gamp Kit in 20 colors, 400 yd each color. (Three gamps require 120 yd per warp color; 72 yd per weft color).
Pattern weft: 10/2 pearl cotton, 1,400 yd Natural.

Total warp ends
563 (includes 2 floating selvedges).

Warp length
4 yd (allows for take-up and 35" loom waste).

E.P.I.
20.

Width in reed
28 3/10".

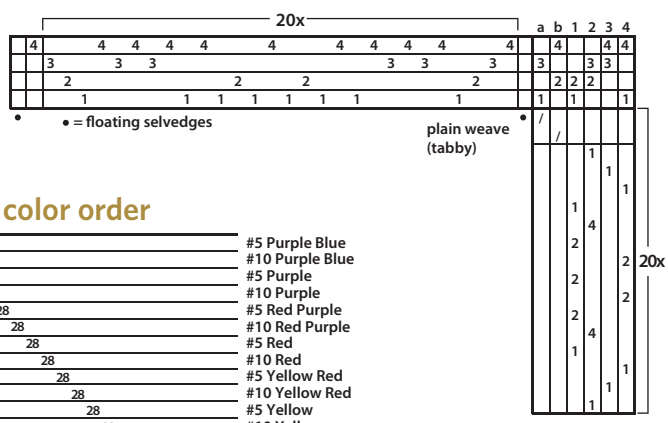
P.P.I.
36 (18 tabby, 18 pattern).

Take-up and shrinkage
10% in width and length.

Weaving
Thread the loom following the Draft. Weave each gamp using the same color order for the tabby weft as for the warp, except begin with 28 Blue and end with 28 Purple Blue. (The extra ends in the warp are for floating selvedges and to balance the design.) Hemstitch the beginning and end of each gamp and place spacers to allow 1" fringe for each. Experiment with different pattern-weft colors and treadling orders for your second and third gamps.

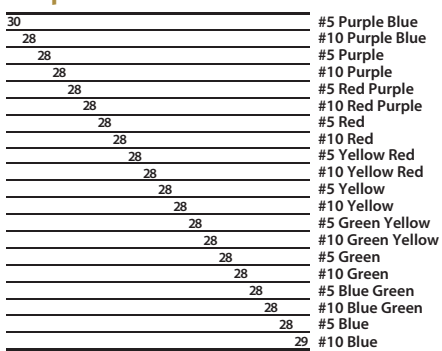
Finishing
Remove the fabric from the loom and cut gamps apart. Machine wash, warm water, gentle, Lay flat to dry and press before completely dry.

Draft



Numbers = the number of pattern picks. Weave tabby (treadle a or treadle b) after each pattern pick. Allow 3" for fringe between gamps; hemstitch ends.

Warp color order



Originally published in *Handwoven*®, January/February 2004, p. 51.

Three little pigments *by Kim Bunke*

Nature creates spectacular effects with color. She mixes light with mist and dust to produce a rainbow, a Lake Michigan dawn, a Florida Keys sunset. She uses prisms to make spectra, sprinkling them across fields of new-fallen snow and hiding them in the mother-of-pearl lining of a seashell. Nature also mixes pigments to make glorious palettes of color. While weavers can't duplicate Nature's rainbows or sunsets, we can imitate her palettes by mixing colors with threads and dyes.

Do you know that only three basic chemicals are needed to produce the colors found in foliage and flowers? Nature squirts only chlorophyll (green), xanthein (yellow) and anthocyanin (red in the presence of acid, blue in the presence of alkali) onto her palette and mixes them sometimes with seeming care, sometimes with abandon. Some things she leaves unpainted, since white is the absence of pigment.

Herb garden colorist

I love observing Nature's color mixes in my herb garden. There are more greens than I can count, including silvery thyme, bluish chives, and golden oregano. I've watched electric purple chive blossoms fade into soft warm pinks. Blue lavender, pink lavender, and lavender lavender draw my attention with their delicate color range and wonderful scents. Nature combines colors in sophisticated ways, surrounding bright purple sage blossoms with calming gray leaves. She contains clashes of volatile reds and oranges with borders of dark green. Skilled painters and dyers use some of the same techniques, modulating an intense red with green, for example.

The color mix in the Herb Garden Stole is the result of the many hours I've spent looking at the colors in my garden, on muddy knees early in the morning, and collapsed on a garden bench at the end of the day. Warp colors range from greens (chlorophyll) through yellows (xanthein) to pinks and purples (anthocyanin). They are placed roughly in spectral order with darker values at the outside and lighter values at the inside of each threading and color-order repeat.

Weaving with fine threads

The small design scale provided by a sewing-thread warp and weft rewards the viewer who looks very closely, just as flowers reveal their amazing inner forms to those who bring their eyes in close. Weaving with sewing thread isn't as difficult as one might expect. Sewing thread is engineered to take the abuse of moving in the eye of the sewing-machine needle several times before being placed as a stitch.

Fine threads require greater care during warping. No matter what warping method you use, keep the threads under tension during beaming and handle them carefully and consistently.

If sewing thread is not for you, substitute thicker threads at an appropriate sett for twill (20/2 cotton at 40 ends per inch or 10/2 at 30 ends per inch, for example). If you enjoy fine threads and would prefer the softer drape of silk, substitute 60/2 silk for the sewing thread at the same sett. For a 4-shaft loom, substitute a favorite 4-shaft twill draft. If you choose a yarn that requires a different sett than for sewing thread, adjust the number of threading repeats to produce a fabric about 24" wide.

Fabric description

Advancing point twill and advancing straight twills.

Finished dimensions

One shawl 21½" by 68" with beaded fringe on each end.

Warp and weft

Warp: 50/3 cotton sewing thread at 14,000 yd/lb or 50/2 cotton-wrapped polyester sewing thread at 21,000 yd/lb or 60/2 silk at 15,000 yd/lb in 18 colors: 402 yd Ultraviolet 308A; 216 yd each Deep Violet 97B, Amethyst 381, Electric Violet 378, Dark Rose 32B, Violet 96, Soft Mauve 363, Shell Pink 130, Peach 161, Temple Gold 83B, Light Okra 577, Light Jade 138, Misty Spruce 331, Olive 444, Cloudy Jade 61, Blue 4, Cornflower 420; and 405 yd Sage 59. (Numbers are for Coats & Clark 50/2; colors are for 50/3.)
Weft (and thread for sewing on beads): 50/3 cotton or 50/2 cotton-wrapped polyester sewing thread or 60/2 silk, 3,228 yd Navy 13.

Notions and other materials

Handsewing needle, size 10 beading needle, beeswax, about 50 linear inches of size 11/0 purple iris seed beads (ask at the bead store for the amount to buy), 74 size 6/0 purple iris seed beads, 24 purple iris flattened oval novelty beads, 26 purple iris bugle beads.

Total warp ends 1,417 plus 2 doubled floating selvedges.

Warp length

3 yd (allows for take-up and 27" loom waste; loom waste includes fringe if you prefer twisted fringe to beading).

E.P.I. 59 epi (6/dent in a 10-dent reed, except sley the 11 ends of Ultraviolet and Sage 6-5).

Originally published in *Handwoven*®, March/April 2000, pp. 42–45.

Width in reed 24". **P.P.I.** 60.

Take-up and shrinkage 10% in width, 5% in length.

Sectional warping

Sectional warping makes warping with many colors easy if the color repeats coincide with the number of ends in each section of the sectional beam. Spools are placed on a spool rack, one spool for each end in a single section. Since my loom has 2" sections, at 59 ends per inch, I need 118 spools. I reuse commercial sewing-thread spools as warping spools.

One color repeat in the stole corresponds to one 2" section. The spools are wound so that each spool contains the number of yards equal to warp length times the number of sections used (for the stole, 3 yd warp length times 12 sections equals 36 yd/spool).

The 118 spools are placed in order on the spool rack. Each end is threaded through a tension box. One of the threads also wraps around an automatic counter so that warp length can be measured for each section.

When all ends are threaded through the tension box, the entire group is knotted and attached to an apron cord in one section of the warp beam. All 118 ends are then wound onto the section until the length of the warp in the section reaches 3 yd. (I wind the outside sections first, then move to the middle, alternating from side to side. Full spools put more drag on the warp ends, causing the first sections to be wound slightly tighter than subsequent ones. The cloth will weave better if the tighter sections are placed at the selvedges and the later, looser sections in the middle.)

Some tension boxes come with two shafts for making a threading cross at the end of the warp in each section. I plan the cross to fall halfway between the warp beam and the heddles. Here's a tip: Use a large safety pin to hold the threading cross in the ends of each section. Lift the first shaft in the tension box, insert one side of the pin, lift the other shaft, insert the other side of the pin, and close the pin.

Once a section is wound, I wrap masking tape around the 118 ends at the 3 yd point, cut them just past the tape, and poke a large-headed quilter's straight pin through the tape and the warp in the section to hold the ends in place as subsequent sections are wound. If your tension box does not have shafts, the masking tape conserves the warp ends for threading. Each end can be pulled in order from the tape.

For each new section, form a knot in the ends of the cut threads coming from the tension box, wind the section, tape, and cut. When all sections are wound, remove the straight pins, slide two dowels as long as the width of your loom through all the threading crosses, remove the safety pins, and suspend the dowels from the castle for threading. If there is no threading cross, drape the taped sections over a single suspended dowel.

If a sectional beam and spool rack are not available, you can prepare the Herb Garden warp in your usual way following the color order on page 18, cutting and tying each new color to the color before it.

Weaving

The weave structure of the stole is an advancing point twill (a series of little point twills, each starting one shaft higher than the previous one). The tie-up is for a 3/l/l/3 twill. A valuable design feature of this tie-up when used with advancing twills is that a little collapse occurs in the cloth where warp-dominant (3/1) and weft-dominant (1/3) areas meet. In the stole; the collapse accentuates the edges of the diamond motifs. It also creates a supple fabric, even in relatively stiff sewing thread.

The intended sett for the stole is 60 epi, but so that the threading order and the color order coincide conveniently with the denting order, the 11 ends of Sage and Ultraviolet are sleyed 6-5 instead of 6-6 for an actual sett of 59 epi.

To prepare the doubled floating selvedges, wind 2 ends of the adjacent color (Sage or Ultraviolet) together onto Mettler-type thread spools (the kind that have a thin rod with large flanges). Use a rubber band to stop the threads from unwinding. Sley the free end of each doubled thread in one dent, leaving an empty dent between it and the last warp end on each side. Tie to the apron rod and put a large knitting stitch holder (like a giant safety pin) through the center of the spool. Add large metal washers as weights, close the stitch holder, and let the spool hang from the warp beam. Unwrap the rubber band and let off more thread as you advance the warp during weaving. Weave the stole for about 72"; ending with a complete treadling repeat.

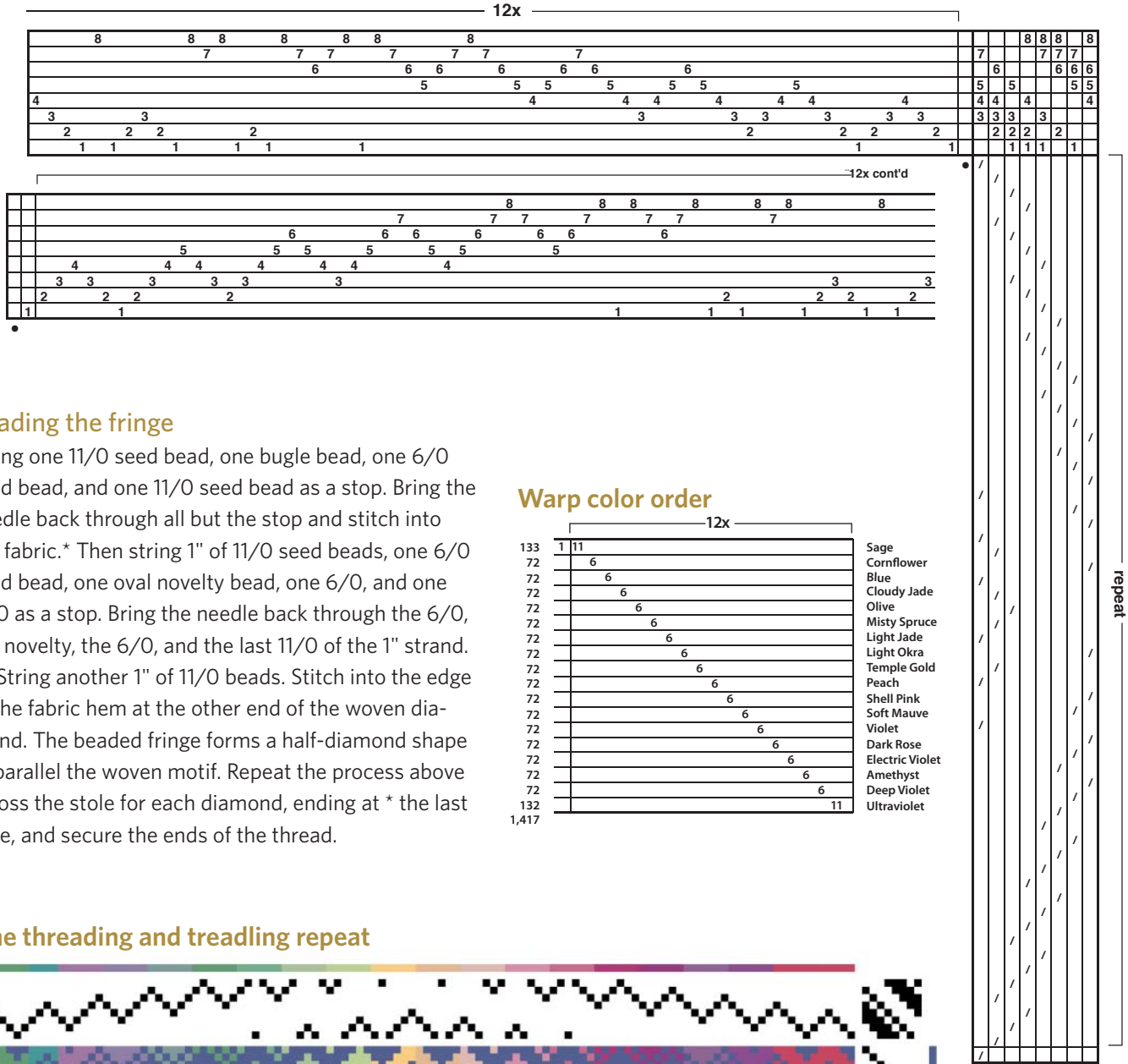
Finishing

Machine wash, warm water, delicate cycle. Interrupt the washing cycle to let fabric soak in water and Era at least one hour or preferably overnight to relax the threads. Press thoroughly with a hot iron while still damp. Hang to complete drying and press.

Turn up hems on both ends by folding along the center of the last diamond motif. Press. Then turn under half the hem allowance and press again. Invisibly handstitch the hems with Navy sewing thread.

Thread a size 10 beading needle with well-waxed Navy thread (although beads abrade sewing thread over time, it is easier to repair the beadwork than fabric torn by nylon beading thread). Stitch to anchor the thread at one selvedge (right-handers at left edge, left-handers at right edge).

Draft



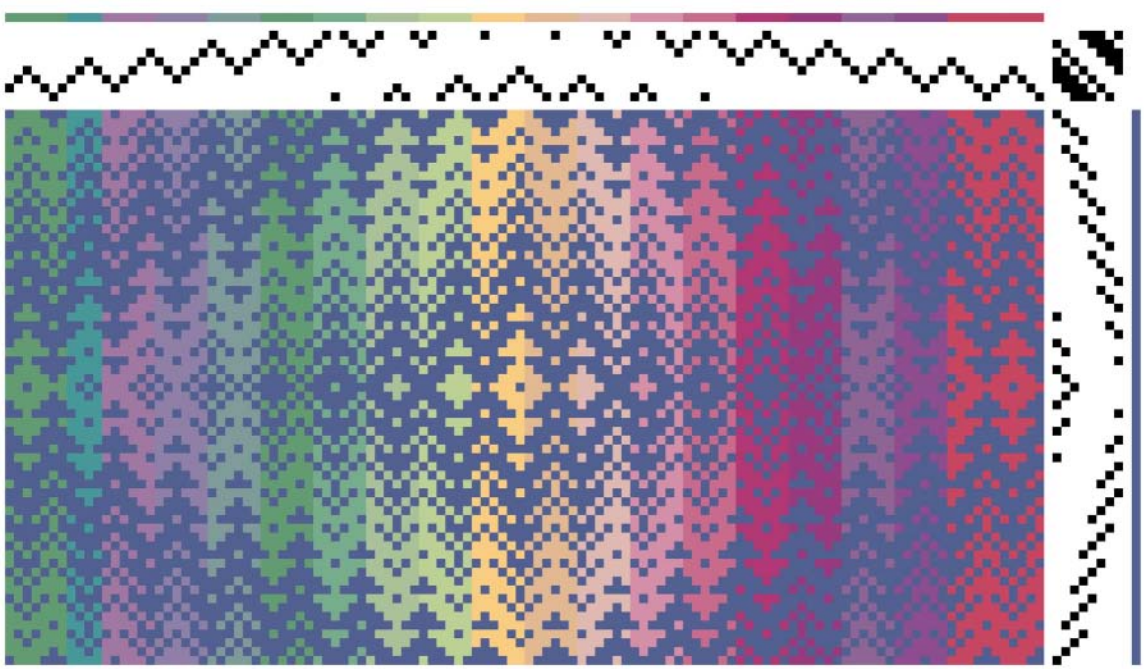
Beading the fringe

String one 11/0 seed bead, one bugle bead, one 6/0 seed bead, and one 11/0 seed bead as a stop. Bring the needle back through all but the stop and stitch into the fabric.* Then string 1" of 11/0 seed beads, one 6/0 seed bead, one oval novelty bead, one 6/0, and one 11/0 as a stop. Bring the needle back through the 6/0, the novelty, the 6/0, and the last 11/0 of the 1" strand.

String another 1" of 11/0 beads. Stitch into the edge of the fabric hem at the other end of the woven diamond. The beaded fringe forms a half-diamond shape to parallel the woven motif. Repeat the process above across the stole for each diamond, ending at * the last time, and secure the ends of the thread.

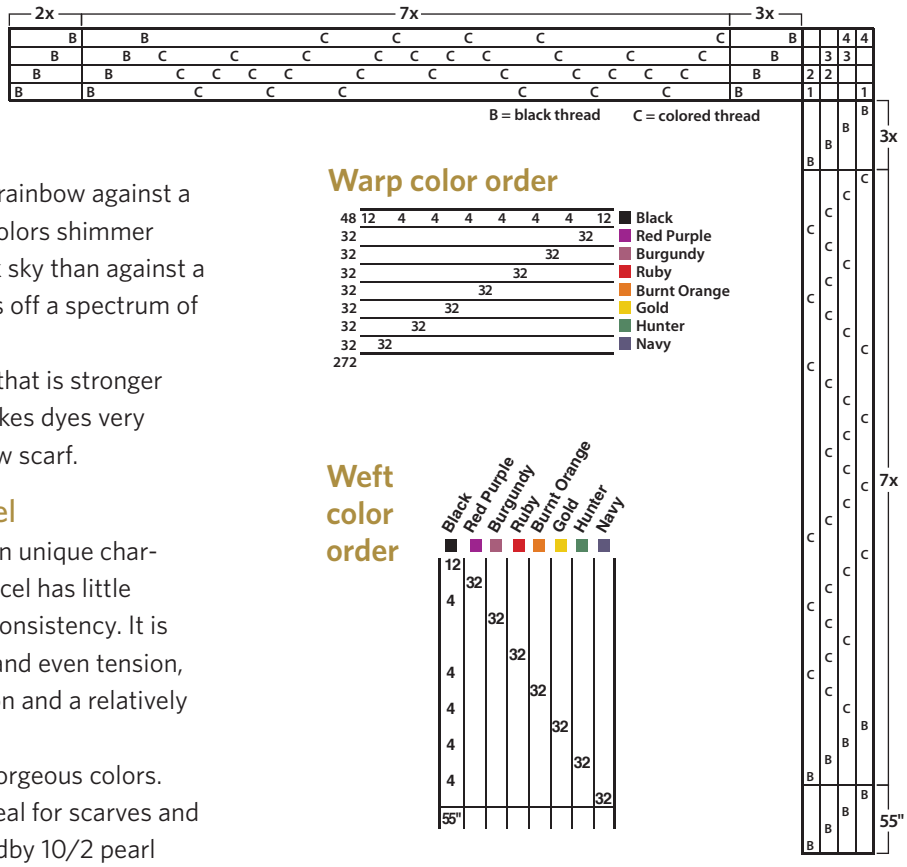
Warp color order

One threading and treadling repeat



Rainbow scarf *by Laura Fry*

Draft



Warp color order

Weft color order

Remember the last time you saw a rainbow against a background of dark clouds? The colors shimmer much more brightly against a dark sky than against a light sky. This rainbow scarf in Tencel sets off a spectrum of shimmering colors with black.

Tencel is a regenerated cellulose fiber that is stronger than cotton yet has the sheen of silk. It takes dyes very beautifully—a perfect choice for a rainbow scarf.

Weaving and designing with Tencel

As is true of every fiber, Tencel has its own unique characteristics. Although it is very strong, Tencel has little elasticity so it needs to be handled with consistency. It is also somewhat slippery. Beam with firm and even tension, weave with light to moderate warp tension and a relatively light beat, and avoid draw-in.

Tencel is available in a wide range of gorgeous colors. The 8/2 weight used for this project is ideal for scarves and shawls. Slightly heavier than our old standby 10/2 pearl cotton, it gives the fabric more body in addition to Tencel's lovely supple silkiness.

This scarf is designed like a color gamp: seven jeweltone stripes are threaded in the warp, separated by four ends of black. At one end of the scarf, the same color sequence is used for the weft; the rest of the scarf is woven in black. The colored warp and weft stripes are threaded and treadled in an M and W twill; the black weft is treadled in straight twill.

Fabric description Extended point twill.

Finished dimensions

10¼" by 62" plus 4" fringe at each end.

Warp and weft

8/2 Tencel at 3,360 yd/lb (Webs), 620 yd Black; 108 yd each of Red Purple, Burgundy, Ruby, Burnt Orange, Gold, Hunter, and Navy.

Total warp ends 272.

Warp length

3 yd (allows for take-up and 35" loom waste; loom waste includes fringe).

E.P.I. 24. **Width in reed** 11⅓". **P.P.I.** 24.

Take-up and shrinkage 10% in width, 7% in length.

Warping and weaving

Wind the warp and thread the loom following the Warp Color Order and the Draft. Unthread the last warp end on each side to use as floating selvedges.

Allowing 6" for fringe, weave the scarf following the Weft Color Order and the treadling in the Draft. Use one shuttle for the black weft, one for the colors. Instead of fastening off the black yarn after every 4 picks, carry it up one selvedge, taking the working weft around it and the floating selvedge. End with 2 or 3 picks of waste yarn to hold the weft in place until you twist the fringe.

Finishing

Remove the scarf from the loom allowing 6" for fringe. Prepare a twisted fringe at each end with two groups of 4 ends in each fringe. Wash by hand in barely warm water with a small amount of liquid Dawn. Rinse until water runs clear. Machine dry on low temperature. Steam press. Trim fringe evenly to 4".

Originally published in *Handwoven*®, January/February 2004, pp. 52–54.

Paint a rainbow *by Tracy Kaestner*

Dyeing was a process I never intended to tackle. Too much fuss, mess, and equipment! A friend finally convinced me to try warp painting, and it took only one project to get me hooked. What a joy a painted warp is to weave—new color combinations occur with each turn of the beam and toss of the shuttle. There's much less fuss, mess, and equipment than you'd think—why don't you give it a try?

Design considerations

Painting gives you more freedom and flexibility than immersion dyeing. You can choose and place different colors along the length and across the width of the warp. Before you start, consider the effect you want to achieve. Are you looking for bold blocks of color, the shading of ikat, or the muted colors of Monet's water lilies?

Different effects can be achieved by different painting styles. Paint stripes for an ikat look. Imitate Monet by using small flowing bits of color followed by an allover color wash. With each warp you paint, more intriguing possibilities will occur to you.

For the shawl, large "flowers," each about 5" wide, are painted on twelve warp chains (the chains shown on page 24 are not the ones used for the shawl). Since the threads are close together for painting, the flowers become much larger (about 12" wide) and more abstract when the warp is spread on the loom.

Choosing colors

Choosing colors from rows of cones or samples on color cards can be intimidating. Choosing among the infinite colors that can be mixed with dyes is even more daunting. One of the best ways to get inspiration for color combinations is from nature. A flower rarely consists of only one color and can reveal interesting combinations you might not think of otherwise. Take photos of special blossoms and pick and press flowers throughout the year. Take scenic photographs when traveling. A weaving can be a wonderful way to remember a trip. Famous paintings are another source for color inspiration. Check out books from the library with paintings by favorite artists. Many museums sell postcards and calendars of great works.

Pick a bright or light accent color to add zip to your pieces. My favorite accent colors are teal, mustard, and melon. Use them sparingly!

Choosing a weave structure

To show off beautiful colors to their best advantage, choose a weave structure that provides warp floats as long as the intended fabric use will allow. Twills are a good choice, providing relatively long floats, a soft drape, and a stable interlacement. Be careful not to choose a design so busy that it competes with the mix of colors. Sett the warp slightly closer than for a 50/50 weave to emphasize the warp colors.

Choosing the weft

It's tempting to use a commercially dyed yarn for the weft, but painting the weft is quick and easy and allows you to pick exactly the colors you want. Remember that painted weft colors do not line up with each other in the woven cloth the way painted warp colors do. The weft will appear in the fabric as a blend of its painted colors. In the shawl, the painted warp shows in the 3/1 (warp) twill blocks. The weft shows a subtler mix of colors in the 1/3 (weft) twill blocks (dark blue-gray in the detail photo).

If the weft yarn is purchased in skeins, use the skeins for painting. Otherwise, wind the yarn into skeins. I use two different methods for painting weft skeins, depending on the effect I want.

Method 1 When I want specific weft colors to interact with the warp colors, I paint horizontal stripes of color as in the photo of the weft skein, page 24. Use accent colors sparingly as dots or small stripes so as not to overpower the warp.

Method 2 For a weft that blends more with the warp, I use the "baggie" method: Paint the skein with spots of the accent colors, pour the other dyes used for the warp into a large baggie, put the skein in the baggie, and squeeze the dye into the skein until the color runs clear. If you're dyeing more than one skein, make sure you reserve enough dye to do all skeins similarly.

Originally published in *Handwoven*®, March/April 2000, pp. 58–61.

Fabric description for shawl Turned twill (twill blocks).

Finished dimensions 20¾" by 67½" with 6" fringe.

Warp and weft

20/2 silk at 5,000 yd/lb (Treenway Silks), 4,500 yd natural (or choose from their colors instead of dyeing yarn!).

Total warp ends 730 (includes 2 floating selvedges).

Warp length 3½ yd (allows for take-up and 40" loom waste; loom waste includes fringe).

E.P.I. 30. **Width in reed** 24⅓". **P.P.I.** 26.

Take-up and shrinkage 14% in width, 12% in length.

Painting the warp and weft

Wind warp chains with a limited number of ends so that the dyes can penetrate thoroughly. A general rule of thumb is to wind chains for a warp width of 2" or less. Add a few extra threads for floating selvedges and to use in case of broken warp threads. Tie the chains tightly at the top and bottom and snugly at the cross; make a loose tie about once every yard. To keep the chains in order, number them with a ballpoint pen on waterproof first-aid tape. Wind the weft into skeins.

Lanaset/Telana dyes (also called Sabraset) are heat-set, acid-based dyes for silk and protein fibers. These dyes give bright jewel-tone colors and they exhaust well: very little dye is left to be washed out. Colors are usually mixed from 1% stock solutions: 1 gram of dye per 100 milliliters of distilled water (except for black, which needs to be a 4% solution). I mix one liter stock solution of each color at a time and store them in a cool, dark cabinet. They can be used for at least six months.

The dyes come in powder form. To make stock solutions, use an accurate scale and measure the powder into a cup-cake paper (discard later). Always wear a mask and gloves when weighing; dye powder is toxic. Add a small amount of boiling water to the powder; stir into a paste. Add the remaining boiling water; stir until well mixed.

Two chemicals are added to the stock solutions to activate the dyes for painting: sodium acetate (⅛ tsp per 100 ml stock solution) and 56% acetic acid (1 ml per 100 ml stock solution). Once activated, the dyes are good for about 6 hours.

Remember, everything you use for dyeing should be dye-dedicated forever (gloves, apron, pots, spoons, scale etc.).

The following nine Lanaset dye colors and Black allow almost any color to be mixed: Yellow (mixing primary), Gold, Scarlet, Red (mixing primary), Bordeaux (Magenta), Violet, Blue/Royal (mixing primary), Navy, and Turquoise. I use large syringes to measure liquid dyes for mixing colors.

Dye procedure for the shawl

Colors are mixed in percentages. Keep a record of each dye session so you can mix the same colors again.

Step 1 Wind 740 ends (10 are extra) in 12 chains of about 62 ends each and number them. Wind the weft into skeins.

Step 2 Wet fiber in warm water and Orvus Paste for 30 minutes or until completely wet.

Step 3 Lay out plastic wrap on a table. Align warp chains close together in numerical order on the plastic wrap.

Step 4 Activate dyes using sodium acetate and acetic acid. The colors are very bright if used as is; to dilute, add chemical water (distilled water mixed with sodium acetate and acetic acid in same proportion as for dyes).

Step 5 Test colors by painting on the ends of the warp. I use Japanese gradation brushes; stencil brushes also work well.

Step 6 Paint the warp. Saturate all threads; flip the chains over to double check. I painted large flowers spanning two or three chains. Some of the flowers are crimson and melon, some are purple and teal; the centers are mustard and yellow. The flowers are connected with wavy vines of light yellow-green. The background is indigo purple, indigo blue, and cornflower.

Step 7 Roll the warp up in the plastic wrap.

Step 8 Follow the above for the weft skeins.

Step 9 Steam, covered, for 15-20 minutes. Begin timing when there is a full head of steam. (I place an aluminum pan with holes in the bottom upside down in a canning pot.) Keep the bundles from touching the sides of the pot so as not to melt the plastic wrap to the silk.

Step 10 Allow the bundles to cool. Re-chain the warps to prevent tangling. Wash in warm water with small amount of Orvus Paste. Rinse in cool water until water runs clear.

Step 11 Hang to dry.

Warping and weaving

When the yarns are dry, warp the loom following the Draft. Allowing 10" for fringe, weave a header with scrap yarn and hemstitch (6 ends per group). Follow the treadling in the Draft; for 72"; end with treadles 1-2-3-4 six times; hemstitch.

Finishing

Remove the fabric from the loom and prepare a twisted fringe: Twist two groups of six ends in one direction tightly; then twist them together in the opposite direction and secure ends with an overhand knot.

Machine wash in warm water, delicate cycle, with Orvus Paste; machine dry, light air. Press with a hot iron. Beat finished shawl on edge of counter or table to revive silk luster.

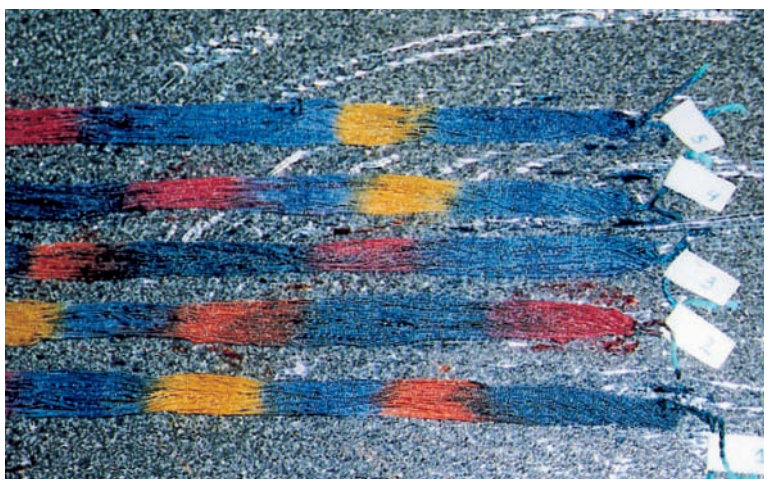
Draft

Supplies for painting: scale, mask, gloves, jars, brushes, dyes, chemicals, syringes.

The warp is spread on plastic in 2" diameter chains for painting.

Weft skeins can also be painted to coordinate with warp colors.

The warp chains and the weft skeins are rolled up in plastic and steamed (covered).



Warp chains are tagged and numbered so they can be placed on the loom in the same order in which they are painted.

Dye colors for the shawl

Indigo blue
90% Navy, 10% Black

Indigo purple
70% Turquoise, 30% Scarlet

Crimson
85% Red, 15% Violet

Purple
80% Violet, 20% Red

Mustard
90% Gold, 10% purple (as mixed)

Yellow
100% Yellow

Teal
85% Turquoise, 15% Yellow

Melon
90% Scarlet, 10% Gold

Yellow-green
90% Gold, 10% Royal

Cornflower blue
85% Royal, 15% Magenta

Resources

PRO Chemical & Dye (dyes, dye chemicals, scales, containers, gloves, masks, etc., 800-2-BUY-DYE).
John Marshall for Japanese gradation brushes, (510) 533-8056.
Orvus Paste and syringes can be purchased at feed stores.

Shadow-weave table runner *by Sarah Saulson*

Shadow-weave patterns remind me of the glorious Kente cloths of Ghana. To make Kente cloth, narrow strips are woven—usually in bright green, gold, red, blue, and black yarns. In each strip, sections of warp-faced patterning alternate with sections of weft-faced patterning. When the strips are sewn together, they create a joyful patchwork of colorful squares. A similar effect can be achieved with shadow-weave—and with no strips to sew!

Shadow weave is an extension of log cabin. Dark and light colors alternate in both the warp and the weft. In log cabin, the designs are made of alternating rectangles of vertical and horizontal pinstripes. In shadow weave, other shapes, such as diamonds and triangles, can be combined with rectangles and squares in endless ways. The design potential for shadow weave on eight shafts is truly astounding!

In this runner, four different shadow-weave threadings (A, B, C, D; see page 27) are used with four different dark/light color combinations:
Threading A: blue/black
Threading B: yellow/black
Threading C: red/black
Threading A: yellow/black
Threading B: green/black
Threading C: yellow/black
Threading D: blue/black.

The ABC threading orders are used as treadling orders (D did not produce interesting designs) with the same color combinations; study the Threading and Treadling Sections on page 27. The patchwork effect of the squares is a result of making sure that no two identical colors or threadings appear next to each other.

Shadow weave

Examine the threading in the Draft on page 27. In each threading section (A, B, C, and D), dark and light threads alternate. Where two sections meet, 2 dark ends are threaded in succession—each section begins and ends with a dark (black) thread (providing a dark frame for each section). Notice also that odd and even shafts always alternate in the threading—essential for producing the basic plain-weave structure of shadow weave.

The same principles apply to the treadling. Dark and light threads alternate, 2 dark picks are woven in succession where two sections meet, and odd treadles always alternate with even treadles.

Fabric description Shadow weave.

Finished dimensions 17¾" by 47".

Warp and weft

Warp: 8/2 unmercerized cotton at 3,360 yd/lb (Webs), 620 yd Black #8990; 85 yd Lollipop #3599; 258 yd Spectra Yellow #1382; 88 yd Stone Green #5468 ; 173 yd Mediterranean Blue #2448.
Weft: 8/2 unmercerized cotton, 450 yd Black #8990; 67 yd Lollipop #3599; 200 yd Spectra Yellow #1382; 67 yd Stone Green #5468; 90 yd Mediterranean Blue #2448). Small amount black 20/2 cotton at 8,400 yd/lb or sewing thread for hems.

Total warp ends 489.

Warp length

2½ yd (allows for take-up and 27" loom waste).

E.P.I. 23⅔. (sley black 1/dent in a 12-dent reed; sley colors 1/dent with the black but skip 1 dent between colors; 1 black is sleyed alone at color changes).

Width in reed 20⅔".

P.P.I. 20.

Take-up and shrinkage

14% in width and length.

Warping

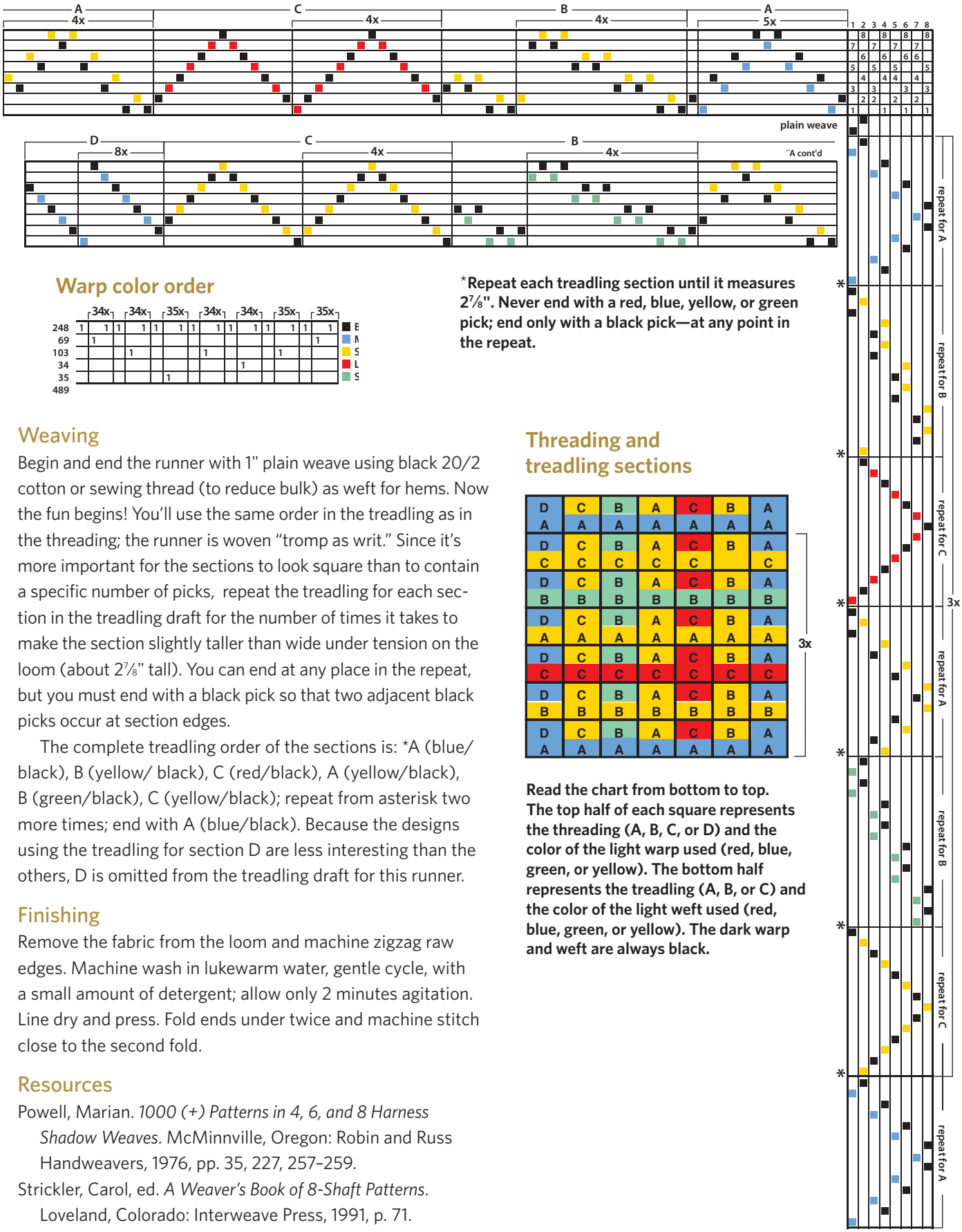
You can use your favorite warping method for the runner, but directions here are for warping front to back:
Wind two warp chains, one with 248 black ends and the other with 35 blue, 35 yellow, 34 red, 34 yellow, 35 green, 34 yellow, 34 blue.

Sley the black chain first, 1/dent, centering for 20⅔". Then, starting at the right, sley the colors 1/dent in the same dents as the black threads except skip a dent after each color (leaving 1 black end in a dent by itself) until all ends are sleyed.

Allow plenty of time for threading the heddles, make sure you have good light, and take breaks. The threading order is a bit complicated, and it changes with each section. When you reach the single black thread that signals a threading change, go back and very carefully check the section you have just completed before continuing.

Originally published in *Handwoven*®, January/February 2004, pp. 40–43.

Draft



Warp color order

*Repeat each treadling section until it measures 2⅞". Never end with a red, blue, yellow, or green pick; end only with a black pick—at any point in the repeat.

Weaving

Begin and end the runner with 1" plain weave using black 20/2 cotton or sewing thread (to reduce bulk) as weft for hems. Now the fun begins! You'll use the same order in the treadling as in the threading; the runner is woven "tromp as writ." Since it's more important for the sections to look square than to contain a specific number of picks, repeat the treadling for each section in the treadling draft for the number of times it takes to make the section slightly taller than wide under tension on the loom (about 2⅞" tall). You can end at any place in the repeat, but you must end with a black pick so that two adjacent black picks occur at section edges.

The complete treadling order of the sections is: *A (blue/black), B (yellow/ black), C (red/black), A (yellow/black), B (green/black), C (yellow/black); repeat from asterisk two more times; end with A (blue/black). Because the designs using the treadling for section D are less interesting than the others, D is omitted from the treadling draft for this runner.

Finishing

Remove the fabric from the loom and machine zigzag raw edges. Machine wash in lukewarm water, gentle cycle, with a small amount of detergent; allow only 2 minutes agitation. Line dry and press. Fold ends under twice and machine stitch close to the second fold.

Threading and treadling sections

Read the chart from bottom to top. The top half of each square represents the threading (A, B, C, or D) and the color of the light warp used (red, blue, green, or yellow). The bottom half represents the treadling (A, B, or C) and the color of the light weft used (red, blue, green, or yellow). The dark warp and weft are always black.

Resources

Powell, Marian. *1000 (+) Patterns in 4, 6, and 8 Harness Shadow Weaves*. McMinnville, Oregon: Robin and Russ Handweavers, 1976, pp. 35, 227, 257–259.

Strickler, Carol, ed. *A Weaver's Book of 8-Shaft Patterns*. Loveland, Colorado: Interweave Press, 1991, p. 71.

Color with overshot blocks *by Patricia Palson*

The draft for this shawl came from an old coverlet. White gloves on my hands and my first child beside me on the floor (on a handwoven blanket, of course!), I counted the threads and determined the draft as part of a study of historical textiles.

As a result of my research, I fell in love with the rich complexity of overshot designs and began weaving overshot pillow tops and shawls. In order to weave more than one project on the same warp (especially since overshot is time-consuming to thread!), I first experimented with using different pattern-weft colors for each new item, then played with changing the colors of both the pattern and tabby wefts within each.

One warp can therefore supply many different-looking articles—and using a variety of colors within a single one creates a very contemporary, noncoverlet-like appearance.

Color considerations

When you are making color choices, remember these two basic principles: complementary colors (across from each other on the color wheel) tend to vibrate. Analogous colors almost always work well together.

The predominant pattern wefts in this piece are Jagger-Spun's Copper (a grayed yellow-orange) and Cinnabar (a grayed red-orange). They are analogous colors and are of similar value.

When you are weaving overshot with two or more pattern-weft colors, for the design to be easy to read it is important that the colors be close in value and intensity. If one color is much stronger than the other, its sections will pop out as horizontal bands, and the overshot pattern will be more difficult to discern. Circles can become blocks of dots; tables can become sets of stripes.

Black is an ideal color for an overshot warp and tabby weft. Black intensifies the pattern-weft colors—it makes them glow. Since it also was not used in historical textiles, it also tends to give a contemporary look.

Add accent colors for an element of surprise. From a distance, the Copper and Cinnabar floats glow on the dark background to give the viewer an impression of warm bronze blends.

As you come closer, you begin to notice the action in the table of diamonds. In some of the large blocks in the centers of the diamonds, the soft red Cinnabar is exchanged for Real Red, a hotter and more intense color. As you come even closer, you notice the purple tabby weft that causes the hot red to vibrate in some of the large diamond blocks. These unexpected accents draw your eye to the diamond area and add interest to the shawl.

When you're varying tabby-weft colors, select values similar to those of the warp yarn. The purple in this shawl is almost as dark as the black. If a color is too light or too bright, it will pop out and overpower the pattern-weft color.

Other considerations

Borders are an important element in an overshot design. If a pattern is simply repeated from side to side and top to bottom, the piece begins to look like yardage. Borders say, "Okay, this is the beginning and this is the end" and provide an essential visual frame that says "I'm Art."

Wool/silk is a soft and lovely fiber, ideally suited to scarves and shawls. As a pattern weft, it is lofty enough to cover the ground cloth yet it compresses sufficiently between tabby wefts. To form a matte background to the wool/silk (yet give the fabric a supple hand), this warp is black unmercerized cotton, and the black and purple tabby wefts are 18/2 merino.

Fabric description Overshot.

Finished dimensions

17¾" by 70½" plus fringe at each end.

Warp and weft

Warp: 16/2 unmercerized cotton at 6,720 yd/lb, 1,350 yd black.
Tabby weft: 18/2 JaggerSpun Superfine Merino at 5,040 yd/lb, 680 yd Black, 160 yd Iris.
Pattern weft: 18/2 JaggerSpun Zephyr wool/silk at 5,040 yd/lb, 350 yd Cinnabar, 408 yd Copper, 20 yd Iris, 60 yd Red.

Total warp ends

450 ends (includes 2 floating selvedges).

Warp length

3 yd (allows for take-up, 27" loom waste; loom waste includes fringe). Add 2½ yd for each additional shawl.

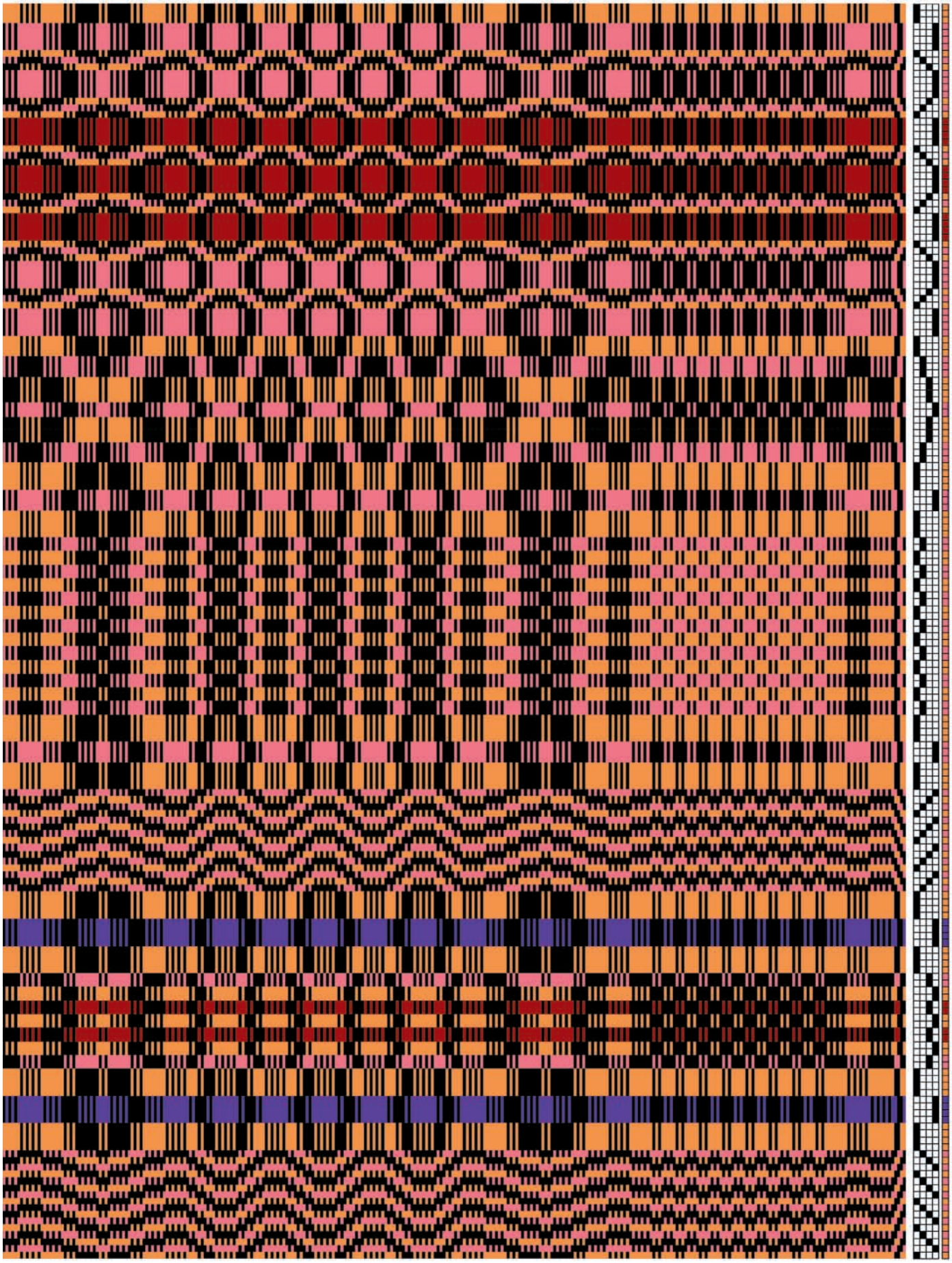
E.P.I. 24.

Width in reed 18¾".

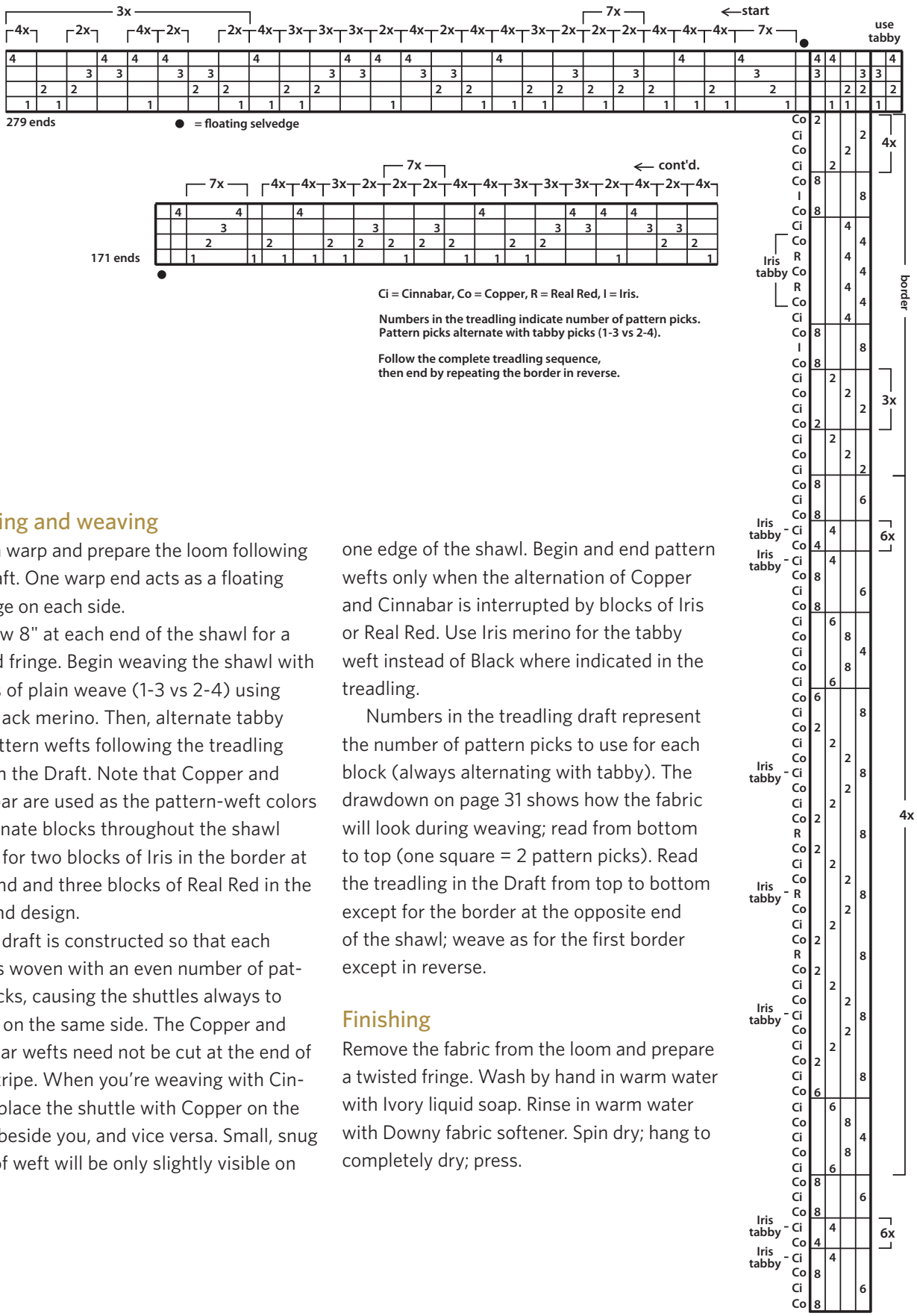
P.P.I. 36 (18 ppi tabby weft, 18 ppi pattern weft).

Take-up and shrinkage 7% in width and length.

Originally published in *Handwoven*®, May/June 2000, pp. 48–51.



Draft



Warping and weaving

Wind a warp and prepare the loom following the Draft. One warp end acts as a floating selvedge on each side.

Allow 8" at each end of the shawl for a twisted fringe. Begin weaving the shawl with 4 picks of plain weave (1-3 vs 2-4) using 18/2 black merino. Then, alternate tabby and pattern wefts following the treadling order in the Draft. Note that Copper and Cinnabar are used as the pattern-weft colors in alternate blocks throughout the shawl except for two blocks of Iris in the border at each end and three blocks of Real Red in the diamond design.

The draft is constructed so that each block is woven with an even number of pattern picks, causing the shuttles always to end up on the same side. The Copper and Cinnabar wefts need not be cut at the end of each stripe. When you're weaving with Cinnabar, place the shuttle with Copper on the bench beside you, and vice versa. Small, snug loops of weft will be only slightly visible on one edge of the shawl. Begin and end pattern wefts only when the alternation of Copper and Cinnabar is interrupted by blocks of Iris or Real Red. Use Iris merino for the tabby weft instead of Black where indicated in the treadling.

Numbers in the treadling draft represent the number of pattern picks to use for each block (always alternating with tabby). The drawdown on page 31 shows how the fabric will look during weaving; read from bottom to top (one square = 2 pattern picks). Read the treadling in the Draft from top to bottom except for the border at the opposite end of the shawl; weave as for the first border except in reverse.

Finishing

Remove the fabric from the loom and prepare a twisted fringe. Wash by hand in warm water with Ivory liquid soap. Rinse in warm water with Downy fabric softener. Spin dry; hang to completely dry; press.

The magic of iridescence *by Bobbie Irwin*

As a child I loved visiting fabric stores and fingering the taffetas that changed color depending on the light and the angle of view. I decided to study this phenomenon in handwoven fabrics. I was surprised to find few references in handweaving literature. One source says iridescence can "just happen," a concept my scientific nature rejects. Most suggest using very fine, shiny threads in a balanced plain weave, with one bright color in the warp and another of the same value (degree of lightness or darkness) in the weft. The hues should be complements—across from each other on a color wheel.

The iridescent commercial fabrics that abound today suggest there are other possibilities to explore. These fabrics vary from sheer plain weaves to velvets and jacquards. Many use the same color combinations: blue or purple with yellow or yellow green; pink or red with green. Some use unusual combinations such as brown velvet pile with a blue ground or brilliant gold with a smoky gray. Few of them use colors that are true complements.

To study the effects of crossing different warp and weft colors, tints, shades, and tones, I wove seven color gamps in plain weave (see the photo bottom right of page 34). Unfortunately, because iridescence requires reflected light and movement, the effects aren't so visible in print.

Iridescence in nature

Iridescence in nature, such as the rainbow sheen from an oil slick or the apparent color shift in a feather, is a function of light refracting from within what might otherwise be a colorless or monochromatic substance. Iridescence in fabric results from the way your eye processes two or more colors. Instead of blending together, the colors seem to vibrate, producing dominant zones of one or the other color that shift with the light.

The good news is that a handweaver can achieve iridescence in many ways—there isn't only one magical hue that works with another to produce iridescence; a range of colors and values can be successful.

In addition to the brilliant, eye-dazzling effects of the colors that work best, there is a gradation, a sort of partial iridescence, that happens in almost every case in which the eye sees one dominant color and smaller amounts of a second color in a fabric at the same time.

Lessons from the color gamps

Each of the color gamps in the photo at bottom right of page 34 uses a different set of six to eight related warp colors, one in a range of blues, another in greens, another in violets, another in yellows, etc. Weft colors not only include the complements of the warp colors, but also a wider range of hues in both light and dark values. (The combination of warp and weft colors that shows the most striking iridescence in the gamps is turquoise and red!) To enjoy some of the effects, weave the napkins shown here and watch the colors shimmer on your loom.

Fabric description Broken twill (crepe).

Finished dimensions Six hemmed napkins 20" by 20" each.

Warp and weft

10/2 pearl cotton at 4,200 yd/lb (UKI), 1,340 yd Light Rust; 1,110 yd Avocado; 1,330 yd Dark Turk; 1,440 yd Magenta.

Total warp ends 554.

Warp length

5 yd (allows for take-up and 24" loom waste.

E.P.I. 24. **Width in reed** 23 1/10". **P.P.I.** 24.

Take-up and shrinkage 13% in width and length.

One Too Many Margaritas napkins

I chose this project name because you might think I had too many margaritas when I selected the colors! Actually, I chose them because they all produce iridescence when crossed with each other. The napkins are woven in a crepe weave, a variation of broken point twill.

Crepe weaves and iridescence are an appealing partnership: color that comes and goes combined with pattern that appears and disappears. The pattern is often difficult to see while you're weaving but is more evident when viewed at a low angle. It becomes more distinct when the fabric is washed.

Weaving

Warp the loom following the Draft and the Warp Color Order and weave each napkin following the treadling and the Weft Color Order. Make sure picks per inch equal ends per inch (you'll weave large 5" squares with 1" stripes in between). Begin and end each napkin with ¾" hems (Light Rust and then Magenta) alternating treadles 1 and 4. Separate napkins with 2 picks of a contrasting color.

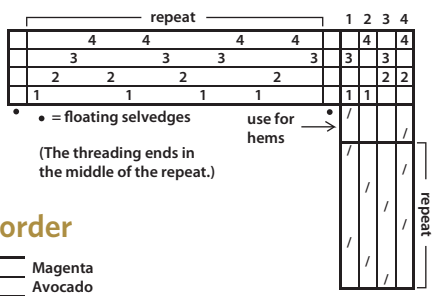
Finishing

Remove the fabric from the loom and machine zigzag raw ends. Machine wash in warm water, mild detergent. Machine dry, normal setting. Cut napkins apart, turn ends under twice, and press; sew hems by hand or machine.

One Too Many Margaritas napkins

Color gamps to test for iridescence

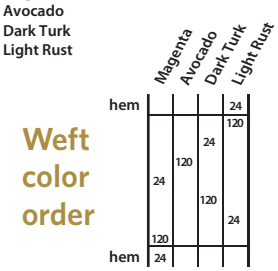
Draft



Warp color order

145	121	24	Magenta
120		120	Avocado
144	120	24	Dark Turk
145	24	121	Light Rust
554			

Weft color order



Originally published in *Handwoven*®, January/February 2004, pp. 68–71.

Color-wheel clock *by John Janson*

My love for weaving is almost equalled by my love for fine woodworking. It has always struck me that there is a similarity between a color wheel and a clock—so why not join the two? Once this idea was born, it grew! The result (a lo-o-ong time later) is a clock face with pie-shaped fabric sections for the hours. Each hour is woven in a different color of the color wheel and also uses a different overshot pattern from *Miniature Overshot Patterns* by Josephine Estes (see Resources).

Clock and background fabrics

The warp and tabby weft for the clock-face fabrics are 40/2 pearl cotton (a special order from the Lunatic Fringe); the pattern weft is doubled 40/2. For each section of the wheel, I threaded 300 ends 48" long at 50 epi for a 6" weaving width—enough to make two pie-shaped pieces (for two clocks). The same colors are used for the pattern weft as for the warp and tabby weft in the clock fabrics, so the patterns are subtle and can be seen only when you are close to the clock. To practice weaving them to square, I sampled first with a white pattern weft. These samples are shown at right with pattern names and page numbers from *Miniature Overshot Patterns*.

The white background fabric is woven in an advancing twill sometimes called Swedish Snowflake; see Resources. I threaded 1,110 ends at 66½ ends per inch (16" wide) 2 yd long and wove with about the same number of picks per inch.

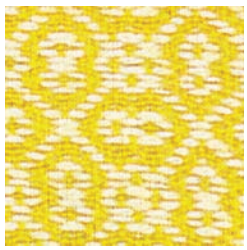
Design ideas

Warping the loom with 300 ends twelve times sounds like a big job (and making clocks isn't for every weaver!), but it is a lot of fun to see twelve different designs develop in twelve different colors. Instead of using such fine threads as 40/2, try miniature overshot in 20/2 pearl cotton for quilt blocks or in 10/2 pearl cotton for sets of towels, napkins, or placemats. Living with a variety of color and design examples (instead of stashing them in a drawer) will inspire you with new ideas for new combinations.

Resources

van der Hoogt, Madelyn. "Back to Basics: Twill Thrills, an Introduction." *Handwoven*, March/April 2001, pp. 22–25 (source for the "snowflake" twill draft).

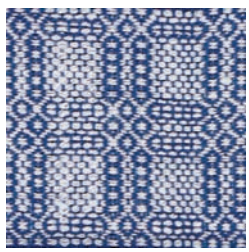
Mitchell, Peter, and Marjie Thompson, ed. *Josephine Estes' Miniature Overshot Patterns for Hand Weaving*. Saunderstown, Rhode Island: The Weavers Guild of Boston, 1994, reprinted from the 1956 edition (source for the drafts for the samples shown here and the 12 clock fabrics).



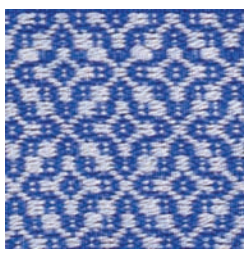
Rambler Rose
page 2
#5 Yellow

Dimes and Dollars
page 12
#5 Green Yellow

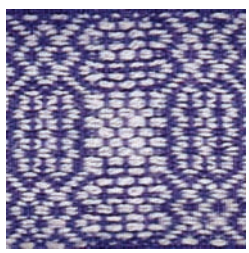
Orange Peel
page 26
#10 Green



Susan Ross
page 24
#10 Blue Green

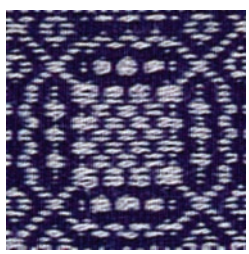


Periwinkle
page 10
#10 Blue



Double Cones
page 16
#5 Purple Blue

Whig Rose
page 19
#10 Purple Blue



Martha Washington
page 20
#5 Purple

Tile
page 6
#10 Purple

Chariot Wheel
page 15
#5 Red Purple

Star of Bethlehem
page 28
#5 Red

Single Snowball
page 17
#5 Yellow Red

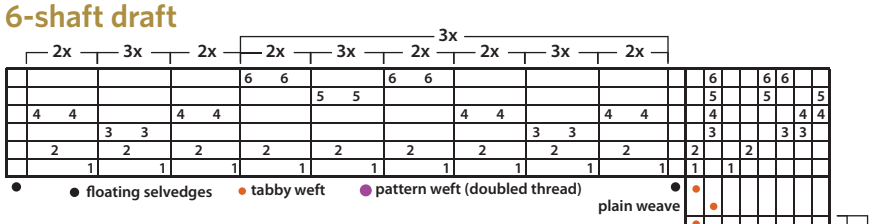
Originally published in *Handwoven*®, January/February 2004, pp. 46–47.

Color in summer and winter

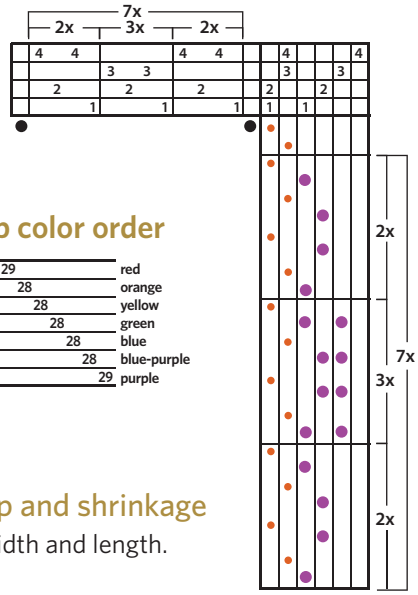
by Anne Dixon

These samples are woven in 20/2 cotton to fit in a study notebook. If you use 10/2 cotton at 24 ends per inch, they will be 8½" wide. You can add to the number of repeats for bigger pieces. In the 4-shaft version, all the frames and centers of the squares will have the same pattern/background configuration instead of alternating as in the 6-shaft samples in the photo.

6-shaft draft



4-shaft draft



Fabric description

Summer and winter.

Finished dimensions

Twelve hemmed samples 6" by 8" each.

Warp and weft

Warp: 20/2 pearl cotton at 8,400 yd/lb, 116 yd each of purple and red; 112 yd each of orange, yellow, green, blue, and blue-purple.

Tabby weft: 20/2 pearl cotton, about 80 yd each of the same colors as in the warp plus black and white. Pattern weft: 20/2 cotton used doubled, about 130 yd of the same colors as warp plus black and white.

Total warp ends

198 (includes 2 floating selvedges).

Warp length

4 yd (allows for take-up and 27" loom waste).

E.P.I. 32. **Width in reed** 6⅜".

P.P.I. 50 (25 tabby, 25 pattern).

Warp color order

29	29	red
28	28	orange
28	28	yellow
28	28	green
28	28	blue
28	28	blue-purple
29	29	purple
198		

Take-up and shrinkage

6% in width and length.

Weaving

Warp the loom and weave the samples following the Warp Color Order and selected draft. Use the colors as listed in Weft Color Orders. Begin and end each sample with 1" plain weave for hems.

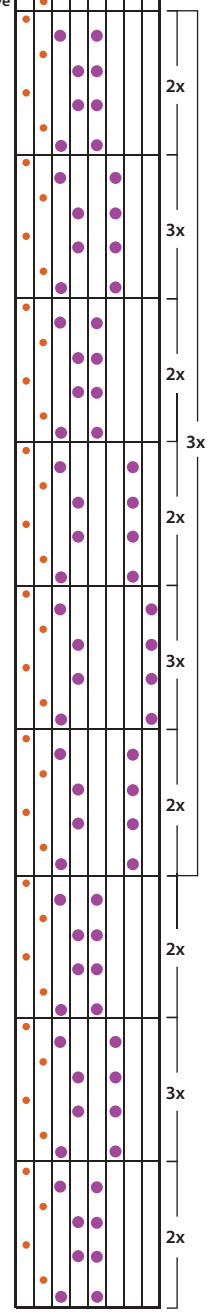
Finishing

Remove the samples and cut apart. Machine zigzag raw edges, turn edges under twice, and sew hems by hand or machine.

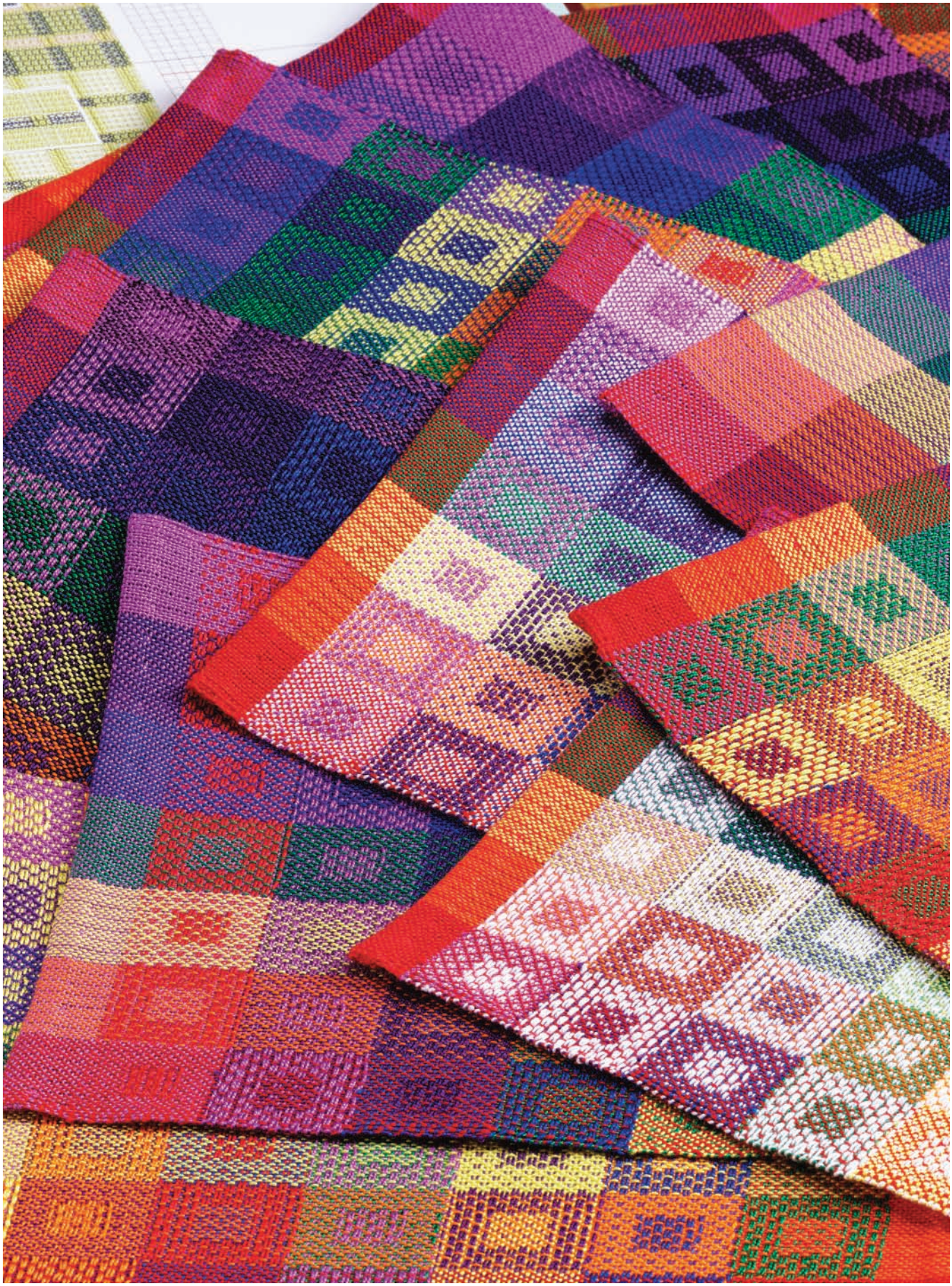
Weft color orders

The tabby weft in Samples 2–10 uses the same color order and number of picks as in the warp. Use a doubled strand of warp yarn as pattern weft. For Samples 1–12, weave :

1. Plain weave (Use 20/2 only following warp color order).
2. Use the same pattern-weft colors/order as for the tabby weft.
3. Start pattern weft with second color (orange) followed by the others.
4. Start pattern weft with third color (yellow) followed by the others.
5. Start pattern weft with fourth color (green) followed by the others.
6. Start pattern weft with fifth color (blue) followed by the others.
7. Start pattern weft with sixth color (blue-purple) followed by the others.
8. Start pattern weft with seventh color (purple) followed by the others.
9. Use black pattern weft
10. Use white pattern weft.
11. Use black tabby, pattern weft as in Sample 2.
12. Use white tabby, pattern weft as in Sample 2.



For two weft marks in the same row, step on both treadles together.



Originally published in *Handwoven*®, May/June 2010, pp. 38–39.

Minuet in color *by Tracy Kaestner*

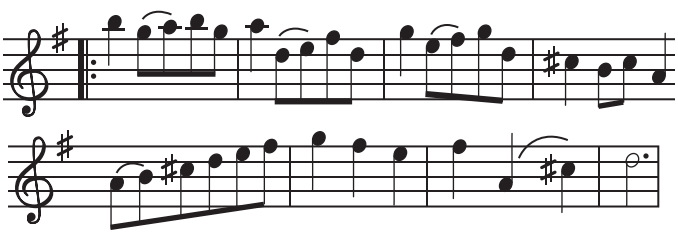
Most new weavers are struck by the similarities between threading drafts and musical scores. When my son took up the violin, and sheet music became part of our lives, the similarities caught my attention again. Then my son requested a weaving based on Minuet 3 by Johann Sebastian Bach. Transposing the notes directly from the score into a threading draft seems the most logical way to begin, but when I've tried this, the results have been too busy and have required extensive adjustments to provide a stable cloth. Associating musical notes with colors rather than shafts has been much more successful for me!

Minuet 3 uses nine colors from around the color wheel (color names are from Lunatic Fringe's Tubular Spectrum). Red is designated to represent the lowest note, Purple Blue the highest. All notes are assigned 11 ends each except for the dotted half note, which is assigned 33 ends (the Green Yellow stripe at one edge), and the note played twice in succession, which is assigned 22 ends (the Red stripe near the center).

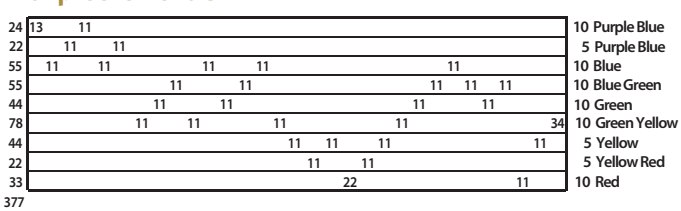
Fabric description
Extended point twill.

Finished dimensions
One hemmed runner 13⅝" by 42" and two hemmed mats 13⅝" by 13½" each.

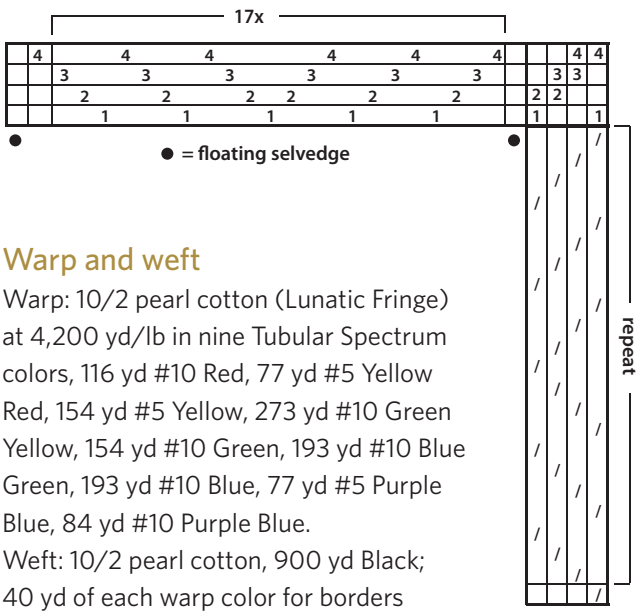
Minuet 3 (eight measures)



Warp color order



Draft



Warp and weft
Warp: 10/2 pearl cotton (Lunatic Fringe) at 4,200 yd/lb in nine Tubular Spectrum colors, 116 yd #10 Red, 77 yd #5 Yellow Red, 154 yd #5 Yellow, 273 yd #10 Green Yellow, 154 yd #10 Green, 193 yd #10 Blue Green, 193 yd #10 Blue, 77 yd #5 Purple Blue, 84 yd #10 Purple Blue.
Weft: 10/2 pearl cotton, 900 yd Black; 40 yd of each warp color for borders (30 total stripes).

Notions
Matching sewing thread.

Total warp ends
377.

Warp length
3½ yd (allows for take-up and 35" loom waste).

E.P.I. 24. Width in reed 15⅞". P.P.I. 28.

Take-up and shrinkage
13% in width, 15% in length.

Weaving
Wind a warp and thread the shafts following the Warp Color order and the Draft. Weave the runner following the Draft: 1¼" with Black weft for first hem, 3½" for a border of five stripes of 11 picks of a selected warp color for each stripe, 38½" with Black weft for body, 3½" for a second border using different colors than for the first, 1¼" Black for second hem (48" total). Weave the pottery mats with the same hems and borders as the runner but weave 8½" with Black for the center (18" total).

Finishing
Cut the three pieces from the loom and serge or machine zigzag between them. Machine wash, warm; tumble dry on low heat. Press with a hot iron.

Cut pieces apart and turn up hems at border edges. Turn half under again and sew hems by hand.

Originally published in ***Handwoven***®, September/October 2000, pp. 44–46, and *Best of* Handwoven, *4-Shaft Twills*, pp. 27–28.

Millennium scarf *by Bonnie Tarses*

When I began my weaving journey in 1960, I was fascinated by the symbolism of many ethnic textiles from around the world. It was thrilling to know that each thread held a secret meaning—even though I might never discover it. In search of a set of symbols that could add meaning to my weaving in a similar way, I developed a system for translating individual horoscopes into colorful warps.

A horoscope is a map of the solar system at a particular moment in time as viewed from a specific place on earth. It has very little to do with the "fortune cookie" predictions that appear in newspapers!

Living rainbows

My palette usually consists of the twelve spectrum colors, which can be combined to make over five billion hues—well beyond the range that can be seen by the human eye. Translating the arcane language of astrology into the non-verbal language of color can turn a warp into a living rainbow of color. There are 360 degrees in a circle, 360 degrees in a horoscope, and 360 warp ends in a horoscope weaving. Each warp end corresponds to a degree of the circle. The chart on page 43 shows the horoscope that produces the millennium scarf.

Fabric description Plain weave.

Finished dimensions

One scarf 10¼" by 66½" with 6" fringe at each end.

Warp and weft

Warp: 10/2 pearl cotton at 4,200 yd/lb, Halcyon Yarn, in twelve colors: 120 yd red (R) #120; 54 yd red-orange (RO) #148; 108 yd orange (O) #118; 96 yd yellow-orange (YO) #112; 84 yd yellow (Y) #143; 69 yd yellow-green(YG) #142; 117 yd green (G) #165; 102 yd turquoise (T) #161; 114 yd blue (B) #157; 105 yd indigo (I) #131; 96 yd purple (P) #126; 93 yd red-purple (RP) #123; Astra-Glow metallic (3,000 yd/lb), 3 yd #003 gold (M).
Weft: 10/2 pearl cotton (4,200 yd/lb), 1,200 yd black, or 20/2 pearl cotton (8,400 yd/lb), 430 yd black.
Floating selvedges: 10/2 pearl cotton, 6 yd black, 12 yd 20/2 pearl cotton used doubled.

Total warp ends 387 plus 2 added floating selvedges.

Warp length

3 yd (allows for take-up and 36" loom waste; loom waste includes fringe) following the Warp Color Order on page 43 (total warp threads of each color are: 40 R, 18 RO, 36 O, 32 YO, 28 Y, 23 YG, 39 G, 34 T, 38 B, 35 I, 32 P, 31 RP, 1 M).

E.P.I. 36. **Width in reed** 10¾". **P.P.I.** 18.

Take-up and shrinkage 5% in width, 10% in length.

Warping

Preparing a horoscope warp takes a bit of time since there are many colors and many non-repeating color changes. Sometimes 2 ends alternate, sometimes 3 or 4.

Wind the warp following the Warp Color Order, page 43. The best way to avoid error is to wind each end separately and tie the next end to it. For example, begin with end #1, a red (R) end. Tie it to the top peg and wind it around the number of pegs that produce three yards on your warping board. At the end peg, tie a green (G) end (#2) to the red end. Wind the green end to the top and tie on a red end (#3).

If you are an experienced warper, you may choose to wind more than 1 end at a time (i.e., a red end and a green end, or later 3 ends, and even 4), but an individual cross must still identify the exact order of the ends.

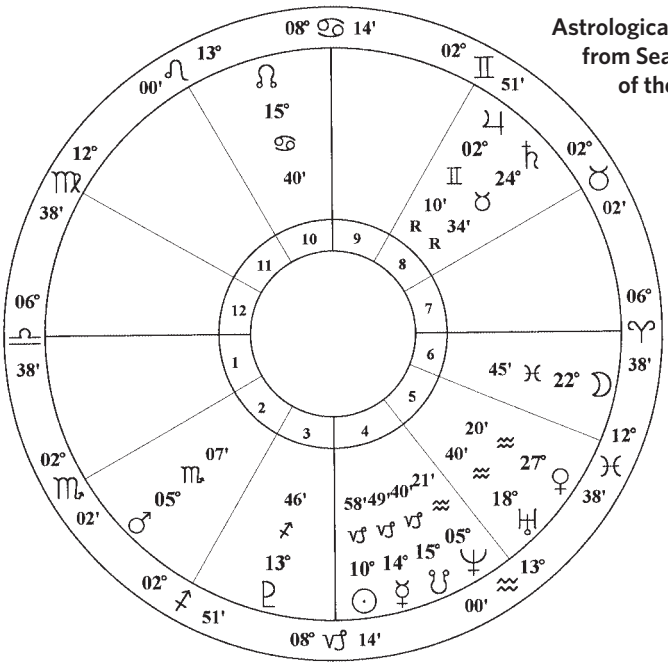
The quadrupled ends (*) in the chart represent the moon and planets; the one metallic thread represents the sun. Wind each set of multiple ends as a single working end (place them in the cross together). Their resulting thickness adds vertical ribs of texture.

If the pegs on your warping board are not long enough to support the entire warp, stop at the halfway point, chain off the first half of the warp, and then wind the second half. Label the chains to keep them in order and mark the first end in each chain.

Whether you warp from back to front or front to back, maintain an individual cross for threading to keep colors in order. If you beam first, wind on with lease sticks in the cross. If you sley first, transfer the lease sticks to the heddle side of the reed for threading.

Sley all ends 3/dent except: Sley the quadrupled planet ends in a dent by themselves; sley the single metallic "sun" end in a dent by itself. If you have an extra end left as you come to a quadrupled planet end or the sun end, place the extra end with the 3 ends that are already in the preceding dent. If you have 2 ends left when you come to a planet/sun end, sley them in the next empty dent; then sley the planet/sun ends in the dent after that. Sley the first and last 8 ends 4/dent.

Originally published in *Handwoven*®, November/December 1999, pp. 26–28.



Astrological map of the solar sytem as viewed from Seattle, January 1, 2001, the first day of the new millennium, at 12:01:00 a.m.

Thread for plain weave (1-2 on a 2-shaft loom, 1-2-3-4 on a 4-shaft loom). Add a weighted floating selvedge to each side but do not beam with the warp. The plain-weave interlacement does not require floating selvedges, but the edges will be smoother if they are used. Leave one empty dent between the body of the warp and each floating selvedge.

Weaving

Allowing about 8" for fringe, weave the scarf for about 70". Use either 10/2 or 20/2 black cotton as weft; 20/2 produces a scarf with a lighter hand.

Choose between three possible fringe treatments. One is to hemstitch the ends of the scarf on the loom and trim the ends neatly. Another is to tie an overhand knot in every 6 to 9 fringe ends (trim fringe to about 4" fringe), snugging the knot against the last weft. The third is to prepare a twisted fringe: Leave unwoven warp at either end of the scarf about one and one-half times the length of the desired fringe. Twist 6 ends tightly in one direction until the twist begins to form loops. Twist an adjacent group of 6 ends in the same direction. Twist both groups together in the opposite direction and tie an overhand knot at the end.

Finishing

Machine wash the scarf in warm water with some colored laundry and machine dry on medium setting. If you remove the scarf from the dryer while it is still warm, you can press it using just your hands on a bed or other flat surface—the lazy way. The usual way with an iron works well too!

Warp color order

*** = 4 threads**

1 **R**	31 **R**	61 **T**	91 **I**	121 **YO**	151 **G**	181 **R**	211 **I**	241 **O**	271 **YO**	301 **Y**	331 **YG**
2 **G**	32 **RO**	62 **O**	92 **T**	122 **P**	152 **Y**	182 **G**	212 **B**	242 **B**	272 **I**	302 **I**	332 **P**
3 **R**	33 **T**	63 **B**	93 **YO**	123 **Y**	153 **RP**	183 **R**	213 **RO**	243 **O**	273 **YO**	303 **Y**	333 **YG**
4 **G**	34 **R**	64 **T**	94 **M**	124 **O**	154 **P**	184 **G**	214 **T**	244 **B**	274 **I**	304 **I**	334 **P**
5 **R**	35 **RO**	65 **O**	95 **I**	125 **RP**	155 **G**	185 **R**	215 **I**	245 **O**	275 **YO**	305 **Y**	335 **YG**
6 **G**	36 **T**	66 **B**	96 **Y**	126 **Y**	156 **YG**	186 **G**	216 **B**	246 **B**	276 **I**	306 **I**	336 **P**
7 **R**	37 **R**	67 **T***	97 **O**	127 **P**	157 **RP**	187 **R**	217 **RO**	247 **O**	277 **YO**	307 **Y**	337 **YG**
8 **G**	38 **RO**	68 **T**	98 **O***	128 **P**	158 **YO**	188 **G**	218 **T**	248 **B**	278 **I**	308 **P**	338 **RP**
9 **R**	39 **T**	69 **O**	99 **RP**	129 **G**	159 **YG**	189 **R**	219 **I**	249 **O**	279 **YO**	309 **Y**	339 **YG**
10 **G**	40 **R**	70 **B**	100 **YO**	130 **Y**	160 **RP**	190 **G**	220 **B**	250 **B**	280 **I**	310 **P**	340 **RP**
11 **R**	41 **RO**	71 **T**	101 **I**	131 **P**	161 **YO**	191 **R**	221 **RO**	251 **O**	281 **YO**	311 **Y**	341 **YG**
12 **G**	42 **T**	72 **O**	102 **Y**	132 **P***	162 **YG**	192 **G**	222 **T**	252 **B**	282 **I**	312 **P**	342 **RP**
13 **R**	43 **R**	73 **B**	103 **O**	133 **P**	163 **RP**	193 **R**	223 **I**	253 **O**	283 **YO**	313 **Y**	343 **YG**
14 **G**	44 **RO**	74 **T**	104 **RP**	134 **G**	164 **YO**	194 **G**	224 **B**	254 **B**	284 **I**	314 **P**	344 **RP**
15 **R**	45 **T**	75 **O**	105 **YO**	135 **Y**	165 **YG**	195 **R**	225 **RO**	255 **O**	285 **YO**	315 **Y**	345 **YG**
16 **G**	46 **R**	76 **B**	106 **I**	136 **P**	166 **YO***	196 **G**	226 **I***	256 **B**	286 **I**	316 **P**	346 **RP**
17 **R**	47 **RO**	77 **T**	107 **Y**	137 **P**	167 **RP**	197 **R**	227 **T**	257 **O**	287 **YO**	317 **Y**	347 **YG**
18 **G**	48 **T**	78 **O**	108 **O**	138 **G**	168 **YO**	198 **G**	228 **I**	258 **B**	288 **I**	318 **P**	348 **RP**
19 **R**	49 **R**	79 **B**	109 **RP**	139 **Y**	169 **YG**	199 **R**	229 **B**	259 **O**	289 **YO**	319 **Y**	349 **YG**
20 **G**	50 **RO**	80 **T**	110 **YO**	140 **P**	170 **RP**	200 **G**	230 **RO**	260 **B**	290 **I**	320 **P**	350 **RP**
21 **R**	51 **T**	81 **O**	111 **I**	141 **G***	171 **YO**	201 **R**	231 **T**	261 **O**	291 **YO**	321 **Y**	351 **YG**
22 **G**	52 **R**	82 **B**	112 **Y**	142 **P**	172 **YG**	202 **G**	232 **I**	262 **B**	292 **I**	322 **P**	352 **RP**
23 **R**	53 **RO**	83 **T**	113 **O**	143 **G**	173 **RP**	203 **R**	233 **B**	263 **O**	293 **YO**	323 **Y**	353 **YG**
24 **G**	54 **T**	84 **O**	114 **RP**	144 **Y**	174 **YO**	204 **G**	234 **O**	264 **B**	294 **I**	324 **P**	354 **RP**
25 **RO**	55 **R**	85 **B**	115 **YO**	145 **RP**	175 **YG**	205 **RO**	235 **T**	265 **YO**	295 **Y**	325 **YG**	355 **G**
26 **T**	56 **RO**	86 **T**	116 **P**	146 **P**	176 **R**	206 **T**	236 **B***	266 **B**	296 **I**	326 **P**	356 **RP**
27 **R**	57 **B**	87 **O**	117 **Y**	147 **G**	177 **YO**	207 **I**	237 **O**	267 **YO**	297 **Y**	327 **YG**	357 **G**
28 **RO**	58 **T**	88 **I**	118 **O**	148 **Y**	178 **YG**	208 **B**	238 **B**	268 **B**	298 **I**	328 **P**	358 **RP**
29 **R***	59 **O**	89 **T**	119 **RP***	149 **RP**	179 **R**	209 **RO**	239 **O**	269 **YO**	299 **Y**	329 **YG**	359 **G**
30 **T**	60 **B**	90 **O**	120 **RP**	150 **P**	180 **G**	210 **T**	240 **B**	270 **B**	300 **I**	330 **P**	360 **RP**

TIPS FOR PLANNING, HEMSTITCHING, AND FRINGING

TAKE-UP AND SHRINKAGE

Weft take-up and shrinkage.

As you weave, extra weft length (beyond the width of the warp in the reed) must be placed in the shed to allow for weft take-up (in *Handwoven* projects, this amount is included in required weft yardage). The fabric then draws in as the weft bends over and under the warp thread so that the width of the woven cloth is narrower than the width of the warp in the reed. The cloth narrows further after it is removed from the loom, and shrinkage will narrow it even more if it is washed. To calculate the percentage of weft take-up and shrinkage, divide the finished width by the width of the warp in the reed.

Warp take-up and shrinkage.

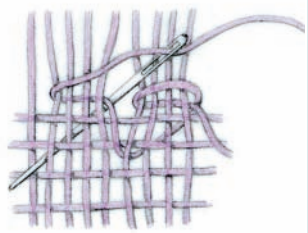
As you weave, the warp bends over and under the weft threads so that fabric length is less than the length of the warp threads that produce it (*Handwoven* projects give the number of inches allowed for this take-up under Warp Length). When you release tension and remove the fabric from the loom, the fabric takes up in the warp direction. If you wash the fabric, shrinkage further decreases its length. To calculate the percentage of warp take-up and shrinkage, divide the finished fabric length by the woven length (measured under tension on the loom) plus the inches given for warp take-up.

To calculate how long to weave a fabric for a specific finished length, use the percentage derived by dividing the finished length listed in the project by the woven length measured under tension on the loom (for this percentage, do not include the inches allowed for take-up in the warp yarn).

TWISTING (OR PLYING) THE FRINGE

Divide the number of threads for each fringe into two groups. Twist each group clockwise until it kinks. Bring both groups together and allow them to twist around each other counterclockwise (or twist them together in that direction). Secure the ends with an overhand knot. (Use the same method to make a plied cord by attaching one end to a stationary object.)

SIMPLE HEMSTITCHING



Weave several picks of plain weave, ending with the shuttle on the right side if you are right-handed, left side if you are left-handed. Measure a length of weft three times the warp width and cut, leaving the measured length as a tail. Thread the tail into a blunt tapestry needle.

Take the needle under a selected group of ends above the fell and bring it up and back to the starting point, encircling the group. Pass the needle under the same group of ends, bringing it out through the weaving two (or more) weft threads below the fell. Repeat for each group of ends across the fell. Needleweave the tail into the selvedge and trim. (See * below.)

DOUBLE (ITALIAN) HEMSTITCHING

Weave several picks plain weave, ending with the shuttle on the right side if right-handed, left side if left-handed. Measure a length of weft four times the warp width and cut, leaving the measured length as a tail. Thread the tail into a blunt tapestry needle.

Take the needle under a selected group of warp ends above the fell and bring the needle back to encircle the ends. Next, pass the needle under the same ends but come up two or more weft rows down from the fell. Then bring the needle back around the same group of ends below the fell. Then begin again, encircling the next group of ends. (See * below.)

**For both methods: To hemstitch the first end of a piece, weave a header, weave four or five picks of plain weave (or of the basic weave structure used in the piece), and hemstitch over the top two or three weft rows. Weave the piece and then hemstitch the other end over the last two or three weft rows. Remove the fabric from the loom and discard the header and weft threads below the first hemstitching.*