AMERICAN TAPESTRY ALLIANCE

Choosing warp and weft: once again and some new stuff!

Kathe Todd-Hooker

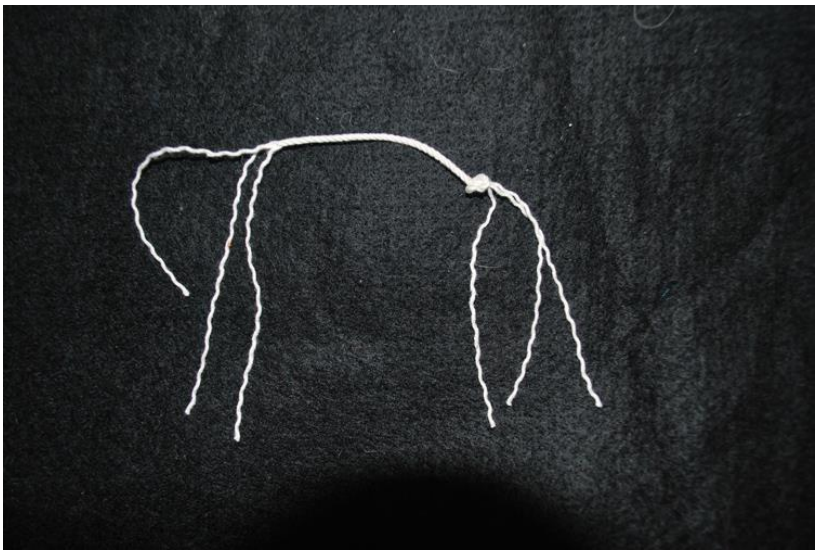
In 2010 Pat Spark and I wrote a book together called “So Warped.” The appendix included a chapter called *The Canons of Warp and Weft: The Ideal and the Slightly Fractured…*This article is a redux with additions, subtractions, deductions and reflection.
Please note that I am not a Navajo style weaver. A great deal of what I am writing may not apply to traditional Navajo style weaving or southwest, low warp tapestry styles. My training is in high warp European, British, Gobelin, Aubusson and Scandinavian weaving styles that have or are being synthesized into a North American weaving style.

A Canon

The concept of a canon is to create a series of rules that define an ideal and the guidelines for attaining it. The biggest variable will always be the weaver and personal choices, BUT one needs a beginning place. AND, there are no tapestry police that are “gonna come” and take your loom away from you, if you do it another way.

The canon, or rules, helps us place and size the variables – the warp, weft and warp sett – so that they work well together and get the job done with the least amount of trouble. For instance, in my ideal canon or perfect world the thickness of the weft is equal to the space between the warps and the warp diameter is about the same as the distance between warps. There are many reasons this doesn’t happen and many reasons not to follow this rule, but that’s for later. So, how do I proceed? Do I choose a warp first, and then figure out the size of the weft and the sett? Or…?

A series of questions can be asked about the finished piece that will help choose the materials and create the canon for the warp, weft and warp sett.



Anatomy of cotton seine twine warp showing the ply construction. An overhand knot stops the unraveling. Photo credit: Kathe Todd-Hooker

How will the tapestry be used?

How much wear will it receive? Will it be used as clothing, jewelry, a wall hanging, rug, pillow top or…? For example, you probably don't want to put a sewing thread tapestry on the floor and walk on it. Or use a coarse wool for a pillow top that your face will find uncomfortable. You may wish your tapestry to stand up, using it sculpturally, or it might receive heavy wear and tear, such as the top of a shoe or boot. A wool or linen tapestry with a heavily twisted cotton seine twine, linen or wool warp and a coarse wool weft would be a better choice in that case. Some warps and wefts might be uncomfortable and scratchy when worn next to the skin, e.g. mohair, rug wool that contains cow's hair for durability and most spelsau yarns – anything with a guard hair. Soft wools such as a Norwegian ALV yarn or merino based weft are not ideal for tapestries that will receive wear, e.g. rugs. In that case, a better wool might be a Paternayan or Paterna, churro, spelsau or Pharos.

Scale and Format Differences: A 4-inch square detail woven at 22 epi with dual duty craft thread. Photo credit: Kathe Todd-Hooker

What loom is appropriate for the project? Are there loom size and restrictions that you need to take into consideration? Will one format or scale work better with a particular loom? Does the loom have a built-in warp spacing device that makes it impossible, or difficult to change the warp spacing? Is the loom big enough for the project? If you are using frame looms with a small weaving area, you need to take loom waste into consideration. To me, the most important loom quality is a tensioning device. I love fine detail, which needs tight tension and heavy beating. Warps stretch so a tensioning device is important. This is extremely important when working with warps that wear with use such as cotton crochet threads, linen warps, wool and sewing threads. There is less wear on a warp if the tension is tighter because the warp is held in place with less movement (less friction) from the loom as you weave and beat. Another technical consideration is that you can't beat as hard on many of the smaller looms and their usual warping methods, so you may need a tad bit more space between the warps and a tad less weft and comb instead of beating.

Scale and Format Differences: A 4-inch square detail woven from the same cartoon at 12 epi with 12/6 cotton seine twine, 4-6 Norwegian ALV and/or 4 Paternayan strands in the weft, Photo credit: Kathe Todd-Hooker

What hand, feel, or touch do you want the tapestry to have? There is a difference between how something will wear and how it feels to the hand. Will it hang on a wall, be walked on, worn as a garment, used as a bag or purse? Should it be solid and stiff or sway in the breeze? Should it wear like iron or have a certain amount of fragility? The warp and weft materials and the warp/weft balance affect these qualities.

Comparison of the rib size and scale differences when switching between 12 epi and 6 epi in the same weaving. The loom is warped at 12 epi. To switch to 6 epi, two warps are used as one, i.e. over two, under two, etc. 12/6 cotton seine twine and 6 Norwegian ALV strands in the weft bundle. Photo credit: Kathe Todd-Hooker

How detailed is the design? The design should determine the size and scale of the tapestry. The size and scale, in turn, determines the warp sett and the warp and weft size. If the design is complicated, with many small details, you may need to increase the size of the design or increase the warp sett and decrease the size of the weft bundle. You can also use less weft strands in your weft bundles so that you have more passes per inch. Materials used in the tapestry need to fit the scale and format of the tapestry. Not choosing a proper combination of cartoon size, warp sett and warp weft balance is the most common mistake people make when designing tapestries. For example, the tapestry is small in size, and the weaving is coarse – larger in scale. Details are then rendered clumsily. These problems are easily avoided by considering the warp and warp sett once you have designed the piece and know the cartoon size.

My first rosary or sample strip. This is a detail of a 2-foot strip. I wasn't sure about warp setts when I first began. I started at the bottom with 12/6 cotton seine twine at 6 epi over a 2-inch width. I realized I didn't like the hand of the sample, so I used a girdle to pull it into a 1-inch-wide strip. The ends of the weft are left hanging out on one side for ease of checking the combination of wefts. The weft bundles are composed of Paternayan Persian and unraveled wool sweaters. Photo credit: Kathe Todd-Hooker

What is the tapestry's format or size? As stated above, this should be determined by the design itself, not chosen just because you've been told that you need to have a certain size warp or weft by a given instructor's tradition. However, if you prefer a certain warp-weft-sett relationship, then you might have to change the size of the cartoon so that it can be woven with your preferred warp sett and warp/weft balance. Or you may need to modify your design adding or taking away detail.

A sample showing switching between 10 and 5 epi by going under and over the warps singly, or in pairs. The sample also shows the principle of hills and valleys (highs and lows), which can be used to create either toothed lines, or smooth lines. 6" x 6". Photo credit: Kathe Todd-Hooker

How prominent do I want the rib structure to be? Rib structure is created by the distance between the warps and the amount of weft in your weft bundle. The bigger the warp the more prominent, or deeper, the ribs that run up the warps. Larger or smaller weft bundles also influence the prominence of the rib structure. Larger weft bundles create a more visible rib.

Comparison of the rib size and scale differences when switching between 12 epi and 6 epi in the same weaving. The loom is warped at 12 epi. To switch to 6 epi, two warps are used as one, i.e. over two, under two, etc. 12/6 cotton seine twine and 6 Norwegian ALV strands in the weft bundle. Photo credit: Kathe Todd-Hooker.

My Canon of Ideal Proportions

Once I have decided the warp sett that will work for a design based on the questions above, the rest follows my canon. My personal canon is: the warp diameter = the weft bundle diameter = the space between the warps. The appropriate warp sett for a given warp size is determined by wrapping the warp around a metal ruler with a cork backing. If the warp sett is ten ends per inch then, 10 wraps of warp should fit in one half inch. I then determine the weft bundle size. Spread the warps out evenly on the ruler to cover one inch. Twist the weft just enough to get the loft out. Wrap the weft bundle between the warps. The weft bundle should fill up the space between the warp wraps. For example, 12/6 cotton seine twine warp at 10 epi and five Norwegian ALV yarns fit my canon. The same warp and warp sett will accommodate two strands of six strand embroidery floss. By sampling and establishing what the diameter of the weft bundle should be for a given warp sett, I can use any weft yarn as long as I keep the size of the weft bundle the same. This allows for using a greater variety of yarns, with more possibilities for texture and colour blending.

Bad choices in warp sett and warp/weft balance will create a struggle in the weaving and may make it difficult to achieve the level of detail in your design. It's difficult, time consuming

and discouraging if you must constantly battle the materials. Set up your own “Canon of Ideal Proportions” by sampling. Small sample looms are easy to make and use. If cost is an issue, find a distributor that is willing to wind off 1 ounce of a given warp size. A one-pound cone is great if you are weaving large tapestries, but for a small format weaver a pound is a life time and beyond supply.

Once you have a series of samples with different warp setts, warp sizes and weft bundle sizes, they are yours to keep and reference. I have many samples I made in graduate school. Carefully considering these factors before you start weaving will increase greatly the success of your tapestries.

Warp size	**Most commonly used for these warp setts**	**Corresponding size of weft bundles**
Molylycke Giant	18-26 epi	1, six strand embroidery floss, 2 ALV wools, 4-5 dressmakers thread, 2-3 DMC, De Medici, 2 20/2 yarns or needlepoint yarns
Dual duty plus and or buttonhole, craft thread	18-26 epi	1, six strand embroidery floss, 2 ALV wools, 4-5 dressmakers thread, 2-3 DMC, De Medici, 2 20/2 yarns or needlepoint yarns
20/6 cotton seine twine	16-22epi	1, six strand embroidery floss, 2 ALV wools, 4-5 dressmakers thread, 2-3 DMC, De Medici, 2 20/2 yarns or needlepoint yarns

12/6 cotton seine twine	10-16	2, six strand embroidery floss, 5-6 ALV yarns, 4 Paterna or Paternayan Persian, 3 spelsau, 4-6 6/1 Pharos
12/9 cotton seine twine	8-10	2, six strand embroidery floss, 5-6 Alv yarns, 4 Paterna or Paternayan Persian, 3 spelsau, 4-6 6/1 Pharos
12/12 cotton seine twine	8 epi	6 needlepoint or Paterna or Paternayan Persian, 10 ALV yarns or 20/2 tapestry yarns, 4-5 spelsau yarns, 1-3 brown sheep or various Navajo style yarns, 4-6 6/1 Pharos
12/18 cotton seine twine	6-8 epi	6-8 needlepoint, tuna or Paterna or Paternayan Persian, 12 ALV yarns or 20/2 tapestry yarns, 4-5 spelsau yarns, 1-3 brown sheep or various Navajo style yarns, 4-6 6/1 Pharos
12/21 cotton sein twine	6 or less	8 needlepoint, Tuna or Paterna or Paternayan Persian,

14 ALV yarns or 20/2 tapestry yarns, 5 spelsau yarns, 4 brown sheep or various Navajo style yarns, 6 6/1 Pharos

Adjusting the Canon

When you begin to apply the canon to tapestry weaving, the important thing to remember is that you can adjust it to accommodate your weaving style, or for specific purposes. For example, if you unbalance the weave by using a smaller weft bundle in proportion to the warp size and warp sett, you can weave more passes in each inch, thus creating the ability to render more detail. There are two ways to do this. One is to use a thinner thread than the normal size in the weft bundle, or to use fewer weft strands in the weft bundle. You can even use just one weft strand in a pass. Of course, you then lose the ability to blend colors in the weft bundle. Using a thicker weft bundle than the canon prescribes allows you to weave a given area faster because there are fewer rows of weft per inch. For example, with Norwegian ALV yarns I might use six threads in my weft bundle instead of a more typical five. In weaving with sewing thread at 22 epi, using 5 threads instead of four in a weft bundle speeds up the weaving by 20 percent. The disadvantage is that it is harder to cover the warp, requiring a larger bubble to pack in the weft.

Another way to get more detail is to add extra warps in a detailed area of the design by adding a supplementary warp. Or, you can create two warp setts by passing under one, over one in the detailed areas and over two, under two in the areas that are less detailed. Four heddles and four peddles on your loom will allow for weaving both setts without manually picking up the wefts. In the areas where you pass over two, under two, the rib structure is larger, and the weft bundle can be doubled, allowing for more colour blending options. Open yourself up to the possibilities!

A sample showing the changing appearance when the number of strands in the weft bundle is decreased (from the top of the sample to the bottom). Norwegian ALV weft; 12/6 cotton seine twine. Decreasing the weft bundle in size by one thread. Photo credit: Kathe Todd-Hooker.

Warp materials

Tapestry weavers have, historically, used just about anything and everything for warp – straw, grass, sisal, human hair (even while attached to a head), basketry materials, metal etc. But, just because you can, doesn't necessarily mean that you should.

Many very questionable warps have shown up lately in my workshops when unsuspecting first timers supply their own materials, often upon the advice of a supplier who considers them to be acceptable substitutes for cotton seine twine. Some of these are: kite string (breaks and stretches easily), 12/6 bamboo warps (mimics cotton seine twine but becomes fuzzy very quickly and breaks), crochet thread (lacks strength and stretches badly), rug warps, e.g. Maysville (wears, stretches and breaks easily over time), tow linen (staple is too short, it breaks easily and is often not spun tightly or cabled), line linen (this is great on large looms, but wears badly at the top and bottom of small looms and is often difficult to warp on small looms), and dual duty craft thread and upholstery thread, which now possibly contains too much nylon and stretches badly. This breaks my heart because it was my go to warp for 22 epi. For that warp sett, I now use 20/6 cotton seine twine, which wasn't available when I first started weaving small format.

Regardless of scale or format, if you want a good tapestry, you need high quality warp and weft. Weavers may use materials of lesser quality because of cost and availability. Often chaos, frustration and disenchantment with the process of tapestry result from using low quality materials. They make weaving harder and the final product might not be the beauty you want it to be.

Tightly and evenly twisted threads which are then plied together make the best and strongest warps. They are the easiest to cover with weft.

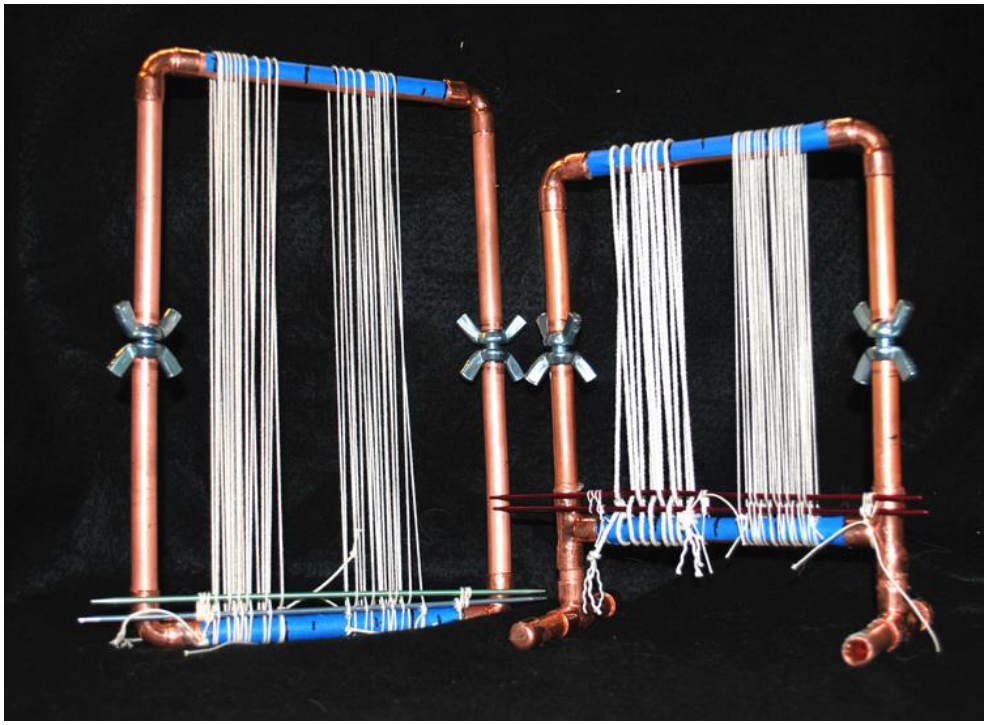
Cotton seine twine is strong, durable and not overly stretchy. It is a tightly spun, cabled cotton that is readily available in 7-8 different sizes. It has only a small amount of stretch. Over the last 30 years the quality and evenness of the spin and stretch has improved, making it a first choice for tapestry warp. Most cotton seine twines are now produced in Egypt, repackaged in Sweden and sold in the United States as Swedish warp. It is spun so tightly that when working on small

looms I always place an overhand knot on cut ends to keep it from unspinning. I have found that the 20/6 is strong enough to be used for smaller warp setts. For larger warp setts cotton seine twine creates a beautiful tapestry with a beautiful hand that becomes softer and more drape able as it is used.

Linen warp should be of line linen and not tow linen and should smell slightly grassy and not musty. Line linens are spun from long filaments of linen. Tow linen is usually spun of shorter filaments, making it less capable of withstanding tension and more likely to fray. While line linen is very strong, it can abrade from beating and from friction on the top and bottom of the loom, especially with very fine warps used on small pieces. If you use a circular warp or figure of eight warp on a small loom, wetting the linen will make it stronger. Linen warps are preferably not waxed because over time the waxy residue can migrate to the wefts and cause discoloration. Linen does not stretch and is, therefore not as forgiving as a cotton seine twine or wool warps. It is also more difficult to tension when using circular and figure of eight warping methods.

Wool warp should be strong, evenly spun and, preferably, 3 ply. Some wool warps are not cabled but will often have a touch of mohair for strength and or be re-spun. On small looms with circular warps, wool has the advantage of re-tensioning itself evenly over night when over tightened and then allowed to rest.

Warp made of rug warp such as Maysville, some crochet threads and silk threads will wear and stretch unevenly in both the weaving process and with use. The warps will fray and thin badly as you weave and the tapestry itself will not wear well.



Small cooper looms produced at Between and Etc. Small looms work well for travel and sampling. They have been warped to sample 4 different warp sizes and warp spacing. Photo credit: Kathe Todd-Hooker.

Rib Structure, warp/weft relationships, hand of the cloth

In large format tapestry, the larger the warp, the larger and deeper the rib structure will be. This creates shadows, which can affect the appearance of colors and the visibility of detail in the tapestry. This effect is greater with wool weft, whose structure is more three dimensional and thus absorbs light, making the color look darker. The opposite happens when using embroidery floss, silks, linen and sewing thread which lack the crimp of wool and reflect more light. They lessen the appearance of the rib structure and colours appear lighter.

The further apart the warps, the thicker the weft bundle must be to create a balanced weave structure. A balanced weave will create a stiffer fabric with a prominent rib structure. The weave can be unbalanced by using a thinner weft bundle. This results in a fabric that is softer. In addition, the rib structure is less evident and thus influences the appearance of the design less. An unbalanced weave can also be created when the warp is larger than the canon recommends for the warp sett. This creates a stiffer, less drape able tapestry.

Tapestry weaving is a lot like handwriting, very personal – each person weaves a tad different. The trick is to find a canon that works for you. Once you establish your canon, feel free to experiment in order to find your own, unique weaving style.

Biography

Kathe Todd-Hooker is the owner of Between & Etc. Tapestry Studio, a supplier of tapestry products, designer of tapestry tools and instructor. She is an award-winning tapestry weaver (two-time ATA Teitelbaum Award winner, First and Second Place) who specializes in tapestry of any format, but weaves primarily small format, small scale tapestries. She offers instruction, workshops in and out of her studio, and is the author of "Tapestry 101," "Line in Tapestry," "Shaped Tapestry," "So Warped" (with Pat Spark) and "Tapestry and Friends," as well as numerous articles on tapestry weaving and other things. She lives and teaches in old town Albany, Oregon.