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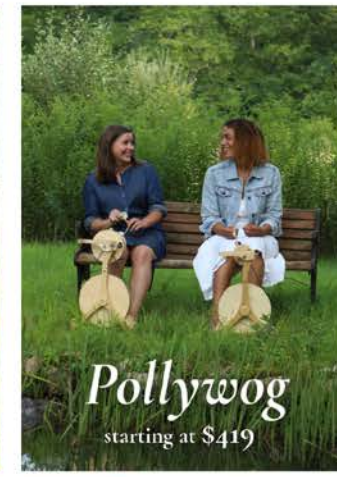

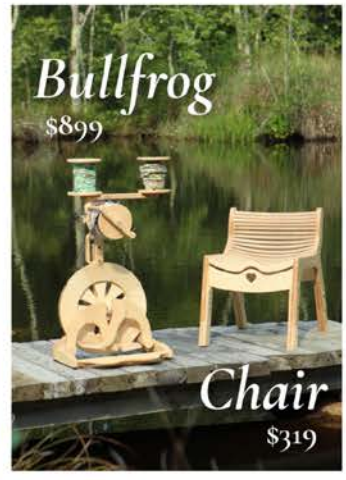

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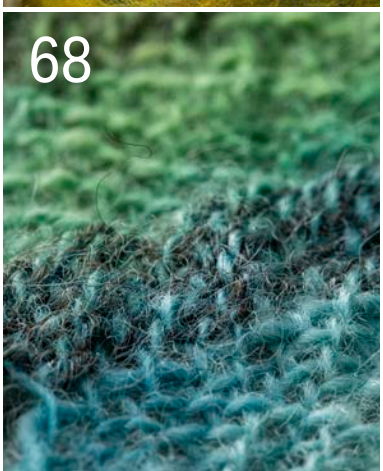

Photos by Matt Graves

DEPARTMENTS

On the cover: Handspun cables by Melanie Bonhomme and Nube fiber from Malabrigo. See page 18. Photo by Matt Graves

spinoffmagazine.com

- Calls for Entries
- Corrections
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Twist is one of handspinning's core elements, but it can be tricky for spinners to discuss. Not only do we hold strong opinions about the amount and direction of twist required for a successful yarn, but the way we evaluate and describe twist varies. Some people carefully measure and calculate, while others rely on look and feel. Like many things in life, twist is more complicated than it seems. This is good news for those of us who love to explore!

Twist is a simple technology, but how we combine it with fiber choice, yarn design, and end use gives our yarns character. This character is both personal and cultural; how we spin helps to place us in the history of handspinners. In this issue, **Liz Hammond-Kaarremaa** shows us in a series of examples spanning millennia how twist acts as storyteller, revealing the movement of peoples, knowledge, and tools.

Today, most of us learned to spin through some combination of one-on-one mentorship, books, and other media. Fiber artist **Sahara Briscoe** shares with us the twist measurements she learned from Mabel Ross and how she adapted them to her own work. Sahara's process is so quick and easy that it keeps pace with her creative flow. Measurements can be as analytical or intiutive as you choose.

In fact, **Gayle Vallance** offers you three different approaches to creating cabled yarns. She starts with a no-math method for intuitive spinners and finishes with a quantitative, scalable formula. All spinners are welcome! And **Carson Demers** offers advice for keeping our bodies safe during those hours at the wheel.

Wishing you peace and perfectly filled bobbins,

A stunning bound-weave rug woven with cabled yarns by Gayle Vallance.

Photo by Matt Graves

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Vol. XLV No. 2 Summer 2021

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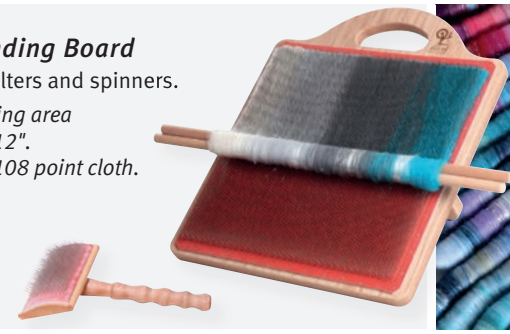

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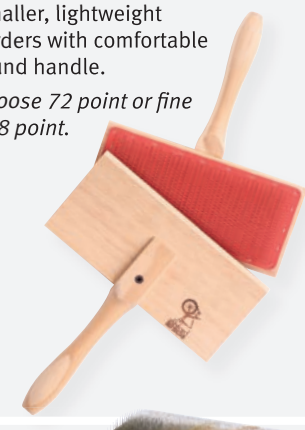

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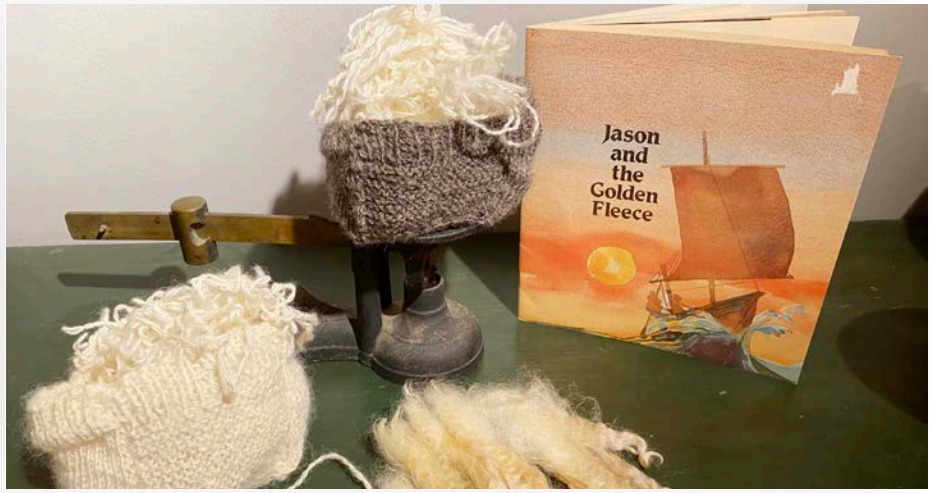
I'M A NEWBIE AND HAVEN'T SPUN *any wool, or anything else, but I wanted to send a picture of the fleece that I bought to share a part of my journey. Inspired by the article "The Great Fleece Makeover" by Emonieiesha Hopkins [*Spin Off, *Winter 2020], I bought a rubbish bag full of wool. I am learning so much about needing to* look *at what I've bought before making a judgment. What I actually bought was lovely Merino fleece and not just a tangle of grass and lanolin with bits of wool thrown in! The learning curve, though steep, is setting me up, and I am having fun.*

Evelynne Crisp
East of Tenterfield, New South Wales, Australia

Update: Evelynne made her first rolag with her new handcards! —Editor



THIS COTSWOLD FIBER *is from Robin and Andy Nistock who are members of the Livestock Conservancy's Shave 'Em to Save 'Em program. The white is from a lovely ewe named Juno. Nistock Farms is in Prattsburgh, in the Finger Lakes area of New York State.*

The stitch gauge of the white basket made from Juno's fiber is 23 stitches per 4 inches, and the gauge for the pewter basket is 23 stitches per 3½ inches. The large basket measures 4½ by 4 inches. As you can see, the large one is somewhat floppy, but it's nice for holding a work in progress. I knitted the large one on size 8 needles and the small one on size 3, though, of course, your gauge may be different.

When I started spinning some 40 years ago, I thought that Merino was my nirvana. Then I met some of the more robust heritage breeds, which are full of charm and character. Cotswold shimmers, which is why it earned its name as the Golden Fleece of the British Empire. Jason, in Jason and the Golden Fleece, *is brave and his story harrowing—and our children should know mythology!*

I feel passionate about supporting shepherds who work so hard, ask so little from us, and help to keep heritage genetics alive. Wouldn't it be fun to see a breed study of these types of baskets?

Linda Voss Plumber
Galeton, Pennsylvania

CORRECTIONS

We apologize for the following omissions:

"Godey's-Inspired Sontag," Summer 2020.
The materials list is missing the crochet hook for the edging, size H/8 (5 mm).

"I Am a Spinner," Winter 2021.
The takli spindles in the bottom left photo are by John Galen Designs.

Would you like to share your handspun finished object? Tell us about it at spinoff @longthreadmedia.com.

Wild Mountain Time:
Native Dye Plants

By Dede Styles; photography by Frederick Park

As you go about your day, look at your surroundings. Dye plants grow everywhere—in abandoned lots, beside vacant buildings, and along railroad tracks—and an abundance of hues are just waiting to be gathered and added to the dyepot. In an easygoing manner, Dede Styles shares her tips for recognizing local dye plants in southern Appalachia as well as her method for mordanting wool and adjusting colors with iron, copper, and more. From bark to flowers, learn what flora to look for and which to avoid, while respecting property rights and being mindful not to harvest too much. You'll never see your neighborhood's vegetation the same way again.

Swannanoa, North Carolina: Self-published, 2019. Paperback, 49 pages, $15. ISBN 9781646697182. To order the book, email dede@skyrunner.net.

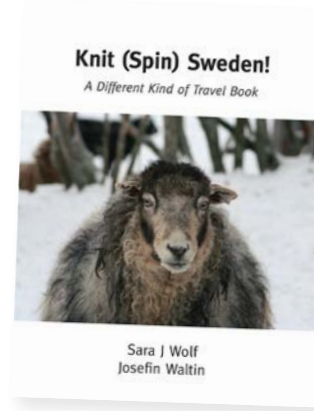
On the Farm:
Heritage & Heralded Animal Breeds in Portraits and Stories

By Aliza Eliazarov

Handspinners recognize the need to preserve rare fiber breeds, but sheep and goats aren't the only barnyard species whose biodiversity is under threat. Spurred by her exploration of our food's journey from industrial agriculture to table and the growing small-farm movement, photographer Aliza Eliazarov goes on location, turning her lens on chickens, cows, pigs, and more. The expressive personalities of the individual animals shine in over 150 color photographs and close-ups. With educational tidbits about the animals sprinkled throughout (such as a description of a turkey's courtship ritual), this book will appeal to eco-conscious admirers of critters everywhere.

Berkeley, California: Ten Speed Press, 2020. Hardcover, 256 pages, $30. ISBN 9781984857408.

Knit (Spin) Sweden!
A Different Kind of Travel Book



By Sara J. Wolf and Josefin Waltin

With its strong textile traditions, Sweden ranks high on any short list of top fiber destinations. But before you purchase an ordinary travel guide, take a look at this one written by and for knitters and handspinners. Sara Wolf and Josefin Waltin begin with the historical significance of Sweden's knitting heritage, from nålbinding to spinning, and include a guide to local sheep breeds. Next, meet Sweden's notable names in knitwear design and find 11 projects that draw on traditional techniques such as *tvåändsstickning* (twined knitting). Plan your tour with the book's list of local yarn shops from Stockholm to north of the arctic circle. And language won't be a barrier; you'll find translations of common knitting terms in the back of the book.

Cleveland, Ohio: Cooperative Press, 2020. Paperback, 164 pages, $29.95. ISBN 9781937513948.

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FRESH FINDS

Handcrafting each of **Celestial Farms'** fiber tools is a team effort. On their Oregon farm, Chris and Nicole Ricard select woods, artfully mixing and matching the colors, and then turn or finish each piece. The **blending board** shown is in spalted maple, wenge, Tennessee red cedar, and cherry. It includes your choice of carding cloth, a packing brush, dowels, and a doffer. **cfmerchantile.etsy.com**

Elevate your spindle plying with a **Spanish Peacock plying stand**. Although it's designed for support spindles, the Baltic birch stand adjusts in width and holds top- and bottom-whorl spindles, too. Disassemble to store flat or take it with you on the go. Shown in Seagulls. **spanishpeacock.com**

What spinner doesn't love a hefty hank of handspun? Wind cakes of yarn up to 17½ ounces with **Ashford's** new **ball winder**. Secure it to your worktable with the included clamp and give the crank a twirl. Thick or thin, most yarns easily glide through the attached yarn guide for evenly wound center-pull balls. **ashford.co.nz**

Whether you're spinning or nuno felting, **BeesyBee Fibers' Signature Custom Blend Merino/bamboo/viscose combed top** in the Kingfisher colorway captures the shades of summer. Spin and draft straight from the top for long bursts of color, or try spinning from the fold for more color blending. **beesybee.etsy.com**

Majacraft offers a new collection of lightweight **bobbins** to pair with its wheel line, making for a quieter, smoother spin. The bobbins come in two styles: wood with black cores and edges or molded black plastic. Both styles feature attractive cutout ends. The wood version comes in a range of sizes, from baby to jumbo. **majacraft.co.nz**

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My Favorite Spinning Tool: The Computer

BY ALANNA WILCOX

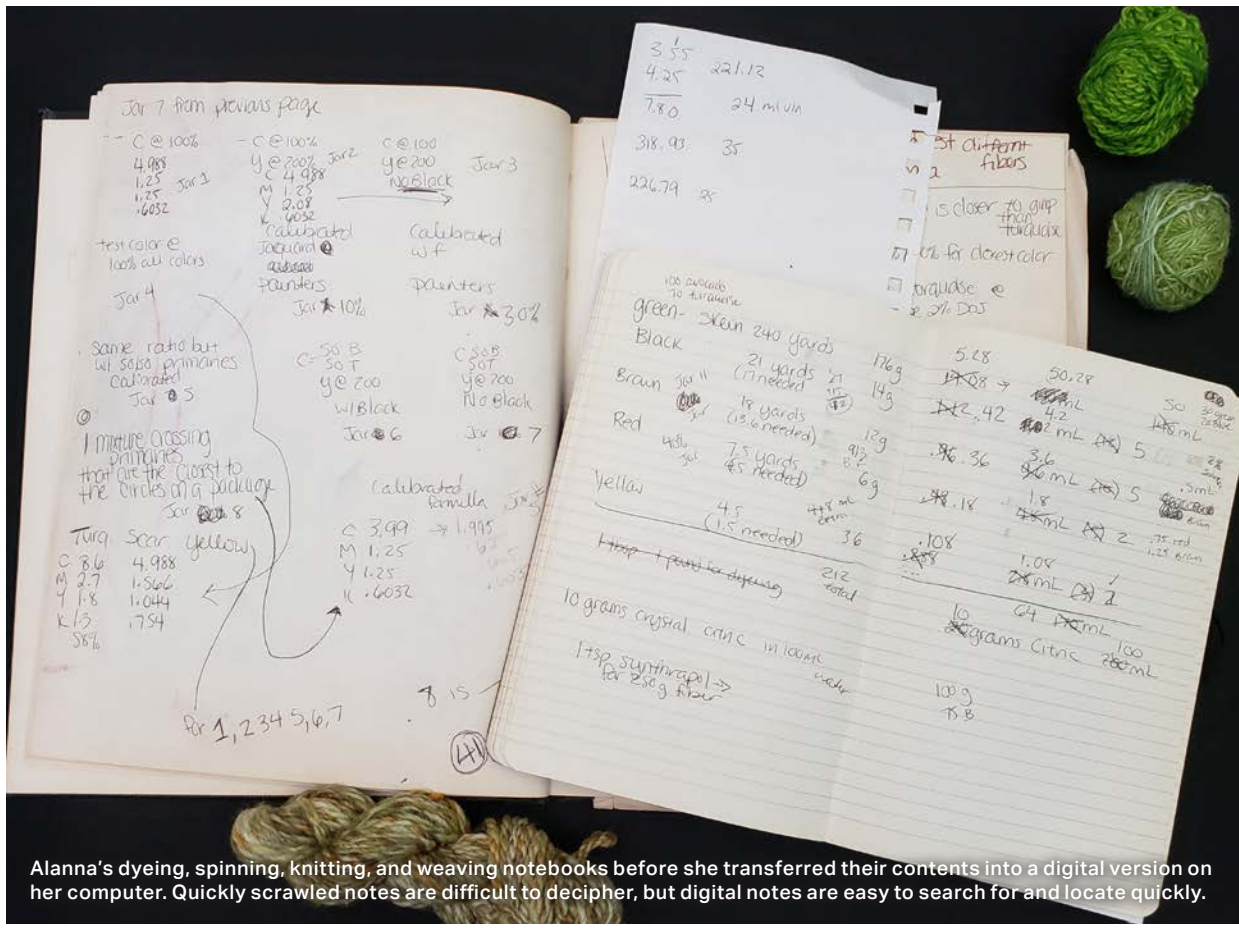
Ask me what my favorite spinning tool is, and you might be surprised to hear that it's my computer. Obviously, I couldn't spin yarn with a laptop (although if you presented me with this challenge, I'm sure I would try to figure out a way to do so!), but using my computer enhances everything I do when it comes to spinning. Here are four reasons why.

1. Organization.

I love to use digital spreadsheets to track project information and notes. I'm a forgetful person when it comes to remembering words and numbers, so having project-based spreadsheets allows me to access key information both in my home studio via my laptop and when I'm using my smartphone on the go. Whether at a yarn shop or fiber festival, I can create a note whenever an idea pops into my head. I don't need to spend time rummaging through my bag for a notebook or frantically trying to locate a sticky note that contains both a dye formula and my grocery list. Everything is organized and easy to find.

2. Quick, accurate math.

If I'm trying to calculate the amount of fiber needed for a project, how much dye to add for a given weight of fiber, or anything else that requires math, the computer is a lifesaver. I'm great at thinking I can do simple math . . . until I get to the sleeves of a sweater and realize I ran out of yarn because I didn't multiply the sleeve yardage



Alanna's dyeing, spinning, knitting, and weaving notebooks before she transferred their contents into a digital version on her computer. Quickly scrawled notes are difficult to decipher, but digital notes are easy to search for and locate quickly.

Photos by Alanna Wilcox

by two. Oops. While I could use a calculator, seeing all the math on my computer, along with written notes next to it, helps create a much clearer picture of what all the numbers mean and how to use them to my advantage. Before I began using my computer, I scrawled notes and numbers on blank paper and was later confused by my own notes, what order the pages went in, and what I was trying to calculate in the first place.

3. Search function.

If I wanted to remember a specific fiber, vendor, pattern, or even a needle size I used 10 years ago, I had to look through pages of notes. No more! With my computer, I can do a digital search much quicker than manually searching through binders and notebooks. I've spent the last few years scanning in all my notes and projects to make them easier to locate—which was time well spent—while also clearing out shelves for much-needed fiber space.

4. Quick transfer of information.

If I am doing a project that uses a dye recipe, I can easily copy and paste it into a new document for an alternate project, then use my spreadsheets to modify the recipe based on the weights and fiber types being used. This allows me to quickly jump into the creation process because the planning time was cut down dramatically. Everything is so much more streamlined when using my computer this way.

Not everyone is tech oriented, but a computer can really be the best tool in your fiber toolbox! It saves you time, eliminates unnecessary papers, helps you do math, keeps track of your inventory, and so much more.

Alanna Wilcox is a master spinner and expert fiber arts instructor who loves sharing her passion with others and is constantly creating, especially with projects focusing on color. She wrote and self-published the popular book *A New Spin on Color* and has developed a method for creating dye formulas to match digital colors. You can learn more about her workshops and books on her website at alannawilcox.com, or follow her on Instagram @spinnybuns.

Alanna documents each step of the creation process in spreadsheets on her computer, and she teaches workshops on how to stay organized.

Keeping dye formulas on her computer helps Alanna match her color every time.

Spinning Paper Thread in Ghana

BY MARY HARK

The pulp (or paper) mulberry plant (*Broussonetia papyrifera*) is one of the most important botanicals used for making high-quality handmade paper worldwide, with historically significant production in Asia. The exquisite Asian papers are known to many as "rice paper."

In 1969, 14 pulp mulberry plants were transported from China to Ghana with the intention of evaluating the potential for paper production in West Africa. After they were planted in a forest preserve, the project was dropped due to political upheaval. However, the climate provided ideal growing conditions, and the pulp mulberry thrived, becoming the most serious invasive nonindigenous plant in Ghana and causing significant damage to the natural environment and local agriculture. Various means of controlling it, including burning, yielded limited success, and now this plant—the very plant that has provided the fiber for some of the most beautiful and important paper production in the world—is found in more than six regions of Ghana and continues to damage the environment.

In 2009, The Ghana Paper Project began developing and producing handmade papers using the invasive pulp mulberry, sometimes in combination with other local botanicals and textile waste from the local fashion industry. The project is now known as the Krataa Foundation. *Krataa* is the word for paper in Twi, the local language spoken in the area where the paper production takes place, and translates into English as "image of the soul." The foundation has produced several successful bodies of work including a portfolio of high-quality handmade papers suitable for a variety of artistic and functional purposes; a series of functional, artistically designed objects covered in handmade paper, such as folding screens and lamps, produced in collaboration with local craftsmen; and

Photos by Mary Hark

One of the project's spinners spins paper on a Turkish-style spindle.

a fine-press artist's book exclusively using papers developed by the project that can be seen in major museums and library special collections internationally.

In developing viable products with Ghanaian handmade paper, participants in the project considered what could be borrowed from Ghana's lively textile traditions. With mentorship from masterful paper spinner Velma Bolyard, the project artisans studied the production of *shifu* in Japan (see "Paper Threadmaking for Shifu" by Susan J. Byrd, *Spin Off*, Spring 2020), which features cloth made from mulberry paper that has been spun and woven. Modifying the traditional Japanese techniques, the Ghanaian papermakers have learned to spin paper thread strong enough to be woven and knitted.

While they have yet to produce this paper thread in large quantities, there is significant local interest in the process. In a place where textiles are profoundly valued and understood by virtually everyone, there is remarkable potential for the development of uniquely Ghanaian commercial and artistic products that make use of the paper thread.

To learn more, visit ghanapaperproject.com or follow the project on Instagram @theghanapaperproject.

Mary Hark is the proprietor of HARK! Handmade Paper, a fiber/mixed-media artist, a professor of design studies at the University of Wisconsin–Madison, and a passionate advocate for sustainable papermaking in Ghana, West Africa. To learn more, visit maryhark.com.

Examples of the handmade pulp mulberry papers, handspun yarns, and knitted fabrics created by the Ghana Paper Project. TactualGoods of Saint Paul, Minnesota, designed and 3D-printed the spindles used by the project.

Samples of cloth woven and knitted with the project's handspun paper yarn.

Scrappy Crochet Socks

BY RENEE STROUTS

Renee wearing her scrappy crocheted socks.

Photos courtesy of Renee Strouts

Pattern and designer Cosy Toes Cuff Down Socks by Dora Does. I made one modification: I moved the end-of-the-row seam to the front of the sock so that the color-change line could be a design feature.

Fiber/preparation The leftovers from at least 13 different sock yarns went into this pair. All fibers were superwash, mostly Merino or Merino/nylon blend, but one was Targhee. Three of the yarns were spun by other spinners, including one by Micki of A Thing for String and two by Melody of Four Rivers Yarn and Fiber, but the rest of the yarns were my own handspun. All my spins for this project started in roving form. Typically, I separate the roving down the length of the fiber into strips and predraft thoroughly. Fiber dyers included Wound Up Fiber Arts, Sosae Caetano Yarn and Fiber, Woolen Mill St. Yarns, and Fully Spun. Not all the leftovers are from yarns that became other projects; several are from singles remaining on bobbins after plying a three-ply yarn, which I then chain-plied into a mini skein for these socks.

Wheel system/spindle Older yarns were spun and plied on my Lendrum double-treadle wheel with a WooLee Winder. More recent yarns were spun on my Electric Eel Wheel (EEW) Nano 1.1 and then plied on the Lendrum.

Ratio I used a 19:1 ratio when spinning or plying on the Lendrum, and the dial speed was set at maximum when spinning on the EEW Nano.

Drafting method Worsted-style, short-backward draft.

Singles direction S-spun.

Singles wraps per inch About 40 wpi.

Ply wraps per inch 20 wpi.

Plying method Chain-plied, Z-spun yarn with high twist for hard wearing.

Total yardage A lot, but most became other socks!

Yards per pound 1,600 to 1,800 ypp.

Yarn classification/weight Fingering.

Yardage used The finished socks weigh 3.63 ounces, and by my calculations on the various yarns, I used about 443 yards.

Hook I used an antique steel Boye hook marked "3" (2.1 mm) inherited from my grandmother and a modern 3.0 mm hook.

Gauge 29 stitches and 30 rows = 4" in pattern.

Finished size Size small per the pattern to fit my U.S. women's size 10 feet.

I learned to knit when I was about ten years old from my great-aunt Marge. During one visit, I asked her how to start, and she showed me the knit stitch and a knitted cast-on. I remember later finding needles and a sparkly blue acrylic yarn amongst my mom's crafting stuff, and stubbornly, I worked through a square of mistakes until I sorted out the rhythm. My mom shortly thereafter taught me to crochet. In college, I discovered the local yarn store, and while buying a pattern and yarn for my first knitted socks, I asked if they were hiring. A week later, I wore the finished socks to the interview and got the job!

After several years working at the yarn store, I started eyeing spinning as my next fiber hobby. I got a beginning spinning kit and learned from a pamphlet on a drop spindle. By grad school, I had bought my first wheel. After building up a stash of chunky handspun yarns, I realized that I needed to spin for what I was knitting, which was fingering-weight yarn. In 2012, I set the goal of spinning 12 skeins of sock yarn.

In 2021, I was suddenly struck with the impulse to play with tiny hooks and make crochet socks. My first attempt, using commercial yarn, came out too large to fit anyone I know, and I also struggled with the S-plied yarn constantly splitting. I remembered hearing that Z-plied yarns are better for crochet, because the hook wrapping direction adds twist to the yarn instead of subtracting it, which helps to combat splitting. I usually spin singles S and ply my handspun yarns Z, having learned to spin that way on a drop spindle, and I carried on with this method on my wheel. Since I was faced with having to restart the crochet socks anyway, I opted to start over with my handspun.

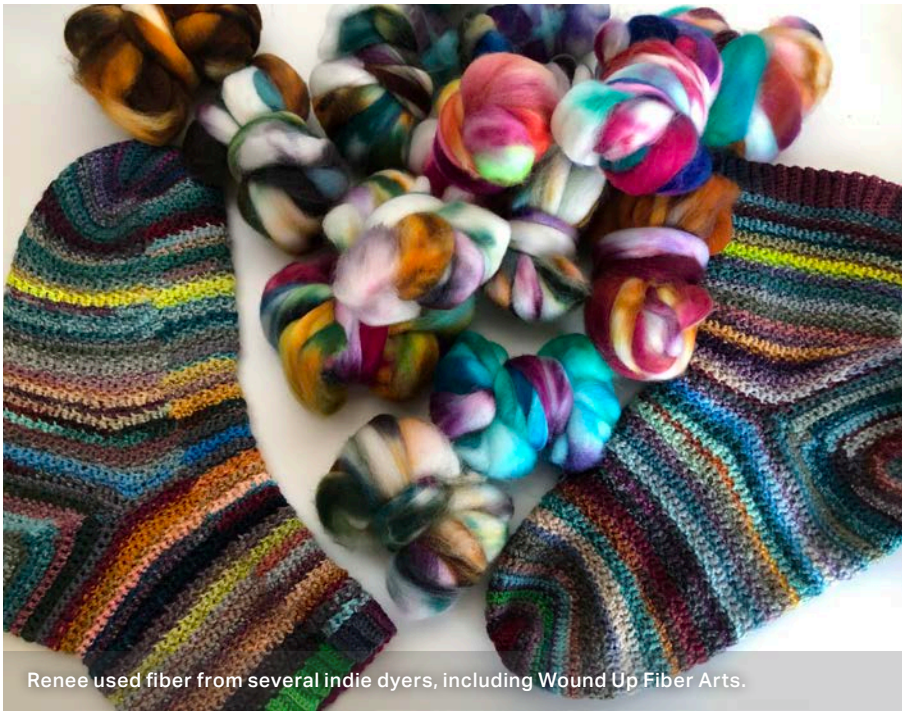
Just before the crochet urge hit me, I had been browsing for a good scrappy project to use some of my overflowing bag of handspun leftovers. Crochet is fantastic for scrappy projects because the ends can be worked in as you go, so it was an obvious match to use my leftovers for the new pair of crochet socks. For a consistent look, I sorted out the leftovers that were specifically superwash, chain-plied fingering weight. I had about 6 ounces in all.

When making the socks, I really enjoyed changing colors often and picking out the next contrasting color. Some small bits only lasted for one row, while I used the larger leftovers for a maximum of six rows at a time. After struggling with the commercial yarn on my first sock, this handspun pair flew off the hook in a matter of days.

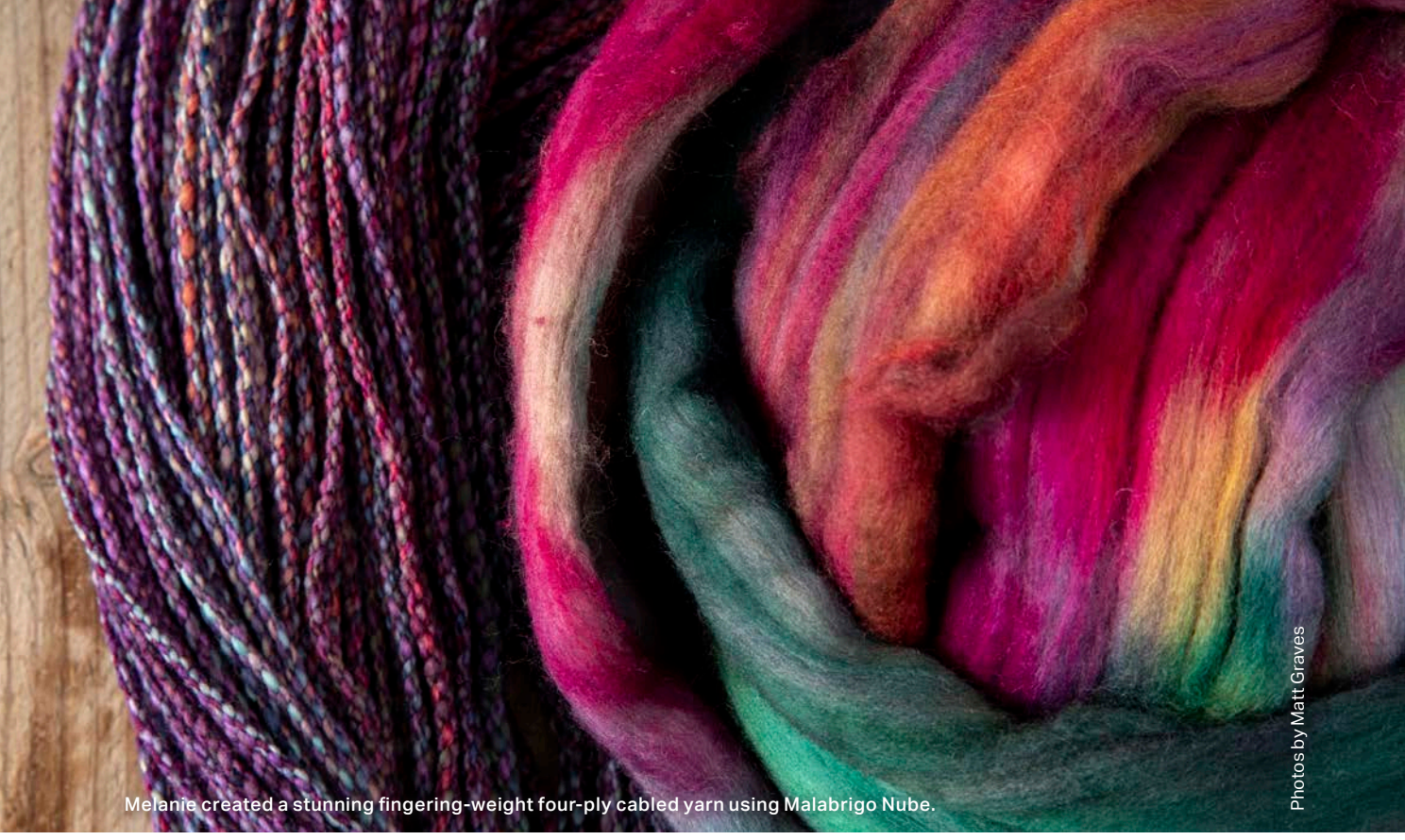
A few of my scraps were from other spinners who spun Z and plied S, and I did notice a distinct difference in the splitting behavior between them and my Z-plied yarns. It was a lot easier to work with the Z-plied yarn. I will definitely be using my own handspun for crocheting in the future!

Have a finished object to share? Tell us about it! Contact **spinoff@longthreadmedia.com** to submit your project.

Renee used the chain-plied leftovers from projects and the singles remaining on bobbins after plying for her scrappy socks.



Renee used fiber from several indie dyers, including Wound Up Fiber Arts.



Melanie created a stunning fingering-weight four-ply cabled yarn using Malabrigo Nube.

Photos by Matt Graves

Beauty Shot

Melanie's Cabled Yarn

BY MELANIE BONHOMME

Cable plying makes a lovely round, durable yarn that looks like it is braided. Most spinners find that cabled yarns are also resistant to pilling when put to use. In 2012, I made fingerless mitts from cable-plied Merino yarn, and those mitts are in regular rotation to this day. The color has faded a little, but there is no wear or pilling; they look like new.

See page 78 for more about cable construction and find a step-by-step guide at spinoffmagazine.com/kate-larsons-tips-spin-cabled-yarn. —Editor

FIBER AND PREPARATION

I started this project with two braids of Malabrigo Nube in the Boreal colorway. The fiber was a little compacted, so I teased it apart sideways, divided each braid into several lengths, and predrafted before beginning to spin.

SPINNING AND PLYING

I spun the singles Z on my Majacraft Little Gem II with a ratio of 4.7:1. I used a worsted drafting technique and spun each braid onto its own bobbin.

I used my HansenCrafts miniSpinner with the speed set to 10:00 for all of the plying. The yarn for the first plying step of a cabled yarn needs twice as much twist as a balanced yarn. I know I can't be trusted to put in twice the twist consistently, so I plied it twice in the S direction—a tip I learned from Judith MacKenzie. The first plying pass creates a balanced two-ply. Using the same ratio and rhythm, I ran the two-ply through my wheel a second time in the S direction. I now had one big bobbin of high-twist two-ply. (Can you see a problem brewing?)

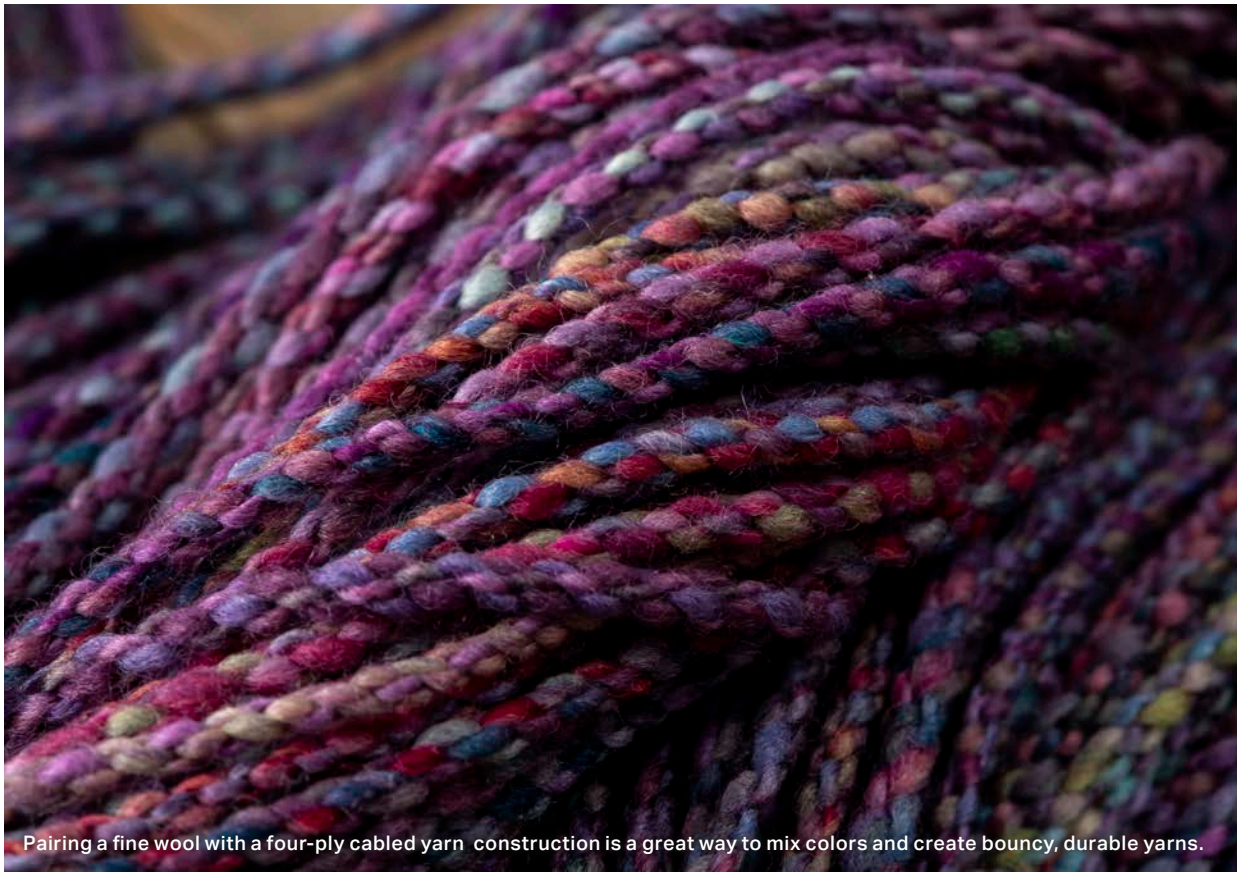
When I started spinning my singles, I hadn't made a decision about plying, so at this point, I had a head-

slap moment wishing I had spun the singles onto four bobbins; this would have resulted in two bobbins of two-ply, allowing me to easily create my four-ply cabled yarn. I did not want to try to ply this now high-twist yarn from a center-pull ball, so I decided to split it evenly between two bobbins. This isn't difficult if you have a few tools: I set the bobbin on a scale, and using a power screwdriver and a Bobbins Up bobbin (artuwear.net), I wound off half of the yarn so I had two equal bobbins of two-ply. I was then able to do the final plying with the same speed and rate of uptake as the initial plying but in the Z direction.

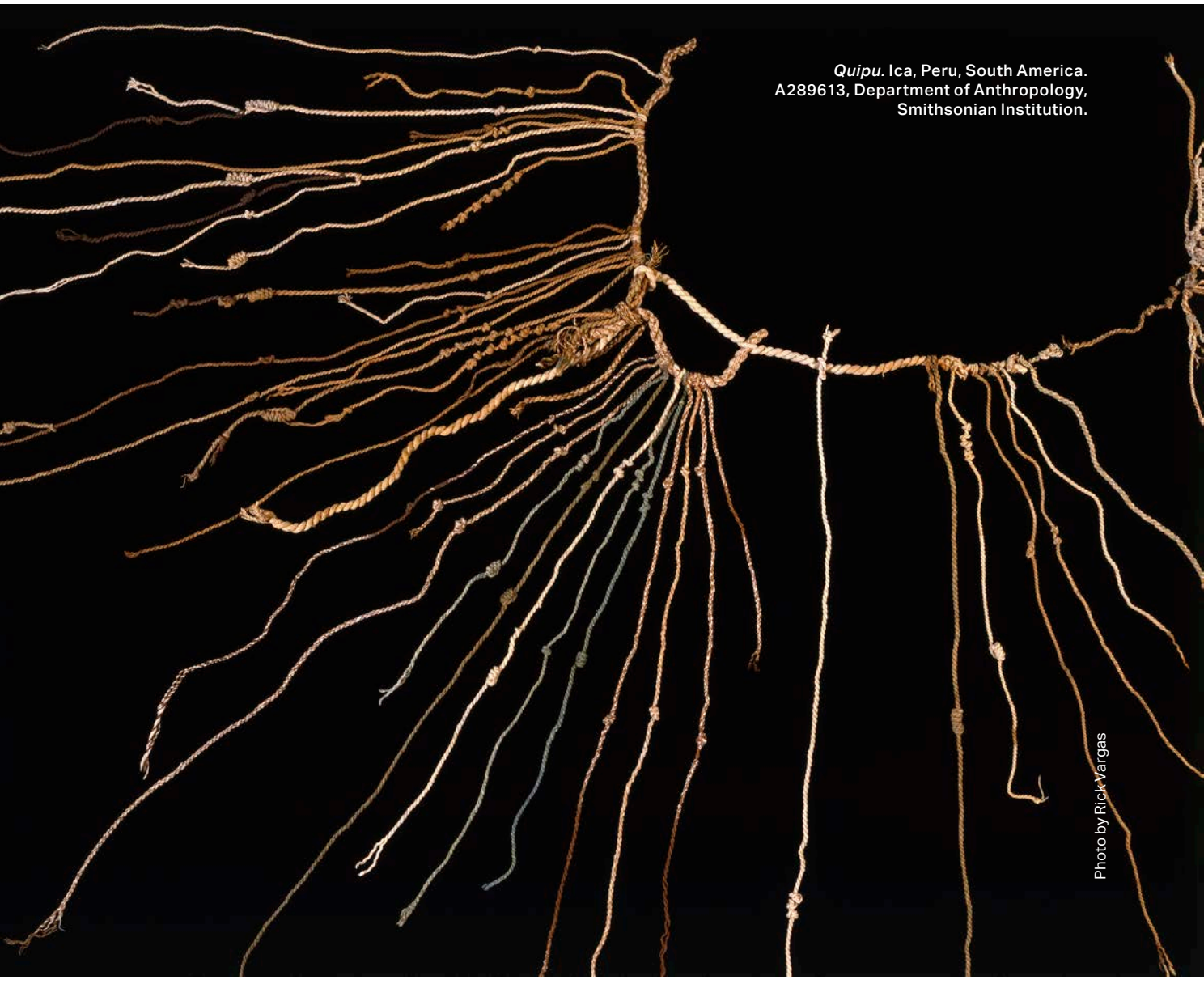
After washing and drying the yarn, I ended up with 405 yards of a balanced, smooth, and very elastic yarn.

Melanie Bonhomme practices productive procrastination with spindle and fiber in the suburbs of Vancouver, British Columbia, Canada, and shares her work on Instagram, Ravelry, and Etsy as Threadbender.

Melanie's yarns on a bobbin.



Pairing a fine wool with a four-ply cabled yarn construction is a great way to mix colors and create bouncy, durable yarns.



Quipu. Ica, Peru, South America. A289613, Department of Anthropology, Smithsonian Institution.

Photo by Rick Vargas

Telling Tales

Twist as Storyteller

BY LIZ HAMMOND-KAARREMAA

Spinners think of twist as an essential technique to hold fibers together, providing myriad options for form and function. It does just that, but if you are looking at historical textiles, twist also provides a fascinating window into the past. One can think of textiles as "text" (the word "text" comes from the Latin for "to weave"). Textiles are documents, the patterns and designs revealing much about our histories. Even the yarn has much to reveal: its twist provides detailed information or, at the very least, suggests where and how a yarn was made and what the purpose of a textile might have been. We might even gain an understanding of historical events that may have impacted a culture.

TEXTILES AS HISTORICAL DOCUMENTS

Among the most remarkable examples of this are *khipus* (or *quipus*), a collection of twisted cords and knots hung from a main cord made by ancient Peruvian Wari and Incas. When Spanish conquistadors invaded Peru, they encountered a sophisticated culture with no Western writing system. Eventually, khipus came to be understood as a form of writing—one we are still trying to read.

Harvard professor Gary Urton happened upon a Spanish census document written in the 1600s. Realizing it was from the same region and period as khipus found in a burial site, he suspected these might be two versions of the same document. He set Manny Medrano, an undergraduate student, to look for patterns between the two. Matching the two enabled Manny to break the code as it related to kinship groups within that particular census, thus providing clues to decoding other khipus.

Oral history tells of khipus used for record keeping and, astoundingly, as letters, histories, and narratives. Cotton khipus seem to be a different type of document from those made with animal fiber (vicuña, alpaca, guanaco, llama, deer, and vizcacha). Cotton khipus, unlike animal fiber khipus, use the same twist direction for all cords and may have been used for counting purposes, such as census records and storehouse inventories. By comparison, animal fibers provided more variables for encoding information. For example, alpacas have at least 22 natural colors, allowing color and color combinations to convey countless meanings—forming names, syllables, or words.

Depending on context, the twist direction of the final ply plays a significant role and can indicate lineage; identify gender of an animal (S-ply = ewes, Z-ply = male sheep); or reveal opposite meanings, such as the number of cows milked versus the number not milked. Even the twist of the knots signifies meaning; for example, S-knots can indicate upper class and Z-knots lower class. The stories in these remarkable khipus are still being decoded and tell us about Peruvian history according to Wari and Inca records.

STRING THEORY

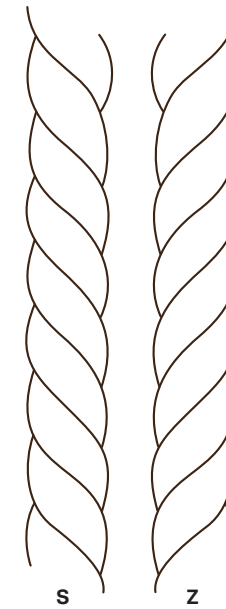
The oldest string ever found is about 50,000 years old—a miniscule fragment stuck to a stone tool. This tiny clue is all the more interesting because it is three-ply laceweight with all three singles twisted z and then plied S. This tells us that since Neanderthals could make cord, they most certainly could tie things together to make fishing nets, clothes, and bags and to attach stone tools to handles. This piece of cord also tells us Neanderthals knew the complex method for processing bast fibers and three-ply yarn, indicating that they thought about numbers, a step in the evolution of the ability to do abstract math. Given this, our notion of Neanderthals being unevolved and ignorant requires a major rethink.

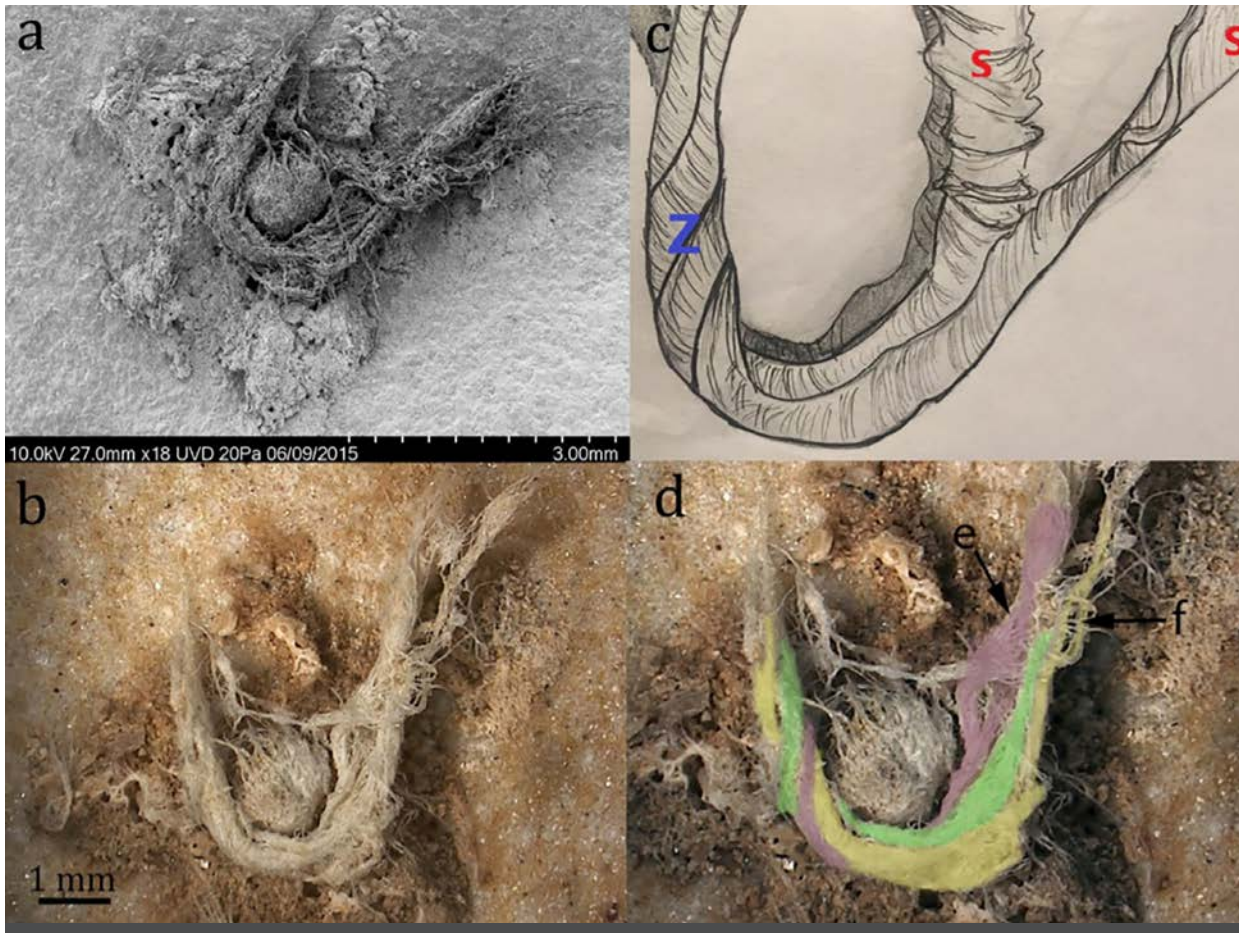
Singles can be made by twisting a bundle of bast fibers and adding more as needed, or they can be produced by twist-splicing long fibers by hand. The latter method involves twisting the ends of two fibers together to lengthen the thread. Once a long thread has been made, a larger-diameter string can be formed by winding a number of these threads together into a ball before plying with a spindle—a labor-intensive process (see page 23).

S and Z Notations

Handspinners often discuss twist direction in terms of S and Z. A twist to the right creates Z-twist, and twist to the left creates S-twist. For clarity, I will use lowercase s and z to represent singles twist and uppercase S and Z for ply twist. For example, two s-singles plied to the right produce an ssZ yarn.

S and Z are frequently used to discuss twist direction because the long slant of the Z (/) and the reverse slant of the S (\) correspond with the angle of twist in the last layer of twist applied to the yarn.





Neanderthal three-ply cord. (a) Scanning electron microscope photo of cord fragment, (b) 3-D Hirox digital photo of cord fragment, (c) schematic drawing illustrating s and Z twist, (d) enlarged Hirox photo with cord structure highlighted; arrows indicate location of photos e and f (omitted here). Licensed under CC-BY-4 (see Resources).

Illustration used by permission; drawing by C. Kerfant; Hirox: C2RMF, N. Mélard

A hundred years ago, the Kwakwaka'wakw of northern Vancouver Island once spliced long, thin nettle fibers this way. They twisted the thicker root end with the thinner top end of the next thread and then coiled this lengthening thread in a box. When the length reached 6 feet, sand was sprinkled over it to weigh it down and the splicing continued with thread and sand eventually filling a box. If the Kwakwaka'wakw wanted sewing thread, three or four nettle threads, each hanging from a box, were joined, then twisted using a spindle, and finally wound into a ball. For a thicker yarn, more threads were added. Other cultures, such as the indigenous cultures of eastern Asia, still use this twist-splicing method.

TWIST AND TIME

Splicing, of course, does not work for animal fibers because they will slip apart. Animal fibers must be drawn out (drafted) to be spun. Simultaneous drafting and spinning is much faster than splicing because twist-splicing is a two-stage process. Using a spindle can be more than two times faster than twist-splicing, and spinning on a wheel can be four times faster. If you know how a yarn was made, you can estimate how long it took to make the yarn needed for a textile, and you start to build up knowledge of a lifestyle, household economies, and trade. Did spinners have to spend most of their time processing and spinning enough yarns for clothing and household goods, or could they spin fast enough to produce excess textiles for trade?

Fibers that can be fluffed up and drawn out—such as wool and cotton—can be spun and used as singles. These singles can be spun either to the right or the left, but one direction tends to be more efficient, depending on techniques and tools. Cultures typically have a preference, and twist direction remains constant across broad geographic areas and generations.

Twist direction can often indicate the technique or tool used to make yarn. Hand twisting or rolling a spindle down the thigh produces an s-yarn. Working up the thigh produces z or a plied ssZ. From 5000 to 100 BCE, people of the Nile area rolled their top-whorl spindles down their thighs achieving an s-twist. Around the same time, spinners in Europe and India flicked their low-whorl spindles producing z-twist. Finding z-twist textiles in a town in the Nile area suggests a robust trade between that town and a foreign town, or, in a town with difficult access to a trade port, an immigrant community might have resided there.

Preference in twist direction seems to be based on what was taught, and it can be one of the indicators of origin of the textile or, in some cases, the people who made it. The twist direction, fiber content, and construction techniques all provide clues about extant textiles. When twist direction changes in a particular culture's textiles, this signifies a change in society and a story needing to be told.

TIMES OF CHANGE

In my research on Coast Salish textiles of the Pacific Northwest, I found that dog fur and mountain goat fiber were thigh-spun, going down the thigh and then up the thigh during plying to produce an ssZ

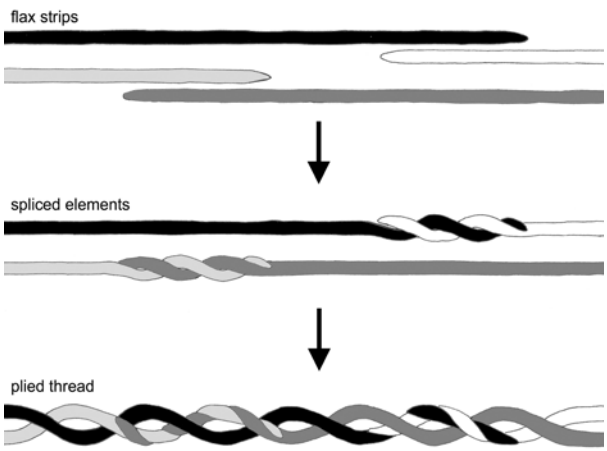


Illustration used by permission, drawing by C. Meyer and K. Grömer

Principle of splicing as illustrated in "Offering with Textile Wrapping from a Bell Beaker Sanctuary in Brodek u Prostejova, Czech Republic," published in the *Annals of the Natural History Museum in Vienna*.

Photo by Donal E. Hurlbert

Quipu. Lima, Peru, South America. A365240, Department of Anthropology, Smithsonian Institution.

yarn. From old Coast Salish blankets, I learned to tell commercial yarn from handspun by the number of plies (handspun = 2, commercial = 3 or 4 or more) and the direction of the ply (handspun = Z-ply, commercial = S-ply). After recording twist direction, twist angle, and twists per inch of over one hundred blankets, a pattern emerged. Blankets from the early 1800s were created with yarns that had more twists per inch and more wraps per inch, while blankets from a hundred years later contain yarns with fewer twists and wraps per inch. This holds true for different styles of textiles: closely twined fabrics, loose twills, and even Cowichan-style sweaters.

In theory, you could use this information to estimate the age of a textile. The change in twist and wrap characteristics reflects the changes and challenges spinners and weavers faced with the impact of colonialism: smallpox decimated the population, European mass-produced blankets flooded the area, and a way of life was disrupted. All these factors led to blankets being more rapidly produced using thicker and loosely spun yarns.

FOLLOWING THE THREADS

Twist direction often reflects cultural beliefs. In Navajo spinning, spinners are taught that Spider Woman instructed the Chief Medicine Woman, "You must spin toward you, or the beautiful goods will depart from you." In Colombia, Kogi men twist to the left while women twist to the right in spinning. In many cultures, if the twist direction is opposite the traditional direction, this carries significance. In some areas of Peru, it is thought that threads twisted against the traditional direction were used to counteract black magic and to improve well-being. In Korea, the nontraditional direction of twist was used only for mourning clothes.

Knowing how to process fibers and use twist to make string, yarn, cordage, rope, and everyday objects had huge material, social, and economic implications for our evolution. Twist helped to keep our ancestors' worlds together, it determined the strength and style of their essential fabrics, it encoded cultural messages, and it carried history. With careful study, we can learn from twist; it reveals invaluable fragments of the human story.

Close-up of a Coast Salish blank From the collection of Burke Museum, Seattle, Washington, showing a tear in the weft; spun from woolly dog fiber. From the collection of Burke Museum, Seattle, Washington.

Photo by Liz Hammond-Kaarremaa

Resources

Grömer, Karina, Pavel Fojtík, Angelika Rudelics, and Andreas Kroh. "Offering with Textile Wrapping from a Bell Beaker Sanctuary in Brodek u Prostejova, Czech Republic." *Annalen des naturhistorischen Museums in Wien [Annals of the Natural History Museum in Vienna]*, Series A, 119 (2017), 47–67.

Hardy, B. L., M. H. Moncel, C. Kerfant, et al. "Direct Evidence of Neanderthal Fibre Technology and Its Cognitive and Behavioral Implications." *Scientific Reports* 10, 4889 (2020).

Medrano, Manuel, and Gary Urton. "Toward the Decipherment of a Set of Mid-Colonial Khipus from the Santa Valley, Coastal Peru." *Ethnohistory* 65, 1 (January 2018), 1–23.

Liz Hammond-Kaarremaa retired as Director of Research Services at Vancouver Island University. She holds a Master Spinner Certificate for which she completed a research project focused on the Coast Salish spinning of traditional fibers into yarns. This opened her eyes to textiles and the stories they can tell. When not spinning, she often paddles the West Coast by kayak or in Tribal Journeys with First Nations by canoe or various *caminos* in Europe by foot. On the next journey, she will be taking a spindle! Links to more resources for this story are on her website, lizhk.ca/home/publications.

Detail of a girl's string skirt discovered in a grave located in Egtved parish, Denmark. Spun from wool, the strings are plied into a cabled yarn.

Ancient Cabled Yarns

BY GAYLE VALLANCE

There are many examples of cabled yarns in the archaeological records from such diverse regions as Peru, Chile, France, Denmark, North America, Egypt, and parts of the Roman Empire. Some of the earliest evidence includes the cast of a long piece of Paleolithic cord found in the Lascaux caves in France dating to about 15,000 BCE. The cord consisted of three Z-plied strands of vegetable fiber twisted together in the S direction.[1]

Another early example, found in North America, is the cordage in a blanket from the Spirit Cave (Nevada) showing a classic rope-twisting technique (s-spinning, Z-plying, Z-cabling) and dated to 9 to 10 thousand radiocarbon years ago.

String skirts are a common female garment dating to about 20,000 BCE. Skirts found in the Caserones village cemetery in the northern Chilean desert consist of long, dangling, retwisted yarns of camelid fiber. They resemble those found on adult females in burial sites in the Andes that go back more than seven thousand years.[2] Similarly, a woolen string skirt, found on the body of a girl at Egtved, Denmark, dates to the

Courtesy of the National Museum of Denmark, photo by Roberto Fortuna

late second millennium BCE and consists of a warp-faced band with weft threads that are twisted in pairs, and then in pairs again, to make the heavy cords that form the skirt.[1]

Notes

1. E. J. W. Barber, *Prehistoric Textiles: The Development of Cloth in the Neolithic and Bronze Ages with Special Reference to the Aegean* (Princeton, New Jersey: Princeton University Press, 1991), 40, 179.
2. Penelope B. Drooker and Laurie D. Webster, eds., *Beyond Cloth and Cordage: Archaeological Textile Research in the Americas* (Salt Lake City: University of Utah Press, 2000), 239.

Gayle Vallance has a Master Spinner Certificate from Olds College and has attained the technical level of the HGA Certificate of Excellence (Spinning). Her aim is to encourage the use of natural dyes and fibers. She raises Corriedale sheep on her farm to provide her with wool for spinning and felting. She grows flax for linen yarns and dye plants for natural dyes.

Courtesy of the National Museum of Denmark, photo by Roberto Fortuna

Bronze Age blouse and string skirt found in Egtved parish, Denmark. Excavated in 1921, the grave of the sixteen- to eighteen-year-old girl contained this woolen ensemble along with other grave goods. Learn more about the Egtved Girl at en.natmus.dk.

Sahara's straightforward approach to twist measurement allows her to explore everything from rugs to fine-gauge embroidery.

Photos by Matt Graves unless otherwise noted

Twisted Love

An Artist Measures Twist & Grist

BY SAHARA BRISCOE

Whenever I pick up some fibers—animal, plant, or even a fabric strip—the first thing I do is twist them! In twist, I see the roots of an artfully functional textile. Simple twisting gives me an intuitive sense of what the fibers could do. Measuring the angle of twist allows me to quantify the twist. Balancing intuition and measurements allows me to unlock the possibilities of the little fiber twist between my fingers.

Before I was a spinner, I learned to knit, crochet, sew, dye, embroider, and weave. The first four skills were inherited; the last two I studied on my own. Combined with design training in college, these skills allowed me to enjoy a successful career as a fabric developer in New York City's garment industry for many years. Eventually, I wanted to work beyond the constraints of ready-made materials and trendiness. My love of textiles and the study of textiles were leading me toward the creation of blankets, rugs, and other fabrics. I wanted more room for expression, and I wanted to engage my familial needlework. This, as you might guess, led me to spinning when my explorations deepened into the inherent possibilities of yarn itself.

So here I am today, exhilarated by the feeling of simply twisting fibers between my fingertips. Making yarn focuses my creative attention. Having the ability to design textiles that are both artful and durable continues to arouse my curiosity, constantly stimulating my practice and personal art. I want to share a bit about my practice, and I hope it helps you explore more, spin more, and create more fearlessly.

TWIST AND MABEL ROSS

The Essentials of Yarn Design for Handspinners by Mabel Ross was pivotal to my understanding of twist power through *twist angle*. I learned that regardless of the size, yarns sharing the same twist angle will

Photo by Ian Keldoulis

Step 1. Attenuate the fiber and finger-twist.

Step 2. Measure the size of the yarn. HipStrings grist tool shown here.

Photos by Sahara Briscoe

Step 3. Measure the twist angle.

After creating a hooked rug sample, Sahara was able to spin larger amounts of yarn for the full-size rug. *From top:* Two-ply Icelandic/Romney blend for woven foundation and two-ply bulky Icelandic for pile.

feel similar—hard or soft. There are, of course, many factors involved, but if spinning at its most basic is simply twist, I felt I could spin anything! My lapsed needlework and sewing skills gained a renewed interest because I could spin specifically for them! The overthinking that sometimes infiltrated my project planning diminished.

In her book *The Encyclopedia of Handspinning,* Mabel Ross discusses two ways to quantify twist: *twist angle* and *twists per unit length.* She also discusses *grist,* which she defines simply as "the size of a yarn." Over the years, I've developed my spinning practice based on two of these: twist angle and grist. The tools I use (see page 29) allow me to measure a section of yarn that is even just a few inches long, making sampling quick, easy, and intuitive.

SAHARA'S METHOD AND WORK

This simple approach works well for me: I take a group of fibers between my fingers and attenuate them until I'm close to the size singles yarn I want. Then I start adding twist with my fingers until there is enough twist to hold them together without being too tight. I lay it against my grist measure and note the size, and then I hold it against my twist-angle measure and note the angle. I may fold and ply it with my fingers and take more notes. Then I might experiment with adding more twist to the singles, depending on what I like to make and the job the yarn needs to do. When I find a twist sample with potential, I'll prepare, spin, and ply a sample skein. After the skein is washed and dried, I'll measure it again.

Woven and Hooked Boot Mat

During the spring of 2019, I thought about making a new boot mat to catch the salt and dirt from our boots in the coming winter. With my bountiful fiber stash tugging at my guilt, my newly learned skill of rug hooking came to mind. Looped pile was an appropriate structure for a boot mat and easy to do. I didn't want to use burlap or expensive linen as a foundation cloth, so why not spin and weave my own? The wool would shrink a bit in finishing, securing the loops. I would need to spin only two types of yarn: a moderately

twisted yarn for the base cloth and a bulky, slightly softer plied yarn for the hooked pile. I was stoked!

Handspun for Base Cloth and Pile

I thoroughly blended the Romney and Icelandic in a 50/50 blend on my drumcarder, and then I dizzed the roving from the carder. I chose to spin with an American long-draw technique. Long draw allows me to see the grist and twist angle of my yarn over a long length to maintain consistency. After setting the twist, the yarn bloomed to 8 wraps per inch (wpi) but was still very strong for both warp and weft yarn.

To create the pile yarn, I drumcarded the Icelandic fleece with the *tog* and *thel* (long and short fibers) together, then dizzed the fiber into roving. I spun the roving using a Navajo spindle. These bulky yarns have a low twist angle (14 degrees), and this spindle makes it easy for me to achieve that.

Sampling and Weaving

Then, I wove a sample using Purl & Loop's Swatch Maker 3-in-1 loom. It started out at 8 warps and wefts per inch but bloomed after finishing to 6.5 ends per inch (epi) and 5 picks per inch (ppi). I added a small amount of pile to the woven strip using a crochet hook. This small sample was intoxicating! I was making my own hooked rug from fleece to finish!

I warped my Glimåkra Emilia 19-inch rigid-heddle loom at 8 epi, which created a nice, close backing to hook into. I decided on a simple pile design, more effective for boots than beauty, and drew it onto the foundation cloth using white chalk. In the end, I didn't full the back; it went on the floor right away. My foyer stayed clean, and I daydream about a larger rug.

My Twisted Crewel Adventure

Embroidery was one of the skills I inherited that lay dormant until I read a *Spin Off* article by Kate Larson on spinning embroidery yarn ("Norwegian Embroidered Handcoverings," *Spin Off*, Summer 2014). I'm a fan of English crewel embroidery with its fantastical flowers stitched in wool yarn on a linen ground cloth. I purchased some Appleton's crewel yarn to analyze and used the 30-degree twist

Photo by Ian Keldoulis

Sahara spins much of her bulky yarn on her Navajo spindle for better control.

Photos by Sahara Briscoe

Rug hooking in progress. The finished mat measures 25 inches × 19 inches. Hook from Little House Rugs.

Mabel Says . . .

Grist

The size of a yarn. Formerly, and still sometimes, expressed as its length per unit weight (e.g., meters per kilogram or yards per pound).

Twist Measures of Yarn

Yarn and fabric quality is largely determined by the degree of twist in the yarn: both the singles and the folded twist. It is therefore very desirable that this should be controlled by some means which are more accurate than guesswork, if it can be made simple.

1. Twist angle.

The angle to which the fibres in the yarn have been twisted, termed the "twist angle" of the yarn. This measure defines the yarn quality. All yarns twisted to the same angle will have a similar quality of handle and flexibility. The twist angle can be assessed by comparison with an "angle guide" based on a protractor.

2. Twists per unit length.

The number of twists in each unit length of yarn, either per centimetre or per inch. This measure enables the handspinner to control the twist degree very simply through the performance of the wheel and the aid of a conversion table to convert twist angle to twists per unit length. The table is necessary because the number of twists which a unit of length of yarn requires for any twist angle varies with the thickness of the yarn. (See *The Essentials of Yarn Design for Handspinners*.)

3. Twist angle related to purpose.

In general terms, single yarn must be twisted to nearly 10 degrees to be stable; between 12 degrees and 20 degrees are a variety of light twists suitable for a range of soft knitting yarns or weft; between 21 degrees and 29 degrees the various twists are suitable for harder-wearing knitting yarn and, at the upper end of that range, for warp. Above 30 degrees, a yarn becomes increasingly hard, but such twists are required for special types of yarns, including some fancy yarns.

From *The Encyclopedia of Handspinning* by Mabel Ross (see Resources).

Sahara purchased Appleton's crewel wool (*left*) so she could measure the twist angle. She then spun her own slightly heavier yarn with the same 30-degree twist angle.

When stitching design elements that lean right or left, ply twist can interact with the stitch angle, changing the visual effect.

angle in my handspun. However, I adjusted the grist to complement the thicker woolen ground cloth I selected. My two-ply yarns averaged 12 to 14 wpi.

Yarns for crewel spin up rather quickly because you don't need much yardage. What I was surprised to learn when I started stitching with handspun was the direction of twist—Z or S—matters greatly, particularly with stitches that twist around each other or where the twist interacts with directional design elements. For example, the flower leaves (see above) have stitches that lean left and right. The angle of the stitches interacts with the twist angle of the yarn, creating a visual difference. Sewing stitches, such as running stitch and backstitch, are not greatly impacted by twist direction.

For the sample piece shown here, I chose a slightly heavier woolen foundation fabric and spun thicker yarns from a variety of fibers. I've observed that in yarns spun from low-luster wools, the twist is visually less evident, so I spin a yarn that is comfortable to work with and worry less about the visual impact of twist amount and direction. Silk and other high-luster fibers, however, will act like high-gloss paint, intensifying the appearance of twist in the stitching. I now spin my yarn according to the type of fiber I have and how it will enhance my design on whatever ground cloth I'm using.

From Ready-Made To "I" Made

Twist, that most basic element of yarn, can give you the confidence to explore and spin many different fibers. When ready-made materials seem too trendy or costly, experimenting with twist can reinvigorate craft skills that had been brushed aside. You can even adapt new fabric crafts to your needs by spinning yarn—it's all about the power of twist. Your creativity, like mine, will take a new turn. ●

Resources

Glimåkra Looms, glimakrausa.com
Hillcreek Fiber Studios, hillcreekfiberstudio.com
Larson, Kate. "Norwegian Embroidered Handcoverings." *Spin Off* (Summer 2014), 86–88.
Little House Rugs, littlehouserugs.com
Purl & Loop, purlandloop.com
Rainbow, Jane. *Beginner's Guide to Crewel Embroidery.* Turnbridge Wells, England: Search Press, 1999.
Ross, Mabel. *The Encyclopedia of Handspinning.* Loveland, Colorado: Interweave, 1988.
———. *The Essentials of Yarn Design for Handspinners.* Kinross, Scotland: Mabel Ross, 1983.
Sunrise Sheep and Wool, sunrisesheep.com

Sahara Briscoe, of the Bronx, New York, is a commissioned artisan textile developer. Textiles developed and produced by Sahara have been exhibited at the Shanghai World's Fair, as well as in museums and galleries in New York and Europe. She is most proud of instituting an in-house message service for seniors at a local residence who were isolated during the COVID-19 pandemic. To communicate with their friends in confinement, the seniors created stitch cards designed by Sahara, which were then distributed by the staff.

A low-backed dining room chair or office-style chair can help you position your body for spinning without twisting your spine.

Photo by Matt Graves, illustrations by Anjuli Keller-King

Twist Your Fibers, Not Your Spine

BY CARSON DEMERS

If you were to track how many hours you spend sitting in a day, the results may surprise you. Meals, driving, computing work—it all adds up. And if you're a spinner who uses a treadle wheel, the hours spent sitting can whiz by without you noticing. Sitting gets a lot of bad press these days for its impact on cardiovascular health. Some of this information is disputable and can be countered with arguments that prolonged standing can be just as bad for the cardiovascular system as prolonged sitting.

There is also research that shows not all sitting is the same. *Static* sitting is restful sitting with little or no other movement. Think watching television. *Fidget* or *dynamic* sitting is sitting that is accompanied by movement. Think spinning! The latter is more cardiovascular-friendly, in part because the muscle activity in your calves helps pump blood out of your legs and back to your heart; score one for spinning. But there are concerns beyond your cardiovascular system that every spinner who sits to spin should know about. And that's where our story begins.

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CURVES AHEAD

Your spine comes with natural curves in it: concave at the neck and low back, convex through the ribs and sacrum. If you are able, take a moment to stand and look straight ahead. Now feel the natural curves in these areas and get a sense of their depth and length in your back. The depth and length vary among people and change with activity, posture, and aging. If you look at the curves in a spinal column, as a spinner they might remind you of crimp. And, in fact, they function the same way. These curves allow for energy storage and return during activities such as walking and jumping. They absorb the reaction force of your contact with the ground and disperse it, so you don't end up with an injured brain after walking the dog.

But like fiber without crimp, a spine without curves has limited means for energy to be stored or returned. It's a bit like the difference between knitting or crocheting with a springy Merino-based yarn compared to a silk or linen yarn. Fortunately, there is a backup system for our body to absorb and distribute these forces when the curves are reduced or absent—your spinal discs.

Back to our experiment: Feel the curve in your neck as you look straight ahead. Now drop your head as if you're watching your hands drafting or plying. Like magic, the curve flattens and the spinal discs rush to the rescue. Stand up and feel the curve in your low back. Then, keeping your hand on the curve, sit back down and notice that the curve flattens. Lean forward as if you're starting to turn your wheel and notice that the curve might even reverse itself from concave to convex. What happens to the discs when the curve flattens? They flatten, too. While they are designed for this, they require some TLC to keep them happy and healthy. And you should want them this way because unhappy, painful discs can distribute their unhappiness down the full length of the leg and into the foot.

Dr. A. L. Nachemson's research in the late 1970s and early 1980s on intradiscal pressure changes with postural change are well cited and widely referred to in the physical therapy community. His work shows

But like fiber without crimp, a spine without curves has limited means for energy to be stored or returned.

What Causes Torso Rotation During Spinning?

CAUSE	SOLUTION
Using both treadles on a double-treadle wheel.	Practice using one treadle and position your chair at an angle to the wheel. Example: right foot treadles and the chair is rotated to the left.
Chair	Stationary chairs limit your shoulder's range of motion and elbow extension length. Using a swivel chair or swivel seat placed on a stationary chair can greatly increase the distance you can move away from your orifice without twisting your spine.
Competitiveness	There's really not a prize for having the longest draft or length of singles off the bobbin when plying. Try the above ideas to increase drafting lengths while saving your spine and shoulders.

Optimal movement patterns are those that will not involve rotation of your torso or repeated shoulder extension.

that disc pressure increases 100 percent when we move from standing to unsupported sitting—that is, sitting without a backrest. Perhaps more startling is the finding that disc pressures increase 400 percent when the spine is flexed (flattened curve, i.e., sitting) and rotated. As a physical therapist and a spinner, this is of great concern to me for my own well-being and that of my students and all spinners.

It's well worth your time to watch how you use your body while drafting and plying. Long draw, backward drafting, and plying are often accompanied by significant torso rotation. As mentioned above, this increases disc pressures up to 400 percent.

Hot Tip!

Can't afford a swivel chair? No problem! Mobility assistance devices help people pivot for transferring from sitting to standing, are inexpensive, and will convert your dining room chair into a swivel chair. You can purchase these from a medical supply company.

Swivel seats, also called pivot or swivel discs, can turn any seat into a swivel.

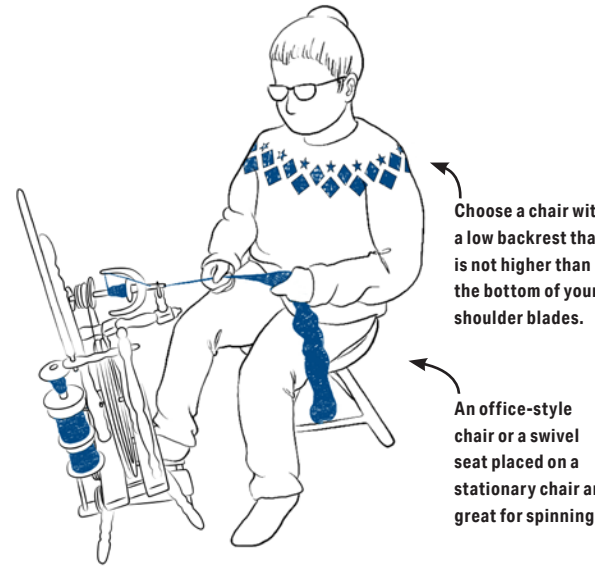


Figure 1. Optimal shoulder starting point.

Figure 2. External shoulder rotation.

Figure 3. Elbow extension.

Figure 4. A risky long-draw position. Because the spinner has both knees close together and facing the wheel as the back hand reaches as far back as possible, the torso may twist and the shoulders are at risk.

Figure 5. If the spinner places only one foot on a treadle and sits at an angle to the orifice, the shoulders are protected.

Neutral posture and optimal movement patterns reduce strain on your body. For seated posture, this means hips and knees at right angles (knees slightly lower than your hips), a slight anterior tilt to your pelvis to keep a curve in your low back, your back supported by a backrest, and your shoulders relaxed at your side. Optimal movement patterns are those that will not involve rotation of your torso or repeated shoulder extension.

When it comes to spinning, a chair that swivels is very helpful. It allows you to rotate the chair and not your spine to get those long drafts.

HOW TO AVOID TWISTING YOUR SPINE

Let's start by talking about your shoulders; don't worry about your feet for now. Drafting fiber for backward or long draw should come from shoulder rotation, elbow extension, or a combination of both. Try this: Start by sitting at a slight angle to the wheel in a neutral position (Figure 1). With your elbow flexed and your arm resting at your side, put your forearm across your abdomen, like the position it's in if you're wearing an arm sling. Now, keeping your elbow at your side, rotate your forearm away from your abdomen. Stop at a comfortable point. This is *external shoulder rotation* (Figure 2), and it saves your shoulder from the damage that reaching behind you repeatedly can cause.

Let's try another movement pattern that does the same thing and is especially useful if you have shoulder issues. With your elbow bent and at your side, now straighten it. This is *elbow extension* (Figure 3), and it's another useful way to draft and save your shoulder and spine.

Armed with this knowledge, how can spinners adjust their motions to allow them to spin safely and comfortably? Let's look at some of the common causes of poor position and easy solutions to keep you spinning comfortably.

Orientation to the Wheel

Spinners often want to get the longest draft or, when plying, attempt to pull a longer length of singles to expose to twist. But what causes them to twist their spines to do it? One reason could be the wheel. Double-treadle wheels are great machines, but having your feet on two treadles locks you squarely facing your wheel. That can be fine, but it means the amount of fiber you can draft or ply is limited by your ranges of

Another reason you might be rotating your spine is the chair you use for spinning. I long for the day when craftspeople will recognize that the chair is as important a tool as their wheels, spindles, needles, and looms.

motion for shoulder rotation and elbow extension if you're using sound body mechanics. To compensate for this reduced drafting range, the spinning position in Figure 4 can put both the spine and shoulder at risk.

If you want to work around this, practice using a single treadle on your double-treadle wheel and sit at an angle to the orifice as shown in Figure 5. You still want to use the safe shoulder movements shown in Figures 2 and 3, but with only one foot on a treadle, you can position yourself at an angle to the wheel, increasing your distance from the orifice. The rotation comes from your hip instead of your spine.

Your Chair

Another reason you might be rotating your spine is the chair you use for spinning. I long for the day when craftspeople will recognize that the chair is as important a tool as their wheels, spindles, needles, and looms. Get a chair that's meant for the job. When it comes to spinning, a chair that swivels is very helpful. It allows you to rotate the chair and not your spine to get those long drafts. I'm a big proponent of office-style chairs at the spinning wheel because they swivel; they are height adjustable, allowing them to be fitted to every wheel and treadle height; and they have an adjustable backrest. The backrest need only come to the bottom of your shoulder blades—not higher. Tall backrests encourage you to tilt forward adding to spinal disc pressure, and they obstruct shoulder movement. You also do not want armrests on a chair for spinning for many reasons, but chiefly because they get in the way of being able to sit at an angle to the wheel and extend your elbow to your side.

Going for Gold

Finally, there's a behavioral reason that often leads to spinal rotation. It perhaps has to do with one's competitive nature and the imagined glory that having the longest draft in the world will bring. To this end, these competitive spinners twist their spines, extend their shoulders behind them, or both. If you're going for the imaginary gold of a lengthy backward draft, or if you want to pull long lengths of singles out to ply, use the body-saving methods already described. Twist only belongs in your fiber and yarn—not in your spine while you're spinning.

Carson Demers is a physical therapist, and he is also the author and publisher of *Knitting Comfortably: The Ergonomics of Handknitting*. Carson has taught classes throughout the United States and internationally, and he is a frequent contributor to several fiber- and craft-related publications. Visit him online at ergoiknit.com.

Knitting Comfortably:
The Ergonomics of Handknitting

By Carson Demers

San Francisco, California: Ergo I, 2017. ergoiknit.com

Laceweight Chameleon Shawl.

Photos by Matt Graves

The Chameleon Shawl

BY MELVENEA HODGES

Handspun cotton can be used to create cloth with a cool, silky drape or a project that is as warm and luxurious as cashmere. However, spinners often shy away from using handspun cotton for knitting. They may say that it doesn't have the loft and elasticity of wool or that it is hard to spin into a consistent yarn.

As with all fibers, these challenges can be managed with practice and skill. My best advice is to experiment by spinning many different types of cotton on many spindles and wheels. Creating the best cotton yarn for knitting is a creative spinning challenge. As you become comfortable with cotton, you'll discover its strengths and weaknesses as well as your preferences.

The Chameleon Shawl can be adjusted to suit different yarns and gauges, making it a perfect project to pair with your handspun cotton explorations. The pattern is designed as a formula that allows you to use your senses and intuition to guide shawl construction. I call it a "chameleon" because it can adapt to whatever cotton yarn you spin. Add as many visual changes as you want by changing yarn colors or stitch-pattern intervals.

SPINNING NOTES

For a laceweight shawl, spin about 3 ounces or 700 yards total; for fingering weight, spin about 4 ounces or 400 to 500 yards; and for a worsted-weight shawl, spin about 10 ounces or 200 to 400 yards. This is not a hard-and-fast rule. You can knit this shawl large enough to wrap yourself into it like a cocoon or small enough to tie comfortably around your head or neck as a dainty kerchief. I like a nice versatile size of about 27 inches deep in the center with 6 feet across the top edge. You can spin and knit a chunky shawl or make it fine enough to slip through a wedding ring. You can use one color of fiber or mix and match as you please.

There are a number of ways to spin cotton, but I usually use a supported long draw whether I am using a wheel, supported spindle, or drop spindle. Long draw can be used to create lofty yarns, but the fiber needs to be well prepared so it drafts freely. Choose a fast ratio on your wheel or a spindle made for speed; you'll need to accumulate twist quickly. Draw your fiber out, stretching your fiber-supply hand away from the spindle or wheel. Once you have an arm's length of soft singles yarn, hold it for a few seconds as twist continues to accumulate and strengthens the yarn. Gently tug the fiber to help coax out any slubs.

To learn more about spinning cotton for knitting, read "Spinning Cotton for Knitting: Advice from a Cotton Lover" by Melvenea Hodges in Spin Off, *Spring 2020.*
—Editor

MATERIALS

Fiber 3 (10) oz cotton.
Yarn 2-ply; 700 (400) yd; 22 (12) wpi; laceweight (worsted weight).
Needles Laceweight: Size 4 (3.5 mm): 32" circular (cir). Worsted weight: Size 11 (8 mm): 32" circular (cir). Adjust needle size if necessary to obtain the correct gauge.
Notions Markers (m); removable m; laceweight: size F/5 (3.75 mm) crochet hook; worsted weight: size L/11 (8 mm) crochet hook; tapestry needle; optional shell beads and sewing thread.
Gauge 21 (11) sts and 32 (19) rows = 4" in St st.
Finished Size 55 (63)" wide and 25 (26)" tall.

Visit **spinoffmagazine.com/spin-off-abbreviations** for terms you don't know.

Cotton slivers can be purchased in a wonderful range of natural colors, such as these slivers from Ecobutterfly Organics. Try mixing them up in a shawl!

Notes

- This triangular shawl is worked from the center neck down and outward to the points.
- Instructions are written for a laceweight shawl with changes for the worsted-weight version in parentheses.
- The shawl can be made larger or smaller by working more or fewer repeats of the garter eyelet and stockinette sections.
- A circular needle is used to accommodate the large number of stitches.

SHAWL

CO 5 sts.

Knit 2 rows.

Next row (RS) K1, [k1f&b, k1] 2 times—7 sts.

Next row (WS) Knit.

Set-up row (RS) K2, place marker (pm), yo, k1, yo, k1 (center st) and mark this st, yo, k1, yo, pm, k2—11 sts.

Next row (WS) Knit.

Garter Eyelet Section

Row 1 (RS) K2, sl m, yo, knit to center st, yo, k1 (center st), yo, knit to m, yo, sl m, k2—4 sts inc'd.

Row 2 (WS) Knit to center st, p1 (center st), knit to end.

Rows 3 and 4 Rep Rows 1 and 2.

Row 5 K2, sl m, yo, k1, *yo, k2tog; rep from * to center st, yo, k1 (center st), yo, **ssk, yo; rep from ** to 1 st before m, k1, yo, sl m, k2—4 sts inc'd.

Row 6 K2, purl to last 2 sts, k2.

Rows 7–10 Rep Rows 1 and 2 two times.

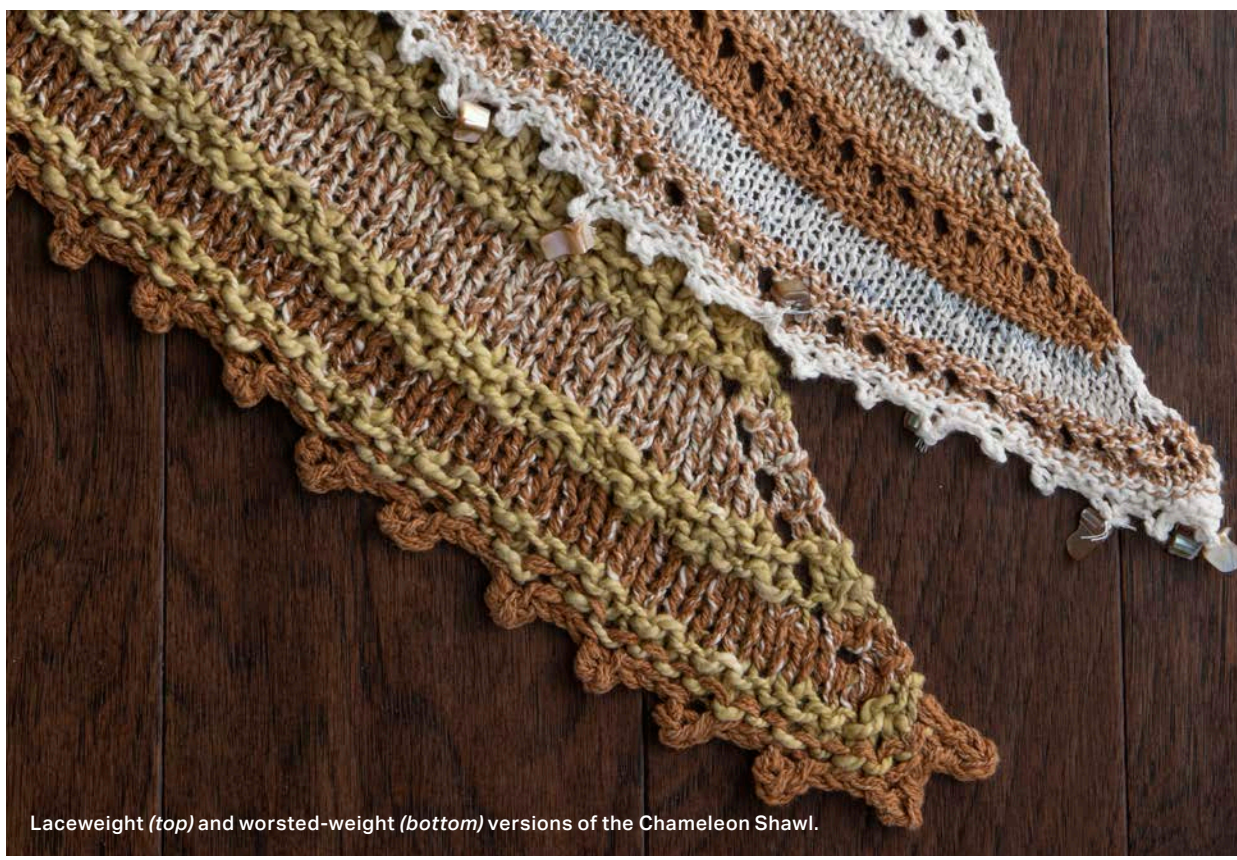
Stockinette Section

Row 1 (RS) K2, sl m, yo, knit to center st, yo, k1 (center st), yo, knit to m, yo, sl m, k2—4 sts inc'd.

Row 2 (WS) K2, purl to last 2 sts, k2.

Rows 3–6 Rep Rows 1 and 2 two times.

Rep garter eyelet and stockinette sections 9 (5) more times, or to desired length.



Laceweight *(top)* and worsted-weight *(bottom)* versions of the Chameleon Shawl.

Melvenea grows, prepares, and spins her own cotton.

Laceweight only:
Work garter eyelet section.

Worsted weight only:
Work Rows 1 and 2 of garter eyelet section 2 times.
Work Rows 1 and 2 of stockinette section 2 times.
Work Rows 1 and 2 of garter eyelet section 2 times.

Both versions:

Crocheted picot bind-off

With crochet hook and RS facing, transfer first st to hook, yo and pull through st on hook, *transfer next st to hook, yo and pull through both sts on hook, ch 4, insert hook into first ch, yo and pull through ch and st on hook (picot made), [transfer next st to hook, yo and pull through both sts on hook (sl st made)] 2 times; rep from * to center st, work 2 picots into center st, **work 2 sl sts then 1 picot; rep from ** to last st, transfer last st to hook, yo and pull through both sts on hook. Fasten off.

FINISHING

Weave in ends.

Optional: Sew a bead to every 3rd picot, between the 2 picots at the point, and to 3 picots at each side of point.

Mist the shawl with water or starch solution from a spray bottle. Stretch and pat the shawl into shape. Allow to dry flat.

Melvenea Hodges is a fiber artist born and raised in Benton Harbor, Michigan. She is committed to practicing traditional textile techniques in honor and expression of her heritage as an American maker. She intermittently blogs about her latest creations and fiber adventures at traditionsincloth.com.

Elizabeth's Shetland fine lace yarns.

Photos by Matt Graves unless otherwise noted

Spinning Shetland Fine Lace

It's All About Twist—Or Is It?

BY ELIZABETH JOHNSTON

Shetland fine lace yarns and knitted textiles are well-known in the handspinning world. For many, Shetland fine lace is the ultimate yarn to spin. I am sure that for others, it is something to avoid. These beautiful yarns knit up into beautiful fabrics, but it does take practice to spin them.

When asked to write this article, my first thought was, "You just spin as fine as you can with enough twist so that it holds together and the yarn feels okay when plied." That is possibly how spinners of the past and present here in Shetland see it, but we have the historical knowledge, the wheels, and the fleece to do

the job. I'll try to share with those of you outside of Shetland what I mean by "enough twist" and how to judge when a yarn feels, looks, and behaves as it should for fine lace. So here goes!

SPINNING WHEELS AND FIBER

Two things to consider when aiming to spin fine lace in the Shetland tradition are the spinning wheel and the fiber. Firstly, when spinning Shetland fine lace, the spinning wheel you choose should have a high ratio. Fine lace yarn needs twist—quite a bit of twist—so a high-ratio wheel is best. It can be a double- or single-drive wheel but not a bobbin-led wheel (see page 76). Choose a wheel with slow pick-up, which is the speed with which the yarn is wound onto the bobbin. You might also hear this called tension or take-up speed, depending on where you live.

For a double-drive wheel, the difference between the diameters of the groove in the flyer whorl and the bobbin's whorl determines the pick-up speed. The closer these are in size, the slower the yarn will wind onto the bobbin. For a single-drive (scotch-tension) wheel, pick-up is set with the brake tension. And when using either type of wheel for fine lace spinning, always keep the moving parts of the wheel well lubricated.*

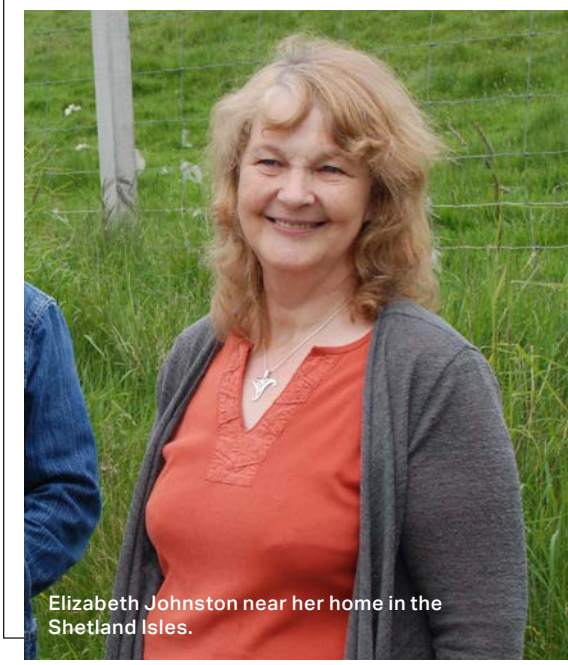
Then you need to choose the fiber, which should be Shetland fleece—that's easy, right? Well, not quite. Shetland fleece comes in a range of qualities, and you need the right quality for fine lace. The Shetland breed was not selectively bred to produce a single quality of fleece. In the past, the breed had to supply every fleece quality that the home needed, from rug wool to fine lace, and it still does today. Therefore, a Shetland fleece with high crimp and extrafine fiber, usually found in the neck and shoulder areas of the fleece, is essential.

Fiber Preparation

For many, washing would be the next step in the process. Traditionally, we did not wash the fleece in Shetland. In fact, we added oil. I still do not wash my fleece, and I add oil, too. The lanolin in the fleece does help with the spinning process, especially when spinning very fine yarns. However, to be practical, the fleeces we have access to in Shetland are clean, and that is not the case for fleeces everywhere. Also, some spinners just do not like working with greasy fleece. I will not say, "Do not wash your Shetland fleece," but a wash in hand-hot water with a little detergent will clean most fleece and remove the smell, while leaving some of the lanolin on the fiber.

With that washing dilemma dealt with, it is on to the preparation. Locks are combed individually using a dog comb. Do not comb the lock up in the air, as you would a flicker. Hold the lock firmly on a cloth on your knee, set the comb in the center of the lock, and draw the lock so that it moves through the comb rather than the comb moving through the lock. Do this for each end of the lock, overlapping a little in the middle. When a "primitive" fleece that is inclined to shed naturally has been sheared, there will be a short section

Elizabeth Johnston is a Shetland spinner and knitter. She absorbed much of her craft as a child, observing and learning from family and friends. She uses these age-old skills, handed down through generations, to turn Shetland fleece into beautiful soft yarns and knitted Fair Isle and lace items for her business, Shetland Handspun.



Elizabeth Johnston near her home in the Shetland Isles.

Photo by Kate Larson

Shetland locks from shorn fleeces will have a short section of next year's fleece on the cut edge. The next year's fleece is a new fiber, not connected to the previous year's fleece, but as it grows it overlaps with the previous fleece and is easily pulled off the lock. *Left:* Locks as they were shorn. *Right:* Locks with the short fibers removed.

of the next year's fleece on the inside edge (cut end) of each lock. During combing, most of those short fibers will be removed, but you need to check that they have all been removed. Prepare as you spin; just comb as much as you will spin in one day.

SPINNING AND PLYING

Eventually, we come to the spinning! Shetland fine lace is a worsted-spun yarn. Always spin from the inside edge of the combed lock (cut end). The wheel is turned to the right for spinning and in the opposite direction to ply. Shetland spinners never referred to twist directions as S and Z. We spun what we called "right," meaning correct, as in turning the wheel clockwise, with the sun, and we plied "wrong," the opposite of "right."

To determine how fine a lace yarn can be, the older spinners would explain: two fibers twisted together is plying, three fibers twisted together is spinning. However, a single thread spun with three fibers is not very strong, so at least two fibers need to be added for strength. A fine lace yarn is not limited to the finest that can be spun—there is a range of fine lace. A singles with up to 20 fibers could also be considered a Shetland fine lace yarn.

Prepared Shetland locks ready for spinning in the grease.

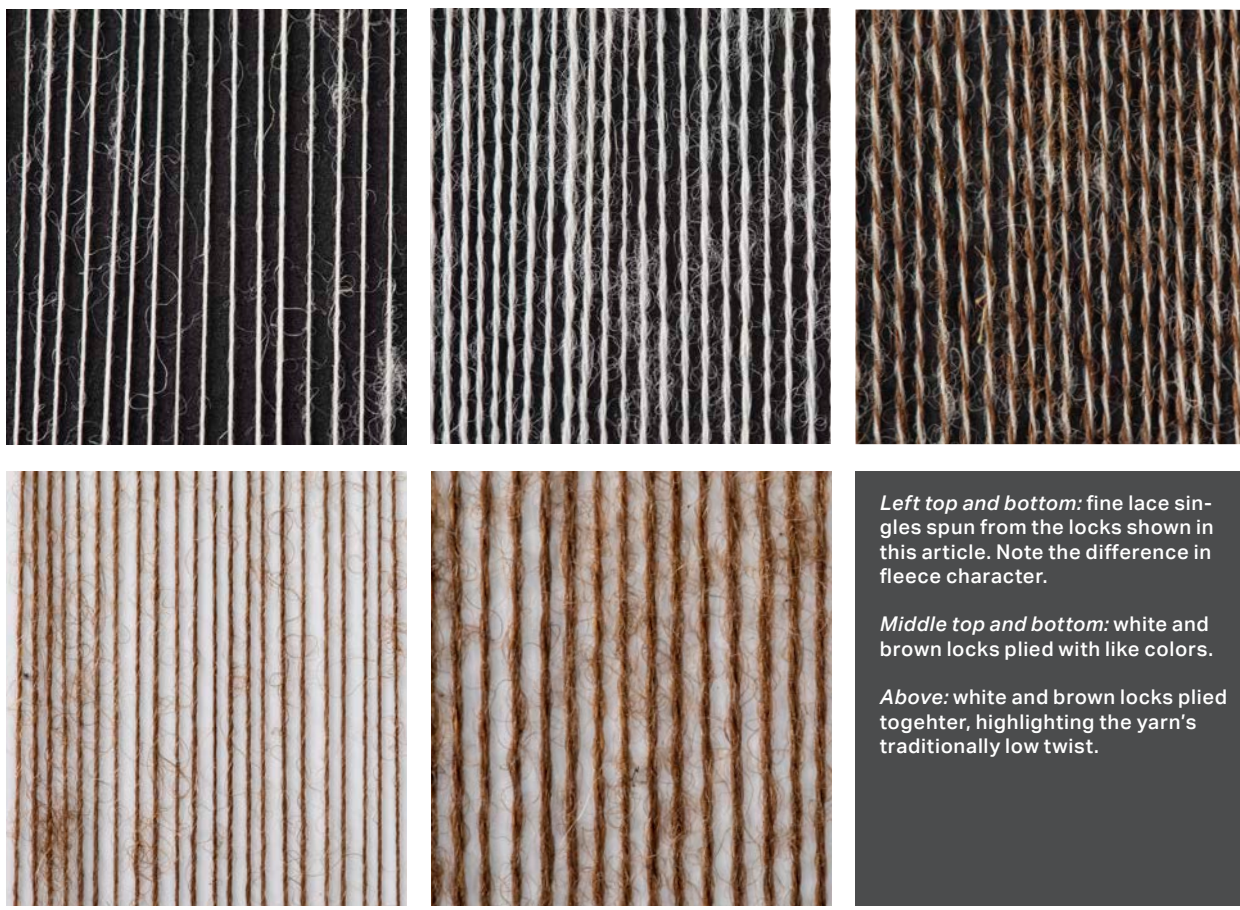
The finer a singles is, the more twist it needs. So, a singles with 5 fibers will require more twists per inch than one with 10 fibers, assuming the fibers are of the same micron count, of course. One problem is that in a thread that fine, seeing the twist well enough to determine the number of twists becomes a problem. Additionally, when trying to put a number on the twists per inch, that number would change with the micron count of the fiber and the number of fibers per singles.

So how do we spin with the optimum amount of twist? Here, I come back to my first thoughts about this article—just add enough twist so that the singles yarn holds together. Finding the right amount of twist is trial and error: spin small amounts, ply, and wash to see the results.

The twist in the singles will determine the final quality and durability of the yarn. If there is too little twist, the final yarn will be soft, but it will also be weak and break easily. If there really is too little twist, it can look as if it is just disintegrating after it is plied. Too much twist will stress the fibers; they will break over time, which will weaken the yarn, and the yarn will feel hard. Ultimately, you should *feel* what you are spinning in your fingers as you spin. This was how Shetland spinners judged the twist in any of their yarns. With practice, it does become intuitive.

Shetland fine lace is a worsted-spun yarn. Always spin from the inside edge of the combed lock (cut end). The wheel is turned to the right for spinning and in the opposite direction to ply.

The next step in the process is the plying, which is also all about twist. The knitting yarns produced in



Left top and bottom: fine lace singles spun from the locks shown in this article. Note the difference in fleece character.

Middle top and bottom: white and brown locks plied with like colors.

Above: white and brown locks plied togehter, highlighting the yarn's traditionally low twist.

Shetland locks from the Shetland Isles selected for fine lace spinning by Elizabeth Johnston.

The yarns will behave differently in a finished garment; the worsted will drape rather like silk, and the woolen will have a softer, lighter feel. They will both have what is called "the Shetland halo."

Shetland are all two-ply, and we describe them as two-ply soft-spun. The term "soft-spun" refers to the ply. The fleece is soft and the spun yarn should also feel soft; the ply helps with that softness. There must be just enough twist in the ply so that the yarn does not split easily when knitted. Too much twist and the yarn will be hard and will look as if it is core-plied. Shetland yarns might be considered loosely plied.

SETTING THE TWIST

As I have said, I do not wash the fleece, and the washing method I use leaves some lanolin in the fleece. The finished yarn, therefore, needs washing to remove any remaining dirt and lanolin. Even if a fleece is scoured before spinning, the final yarn still needs washing. That wash is required to "set the twist" in the yarn, as it is often described. Fine lace has more twist than thicker yarns, and that twist needs to be stabilized. Think of the washing as a blocking process. Finished garments—whether knitted, woven, or created with any other technique—are traditionally always washed and blocked. It is very obvious that blocking is essential for a knitted lace garment, and washing and blocking are essential for the spun yarn.

To set the twist, yarn has to be thoroughly wet. Wash in soap with the temperature a little above 100 degrees Fahrenheit (38 degrees Celsius), the melting point of lanolin. A short soak is okay, but do not let the water cool. To finish, rinse, wrap in a towel, and squeeze to remove as much water as possible.

Hanging up the hanks to dry is the blocking process, which means the hanks need to be hung under tension while they dry, just as when blocking finished knitwear. In Shetland, fine lace yarn was often blocked using an adjustable frame (see below). The easiest way to block several skeins at once is with two wooden poles. Hang the hanks on one pole and slot the other through the bottom as a weight. More weight can be added to the bottom pole. Leave to dry completely—for at least 24 hours—then let the hanks hang without any weight for an additional 24 hours to relax. This helps with other steps as well; let each stage of the process sit and relax for 24 hours before going on to the next stage.

Wooden frames were used to block skeins of yarn spun for very fine lacework. After knitting, the lace textiles were blocked again.

Shetland spinners use the term fine lace to refer to both the yarn and the finished product, as in a fine lace shawl. The type of yarn used in a shawl is referenced in the description, also as in a lace shawl, where lace-weight yarn is used. I meet spinners who think that haps are the same thing as Shetland fine lace because they both include yarn overs and decreases, or they think that all Shetland spinning must be woolen.

Although the construction of haps and shawls are the same, they are made for different purposes. A hap is traditionally knitted in hap yarn—spun woolen of a specific thickness—and is a garment to use as a wrap for warmth. "Hap" means to wrap up warmly, and describes both the garment and the yarn. The finest lace yarns are worsted spun, and the shawls knitted are delicate with crisp motifs and worn to be seen.

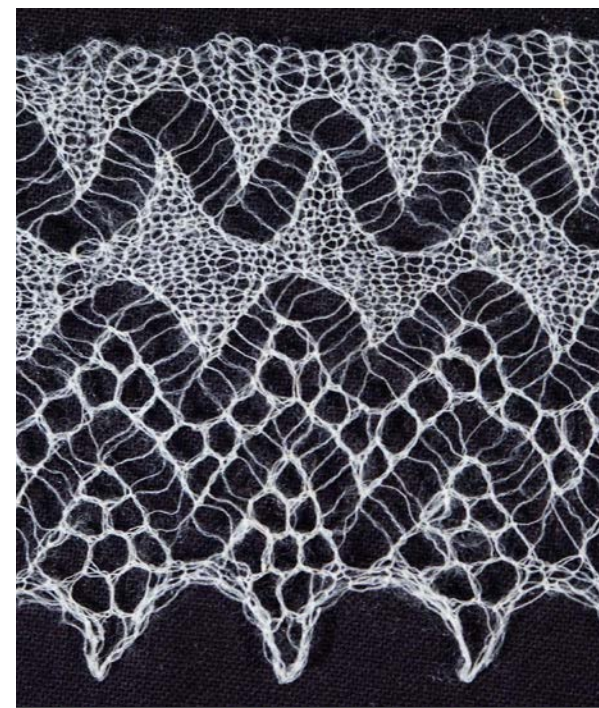
WORSTED VS WOOLEN

Shetland fine lace yarn is spun worsted, but it is possible to spin fine yarn from carded rolags producing a semiwoolen yarn. The yarns will behave differently in a finished garment; the worsted will drape rather like silk, and the woolen will have a softer, lighter feel. They will both have what is called "the Shetland halo."

Yarns produced in the worsted tradition should be smooth, but Shetland worsted yarn is not smooth and will always have a haze around the yarn. This is a characteristic of Shetland wool; it is just how it spins. The fiber, wheels, process, and patterns needed for traditional Shetland fine lace all fit together to create this knitted luxury. But ultimately, it is all about twist!

**For details about lubricating different types of spinning wheels, refer to each manufacturer's guidelines.*
—Editor

Elizabeth Johnston is the owner of Shetland Handspun. She is a coauthor of *The Warp-Weighted Loom* and contributed to *Shetland Textiles: 800 BC to the Present*. Elizabeth has demonstrated, lectured, and taught workshops in spinning, lace, Fair Isle knitting, and natural dyeing in Shetland, the United Kingdom, Europe, Scandinavia, and the United States. Learn more at shetlandhandspun.com.



Above: A Shetlander at a wheel. *Below:* A sample of fine Shetland lace edging (about 5 centimeters wide, enlarged here) in two-ply yarn. Knitted in 1900 by Mrs. David Sutherland, Unst, Shetland, and reputed to be the finest work ever attempted. Unst spinners and knitters were famed throughout Shetland for their fine lace.

Emily used dyed wool combed tops with bamboo and flax accents to investigate twist as a visual effect.

Photos by Matt Graves unless otherwise noted

Color-Swirl Blending Effects for Spinning

BY EMILY WOHLSCHEID

Although twist is mainly a structural component of spinning, it also creates a visual effect in plied yarn and influences the color outcome. To examine twist as a visual component in a singles yarn, I explored how blending the same fibers in two different ways on a drumcarder would affect the look of the resulting yarn and cloth.

THE BLENDS: INTENTIONAL VS SPONTANEOUS

For these blends, I knew I needed to make color choices that would remain distinct no matter what gauge or type of yarn I created. I chose equal amounts of four colors of dyed wool top with accent layers of bamboo and flax in smaller equal amounts. The final blend ended up being about 80% wool, 10% bamboo, and 10% flax. Although I used wool top for blending, these effects could be achieved using any preparation of fiber.

There are two important factors to remember when choosing fibers for blending. First, you need to be sure that the staple lengths are similar so that the colors draft out more or less evenly. Second, the main colors you have selected need to be present in large enough proportions so that once carded, they will be easily distinguishable from one another.

Stacked Blend for Intentional Color

I arranged my fibers in an order that complemented them and then made sure they were all prepped and open. Next, I began adding layers of color to the drumcarder, taking care to evenly cover the drum with each color before beginning the next layer of color. Optionally, you could add accent fibers, such as Angelina sparkle, silk noils, or soybean staple, for a subtle textured effect.

This blend is not very exciting to look at, but its crisp and calculated layers of fibers will yield consistent results when spun. To remove the batt, I chose to take it off all in one sheet, leaving it whole until I was ready to spin it. You also could pull it into roving directly from the carder for similar results. Either of these methods will give you a consistent color-swirl blend.

Mixed Blend for Spontaneous Color

Using the same amounts of each color and fiber type as in the stacked blend, I prepared a second batt by alternating bits of color and fiber types randomly. I wanted to make sure that the colors stayed somewhat distinct, so I added just enough fiber for a small layer of blocked, slightly blended color. The effect this creates in the batt is similar to that of a brushstroke in an impressionist painting. Because there is no real order to this blend, it can be removed and kept whole until it is ready to be spun. The cross section of this batt indicates that the color swirls will still be present but will be variegated and have pools of color in some areas.

Emily chose her colors spontaneously when creating her mixed blend, feeding small amounts of colors into the carder rather than building layers of color across the drum.

Photo by Emily Wohlscheid

SAMPLING & SWATCHING

Because a swirl can be such a visually intense color effect, I chose to examine how different methods of spinning singles would impact the resulting yarns and cloth. I set up my Schacht Ladybug with the medium pulley on the 6.5:1 ratio for all of my spinning and varied only the drafting method to achieve different types of twist for each pair of yarns.

Low-Twist Singles

For the low-twist singles, I began with about a half ounce of fiber from each of my two blends and then tore the fiber into strips and predrafted as evenly as possible. Treadling slowly, I used a short-backward

Photo by Emily Wohlscheid

Emily used a two-ply core yarn and stripped sections of each batt to create core-spun samples.

draw to keep a little more control over my gauge and how the colors drafted together. The softly spun yarns both had about a 20-degree angle of twist and averaged 10 to 11 wraps per inch (wpi).

High-Twist Singles

I prepared the fibers for the high-twist singles in the same manner as for the low-twist singles by predrafting strips torn from the original batts. I spun both blends using a short-forward draft that resulted in much smoother yarns than the low-twist singles with a more distinct barber-pole swirl. These yarns averaged about 12 wpi with a twist angle of about 40 degrees.

Core-Spun Singles

I wanted to achieve something distinctly different with this third set of singles, so I chose to spin the fibers around a fine two-ply core yarn. I held my fiber supply at about a 60-degree angle to the core yarn while using a quick short-forward draft (see photo at left). This

The mixed blend (*left*) and stacked blend (*right*) look different both on the surface of the batt and in cross section.

The stacked blend had clearer, brighter colors when core spun. Spun samples with twist angles: (*from top*) 20 degrees, 40 degrees, and 60 degrees.

The colors in the mixed blend were more muted, which led to an optical blending effect. Spun samples with twist angles: (*from top*) 20 degrees, 40 degrees, and 60 degrees.

resulted in a super high twist angle that matched the 60 degrees I held the fiber at while spinning. The yarn I spun from the carefully stacked batt was a bit airier than the one from the spontaneously mixed batt even though they were both prepared the same way, so their gauges were slightly different. They measured about 11 wpi and 13 wpi, respectively.

THE RESULTS

If possible, I like to allow singles to rest on the bobbin for at least a day to let the active twist relax. For these skeins, I chose to use steam to finish them, but a wash and whack would also be a great method to set the twist on these hearty singles.

The major difference between each pair of skeins was the level of blending between colors. This became even more evident once I knitted them into swatches. The stacked batt resulted in a fairly consistent swirl with barber-poled colors. Despite the care I took to draft the colors evenly, there were still some areas of color pooling that created a subtle self-striping effect.

In the skeins spun from the spontaneously blended sample, there were areas with optical blending that created new colors or varied shades as well as areas where certain colors were absent or dominant for significant lengths. The randomly carded swatches were more blended, and once spun and knitted, they appeared more subdued than the stacked blend and maintained small pops of swirled color.

Understanding the visual effects that can be achieved when blending the same materials can be a great way to explore how twist affects blends differently. Early choices made while blending can have a ripple effect that touches every part of the process from preparation to cloth.

Emily Wohlscheid is the fiber and jewelry artist behind Bricolage Studios. She works out of a cooperative studio in west Michigan and teaches online and in person around the country. Learn more at bricolagestudios.bigcartel.com.

Decorating with woven tapestries is all the rage, and Connie gives the trend a new twist with her handspun crocheted wall hanging.

Photos by Matt Graves

A New Twist on Tapestry

Crochet Wall Art

BY CONNIE LEE LYNCH

As a crochet instructor, I've frequently discussed yarn twist with my students. Many commercial yarns are S-plied, which is great for knitting, but some crochet students struggle with their yarn untwisting as they crochet with it. Although Z-twist singles are pretty easy to find, being able to make my own Z-plied yarn was the driving force behind learning to spin.

Spinning is now what I do to procrastinate, and the hum of my little Electric Eel Wheel Nano is my new favorite white noise. But I also love handspinning because I get to paint with fiber. My favorite spinning projects are those in which I combine mill-ends or bits and bobs or leftovers to create a cohesive, truly one-of-a-kind yarn. As a bonus, I get to crochet it into a fabulous project. Spun for my own needs, this Z-plied handspun doesn't untwist when I crochet.

I started making tapestries, landscapes of color that simply demand to be hung on the wall. The linen stitch, composed of single crochets and chain-one spaces, is my preferred stitch for crocheting handspun tapestries. It creates a delightfully woven-looking textile that allows the perfectly imperfect irregularities of handspun yarn to shine.

I more than once considered adding buttons to this particular tapestry so I could wear it as a cowl instead of framing it. However, the beauty of this display method is that I could do exactly that; it's easily removed from the frame. Does that make it wearable art? Sure! But then, that's what many of our fiber-art projects are already.

SPINNING NOTES

I went into this project with purpose and imagination, blending my fibers at the wheel by holding more than one fiber in my drafting hand at a time. I really had fun blending from teal to orange with delightful little slubs of texture using art batts. I removed some of the darker colors in the Gothic Pumpkin batt, leaving some of the purple but taking out most of the black. I then split each color evenly, weighing them to be sure, and then divided those by half again so that I had four quarters of a batt.

Connie used a range of batts and fibers for her tapestry. *Clockwise from top:* Teal Firestar, Dark Aqua wool roving, Gothic Pumpkin batt, Carrot Orange wool roving, Copper Firestar, and Verdigris batt.

I added Firestar into the mix randomly, occasionally allowing it to spin alone for more variety in the tonal sections. When I started adding in the Verdigris batt, I began with a smaller ratio of batt to roving and slowly increased it until I was using more batt than roving, fading the last of the roving out as I moved into the Gothic Pumpkin batt. I continued this process throughout both singles.

I blended at the wheel in the following order, creating two S-twist singles:

- ¼ Dark Aqua wool roving + Teal Firestar
- ¼ Dark Aqua wool roving + ¼ Verdigris batt
- ¼ Verdigris batt + ¼ Gothic Pumpkin batt
- ¼ Gothic Pumpkin batt + ¼ Carrot Orange wool roving
- ¼ Carrot Orange wool roving + Copper Firestar

Detail of Connie's two-ply, Z-plied yarn.

After spinning the singles, I combined them into Z-plied gradient yarn, allowing the colors to shift and blend as they appeared during the plying. You could, of course, tweak it a bit by removing sections of one singles if the colors seem to be getting too far away from each other, but since this is really just a shift through two colors, I didn't find that to be necessary.

MATERIALS

Fiber Wildethyme wool roving, 100% Corriedale cross, 1 oz (28.5 g) each of Dark Aqua and Carrot Orange; Wildethyme Firestar, 100% fine denier nylon top, ½ oz (14.2 g) each of Teal and Copper; Wildethyme fiber art batts, 1 oz (28.5 g) each of Verdigris and Gothic Pumpkin.
Yarn 2-ply; 475 yd; about 1,526 ypp; 12 wpi; DK weight.
Hook F/5 (3.75 mm). Adjust hook size if necessary to obtain the correct gauge.
Notions Tapestry needle; 15⁄16" birch wood panel, cradled (see Resources), measuring 26½" × 11½", or ½" to 1" larger than finished tapestry size; metallic gold paint; matte spray sealer; #18 escutcheon pins for nail art (see Resources), gold-colored brass, ¾" (20 mm) in length; hammer.
Gauge 25 sts and 24 rows = about 4" in pattern, blocked. Gauge is not critical for this project.
Finished Size 25½" long and 10½" wide.

Notes

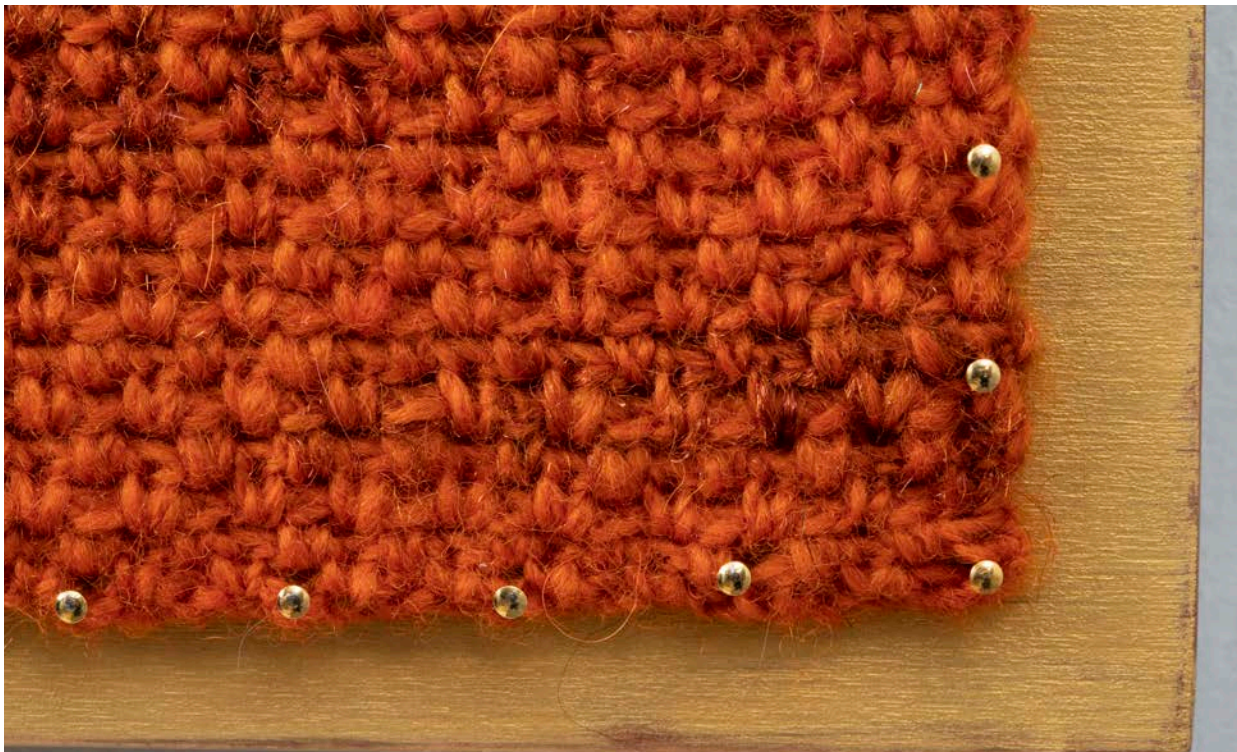
- Keep your tension snug for your starting chain and first row or two of stitches; the linen stitch tends to be a bit loose starting out. I've found that working into the top and back loop of the starting chain works best with the linen stitch, but feel free to experiment with your own hook placement.

Visit **spinoffmagazine.com/spin-off-abbreviations** for terms you don't know.

INSTRUCTIONS

Ch 70 (or any even number of chains).

Row 1 Sc in 4th ch from hook. Place marker (pm) in beg ch-3 sp. Work [ch 1, sk next ch, sc in next ch]



Space pins evenly, making sure the corners are squared.

across, turn—1 ch-3 sp, 34 sc, 33 ch-1 sps.

Row 2 Ch 2, sk first sc, sc in first ch-1 sp, pm in beg ch-2 sp. Work [ch 1, sk next sc, sc in next ch-1 sp] across to last st, ch 1, sk last sc, sc in beg ch-3 sp of last row, turn—1 ch-2 sp, 34 sc, 33 ch-1 sps.

Row 3 Ch 2, sk first sc, sc in first ch-1 sp, pm in beg ch-2 sp. Work [ch 1, sk next sc, sc in next ch-1 sp] across to last st, ch 1, sk last sc, sc in beg ch-2 sp of last row, turn—1 ch-2 sp, 34 sc, 33 ch-1 sps.

Rows 4–158 Repeat Row 3 another 155 times or until desired length is reached or you run out of yarn.

Fasten off. Weave in ends.

FINISHING AND MOUNTING

Give the tapestry a good long soak and block it with T-pins, making sure it's squared up at the ends. Either gently block it for a denser-looking fabric or really stretch it out with aggressive blocking to open up the stitches. Once the fabric has fully dried, remove the T-pins and allow it to relax before taking the final measurements.

Note: I ordered a custom-made cradled wood panel that was ½" wider and longer than my finished tapestry, but the fabric did shrink back a bit more by the time I mounted it. You can also work your tapestry so that it will fit a standard-sized panel. I like leaving ¼" to ½" border of the frame around my fabric when mounted.

Sand down any rough edges on the wood panel and paint it gold or desired color, sanding between coats if necessary. After the paint is dry, seal the panel with a matte spray sealer. Lay your tapestry on the panel to see how far in from the edge you need to place the escutcheon pins (I recommend ¼" to ½") and then measure and mark out every ⅝" along all four sides of the wood panel to place the pins. Make minor adjustments to the spacing over four to five pins at the corners or in the center if necessary to make sure the corners are squared. Hammer the pins in about halfway, or until adequately secured, and then hook loops of fabric over each pin, ensuring even distribution throughout.

Resources

KeenART Media, usaoncanvas.com
Blackbird Tacks and Nails, tacksandnails.etsy.com
Wildethyme, wildethyme.etsy.com

Connie Lee Lynch is a crochet instructor certified by the Craft Yarn Council and has been designing since 2009, delighting in exploring texture and color inspired by nature and the scenery that surrounds us. As an Army wife, Connie moves with her family every few years, constantly finding new inspiration and sprinkling her love for the fiber arts behind her as she goes! You can find her online at crochetcetera.com as well as on Ravelry.

High-Twist Textiles

BY MEAGAN CONDON

Meagan experimented with knitting, crocheting, and weaving high-twist singles, using two different wool breeds. *From left:* Wensleydale and Rambouillet.

Photos by Matt Graves unless otherwise noted

When I first learned to spin, I remember being told over and over that my yarn should be plied, and it needed to be "balanced." If I held a hank up, it needed to hang straight without twisting back on itself. If it had too much twist, my project wouldn't lie correctly. Over the last decade, I learned to follow those rules . . . and then I learned to break them when I liked.

Yarn has so much character on its own, and that is what draws us to spinning and to pushing the limits of what yarn can be. If I am honest, there are times when I don't want my project to behave like a starched doily; I want it to have its own life. I want it to move! In those moments—whether I'm knitting, crocheting, or weaving—I turn to high-twist singles.

Yarn has so much character on its own . . . there are times when I don't want my project to behave like a starched doily; I want it to have its own life. I want it to move! In those moments—whether I'm knitting, crocheting, or weaving—I turn to high-twist singles.

WHAT IS A HIGH-TWIST SINGLES YARN?

Active twist, energized, and crêpe are all terms used to describe intentionally high-twist yarns. Like most other concepts in textile arts, what makes a singles "high twist" is debated. To me, high twist describes a singles that, when folded, has enough energy to ply itself. In theory, the more twist the yarn holds, the more dramatic the effect created in the fabric you make. However, the type of fiber used also impacts how the yarn behaves in a textile.

To explore fiber character in high-twist yarns, I spun high-twist samples of Rambouillet and Wensleydale wool from Lisa Souza Dyeworks in the colorway Wild Things using the same spinning variables. I measured the twist, then crocheted, knitted, and wove samples to show how the twist behaves in the different textiles.

Fiber Choice Matters

Both crimp and fiber diameter have significant impacts on how fibers respond to twist. I have found that coarser wools and other low-crimp fibers will create more dramatic results in high-twist textiles, including bias, twisting, and fascinating three-dimensional effects, such as puckering. These fibers usually aren't as soft as fibers with finer, tighter crimp, though, so it can be a trade-off. As an artist, you get to decide. What's more important for your particular project—texture and energy or next-to-skin softness?

Measuring Twist

How do you know if you've got enough twist? Twist can be measured a few different ways. First is by identifying the twists per inch (tpi) using a ruler. The tpi measurement indicates how many times the fiber twists in a 1-inch length of singles. If you lay your singles yarn lengthwise along a ruler, you should be able to see and count the twist. This method can be tricky, even with magnification. Instead of measuring my singles tpi, I will often count the twists per inch of a self-plied sample even if I am spinning a singles yarn. I take a length of my singles yarn, fold it back on itself, and allow it to twist like a plied yarn. Then, I count the bumps per inch (bpi). To get your tpi, divide bpi by the number of plies. In a twist-back sample, that would be two plies. Twists per inch is a useful measurement all around but requires a considerable amount of sampling when used to measure high-twist singles.

There are some indicators to look for when you are trying to determine if you have enough or too much twist:

- If the yarn starts to coil like a spring when held under tension, there is probably too much twist for most projects, and the yarn will be hard and may even break.
- If, when you fold the singles in half, they don't easily twist together into a two-ply yarn, you've probably got yourself a nice low-twist singles that won't behave like a high-twist yarn.

Wensleydale skeins sized and unsized. *Swatches from top:* woven swatch unwashed, woven swatch washed, knitted swatch washed, and crocheted swatch washed.

Photo by Meagan Condon

High-twist singles on the bobbin. *From front:* Rambouillet and Wensleydale from Lisa Souza Dyeworks in the Wild Things colorway.

My favorite method of measuring twist is to use a protractor to determine the angle of the twist. The singles yarn is laid lengthwise along the bottom of the protractor. Then a ruler or other flat edge is lined up with the direction of the twist to determine the angle.

My favorite method of measuring twist is to use a protractor to determine the angle of the twist. The singles yarn is laid lengthwise along the bottom of the protractor. Then a ruler or other flat edge is lined up with the direction of the twist to determine the angle. I find this method to be reliable and easy to replicate. Twist-angle tools are also available to spinners.

Depending on the type of fiber, I find that a 20- to 40-degree twist angle is best for a high-twist singles. Many fibers get hard and ropy over 40 degrees. For my samples, I opted for a 25-degree twist angle for the Rambouillet and a 20-degree twist angle for the Wensleydale. I like to keep my yarns at the softer end of the spectrum, but higher twist will produce more dramatic results in the cloth.

PREPARING THE YARN FOR USE

There is no need to finish or "set the twist" the way one might for a plied yarn or a low-twist singles yarn. However, I chose to size my high-twist singles yarns before creating my samples. This technique is sometimes used to prepare yarns for weaving to protect warp threads and make them more manageable. For me, it is a must for working with high-twist singles.

There are a number of recipes for creating a sizing adhesive, from flour mixtures to starches. I use gelatin. I add about a tablespoon of unflavored gelatin to 2 cups of boiling water and stir until the gelatin is dissolved. Then I add 2 cups of cold water and stir again. This gives me enough liquid to size two or three skeins of yarn. I gently soak the yarn in the gelatin for a few minutes, and once it has evenly absorbed the size, I press the excess gelatin out.

I don't recommend drying most yarns under tension, but high-twist singles are an exception. I hang them to dry with a weight at the bottom to pull the yarn straight so that it doesn't kink up, and I rotate the skeins a few times as they dry. This step is all about making the yarn more manageable. While it is still wet, the gelatin makes the yarn sticky and a little gross

Variables

Fiber	Wheel Ratio	Treadles	Draw	Direction	WPI	Twist Angle
Rambouillet	8:1 Ashford Joy 2	2 treadles per draft	Short-forward draw	S-twist	16	25°
Wensleydale	8:1 Ashford Joy 2	2 treadles per draft	Short-forward draw	S-twist	16	20°

Rambouillet skeins sized and unsized. *Swatches from top:* woven swatch washed, woven swatch unwashed, knitted swatch washed, and crocheted swatch washed.

After the project is complete, the fabric can be soaked in warm water to dissolve the gelatin and release the restrained energy in the singles.

to touch, but once it dries, it is stiff and easy to work with. After the project is complete, the fabric can be soaked in warm water to dissolve the gelatin out of the yarn and release the restrained energy of the singles.

HOW HIGH-TWIST SINGLES BEHAVE IN TEXTILES

For the knitted, crocheted, and woven samples shown here, I chose larger needles and hooks and a lower sett than I would usually use for the gauge of this yarn. If the textile is too tight, the singles don't have adequate room to move once the twist is reactivated. It is also worth noting that I spun my singles in the S-twist direction, as I am left-handed and choose to work my knitted stitches opposite to most knitters. When I washed out the sizing, I did not block my samples. After all, the point was to show what happens when twist energy is left in the yarn.

The knitted samples slanted heavily into a rhombus shape but tended to lie mostly flat. The individual stitches twist so that one leg of the V in each stitch lies straight up and down. Even though the yarns were spun to the same diameter and variables (with a slight difference in twist angle), the Rambouillet drew in significantly more than the Wensleydale but was slightly less skewed.

The crocheted samples weren't slanted like my rhombus-shaped knitted swatches. Instead, they rolled into a tube from corner to corner in the same direction that the knitted samples were slanted. Again, the Rambouillet drew in more and rolled less fiercely than the Wensleydale. The top portion of the individual stitches appeared slightly distorted.

My favorite samples of this set were the woven swatches. Because the high-twist singles were used in both warp and weft, the fabric puckered when it drew in and it took on a rippled texture. The Wensleydale sample was significantly more textured even though it didn't appear to draw in as much as the Rambouillet. The Rambouillet had barely any puckering.

As a test, I went back and respun some of the Rambouillet singles to get a 40-degree twist angle and wove another sample. The puckering on this sample was greater than for the 25-degree sample, but it still wasn't as significant as the Wensleydale at 20 degrees. It really goes to show that the fiber you use matters in getting the outcome you want.

While I might not suggest using high-twist singles in an heirloom sweater or your next gossamer lace project, I love high-twist singles in woven scarves and shawls. I've also used high-twist crocheted fabric to create three-dimensional elements in a display piece. There are so many opportunities for these yarns to steal the spotlight. I am as guilty as anyone of spinning the life out of the occasional project, but there is something so deliciously rebellious about a textile that doesn't listen when you tell it to stay put.

Meagan Condon is a librarian and fiber artist with more than a decade of spinning experience. She focuses on digital connection and teaches fiber arts across the Midwest and online. You can follow her at luthvarian.com.

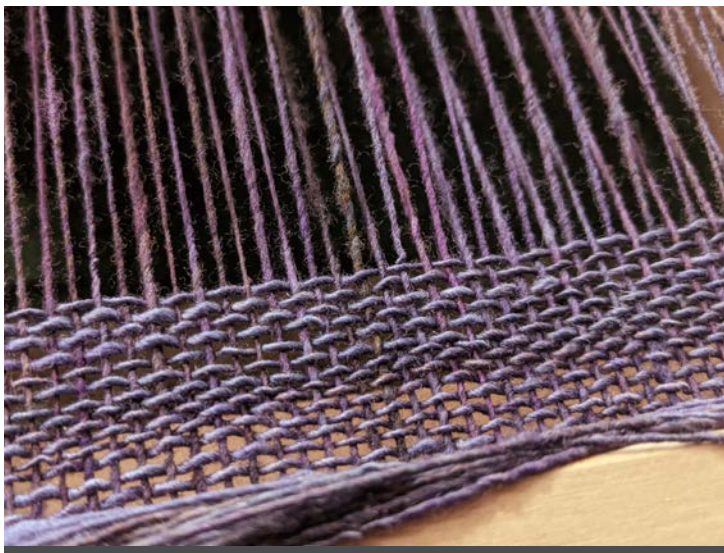


Photo by Meagan Condon

Sized high-twist Rambouillet singles used as warp and weft on an Ashford SampleIt loom.

Harness the energy in high-twist yarns to create pleasing pleats and poufs.

Photos by Matt Graves unless otherwise noted

Twist & Pleat

High-Twist Singles for Easy Woven Texture

BY DENISE BOLGER KOVNAT

There are many ways to create texture in weaving, which—in addition to color and pattern—can add a lot of interest to handwoven fabric. Broadly categorized, these methods are:

- Weaving a structure that creates texture naturally, such as waffle weave or deflected doubleweave.
- Encouraging differential shrinkage by weaving with yarns that full and those that do not.
- Using energized or active-twist yarns—which include high-twist yarns and man-made elasticized yarns—either alone or together with inactive-twist yarns.

For handspinners, it's easy to create high-twist yarns; we simply add more twist to a singles or plied yarn than we would if creating a balanced yarn. These high-twist yarns may look neat and tidy on the bobbin, but once let loose, they are unruly, earning the common appellation "energized yarns." We fine-tune this energizing process by adjusting how much twist and in what direction we are inserting twist.

A note here: handweavers often use the term "collapse weave" when talking about textured fabrics. This is a misnomer because collapse weave is not a weave structure at all. I prefer using the term "collapse fabric" to describe handwoven cloth that pushes away the grid of traditional weaving, having rounded shapes, curves, and depth that can be achieved by using one of several methods.

WEAVING WITH HIGH-TWIST YARNS

Handwovens with collapse effects can be created with high-twist singles because the energy stored in the yarn creates pleats and poufs in the finished cloth. While on the loom, the high-twist yarns are held under tension. Off the loom and when wet-finished, the S-twist yarns will create folds in the fabric, releasing their overtwisted energy to loosen the S-twist. The Z-twist yarns will do the same thing but create folds that move in the opposite direction, allowing the yarn to relax to create a looser, more steeply angled Z-twist.

Your job as a weaver is to keep these highly twisted yarns under tension as much as possible throughout the process of winding the warp, dressing the loom, and weaving the fabric. The other major factor in creating textured fabric is using a wide sett—wider than is normally recommended for plain weave—and a loose beat to produce a balanced weave. You want the yarns to have plenty of space to move about, relax, and loosen up. I liken this technique to raising teenagers: Give them plenty of structure, and they are less apt to misbehave, but with a loose structure, they can really act up!

More often than not, you won't see the textured effects when the fabric is under tension on the loom. But in the wash with a bit of detergent, hot water, and agitation, the fabric will change dramatically and—

Detail of tracking in plain weave. Notice how the weft yarns untwist slightly and curve away from the fabric, creating a diagonal line and a look that mimics woven twill.

Photo by Denise Bolger Kovnat

When tension is relaxed on the warp, the high-twist singles will look like a tangled mess. With good warping technique, the singles will stretch back out in an orderly fashion when under tension.

Find instructions for the Alpaca Pleated Scarf on our website.

to my eye—magically. It's the texture in textiles that fascinates me. Of course, I find the colors and patterns delightful and intriguing, too, but the tactile aspect and the way that fibers reveal depth and substance never fail to draw me in.

PLEATED SCARVES

For both the green Romney Pleated Scarf (see page 72) and the Alpaca Pleated Scarf, I created fabrics with vertical pleats using overtwisted singles. The warps had alternating stripes of S- and Z-twist singles. The stripes don't have to be different colors, but I like the effect. Both scarves are woven in plain weave with wefts of Z-twist singles and warps of alternating S and Z singles.

Alternate Method: Bumps

For similar projects in the past, I wove *bumps* rather than pleats. Using overtwisted yarns for the warp and weft in plain weave, weave horizontal stripes and alternate between a group of picks (weft beats) with S-twist singles and a group of picks with Z-twist singles. It may not look like much on the loom, and in fact, your fabric will look like gauze because your sett and beat need to be loose, but after washing, your fabric will have lots of poufs and puckers.

Alternate Method: Tracking

Another way that handspun overtwisted singles can be used to create texture in weaving is called *tracking*. Most often appearing in plain-weave fabrics, tracking develops after washing, when yarns relax and unwind into a looser ply with a steeper angle. Given enough room in the beat (how you pack in the weft with your loom's beater) and the sett (the number of yarns per inch in the warp), your weft yarns will curve rhythmically, creating the illusion of a twill pattern and, frustrating for weavers, sometimes competing with the design. But in this case, tracking is desirable!

Denise Bolger Kovnat weaves and teaches from her home in Rochester, New York, focusing on collapse techniques, echo, jin, extended parallel threadings, warp painting, and deflected doubleweave. She blogs about her work at www.denisekovnat.com.

Experiment with weaving energized singles to create a striking textured scarf with plain weave.

Photos by Matt Graves unless otherwise noted

Romney Pleated Scarf

BY DENISE BOLGER KOVNAT

I've been spinning for about 20 years, but I still think of myself as a beginner. I like to spin fine high-twist singles, and I love the character they add to my handwoven fabrics, including pleats, bumps, and even tracking. Collapse fabric can be created in a number of ways, but simply adjusting the direction and amount of twist in warp, weft, or both warp and weft can yield an amazing variety of collapse effects. See page 68 for more about collapse fabrics.

SPINNING NOTES

I used my Lendrum double-treadle wheel and a short-forward draft to create an S-twist singles using natural-colored gray Romney roving and a Z-twist singles yarn with white Romney. How much twist to add? My approach is simple: add enough twist to the single as it is spun that it self-plies when tension is relaxed (twists back on itself). This is more of a guesstimate approach, and it works well for me. However, you could use a twists per inch measurement if you prefer. These fingering-weight yarns were wound straight from the bobbin to the warping mill, with no washing or steaming beforehand. The reason: I wanted to maximize the energized, high-twist effects.

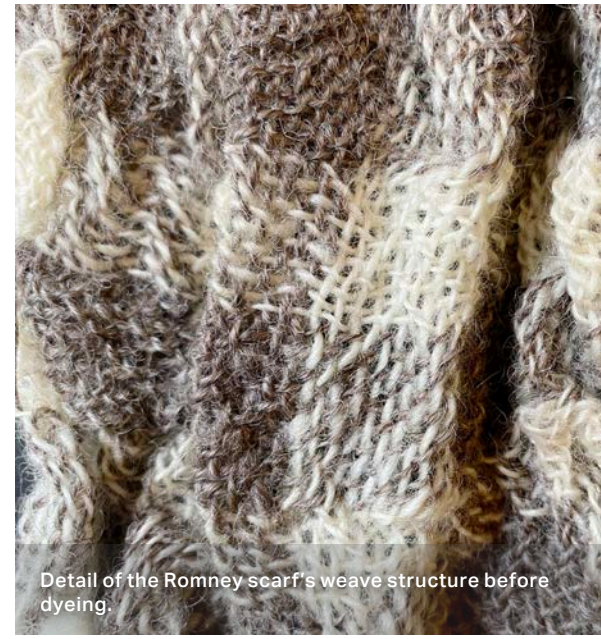
After the scarf was woven, washed, and dried, I handpainted the entire scarf using washfast acid dyes in green and rust.

PROJECT NOTES

STRUCTURE
Plain weave.

EQUIPMENT
2-shaft loom, minimum 14" weaving width; 10-dent reed; 1 shuttle.

FIBER
Romney roving, 4 oz white, 2 oz gray.



Detail of the Romney scarf's weave structure before dyeing.

Photo by Denise Bolger Kovnat

YARNS
Singles, 18 wpi, about 2,000 ypp, 6–8 tpi, about 30° twist angle.

Warp: Z-twist white, 216 yd; S-twist gray, 180 yd.

Weft: Z-twist white, 300 yd.

OTHER SUPPLIES
Optional: Green and rust washfast acid dyes for dyeing.

WARP LENGTH
132 ends (6 stripes in white at 12 ends each and 5 stripes in gray at 12 ends each; begin and end with white stripes) 3 yd long (allows 8" for take-up, 28" for loom waste; loom waste includes fringe).

SETTS
Warp: 10 epi (1/dent in a 10-dent reed).

Weft: 10 ppi.

DIMENSIONS
Width in the reed: 13 3/10".

Woven length: (measured under tension) 72".

Finished size: 6½" × 46" plus 4" fringe.

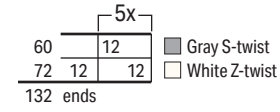
The scarf edge is not finished with a usual hemstitch; the energy from the yarn keeps the weft in place.

1 Wind a warp of 132 ends, 3 yd long following the warp color order, Figure 1.

2 Beam the warp using your preferred method, maintaining a taut, even tension as you wind on. If the yarns begin to curl up on themselves, gently but firmly draw them out to full tension. Thread the loom for plain weave, Figure 2. Centering for a weaving width of 13⁹⁄₁₀", sley 1 per dent in a 10-dent reed.

3 Weave a header using waste yarn, then leave 4" unwoven for fringe. Wind a bobbin with Romney Z-twist singles in white. Weave 2 yd in plain weave, beating at 10 picks per inch. Leave 4" unwoven at the end of the scarf. Weave 1" in waste yarn. Remove the scarf from the loom.

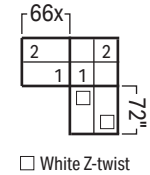
Figure 1. Warp Color Order



Heddle Count

Shaft 2	66
Shaft 1	66
Total	132

Figure 2. Draft

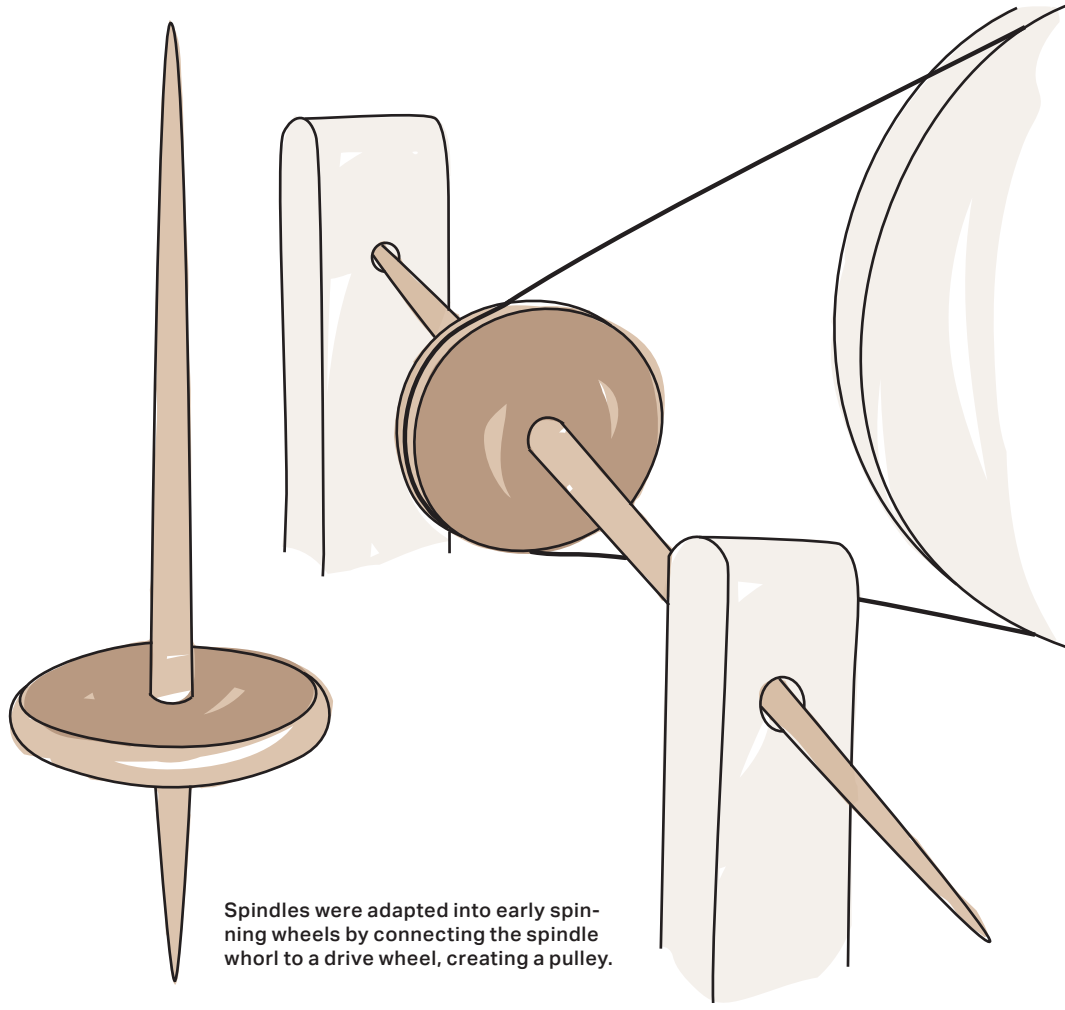


FINISHING

Fill a bin or sink with hot tap water. Add one-half teaspoon of mild detergent. Immerse the scarf and agitate gently for 1 to 2 minutes. Rinse with water of the same temperature. Remove the scarf from the water and press out the excess water using a towel. Lay flat to dry without disturbing the texture.

When the scarf is completely dry, place a ruler horizontally across the fringe about 3" down from the beginning of the weaving and hold it in place. With a rotary cutter, cut across the fringe, using the ruler as a guide.

Denise Bolger Kovnat weaves and teaches from her home in Rochester, New York, focusing on collapse techniques, echo, jin, extended parallel threadings, warp painting, and deflected doubleweave. She blogs about her work at denisekovnat.com.



Spindles were adapted into early spinning wheels by connecting the spindle whorl to a drive wheel, creating a pulley.

Illustration by Ann Sabin Swanson

What Is a Whorl?

Beginner Basics

BY AMY TYLER

Long before the advent of the spinning wheel, drop spindles were used to twist fiber into yarn. A drop spindle is basically a stick held vertically with a weight at one end. That weight is often disk-shaped and is typically called a "whorl." The primary function of the whorl is to extend the time that the spindle rotates.

Early spinning wheels oriented the familiar spindle horizontally and connected a larger drive wheel to the whorl of the spindle with a drive band, thus creating a pulley with the whorl. This setup allows for multiple turns of the spindle—and therefore a lot of twist—per one rotation of the drive wheel.

Later spinning wheels added a flyer and a bobbin, and the shaft of the flyer was a remnant of the spindle. The flyer is the device that adds twist to fiber, and the bobbin allows for simultaneous storage of the yarn. The drive wheel is attached to what spinners refer to as a "whorl" or "pulley" on the bobbin or on the flyer by way of a drive band.

There are three common ways for the drive band to attach to the flyer or bobbin:

1. Single Drive, Flyer Lead (Scotch Tension): The drive band is attached to a whorl on the flyer; the drive wheel drives the flyer, and the bobbin follows and is controlled by a separate brake band.

2. Single Drive, Bobbin Lead (Irish Tension): The drive band is attached to a whorl on the bobbin; the drive wheel drives the bobbin, and the flyer follows, typically controlled by a separate brake band.

Courtesy of Leiden University Library

Woman in India spinning on a charkha, circa 1870. Collection of the Royal Netherlands Institute for Southeast Asian and Carribean Studies.

3. Double Drive, Bobbin Lead (Double Drive): The drive band is attached to a whorl on the flyer and a groove on the bobbin. The pulley diameter on the bobbin is smaller than the pulley diameter on the flyer whorl; the drive wheel drives both flyer and bobbin, but the bobbin leads, and the flyer follows.

For all three of these drive systems, the rotation of the flyer imparts twist into fibers. Each time the flyer rotates 360 degrees, one whole twist is added to the yarn. The number of times the flyer goes around per treadle (or per time the drive wheel goes around) is called the "drive ratio."

Most modern flyer/bobbin wheels have whorls with more than one groove, with each groove (or pulley) a different diameter. These different pulley diameters provide various drive ratios and, therefore, various amounts of twist.

THE TAKEAWAY

For me, it's not so important to know exactly what the drive ratio is. It's more important to know the effect of whorl/pulley diameter on the amount of twist imparted to the fiber: The *larger the diameter* of the whorl pulley, the *less twist* per treadle (or drive-wheel rotation). The *smaller the diameter* of the whorl pulley, the *more twist* per treadle (or drive-wheel rotation). This relationship holds true regardless of whether the whorl is located on the bobbin or on the flyer.

Amy Tyler spins and knits and writes about such in northwest lower Michigan. She also travels to teach spinning and share her fascination with the mechanics of the spinning wheel. You can find out more about her on her website, stonesockfibers.com.

Large diameter whorl, less twist. Smaller diameter whorl, more twist.

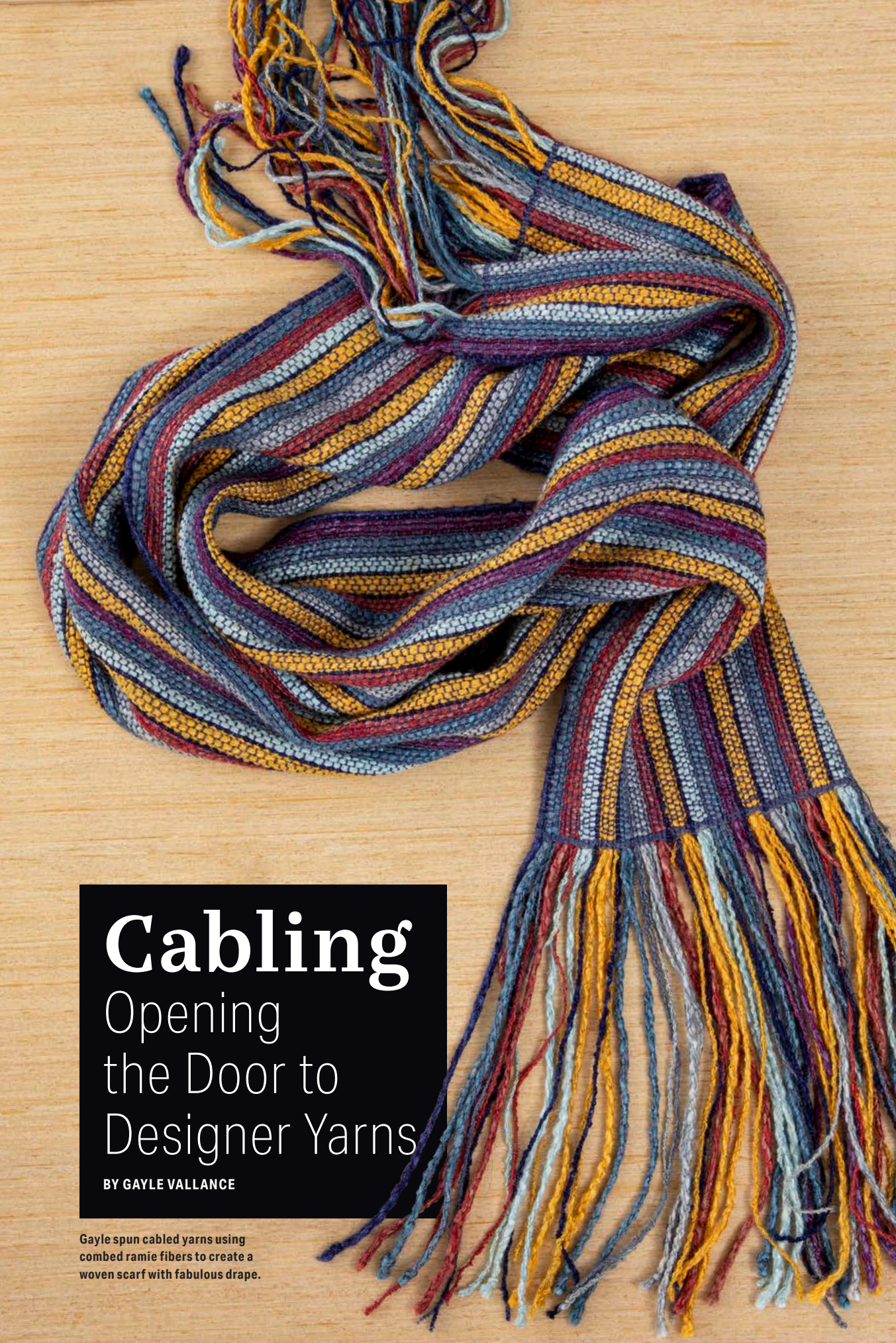
1. Scotch Tension

2. Irish Tension

3. Double Drive

Photos by Kate Larson

Most spinning wheels are made to spin with one or two drive systems. The Schacht Matchless (shown here) is designed to allow three drive systems. If you have a different type of wheel, your pulleys might be located in front of the bobbin.



Cabling
Opening the Door to Designer Yarns

BY GAYLE VALLANCE

Gayle spun cabled yarns using combed ramie fibers to create a woven scarf with fabulous drape.

Photos by Matt Graves

What is cabling? Searching for a universally accepted definition, I found myself agreeing with author Patricia Baines that textile terminology can present problems. Since industrialization, some words are used as before, but they are also used now with a more precise or slightly different meaning.[1] In modern handspinning, there are a number of commonly held definitions of cabling.

It seems reasonable to assume that our current use of the term "cabling" has roots in our rope-making heritage. Some ropes and cords consist of singles yarns plied together using a reverse twist, and the plied yarns are then twisted together in the same direction as the singles, which we could describe as zSZ (see box at right). Other examples include singles that are twisted together in the same direction as they were spun and then twisted together in the reverse direction (zZS), or two-ply yarns combined in the same direction in which they were plied (zSS).[2]

The various sequences of twisting directions were all devised to make ropes and cords strong, flexible, and water resistant. The sequences were probably more dependent upon cultural convention rather than utility, but all include a variety of twisting directions, and each twist does not have to be opposite to the one previous.

Based on its rope-making roots, "cabling" seems to have two common definitions. The first is that cabling occurs when singles yarns are twisted together in the same direction as their own twist (zZ or sS).[3, 4, 5] I assume that this is in deference to the traditional rope-making practice of doubling yarns and strands in the same direction that they were originally twisted.

The second—and more common—definition is that cabling occurs when plied yarns are combined with a twist reversal. That is, the plying twist is the reverse of the singles twist, and the cabling twist is the reverse of the plying twist.[6, 7, 8] A third definition is possible if we again defer to the traditions in rope making, which allow for the same twist in any two stages of the twisting sequence: zSS, zZS, sSZ, and sZZ.[2]

Patricia Baines was correct when she warned us about confusion in modern terminology. For simplicity and clarity in this article, I define "spinning" as the twisting of fibers into yarn and "plying" as the twisting of singles together in a direction opposite to the twist in the singles. "Cabling" is any stage in yarn construction that is not spinning or plying.

Twist Notations

I could not find a standardized method of yarn notation on which spinners and archaeologists agree. For this article, I have indicated the sequence of yarn construction by using lowercase letters to designate the direction of twist in singles yarn. The first uppercase letter in a sequence designates the direction of twist by which singles are combined. Subsequent uppercase letters indicate the direction of twist by which plied or cabled yarns are combined. For example, zS indicates that singles were spun with a z-twist, and they were plied in an S direction. And zSZ indicates that z-spun singles were plied in an S direction and then the plied yarns were cabled in a Z direction.

For an introduction to S and Z twist directions, see page 21. — Editor

WHY CABLE?

Cabling creates yarns that are stronger, more durable, and less prone to snagging and pilling than two-ply yarns. This happens for a number of reasons. Combining yarns in the same direction in at least two stages of yarn construction can make a yarn that is more pliable, less hairy, more resistant to creasing, and less elastic. A good example of this is early French tapestry yarns spun from linen and used for warp; they might contain as many as nine singles and were cabled using the same direction of twist as in spinning and multiple twisting. This produced a tough, smooth, inelastic warp that was ideal for large tapestry looms.

However, for other handspun yarns, we might want softer, more elastic yarns that are also strong and durable. The addition of reverse twist during plying or cabling incorporates these elements in addition to making yarns easy to handle because they can have a balanced twist. The yarns have greater loft and bulk, are softer and warmer, and have shorter sections of yarn that are exposed to surface friction. Cabling also

While the amount of twist needed to balance a two-ply yarn is usually two-thirds of the singles' twist, some stiff, coarse fibers, such as ramie (shown here), require slightly more twist to balance. Gayle created a sample using her standard formula for cabled yarns based on twists per inch, which resulted in an unbalanced yarn (*left*). She repeated the experiment, increasing the amount of twist in both ply and cable steps, producing a balanced sample (*center*). Based on the second sample, she created more yardage to weave a scarf (*see page 78*).

introduces the possibility of creating novelty yarns through the combination of different fibers, hues, and spinning techniques.

DETERMINING TWIST: SPINNING—PLYING—CABLING

The handle and drape of a cabled yarn are determined by the amount of twist inserted in each step of construction. It starts with the amount of twist in the singles yarn, which helps to determine the twist in the plying and cabling.

Starting with the singles, the amount of spinning twist is determined by the character of the fibers, the desired size of the finished yarn, and the intended use of the textile. Short or slippery fibers generally require more twist per inch and longer-stapled, low-crimp fibers will require less. Think about your goals for the final yarn; are you making a scarf or boat rigging?

The amount of plying twist is critical to the character of the final cabled yarn. For a reverse cable (plied yarns that are cabled in the reverse direction), additional plying twist must be added since balanced plied yarns will not bind together. As a general rule, the amount of extra twist in the plying step must be at least equal to that added to the singles. I have also found that stiff, coarse fibers often need more plying twist than fine, flexible fibers.

Finally, a truly cohesive reverse-cabled yarn can only be achieved when the cabling twist balances the excess twist inserted into the plied yarns. If the constituent strands are not nested together tightly in the cable, there is a problem with aesthetics as well as function. A yarn should have adequate twist to protect the strands from snagging or from being separated by knitting needles, and it should appear as a twisted yarn in the fabric, not as singles lying next to each other.

Balancing Yarns

A balanced yarn has no residual tendency to twist in the S or Z direction after wet-finishing because the fibers lie parallel to the axis of the yarn. In a reverse-twisted cable, excess twist in the ply is balanced by the cabling twist. We have our individual biases when it comes to producing balanced yarns (or not), but my preference is to produce balanced yarns by controlling the twists per inch in each stage of cable yarn construction.

A cable produced by combining singles in the same direction as they were spun will not be balanced, but in rope making, most of these have a reverse twist at some stage of construction to give balance. An exception is the nine-strand linen warp yarns mentioned earlier; these were twisted with a minimum of twist, the strength coming from constituent flax fibers rather than twist, and loom tension made the active twist manageable.

To determine if a yarn is balanced, allow the wet-finished and dried skein to hang loosely in one hand. If the skein hangs straight in an open loop, it is balanced, and the amount of twist in the singles has been balanced by the twist in the plying and cabling. If the skein twists in either the Z or S direction, it is considered unbalanced.

If an unbalanced skein twists in the Z direction, there is too much S-twist in the yarn, and it needs more Z-twist to balance. If the skein twists in the S direction, there is too much Z-twist, and it needs more S-twist to balance.

THREE WAYS TO PRODUCE A REVERSE-CABLED YARN

In each of the following methods for making a balanced *reverse-cabled* yarn, I have based my calculations on Mabel Ross's theory that a balanced two-ply yarn requires two-thirds the amount of twist used to make the individual singles.[8]

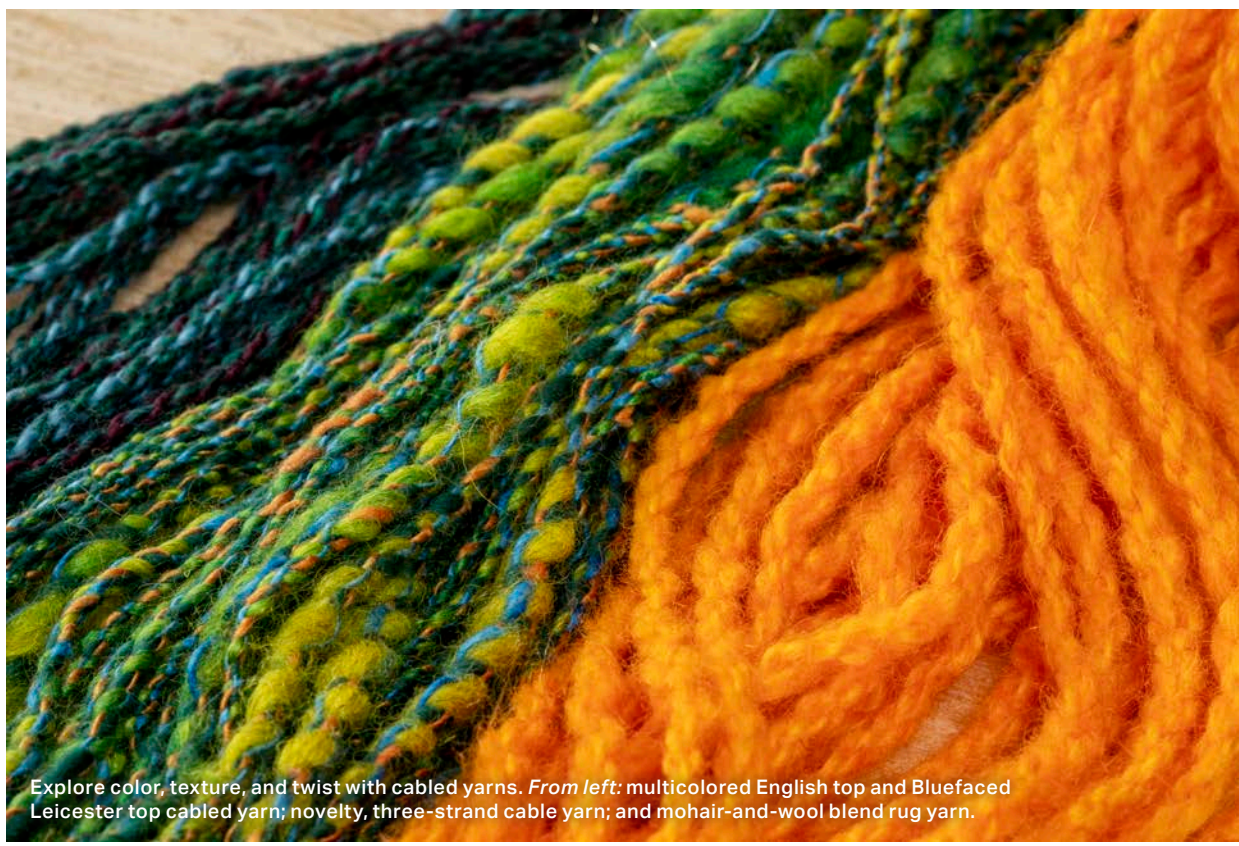
1. No-Math Method

Spin a z-twist singles yarn.

Ply S to produce a balanced two-ply. Test the yarn for balance by allowing the freshly spun yarn to hang loosely in front of the orifice to see if it hangs in a relaxed U shape.[9]

Remove the bobbin of plied yarn from the wheel, place it on a lazy kate, and feed the yarn back onto the wheel, adding enough extra S-twist so that when the yarn is allowed to hang at the orifice, it will self-cable.

Remove the bobbin again, and with two sources of overplied two-ply yarns, feed them back into the wheel



Explore color, texture, and twist with cabled yarns. *From left:* multicolored English top and Bluefaced Leicester top cabled yarn; novelty, three-strand cable yarn; and mohair-and-wool blend rug yarn.

Gayle spun a Bluefaced Leicester combed top and a multicolored English wool top in sequence, using a worsted draw, and then plied the singles on themselves, creating interesting variegations and texture.

but with Z-twist. This time, test until you achieve a balanced yarn at the orifice.

A disadvantage of the No-Math Method is that spinning will be slowed as the yarn is repeatedly tested for balance. Another disadvantage is that if the project requires hundreds of yards of yarn, singles will be sitting on bobbins long enough for the twist to set, thus losing the energy necessary to self-ply at the orifice.

2. Count Your Treadles

A simple, but more precise method of making a balanced reverse-cabled yarn involves using one flyer whorl (one ratio) for all three steps: spinning, plying, and cabling. You must be able to draft the same length of fiber (or yarn) for each number of treadles, but the length can be adjusted to personal preference.

The rules are:

- Use the same wheel ratio for spinning, plying, and cabling. Choose the largest whorl (see page 76).
- Use the same length of draft for each step. I use a long-backward draw and count treadles for each 12 inches of fiber drafted or yarn plied/cabled. I make certain that no yarn is fed into the orifice before the treadle count is finished, and I take care to feed all 12 inches of yarn onto the bobbin at the end of each treadle count.
- Use the same or a greater number of treadles for plying as for spinning.
- Cable using two-thirds of the excess treadles in the ply. ("Excess" treadles occur when the number of plying treadles is greater than the number of treadles for the singles.)

Sample Exercise

Use the lowest wheel ratio, something like 6:1, to spin a singles yarn with z-twist, treadling six times for every 12 inches of fiber drafted.

Take two strands of this yarn and ply them with S-twist, treadling 10 times per 12 inches of yarn drafted. (Four treadles would represent a two-thirds plying twist for a balanced two-ply, but we have added 6 extra treadles, creating an unbalanced yarn with extra S-twist.)

Cable Z by twisting two strands of the two-ply together and treadling four times per 12 inches of

draft (⅔ × 6 excess treadles in the ply) to produce a balanced cable.

3. Calculate Twists Per Inch

Some may find this method intimidating, but it is the most flexible method of creating a balanced cable yarn. The ratio and the length of draft can vary, but the calculations are much simpler if a 12-inch draft of fibers or yarns is used for all steps in the yarn creation.

The Formula

$$\frac{\text{Wheel ratio} \times \text{Number of treadles}}{\text{Length of draft}} = \text{Twists per inch (tpi)}$$

Sample Exercise

Select a wheel ratio that suits your spinning style; let's say 6:1.

Select a drafting method and a length of draft. If you prefer to use a short-forward draft, then your length of draft for spinning may be slightly shorter than your fiber length, possibly 3 inches.

If you treadle three times, adding z-twist for each 3 inches of fiber drafted forward, there will be a total of 18 twists in the yarn, or 6 twists per inch (tpi) of yarn:

$$\frac{\text{6:1 ratio} \times \text{3 treadles}}{\text{3"}} = \text{6 tpi (⅔ × 6 = 4 tpi to balance)}$$

If you want a balanced two-ply yarn, treadle two times for each 3 inches of yarn being plied:

$$\frac{\text{6:1 ratio} \times \text{2 treadles}}{\text{3"}} = \text{4 tpi}$$

But for a four-strand reverse-cable yarn, treadle four times to give an excess of 4 tpi:

$$\frac{\text{6:1 ratio} \times \text{4 treadles}}{\text{3"}} = \text{8 tpi (an excess of 4 tpi, which will require 2⅔ tpi [⅔ × 4] to balance)}$$

To balance the excess plying twist, cable with Z-twist to get approximately 2⅔ tpi:

$$\frac{\text{6:1 ratio} \times \text{1½ treadles}}{\text{3"}} = \text{3 tpi}$$

Because it is difficult to treadle only 1½ times for each 3 inches of draft, it makes sense to move to a 6-inch draft and treadle three times, or use a 12-inch draft and treadle six times. Each of these options would produce the same 3 tpi to balance.

If 3 tpi gives slightly too much twist, treadling five times with a 12-inch draft will give 2½ tpi. Sampling will show which formula works best.

MAKE IT YOUR OWN

One of my favorite ways of creating designer yarns is to use cabling. It is a simple way to combine fibers, yarns, colors, and textures to make magical combinations for every purpose—from elegant scarves to rug warps to cord handles for handbags. The trick is to understand the importance of twist and how to make it work for us. That understanding will give us the confidence to make every experiment a success.

Notes

1. Patricia Baines, *Spinning Wheels: Spinners and Spinning* (London: B. T. Batsford, 1982), 12.
2. P. J. Stopford, *Cordage and Cables: Their Uses at Sea* (Glasgow: Brown, Son & Ferguson, 1925, reprinted 1968), 1–3.
3. Enid Anderson, *The Spinner's Encyclopedia* (Newton Abbot, Devon: David & Charles, 1987), 25.
4. Allen Fannin, *Handspinning: Art and Technique* (New York: Van Nostrand Reinhold, 1970), 174.
5. Paula Simmons, *Spinning and Weaving with Wool* (Seattle: Madrona, 1977), 106.
6. Alden Amos, *The Alden Amos Big Book of Handspinning* (Loveland, Colorado: Interweave, 2001), 414.
7. Dorothy K. Burnham, *The Comfortable Arts: Traditional Spinning and Weaving in Canada* (Ottawa, Ontario: National Gallery of Canada, 1981), 36.
8. Mabel Ross, *The Encyclopedia of Handspinning* (London: B. T. Batsford, 1988), 35, 53.
9. Be aware that a yarn tested in this manner will probably ply at 50 percent of the singles' twists per inch (tpi), and most two-ply yarns require two-thirds of the singles' twist to be perfectly balanced after wet-finishing. This is an imperfect measurement, but it helps.

Gayle Vallance has a Master Spinner Certificate from Olds College and has attained the technical level of the HGA Certificate of Excellence (Spinning). Her aim is to encourage the use of natural dyes and fibers. She raises Corriedale sheep on her farm to provide her with wool for spinning and felting. She grows flax for linen yarns and dye plants for natural dyes.

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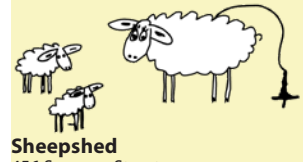

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Emptying the Bucket

A Handspun Crochet Challenge

By Mary-Lyn Tebby

Photo by Mary-Lyn Tebby

Mary-Lyn's bold handspun cotton doily.

I don't believe in bucket lists. I'm terrified that, after I die, all the undone things on my list will chase me through eternity, making me feel forever guilty because I never took the time to deal with them. However, years ago, I gave myself a challenge, and recently, I accepted it and did it.

When I was very young, I learned to crochet, and all I made for years were doilies, because that's what I first learned to make. Once I learned to spin, I told myself that someday I'd learn to spin crochet cotton and make a doily from my own handspun cotton. I thought of this challenge a few times over the years but didn't do anything about it until I reached level five of the Ontario Handweavers and Spinners (OHS) Spinning Certificate course, and I decided it was time. Level five was all about spinning those "other" fibers, such as plant and man-made, and the final assignment was to choose a cellulose fiber, spin it, and make a small item from the handspun yarn.

I saw this as a chance to finally put my doily challenge to rest. I would spin cotton as fine as I could and crochet that doily. Because it was going to be my one and only cotton project, I decided it would be big, bold, and beautiful. I chose the Breezy Pineapple Doily pattern from Leisure Arts, measuring about 45 centimeters in diameter when made in size 10 crochet cotton. For this project, I would need much more yarn than the OHS assignment's required 150 meters, so I decided not to mess around with prepping my own cotton. I bought Egyptian cotton tops from The Fibre Garden.

I started spinning. To spin the singles, I used several spinning wheels, including my Lendrum and Ashford e-Spinner 3, and even my little Woolmakers' Bliss contributed a bobbin. When I got tired of one wheel, I moved to another, always pulling out the very short fibers with a sort of long draw and adding more and more twist, making the singles as skinny as I could. Given how much twist cotton needs, it took forever to finally spin enough singles to make enough crochet cotton for the doily. Most of the plying happened on the e-spinner because my ankles were weary by the time I got that far. All the spinning was done to the varied rhythms of the music of Queen, which gave me a rather inconsistent yarn since the beat changed constantly and with it, the speed of treadling. Even so, I was happy with my yarn.

To make the doily, I used a 1.5-millimeter steel crochet hook, and the finished doily measures about 52 centimeters in diameter. I finished it by steaming with an iron over a wet cloth covering the doily. In the end, the doily took 327 meters of two-ply cotton yarn at 25 wraps per inch, which is similar to size 3 crochet cotton. I had about 20 meters left over, enough to make the samples required for the assignment.

At the time, I decided not to dye it; I was in a "let's get this assignment done and gone—forget the dye" mood. However, after looking at it hanging over the back of a seldom-used chair, I decided it needed color. I dyed it with raspberry-colored Procion MX fiber-reactive dye from G&S Dye. The end result is a doily that is a brilliant dark magenta.

Big, bold, and beautiful, the doily now glorifies the back of that chair and moves frequently to the center of the kitchen table, where it gets all the admiration it deserves.

If I ever had a bucket list, it is now empty.

Mary-Lyn Tebby is a freelance writer who prefers spinning wool. She lives in Muskoka, Ontario, Canada.