



Spinning and Weaving

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I. GOAL

Students will learn about hand spinning and hand weaving on the American frontier of the 1840's.

II. OBJECTIVES

- A. Students will spin wool into yarn and weave that yarn into fabric. By doing this they will gain an understanding of the time involved in the hand manufacture of textiles, and why the people of that time were so thrifty. Instead of discarding scraps of cloth, they used the scraps to make quilts, rag rugs, or to patch holes in garments. Instead of discarding worn garments, they often cut out the most worn parts of a garment and remade it to fit a smaller person. Quilts were often stuffed with old blankets or tattered quilts.
- B. Students should learn that textile production at Sutter's Fort was not state of the art for the 1840's. In the northeastern part of the United States, water powered manufactories had automated most steps, from carding raw fibers through printing designs on finished cloth.
- C. Students should learn that Captain Sutter manufactured blankets to sell. He did not manufacture other types of cloth. He did, however, import manufactured cloth from the United States.
- D. Students should learn that local Native Americans, not white immigrants, worked in Captain Sutter's "Blanket Factory".

III. THE PEOPLE

John Bidwell wrote that James Marshall, Sutter's head carpenter, made the looms and spinning wheels for Sutter's blanket factory. The weavers and spinners were local Native Americans. In addition to the spinners and weavers, Sutter employed people to look after his sheep and shear them in the spring. Sutter sold, traded, or made gifts of the blankets produced in his blanket factory at the Fort.

IV. THE PLACE

Captain Sutter owned several thousand sheep, which grazed on his land near the Fort. In the spring, the sheep were herded together and sheared. After shearing, the fleeces were rolled and tied, then transported by cart to the Fort and stored until processing.

The first step in processing the fleeces required water; possibly it took place at the slough behind the Fort. The fleeces were sorted and the obvious tags and junk discarded, then washed, rinsed, and dried on racks. There were no carding mills in northern California at that time. Therefore, the next step in the process, carding, was all done by hand. Carding requires only two small hand cards and a place to sit, so it occurred any place handy and comfortable for the carders - indoors in bad weather, outdoors in good.

Sutter's blanket factory, where the spinning and weaving took place, was in much the same location in 1846 that it is today.



V. SPINNING, WEAVING AND DYEING

MATERIAL LIST – your responsibility

Fiber.....	Fleece (unprocessed wool) or roving (washed and machine carded wool) if you want to handspin part or all of the yarn you use for weaving. One half to one ounce of wool per child is generally enough. You can buy fleece or roving at spinning or weaving stores. Many knitting stores also carry roving. You may be able to get inexpensive fleece from your local 4-H or sheep ranchers. If you have none of these sources, you can find advertisements to buy fleece or roving on the Internet.
Cards.....	Needed to card the wool if you begin with fleece and wish to process your fleece before your ELP day. Sutter's Fort provides several sets of cards for use at the Fort. Carding opens up the fibers so they are easier to spin. Carders are expensive, but you can use a pair of flat dog brushes instead. You can also pick apart and fluff up the wool by hand.
Soap.....	Needed to wash wool if you begin with dirty fleece. You can use lye soap, dishwashing liquid or shampoo. Wool is generally very greasy so you need a soap that will cut the grease.
Wash tub.....	Needed to wash and rinse wool if you begin with dirty fleece. A sink or large bucket will also work. Do not use a washing machine because the agitation and temperature change will permanently mat (felt) your wool.
Spinning Sticks.....	Needed to spin wool into yarn if you plan to spin yarn before your ELP day. Sutter's Fort provides a number of spinning sticks for use at the fort. You can make spinning sticks from dowels and cuphooks. You'll need 3/8" or 1/2" wooden dowels in 1 foot lengths. Sand down any rough spots. Screw a small cuphook into one end.
Dye.....	See notes on page 6.
Scissors.....	Sutter's Fort provides two pairs of scissors for use at the Fort, but you may want to bring a small pair "just in case." Scissors are needed to trim ends of yarn on your weaving and to cut the finished weaving off the loom. To keep track of your scissors, tie a cord to the scissors and tie the cord to your apron, or belt, or to the loom.
Yarn.....	You will need approx. 12 yards of yarn per child. Some children will want to weave more while others lose interest quickly. You may use only handspun yarn or you may purchase yarn. If you plan to use only your own handspun yarn, you must spin it before your ELP day because inexperienced children will not be able to spin enough in one day to complete a weaving.
Decorations.....	Feathers, beads, sticks or other doo-dads may be woven into your cloth or attached after your weaving is complete.



MATERIALS LIST – what Sutter's Fort will provide.

- ELP Box..... Large wooden box that contains several pairs of cards, drop spindles, spinning sticks, stick shuttles, two pairs of scissors. You will be asked to inventory the contents of the box at the beginning and end of the day your class visits the fort.
- Loom..... Small rigid heddle loom which will be warped with enough yarn for your class to weave. Larger groups will have two looms. Most classes weave 1 – 3 yards of cloth. The loom is not period, but you can use it to weave authentic fabric. You can see authentic 1840s-type home looms in the Blanket Factory.
- Benches..... There are various benches and chairs around the fort for the weavers, carders and spinners.

WASHING WOOL

1. If you start with a greasy fleece, your children will be able to spin more easily if you wash the fleece first. Be sure to wash it well ahead of time because, depending on the weather, wool may take several days to dry.
2. Unwashed wool will feel greasy due to the lanolin. You may wish to have your students feel the wool and note the greasy, soft feel.
3. Do not try to wash too much wool at once – one pound at most. Make sure you have a container that will provide plenty of space for your wool. Fill the container with hot water and add soap. A grease cutter such as dish detergent is fine – keep in mind that pioneers used harsh lye soap. Mix the soap in well before adding the raw wool. Place the wool in the water and gently push it under. Let it soak for a while – a few minutes will do. DO NOT wring or agitate or you may mat the wool.
4. Squeeze as much water out of the wool as you can, and set it aside. Drain the water.
5. Fill the container with clean water of a similar temperature; i.e., don't shock wool by moving it from hot to cold or cold to hot water. You don't need a thermometer – if it feels similar to your hands, that's close enough. Soak. Squeeze. Set aside. Drain. Repeat until the water is fairly clean.
6. Squeeze out as much water out as you can. Rolling the wool in a towel helps. If a washing machine is available, put the wool in an old pillow case or net bag and run it through a spin cycle. DO NOT use the washing machine for anything but a dry spin cycle.
7. Put the wool on a wooden or plastic rack out of direct sunlight, and let it drip dry. Make sure you don't place the wool on a rack that could rust. Rust stains may be impossible to remove.

PICKING/TEASING WOOL

1. When the wool is dry, take a small handful at a time and fluff the fibers apart. Be gentle and try not tear or tangle the fibers.
2. Take this opportunity to shake out more dirt, remove stickers and snarls, and remove small clumps of short hairs.
3. Set the fluffed wool aside in a bag or basket to be carded. Or, you can spin this fluffed wool.



CARDING WOOL



1. Take a small piece of wool and pull it onto the teeth of one of the cards. Pull it so that only about 1/2 of the card is covered and the fibers extend off the edge of the card.
2. Pull the second card gently over the top of the wool as if you are combing hair. Do not dig the teeth of the cards into each other because this will break the wool fibers and the teeth on the cards.
3. Some of the wool will transfer to the second card. Continue carding until the fibers of wool on both cards seem smooth and straight.
4. Remove the wool from the cards by lifting one edge of the fringe of wool and pulling it gently off the card. Roll the little pad of wool up and set it aside to be spun later. You should get a little roll (rolag) of wool off each card. (This is the ELP way. Experienced carders can flick the wool off the cards and roll it up just by using the cards.) **Note:** Before batting was commercially available, the rectangular pads of wool from the cards were used as batting to line quilts or quilted garments.

SPINNING WOOL WITH A SPINNING STICK

1. Spinning with a spinning stick is the easiest way for a child to spin wool into yarn. One child can spin by holding the spinning stick in one hand and the wool in the other, or two children can work together with one holding the spinning stick and the other holding the wool.
2. A spinning stick is just a fairly straight stick with a crook at one end. The easiest way to make one is to screw a brass cup hook into one end of a 1 foot length of 3/8" or 1/2" dowel. Make sure to sand any jagged edges.
3. Take a small rolag of handcarded wool or a piece of purchased roving, and use the cuphook to catch a few strands of wool.
4. Pull the wool out gently, straight from the end of the spinning stick, into a thin strand a few inches long. Don't pull the wool out too thin or it may pull apart. Don't pull out at an angle or it will fall off the cuphook.
5. Pinch the fingers of the hand holding the wool together, between the thin strand and the rest of the wool.
6. Turn the spinning stick (always in the same direction) until the fibers you pulled out are twisted together enough to hold together and feel strong. If you relax slightly, the fibers you twisted together should try to spin back on themselves.
7. When the twisted fibers (yarn) are 1 – 2 feet long,
 - Stop and wind the yarn around the spinning stick.
 - While you are winding the yarn on, continue to pinch the fibers between the yarn and the rest of the wool in your hand.



- Wind most of the yarn into a ball around the stick but leave an inch or so loose and wrap it a couple of times around the hook. This will ensure that when you begin to spin more fiber into yarn, you won't pull the wound yarn off.
 - **Note:** unwrap the yarn from the hook and wind it onto the spinning stick each time or you will end up with a big knot of yarn around the hook.
8. Repeat steps 4, 5, 6, 7 until you have almost no unspun wool in your hand.
 9. Fluff the fibers out at the end and overlap them with the fluffed end of a new rolag or piece of roving. Turning the spinning stick until the old and new pieces of wool have spun together.
 10. Repeat the process – add, spin, wind, add, spin wind - until you have spun all of your fibers into yarn.
 11. Now it's time to create a balanced two ply yarn for your weaving; i.e., two stranded yarn that doesn't wind back on itself and snarl. You need a helper for this.
 - One person should hold the end of the yarn and the spinning stick.
 - The other will back up while gently unwinding the yarn and keeping the two strands apart.
 - When the yarn is fully unwound, the two people may be standing several feet, or even yards, apart.
 - The person who has unwound the yarn should move the two strands together – they will begin spinning together – this is what you want.
 - Gently move your hands along the entire length and help the yarn to spin smoothly together.
 - Remove the end of the yarn from the cuphook, and knot the two ends together to prevent them from unspinning.
 12. You can wind this yarn directly onto a stick shuttle to weave. If you wish to dye the yarn, you should wash it again because wool must be very clean for the dye to take. To wash yarn,
 - Wind it into a skein.
 - Put 3 or 4 ties on the skein to prevent tangling.
 - Wash the skein as you washed the raw fleece (see page 4).
 - Hang to dry.

DYEING WOOL

If you want to dye your yarn using natural dyes you can find many books in the library. Following is an easy, safe, modern method.

1. Start with clean wool, unspun or already spun into yarn. Dye will not take if the wool is greasy.
2. Each child needs a plastic container; large plastic jars or milk jugs with the tops cut off work well.
3. Fill the containers with a dye bath; e.g., unsweetened Kool-Aid dissolved in water, the liquid in which red or yellow onion skins, or beets, or marigolds were simmered, etc. Generally, the darker the liquid, the more dye available for the yarn to absorb.
4. Place the wool in the container. If you want the wool to be a solid color, immerse it in the dye. If you want a variegated color, don't fill the container with dye. Then make sure some of the wool is immersed in the dye and some of the wool is out of the dye.
5. Place the container on a shelf - in front of a window is good. Leave overnight or over a weekend.
6. Pour off the liquid.

7. Rinse the wool and squeeze out excess water.
8. Let the wool drip dry.

WEAVING ON THE ELP LOOM



1. Rigid heddle. Move up and down to change position of length-wise (warp) threads, so you can weave.
2. Back beam or warp beam.
3. Rear ratchet – loosen to move cloth forward. Then tighten up to weave.
4. Wing nuts. Loosen to fold loom up. Tighten to hold in position while you weave.
5. Cloth.
6. Front beam.
7. Front ratchet. Wind towards yourself to move the cloth forward.
8. Cloth beam. As you weave, you will wind cloth onto this beam to free up more warp threads for your children to weave.
9. Base.

1. When you come to the fort, the loom will be warped with cotton threads; i.e., lengthwise threads will be tied onto the loom ready for you to weave cloth.
2. Getting ready to weave:
 - Set up the loom upright and tighten all six (6) wing nuts.
 - Check the tension of the warp threads. The warp should be firm, but not so tight the threads will snap. You can tighten or loosen the overall warp tension by turning the front and back ratchets on the right side. You also use these ratchets to move your cloth forward.
 - If some of the threads are very tight and others loose, you can even them out by tightening or loosening the knots at the front of the loom.
 - Wrap the yarn you've spun or purchased around the stick shuttles.
3. Weaving:
 - Take a shuttle wound with yarn and unwind a couple of feet.
 - With the **rigid heddle up**, push the shuttle between the two sets of threads.
 - Leave a short tail of yarn extending over the threads at the beginning.
 - Use the rigid heddle to beat the yarn forward.
 - If you beat softly, your cloth will be loosely woven. If you beat hard, your cloth will be tightly woven. Either is fine. Weavers vary their beat depending on what the cloth will be used for – from a soft, drapery scarf to a long-wearing rug.
 - At first, your cloth will make little fan shapes because of the way the warp threads are tied onto the cloth beam. Don't worry. As you weave further, this will even out.
 - Unwind enough yarn to reach the other side of the cloth.



- With the **rigid heddle down**, push the shuttle in the other direction, between the two sets of threads. You should now be on the side where you began.
- Use the rigid heddle to beat the yarn forward.
- Continue moving the rigid heddle up and down, pushing the shuttle back and forth, and beating each thread in, until you run out of yarn, daylight, and children who haven't woven.

4. Changing yarn. When you run out of yarn on a shuttle, or just want to change colors:

- If you haven't run out of yarn, cut the yarn.
- Overlap the old yarn and new yarn by a few inches to avoid a hole.



- Continue weaving.

5. Removing your weaving from the loom:

- Make sure the rigid heddle is in the “up” position, supported by the loom. If the rigid heddle is not supported, when you cut the threads, the rigid heddle will fall on the ground; all the warp threads will come undone; and you will have to ask the Fort staff to call Jennifer to rethread the loom before the next class comes to the Fort.
- Loosen the back ratchet.
- Turn the front ratchet to wind your cloth onto the cloth beam. Between the cloth beam and the rigid heddle, you should see 18” or so of warp threads.
- Cut warp threads about ½ way between your cloth and the rigid heddle.
- Group the threads into several even bundles (eight works well because you just need to divide in ½ to get 2 even bundles, then divide those in ½ to get 4 even bundles, then divide those in ½ to get 8 even bundles).
- Put some sort of knot in the bundles so the threads won't fall back through the rigid heddle. Use a knot that will be easy to undo when you come to the last step.
- Loosen the front ratchet, and roll your cloth off the cloth beam. Tuck the cut ends into the cloth as you roll it.
- When you have rolled all the cloth off the beam, untie the knots holding your cloth to the cloth beam.
- Set your cloth aside.
- Take all the knotted warp threads in your hands and pull them forward at once. (You may have to loosen the back ratchet.)
- Make sure you have pulled the threads OVER the front beam.
- Tie the warp threads back onto the cloth beam so the loom is ready for the next school. Use the knot you see pictured on page 22, spreading the threads as evenly as you can across the cloth beam.
- Loosen all the wing nuts and fold the loom up.

6. Finishing your cloth:

- Unroll your cloth.
- At each end, divide the loose threads into even bundles and tie knots. The knots should be tied very close to the end of the cloth, so the cloth doesn't come undone.
 - The knotted fringe you have created is a nice edge.
 - Or you can braid the fringe or knot a macramé edging.
 - You can also add various decorative doo-dads to the edge or the body of your cloth, such as beads, tin-punched metal disks, thin wood disks with painted or wood-burned designs, a thin, flat piece of wood about as wide as the cloth with the name of your school, the year, etc. painted or wood-burned on, etc.

8. Displaying your cloth – tie the fringe at one end to a branch or dowel and hang it on the wall.



SUGGESTIONS FROM OTHER SCHOOLS

Washing wool

Divide your raw wool into one or two ounce batches.
 Make up one page instructions for washing, drying, and picking wool.
 Place wool and instruction sheet in a bag and send home as homework.

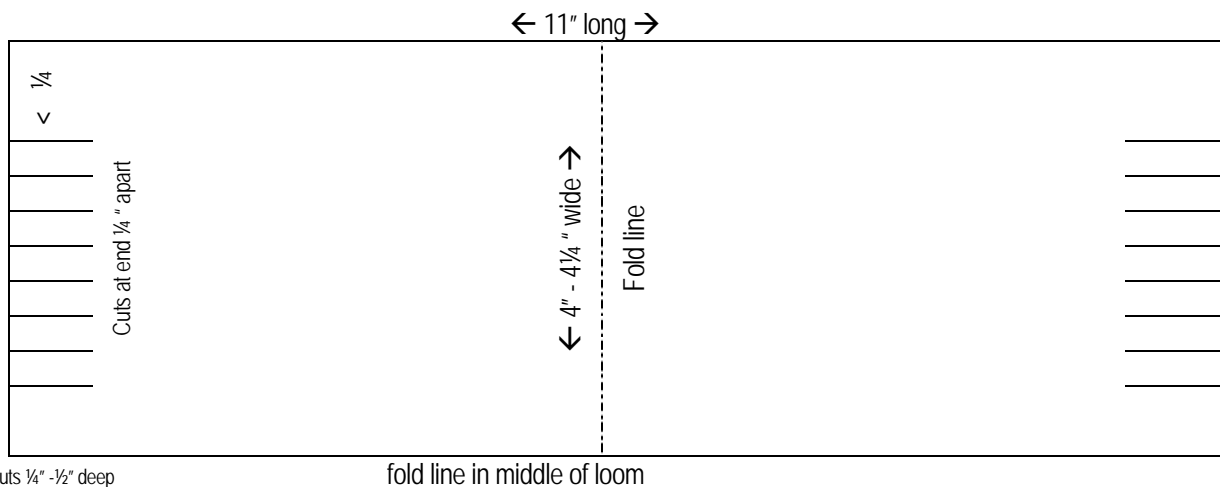
Weaving shuttles

Some schools make stick shuttles for each child out of wooden paint stirrers. Just cut a notch in each end and sand lightly. Before ELP day, wind each child's yarn onto a shuttle, label the shuttle, place all the shuttles in a bag or box or basket to be delivered to the Spinning/Weaving station. This may save some time and confusion in large groups.



Weaving small bag with no seams – generally completed before your ELP day:

- Make your loom:
 - a. You need a sturdy piece of cardboard for each loom.
 - i. Version 1: Use the cardboard backing from 8½" X 11" note pads, and cut lengthwise. You'll end up with two pieces of cardboard approximately 4¼" X 11". Each piece will make one loom.
 - ii. Version 2: Purchase posterboard. As of 12/07, I purchased a package of 5 pieces of 22" X 28" posterboard for \$5.29. Cut each sheet into 14 - 4" X 11" pieces. Each piece makes one loom. A package of 5 sheets will make 70 looms. You can purchase the sheets individually if you have a small class.
 - b. Make small cuts in each short end. Start at least ¼" in from each side and make the cuts approximately ¼" apart and ¼" to ½" deep.
 - c. Make one ¼" cut at the fold line.



- Warp your loom – that is – put the lengthwise string on it so the children can weave. You'll need thin but sturdy string. Kite string is ok. If you're near a store that sells weaving supplies, cotton warp is very good. You can buy a ball of



840 yards for \$5.80 (as of 12/07). You need about 5 yards per loom, so one ball of cotton warp will be enough for 168± looms.

- a. Make a knot in your string then push the string into the first cut on one end. The knot should be pulled snugly up to the cardboard on what will become the backside of your loom.
 - b. Run the string back and forth from end to end and push down into a cut at each end.
 - c. All the lengthwise threads should be on one side of the cardboard. On the other side, the only string you should see are loops around the cuts.
 - d. After you have string strung through each cut, put a knot in the end so the string won't come out during weaving. **However, the very last thread** should not go all the way to the end. You must string it into the cut at the fold line.
 - e. When you're done, you should have a grid of strings on one side of the cardboard that run parallel to each other from one end of the cardboard to the other, except for the last thread that runs only ½ way. These are your warp threads.
- Finish your loom:
 - a. Now fold your loom along the fold line – warp threads/strings outside, blank cardboard inside, and tape the loom together. Two small pieces of tape are sufficient.
 - b. If you count the threads on both sides, you should have an odd number of warp threads.
 - Weave:
 - a. If a weaver packs the yarn in very tightly, it will take approximately 25 yards of medium weight yarn to weave the bag and make the drawstrings. Most children do not pack the yarn in, but that gives you an idea of the maximum amount of yarn you'll need for the bags. FYI – a fairly common yardage for a medium weight skein of yarn is 200 yards. So one skein would be enough for 8 or more bags.
 - b. Thread a couple of yards of yarn through a large plastic sewing needle or a mini-Popsicle stick with a hole drilled in one end. As of 12/07, you could purchase a package of two large plastic sewing needles for \$1.29 at fabric or craft stores.
 - c. Start weaving at the end of the loom where there are cuts in the cardboard.
 - d. Use the tapestry needle/Popsicle stick to weave the yarn over and under each thread.
 - e. When you come to the edge, turn the loom and continue weaving on the next side. You will be making a circle around the folded loom.
 - f. The weaving yarn should cross over and under the warp threads in a different pattern for each row. That is, if the yarn goes over a warp thread on Row 1, it should go under the warp thread on Row 2.



(Interweave Press logo)

- g. Use your fingers to push the yarn firmly together so you don't see the warp threads.
 - h. To add more yarn or change color, overlap the old and new yarns, just as you do on the group loom.
 - i. It gets difficult to weave at the very bottom where the fold line is. But encourage the children to weave as tightly as possible to the very end. Otherwise, they will have holes in the bottom of their bags.
- Finishing:
 - a. Take the bag off the loom by bending the cardboard tabs over and pushing up on the warp thread loops at each end. You may have to crumple the cardboard slightly to remove it from the woven bag.
 - b. Cut two pieces of string or yarn and thread them loosely through the top of the bag. It helps to use different colors because you will need to knot the ends of each piece of string/yarn together.
 - c. Knot the ends of the string/yarn together so you end up with two separate loops.
 - d. Pull the loops out to opposite ends to close the top of the bag.
 - e. Children can put important things such as their Sutter bucks in their bags.



GENERAL INFORMATION

INTRODUCTION

Following are some general facts, including the sort of information that any person in the mid-19th century United States might know. At that time spinning and weaving were not obscure hobbies or artistic endeavors. Just as most people now are familiar with the concept, appearance, and use of a car even if they don't own one, so would a person in the 1840's be familiar with spinning and weaving.

However, it is also important to remember that in the 1840's the Industrial Revolution was well on its way. In western Europe and along the east coast of the United States, many manufactories produced cotton and wool yarns and cloth on water powered machinery. Although many country women still spun and wove part of what they needed, few families in the United States at that time were totally dependent on their own production for textiles. Women born and raised in cities might be very inexperienced or not know how to spin or weave.

John Sutter imported thread, yarn, and cloth. He manufactured blankets. Immigrants from the United States did not work in Sutter's blanket factory. He employed local Native Americans to spin the wool from his sheep into yarn, and to weave the yarn into blankets.

Sutter wrote that James Marshall made his spinning wheels and looms. The blanket factory at Sutter's Fort has been furnished with equipment typical of that available to the common people of the United States of that time.

We have no examples or descriptions of the blankets Sutter manufactured. Sutter said he taught the local natives to weave. It is possible that Sutter directed the Indians to weave blankets that looked like Hudson Bay trade blankets since they were known and valued in California.

We do believe that some of the blankets were woven entirely of wool and others with wefts of California wool and warps of cotton thread imported from the United States. Blankets woven entirely of wool are warmer, softer, sturdier and more expensive than wool/cotton.

2500 YEARS OF HISTORY ON A PAGE AND A HALF

- 500BC-750AD. Sticks and spindles became spinning wheels, probably in India.
- 1200's Wooden cards with wire teeth set in leather were invented to replace teasels.
- 1300 or so The spinning wheel was introduced to Europe.
- 1480 The flyer assembly on spinning wheels was in use.
- early 1500's The treadle appeared on spinning wheels.
- 1500 -1600 Gig mills for carding and napping were in operation.
- 1643 First American wool mill established at Rowley, Mass.



- 1700 American colonies producing enough woolen yarn and cloth for their own needs and to sell. England wanted colonies to produce raw materials and provide a marketplace for English manufactured goods. Colonial manufacturing and shipping of woolen goods was first discouraged, then condemned, then outlawed. Before the Revolution, no textile equipment, models or plans were legally imported into the American colonies.
- 1733 Fly shuttle loom invented by John Kay.
- 1765 Spinning Jenny invented by James Hargreaves but destroyed by angry neighbors.
- 1774 Power loom invented by Edmund Cartwright.
- 1784 Drum carder similar to modern ones invented by Paul Lewis.
- 1785 Spinning Jenny ubiquitous.
- 1787 First American cotton mill established at Beverly, Mass.
- 1790 First steam powered cotton processing machines in America in Rhode Island.
- 1792 Cotton gin (engine) invented by Eli Whitney.
- 1797 Machine invented by Amos Whittemore which automatically cut, bent, and set wire teeth into leather for carding cloth.
- 1810 Riots in England to destroy gig mills which mechanized wool carding.
- 1814 First totally mechanized factory for processing raw cotton into finished cloth was opened by Francis C. Lowell.
- 1815 New England textile mills processing 90,000 bales of cotton/year versus 500 bales/year in 1800.
- 1815-1840 Power looms developed, cylinder printing perfected, continuing improvements in dye technology.
- 1846 Lockstitch sewing machine patented by Elias Howe – this is the first commercially viable home-sewing machine.
- 1856 First artificial dye (mauve) produced from coal tar derivatives by William Henry Parkin while trying to find a formula for artificial quinine.



COMMON PROCESSING STEPS – from the sheep's back to your back

Following are common steps in processing a fleece to clothing. Some steps can be skipped, and some people add a few more steps. It depends on how much time you have available and how persnickety you are. Each double asterisk ** indicates a step where the fibers or fabric can be dyed. At what point you choose to dye depends on what you want to achieve and personal preference. E.g., if you want woven plaid cloth, you must dye the yarn before you weave the fabric.

1. In the spring, run your sheep through a farm pond or creek to wash the worst of the mud and dirt off. Then keep the sheep penned somewhere clean until they are dry. Fleece is sold by weight. If you buy dirty fleece, as much as 30% of the cost is for grease and dirt.
2. Shear fleece. Sort out and discard soiled and unusable parts.
3. **Wash fleece. At a time when producing a lot of hot water is very laborious, some people use the nature of raw wool to decrease the work. If you put an unwashed fleece in tepid water and let it stay there for 24 hours or more, the acid salts (from sweat) and grease (lanolin) will combine to form a type of soap, dissolving and removing much of the grease and dirt. After this long soaking, it is only necessary to rinse out the impurities. Wool dyed at this step is referred to as 'dyed in the wool.'
4. Pick the fleece. That is, pick out stickers and other junk, and fluff out the fibers for easier carding. This is a good job for little children.
5. Card the fleece. This rids of the fleece of more dirt and foreign matter as well as aligning the fibers somewhat. Carding is often done by children or at carding bees. If you are lucky enough to live near a carding mill – you can take your cleaned, picked fleeces to the mill where you can pay for the automated carding in cash or in kind.
6. Spin wool into yarn. Ply the yarn; i.e., spin two or more strands together. Unplied or singles yarn is often used for weaving, but generally plied yarns are used for knitting and crocheting.
7. Wind the yarn into skeins.
8. **Set the spin by washing or rinsing the skeins and hanging them to dry.
9. Warp the loom (plan, measure, dress, etc.)
10. Fill shuttles and weave in the weft threads.
11. Cut the web off the loom.
12. **Wash and full the woven material.
13. Proceed with any other finishing touches such as napping (brushing) the cloth.
14. Cut your garment out and sew by hand. The sewing machine was only recently invented and you certainly don't own one. (In 1846 California, you probably haven't heard of it.)



COMMON PROCESSING STEPS – from the field to your back

Following are common steps in processing the flax plant to linen clothing. Flax fibers run lengthwise along the stalk between the outer cover and the inner core. Some steps can be skipped, and some people add a few more steps. It depends on how much time you have available and how persnickety you are. Before man-made dyes were invented, linen was often not dyed because natural dyes are not very effective with linen, and because if linen was used for underwear it wasn't worth the trouble or expense to dye. Linen's natural colors vary from almost white through creams, beiges and light grays.

1. When flax is ready to be harvested, pull the stalks out by their roots to ensure the longest fiber possible.
2. Tie stalks into bundles and stack to dry.
3. Remove the flax seeds from the heads. (Use seeds to plant your next crop, to boil into a starch, press into oil, to feed animals, etc.)
4. Remove the outer cover of the flax so you can get to the fibers by weighting the stalks under water for a few days or laying them out in a field where the dew will wet them each night. This process is called 'retting'. The rotting outer covering of the flax can pollute streams and make the water downstream unusable. If you let flax ret too long, instead of just getting rid of the outer covering, the whole plant can rot and become unusable.
5. Lay the stalks out to dry.
6. Beat the flax with a wooden mallet to break up the woody core. This is called 'breaking.'
7. Scrape the flax with a wooden knife to remove the outer husk and bits of woody core loosened up by breaking. This is called 'scutching.'
8. Comb the fibers through sharp upright combs called hackles. This is called 'hackling.' As you comb, short fibers (called 'tow') are removed, and the fibers left (called 'line') are comparatively long and fine.
9. Spin the line and tow separately. Line can be used for warp and generally makes finer cloth. Tow is generally weaker, not as smooth and is less satisfactory for warp. Therefore, tow was generally used for weft for less expensive fabrics.
10. Ply the yarn.
11. Weave the yarn into cloth.
12. Linen does not absorb most natural dyes well. Before modern dyes, most people used linen as is or bleached very white. Unbleached linen is usually a shade of gray or beige. If you want very white linen, place the cloth on the grass in a sunny place and sprinkle daily with water to keep damp. The linen will become lighter and lighter every day.
13. Although chlorine bleach was developed in the late 1700's, it was used primarily for cotton, not linen.



DYEING

HISTORY

Until 1856 when the first artificial dye was developed, dyers relied on natural substances such as dried insects and plants. The colors derived from natural substances vary greatly depending on how wet or dry the weather is, the type of soil in which a plant is grown, what type of fiber is being dyed, etc.

Additionally, certain dyes don't form stable combinations with some fibers; i.e., the color will bleed or fade very quickly. Fast dyes, which don't bleed or fade, such as indigo, were highly prized. Some chemicals can be used to increase the fastness of dyes, and to change or intensify the color. These additives are called mordants, and include tartaric acid, alum, metallic oxides, etc.

COMMON PROCESSING STEPS FOR DYEING

1. Thoroughly scour/wash/clean the material to be dyed - fleece, yarn or cloth.
2. Dissolve the mordant completely in water.
3. Soak the material to be dyed in the mordant solution. The quantity of mordant used depends on the dry weight of the fiber to be dyed and the dyer's chosen recipe.
4. Place the material into the dye bath and simmer. You have previously prepared the dye bath by simmering the dye stuff in water for several hours, then straining out any foreign matter (e.g. onion skins, flowers). Some dye preparations, such as indigo, rely on a different chemical reaction. These dyes are not simmered with the fiber to be dyed.
5. Remove the material when it is a few shades darker than you want it to be or when all the dyestuff is taken up. This is because wet material appears darker than dry and because some of the dye will rinse out.
6. Rinse the material, and if necessary, neutralize the alkali or acid.
7. Dry the material in a shady place to avoid the sun which can damage fibers and begin the fading process.

SOME COMMON DYES OF SUTTER'S TIME

An 1831 dye manual mentioned the following six items as principal dyestuffs and gave their prices.

Name	Unit price	Color	Source
Quercitron	\$.06 per pound	yellow	black oak bark
Fustic	.06 per pound	yellow	dyer's mulberry
Logwood	.06 per pound	black	heartwood of logwood
Madder	.18 ³ / ₄ per pound	red & orange	root of madder bush
Indigo	2.25 per pound	blue	leaf and stalk of indigo plant
Cochineal	.31 per ounce	red & purple	insect

The dyes listed on the previous page were used by professional dyers as well as home dyers. There were also many dyes used by home dyers that were not commercially important such as bark, walnut hulls, flowers, onion skins, lichens. Various



berries, beetroots and other edible plants can also be used as dye. However, it is less likely that a farm family would use foodstuff as dye; what the family didn't eat, the pigs or chickens would.

COLORED FABRIC

Colored handspun, handwoven fabric is more often stripes, checks, plaids, or a solid color because these variations can be produced easily on a simple loom. Before mechanized dye printing techniques were perfected, patterns were block printed by hand or on machines similar to printing presses.

Between 1815 and 1840, cylinder printing was improved so that design repeats were shortened and motifs could be finely drawn. Repeating designs were etched into metal cylinders which rolled dye onto many yards of fabric, one color at a time.

Each color in a pattern required a separate cylinder and dye run. A pattern consisting of the basic color of the fabric plus 3 - 4 additional pattern colors was about as complex as most designs got. Popular designs in the 1830's and 1840's included flowers, stripes, and birds, often outlined with clusters of small dots.



PERSONAL GLIMPSES

From The Diary of Johann August Sutter - Originally published in the *San Francisco Argonaut* – January 26, February 2, 9, 16, 1878.

Page 13 – 1841 - *Referring to purchases from Fort Ross*: September 28th. I dispatched a number of men and my Clerk by Land to Bodega, to receive the Cattle, Horses, Mules & Sheep, to bring them up to Sutter's fort. . .

Page 18 – 1844 - During this time my Stock was increasing; had then 8000 head of Cattle and 2000 horses and breeding Mares and about 4000 Sheep. Of the Wool we made our own Plankets, as we established under great Difficulties a factory. Plankets, like nearly all other articles was very scarce and sold to at very high prices for the time.

From the *New Helvetia Diary* - *A record of events kept by John A. Sutter and his clerks at New Helvetia, California, from September 8, 1845, to May 25, 1848*

1845

- Friday October 31st ...delivered 100 head of sheep to Peter Lassen...
- Saturday December 6th...finished 3 blankets...

1846

- Thursday February 29th...Mr. Loker went up and delivered 100 Sheep to Capt. Leidsdorff...

1847

- Tuesday May 25th ...Works going on like usual, as carding, spinning, weaving...
- Monday June 7th ...Carting, spinning & weaving going on...
- Tuesday June 8th ...Received 21 Blankets from the factory...
- Monday July 5th ... five Muquelemnes & 2 Women arrived to work, and have been employed in the Weaving business...
- Friday July 30th ...Send Mr Kyburz to examine the Shepperd and inspect the Sheep...
- Saturday July 31st ...Presented Sixto & Pompeyo with small Blankets for their boys...
- Monday Aug 9th ...More people in the weaving establishment...

1848

- Wednesday January 5th ...Mr Sinclair came here in search for his sheep which partly has been destroyed by his dogs, which he has killed off. It would be a loss if the fine Merino Ram would be death...
- Thursday January 6th ...The Merino Ram has been found again...
- Saturday January 29th ...Delivered 50 sheet to Mr Sinclair of which he will have half of the increase. In this Manner we will get a good breed of Sheep...
- Thursday April 13th ...Finished sheering sheep. Sheered about 1025, sold 52 to Nicholas Higuer. Remains about 1000 with the 50 by Mr Sinclair, as from time to time one is killed. The young Lams may amount to 4 or 500...
- Monday May 8th ...The spinning, Carting & Weaving going pretty well on.
- Friday May 12th ...cut 10 Blankets in the factory...

From Six French Letters: Captain John Augustus Sutter to Jean Jacques Vioget 1842-1843

Page 27 – letter dated February 2, 1843 - Next summer I will have all the blankets for my Indians manufactured right here because I have nearly 2000 sheep for which I have a very good shepherd from New Mexico.



From Women of the West by Cathy Luchetti & Carol Olwell

Keturah Penton Belknap b. 8/15/1820, m. 10/3/1839, d. 8/19/1913

Page 129/130 – circa 1826 - 1830

we had two suits of home made cloaths they was washed and Ironed nicely put on us clean for Sunday and we thought we was nice

Mother and ann (that was my oldest Sister) made hats for Father and the boys for summer out of Rye straw braided and sewed them and [they] would make some to sell every summer got a half dolar apiece for them.

About this time I got the first calico dress I ever had it was Blue calico twelve and a half cts per yard.

This summer I am ten years old and began to think about earning my own living . . . I cloathed myself. we made our own flannel for winter ware and Father always bought A side of upper leather and one of sole leather and had a shoe maker come to the house with his [bench] and tools and shoe the family and that was all we expected till another winter. . . then with our clean shoes laced up with a good leather string and a flannel dress and a clean calico apron and a small round cape to match we was ready for meeting. . .

Page 131 – 1831

then the girls would spin flax or knit till bed time. that was Generaly about ten oclock. we would [have]spin races and knit races to see who could do the most.

Page 136 – 1840

Now it was spring and we have got a few sheep on the shares and they are sheared. All this winter I have been spinning flax and tow to make some summer clothes – have not spent an idle minute and now the wool must be taken from the sheeps back, washed and picked and sent to the carding machine and made into rolls then spun, colored and wove ready for next winter. I cant weave so I spin for my mother-in-law and she does my weaving.

I have been spinning flax all my spare time thru the winter. made a piece of linen to sell, got me a new calico dress for Sunday and a pair of fine shoes and made me one home-made dress for every day. It was cotton warp colored blue and copper and filled with pale blue tow filling, so it was striped on way and almost as nice as gingham.

It is now May and the sheep are sheared and the wool must be washed and picked and got off to the carding machine. So my summers work is before me.

Page 137 – 1842

May 1st. . . and now the sheep must be sheared.

Today the neighborhood all turns out to make a sheep pen on the bank of the Demoin River, wither they will drive their flocks to wash them before shearing. And now the fun begins for all the men and boys are there to help or see the fun. There were five men and their sheep and their boys. George's [Keturah's husband] was the first ones in the pen. They were taken one at a time out in the river where they could not touch bottom with their feet – then hold their heads out of the water with one hand and with the other rub and souse them up and down till the water would look clean when they squeezed it out of the wool. then they took them out to a clean apartment and



when they got one mans done they sent the boys home with them and put them in a little clean pasture to dry, and so on till all was done. They all took their dinner and had a regular picnic.

Page 138 – 1842

July 1st. My wool came home today from the carding machine in nice rolls ready to spin. First I will spin my stocking yarn, can spin two skeins a day and in the evening will double and twist it while George reads the history of the U.S.

November . . . [I] have got my work for the winter pretty well in hand. have made me a new flannel dress colored blue and red – had it wove in small plaid. I am going to try and make me one dress every year then I can have one for nice and with a clean check apron I would be alright.

I made some jeans enough for two pair of pants. . . for George and have the knitting done so we have two good pair of stockings for all.

Page 140/141 – 1847/1848

There was nothing done or talked of but what had Oregon in it and the loom was banging and the wheels buzzing and trades being made from daylight till bedtime...

Nov 15, 1847. Have cut out four muslin shirts for George and two suits for the little boy (Jessie) with what he has that will last him (if he lives) until he will want a different pattern.

The material for the mens outer garments has to be woven yet.

...so the first thing is to make a piece of linen for a wagon cover and some sacks – will spin mostly evenings while my husband reads to me. The little wheel in the corner dont make any noise. I spin for Mother B. and Mrs. Hawley and they will weave now that it is in the loom. I must work almost day and night to get the filling ready to keep the loom busy. The men are busy making ox yokes and bows for the wagon covers and trading for oxen.

... will make a muslin cover for the wagon as we will have a double cover so we can keep warm and dry. put the muslin cover on first and then the heavy linen one for strength. They both have to be sewed real good and strong and I have to spin the thread and sew all those long seams with my fingers. then I have to make a new feather tick for my bed.

Feb. 1st and the linen is ready to go to work on and six two bushel bags all ready to sew up that I will do evenings by the light of a dip candle for I have made enough to last all winter after we get to Oregon and now my work is all planned so I can go right along. Have cut out two pairs of pants for Geo. (home made jeans) a kind lady friend came in today and sewed all day on one pair then took them home with her to finish. Another came and wanted to buy some of my dishes and she took two shirts home to make to pay for them.

I worked almost day and night this winter. have the sewing about all done but a coat and vest for George. he got some nice material for a suit and had a taylor cut it out and Aunt Betsy Starr helped me two days with them so I am about ready to load up. Will wash and begin to pack and start with some old clothes on and when we can't wear them any longer will leave them on the road.

Page 142 – 1848

Now we we will put in the long sacks of flour and other things. The sacks are made of home made linen and will hold 125 pounds --



John Burroughs writing of his youth circa 1845.

"House linen and summer shirts and trousers were made from flax that grew on the farm...and bits of stump...were interwoven in their texture and made the wearer of them an unwilling penitent for weeks, or until use and the washboard has subdued them...but those tow shirts stood by you. If you lost your hold in climbing a tree and caught on a limb your shirt or your linen trousers would hold you."

P. S. Richards writing of his youth in Michigan

She [mother] was my father's equal in every respect; in energy, ambition and perseverance. We children were destitute of foot-wear and my mother took some wool . . . and carded, spun and knit one-half . . . which she knit into stockings, the first we had in Michigan. Mother was a woman of great ambition and besides doing her own work she did considerable for others and in 1835 she wove over 700 yards of woolen cloth for her neighbors.

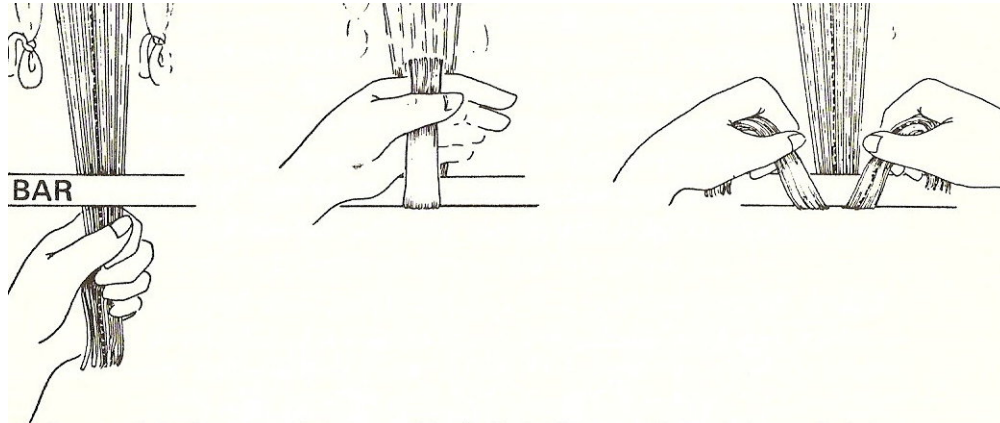
GLOSSARY

Cards	Pairs of wooden paddles covered by carding cloth, used to brush wool, cotton, etc. into a form for efficient spinning.
Carding	The process of brushing wool, etc.
Carding cloth . . .	Leather or rugged fabric set with wire teeth.
Carding mill	Mill powered by water, etc. with several large drums covered by carding cloth. Automatically cards fleeces into roving or batting that can be used for machine or hand spinning.
Denim	A type of rugged, handspun, twill cotton cloth that originated in Nimes, France. Poor pronunciation of French turned the phrase cloth 'de Nimes' (from Nimes) into denim. In addition, since this cloth was commonly used as a trouser material for Genoese sailors who were known as 'Genes', the word 'jeans' refers to trousers made from any type of rugged cotton, particularly denim.
Felt	A non-woven material made from wool or similar materials, or the process of making felt. Because of the physical properties of wool (tiny scales on each fiber that open up when warm and clamp down when cool), wool fibers can be wetted then repeatedly heated, cooled and agitated to form a dense mat referred to as felt. Woven and knitted wool fabric can also be felted to create a thicker, denser, warmer fabric.
Flax	A plant whose fibers are spun and woven into linen. Flax fibers may be many different colors but are most commonly very pale or white, hence, flaxen haired. See Tow and Line.
Fleece	The coat of wool that covers sheep and similar animals.

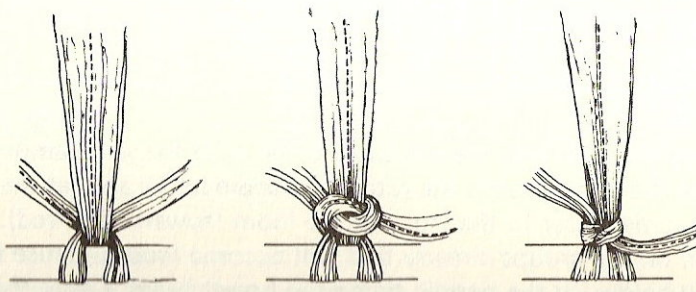


Full	The process of finishing cloth, making it fuller, by washing, agitating, pounding, brushing, etc. The person who performs this task is a fuller.
Line	The longest flax fibers. Line is used to spin the finest, strongest, most expensive linen cloth.
Linsey-Woolsey	Fabric made with linen warp threads and wool weft threads.
Rolag	Small roll of fibers ready to spin. See Carding.
Roving	Long roll of machine carded fibers.
Spin	The twisting of fibers together into a continuous strand. Depending on the fibers used, thickness, texture, and use, this strand may be referred to as thread, yarn, twine, rope, cord, etc.
Spinster	A girl or woman who spins. (A boy or man who spins is a spinner.) In many families the person who spun most of the fiber was an unmarried woman, so the term came to mean an unmarried adult woman.
Warp	The long threads tied onto a loom which become the lengthwise threads in a fabric or bolt of cloth. These threads must be strong enough to withstand tension during weaving. The act of placing these threads on a loom is called 'warping' or 'dressing' the loom.
Weave	The interlacing of yarn (or thread or lengths of other materials) to form fabric.
Web	Woven material before it has been fulled. Hence the other name for weavers, 'webber' or 'webster.'
Weft	The threads interlaced into the warp. These threads run from selvedge to selvedge on a length of cloth. Sometimes called 'woof.'
Woolen	Anything made from wool. Sometimes applied specifically to wool yarn in which the individual fibers run in various directions. This yarn is generally bulkier and softer than worsted, and does not wear as well.
Worsted	Yarn spun from combed wool with all the fibers neatly aligned, or the cloth woven from worsted yarn.

WEAVER'S KNOT



Put each half around the outside (left half toward the left, and right half toward the right), *criss-cross* the halves underneath and then tie them on top with a single knot.





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