On Two-Handed Spinning

The often-quoted chapter thirteen of Marx's *Capital*, "Machinery and Large-Scale Industry," contains a puzzling statement:

In Germany they tried at first to make one spinner work two spinning-wheels, that is to work simultaneously with both hands and both feet. That proved to be too exhausting. Later, a treadle spinning-wheel with two spindles was invented, but adepts in spinning who could spin two yarns at once were almost as scarce as two-headed men.¹

Marx mentions *Spinnvirtuosen*, which means masterly performing male spinners, but no doubt at least some of these rare virtuosi must have been women. This assumption is rooted in a long tradition of literary, linguistic, and cultural evidence identifying those who spin as women. In the Western tradition, artifactual and documentary evidence associates women with spinning in Egyptian times, and by the time Homer wrote of Helen spinning at the court of Menelaus at Sparta, the femininity of the craft was well established.² In the familiar King James translation of the New Testament, Jesus of Nazareth asks his listeners to "consider the lilies of the field, they toil not, neither do they spin." While gender is not mentioned, it is likely that the *ou . . . oude* construction of the Greek in which the text comes down to us was meant to suggest a distinction between two kinds of labor, one traditionally performed by men and the other by women.³

The origins of spinning as female-gendered work may in fact be Neolithic, as old as spinning itself; deities of spinning, where they exist, are nearly always female.⁴ It is possible that spinning (and indeed the textile arts generally) developed from gathering activities, since the finding and/or making of a container is the first requirement of gathering. Leaves, skins, and similar natural container materials must be fastened together securely if foodstuffs are to be carried in them for any significant distance. Gathering, an activity more compatible with childcare than is hunting, is nearly always gendered female, both historically and in modern gathering-and-hunting cultures.⁵ The association of spinning with women is evident in language as well. We speak in English of the "distaff side" of the family, in French of inheritances as "tomber en quenouille," and in German of relations "über die Spindel verwandt." Like food preparation and child-rearing, textile production is a
traditionally feminine and undervalued activity with paradoxically dramatic implications for the survival of the species.

The significance of textiles to culture at its most basic level stems from the vulnerability of the human body to extremes of climate. Tacit or explicit cultural knowledge of this role of spinning in survival probably accounts for its associations with feminine power, wisdom, and virtue. In ancient Greece, the fate of each human being was thought to be embodied in a strand of yarn worked on a drop spindle by three goddesses, known as the Moirae or Fates. These women stood outside the world of physical reality, controlling birth, life, and death by spinning, measuring, and cutting off the magical silver yarn. In this paranoid fantasy of the late Mesolithic, textile producers stand between life and death for each individual. Like most such tales, it contains a germ of truth: textiles do often stand between life and death in potentially hostile environments.

Not only the Mediterranean has spawned such myths. The Hopi of North America believe that Spider Woman and her twin sons created the world and shaped its inhabitants by spinning and weaving a magical yarn. The Dogon of Africa assert that their messiah, the Nommo, taught humanity to speak (another survival adaptation) by spitting cotton threads from between his teeth.

Without body coverings, human beings could inhabit less than 5 percent of the earth’s land area. A development of the late Paleolithic, textiles have enabled the species to take up residence at every latitude from the equator to the polar circles, carrying on our backs the intimate shelter of our apparel. Textiles are sufficiently important to survival in the Quaternary that they may usefully be regarded as a kind of removable organ, an adaptive second skin that permits much greater flexibility than the fixed fur, feathers, and fat layers of our fellow vertebrates.

Time and technology have only slightly modified our dependence on textiles. Buildings provide shelter from wind and precipitation, but not until the twentieth century could they be heated uniformly enough to obviate the need for warm indoor clothing in winter in subtropical, temperate, and cold regions. The products of spinning and weaving satisfied this fundamental need of humanity for warmth in a range of conditions, while spinners and weavers occupied the lowest rungs of the artisanal and, later, industrial hierarchy.

Spinning for family use is typically portrayed in literature and art as a virtuous and commendable feminine pursuit. As market activities, however, women’s spinning and, later, apparel production have the dubious distinction of a consistent claim to the nadir of manufacturing wages throughout all of Western history, including the present. In the fourteenth century, for example, Piers the Ploughman met women who "whatever they save by spinning they spent on rent, or on milk and oatmeal to make gruel and fill the bellies of their children. . . . The miseries of these women who dwell in hovels are too pitiful to read or describe in verse.”

In this economic environment, improvements in productivity could mean the difference between survival and starvation. While great dexterity was required, some spinners apparently learned to spin two yarns at the same time even during
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the millennia of drop spindles, as G. M. Crowfoot asserts of Egyptian tomb representations of spinning:

Many of these scenes show rows of women preparing flax fibres by hand. This may be regarded as hand spinning, and the final product as a partly spun thread [i.e., yarn] or rove for use of the spinners. This careful preparation no doubt contributed to the excellent quality of the linen. The same scenes often show spinning with two spindles at a time. Though this is an intricate way of spinning which requires great skill, it has been proved possible and modern instances are quoted. It goes to show what expert spinners the ancient Egyptians must have been.10

It may also go to show the economic pressures on the women artisans of Egypt. In Coptic times, a later text cited by Crowfoot speaks of a male spinner achieving similar ambidexterity: “forty-eight threads . . . which David has spun from each pair [of spindles].”

Like many writers, Crowfoot fails to recognize the distinction between thread and yarn. Yarn is the product of the spinning process, which imparts a twist in either the “s” or “z” direction to fiber prepared as roving or rolag. Thread is the hard-twisted product of plied yarns of linen, silk, or cotton.11 Yarn can be produced from almost any fiber, the method of preparation depending on the fiber source. Wool, for example, must be carded after shearing to straighten and align the fibers. Pre-industrial carding was performed on two rectangular, slightly dished paddles to which leather card clothing was attached to the interior (convex) surfaces. Through this leather clothing, sturdy bent wires were punched to create a pair of working surfaces much like those of the modern brushes used for grooming pets. The carder worked the fiber between the paddles, pulling the wool back and forth across them until a smooth, relatively straight mass was formed. This was removed in a small bundle called a rolag and stored, usually in a basket, for spinning. Air circulation in storage was necessary, as wool is hygroscopic and will absorb up to three times its weight in water before it feels wet to the touch. While wool can be spun very fine, it could not until the eighteenth century be spun fine enough or plied tightly enough to produce the very strong and smooth products required for carpet warps, the longitudinal yarns in the loom. It is too rough and soft for use as a raw material for thread.

Linen is a plant fiber, the bast or longitudinal stalk fibers of the flax plant. Good linen is produced by pulling the stalks out of the ground whole, with the roots, and submerging bundles of them in water, a procedure called retting, until the plant pulp rots away from the bast fibers. The trash is removed from the bundles by pounding with a narrow wooden paddle, called scutching. The fibers are straightened in a process analogous to wool carding by drawing them through hackles, rectangular blocks of wood from which long iron spikes protrude. This separates the long fibers, called line linen, from the short fibers or tow. Line linen is sturdy and easy to spin; for centuries it was the only practical choice in Europe for the making
of carpet and blanket warps. For this purpose the yarn was spun on the wheel more than once. The single-spun yarn was plied and hard-twisted with one or more additional yarns in the opposite direction from that in which it had been originally spun, either “s” or “z.” The tow linen was the fiber of choice for making soft yarns for such end uses as undergarments, and for the making of thread. For this latter purpose, it was spun on small table wheels and then plied and twisted on the wheel a second time with other strands in much the same way carpet warp was made from line linen. This process was time-consuming, of course, and could not have been performed two-handed, as table wheels were hand-operated. When cotton is spun by hand, a difficult procedure because of the shortness of the fibers, it is typically treated like tow linen, with an intermediate step of consolidating the combed fibers into roving, a soft, loose rope or elongated bundle.

Silk yarn was produced by two methods, neat silk by the traditional Asian method of reeling the 120-yard-long silk filaments from the cocoons and twisting them together, and spun silk by cutting the cocoons and spinning the noil or short fibers on a wheel, much like the process used for tow linen. An expensive but very high quality sewing thread is produced by plying neat silk yarns.

From Neolithic times to the Middle Ages, the production of yarn in Western cultures was accomplished by twisting fibers together on a spindle suspended usually (but not always) from the spinner’s dominant hand, rarely one from each hand, weighted with a whorl that served as a flywheel, regulating the rotary motion of the spindle. Fibers were fed to the yarn as it from a loose bundle on a forked stick or similar device, called a distaff. Whether spinning was performed standing or sitting, the spindle suspended from the attenuated fibers, twisted from the end of the spindle into yarn, eventually reached the floor. At this point the spinner paused to wind the yarn onto the shaft of the spindle, and to bring the spindle and its whorl or weight back up to shoulder or elbow height. This technique is called “drop” spinning, as the spindle is “dropped” as it rotates.

Spinning techniques, whether hand or mechanized, vary considerably in accordance with the fiber being spun. Wool spins easily because the fibers are covered with scales that interlock readily when twisted and pulled. Although the cellulosic fibers of cotton and linen are smooth, the long fibers of line linen have considerable tensile strength, and their lengths, averaging from 30 centimeters to a meter, allow them to be joined by twisting. The shorter fibers of tow linen and of cotton are more difficult to spin, as more torque must be introduced per centimeter of spun yarn to make the fibers hold together in tension. It is difficult to imagine double hand spinning of cotton or tow linen.

The spinning wheel translated the yarn attenuation, stretching, and twisting procedures from the vertical to the horizontal plane. The device is thought by some to have originated in ancient India, where it is in fact still in use. The primary fabric of India is, of course, cotton; the plant is indigenous there. Herodotus wrote of cotton being spun east of Persia in the fifth century B.C. Early Indian wheels had small knibs attached to a spoke; later and modern models were operated with a crank.
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The wheel appeared in the Middle Ages first in Flanders and northern Europe, and was used in Austria in the fourteenth century. Changes and improvements were continuously made in the arrangement and dimensions of the wheel, distaff, and spindle. Although we have little documentary evidence, it seems likely that many of these innovations were made by women.16

Until the introduction of the flyer bobbin in the fourteenth and fifteenth centuries, the wheel spinner fed the fiber from the distaff and put tension on the yarn, into which she introduced torque by turning the spindle with one hand, drawing it back until she reached the limit of her arm's length. The rotation of the spindle was then reversed to wind the yarn onto it, and the cycle began again. The other hand was required to rotate the wheel, either with a crank or directly, as in the case of the great or walking wheel.

The flyer bobbin eliminated the winding step, as it wound the yarn during spinning, greatly enhancing the spinner's productive capacity. But both hands were still required to spin a single yarn, one to serve as the power source and the other for feeding fiber and drawing the yarn. Drop spinning with two hands required the use of both halves of the brain at an almost superhuman level of ambidexterity; wheel spinning with both hands added to this the requirement of a power source—the feet—to replace that of the spinner's subordinate hand.

Productivity gains in spinning and weaving have always been economically significant, as labor is the most costly input into textile production. In the Neolithic era, when textiles began to be traded over long distances, opportunities for saving and investment were, as one might expect, quite limited. Agriculture rewarded the worker with food for the family, and perhaps a surplus for trade, but few of its products kept well, and most were cumbersome to transport. Toolmaking was an honored and remunerative skill, but it required, both for education and for production, exemption from at least some of the endless labor of subsistence farming. Textile production, on the other hand, was highly compatible with agriculture, since its raw materials could be raised as part of the farming enterprise, and the labor of spinning and weaving could be carried out during the winter, when crops did not demand attention. Significantly, in the case of women, textile production was more compatible with childcare than such activities as hunting and warfare. As a trade good, cloth could be transported easily, did not spoil as grain, fruit, and vegetables did, was available at all seasons, and even a small family could produce a surplus over immediate needs. The market outside the community for such products consisted of two main groups: those from distant areas whose textiles were different and who wanted to trade for variety, and those whose specialized function in Neolithic society, such as warrior, hunter, or toolmaker, prevented their engaging in textile production themselves.

By 2000 B.C. cloth had become an important medium of trade, carrying with it not so much the value of its raw materials as of the labor invested in it. Textiles' position as the cornerstone of the trading economy had been elevated to symbolism of almost mystical significance as the embodiment of group identity. In the twelfth century in Flanders were already well established as symbols of esprit de corps. Loss of
the symbolic scrap of fabric held aloft in battle, then as now, meant demoralization, often followed by defeat. Costume, too, had already become a means of demonstrating economic power and personal rank.

Throughout antiquity, textiles were an important component of intercontinental trade. Linen traveled from Egypt as far north as Britain, cotton and silk came to the Mediterranean overland from India and China, and wool was traded everywhere along the coastal areas of Europe and Britain.

By the eighth century A.D., patterns of textile economics had begun to emerge that were to persist, in modified form, well into the modern era. Britain, for example, had begun exporting wool to continental Europe. Five centuries later, wool had become so significant to the economy of the British Isles that a red sack of it became, as it still is, the permanent seat of judges’ court and of the Lord Chancellor in Parliament, lest these officials forget the source of Britain’s power.

International rivalries inevitably arose, made especially bitter when competing nations were at war. France and Italy struggled for control of the international silk market from the fourteenth century until well into the nineteenth. Britain held its leading position in wool textiles with difficulty against stiff competition from nearly every European nation. Then as now, systems of tariffs and restrictions were imposed to protect domestic industries; few of these are thought to have been successful. Prohibitions of certain fabrics, such as the ban on Belgian lace in France and that on imported cotton in Britain in the seventeenth century, simply made these commodities more expensive and fashionable on the black market.

In this environment, an innovation that could double productivity in spinning would have created a considerable competitive advantage, and indeed did so when the spinning jenny and spinning mule were invented in the eighteenth century. Spinning two yarns at once on human-powered machinery proved so difficult that it was never implemented on a large scale. Our sources are silent for a millennium or so after David’s achievement, but the idea was taken up again at some point in the seventeenth century. Sometime after 1600 in Europe, foot-powered spinning was introduced. The pedal had long been known for driving emery wheels and lathes; in the seventeenth century it was attached to a drive band on the spinning wheel. The speed of spindle rotation could be increased considerably with foot power, and it was thus necessary to deliver fibers and impart tension to the yarn at an accelerated rate. According to Mokyr’s discussion of the industrial revolution in textiles,

The central technical problem in textiles was that of spinning. Since time immemorial, the crucial operating part in the spinning process had been the human finger, the thumbs and index fingers of millions of women who gave the raw materials in the rovings the “twist” that made it into yarn. The spinning wheel increased the efficiency of the spinner’s work, but did not replace the human finger as the tool that transformed the material.17

The release of one of the spinner’s hands from turning the wheel might have given the impetus to manufacturers to employ this anatomical resource in two-handed spinning,
but it seems likely that other technological and economic factors played a role as well. Weaving productivity began to accelerate in England and elsewhere in the 1730s, putting pressure on spinners to produce more yarn. Later in the century, developments in spinning machinery were to reverse the situation, producing "demand pull" innovations in looms and their power sources. Clothiers, some of whom operated integrated protoindustrial factories employing hundreds of textile artisans, were especially concerned about maintaining workflow from spinners to weavers. After the middle of the eighteenth century, hand spinners, especially those in worsted yarn, faced competition from power machinery that drove piece rates down. The spinning jenny and spinning mule both employed the principle of the great or walking wool wheel, in which the spinner attenuated the yarn by simultaneously stretching the yarn from the spindle, turning the wheel, and walking away from it. The machinery placed the spindles on a moving rack that "walked," or rather rolled, away from the distaffs that held the roving. These were, of course, multiple-headed so that a number of yarns were spun at once. Not only could these machines spin more yarn faster than even the most ambitious and ambidextrous hand spinner, but the mule could spin and ply a woolen yarn strong and smooth enough for carpet warp.

The double-headed wheel's place of origin is difficult to determine, but a case can be made for its emergence in England or France in the seventeenth century. The English origin is supported by the fact that its earliest representation is found in a letter of the philanthropist Thomas Firmin in 1681. It had already become well established in England by the eighteenth century. W. Bailey describes three different wheels of this type in the 1760s, and Macquoid's work on English furniture mentions a late eighteenth-century double spinning wheel. Alastair Durie cites evidence that two-handed spinning wheels were being introduced into the Scottish linen industry in 1757, as part of a larger program to improve spinning productivity.

There is evidence from the middle of the eighteenth century about technological transfer of the process to the northern countries and to France in the form of schools where the two-handed spinning was taught to girls and women. The first data came from Scandinavia, where an inventor, Abraham Hedman, is mentioned in 1738. A teacher of the technique, Elisabeth Forsellt, was sent to Finland, which had several spinning schools about 1750.

A spinning school is depicted in a drawing by G. de Saint-Aubin (1724-80), now in the École des Beaux Arts, Paris. It shows at least forty young women spinning in a large room. The equipment, shown separately in the right corner, has one wheel in the middle driving two spindles with flyer bobbins. The fibers are spent from a single distaff, drawn with both hands. The inventor of this wheel, de Bernière, had in mind training children to take advantage of what he took to be their natural ambidexterity. In Germany, the first evidence of double-spindle spinning is given by Krunitz, according to whom a certain Herr von Wullen improved a French prototype in 1760.

In Austria, Josepha Sedlmayer is credited with having invented the double-spindle wheel in 1782, although her device clearly postdated similar inventions elsewhere. She developed her machine in Brno (Brno), and her method was subsequently transferred
to Klagenfurt in 1785, and then to Pozsony (Bratislava), then the capital of Hungary.\textsuperscript{24} The Klagenfurt school still existed in 1793, when a Hungarian woman, Erzsébet Martin, applied for a \textit{privilegium exclusivum} (patent) for her "spinning-machine," which she used in her "spinning school for two hands."\textsuperscript{25} She claimed that this school trained fifty women in the skill. Some of the artifacts of this technolgocial movement have survived at the Technisches Museum in Vienna, which has several double-spindle wheels from the period of the Austro-Hungarian monarchy.\textsuperscript{26}

The double-spindle wheel lost ground in these countries when spinning jennies escaped governmental efforts to control their spread and appeared in Vienna and Pozsony between 1787 and 1789. By 1811, a blueprint for Arkwright's water frame had been published in Pest. It seems doubtful that Arkwright's invention had much immediate effect on spinners of wool and flax, but as the harbinger of a trend it must certainly have suggested that the pace of spinning generally was undergoing irreversible acceleration.

The perception of actual or potential competition from other multiple-spindle machinery such as jennies may account for the double-spindle wheel's persistence in some German countries, where it survived tenaciously into the nineteenth century. Spinners may have felt a need to increase productivity in order to survive. Rettich mentions the invention of a certain Roemer in 1821, and gives a precise picture of Walter's wheel.\textsuperscript{27} Vallinheiro writes about one Alois Mager of Würtemberg, whose wheel had been introduced in Sweden in the 1840s, but which cannot have represented much of an improvement in efficiency, as it required two women to spin on it.\textsuperscript{28} In a German weaver's sampler of 1841, the introduction enumerates five different wheels of this kind, two of which are pictured.\textsuperscript{29} The author describes the difficulties of spinning with both hands:

\begin{quote}
It takes a lot of practice to pull the two strands out of the distaff using both hands simultaneously. In particular this requires agility because one hand must help the other separate the bundles into their constituent fibers so that a homogeneous yarn is spun. In order that this can be made easier, it is necessary to have not only a very well hackled flax, but also the flax must not be wound tightly around the distaff.\textsuperscript{30}
\end{quote}

This description shows that the device could be used only with excellently prepared flax; a part of the time saved had to be invested in the hackling process. Hackling is not, however, as skilled an activity as spinning, and good hackers must have been far more plentiful than ambidextrous spinners. In addition, hackling is typically performed at a different time of year than is spinning, so the additional time burden required to prepare it for this type of spinning might not have been apparent to spinners.

The German inventors of this equipment made productivity studies which claimed that yarn output per unit of time could be doubled with their device. Müller, however, states that the double-spindle wheels "are not fit for fine yarns, as these require the undivided attention and the cooperation of both hands of the spinner." He then gives measurements of productivity showing that in a workday of thirteen hours, coarse numbers [Nm 13-17] ought to be spun in a relation of 2:1,

\begin{center}
\begin{tabular}{|c|c|}
\hline
Yarn Type & Spinners \textsuperscript{31} \\
\hline
Coarse & 2 \textsuperscript{31} \\
\hline
Fine & 1 \textsuperscript{31} \\
\hline
\end{tabular}
\end{center}
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i.e., 3,940 meters on the single- and 7,880 on the double-spindle wheel. This diminishes with somewhat finer numbers [Nm 30-34] to the proportion 1.5:1, and becomes equal with the finest linen yarn [Nm 47-50]. That would mean that over a fineness of about Nm 40, the double-spindle wheel had no advantage. Rettich does not mention the fineness of yarn, but indicates 498 meters per hour for the double and 350 m/h for the single wheel, corresponding to the Müller data for about Nm 30 yarns. However, it seems doubtful whether anyone had the capacity to spin with both hands for thirteen hours a day. Jeremy provides figures of “340 yards of low-count (2-run) woolen yarn an hour on the [single] wool or spindle wheel (not including fiber preparation, chiefly carding)—some 4,080 yards in twelve hours” in eighteenth-century New England.32

Between 1880 and 1920, this spinning wheel for virtuosi was still used in remote places before finding its way into museums.33 There is an analog in the brief fashion in the United States during World War I for knitting two socks at once on the same pair of needles; the technique was too demanding to remain popular after the war.34 It is possible that the eighteenth-century double-spindle wheel was used for special occasions such as spinning contests in some places longer than it was used as a production mechanism; this may have been how Marx came to hear of it. We cannot call the appearance of two-handed spinning anything but an intermezzo in the pre-industrial development of European countries, which brought additional burden and stress to the mainly rural working women whose economic condition in difficult times required productivity almost beyond human capacity. Had not Marx thought two-handed spinning to be a rare exception, he would have denounced it as an example of the total exploitation of the body.

Notes


5. We reverse the normal word order here as the vast majority of all food consumed by gathering-and-hunting societies is gathered, not hunted. For the role of textiles in such cultures, see Elizabeth C. Bairly, Man Is a Weaver (London: Harrap, 1947), and Horace Miner, "Textile remains of Textile in Archaeology," American Antiquity 1 (1935-36). The compatibility of commercial spinning with other home-based activities in medieval times is men-

6. Thus Thomas Carlyle’s remark in *Sartor Resartus* that “Society is founded upon Cloth.”


13. This procedure is illustrated in Mario Bussaglia’s *Cotton and Silk Making in Manchu China* (New York: Rizzoli, 1980, second series of plates [unpaginated]). The captions to the illustrations should be disregarded, as the author, who seems to be an art historian, clearly does not understand the technology depicted.


15. Linen is the long bast fiber of the flax plant, after hackling to remove the short fibers. Tow are the short fibers left in the hackles, which make a softer but less durable yarn.


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ique. The invention of one “sieur Price” had the following appearance: “vingt-cinq fileuses autour d’un cinconférence de dix pieds de diamètre, chaque ouvrière filant deux fils à la fois; un enfant de dix à douze ans, d’une seule main peut, la machine, faire mouvoir . . . .”

31. Nm, the metrical number of a yarn, indicates how many meters of it weigh one gram.
33. Slavic people (Polabs) between the Elbe and Oder rivers in Germany. Tetzner, Die Slaven in Deutschland (Braunschweig, 1902), p. 363, provides the only known photograph of such a spinner. Swedish spinners in Shonen (Vallinheimo, p. 201) might have been the last.
34. Mrs. A. Reeder, “How to Knit Two Socks at Once,” Needlecraft (August 1918). Errors in this technique would result in the two socks being joined, one inside the other. See also Ann L. MacDonald, No Idle Hands: The Social History of American Knitting (New York: Bal- lantine, 1988), pp. 199-238.