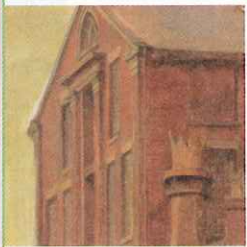


21

The Revolution in Energy and Industry

ca. 1780–1850



While the revolution in France was opening a new political era, another revolution was beginning to transform economic and social life. The Industrial Revolution began in Great Britain around the 1780s and started to influence continental Europe after 1815. Some historians see industrial development as basically moderate and evolutionary, but it was rapid and brought about numerous radical changes. Quite possibly only the development of agriculture during Neolithic times had a comparable impact and significance.

The Industrial Revolution profoundly modified much of human experience. It changed patterns of work, transformed the social class structure and the way people thought about class, and eventually altered the international balance of political power. The Industrial Revolution also helped ordinary people gain a higher standard of living as the widespread poverty of the preindustrial world was gradually reduced.

Unfortunately, the improvement in the European standard of living was limited until about 1850 for at least two reasons. First, even in Britain, only a few key industries experienced a technological revolution. Many more industries continued to use old methods, especially on the continent, and this held down the increase in total production. Second, the increase in total population, which began in the eighteenth century (see Chapter 18), continued across Europe as the era of the Industrial Revolution unfolded. The rapid growth in population threatened to eat up the growth in production and to leave most individuals poorer than ever. As a consequence, rapid population growth provided a somber background for European industrialization and made the wrenching transformation all the more difficult. ■

© Manchester Art Gallery, U.K./The Bridgeman Art Library





Life in the Industrial Revolution. This realistic painting from mid-nineteenth-century northern England shows women textile workers as they relax and socialize on their lunch break. Most of the workers are young and probably unmarried.

CHAPTER PREVIEW

The Industrial Revolution in Britain

- What were the origins of the Industrial Revolution in Britain, and how did it develop between 1780 and 1850?

Industrialization in Continental Europe

- How after 1815 did continental countries respond to the challenge of industrialization?

Relations Between Capital and Labor

- How did the Industrial Revolution affect people of all social classes, and what measures were taken to improve the conditions of workers?

The Industrial Revolution in Britain

What were the origins of the Industrial Revolution in Britain, and how did it develop between 1780 and 1850? ■

The Industrial Revolution began in Great Britain, that historic union of Scotland and Wales with England—the wealthiest and the dominant part of the country. The transformation in industry was something new in history, and it was quite unplanned. With no models to copy and no idea of what to expect, Britain had to pioneer not only in industrial technology but also in social relations and urban living. Between 1793 and 1815, these formidable tasks were complicated by almost constant war with France. Just as France was the trailblazer in political change, Britain was the leader in economic development, and it must therefore command special attention.

Eighteenth-Century Origins

Although many aspects of the British Industrial Revolution are still matters for scholarly debate, it is generally agreed that the industrial changes that did occur grew out of a long process of development. Without a doubt, the expanding Atlantic economy of the eighteenth century served mercantilist Britain remarkably well. The colonial empire that Britain aggressively built, augmented by a strong position in Latin America and in the African slave trade, provided a growing market for British manufactured goods.

Agriculture also played a central role in bringing about the Industrial Revolution in Britain. English farmers were second only to the Dutch in productivity in 1700, and they were continually adopting new methods of farming as the century went on. The result, especially

before 1760, was a period of bountiful crops and low food prices. The ordinary English family did not have to spend almost everything it earned just to buy bread. Thus the family could spend more on manufactured goods—a razor for the man or a shawl for the woman. Moreover, in the eighteenth century the members

of the average British family were redirecting their labor away from unpaid work for household consumption toward work for wages that they could spend on goods, a trend reflecting the increasing commercialization of the entire European economy (see Chapter 18).

As manufacturing expanded to supply both foreign and British customers, the domestic market for raw materials was well-positioned to meet the growing demands of manufacturers. In an age when it was much cheaper to ship goods by water than by land, no part of England was more than fifty miles from navigable water. Beginning in the 1770s, a canal-building boom greatly enhanced this natural advantage. Rivers and canals provided easy movement of England's and Wales's enormous deposits of iron and coal, resources that would be critical raw materials in Europe's early industrial age. Nor were there any tariffs within the country to hinder trade, as there were in France before 1789 and in politically fragmented Germany.

Britain had a host of other assets that helped give rise to its industrial leadership. Unlike eighteenth-century France, Britain had an effective central bank and well-developed credit markets. The monarchy and the aristocratic oligarchy, which had jointly ruled the country since 1688, spent lavishly on stylish luxuries and provided stable and predictable government. At the same time, the government let the domestic economy operate with few controls, encouraging personal initiative, technical

change, and a free market. Finally, Britain had long had a large class of hired agricultural laborers, rural proletarians whose numbers were further increased by the second great round of enclosures (the division of common lands into privately held and managed properties) in the late eighteenth century. These rural wage earners were relatively mobile—compared to village-bound peasants in France and western Germany, for example—and along with cottage workers they formed a potential industrial labor force for capitalist entrepreneurs.

All these factors combined to initiate the **Industrial Revolution**, a term first coined by awed contemporaries in the 1830s to describe the burst of major inventions and technical changes they had witnessed in certain industries. This technical revolution went hand in hand with an impressive quickening in the annual rate of industrial growth in Britain. Whereas industry had grown at only 0.7 percent between 1700 and 1760



Cottage Industry and Transportation in Eighteenth-Century England

Industrial Revolution

A term first coined in the 1830s to describe the burst of major inventions and economic expansion that took place in certain industries, such as cotton textiles and iron.

Chronology

(before the Industrial Revolution), it grew at the much higher rate of 3 percent between 1801 and 1831 (when industrial transformation was in full swing).¹ The decisive quickening of growth probably came in the 1780s, after the American War of Independence (1775–1783) and just before the French Revolution (1789–1799).

Therefore, the great economic and political revolutions that shaped the modern world occurred almost simultaneously, though they began in different countries. The Industrial Revolution was, however, a longer process than the political upheavals. It was not complete in Britain until 1850 at the earliest, and it had no real impact on continental countries until after the end of the Napoleonic wars in 1815.

ca. 1765	Hargreaves invents spinning jenny; Arkwright creates water frame
1769	Watt patents modern steam engine
1775–1783	American Revolution
ca. 1780–1850	Industrial Revolution; population boom in Great Britain
1789–1799	French Revolution
1799	Combination Acts passed
1810	Strike of Manchester cotton spinners
1824	Combination Acts repealed
1830	Stephenson's <i>Rocket</i> ; first important railroad
1830s	Industrial banks in Belgium
1833	Factory Act
1842	Mines Act
1851	Great Exhibition held at Crystal Palace

The First Factories

The pressure to produce more goods for a growing market was directly related to the first decisive breakthrough of the Industrial Revolution—the creation of the world's first large factories in the British cotton textile industry. Technological innovations in the manufacture of cotton cloth led to a new system of production and social relationships. Since no other industry experienced such a rapid or complete transformation before 1830, these trailblazing developments deserve special consideration. Although the putting-out system of merchant capitalism (see Chapter 18) was expanding all across Europe in the eighteenth century, this pattern of rural industry was most fully developed in Britain. There, under the pressure of growing demand, the system's limitations began to outweigh its advantages for the first time. This was especially true in the British textile industry after about 1760.

A constant shortage of thread in the textile industry focused attention on ways of improving spinning. Many a tinkering worker knew that a better spinning wheel promised rich rewards. It proved hard to spin the traditional raw materials—wool and flax—with improved machines, but cotton was different. Cotton textiles had first been imported into Britain from India by the East India Company as a rare and delicate luxury for the upper classes, and by 1760 a tiny domestic cotton industry had emerged in northern England. After many experiments over a generation, a gifted carpenter and jack-of-all-trades, James Hargreaves, invented his cotton-spinning jenny about 1765. At almost the same moment, a barber-turned-manufacturer named Richard Arkwright invented (or possibly pirated) another kind of spinning machine, the water frame. These break-

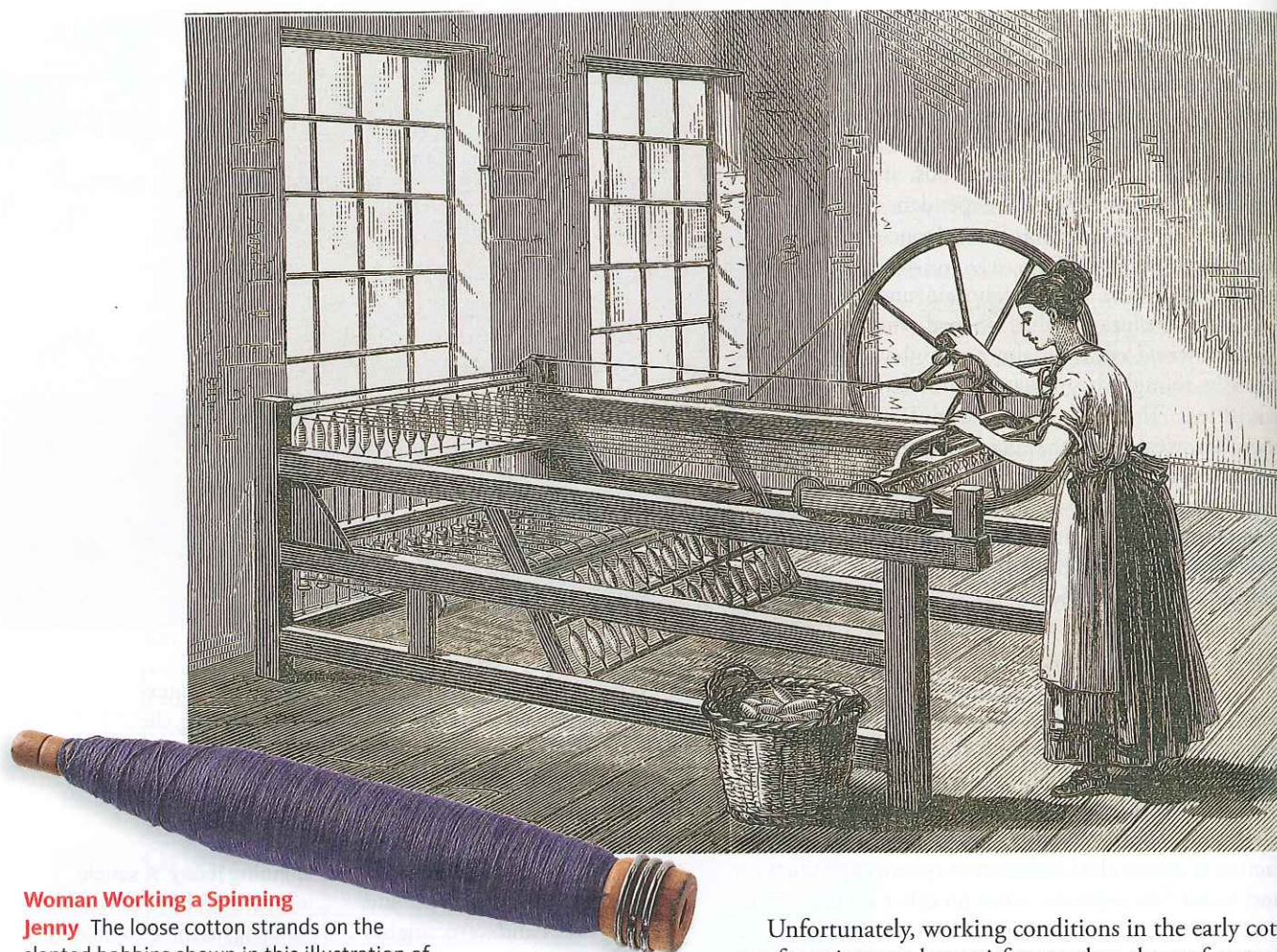
throughs produced an explosion in the infant cotton textile industry in the 1780s, when it was increasing the value of its output at an unprecedented rate of about 13 percent each year. By 1790 the new machines were producing ten times as much cotton yarn as had been made in 1770.

Hargreaves's **spinning jenny** was simple, inexpensive, and powered by hand. Arkwright's **water frame**, however, quickly acquired a capacity of several hundred spindles and demanded much more power—waterpower. The water frame thus required large specialized mills, factories that employed as many as one thousand workers from the very beginning. The water frame could spin only a coarse, strong thread, which was then put out for respinning on hand-powered cottage jennies. Around 1790, an alternative technique invented by Samuel Crompton also began to require more power than the human arm could supply. After that time, all cotton spinning was gradually concentrated in factories.

The first consequences of these revolutionary developments in the textile industry were more beneficial than is generally believed. Cotton goods became much cheaper, and they were increasingly bought and treasured by all classes. In the past, only the wealthy could afford the comfort and cleanliness of underwear, which was called body linen because it was made from expensive linen cloth. Now millions of poor people, who had earlier worn nothing underneath their coarse, filthy

spinning jenny A simple, inexpensive, hand-powered spinning machine created by James Hargreaves in 1765.

water frame A spinning machine created by Richard Arkwright that had a capacity of several hundred spindles and used waterpower; it therefore required a larger and more specialized mill—a factory.



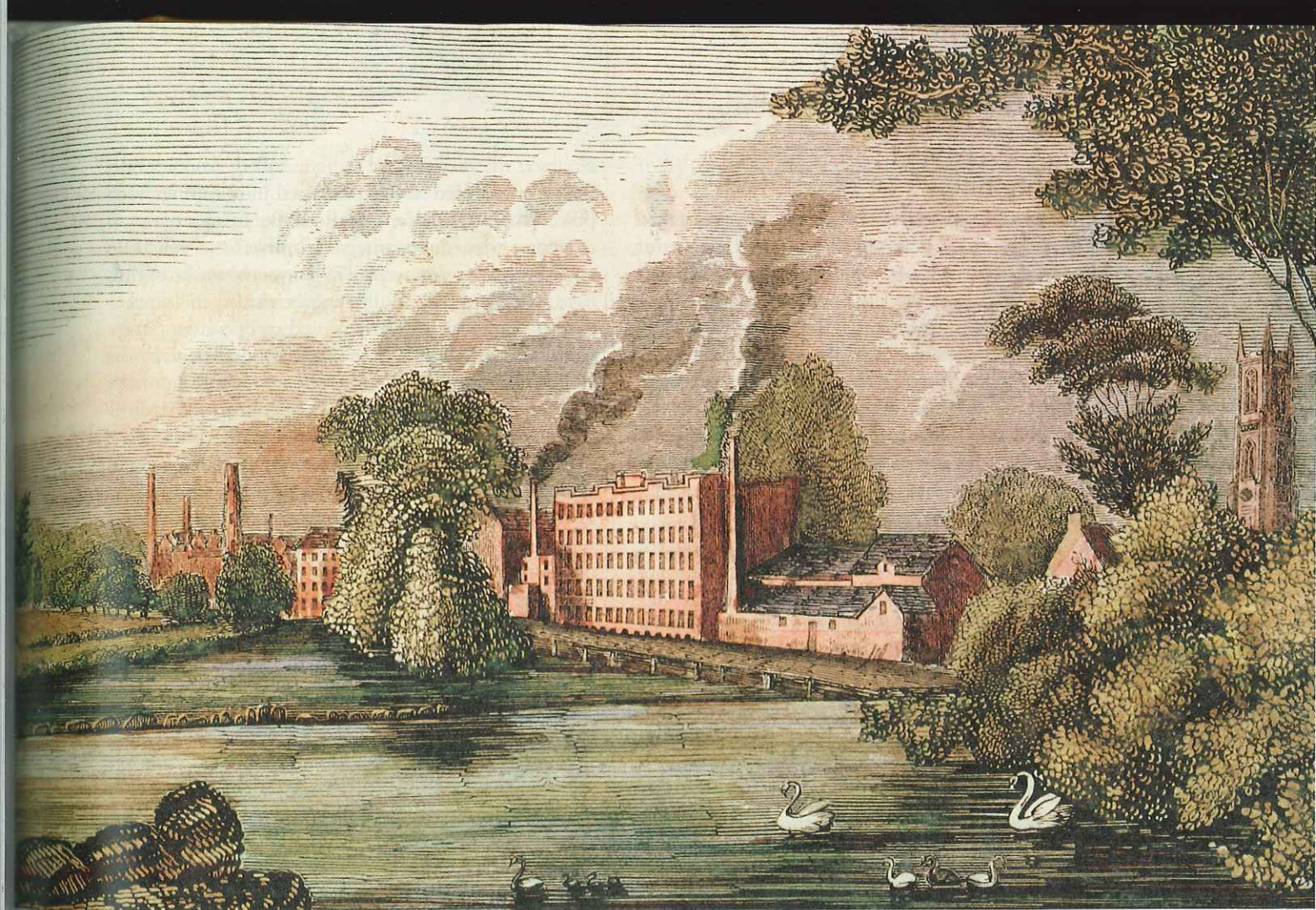
Woman Working a Spinning Jenny

The loose cotton strands on the slanted bobbins shown in this illustration of Hargreaves's spinning jenny passed up to the sliding carriage and then on to the spindles (inset) in back for fine spinning. The worker, almost always a woman, regulated the sliding carriage with one hand, and with the other she turned the crank on the wheel to supply power. By 1783 one woman could spin by hand a hundred threads at a time. (spinning jenny: Mary Evans Picture Library/The Image Works; spindle: Picture Research Consultants & Archives)

outer garments, could afford to wear cotton slips and underpants as well as cotton dresses and shirts. Families using cotton in cottage industry were freed from their constant search for adequate yarn from scattered part-time spinners, since all the thread needed could be spun in the cottage on the jenny or obtained from a nearby factory. The wages of weavers, now hard-pressed to keep up with the spinners, rose markedly until about 1792. Weavers were among the best-paid workers in England. As a result, large numbers of agricultural laborers became hand-loom weavers, while mechanics and capitalists sought to invent a power loom to save on labor costs. This Edmund Cartwright achieved in 1785. But the power looms of the factories worked poorly at first, and hand-loom weavers continued to receive good wages until at least 1800.

Unfortunately, working conditions in the early cotton factories were less satisfactory than those of cottage weavers and spinners, and adult workers were reluctant to work in them. Therefore, factory owners often turned to young children who had been abandoned by their parents and put in the care of local parishes. Parish officers often “apprenticed” such unfortunate foundlings to factory owners. The parish thus saved money, and the factory owners gained workers over whom they exercised almost the authority of slave owners.

Apprenticed as young as five or six years of age, boy and girl workers were forced by law to labor for their “masters” for as many as fourteen years. Housed, fed, and locked up nightly in factory dormitories, the young workers received little or no pay. Hours were appalling—commonly thirteen or fourteen hours a day, six days a week. Harsh physical punishment maintained brutal discipline. To be sure, poor children typically worked long hours and frequently outside the home for brutal masters, but the wholesale coercion of orphans as factory apprentices constituted exploitation on a truly unprecedented scale. This exploitation ultimately piqued the conscience of reformers, reinforced more humanitarian attitudes toward children and their labor in the early nineteenth century, and resulted in laws to protect young workers (see page 678).



A Pioneering Silk Mill In the 1600s Italians invented a machine to spin the thread for the silk that rich people loved. Their carefully guarded secret was stolen in 1717 by John Lombe, who then built this enormous silk mill in England. But the factory production of textiles only took off when the spinning of cotton — a fabric for all classes — was mechanized in the later eighteenth century.

(© The Art Gallery Collection/Alamy)

The creation of the world's first modern factories in the British cotton textile industry in the 1770s and 1780s, which grew out of the putting-out system of cottage production, was a major historical development. Both symbolically and substantially, the big new cotton mills marked the beginning of the Industrial Revolution in Britain. By 1831 the largely mechanized cotton textile industry towered above all others, accounting for fully 22 percent of the country's entire industrial production.

The Problem of Energy

The growth of the cotton textile industry might have been stunted or cut short if water from rivers and streams had remained the primary source of power for the new factories, but this did not occur. Instead, an epoch-making solution was found to the age-old problem of energy and power.

Human beings have long used their toolmaking abilities to construct machines that convert one form of energy into another for their own benefit. In the medi-

eval period, people began to develop water mills to grind their grain and windmills to pump water and drain swamps. More efficient use of water and wind in the sixteenth and seventeenth centuries enabled human beings to accomplish more; intercontinental sailing ships were a prime example. Nevertheless, even into the eighteenth century, society continued to rely mainly on wood for energy, and human beings and animals continued to perform most work. This dependence meant that Western civilization remained poor in energy and power. No matter how hard people worked, they could not produce very much.

The shortage of energy had become particularly severe in Britain by the eighteenth century. Wood was in ever-shorter supply, yet it remained tremendously important. It served as the primary source of heat for all homes and industries and as a basic raw material. Processed wood (charcoal) was the fuel that was mixed with iron ore in the blast furnace to produce pig iron. The iron industry's appetite for wood was enormous, and by 1740 the British iron industry was stagnating.

The Steam Engine Breakthrough

As this early energy crisis grew worse, Britain looked toward its abundant and widely scattered reserves of coal as an alternative to its vanishing wood. Coal was first used in Britain in the late Middle Ages as a source of heat. By 1640 most homes in London were heated with coal, and it was also used in industry to provide

steam engines A breakthrough invention by Thomas Savery in 1698 and Thomas Newcomen in 1705 that burned coal to produce steam, which was then used to operate a pump; the early models were superseded by James Watt's more efficient steam engine, patented in 1769.

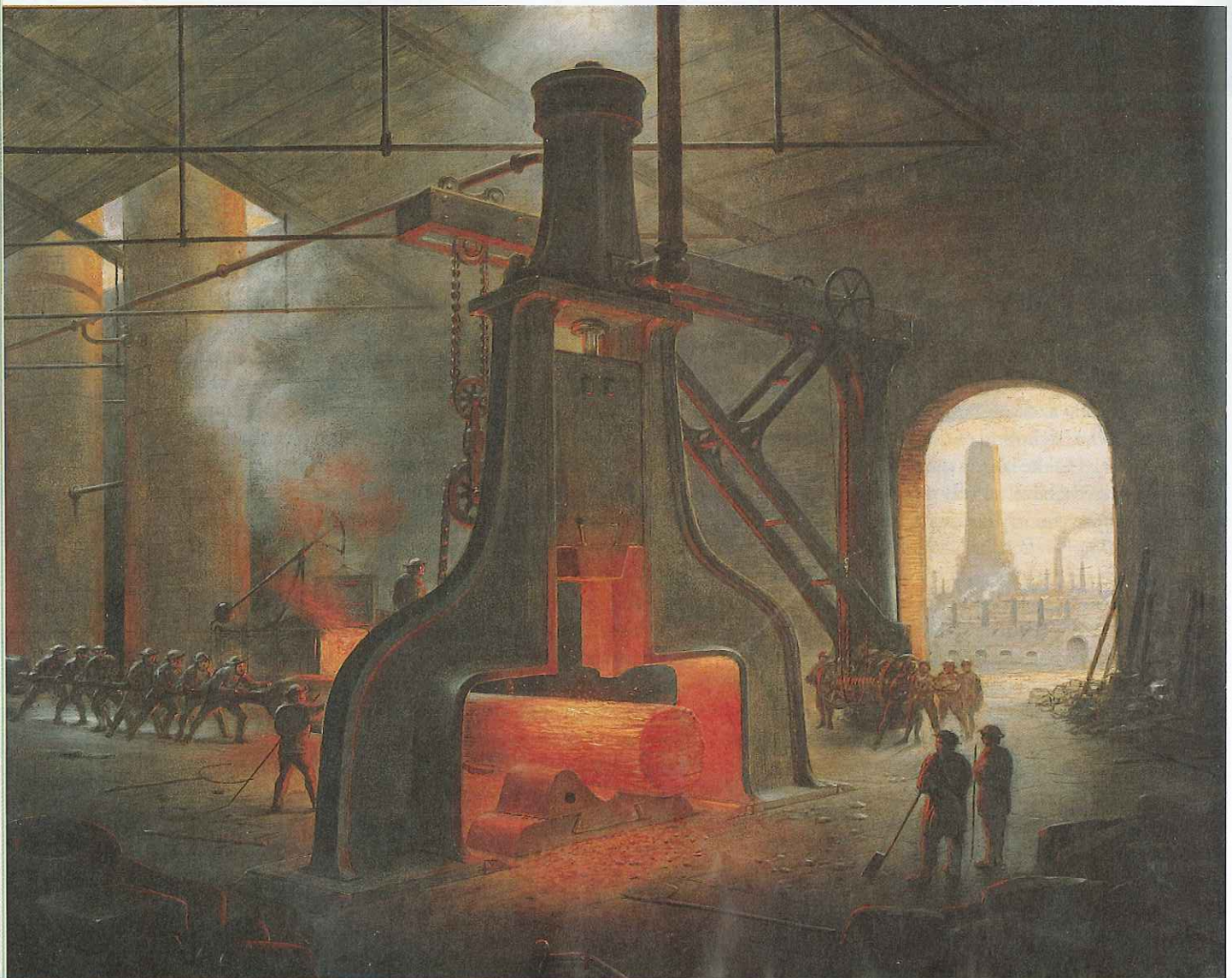
heat for making beer, glass, soap, and other products. The breakthrough came when industrialists began to use coal to produce mechanical energy and to power machinery.

As more coal was produced, mines were dug deeper and deeper and were constantly filling with water. Mechanical pumps, usually powered by animals walking in

circles at the surface, had to be installed. At one mine, fully five hundred horses were used in pumping. Such power was expensive and bothersome. In an attempt to overcome these disadvantages, Thomas Savery in 1698 and Thomas Newcomen in 1705 invented the first primitive **steam engines**. Both engines burned coal to produce steam, which was then used to operate a pump. Although both models were extremely inefficient, by the early 1770s many of the Savery engines and hundreds of the Newcomen engines were operating successfully in English and Scottish mines.

In the early 1760s, a gifted young Scot named James Watt (1736–1819) was drawn to a critical study of the steam engine. Watt was employed at the time by the University of Glasgow as a skilled craftsman making scientific instruments. The Scottish universities were pioneers in practical technical education, and in 1763 Watt was called on to repair a Newcomen engine being used in a physics course. After a series of observations, Watt saw

James Nasmyth's Mighty Steam Hammer Nasmyth's invention was the forerunner of the modern pile driver, and its successful introduction in 1832 epitomized the rapid development of steam power technology in Britain. In this painting by the inventor himself, workers manipulate a massive iron shaft being hammered into shape at Nasmyth's foundry near Manchester. (Science & Society Picture Library, London)



that the Newcomen engine's waste of energy could be reduced by adding a separate condenser. This splendid invention, patented in 1769, greatly increased the efficiency of the steam engine.

To invent something in a laboratory is one thing; to make it a practical success is quite another. Watt needed skilled workers, precision parts, and capital, and the relatively advanced nature of the British economy proved essential. A partnership in 1775 with Matthew Boulton, a wealthy English industrialist, provided Watt with adequate capital and exceptional skills in salesmanship that equaled those of the renowned pottery king, Josiah Wedgwood. (See "Individuals in Society: Josiah Wedgwood," page 662.) In the craft tradition of locksmiths, tinsmiths, and millwrights, Watt found skilled mechanics who could install, regulate, and repair his sophisticated engines. From ingenious manufacturers such as the cannonmaker John Wilkinson, Watt was gradually able to purchase precision parts. This support allowed him to create an effective vacuum and regulate a complex engine. In more than twenty years of constant effort, Watt made many further improvements. By the late 1780s, the firm of Boulton and Watt had made the steam engine a practical and commercial success in Britain.

The steam engine of Watt and his followers was the Industrial Revolution's most fundamental advance in technology. For the first time in history, humanity had, at least for a few generations, almost unlimited power at its disposal. For the first time, inventors and engineers could devise and implement all kinds of power equipment to aid people in their work. For the first time, abundance was at least a possibility for ordinary men and women.

The steam engine was quickly put to use in several industries in Britain. It drained mines and made possible the production of ever more coal to feed steam engines elsewhere. Steam power began to replace waterpower in the cotton-spinning mills during the 1780s, contributing greatly to that industry's phenomenal rise. Steam also took the place of waterpower in flour mills, in the malt mills used in breweries, in the flint mills supplying the pottery industry, and in the

mills exported by Britain to the West Indies to crush sugar cane.

Steam power promoted important breakthroughs in other industries. The British iron industry was radically transformed. The use of powerful steam-driven bellows in blast furnaces helped ironmakers switch over rapidly from limited charcoal to unlimited coke (which is made from coal) in the smelting of pig iron after 1770. In the 1780s, Henry Cort developed the puddling furnace, which allowed pig iron to be refined in turn with coke.

Strong, skilled ironworkers—the puddlers—"cooked" molten pig iron in a great vat, raking off globs of refined iron for further processing. Cort also developed heavy-duty steam-powered rolling mills, which were capable of spewing out finished iron in every shape and form. The economic consequence of these technical innovations was a great boom in the British iron industry. In 1740 annual British iron production was only 17,000 tons. With the spread of coke smelting and the impact of Cort's inventions, production had reached 260,000 tons by 1806. In 1844 Britain produced 3 million tons of iron. This was a truly amazing expansion. Once scarce and expensive, iron became the cheap, basic, indispensable building block of the economy.

The Coming of the Railroads

The second half of the eighteenth century saw extensive construction of hard and relatively smooth roads, particularly in France before the Revolution. Yet it was passenger traffic that benefited most from this construction. Overland shipment of freight, relying solely on horsepower, was still quite limited and frightfully expensive; shippers used rivers and canals for heavy freight

The New World of Speed A colorful timetable poster lists the trains from London to Folkestone, the English Channel's gateway port to the European continent, and proudly proclaims a speedy journey. Tunneling through hills and spanning rivers with bridges, railroad construction presented innumerable challenges and required enormous amounts of capital and labor. (Private Collection/The Bridgeman Art Library)

LONDON TO FOLKSTONE IN 3 HOURS.

LONDON & DOVER RAILWAY

LONDON AND FOLKSTONE TIME TABLE.

DAILY TRAINS FROM LONDON.		SUNDAY TRAINS		DAILY TRAINS FROM FOLKSTONE.		SUNDAY TRAINS	
Time	Class	Time	Class	Time	Class	Time	Class
8 0 A.M.	Fast	7 30 A.M.	3 rd Cl.	6 5 A.M.	3 rd Class	6 50 A.M.	3 rd Cl.
9 30	3 rd Class	9 30		7 10		9 50	
11 30	Fast	1 30 P.M.		9 50	Fast	12 50 P.M.	
1 30 P.M.	3 rd Class	4		11 40	3 rd Class	3 50	
4 0		8 30		3 5 P.M.		6 50	

INDIVIDUALS IN SOCIETY

AS THE MAKING OF CLOTH AND IRON WAS REVOLUTIONIZED by technical change and factory organization, so too were the production and consumption of pottery. Acquiring beautiful tableware became a craze for eighteenth-century consumers, and continental monarchs often sought prestige in building royal china works. But the grand prize went to Josiah Wedgwood, who wanted to "astonish the world."

The twelfth child of a poor potter, Josiah Wedgwood (1730–1795) grew up in the pottery district of Staffordshire in the English Midlands, where many tiny potteries made simple earthenware utensils for sale in local markets. Growing up as an apprentice in the family business inherited by his oldest brother, Wedgwood struck off on his own in 1752. Soon manager of a small pottery, Wedgwood learned that new products recharged lagging sales. Studying chemistry and determined to succeed, Wedgwood spent his evenings experimenting with different chemicals and firing conditions.

In 1759, after five years of tireless efforts, Wedgwood perfected a beautiful new green glaze. Now established as a master potter, he opened his own factory and began manufacturing teapots and tableware finished in his green and other unique glazes, or adorned with printed scenes far superior to those being produced by competitors. Wedgwood's products caused a sensation among consumers, and his business quickly earned substantial profits. Subsequent breakthroughs, including ornamental vases imitating classical Greek models and jasperware for jewelry, contributed greatly to Wedgwood's success.

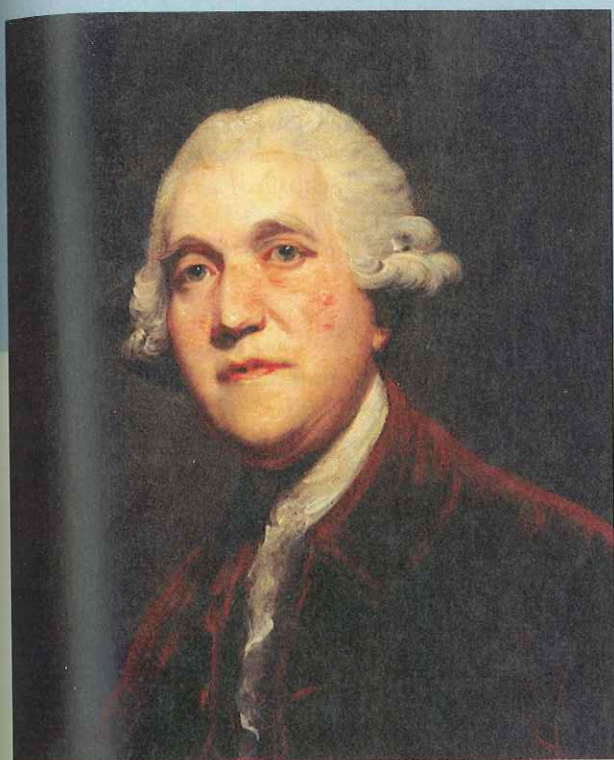
Competitors were quick to copy Wedgwood's new products and sell them at lower prices. Thus Wedgwood and his partner Thomas Bentley sought to cultivate an image of superior fashion, taste, and quality in order to develop and maintain a dominant market position. They did this by first capturing the business of the trend-setting elite. In one brilliant coup the partners first sold a very large cream-colored dinner set to Britain's queen, which they quickly christened "Queen's ware" and sold as a very expensive, must-have luxury to English aristocrats. Equally brilliant was Bentley's suave expertise in the elegant London showroom selling Wedgwood's imitation Greek vases, which became the rage after the re-discovery of the Roman towns Pompeii and Herculaneum in the mid-eighteenth century.

Above all, once Wedgwood had secured his position as the luxury market leader, he was able to successfully extend his famous brand to the growing middle class, capturing an enormous mass market for his "useful ware." Thus when sales of a luxury good grew "stale," Wedgwood made tasteful modifications and sold it to the middling classes for twice the price his competitors could charge. This unbeatable combination of mass appeal and high prices all across Europe brought Wedgwood great fame and enormous wealth.

A workaholic with an authoritarian streak, Wedgwood contributed substantially to the development of the factory system. In 1769, he opened a model factory on a new canal he had promoted. With two hun-



Typical Wedgwood jasperware, this elegant cylindrical vase, decorated in the form of a miniature Roman household altar, was destined for the luxury market. (Image copyright © The Metropolitan Museum of Art/Art Resource, NY)



Josiah Wedgwood perfected jasperware, a fine-grained pottery usually made in "Wedgwood blue" with white decoration. (Down House, Kent, Darwin Heirlooms Trust)

dred workers in several departments, Wedgwood exercised tremendous control over his workforce, imposing fines for many infractions, such as being late, drinking on the job, or wasting material. He wanted, he said, to create men who would be like "machines" that "cannot err." Yet Wedgwood also recognized the value in treating workers well. He championed a division of labor that made most workers specialists who received ongoing training. He also encouraged employment of family groups, who were housed in company row houses with long narrow backyards suitable for raising vegetables and chickens. Paying relatively high wages and providing pensions and some benefits, Wedgwood developed a high-quality labor force that learned to accept his rigorous discipline and carried out his ambitious plans.

QUESTIONS FOR ANALYSIS

1. How and why did Wedgwood succeed?
2. Was Wedgwood a good boss or a bad one? Why?
3. How did Wedgwood exemplify the new class of factory owners?

whenever possible. It was logical, therefore, that inventors would try to use steam power.

As early as 1800, an American drove a "steamer on wheels" through city streets. Other experiments followed. In the 1820s, English engineers created steam cars capable of carrying fourteen passengers at ten miles an hour—as fast as the mail coach. But the noisy, heavy steam automobiles frightened passing horses and damaged themselves as well as the roads with their vibrations. For the rest of the century, horses continued to reign on highways and city streets.

The coal industry had long been using plank roads and rails to move coal wagons within mines and at the surface. Rails reduced friction and allowed a horse or a human being to pull a heavier load. Thus once a rail capable of supporting a heavy locomotive was developed in 1816, all sorts of experiments with steam engines on rails went forward. In 1825 after ten years of work, George Stephenson built an effective locomotive. In 1830 his *Rocket* sped down the track of the just-completed Liverpool and Manchester Railway at sixteen miles per hour. This was the world's first important railroad, fittingly steaming in the heart of industrial England. The line from Liverpool to Manchester was a financial as well as a technical success, and many private companies were quickly

organized to build more rail lines. Within twenty years, they had completed the main trunk lines of Great Britain (Map 21.1). Other countries were quick to follow.

The significance of the railroad was tremendous. It dramatically reduced the cost and uncertainty of shipping freight over land. This advance had many economic consequences. Previously, markets had tended to be small and local; as the barrier of high transportation costs was lowered, markets became larger and even nationwide. Larger markets encouraged larger factories with more sophisticated machinery in a growing number of industries. Such factories could make goods more cheaply and gradually subjected most cottage workers and many urban artisans to severe competitive pressures.

In all countries, the construction of railroads created a strong demand for unskilled labor and contributed to the growth of a class of urban workers. Hard work on construction gangs was done in the open air with animals and hand tools. Many landless farm laborers and poor peasants, long accustomed to leaving their villages for temporary employment, went to build railroads. By the time the work was finished, life back home in the village often seemed dull and unappealing, and many men drifted to towns in search of work. By the time they sent for their wives and sweethearts to join them, they had become urban workers.

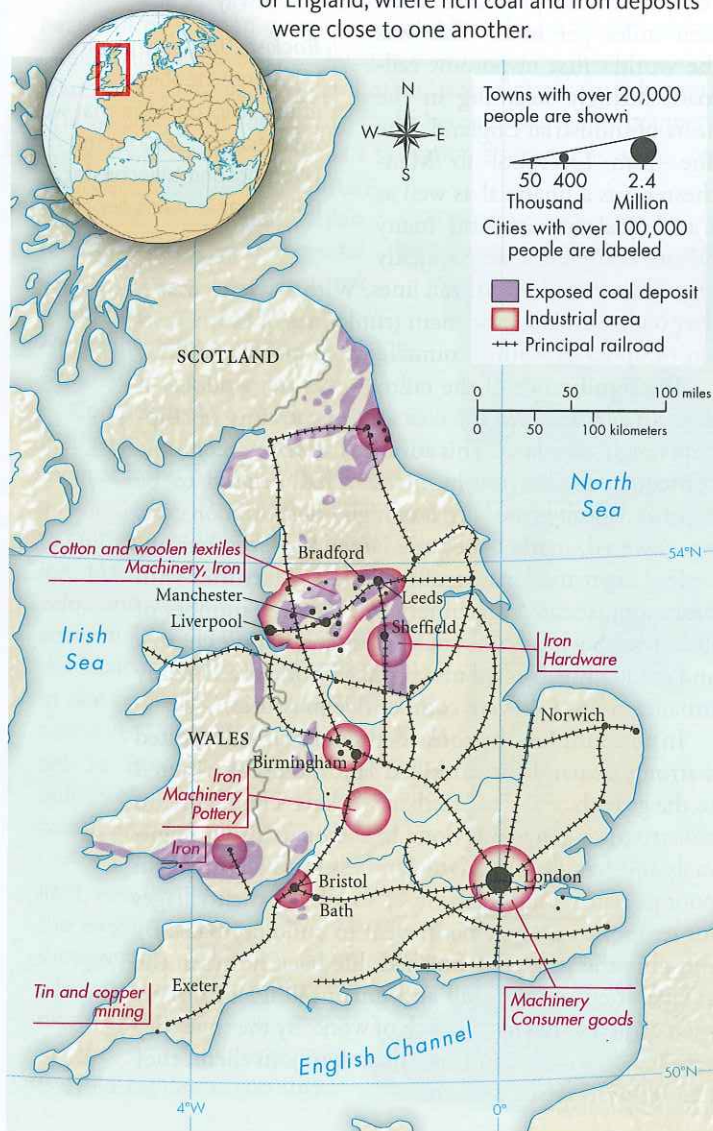
Rocket The name given to George Stephenson's effective locomotive that was first tested in 1830 on the Liverpool and Manchester Railway at 16 miles per hour.

The railroad changed the outlook and values of the entire society. The last and culminating invention of the Industrial Revolution, the railroad dramatically revealed the power and increased the speed of the new age. Racing down a track at sixteen miles per hour or, by 1850, at a phenomenal fifty miles per hour was a new and awe-inspiring experience. As a French economist put it after a ride on the Liverpool and Manchester in 1833, “There are certain impressions that one cannot put into words!”

Some great painters, notably Joseph M. W. Turner (1775–1851) and Claude Monet (moh-NAY) (1840–1926), succeeded in expressing this sense of power and awe. So did the massive new train stations, the cathedrals of the industrial age. Leading railway

Crystal Palace The location of the Great Exhibition in 1851 in London, an architectural masterpiece made entirely of glass and iron.

Map 21.1 The Industrial Revolution in England, ca. 1850 Industry concentrated in the rapidly growing cities of the north and the center of England, where rich coal and iron deposits were close to one another.



engineers such as Isambard Kingdom Brunel and Thomas Brassey, whose tunnels pierced mountains and whose bridges spanned valleys, became public idols—the astronauts of their day. Everyday speech absorbed the images of railroading. After you got up a “full head of steam,” you “highballed” along. And if you didn’t “go off the track,” you might “toot your own whistle.” The railroad fired the imagination.

Industry and Population

In 1851 London hosted a famous industrial fair called the Great Exhibition in the newly built **Crystal Palace**, an architectural masterpiece that helped draw millions of visitors. (See “Living in the Past: Visiting the Crystal Palace Exhibition,” page 666.) For the visiting multitude, one fact stood out: the little island of Britain was the “workshop of the world.” Britain alone produced two-thirds of the world’s coal and more than one-half of its iron and cotton cloth. More generally, it has been carefully estimated that in 1860 Britain produced a truly remarkable 20 percent of the entire world’s output of industrial goods, whereas it had produced only about 2 percent of the world total in 1750.² Experiencing revolutionary industrial change, Britain became the first industrial nation (see Map 21.1).

As the British economy significantly increased its production of manufactured goods, the gross national product (GNP) rose roughly fourfold at constant prices between 1780 and 1851. In other words, the British people as a whole increased their wealth and their national income dramatically. At the same time, the population of Britain boomed, growing from about 9 million in 1780 to almost 21 million in 1851. Thus growing numbers consumed much of the increase in total production. According to one important study, average consumption per person increased by only 75 percent between 1780 and 1851, as the growth in the total population ate up a large part of the fourfold increase in GNP in those years.³

Although the question is still debated, many economic historians now believe that rapid population growth in Great Britain was not harmful because it facilitated industrial expansion. More people meant a more mobile labor force, with a wealth of young workers in need of employment and ready to go where the jobs were.

Contemporaries were much less optimistic. In his famous and influential *Essay on the Principle of Population* (1798), Thomas Malthus (1766–1834) examined the dynamics of human populations. He argued that “there are few states in which there is not a constant effort in the population to increase beyond the means of subsistence. This constant effort as constantly tends to subject the lower classes of society to distress, and to prevent any great permanent melioration of these conditions.”⁴

“There are few states in which there is not a constant effort in the population to increase beyond the means of subsistence.”

—THOMAS MALTHUS

Since, in his opinion, population would always tend to grow faster than the food supply, Malthus concluded that the only hope of warding off such “positive checks” to population growth as war, famine, and disease was “prudential restraint.” That is, young men and women had to limit the growth of population by the old tried-and-true means of marrying late in life. But Malthus was not optimistic about this possibility. The powerful attraction of the sexes would cause most people to marry early and have many children.

Wealthy English stockbroker and leading economist David Ricardo (1772–1823) coldly spelled out the pessimistic implications of Malthus’s thought. Ricardo’s depressing **iron law of wages** posited that because of the pressure of population growth, wages would always sink to subsistence level. That is, wages would be just high enough to keep workers from starving. With Malthus and Ricardo setting the tone, economics was soon dubbed “the dismal science.”

Malthus, Ricardo, and their many followers were proved wrong—in the long run. However, until the 1820s, or even the 1840s, contemporary observers might reasonably have concluded that the economy and the total population were racing neck and neck, with the outcome very much in doubt. The closeness of the race added to the difficulties inherent in the journey toward industrial civilization. There was another problem as well. Perhaps workers, farmers, and ordinary people did not get their rightful share of the new wealth. Perhaps only the rich got richer, while the poor got poorer or made no progress. We will turn to this great issue after looking at the process of industrialization in continental countries.

Industrialization in Continental Europe

How after 1815 did continental countries respond to the challenge of industrialization? ■

The new technologies developed in the British Industrial Revolution were adopted rather slowly by businesses in continental Europe. Yet by the end of the nineteenth century, several European countries as well as the United States had also industrialized their economies to a con-

siderable but variable degree. This meant that the process of Western industrialization proceeded gradually, with uneven jerks and national and regional variations. Scholars are still struggling to explain these variations, especially since good answers may offer valu-

able lessons in our own time for poor countries seeking to improve their material condition through industrialization and economic development. The latest findings on the Western experience are encouraging. They suggest that there were alternative paths to the industrial world in the nineteenth century and that, today as then, there was no need to follow a rigid, predetermined British model.

National Variations

European industrialization, like most economic developments, requires some statistical analysis as part of the effort to understand it. Comparative data on industrial production in different countries over time help give us an overview of what happened. One set of data, the work of a Swiss scholar, compares the level of industrialization on a per capita basis in several countries from 1750 to 1913. These data are far from perfect because there are gaps in the underlying records. But they reflect basic trends and are presented in Table 21.1 for closer study.

As the heading of Table 21.1 makes clear, this is a per capita comparison of levels of industrialization—a comparison of how much industrial product was produced, on average, for each person in a given country in a given year. Therefore, all the numbers in Table 21.1 are expressed in terms of a single index number of 100, which equals the per capita level of industrial goods in Great Britain (and Ireland) in 1900. Every number in the table is thus a percentage of the 1900 level in Britain and is directly comparable with other numbers. The countries are listed in roughly the order that they began to use large-scale, power-driven technology.

What does this overview of European industrialization tell us? First, and very significantly, one sees in the first column that in 1750 all countries were fairly close together and that Britain was only slightly ahead of its archenemy, France. Second, the column headed 1800 shows that Britain had opened up a noticeable lead over all continental countries by 1800, and that gap progressively widened as the British Industrial Revolution accelerated to 1830 and reached full maturity by 1860. The British level of per capita industrialization was twice

iron law of wages

Theory proposed by English economist David Ricardo suggesting that the pressure of population growth prevents wages from rising above the subsistence level.

Visiting the Crystal Palace Exhibition

LIVING IN THE PAST

IN 1851 BRITAIN HOSTED A SPECTACULAR EVENT, the Great Exhibition of the Works of Industry of All the Nations, popularly known as the Crystal Palace Exhibition. The more than 6 million visitors from all over Europe marveled at the gigantic new exhibition hall set in the middle of a large, centrally located park. The building was made entirely of glass and iron, both of which were now cheap and abundant in Great

Britain. Little wonder that people bought millions of souvenirs picturing the Crystal Palace. The handsome depiction shown here brightened the lid of a ceramic pot.

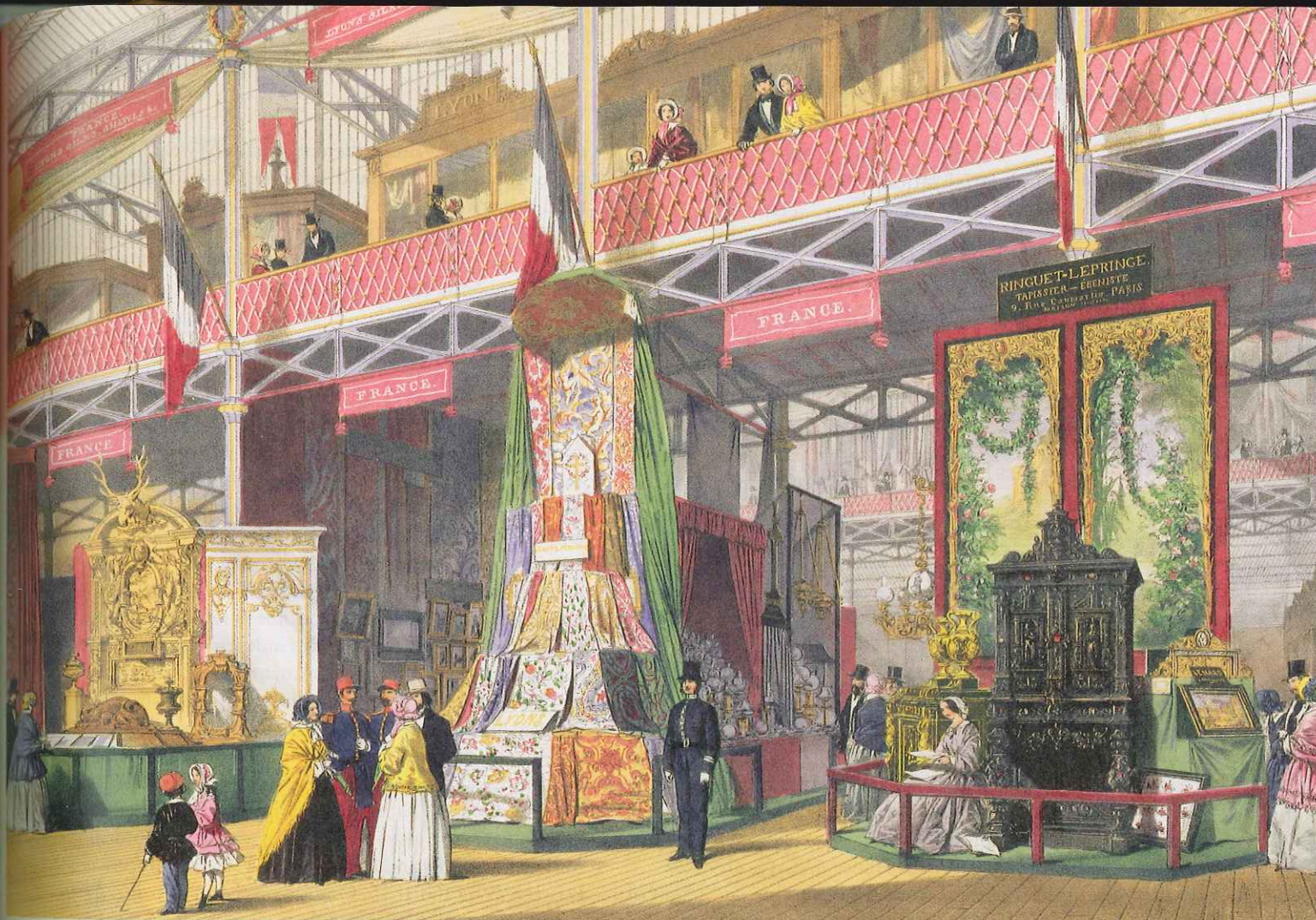
Entering the 1,800-foot-long domed hall — five times the length of an American football field — visitors could peruse an astonishing 1,500 exhibits arranged by country of origin. Many other exhibits featured machines and industrial products, for the Crystal Palace was the grandest and most recent staging of the industrial fair, which was designed to promote prosperity and the diffusion of technical knowledge. Half of the exhibits were British, and many proudly demonstrated the country's dominant position in machine tools and factory production.

Other countries' displays showed that industrial progress was spreading. For example, the small American exhibit featured a few sophisticated industrial products, such as Samuel Colt's prizewinning six-shot revolver.

This great industrial fair was also a consumer's paradise. In many ways the exhibits foretold the creation of big department stores in the 1860s and 1870s, and even the coming of mass consumption and enclosed shopping malls. While the British dominated in industrial goods, other countries led in the



Lid to a souvenir pot showing the Crystal Palace.
(Fitzwilliam Museum, Cambridge University, UK/Bridgeman
Giraudon/The Bridgeman Art Library)



View of the French furniture exhibit. (Private Collection/The Stapleton Collection/The Bridgeman Art Library)

luxury products that greatly appealed to aspiring members of the middle class. The luxury products of French artisans stood out, and France won more prizes in the furniture category than any other nation. Many other handmade luxuries came from Persia, China, and India. Last but not least, the Crystal Palace was equipped with some of the very first public toilets, where a small fee purchased a clean seat, a towel, a comb, and a shoeshine.

QUESTIONS FOR ANALYSIS

1. Describe the Crystal Palace. In what ways was it a revolutionary building?
2. Compare the products that Britain and France presented. How do you explain the differences?
3. The Crystal Palace Exhibition exceeded all expectations. How do you account for its success?

Samuel Colt's six-shot revolver. (Visual Connection Archive)



Table 21.1

Per Capita Levels of Industrialization, 1750–1913

	1750	1800	1830	1860	1880	1900	1913
Great Britain	10	16	25	64	87	100	115
Belgium	9	10	14	28	43	56	88
United States	4	9	14	21	38	69	126
France	9	9	12	20	28	39	59
Germany	8	8	9	15	25	52	85
Austria-Hungary	7	7	8	11	15	23	32
Italy	8	8	8	10	12	17	26
Russia	6	6	7	8	10	15	20
China	8	6	6	4	4	3	3
India	7	6	6	3	2	1	2

Note: All entries are based on an index value of 100, equal to the per capita level of industrialization in Great Britain in 1900. Data for Great Britain includes Ireland, England, Wales, and Scotland.

Source: P. Bairoch, "International Industrialization Levels from 1750 to 1980," *Journal of European Economic History* 11 (Spring 1982): 294, U.S. Journals at Cambridge University Press.

the French level in 1830, for example, and more than three times the French level in 1860. All other large countries (except the United States) had fallen even further behind Britain than France had at both dates.

Third, variations in the timing and in the extent of industrialization in the continental powers and the United States are also apparent. Belgium, achieving independence from the Netherlands in 1831 and rich in iron and coal, led in adopting Britain's new technology, and it experienced a truly revolutionary surge between 1830 and 1860. France developed factory production more gradually, and most historians now detect no burst in French mechanization and no acceleration in the growth of overall industrial output that may accurately be called revolutionary. They stress instead France's relatively good pattern of early industrial growth, which was unjustly tarnished by the spectacular rise of Germany and the United States after 1860. In general, eastern and southern Europe began the process of modern industrialization later than northwestern and central Europe. Nevertheless, these regions made real progress in the late nineteenth century, as growth after 1880 in Austria-Hungary, Italy, and Russia suggests.

Finally, the late but substantial industrialization in eastern and southern Europe meant that all European states (as well as the United States, Canada, and Japan) managed to raise per capita industrial levels in the nineteenth century. These continent-wide increases stood in stark contrast to the large and tragic decreases that occurred at the same time in many non-Western countries, most notably in China and India, as Table 21.1 clearly shows. European countries industrialized to a greater or lesser extent even as most of the non-Western world

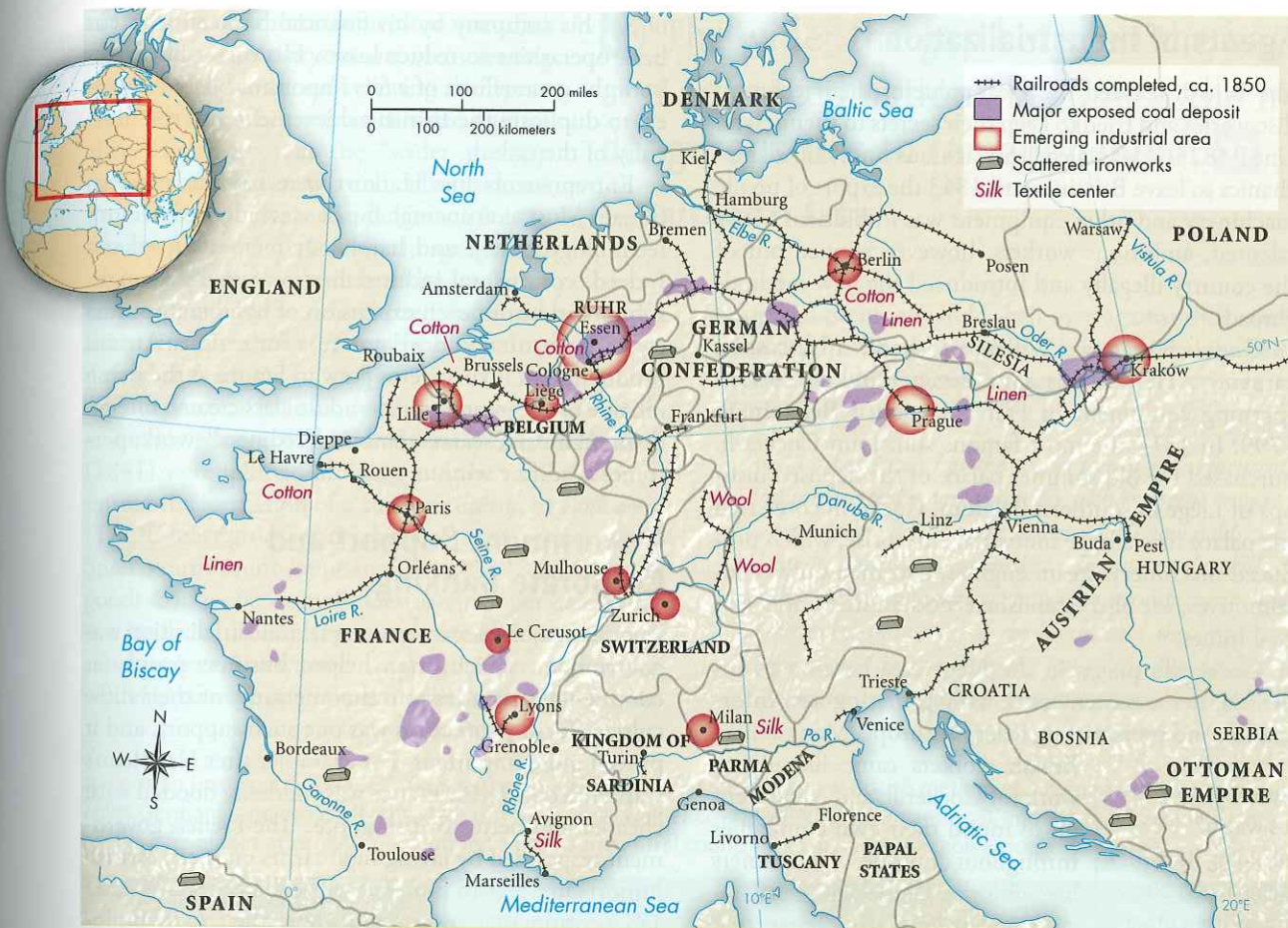
deindustrialized. Thus differential rates of wealth- and power-creating industrial development, which heightened disparities within Europe, also greatly magnified existing inequalities between Europe and the rest of the world. We shall return to this momentous change in world economic relationships in Chapter 25.

The Challenge of Industrialization

The different patterns of industrial development suggest that the process of industrialization was far from automatic. Indeed, building modern industry was an awesome challenge. To be sure, throughout Europe the eighteenth century was an era of agricultural improvement, population increase, expanding foreign trade, and growing cottage industry. Thus when the pace of British industry began to accelerate in the 1780s, continental businesses began to adopt the new methods as they proved their profitability. British industry enjoyed clear superiority, but at first the continent was close behind.

By 1815, however, the situation was quite different. No wars in the early industrial period had been fought on British soil, so Britain did not experience nearly as much physical destruction or economic dislocation as the continent did. Rather, despite the wartime challenges that it did face, British industry maintained the momentum of the 1780s and continued to grow and improve between 1789 and 1815. On the continent, by contrast, the upheavals that began with the French Revolution disrupted trade, created runaway inflation, and fostered social anxiety. War severed normal communications between Britain and the continent, severely handicapping continental efforts to use new British machinery and technology. Moreover, the years from 1789 to 1815 were, even for the privileged French economy receiving special favors from Napoleon, a time of "national catastrophe"—in the graphic words of a famous French scholar.⁵ Thus France and the rest of Europe were further behind Britain in 1815 than in 1789.

This widening gap made it more difficult, if not impossible, for other countries to follow the British pattern in energy and industry after peace was restored in 1815. Above all, in the newly mechanized industries, British goods were being produced very economically, and these goods had come to dominate world markets completely while the continental states were absorbed in war between 1792 and 1815. In addition, British technology had become so advanced and complicated that very few engineers or skilled technicians outside England understood it. Moreover, the technology of steam power had grown much more expensive. It involved large investments in the iron and coal industries and, after 1830, required the existence of railroads, which were very costly. Continental business people had great difficulty finding the large sums of money the new methods demanded, and there was a shortage of laborers accus-



Mapping the Past

Map 21.2 Continental Industrialization, ca. 1850 Although continental countries were beginning to make progress by 1850, they still lagged far behind Britain. For example, continental railroad building was still in an early stage, whereas the British rail system was essentially complete (see Map 21.1). Coal played a critical role in nineteenth-century industrialization both as a power source for steam engines and as a raw material for making iron and steel.

ANALYZING THE MAP Locate the major exposed (that is, known) coal deposits in 1850. Which countries and areas appear rich in coal resources, and which appear poor? Is there a difference between northern and southern Europe?

CONNECTIONS What is the relationship between known coal deposits and emerging industrial areas in continental Europe? In England (see Map 21.1)?

To complete this activity online, go to the Online Study Guide at bedfordstmartins.com/mckaywest.

tomed to working in factories. All these disadvantages slowed the spread of modern industry (Map 21.2).

After 1815, however, when continental countries began to face up to the British challenge, they had at least three important advantages. First, most continental countries had a rich tradition of putting-out enterprise, merchant capitalists, and skilled urban artisans (see Chapter 18). Such a tradition gave continental firms the ability to adapt and survive in the face of new market conditions. Second, continental capitalists did not need to develop their own advanced technology. Instead,

they could simply “borrow” the new methods developed in Great Britain, as well as engineers and some of the financial resources these countries lacked. European countries such as France and Russia also had a third asset that many non-Western areas lacked in the nineteenth century. They had strong independent governments that did not fall under foreign political control. These governments could fashion economic policies to serve their own interests, as they proceeded to do. They would eventually use the power of the state to promote industry and catch up with Britain.

Agents of Industrialization

The British realized the great value of their technical discoveries and tried to keep their secrets to themselves. Until 1825 it was illegal for artisans and skilled mechanics to leave Britain; until 1843 the export of textile machinery and other equipment was forbidden. Many talented, ambitious workers, however, slipped out of the country illegally and introduced the new methods abroad.

One such man was William Cockerill, a Lancashire carpenter. He and his sons began building cotton-spinning equipment in French-occupied Belgium in 1799. In 1817 the most famous son, John Cockerill, purchased the old summer palace of the deposed bishops of Liège in southern Belgium. Cockerill converted the palace into a large industrial enterprise, which produced machinery, steam engines, and then railway locomotives. He also established modern ironworks and coal mines.

Cockerill's plants in the Liège area became an industrial nerve center, continually gathering new information and transmitting it across Europe. Many skilled

British workers came illegally to work for Cockerill, and some went on to found their own companies throughout Europe. Newcomers brought the latest plans and secrets, so Cockerill could boast that ten days after an industrial advance occurred in Britain, he knew all about it in Belgium.

Thus British technicians and skilled workers were a powerful force in the spread of early industrialization.

A second agent of industrialization were talented entrepreneurs such as Fritz Harkort, a business pioneer in the German machinery industry. Serving in England as a Prussian army officer during the Napoleonic wars, Harkort was impressed and enchanted with what he saw. He concluded that Germany had to match all these English achievements as quickly as possible. Setting up shop in an abandoned castle in the still-tranquil Ruhr Valley, Harkort felt an almost religious calling to build steam engines and become the "Watt of Germany."

Harkort's basic idea was simple, but it was enormously difficult to carry out. Lacking skilled laborers to do the job, Harkort turned to England for experienced, though expensive, mechanics. Getting materials also posed a great problem. He had to import the thick iron boilers that he needed from England at great cost. In spite of all these problems, Harkort built and sold engines, winning fame and praise. His ambitious efforts over sixteen years also resulted in large financial losses for himself and his partners, and in 1832 he was forced

out of his company by his financial backers, who cut back operations to reduce losses. His career illustrates both the great efforts of a few important business leaders to duplicate the British achievement and the difficulty of the task.

Entrepreneurs like Harkort were obviously exceptional. Most continental businesses adopted factory technology slowly, and handicraft methods lived on. Indeed, continental industrialization usually brought substantial but uneven expansion of handicraft industry in both rural and urban areas for a time. Artisan production of luxury items grew in France as the rising income of the international middle class created foreign demand for silk scarves, embroidered needlework, perfumes, and fine wines.

Government Support and Corporate Banking

Another major force in continental industrialization was government, which often helped business people in continental countries to overcome some of their difficulties. **Tariff protection** was one such support, and it proved quite important. For example, after Napoleon's wars ended in 1815, France was suddenly flooded with cheaper and better British goods. The French government responded by laying high tariffs on many British imports in order to protect the French economy. After 1815 continental governments bore the cost of building roads and canals to improve transportation. They also bore to a significant extent the cost of building railroads. Belgium led the way in the 1830s and 1840s. In an effort to tie the newly independent nation together, the Belgian government decided to construct a state-owned system. Built rapidly as a unified network, Belgium's state-owned railroads stimulated the development of heavy industry and made the country an early industrial leader. Several of the smaller German states also built state systems.

The Prussian government provided another kind of invaluable support. It guaranteed that the state treasury would pay the interest and principal on railroad bonds if the closely regulated private companies in Prussia were unable to do so. Thus railroad investors in Prussia ran little risk, and capital was quickly raised. In France the state shouldered all the expense of acquiring and laying roadbed, including bridges and tunnels. Finished roadbed was leased to a carefully supervised private company, which usually benefited from a state guarantee of its debts. In short, governments helped pay for railroads, the all-important leading sector in continental industrialization.

The career of German journalist and thinker Friedrich List (1789–1846) reflects government's greater role in industrialization on the continent than in England. List considered the growth of modern industry

tariff protection

A government's way of supporting and aiding its own economy by laying high taxes on imported goods from other countries, as when the French responded to cheaper British goods flooding their country by imposing high tariffs on some imported products.

of the utmost importance because manufacturing was a primary means of increasing people's well-being and relieving their poverty. Moreover, List was a dedicated nationalist. He wrote that the "wider the gap between the backward and advanced nations becomes, the more dangerous it is to remain behind." A backward, agricultural nation was not only poor but also weak, increasingly unable to defend itself and maintain its political independence. To promote industry was to defend the nation.

The practical policies that List focused on in articles and in his influential *National System of Political Economy* (1841) were railroad building and the tariff. List supported the formation of a customs union, or *Zollverein* (TSOL-feh-rign), among the separate German states. Such a tariff union came into being in 1834, allowing goods to move between the German member states without tariffs, while erecting a single uniform tariff against other nations. List wanted a high protective tariff, which would encourage infant industries, allowing them to de-

“ The wider the gap between the backward and advanced nations becomes, the more dangerous it is to remain behind. ”

—FRIEDRICH LIST

velop and eventually hold their own against their more advanced British counterparts. He denounced the British doctrine of free trade as part of Britain's attempt to dominate the entire world.

At no other epoch has the world seen a manufacturing and commercial power possessing such immense resources as those in the hands of the power which now holds sway [Britain] pursuing a system that is so consistently selfish. It is absorbing with untiring energy the manufacturing and commercial industries of the world and the important colonies, and it is making the rest of the world, like the Hindus, its serfs in all industrial and commercial relations.⁶

A German Ironworks, 1845 The Borsig ironworks in Berlin mastered the new British method of smelting iron ore with coke. Germany, and especially the state of Prussia, was well endowed with both iron and coal, and the rapid exploitation of these resources after 1840 transformed a poor agricultural country into an industrial powerhouse. (akg-images)



By the 1840s List's **economic nationalism**, designed to protect and develop the national economy, had become increasingly popular in Germany and elsewhere.

economic nationalism

Policies aimed at protecting and developing a country's economy.

class-consciousness An individual's sense of class differentiation.

Finally, banks, like governments, also played a larger and more creative role on the continent than in Britain. Previously, almost all banks in Europe had been private, organized as secretive partnerships. Because of the possi-

bility of unlimited financial loss, the partners of private banks tended to be quite conservative and were content to deal with a few rich clients and a few big merchants. They generally avoided industrial investment as being too risky.

In the 1830s, two important Belgian banks pioneered in a new direction. They received permission from the growth-oriented government to establish themselves as corporations enjoying limited liability. That is, stockholders could now lose only their original investments in the bank's common stock, and they could not be forced by the courts to pay for any additional losses out of other property they owned if the bank went bankrupt. Publicizing the risk-reducing advantage of limited liability for investors, these Belgian banks were able to attract many shareholders, large and small. They mobilized impressive resources for investment in big companies, became industrial banks, and successfully promoted industrial development.

Similar corporate banks became important in France and Germany in the 1850s and 1860s. Usually working in collaboration with governments, corporate banks established and developed many railroads and many companies working in heavy industry, which were also increasingly organized as limited liability corporations. The most famous such bank was the *Crédit Mobilier* of Paris, founded by Isaac and Emile Pereire, two young Jewish journalists from Bordeaux. The *Crédit Mobilier* advertised extensively. It used the savings of thousands of small investors as well as the resources of big ones. The activities of the bank were far-reaching; it built railroads all over France and Europe. As Emile Pereire had said in 1835, "It is not enough to outline gigantic programs on paper. I must write my ideas on the earth."

The combined efforts of skilled workers, entrepreneurs, governments, and industrial banks meshed successfully between 1850 and the financial crash of 1873. This was a period of unprecedentedly rapid economic growth on the continent. In Belgium, Germany, and France, key indicators of modern industrial development—such as railway mileage, iron and coal production, and steam-engine capacity—increased at average annual rates of 5 to 10 percent. As a result, rail networks were completed in western and much of central Europe, and the leading continental countries mas-

tered the industrial technologies that had first been developed in Great Britain. In the early 1870s, Britain was still Europe's most industrial nation, but a select handful of countries were closing the gap that had been opened up by the Industrial Revolution.

Relations Between Capital and Labor

How did the Industrial Revolution affect people of all social classes, and what measures were taken to improve the conditions of workers? ■

Industrial development brought new social relations and intensified long-standing problems between capital and labor in both urban workshops and cottage industry (see Chapter 18). A new group of factory owners and industrial capitalists arose. These men and women and their families strengthened the wealth and size of the middle class, which had previously been made up mainly of merchants and professional people. The nineteenth century became the golden age of the middle class. Modern industry also created a much larger group, the factory workers. For the first time, large numbers of men, women, and children came together under one roof to work with complicated machinery for a single owner or a few partners in large companies.

The growth of new occupational groups in industry stimulated new thinking about social relations. Often combined with reflections on the French Revolution, this thinking led to the development of a new overarching interpretation—a new paradigm—regarding social relationships. Briefly, this paradigm argued, with considerable success, that individuals were members of economically determined classes that had conflicting interests. Accordingly, the comfortable, well-educated "public" of the eighteenth century came increasingly to see itself as the backbone of the middle class (or the middle classes), and the "people" gradually transformed themselves into the modern working class (or working classes). And if the new class interpretation was more of a deceptive simplification than a fundamental truth for some critics, it appealed to many because it seemed to explain what was happening. Therefore, conflicting classes existed, in part, because many individuals came to believe they existed and developed an appropriate sense of class feeling—what Marxists call **class-consciousness**.

The New Class of Factory Owners

Early industrialists operated in a highly competitive economic system. As the careers of Watt and Harkort illustrate, there were countless production problems, and



Picturing the Past

Ford Maddox Brown, *Work* This midcentury painting provides a rich and realistic visual representation of the new concepts of social class that became common by 1850. (Birmingham Museums and Art Gallery/The Bridgeman Art Library)

ANALYZING THE IMAGE Describe the different types of work shown. What different social classes are depicted, and what kinds of work (or leisure) are the members of the different social classes engaged in?

CONNECTIONS What does this painting and Ford's title for it (*Work*) suggest about the artist's opinion of the work of common laborers?

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success and large profits were by no means certain. Manufacturers therefore waged a constant battle to cut their production costs and stay afloat. Much of the profit had to go back into the business for new and better machinery. "Dragged on by the frenzy of this terrible life," according to one of the dismayed critics, the struggling manufacturer had "no time for niceties. He must conquer or die, make a fortune or drown himself."⁷

Most early industrialists drew upon their families and friends for labor and capital, but they came from a variety of backgrounds. Many, such as Harkort, were from well-established merchant families with a rich network of contacts and support. Others, such as Watt, Wedgwood, and Cockerill, were of modest means, especially in the early days. Artisans and skilled workers of exceptional ability had unparalleled opportunities.

Members of ethnic and religious groups who had been discriminated against in the traditional occupations controlled by the landed aristocracy jumped at the new chances and often helped one another. Scots, Quakers, and other Protestant dissenters were tremendously important in Britain; Protestants and Jews dominated banking in Catholic France. Many of the industrialists were newly rich, and, not surprisingly, they were very proud and self-satisfied.

As factories and firms grew larger, opportunities declined, at least in well-developed industries. It became considerably harder for a gifted but poor young mechanic to start a small enterprise and end up as a wealthy manufacturer. Formal education (for sons and males) became more important as a means of success and advancement, and formal education at the advanced

level was expensive. In Britain by 1830 and in France and Germany by 1860, leading industrialists were more likely to have inherited their well-established enterprises, and they were financially much more secure than their struggling fathers and mothers had been. They also had a greater sense of class-consciousness; they were fully aware that ongoing industrial development had widened the gap between themselves and their workers.

The wives and daughters of successful businessmen also found fewer opportunities for active participation in Europe's increasingly complex business world. Rather than contributing as vital partners in a family-owned enterprise, as so many middle-class women had done, these women were increasingly valued for their ladylike gentility. By 1850 some influential women writers and most businessmen assumed that middle-class wives and daughters should steer clear of undignified work in offices and factories. Rather, a middle-class lady should protect and enhance her femininity. She should concentrate on her proper role as wife and mother, preferably in an elegant residential area far removed from ruthless commerce and the volatile working class.

The New Factory Workers

The social consequences of the Industrial Revolution have long been hotly debated. The condition of British workers during the transformation has always generated the most controversy among historians because Britain was the first country to industrialize and because the social consequences seemed harshest there. Before 1850 other countries had not proceeded very far with industrialization, and almost everyone agrees that the economic conditions of European workers improved after 1850. Thus the experience of British workers to about 1850 deserves special attention. (Industrial growth also promoted rapid urbanization, with its own awesome problems, as will be shown in Chapter 23.)

From the beginning, the Industrial Revolution in Britain had its critics. Among the first were the romantic poets. William Blake (1757–1827) called the early

factories “satanic mills” and protested against the hard life of the London poor. William Wordsworth (1770–1850) lamented the destruction of the rural way of life and the pollution of the land and water. Some handicraft workers—notably the **Luddites**, who attacked whole factories in northern England in 1812 and after

Luddites Group of handicraft workers who attacked whole factories in northern England in 1812 and after, smashing the new machines that they believed were putting them out of work.

ter—smashed the new machines, which they believed were putting them out of work. Doctors and reformers wrote eloquently of problems in the factories and new towns, while Malthus and Ricardo concluded that workers would earn only enough to stay alive.

This pessimistic view was accepted and reinforced by Friedrich Engels (1820–1895), the future revolutionary and colleague of Karl Marx. After studying conditions in northern England, this young middle-class German published in 1844 *The Condition of the Working Class in England*, a blistering indictment of the middle classes. “At the bar of world opinion,” he wrote, “I charge the English middle classes with mass murder, wholesale robbery, and all the other crimes in the calendar.” The new poverty of industrial workers was worse than the old poverty of cottage workers and agricultural laborers, according to Engels. The culprit was industrial capitalism, with its relentless competition and constant technical change. Engels's extremely influential charge of middle-class exploitation and increasing worker poverty was embellished by Marx and later socialists.

Meanwhile, other observers believed that conditions were improving for the working people. Andrew Ure (yoo-RAY) wrote in 1835 in his study of the cotton industry that conditions in most factories were not harsh and were even quite good. Edwin Chadwick, a great and conscientious government official well acquainted with the problems of the working population, concluded that the “whole mass of the laboring community” was increasingly able “to buy more of the necessities and minor luxuries of life.”⁸ Nevertheless, those who thought conditions were getting worse for working people were probably in the majority.

In an attempt to go beyond the contradictory judgments of contemporaries, some historians have looked at different kinds of sources. Statistical evidence is one such source. If working people suffered a great economic decline, as Engels and later socialists asserted, then the purchasing power of the working person's wages must have declined drastically.

Scholarly statistical studies have weakened the idea that the condition of the working class got much worse with industrialization. But the most recent scholarship also confirms the view that the early years of the Industrial Revolution were hard ones for British workers. There was little or no increase in the purchasing power of the average British worker from about 1780 to about 1820. The years from 1792 to 1815, a period of almost constant warfare with France, were particularly difficult. Food prices rose faster than wages, and the living conditions of the laboring poor declined. Only after 1820, and especially after 1840, did real wages rise substantially, so that the average worker earned and consumed roughly 50 percent more in real terms in 1850 than in 1770.⁹ In short, there was considerable economic improvement for workers throughout Great Britain by 1850, but that improvement was hard won and slow in coming.

This important conclusion must be qualified, however. First, the hours in the average workweek increased, as some economic historians now believe it had been

increasing in parts of northern Europe since the late seventeenth century. Thus, to a large extent, workers earned more simply because they worked more. Indeed, in England nonagricultural workers labored about 250 days per year in 1760 as compared to 300 days per year in 1830, while the normal workday remained an exhausting eleven hours throughout the entire period. In 1760 nonagricultural workers still observed many religious and public holidays by not working, and Monday was popularly known as “Saint Monday” because so many workers took the day off. These days of leisure and relaxation declined rapidly after 1760, and by 1830 nonagricultural workers had joined landless agricultural laborers in toiling six rather than five days a week.¹⁰

Second, the wartime decline in the average worker's real wages and standard of living from 1792 to 1815 had a powerful negative impact on workers. These difficult war years, with more unemployment and sharply higher prices for bread, were formative years for the new factory labor force, and they colored the early experience of modern industrial life in somber tones.

Another way to consider the workers' standard of living is to look at the goods that they purchased. Again

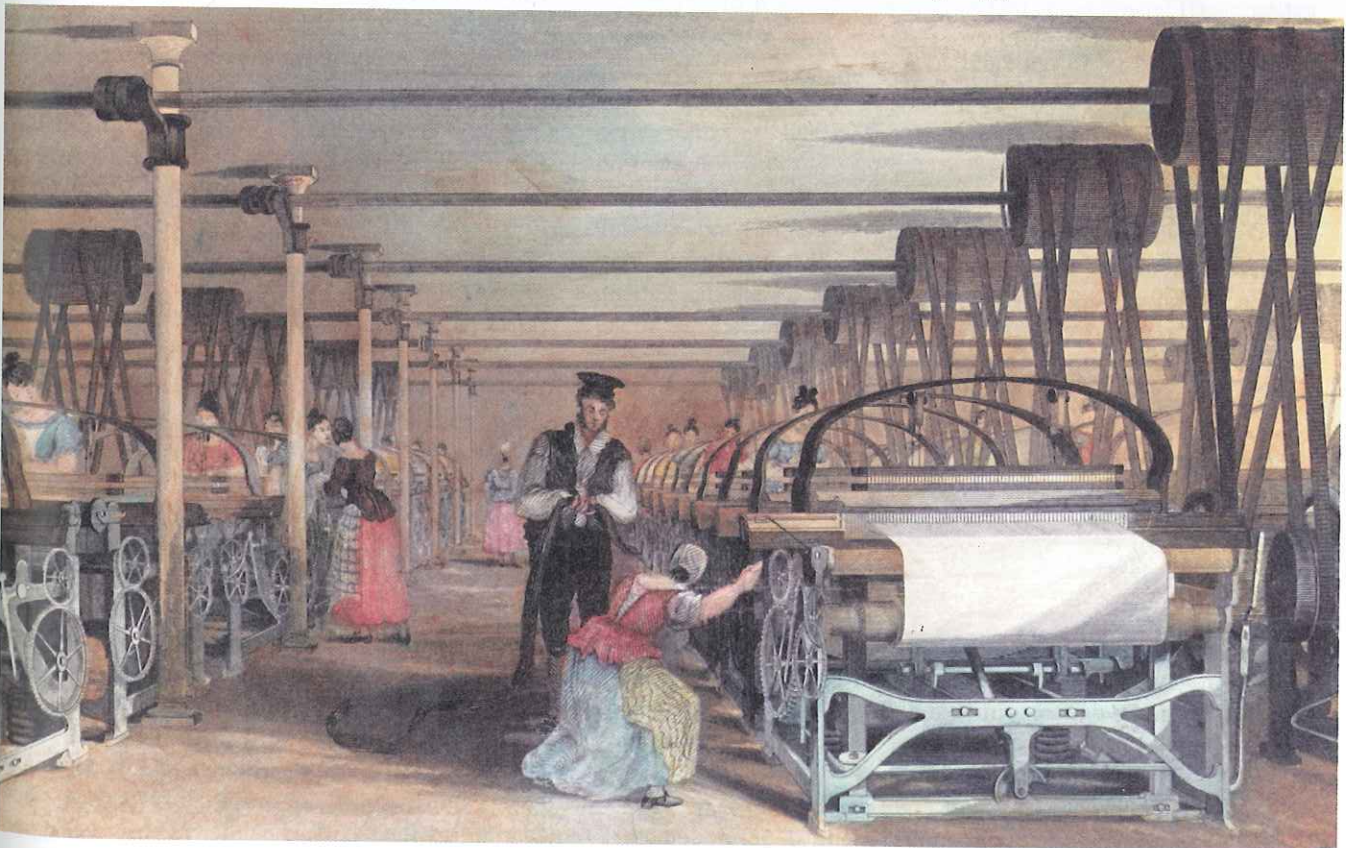
the evidence is somewhat contradictory. Speaking generally, workers ate somewhat more food of higher nutritional quality as the Industrial Revolution progressed, except during wartime. Diets became more varied; people ate more potatoes, dairy products, fruits, and vegetables. Clothing improved, but housing for working people probably deteriorated somewhat. In short, per capita use of specific goods supports the position that the standard of living of the working classes rose, at least moderately, after the long wars with France.

Work in Early Factories

What about working conditions? Did workers eventually earn more only at the cost of working longer and harder? Were workers exploited harshly by the new factory owners?

The first factories were cotton mills, which began functioning in the 1770s along fast-running rivers and streams and were often located in sparsely populated areas. Cottage workers in the vicinity, accustomed to the putting-out system, were reluctant to work in the new factories even when they received relatively good wages because factory work was unappealing. In the

Workers at a Large Cotton Mill This 1833 engraving shows adult women operating power looms under the supervision of a male foreman, and it accurately reflects both the decline of family employment and the emergence of a gender-based division of labor in many English factories. The jungle of belts and shafts connecting the noisy looms to the giant steam engine on the ground floor created a constant din. (Time Life Pictures/Getty Images)



The Testimony of Young Mine Workers

LISTENING TO THE PAST

The use of child labor in British industrialization quickly attracted the attention of humanitarians and social reformers. This interest led to investigations by parliamentary commissions, which resulted in laws limiting the hours and the ages of children working in large factories. Designed to build a case for remedial legislation, parliamentary inquiries gave large numbers of workers a rare chance to speak directly to contemporaries and to historians.

The moving passages that follow are taken from testimony gathered in 1841 and 1842 by the Ashley Mines Commission. Interviewing employers and many male and female workers, the commissioners focused on the physical condition of the youth and on the sexual behavior of workers far underground. The subsequent Mines Act of 1842 sought to reduce immoral behavior and sexual bullying by prohibiting underground work for all women and girls (and for boys younger than ten).

Mr. Payne, coal master

“That children are employed generally at nine years old in the coal pits and sometimes at eight. In fact, the smaller the vein of coal is in height, the younger and smaller are the children required; the work occupies from six to seven hours per day in the pits; they are not ill-used or worked beyond their strength; a good deal of depravity exists but they are certainly not worse in morals than in other branches of the Sheffield trade, but upon the whole superior; the morals of this district are materially improving; Mr. Bruce, the clergyman, has been zealous and active in endeavoring to ameliorate their moral and religious education. . . .”

Ann Eggle, hurrier, 18 years old

“I'm sure I don't know how to spell my name. We go at four in the morning, and sometimes at half-past four. We begin to work as soon as we get down. We get out after four, sometimes at five, in the evening. We work the whole time except an hour for dinner, and sometimes we haven't time to eat. I hurry [move coal wagons underground] by myself, and have done so for long. I know the corves [small coal wagons] are very heavy, they are the biggest corves anywhere about. The work is far too hard for me; the sweat runs off me all over sometimes. I am very tired at night. Sometimes when we get home at night we have not power to wash us, and then we go to bed. Sometimes we fall asleep in the chair. Father said last night it was both a shame and a disgrace for girls to work as we do, but there was naught else for us to do. I began to hurry when I was seven and I have been hurrying

ever since. I have been 11 years in the pits. The girls are always tired. I was poorly twice this winter; it was with headache. I hurry for Robert Wiggins; he is not akin to me. . . . We don't always get enough to eat and drink, but we get a good supper. I have known my father go at two in the morning to work . . . and he didn't come out till four. I am quite sure that we work constantly 12 hours except on Saturdays. We wear trousers and our shifts in the pit and great big shoes clinkered and nailed. The girls never work naked to the waist in our pit. The men don't insult us in the pit. The conduct of the girls in the pit is good enough sometimes and sometimes bad enough. I never went to a day-school. I went a little to a Sunday-school, but I soon gave it over. I thought it too bad to be confined both Sundays and week-days. I walk about and get the fresh air on Sundays. I have not learnt to read. I don't know my letters. I never learnt naught. I never go to church or chapel; there is no church or chapel at Gawber, there is none nearer than a mile. . . . I have never heard that a good man came into the world who was God's son to save sinners. I never heard of Christ at all. Nobody has ever told me about him, nor have my father and mother ever taught me to pray. I know no prayer; I never pray.”

Patience Kershaw, aged 17

“My father has been dead about a year; my mother is living and has ten children, five lads and five lasses; the oldest is about thirty, the youngest is four; three lasses go to mill; all the lads are colliers, two getters and three hurriers; one lives at home and does nothing; mother does nought but look after home.

factory, workers had to keep up with the machine and follow its relentless tempo. Moreover, they had to show up every day, on time, and work long, monotonous hours under the constant supervision of demanding overseers, and they were punished systematically if they broke the work rules. For example, if a worker was late to work, or accidentally spoiled material, or nodded off

late in the day, the employer imposed fines that were deducted from the weekly pay. Children and adolescents were often beaten for their infractions.

Cottage workers were not used to that kind of life and discipline. All members of the family worked hard and long, but in spurts, setting their own pace. They could interrupt their work when they wanted to. Women



This illustration of a girl dragging a coal wagon was one of several that shocked public opinion and contributed to the Mines Act of 1842. (© British Library Board)

All my sisters have been hurriers, but three went to the mill. Alice went because her legs swelled from hurrying in cold water when she was hot. I never went to day-school; I go to Sunday-school, but I cannot read or write; I go to pit at five o'clock in the morning and come out at five in the evening; I get my breakfast of porridge and milk first; I take my dinner with me, a cake, and eat it as I go; I do not stop or rest any time for the purpose; I get nothing else until I get home, and then have potatoes and meat, not every day meat. I hurry in the clothes I have now got on, trousers and ragged jacket; the bald place upon my head is made by thrusting the corves; my legs have never swelled, but sisters' did when they went to mill; I hurry the corves a mile and more under ground and back; they weigh 300 cwt.;* I hurry 11 a day; I wear a belt and chain at the workings to get the corves out; the putters [miners] that I work for are *naked* except their caps; they pull off all their clothes; I see them at work when I go up; sometimes they beat me, if I am not quick enough, with their hands; they strike me upon my back; the boys take liberties with me, sometimes, they pull me about; I am the only girl in the pit; there are about 20 boys and 15 men; all the men are naked; I would rather work in mill than in coal-pit. ”

*An old English unit of weight equaling 112 pounds.

Isabel Wilson, 38 years old, coal putter

“When women have children thick [fast] they are compelled to take them down early. I have been married 19 years and have had 10 bairns [children]; seven are in life. When on Sir John's work was a carrier of coals, which caused me to miscarry five times from the strains, and was gai [very] ill after each. Putting is no so oppressive; last child was born on Saturday morning, and I was at work on the Friday night.

Once met with an accident; a coal brake my cheek-bone, which kept me idle some weeks. I have wrought below 30 years, and so has the guid man; he is getting touched in the breath now.

None of the children read, as the work is no regular. I did read once, but no able to attend to it now; when I go below lassie 10 years of age keeps house and makes the broth or stir-about. ”

Source: *Voices of the Industrial Revolution: Selected Readings from the Liberal Economists and Their Critics*, pp. 87–90, edited by J. Bowditch and C. Ramsland (Ann Arbor: The University of Michigan Press, 1961). Reprinted by permission of the publisher.

QUESTIONS FOR ANALYSIS

1. How does Payne's testimony compare with that of Ann Eggley and Patience Kershaw?
2. Describe the work of Eggley, Kershaw, and Wilson. What strikes you most about the testimonies of these workers?
3. The witnesses were responding to questions from middle-class commissioners. What did the commissioners seem interested in? Why?

and children could break up their long hours of spinning with other tasks. On Saturday afternoon the head of the family delivered the week's work to the merchant manufacturer and got paid. Saturday night was a time of relaxation and drinking, especially for the men. Recovering from his hangover on Tuesday, the weaver bent to his task on Wednesday and then worked frantically

to meet his deadline on Saturday. Like some students today, he might “pull an all-nighter” on Thursday or Friday in order to get his work in.

Also, early factories resembled English poorhouses, where totally destitute people went to live at public expense. Some poorhouses were industrial prisons, where the inmates had to work in order to receive their food

and lodging. The similarity between large brick factories and large stone poorhouses increased the cottage workers' fear of factories and their hatred of factory discipline. It was cottage workers' reluctance to work in factories that prompted the early cotton mill owners to turn to abandoned and pauper children for their labor. As we have seen, these owners contracted with local officials to employ large numbers of these children, who had no say in the matter. Pauper children were often badly treated and terribly overworked in the mills, as they were when they were apprenticed as chimney sweeps, market girls, shoemakers, and so forth. In the eighteenth century, semi-forced child labor seemed necessary and was socially accepted. From our modern point of view, it was cruel exploitation and a blot on the record of the new industrial system.

Working Families and Children

By the 1790s the early pattern was rapidly changing. The use of pauper apprentices was in decline, and in 1802 it was forbidden by Parliament. Many more textile factories were being built, mainly in urban areas, where they could use steam power rather than waterpower and attract a workforce more easily than in the countryside. The need for workers was great. As a result, people came from near and far to work in the cities, both as factory workers and as laborers, builders, and domestic servants. Yet as they took these new jobs, working people did not simply give in and accept the highly

Factory Act of 1833 English law that led to a sharp decline in the employment of children by limiting the hours that children over age nine could work and requiring younger children to attend factory-run elementary schools.

disciplined system of labor that had formerly repelled them. Rather, they helped modify the system by carrying over old, familiar working traditions.

For one thing, workers often came to the mills and the mines as family units. This was how they had worked on farms and in the putting-out system. The mill or mine owner bargained with the head of the family and paid him or her for the work of the whole family. In the cotton mills, children worked for their mothers or fathers, collecting scraps and "piecing" broken threads together. In the mines, children sorted coal and worked the ventilation equipment. Their mothers hauled coal in the tunnels below the surface, while their fathers hewed with pick and shovel at the face of the seam.

The preservation of the family as an economic unit in the factories from the 1790s on made the new surroundings more tolerable, both in Great Britain and in other countries, during the early stages of industrialization. Parents disciplined their children, making firm measures socially acceptable, and directed their upbringing. The presence of the whole family meant that children and adults worked the same long hours (twelve-hour

shifts were normal in cotton mills in 1800). In the early years, some very young children were employed solely to keep the family together. For example, the early industrialist Jedediah Strutt believed that children should be at least ten years old to work in his textile mills, but he reluctantly employed seven-year-olds to satisfy their parents. Adult workers were not particularly interested in limiting the minimum working age or hours of their children as long as family members worked side by side. Only when technical changes threatened to place control and discipline in the hands of impersonal managers and overseers did adult workers protest against inhuman conditions in the name of their children.

Some enlightened employers and social reformers in Parliament definitely felt otherwise. They argued that more humane standards were necessary, and they used widely circulated parliamentary reports to influence public opinion. For example, Robert Owen (1771–1858), a very successful manufacturer in Scotland, testified in 1816 before an investigating committee on the basis of his experience. He stated that "very strong facts" demonstrated that employing children under ten years of age as factory workers was "injurious to the children, and not beneficial to the proprietors."¹¹ Workers also provided graphic testimony at such hearings as the reformers pressed Parliament to pass corrective laws. They scored some important successes.

Their most significant early accomplishment was the **Factory Act of 1833**. It limited the factory workday for children between nine and thirteen to eight hours and that of adolescents between fourteen and eighteen to twelve hours, although the act made no effort to regulate the hours of work for children at home or in small businesses. Children under nine were to be enrolled in the elementary schools that factory owners were required to establish. The employment of children declined rapidly. Thus the Factory Act broke the pattern of whole families working together in the factory because efficiency required standardized shifts for all workers.

Ties of blood and kinship were important in other ways in Great Britain in the formative years between about 1790 and 1840. Many manufacturers and builders hired workers through subcontractors. They paid the subcontractors on the basis of what the subcontractors and their crews produced—for smelting so many tons of pig iron or moving so much dirt or gravel for a canal or roadbed. Subcontractors in turn hired and fired their own workers, many of whom were friends and relations. The subcontractor might be as harsh as the greediest capitalist, but the relationship between subcontractor and work crew was close and personal. This kind of personal relationship had traditionally existed in cottage industry and in urban crafts, and it was more acceptable to many workers than impersonal factory discipline. This system also provided people with an easy way to find a job. Even today, a friend or relative who is

a supervisor is frequently worth a host of formal application forms.

Ties of kinship were particularly important for newcomers, who often traveled great distances to find work. Many urban workers in Great Britain were from Ireland. Forced out of rural Ireland by population growth and deteriorating economic conditions from 1817 on, Irish in search of jobs took what they could get. As early as 1824, most of the workers in the Glasgow cotton mills were Irish; in 1851 one-sixth of the population of Liverpool was Irish. Like many other immigrant groups held together by ethnic and religious ties, the Irish worked together, formed their own neighborhoods, and not only survived but also thrived.

The Sexual Division of Labor

The era of the Industrial Revolution witnessed major changes in the sexual division of labor. In preindustrial Europe most people generally worked in family units. By tradition, certain jobs were defined by gender—women and girls for milking and spinning, men and boys for plowing and weaving—but many tasks might go to either sex. Family employment carried over into early factories and subcontracting, but by the 1830s it was collapsing as child labor was restricted and new attitudes emerged. A different sexual division of labor gradually arose to take its place. By 1850 the man was emerging as the family's primary wage earner, while the married woman found only limited job opportunities. Generally denied good jobs at good wages in the growing urban economy, women were expected to concentrate on housework, raising the children, and some craft-work at home.

This new pattern of **separate spheres**, which will be considered further in Chapter 23, had several aspects. First, all studies agree that married women from the working classes were much less likely to work full-time for wages outside the house after the first child arrived, although they often earned small amounts doing putting-out handicrafts at home and taking in boarders. Second, when married women did work for wages outside the house, they usually came from the poorest families, where the husbands were poorly paid, sick, unemployed, or missing. Third, these poor married or widowed women were joined by legions of young unmarried women, who worked full-time but only in certain jobs, of which textile factory work, laundering, and domestic service were particularly important. Fourth, all women were generally confined to low-paying, dead-end jobs. Virtually no occupation open to women paid a wage sufficient for a person to live independently. Men predominated in the better-paying, more promising employments. Evolving gradually, but largely in place by 1850, the new sexual division of labor in Britain constituted a major development in the history of women and of the family.

If the reorganization of paid work along gender lines is widely recognized, there is no agreement on its causes. One school of scholars sees little connection with industrialization and finds the answer in the deeply ingrained sexist attitudes of a “patriarchal tradition,” which predated the economic transformation. These scholars stress the role of male-dominated craft unions in denying working women access to good jobs and relegating them to unpaid housework. Other scholars, stressing that the gender roles of women and men can vary enormously with time and culture, look more to a combination of economic and biological factors in order to explain the emergence of a sex-segregated division of labor.

Three ideas stand out in this more recent interpretation. First, the new and unfamiliar discipline of the clock and the machine was especially hard on married women of the laboring classes. Above all, relentless factory discipline conflicted with child care in a way that labor on the farm or in the cottage had not. A woman operating earsplitting spinning machinery could mind a child of seven or eight working beside her (until such work was outlawed), but she could no longer pace herself through pregnancy or breast-feed her baby on the job. Thus a working-class woman had strong incentives to concentrate on child care within her home if her family could afford it.

Second, running a household in conditions of primitive urban poverty was an extremely demanding job in its own right. There were no supermarkets or public transportation. Everything had to be done on foot. Shopping and feeding the family constituted a never-ending challenge. The wife marched from one tiny shop to another, dragging her tired children (for who was to watch them?) and struggling valiantly with heavy sacks and tricky shopkeepers. Yet another brutal job outside the house—a “second shift”—had limited appeal for the average married woman from the working class. Thus many women might well have accepted the emerging division of labor as the best available strategy for family survival in the industrializing society.¹²

Third, why were the young, generally unmarried women who did work for wages outside the home segregated and confined to certain “women’s jobs”? No doubt the desire of males to monopolize the best opportunities and hold women down provides part of the answer. Yet as some feminist scholars have argued, sex-segregated employment was also a collective response to the new industrial system. Previously, at least in theory, young people worked under a watchful parental eye. The growth of factories and mines brought unheard-of opportunities for girls and boys to mix on the job, free of familial supervision. Continuing to mix after work, they

separate spheres A gender division of labor with the wife at home as mother and homemaker and the husband as wage earner.

were “more likely to form liaisons, initiate courtships, and respond to advances.”¹³ Such intimacy also led to more unplanned pregnancies and fueled the illegitimacy explosion that had begun in the late eighteenth century and that gathered force until at least 1850 (see Chapter 19). Thus segregation of jobs by gender was partly an effort by older people to help control the sexuality of working-class youths.

Investigations into the British coal industry before 1842 provide a graphic example of this concern. (See “Listening to the Past: The Testimony of Young Mine Workers,” page 676.) The middle-class men leading the inquiry, who expected their daughters and wives to pursue ladylike activities, often failed to appreciate the physical effort of the girls and women who dragged with belt and chain the heavy carts of coal along narrow underground passages. But they professed horror at the sight of girls and women working without shirts, which was a common practice because of the heat, and they quickly assumed the prevalence of licentious sex with the male miners, who also wore very little clothing. In fact, most girls and married women worked for related males in a family unit that provided considerable protection and restraint. Yet many witnesses from the working class also believed that “blackguardism and debauchery” were common and that “they are best out of the pits, the lasses.” Some miners stressed particularly the danger of sexual aggression for girls working past puberty. As one explained: “I consider it a scandal for

girls to work in the pits. Till they are 12 or 14 they may work very well but after that it’s an abomination. . . . The work of the pit does not hurt them, it is the effect on their morals that I complain of.”¹⁴

Mines Act of 1842 English law prohibiting underground work for all women and girls as well as for boys under ten.

The **Mines Act of 1842** prohibited underground work for all women and girls as well as for boys under ten.

Some women who had to support themselves protested against being excluded from coal mining, which paid higher wages than most other jobs open to working-class women. But provided they were part of families that could manage economically, the girls and the women who had worked underground were generally pleased with the law. In explaining her satisfaction in 1844, one mother of four provided real insight into why many married working women accepted the emerging sexual division of labor:

While working in the pit I was worth to my [miner] husband seven shillings a week, out of which we had to pay 2½ shillings to a woman for looking after the younger children. I used to take them to her house at 4 o’clock in the morning, out of their own beds, to put them into hers. Then there was one shilling a week for washing; besides, there was mending to pay for, and other things. The house was not guided. The other children broke things; they did not go to school when they were sent; they would be playing

*about, and get ill-used by other children, and their clothes torn. Then when I came home in the evening, everything was to do after the day’s labor, and I was so tired I had no heart for it; no fire lit, nothing cooked, no water fetched, the house dirty, and nothing comfortable for my husband. It is all far better now, and I wouldn’t go down again.*¹⁵

The Early Labor Movement in Britain

Many kinds of employment changed slowly during and after the Industrial Revolution in Great Britain. In 1850 more British people still worked on farms than in any other occupation. The second-largest occupation was domestic service, with more than one million household servants, 90 percent of whom were women. Thus many old, familiar jobs outside industry lived on and provided alternatives for individual workers. This helped ease the transition to industrial civilization.

Within industry itself, the pattern of artisans working with hand tools in small shops remained unchanged in many trades, even as others were revolutionized by technological change. For example, as in the case of cotton and coal, the British iron industry was completely dominated by large-scale capitalist firms by 1850. Many large ironworks had more than one thousand people on their payrolls. Yet the firms that fashioned iron into small metal goods, such as tools, tableware, and toys, employed on average fewer than ten wage workers who used time-honored handicraft skills. Only gradually after 1850 did some owners find ways to reorganize some handicraft industries with new machines and new patterns of work. The survival of small workshops gave many workers an alternative to factory employment.

Working-class solidarity and class-consciousness developed in small workshops as well as in large factories. In the northern factory districts, where thousands of “hired hands” looked across at a tiny minority of managers and owners, anticapitalist sentiments were frequent by the 1820s. Commenting in 1825 on a strike in the woolen center of Bradford and the support it had gathered from other regions, one paper claimed with pride that “it is all the workers of England against a few masters of Bradford.”¹⁶ Modern technology and factory organization had created a few versus the many.

The transformation of some traditional trades by organizational changes, rather than technological innovations, could by themselves also create ill will and class feeling. The classical liberal concept of economic freedom and laissez faire emerged in the late eighteenth century, and it continued to gather strength in the early nineteenth century (see Chapter 22). As in France during the French Revolution, the British government attacked monopolies, guilds, and workers combinations in the name of individual liberty. In 1799 Parliament passed the **Combination Acts**, which outlawed unions

and strikes. In 1813 and 1814, Parliament repealed the old and often disregarded law of 1563 regulating the wages of artisans and the conditions of apprenticeship. As a result of these and other measures, certain skilled artisan workers, such as bootmakers and high-quality tailors, found aggressive capitalists ignoring traditional work rules and trying to flood their trades with unorganized women workers and children to beat down wages.

The capitalist attack on artisan guilds and work rules was bitterly resented by many craftworkers, who subsequently played an important part in Great Britain and in other countries in gradually building a modern labor movement to improve working conditions and to serve worker needs. The Combination Acts were widely disregarded by workers. Printers, papermakers, carpenters, tailors, and other such craftsmen continued to take collective action, and societies of skilled factory workers also organized unions. Unions sought to control the number of skilled workers, limit apprenticeship to members' own children, and bargain with owners over wages.

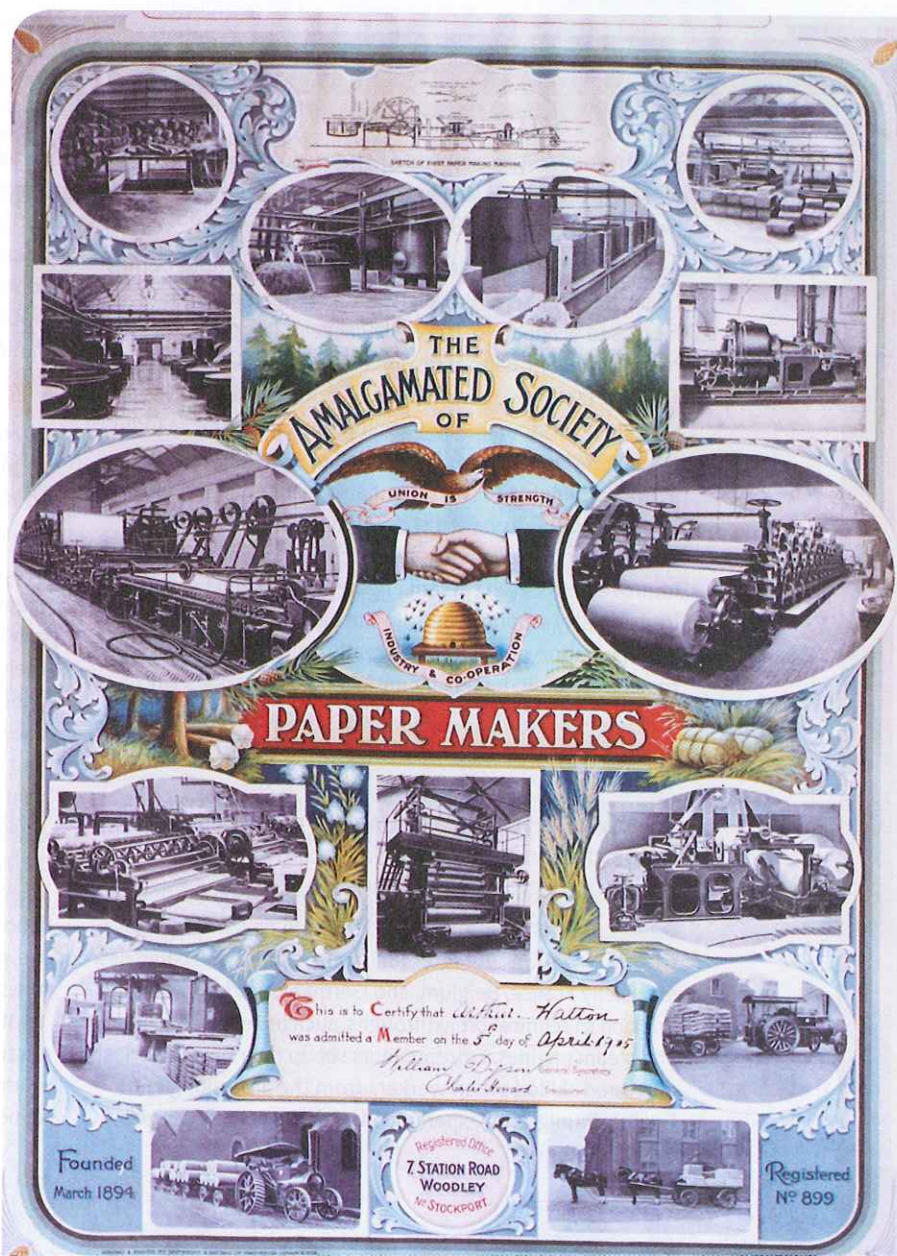
They were not afraid to strike; there was, for example, a general strike of adult cotton spinners in Manchester in 1810. In the face of widespread union activity, Parliament repealed the Combination Acts in 1824, and unions were tolerated, though not fully accepted, after 1825. The next stage in the development of the British trade-union movement was the attempt to create a single large national union. This effort was led not so much by working people as by social reformers such as Robert Owen. Owen, a self-made cotton manufacturer (see page 678), had pioneered in industrial relations by combining firm discipline with concern for the health, safety, and hours of his workers. After 1815 he experimented with cooperative and socialist communities, including one at New Harmony, Indiana. Then in 1834 Owen organized one of the largest and most visionary of the early national unions, the Grand National Consolidated Trades Union.

When Owen's and other grandiose schemes collapsed, the British labor movement moved once again after 1851 in the direction of craft unions. The most famous of these "new model unions" was the Amalgamated Society of Engineers, which represented skilled machinists. These unions won real benefits for members by

fairly conservative means and thus became an accepted part of the industrial scene.

British workers also engaged in direct political activity in defense of their own interests. After the collapse of Owen's national trade union, many working people went into the Chartist movement, which sought political democracy. The key Chartist demand—that all men be given the right to vote—became the great hope of millions of aroused people. Workers were also active in campaigns to limit the workday in factories to ten hours and to permit duty-free importation of wheat into Great Britain to secure cheap bread. Thus working people developed a sense of their own identity and played an active role in shaping the new industrial system. They were neither helpless victims nor passive beneficiaries.

Combination Acts English laws passed in 1799 that outlawed unions and strikes, favoring capitalist business people over skilled artisans. Bitterly resented and widely disregarded by many craft guilds, the acts were repealed by Parliament in 1824.



Union Membership Certificate This handsome membership certificate belonged to Arthur Watton, a properly trained and certified papermaker of Kings Norton in Birmingham, England. Members of such unions proudly framed their certificates and displayed them in their homes, showing that they were skilled workers. (Courtesy, Sylvia Waddell)



LOOKING BACK LOOKING AHEAD

ONE POPULAR IDEA in the 1830s, first developed by a French economist, was that Britain had experienced an “industrial revolution” at the same time that France had experienced the French Revolution. One revolution was economic, while the other was political; one was ongoing and successful, while the other had failed and come to a definite end in 1815, when Europe’s conservative monarchs defeated Napoleon and restored the French kings of the Old Regime.

In fact, in 1815 the French Revolution, like the Industrial Revolution, was an unfinished revolution. Just as Britain was in the midst of its economic transformation and the states of northwestern Europe would begin rapid industrialization only in the 1850s, so too after 1815 were the political conflicts and ideologies of revolutionary France still very much alive. The French Revolution had opened the era of modern political life in Europe. It had brought into existence many of the political forces and ideologies that would interact with industrialization to refashion Europe and create a new urban society. Moreover, in 1815 the unfinished French Revolution carried the very real possibility of renewed political upheaval. This possibility, which conservatives feared and radicals longed for, would become dramatic reality in 1848, when political revolutions swept across Europe like a whirlwind.

CHAPTER REVIEW

■ What were the origins of the Industrial Revolution in Britain, and how did it develop between 1780 and 1850? (p. 656)

As markets for manufactured goods increased both domestically and overseas, Britain was able to respond with increased production, largely because of its stable government, abundant natural resources, and flexible labor force. The first factories arose as a result of technical innovations in spinning cotton, thereby revolutionizing the textile industry. The widespread availability and affordability of cotton provided benefits for many, but also resulted in the brutal forced labor of orphaned children on a large scale. The demand for improvements in energy led to innovations and improvements in the steam engine, which transformed the iron industry among others. In the early nineteenth century, transportation of goods was greatly enhanced when railroads were built, largely by unskilled farm workers who subsequently often left their villages for a more exciting life in towns.

■ How after 1815 did continental countries respond to the challenge of industrialization? (p. 665)

For reasons including warfare on home soil and barriers to trade, continental Europe lagged behind England in industrialization in 1815. But after 1815, some continental countries, especially France, Belgium, and Germany, gradually built on England’s technical breakthroughs, such as textile machinery and steam engines. Entrepreneurs set up their own factories and hired skilled urban workers from the area along with English immigrants experienced in the new technologies.

England tried to limit the spread of trade secrets, and financing was difficult for early continental capitalists, but government intervention, such as tariff protection and infrastructure, was a great boon to industrialization on the continent. In addition, newly established corporate banks worked in conjunction with governments to invest heavily in railroads and other industries.

■ How did the Industrial Revolution affect people of all social classes, and what measures were taken to improve the conditions of workers? (p. 672)

The rise of modern industry had a profound impact on people and their lives, beginning in Britain in the late eighteenth century. Industrialization led to the growing size and wealth of the middle class, as factory owners took their place beside successful merchants and professional people. These early entrepreneurs at first came from diverse backgrounds, providing economic opportunities for religious and ethnic minorities, but by the middle of the nineteenth century, wealthy industrial families controlled large enterprises, and it was difficult for the poor but talented person to break in. The modern industrial working class also developed during this time, filling the need for vast quantities of labor power. Rigid rules, stern discipline, and long hours weighed heavily on factory workers, and improvements in the standard of living came slowly, but they were substantial by 1850. Family members often worked together in early factories, but as restrictions were placed on child labor, married women withdrew increasingly from wage work and concentrated on child care and household responsibilities.

At the same time many young women worked before they were married, and jobs for young workers were often separated by gender in an attempt to control sexual behavior. The era of industrialization also fostered new attitudes toward child labor, encouraged protective factory legislation, and called forth a new sense of class feeling and an assertive labor movement.

Suggested Reading

- Cameron, Rondo, and Larry Neal. *A Concise Economic History of the World*, 4th ed. 2003. Provides an introduction to key issues related to the Industrial Revolution and has a carefully annotated bibliography.
- Davidoff, Leonore, and Catherine Hall. *Family Fortunes: Men and Women of the English Middle Class, 1750–1850*, rev. ed. 2003. Examines both economic activities and cultural beliefs with great skill.
- Dolan, Brian. *Wedgwood: The First Tycoon*. 2004. A comprehensive study of the famous entrepreneur.
- Fuchs, Rachel G. *Gender and Poverty in Nineteenth-Century Europe*. 2005. Provides a broad comparative perspective.
- Gaskell, Elizabeth. *Mary Barton*. 1848. Gaskell's famous novel offers a realistic portrayal of the new industrial society.
- Goodman, Jordan, and Katrina Honeyman. *Gainful Pursuits: The Making of Industrial Europe, 1600–1914*. 1988. An excellent general treatment of European industrial growth.
- Horn, Jeff. *Understanding the Industrial Revolution: Milestones in Business History*. 2007. Clear, concise, and engaging, this is an excellent work for students.
- Kemp, Tom. *Industrialization in Europe*, 2d ed. 1985. A useful overview.
- Landes, David. *Dynasties: Fortunes and Misfortunes of the World's Great Family Businesses*. 2006. A collection offering fascinating and insightful histories of famous enterprises and leading capitalists.
- Pomeranz, Kenneth. *The Great Divergence: China, Europe, and the Making of the Modern World Economy*. 2000. A sophisticated reconsideration of why western Europe underwent industrialization and China did not.
- Stearns, Peter N. *The Industrial Revolution in World History*, 3d ed. 2007. A useful brief survey.
- Thompson, E. P. *The Making of the English Working Class*. 1963. A fascinating book in the Marxian tradition that is rich in detail and early working-class lore.
- Valenze, Deborah. *The First Industrial Woman*. 1995. A gender study that reinvigorates the debate between optimists and pessimists about the consequences of industrialization in Britain.
- Walton, Whitney. *France and the Crystal Palace: Bourgeois Taste and Artisan Manufacture in the 19th Century*. 1992. Examines the gradual transformation of handicraft techniques and their persistent importance in the international economy.

Notes

1. N. F. R. Crafts, *British Economic Growth During the Industrial Revolution* (Oxford: Oxford University Press, 1985), p. 32.
2. P. Bairoch, "International Industrialization Levels from 1750 to 1980," *Journal of European Economic History* 11 (Spring 1982): 269–333.
3. Crafts, *British Economic Growth*, pp. 45, 95–102.
4. Quoted by J. Bowditch and C. Ramsland, eds., *Voices of the Industrial Revolution* (Ann Arbor: University of Michigan Press, 1961), p. 55, from the fourth edition of Thomas Malthus, *Essay on the Principle of Population* (1807).
5. M. Lévy-Leboyer, *Les banques européennes et l'industrialisation dans la première moitié du XIXe siècle* (Paris: Presses Universitaires de France, 1964), p. 29.
6. Friedrich List, *The National System of Political Economy*, trans. G. A. Matile (Philadelphia: J. B. Lippincott, 1856), p. 61; edited slightly.
7. J. Michelet, *The People*, trans. with an introduction by J. P. McKay (Urbana: University of Illinois Press, 1973; original publication, 1846), p. 64.
8. Quoted in W. A. Hayek, ed., *Capitalism and the Historians* (Chicago: University of Chicago Press, 1954), p. 126.
9. Crafts, *British Economic Growth*, p. 95.
10. H.-J. Voth, *Time and Work in England, 1750–1830* (Oxford: Oxford University Press, 2000), pp. 268–270; also pp. 118–133.
11. Quoted in E. R. Pike, *"Hard Times": Human Documents of the Industrial Revolution* (New York: Praeger, 1966), p. 109.
12. See especially J. Brenner and M. Rama, "Rethinking Women's Oppression," *New Left Review* 144 (March–April 1984): 33–71, and sources cited there.
13. J. Humphries, "... 'The Most Free from Objection' ...: The Sexual Division of Labor and Women's Work in Nineteenth-Century England," *Journal of Economic History* 47 (December 1987): 948.
14. *Ibid.*, p. 941; Pike, *"Hard Times,"* p. 266.
15. Pike, *"Hard Times,"* p. 208.
16. Quoted in D. Geary, ed., *Labour and Socialist Movements in Europe Before 1914* (Oxford: Berg, 1989), p. 29.

Key Terms

Industrial Revolution
(p. 656)
spinning jenny (p. 657)
water frame (p. 657)
steam engines (p. 660)
Rocket (p. 663)
Crystal Palace (p. 664)
iron law of wages (p. 665)
tariff protection (p. 670)
economic nationalism
(p. 672)
class-consciousness
(p. 672)
Luddites (p. 674)
Factory Act of 1833 (p. 678)
separate spheres (p. 679)
Mines Act of 1842 (p. 680)
Combination Acts (p. 680)

For practice quizzes and other study tools, visit the Online Study Guide at bedfordstmartins.com/mckaywest.

For primary sources from this period, see *Sources of Western Society, Second Edition*.

For Web sites, images, and documents related to topics in this chapter, visit Make History at bedfordstmartins.com/mckaywest.

REVIEW and EXPLORE

MAKE IT STICK



LearningCurve

After reading the chapter, go online and use LearningCurve to retain what you've read.

Identify Key Terms

Identify and explain the significance of each item below.

Industrial Revolution (p. 651)

spinning jenny (p. 652)

water frame (p. 652)

steam engines (p. 654)

Rocket (p. 657)

Crystal Palace (p. 660)

iron law of wages (p. 661)

tariff protection (p. 665)

Factory Acts (p. 669)

separate spheres (p. 670)

Mines Act of 1842 (p. 673)

class-consciousness (p. 674)

Luddites (p. 676)

Combination Acts (p. 677)

Review the Main Ideas

Answer the focus questions from each section of the chapter.

- ◆ What were the origins of the Industrial Revolution in Britain, and how did it develop between 1780 and 1850? (p. 650)
- ◆ How did countries outside of Britain respond to the challenge of industrialization? (p. 661)
- ◆ How did work evolve during the Industrial Revolution, and how did daily life change for working people? (p. 667)
- ◆ How did the changes brought about by the Industrial Revolution lead to new social classes, and how did people respond to the new structure? (p. 674)

Make Connections

Think about the larger developments and continuities within and across chapters.

1. Why did Great Britain take the lead in industrialization, and when did other countries begin to adopt the new techniques and organization of production?
2. How did the achievements in agriculture and rural industry of the late seventeenth and eighteenth centuries (Chapter 17) pave the way for the Industrial Revolution of the late eighteenth century?
3. How would you compare the legacy of the political revolutions of the late eighteenth century (Chapter 19) with the Industrial Revolution? Which seems to you to have created the most important changes, and why?

ONLINE DOCUMENT ASSIGNMENT

Josiah Wedgwood

How did observers of early industrialization imagine the relationship between workers and their work, and between workers and their employers?

You encountered Josiah Wedgwood's story on page 656. Keeping the question above in mind, go to the Integrated Media and explore different views on the impact of industrial production on individual workers in light of Wedgwood's approach to industrial labor. Then complete a writing assignment based on the evidence and details from this chapter.

Suggested Reading and Media Resources

BOOKS

- Allen, Robert C. *The British Industrial Revolution in Global Perspective*. 2010. Explains the origins of the Industrial Revolution and why it took place in Britain and not elsewhere.
- Davidoff, Leonore, and Catherine Hall. *Family Fortunes: Men and Women of the English Middle Class, 1750–1850*, rev. ed. 2003. Examines both economic activities and cultural beliefs with great skill.
- Dolan, Brian. *Wedgwood: The First Tycoon*. 2004. A comprehensive study of the famous entrepreneur.
- Griffin, Emma. *A Short History of the British Industrial Revolution*. 2010. An accessible and lively introduction to the subject.
- Horn, Jeff, Leonard N. Rosenband, and Merritt Roe Smith. *Reconceptualizing the Industrial Revolution*. 2010. A collection of essays by leading scholars that re-examines the most contentious debates in the field.
- Humphries, Jane. *Childhood and Child Labour in the British Industrial Revolution*. 2010. A moving account of the experience of children during the Industrial Revolution, based on numerous autobiographies.
- James, Harold. *Family Capitalism*. 2006. A study of the entrepreneurial dynasties of the British Industrial Revolution.
- Mokyr, Joel. *The Enlightened Economy: An Economic History of Britain, 1700–1850*. 2009. A masterful explanation of industrialization and economic growth in Britain that emphasizes the impact of Enlightenment openness and curiosity.
- Pomeranz, Kenneth. *The Great Divergence: China, Europe, and the Making of the Modern World Economy*. 2000. A sophisticated reconsideration of why western Europe underwent industrialization and China did not.
- Prados de la Escosura, Leandro, ed. *Exceptionalism and Industrialisation: Britain and Its European Rivals, 1688–1815*. 2004. Compares the path toward economic development in Britain and the rest of Europe.

DOCUMENTARIES

- *Engineering an Empire: Britain: Blood and Steel* (History Channel, 2006). Examines the feats of engineering from the Industrial Revolution onward that led to Britain's imperial expansion.
- *Great Victorian Railway Journeys: How Modern Britain Was Built by Victorian Steam Power* (BBC, 2012). A popular British television series re-creates five journeys by train from the Victorian era, showing the impact of rail travel on English culture and society.
- *Mill Times* (PBS, 2006). A combination of documentary video and animated re-enactments that tell the story of the mechanization of the cotton industry in Britain and the United States.

FEATURE FILMS AND TELEVISION

- *Germinal* (Claude Berri, 1993). In a European coal-mining town during the Industrial Revolution, exploited workers go on strike and encounter brutal repression from the authorities.
- *Hard Times* (Granada TV, 1977). A four-hour miniseries adaptation of Charles Dickens's famous novel about the bitter life of mill workers in England during the Industrial Revolution.
- *Oliver Twist* (Roman Polanski, 2005). A film based on a novel by Charles Dickens depicting the harsh conditions of life for orphans and poor children in nineteenth-century London.

WEB SITES

- *Industrial Revolution*. A collection of primary sources on the Industrial Revolution at the Fordham University Internet Modern History Sourcebook.
www.fordham.edu/halsall/mod/modsbook14.asp
- *Spinning the Web*. A Web site offering comprehensive information on the people, places, industrial processes, and products involved in the mechanization of the British cotton industry.
www.spinningtheweb.org.uk/industry
- *Women Working, 1800–1930*. A digital collection of the Harvard University Library, with sources and links related to women's labor in the nineteenth and early twentieth centuries.
ocp.hul.harvard.edu/ww