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The Revolution in Energy and Industry

ca. 1780–1850

While revolutions in France and across the Atlantic were opening a new political era, another revolution was beginning to transform economic and social life. The Industrial Revolution took off around 1780 in Great Britain and soon began to influence continental Europe and the United States. Industrialization 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. Quite possibly only the development of agriculture during Neolithic times had a comparable impact and significance.

What was revolutionary about the Industrial Revolution was not its pace or that it represented a sharp break with the previous period. On the contrary, the Industrial Revolution built on earlier developments and the rate of progress was slow. What was remarkable about the Industrial Revolution was that it inaugurated a period of sustained and continuous economic growth that has continued to the present day. Although it took time, the Industrial Revolution eventually helped ordinary people in the West gain a higher standard of living as the widespread poverty of preindustrial Europe gradually receded. It also allowed for an unprecedented continuous growth in population, which persists to this day.

Such fundamental transitions did not occur overnight. National wealth rose much more quickly than improvements in the European standard of living until about 1850. This was because, even in Britain, only a few key industries experienced a technological revolution. Many more industries continued to use old methods. In addition, wage increases were modest until the mid-nineteenth century, and the gradual withdrawal of children and married women from paid work meant that the household as a whole earned the same or less.

Early progress in industrialization allowed Britain and other Western nations to increase their economic and political dominance over other regions of the world. ■



Life in the Industrial Revolution. Daily life for industrial workers was harsh, especially for the many child laborers who worked in the new factories and in other industries, like the glassworks pictured here. Long hours of work, strict discipline, and low wages were the lot of most industrial workers, whose living standards did not improve until the 1840s. (© Museum of London/HIP/The Image Works)

CHAPTER PREVIEW



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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 Beyond Britain

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New Patterns of Working and Living

How did work evolve during the Industrial Revolution, and how did daily life change for working people?

Relations Between Capital and Labor

How did the changes brought about by the Industrial Revolution lead to new social classes, and how did people respond to the new structure?

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, the nation created in 1707 by the formal union of Scotland, Wales, and England. The transformation in industry was something new in history, and it was unplanned. With no models to copy and no idea of what to expect, Britain pioneered not only in industrial technology but also in social relations and urban living. Just as France was a trailblazer in political change, Britain was the leader in economic development, and it must therefore command special attention.

Origins of the British Industrial Revolution

Although many aspects of the origins of the British Industrial Revolution are still matters for scholarly debate, it is generally agreed that industrial changes grew out of a long process of development. The Scientific Revolution and Enlightenment fostered a new worldview that embraced progress and the role of research and experimentation in understanding and mastering the natural world. The British Royal Society of Arts, for example, sponsored prizes for innovations in machinery and agriculture and played a pivotal part in the circulation of “useful knowledge.” Britain’s vibrant scientific and Enlightenment culture allowed British industrialists to exploit the latest findings of scientists and technicians from other countries.

In the economic realm, the seventeenth-century expansion of English woolen cloth exports throughout Europe brought commercial profits and high wages to the detriment of traditional producers in Flanders and Italy. By the eighteenth century the expanding Atlantic economy and trade with India and China were also serving Britain well. The mercantilist colonial empire Britain aggressively built, augmented by a strong position in Latin America and in the African slave trade, provided raw materials like cotton and a growing market for British goods (see Chapter 17). Strong demand for British

manufacturing meant that British workers earned high wages compared to the rest of Europe.

Agriculture also played an important 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. The result was a period of bountiful crops and low food prices. Because of increasing efficiency, landowners were able to produce more food with a smaller workforce. By the mid-eighteenth century, on the eve of the Industrial Revolution, less than half of Britain’s population worked in agriculture. The enclosure movement had deprived many small landowners of their land, leaving the landless poor to work as hired agricultural laborers or in cottage industry. These groups created a large pool of potential laborers for the new factories.

Abundant food and high wages meant that the ordinary English family no longer had 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. They could also pay to send their children to school. Britain’s populace enjoyed high levels of literacy and numeracy (knowledge of mathematics) compared to the rest of Europe. Moreover, in the eighteenth century the members of the average British family were redirecting their labor away from unpaid work for household consumption and toward work for wages that they could spend on goods, a trend reflecting the increasing commercialization of the entire European economy.

Britain also benefited from rich natural resources and a well-developed infrastructure. 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 enhanced this 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. The abundance of coal combined with high wages in manufacturing placed Britain in a unique position among European nations: its manufacturers had extremely strong incentives to develop technologies to draw on the power of coal to increase workmen’s productivity.

A final factor favoring British industrialization was the heavy hand of the British state and its policies, especially in the formative decades of in-

Cottage Industry and Transportation in Great Britain in the 1700s



dustrial change. Despite its rhetoric in favor of “liberty,” Britain’s parliamentary system taxed its population aggressively. The British state collected twice as much per capita as the supposedly “absolutist” French monarchy and spent the money on a navy to protect imperial commerce and on an army that could be used to quell uprisings by disgruntled workers. Starting with the Navigation Acts under Oliver Cromwell (see Chapter 15), the British state also adopted aggressive tariffs, or duties, on imported goods to protect its industries.

All these factors combined to initiate the **Industrial Revolution**, a term first coined in 1799 to describe the burst of major inventions and technical changes under way. 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 (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 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 much longer process than the political upheavals of the French Revolution. It was not complete in Britain until 1850 at the earliest, and it did not reach the continent as a whole until after 1815. It spread beyond Europe in the second half of the nineteenth century.

Technological Innovations and Early Factories

The pressure to produce more goods for a growing market and to reduce the labor costs of manufacturing was directly related to the first decisive breakthrough of the Industrial Revolution: the creation of the world’s first machine-powered 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. This was not the first time in European history that large numbers of people were systematically put to work in a single locale; the military arsenals of late medieval Venice are one example of a much older form of “factory.” The crucial innovation in Britain was the introduction of

machine power into the factory and the organization of labor around the functioning of highly productive machines.

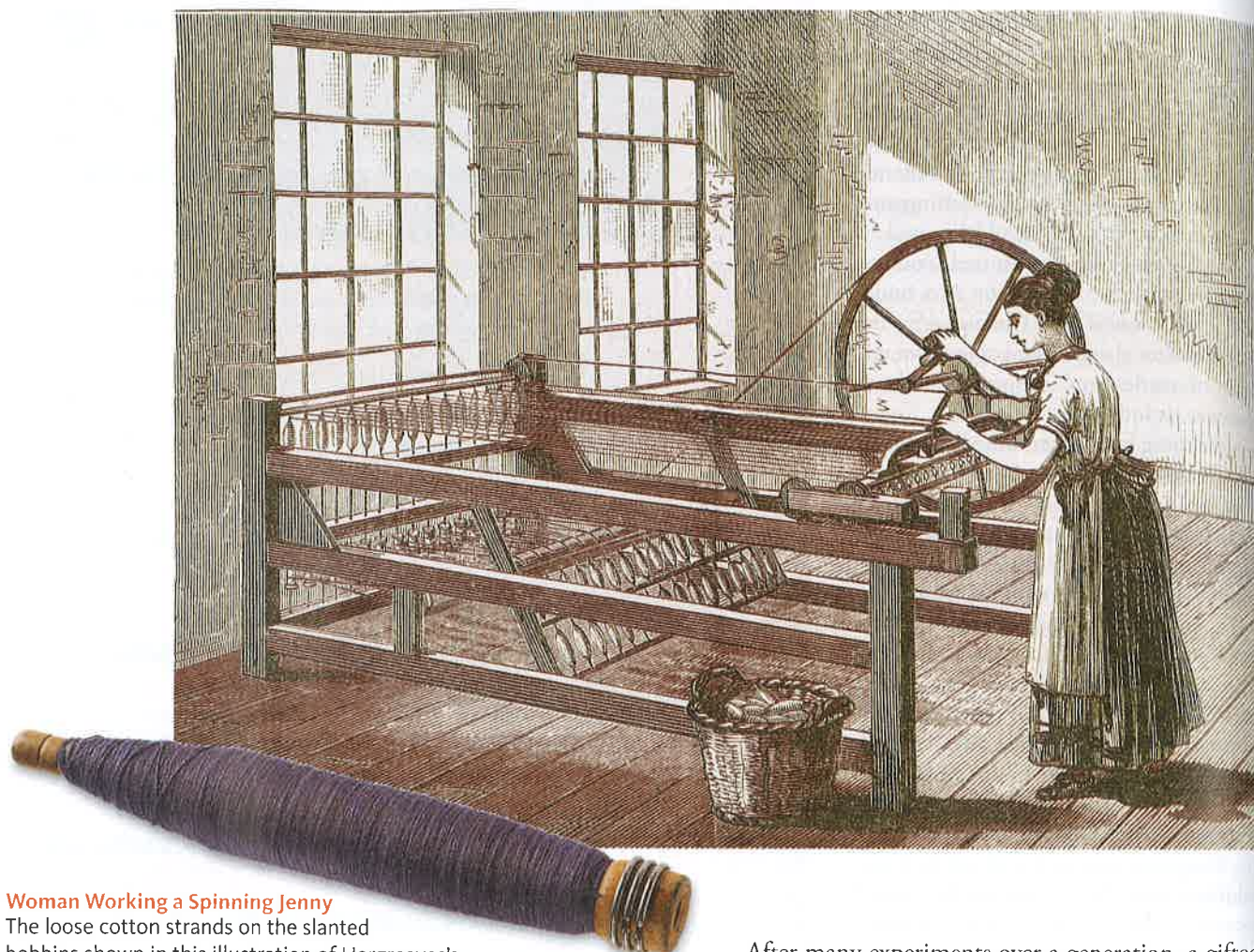
The putting-out system that developed in the seventeenth-century textile industry involved a merchant who loaned, or “put out,” raw materials to cottage workers who processed the raw materials in their own homes and returned the finished products to the merchant. There was always a serious imbalance in textile production based on cottage industry: the work of four or five spinners was needed to keep one weaver steadily employed. Cloth weavers constantly had to find more thread and more spinners. During the eighteenth century the putting-out system grew across Europe, but most extensively in Britain. There, pressured by growing demand, the system’s limitations began to outweigh its advantages around 1760.

Industrial Revolution

A term first coined in 1799 to describe the burst of major inventions and economic expansion that began in Britain in the late eighteenth century.

Chronology

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 Britain
1799	Combination Acts passed
1802–1833	Series of Factory Acts passed by British government to limit the workday of child laborers and set minimum hygiene and safety requirements
1810	Strike of Manchester cotton spinners
ca. 1815	Western European countries seek to adopt British industrial methods
1824	Combination Acts repealed
1829	Stephenson introduces the <i>Rocket</i> , an early locomotive
1830s	Industrial banks in Belgium
1834	<i>Zollverein</i> erected among most German states
1842	Mines Act passed in Britain
1844	Engels publishes <i>The Condition of the Working Class in England</i>
1850s	Japan begins to adopt Western technologies; industrial gap widens between the West and the rest of the world
1851	Great Exhibition held at Crystal Palace in London
1860s	Germany and the United States begin to rapidly industrialize



Woman Working a Spinning Jenny

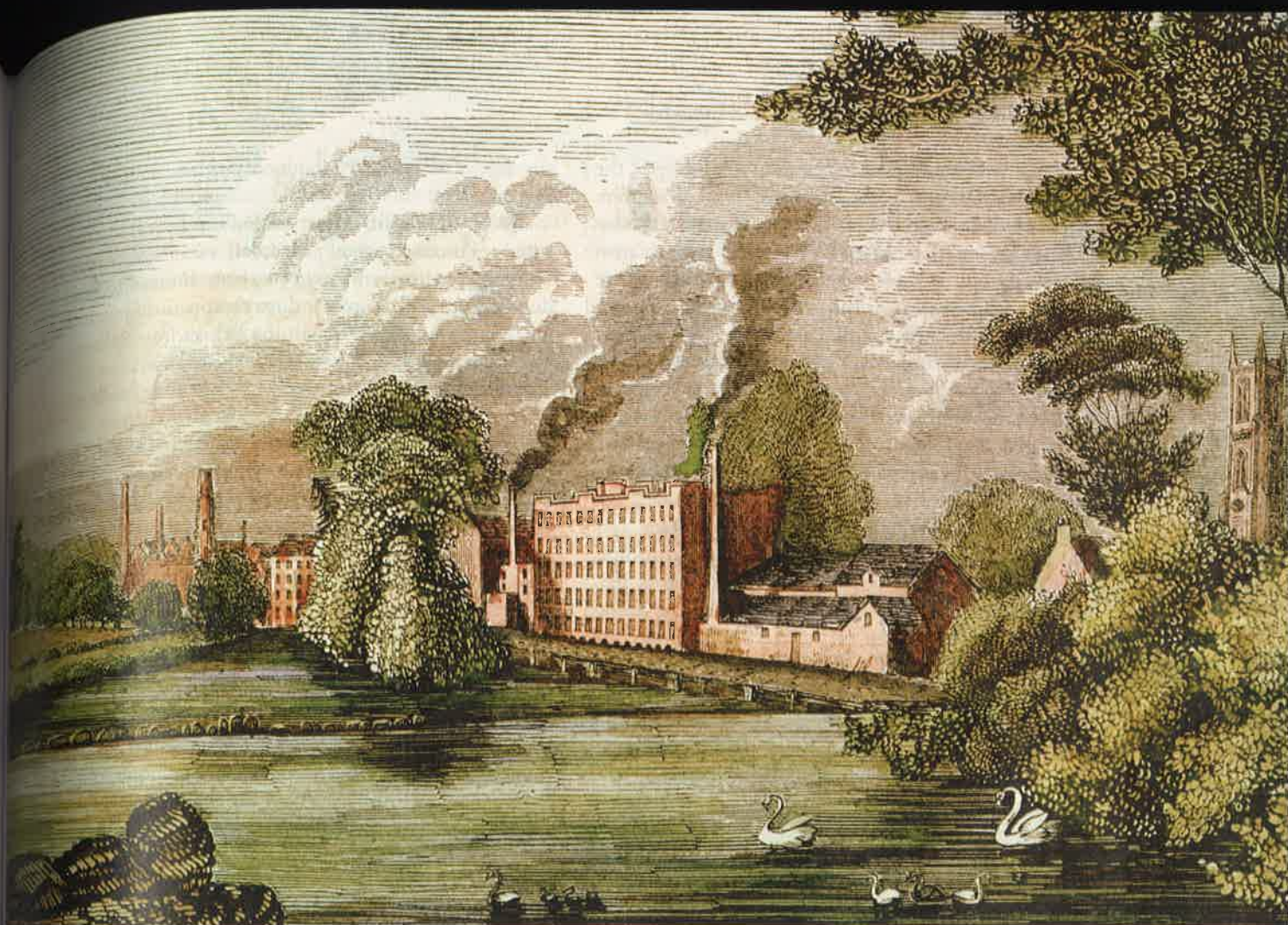
The loose cotton strands on the slanted bobbins shown in this illustration of Hargreaves's spinning jenny passed up to the sliding carriage and then on to the spindles (inset) in back for fine spinning. The worker, almost always a woman, regulated the sliding carriage with one hand, and with the other 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)

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. In the eighteenth century a lively market for cotton cloth emerged in West Africa, where the English and other Europeans traded it in exchange for slaves. By 1760 a tiny domestic cotton industry had emerged in northern England, but it could not compete with cloth produced by low-paid workers in India and other parts of Asia. International competition thus drove English entrepreneurs to invent new technologies to bring down labor costs.

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 breakthroughs 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. In early models from six to twenty-four spindles were mounted on a sliding carriage, and each spindle spun a fine, slender thread. The machines were usually worked by women, who moved the carriage back and forth with one hand and turned a wheel to supply power with the other. Now it was the male weaver who could not keep up with the vastly more efficient female spinner.

Arkwright's **water frame** employed a different principle. It quickly acquired a capacity of several hundred spindles and demanded much more power than a single operator could provide. A solution was found in



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 late eighteenth century. (© The Art Gallery Collection/Alamy)

waterpower. The water frame required large specialized mills to take advantage of the rushing currents of streams and rivers. The factories they powered employed as many as one thousand workers from the very beginning. The water frame did not completely replace cottage industry, however, for it could spin only a coarse, strong thread, which was then put out for re-spinning on hand-operated cottage jennies. Around 1790 a hybrid machine invented by Samuel Crompton proved capable of spinning very fine and strong thread in large quantities. Gradually, all cotton spinning was concentrated in large-scale **water-powered** factories.

These revolutionary **developments** in the textile industry allowed British **manufacturers** to compete successfully in international **markets** in both fine and coarse cotton thread. At first, the machines were too expensive to build and did not provide enough savings in labor to be adopted in continental Europe or elsewhere. Where wages were low and investment capital was more scarce, there was little point in adopting mechanized production until significant increases in the machines' productivity, and a drop in the cost of

manufacturing them, occurred in the first decades of the nineteenth century.

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 income of weavers, now hard-pressed to keep up with the spinners, rose markedly until about 1792. They were among the highest-earning workers in England. As a result, large numbers of agricultural laborers became handloom 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 did not replace handlooms until the 1820s.

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.

Despite the significant increases in productivity, the working conditions in the early cotton factories were atrocious. Adult weavers and spinners were reluctant to leave the safety and freedom of work in their own homes to labor in noisy and dangerous factories where the air was filled with cotton fibers. Therefore, factory owners often turned to young orphans and 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 labored thirteen or fourteen hours a day for little or no pay. Harsh physical punishment maintained brutal discipline. Hours were appalling—commonly thirteen or fourteen hours a day, six days a week. To be sure, poor children typically worked long hours in many types of demanding jobs, but this wholesale coercion of orphans as factory apprentices constituted

exploitation on a truly unprecedented scale.

The creation of the world’s first machine-powered 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 begin-

ning of the Industrial Revolution in Britain. By 1831 the largely mechanized cotton textile industry accounted for fully 22 percent of the country’s entire industrial production.

The Steam Engine Breakthrough

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 medieval period Europeans began to adopt 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 them to accomplish more. Nevertheless, even into the eighteenth century Europe, like other areas of the world, continued to rely mainly on wood for energy, and human beings and animals continued to perform most work. This dependence meant that Europe and

the rest of the world remained poor in energy and power.

By the eighteenth century wood was in ever-shorter supply. 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. Vast forests enabled Russia in the eighteenth century to become the world’s leading producer of iron, much of which was exported to Britain. As wood became ever more scarce, the British looked to coal as an alternative. They had first used coal 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 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.

To produce more coal, mines had to be 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 1763 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. Scotland’s Enlightenment emphasis on practicality and social progress had resulted in its universities becoming pioneers in technical education. In 1763 Watt was called on to repair a Newcomen engine being used in a physics course. After a series of observations, Watt saw 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 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 656.) Among Britain’s highly skilled locksmiths, tinsmiths, and millwrights, Watt found

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.

ca. 1780–1850

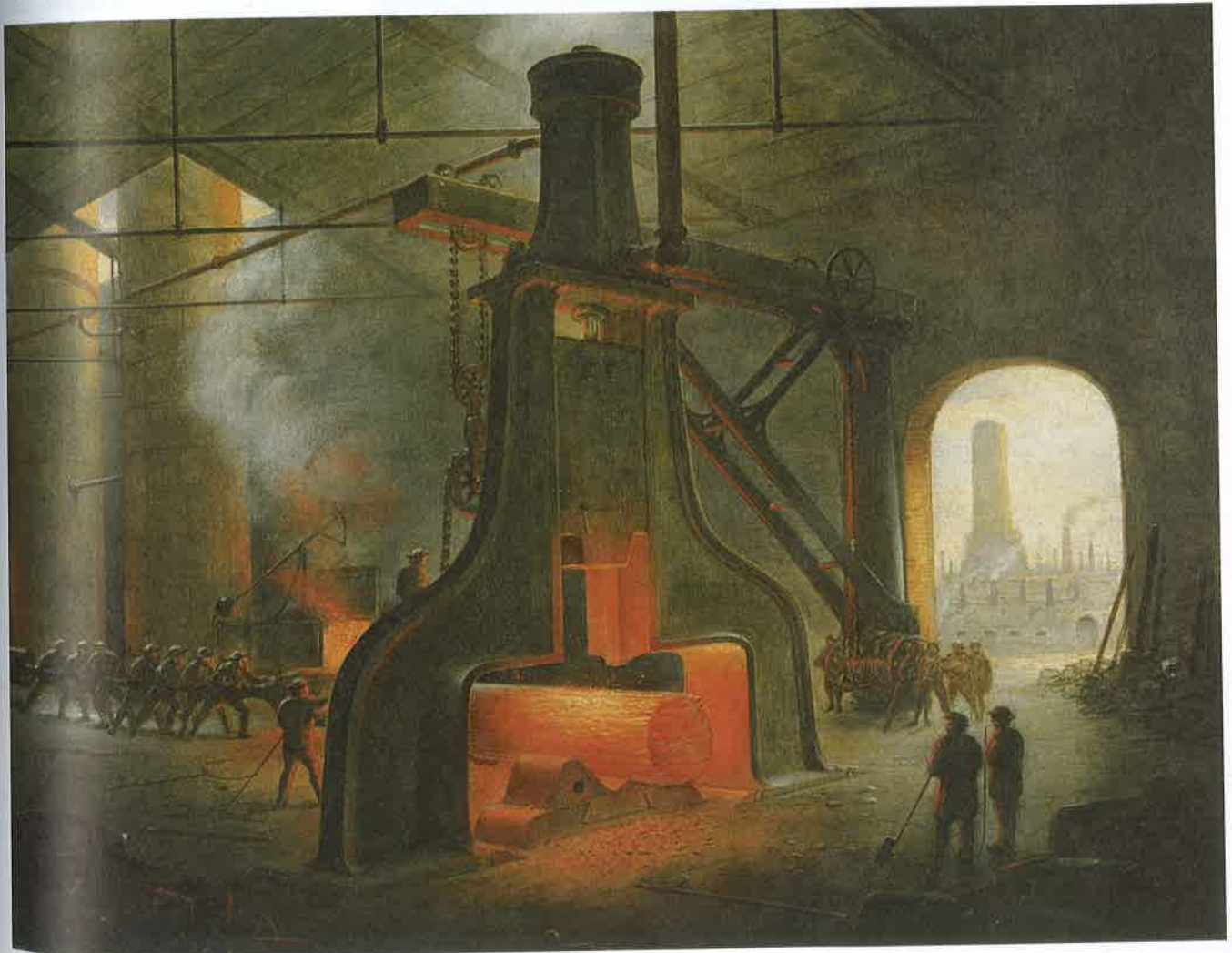
mechanics who could install, regulate, and repair his sophisticated engines. From ingenious manufacturers such as the cannonmaker John Wilkinson, Watt was gradually able to purchase precision parts. This support allowed him to create an effective vacuum in the condenser and regulate a complex engine. 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 coal-burning 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.

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. The steam-power plant began to replace waterpower in cotton-spinning factories 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 sugarcane.

Coal and steam power promoted important breakthroughs in other industries. The British iron industry was radically transformed. Originally, the smoke and fumes resulting from coal burning meant that coal could not be used as a cheap substitute for expensive charcoal in smelting iron. Starting around 1710,

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)



INDIVIDUALS IN SOCIETY

Josiah Wedgwood

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.

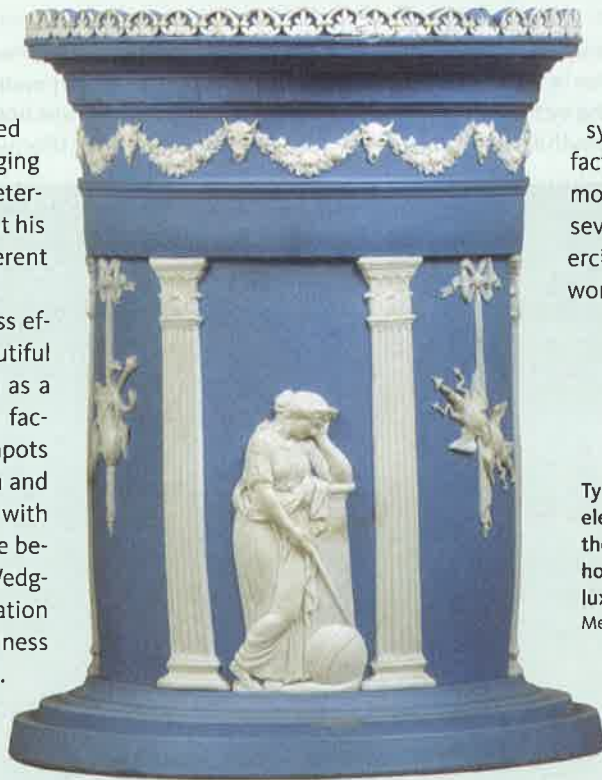
In 1759, after five years of tireless efforts, Wedgwood perfected a beautiful new green glaze. Now established as a master potter, he opened his own factory and began manufacturing teapots and tableware finished in his green and other unique glazes, or adorned with printed scenes far superior to those 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 trendsetting 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 rediscovery 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 hundred workers in several departments, Wedgwood exercised tremendous control over his workforce, imposing fines for many



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)



ONLINE DOCUMENT ASSIGNMENT

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



Josiah Wedgwood, who perfected jasperware, a fine-grained pottery usually made in "Wedgwood blue" with white decoration. (Down House, Downe, Kent, UK/© English Heritage Photo Library/The Bridgeman Art Library)

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?

ironmakers began to use coke—a smokeless and hot-burning fuel produced by heating coal to rid it of water and other impurities—to smelt pig iron. After 1770 the adoption of steam-driven bellows in blast furnaces allowed for great increases in the quantity of pig iron produced by British ironmakers. 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 steam-powered rolling mills, which were capable of turning 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. Once expensive, iron became the cheap, basic, indispensable building block of the economy.

The Coming of the Railroads

The coal industry had long used plank roads and rails to move coal wagons. Rails reduced friction and allowed a horse or a human being to pull a much 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.

The first steam locomotive was built by Richard Trevithick after much experimentation. George Stephenson acquired glory for his locomotive named *Rocket*, which sped down the track of the just-completed Liverpool and Manchester Railway at a maximum speed of 24 miles per hour in 1829. (See "Living in the Past: The Steam Age," page 658.) The line from Liverpool to Manchester was a financial as well as a technical success, and many private companies quickly emerged to build more rail lines. Within twenty years they had completed the main trunk lines of Great Britain (Map 20.1). Other countries were quick to follow, with the first steam-powered trains operating in the United States in the 1830s and in Brazil, Chile, Argentina, and the British colonies of Canada, Australia, and India in the 1850s.

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

Rocket The name given to George Stephenson's effective locomotive that was first tested in 1829 on the Liverpool and Manchester Railway at 24 miles per hour.

LIVING IN THE PAST

The Steam Age

On Tuesday, October 6, 1829, a huge crowd gathered at the small town of Rainhill in northern England. Pedestrians and horse-drawn carriages jostled for space as a band played and the Union Jack waved. The occasion was a race over a newly laid two-mile stretch of track sponsored by the Liverpool and Manchester Railway Company. The victor was the *Rocket*, a locomotive designed by George Stephenson, the company's chief engineer, a man of modest origins who had no formal schooling. Pulling heavy wagons, *Rocket* first achieved over 13 miles per hour and then astounded the crowds by whizzing by at 24 miles per hour when the wagons were detached. It was probably the fastest a vehicle had traveled in history.*

The last and culminating invention of the Industrial Revolution, the railroad dramatically revealed the power and increased the speed of the new age. Until the coming of the railroad, travel was largely measured by the distance that a human or a horse could cover before becoming exhausted. Steam power created a revolution in human transportation, allowing a constant, rapid rate of travel with no limits on its duration. Time and space suddenly and drastically contracted, as faraway places could be reached in one-third the time or less. As the poet Heinrich Heine proclaimed in 1843, "What changes must now occur, in our way of looking at things, in our notions! . . . I feel as if the mountains and forests of all countries were advancing on Paris. Even now, I can smell the German linden trees; the North Sea's breakers are rolling against my door."†

Racing down the track at speeds that reached 50 miles per hour by 1850 was an overwhelming experience. Some great painters, notably Joseph M. W. Turner (1775–1851) and Claude Monet (1840–1926), succeeded in expressing this sense of power and awe. Contemporary novelists also recorded their impressions of early train travel, as in this striking passage by Charles Dickens: "Through the hollow, on the height, by the heath, by the orchard, by the park, by the garden, over the canal, across the river, where the sheep are feeding, where the mill is going, where the barge is floating,

LONDON TO FOLKSTONE IN 3 HOURS.

LONDON & DOVER RAILWAY

LONDON AND FOLKSTONE TIME TABLE.

FROM LONDON	TO FOLKSTONE	FROM FOLKSTONE	TO LONDON
8 0 A.M. Fast	7 30 A.M. 3 rd Cl.	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 —
5 30 —	—	6 35 —	—
8 30 — Fast	—	8 25 —	—
12 0 — Goods only	—	11 5 —	—

From London: 1st Class 15s., 2nd Class 10s., 3rd Class 5s. From Folkestone: 1st Class 15s., 2nd Class 10s., 3rd Class 5s.

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)

where the dead are lying, where the factory is smoking, where the stream is running, where the village clusters . . . away with a strike and a roar and a rattle, and no trace to leave behind but dust and vapour."‡ After surviving a terrible railroad crash, Dickens himself developed an intense

*Christopher McGowan, *Rail, Steam, and Speed: The "Rocket" and the Birth of Steam Locomotion* (New York: Columbia University Press, 2004), p. 21.

†Quoted in Wolfgang Schivelbusch, *The Railway Journey: The Industrialization of Time and Space in the Nineteenth Century* (Berkeley: University of California Press, 1986), p. 37.

‡Charles Dickens, *Dombey and Son* (Ware, U.K.: Wordsworth Editions, 1999), p. 262.



Turner's *Rain, Steam, and Speed*. This 1844 painting captures the rush of an oncoming train as it swoops across the Maidenhead railway bridge on a rainy day. (National Gallery, London, UK/The Bridgeman Art Library)

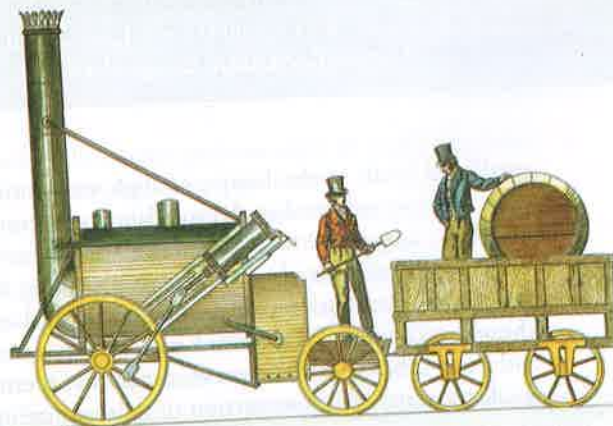
fear of train travel. The increase in speed also led doctors to worry about the effects of the constant noise and vibration on passengers and crew.

Despite these concerns, the railroad quickly became a central institution of society. So did the massive new train stations, the cathedrals of the industrial age. Leading railway 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.

QUESTIONS FOR ANALYSIS

1. Why was the train so revolutionary? What evidence is provided here for contemporaries' perceptions of train travel?
2. Why is the train less important in today's culture?

THE LOCOMOTIVE STEAM ENGINES.
WHICH COMPETED FOR THE PRIZE OF £500 OFFERED BY THE DIRECTORS OF THE LIVERPOOL AND MANCHESTER RAILWAY COMPANY,
DRAWN TO A SCALE OF 1 INCH TO A FOOT.



THE 'ROCKET' OF MR. ROBT STEPHENSON OF NEWCASTLE.
WHICH DRAWING A LOAD EQUIVALENT TO THREE THOUSAND WEIGHT TRAVELLED AT THE RATE OF TEN MILES AN HOUR, AND WITH A CONSUMPTION OF STEAM AT THE RATE OF 25 MILES,
COST PER MILE FOR FUEL ABOUT THREE HALFPENCE.

An advertisement announcing the *Rocket* as winner of the 1829 Liverpool and Manchester Railway race for the fastest locomotive. (The Granger Collection, New York)



Map 20.1 The Industrial Revolution in Great Britain, 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.

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.

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

Water travel was also transformed by the steam engine. French engineers completed the

first steam ships in the 1770s, and the first commercial steam ships came into use in North America several decades later. The *Clermont* began to travel the waters of the Hudson River in New York State in 1807, shortly followed by ships belonging to brewer John Molson on the St. Lawrence River.

Industry and Population

In 1851 London hosted an industrial fair called the Great Exhibition in the newly built **Crystal Palace**. 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. Sponsored by the British royal family, the exhibition celebrated the new era of industrial technology and the kingdom's role as world economic leader.

Britain's claim to be the "workshop of the world" was no idle boast, for it produced two-thirds of the world's coal and more than half of all iron and cotton cloth. More generally, in 1860 Britain produced a remarkable 20 percent of the entire world's output of industrial goods, whereas it had produced only about 2 percent of the total in 1750.² 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. 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.

Rapid population growth in Britain was key to industrial development. More people meant a more mobile labor force, with many young workers in need of employment and ready to go where the jobs were. Sustaining the dramatic increase in population, in turn, was only possible through advances in production in agriculture and industry. Based on the lessons of history, many contemporaries feared that the rapid growth in population would inevitably lead to disaster. In his *Essay on the Principle of Population* (1798), Thomas Malthus (1766–1834) examined the dynamics of human populations. He argued:

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.³

Given the limited resources available, Malthus concluded that the only hope of warding off such "positive

ca. 1780–1850

Lid to a Souvenir Pot Showing the Crystal Palace

The 6 million visitors to the Crystal Palace Exhibition created an enormous market for souvenirs picturing the Crystal Palace. The handsome depiction shown here brightened the lid of a ceramic pot. (Fitzwilliam Museum, Cambridge University, UK/Bridgeman Giraudon/The Bridgeman Art Library)



checks” to population growth as famine and disease was “prudential restraint.” That is, young men and women had to limit the growth of population by marrying late in life. But Malthus was not optimistic about this possibility. The powerful attraction of the sexes, he feared, would cause most people to marry early and have many children.

Economist David Ricardo (1772–1823) spelled out the pessimistic implications of Malthus’s thought. Ricardo’s depressing **iron law of wages** posited that over an extended period of time, 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.

Malthus, Ricardo, and their followers were proved wrong in the long run, largely because industrialization improved productivity beyond what they could imagine. 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. 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 beyond the British Isles.

Industrialization Beyond Britain

How did countries outside of Britain respond to the challenge of industrialization?

As new technologies and new ways of employing labor began to revolutionize production in Britain, other countries took notice and began to emulate its example. With the end of the Napoleonic Wars, the countries of the European continent quickly adopted British inventions and achieved their own pattern of technological innovation and economic growth. By the last decades of the nineteenth century, western European countries as well as the United States and Japan had industrialized their economies to a considerable, albeit variable, degree.

Outside of western Europe industrialization proceeded more

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.

gradually, with uneven jerks and national and regional variations. Scholars are still struggling to explain these variations as well as the dramatic gap that emerged for the first time in history between Western and non-Western levels of economic production. These questions are especially important because they may offer valuable lessons for poor countries that today are seeking to improve their material condition through industrialization and economic development. The latest findings on the nineteenth-century experience are encouraging. They suggest that there were alternative paths to the industrial world and that there was and is no need to follow a rigid, predetermined British model.

National and International Variations

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, but they reflect basic trends and are presented in Table 20.1 for closer study.

Table 20.1 presents a comparison of how much industrial product was produced, on average, for each person in a given country in a given year. All the numbers are expressed in terms of a single index number of 100, which equals the per capita level of industrial goods in Great Britain 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 tell us? First, one sees in the first column that in 1750 all countries were fairly close together, including non-Western nations such as China and India. Both China and India had been extremely important players in early modern world trade, earning high profits from exporting their luxury goods (see Chapter 14). However, the column headed 1800 shows that Britain had opened up a noticeable lead over all countries by 1800, and that gap progressively widened as the Industrial Revolution accelerated through 1830 and reached full maturity by 1860.

Second, the table shows that Western countries began to emulate the British model successfully over the course of the nineteenth century, with significant variations in the timing and in the extent of industrialization. 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. Its slow but steady growth—and continued dominance of the market in luxury goods using traditional artisanal techniques—was overshadowed by the spectacular rise of the German lands and the United States after 1860 in what has been termed the “second industrial revolution.” 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 managed to raise per capita industrial levels in the nineteenth century. These increases stood in stark contrast to the decreases that occurred at the same time in many non-Western countries, most notably in China and India, as Table 20.1 shows. European countries industrialized to a greater or lesser extent even as most of the non-Western world stagnated. Japan, which is not included in this table, stands out as an exceptional area of non-Western industrial growth in the second half of the nineteenth century. After the forced opening of the country to the West in the 1850s, Japanese entrepreneurs began to adopt Western technology and manufacturing methods, resulting in a production boom by

Table 20.1 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.

ca. 1780–1850

the late nineteenth century. Different 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.

Industrialization in Continental Europe

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 the European continent was close behind. During the period of the revolutionary and Napoleonic Wars, from 1793 to 1815, however, western Europe experienced tremendous political and social upheaval that temporarily halted economic development. With the return of peace in 1815, however, western European countries again began to play catch-up.

They faced significant challenges. In the newly mechanized industries, British goods were being produced very economically, and these goods had come to dominate world markets. In addition, British technology had become so advanced and complicated that 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. Continental business people had difficulty finding the large sums of money the new methods demanded, and laborers bitterly resisted the move to working in factories. All these factors slowed the spread of machine-powered industry (Map 20.2).

Nevertheless, western European nations possessed a number of advantages that helped them respond to their challenges. Most had a rich tradition of putting-out enterprise, which endowed them with experienced merchant capitalists and skilled urban artisans. Moreover, while British inventors and entrepreneurs had to discover and implement new technologies on their own, other nations could simply “borrow” the new methods developed in Great Britain. Such a tradition gave their firms the ability to adapt and survive in the face of new market conditions. European countries 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 would use the power of the state to promote industry and catch up with Britain.

Agents of Industrialization

Western European success in adopting British methods took place despite the best efforts of the British to prevent it. 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.

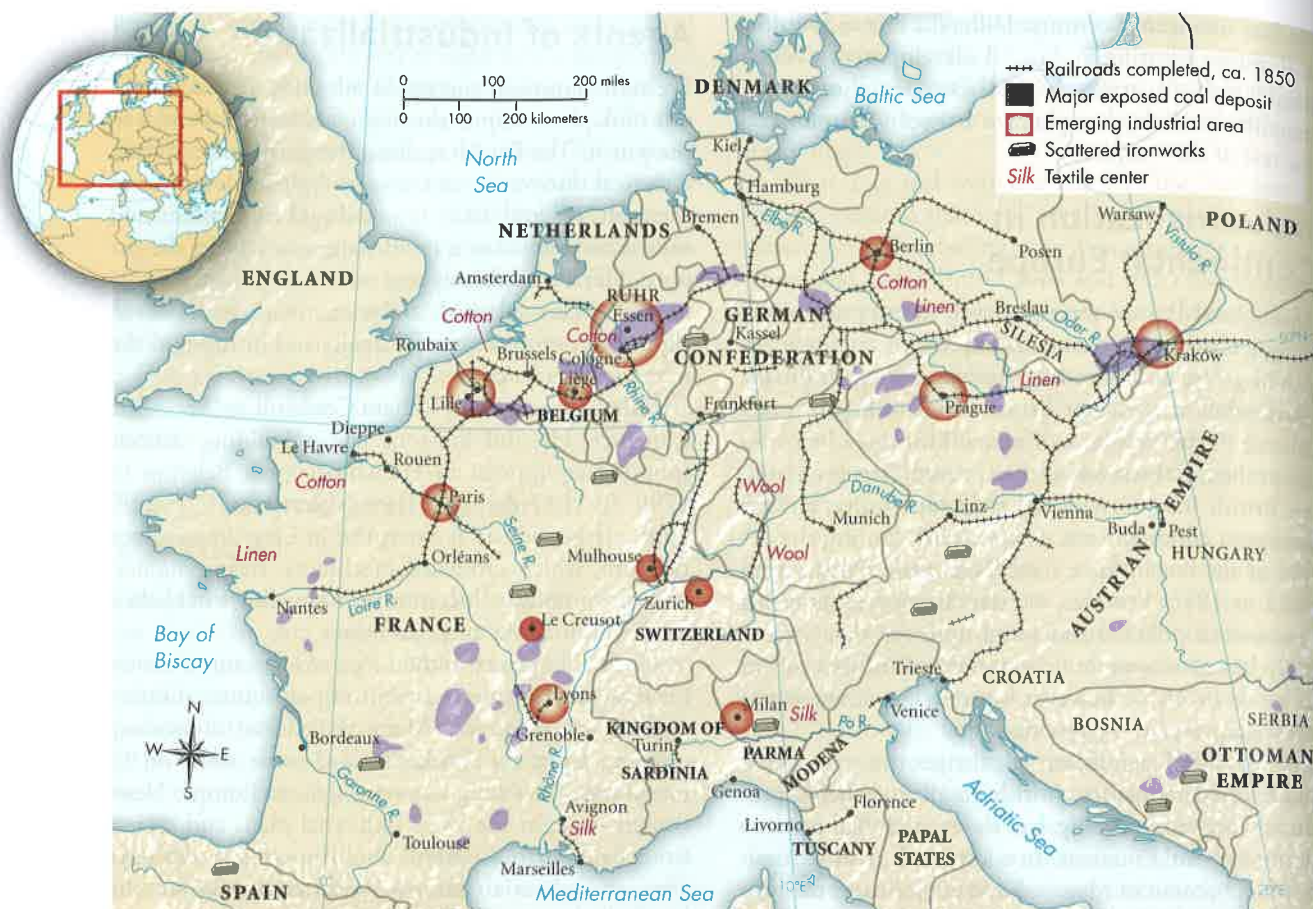
One such man was William Cockerill, a Lancashire carpenter. He and his sons began building cotton-spinning equipment in French-occupied Belgium in 1799. In 1817 the most famous son, John Cockerill, built a large industrial enterprise in Liège in southern Belgium, which produced machinery, steam engines,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

Cockerill's plants in the Liège area became a center for the gathering and transmitting of industrial information across Europe. Many skilled British workers came to work for Cockerill, and some went on to found their own companies throughout Europe. Newcomers brought the latest industrial plans and secrets from Britain, 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 consisted of talented entrepreneurs such as Fritz Harkort (1793–1880), a pioneer in the German machinery industry. Serving in England as a Prussian army officer during the Napoleonic Wars, Harkort was impressed with what he saw. He contrasted British achievements with the situation in the German-speaking lands, where some territories in the west, especially Prussia, were quite advanced, but much of the east lagged behind. Harkort set up shop building steam engines in the Ruhr Valley, on the western border with France.

Lacking skilled laborers, Harkort turned to Britain for experienced, though expensive, mechanics. Getting materials was also difficult. He had to import the thick iron boilers that he needed from England at great cost. In spite of all these problems, Harkort succeeded in building and selling engines. His ambitious efforts over sixteen years also resulted in large financial losses for himself and his partners. 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



MAPPING THE PAST

Map 20.2 Continental Industrialization, ca. 1850

Although continental countries were beginning to make progress by 1850, they still lagged far behind Great Britain. For example, continental railroad building was still in an early stage, whereas the British rail system was essentially complete (see Map 20.1). 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 Great Britain (see Map 20.1)?

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 increased foreign demand for silk scarves, embroidered needlework, perfumes, and fine wines. Many historians now emphasize that focusing on artisanal luxury production made sense for French entrepreneurs given their long history of dominance in that sector; rather

than being a “backward” refusal to modernize, it represented a sound strategic choice that allowed the French to capitalize on their know-how and international reputation.

Government Support and Corporate Banking

Just as the British government provided crucial support for the growth of industrialization, so did national governments in other parts of Europe. After 1815 west-

ca. 1780–1850

ern European states adopted a set of largely successful policies similar to those in Britain. **Tariff protection** was one such support. The French, for example, responded to a flood of cheap British goods in 1815 after the Napoleonic Wars by laying high tariffs on imported goods.

After 1815 continental governments also bore the cost of building roads, canals, and railroads to improve transportation. Belgium led the way in the 1830s and 1840s. 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. The Prussian government provided another kind of invaluable support for railroads. 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. In France, the state shouldered all the expense of acquiring and laying roadbed, including bridges and tunnels. In short, governments helped pay for railroads, the all-

important leading sector in continental industrialization.

German journalist and thinker Friedrich List (1789–1846) was a strong proponent of government support for industrialization. In the 1820s and 1830s List spent several years in the United States, where he observed the country's rapidly developing economy with great interest. He returned with the conviction that the growth of modern industry was of the utmost importance. For List, manufacturing was a primary means of increasing people's well-being and relieving their poverty. Moreover, he believed industrialization was essential to prevent the German states from falling behind the rest of the world. He wrote that the "wider the gap between the backward and advanced nations becomes, the more dangerous it is to remain behind."

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.

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)



The practical policies that List focused on were railroad building and the tariff. An early proponent of unifying the German lands, List supported the formation of a customs union, or *Zollverein* (TSOL-feh-rign), among the separate states. Such a tariff union came into being in 1818 and had spread to most of the German states by 1834, allowing goods to move between 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 develop and eventually hold their own against their more advanced British counterparts.

Finally, banks also played an important role in supporting development on the continent, more so than in Britain. Previously, almost all banks in Europe had been private. Because of the possibility of unlimited financial loss, the partners of private banks tended to be 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, if the bank went bankrupt, 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. Limited liability helped these Belgian banks attract investors. 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 the German lands 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 combined efforts of governments, skilled workers, entrepreneurs, and industrial banks meshed successfully after 1850. In Belgium, France, and the German states, 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 mastered the industrial technologies that had first been developed by the British. In the early 1870s Britain was still Europe's most industrial nation, but a select handful of nations had closed the gap. Western European countries—along with the United States—thus

became technological innovators in their own right and enjoyed sustained economic growth that made them the wealthiest nations in the world.

The Situation Outside of Europe

The Industrial Revolution did not have a transformative impact beyond Europe prior to the 1860s, with the exception of the United States and Japan, both early adopters of British practices. In many countries, national governments and pioneering entrepreneurs did make efforts to adopt the technologies and methods of production that had proved so successful in Britain, but they fell short of transitioning to an industrial economy. For example, in Russia the imperial government brought steamships to the Volga River and a railroad to the capital, St. Petersburg, in the first decades of the nineteenth century. By midcentury ambitious entrepreneurs had established steam-powered cotton factories using imported British machines. However, these advances did not lead to overall industrialization of the country, most of whose people remained mired in rural servitude. Instead, Russia confirmed its role as provider of raw materials, especially timber and grain, to the hungry West.

Egypt similarly began an ambitious program of modernization in the first decades of the nineteenth century, which included the use of imported British technology and experts in textile manufacture and other industries. These industries, however, could not compete with lower-priced European imports. Like Russia, Egypt fell back on agricultural exports to European markets, like sugar and cotton.

Such examples of faltering efforts at industrialization could be found in many other regions of the Middle East, Asia, and Latin America. Where European governments maintained direct or indirect political control, they acted to monopolize colonial markets as both sources of raw materials and consumers for their own products, rather than encouraging the spread of industrialization. Such regions could not respond to low-cost imports by raising tariffs, as the United States and western European nations had done, because they were controlled by imperial powers that did not allow them to do so. In India, millions of poor textile workers lost their livelihood because they could not compete with industrially produced British cottons. As a British trade encyclopedia boasted in 1844:

The British manufacturer brings the cotton of India from a distance of 12,000 miles, commits it to his spinning jennies and power-looms, carries back their products to the East, making them again to travel

ca. 1780–1850

12,000 miles; and in spite of the loss of time, and of the enormous expense incurred by this voyage of 24,000 miles, the cotton manufactured by his machinery becomes less costly than the cotton of India spun and woven by the hand near the field that produced it.⁴

Latin American countries were distracted from economic concerns by the early-nineteenth-century wars of independence. By the mid-nineteenth century they had adopted steam power for sugar and coffee processing, but as elsewhere these developments led to increased reliance on agricultural crops for export, not a rise in industrial production. As in India, the arrival of cheap British cottons destroyed the pre-existing textile industry that had employed many Latin American men and women. The rise of industrialization in Britain, western Europe, and the United States thus resulted in other regions of the world becoming increasingly economically dependent and, in turn, ever more vulnerable to political domination. Instead of industrializing, many territories underwent a process of deindustrialization due to imperialism and economic competition.

New Patterns of Working and Living

How did work evolve during the Industrial Revolution, and how did daily life change for working people?

Having first emerged in the British countryside in the late eighteenth century, factories and industrial labor began migrating to cities by the early nineteenth century. As factories moved from rural to urban areas, their workforce evolved as well, from pauper children to families to men and women uprooted from their traditional rural communities. Many women, especially young single women and poor women, continued to work, as married women began to limit their participation in the workforce when possible. For some people, the Industrial Revolution brought improvements, but living and working conditions for the poor stagnated or even deteriorated until around 1850, especially in overcrowded industrial cities.

Work in Early Factories

The first factories of the Industrial Revolution 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, accustomed to the putting-out system, were reluctant to work in the new factories even when they received relatively good wages. In a 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 way of life. In the putting-out system, all members of the family worked hard and long, but in spurts, setting their own pace. They could interrupt their work when they wished. Women 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.

Also, early factories resembled English poorhouses, where destitute people went to live at public expense. Some poorhouses were industrial prisons, where the inmates had to work in order to receive 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 pauper children for their labor. Mill owners contracted with local officials to employ large numbers of such children, who had no say in the matter. In the eighteenth century semi-forced child labor seemed necessary to the survival of poor families and was therefore socially accepted. Attitudes began to change in the last decade of the eighteenth century, as middle-class reformers publicized the brutal toil imposed on society's most vulnerable members.

Working Families and Children

By the 1790s the early pattern had begun to change. 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. As a result, people came from near and far to work in the cities, both as factory workers and as porters, builders, and domestic servants. Collectively,



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 British 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)

these wage laborers came to be known as the “working class,” a term first used in the late 1830s.

In some cases, workers were able to accommodate to the system by carrying over familiar working traditions. Some came to the mills and the mines as family units. This was how they had labored 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 efforts 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.

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. They were forced out of rural Ireland by population growth and deteriorating economic conditions from 1817

Factory Acts English laws passed from 1802 to 1833 that limited the workday of child laborers and set minimum hygiene and safety requirements.

on and their numbers increased dramatically in the desperate years of the potato famine, from 1845 to 1851 (see Chapter 21). 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. Pauper children were especially likely to be Irish, reflecting the precariousness of life for migrants. Like many other immigrant groups held together by ethnic and religious ties, however, the Irish worked together, formed their own neighborhoods, and not only survived but also thrived.

The preservation of the family as an economic unit in the factories helped people accommodate to the new surroundings during the early stages of industrialization. Parents disciplined their children 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). Adult workers were often complicit in the exploitation of their children. They were not particularly interested in limiting the minimum working age or hours of children as long as family members worked side by side and they maintained control of their young. Only when technical changes threatened to place control in the hands of impersonal managers did adult workers protest against inhuman conditions in the name of their children.

Some enlightened employers and social reformers in Parliament argued that more humane standards were necessary, and they used widely circulated parliamen-

Debate over Child Labor Laws

The Cotton Mills and Factories Act of 1819 was one of a series of acts intended to prevent the exploitation of child laborers in Britain, largely by restricting their working hours. Debate in the House of Commons over the legislation pitted those arguing for humanitarian considerations against defenders of economic freedom. A passionate proponent of the bill was Sir Robert Peel, himself a factory owner and father of a future British prime minister.

19 February 1818

Sir Robert Peel. . . . About fifteen years ago he had brought in a Bill for the Regulation of Apprentices in Cotton Manufactories. At that time they were the description of persons most employed in those manufactories. He himself had a thousand of them. . . . Since that time, however, the business had been much extended. Manufactories were established in large towns, and the proprietors availed themselves of all the poor population of those towns. In Manchester alone 20,000 persons were employed in the cotton manufactories, and in the whole of England about three times that number. . . . It was notorious that children of a very tender age were dragged from their beds some hours before day light, and confined in the factories not less than fifteen hours; and it was also notoriously the opinion of the faculty, that no children of eight or nine years of age could bear that degree of hardship with impunity to their health and constitution. It had been urged by the humane, that there might be two sets of young labourers for one set of adults. He was afraid this would produce more harm than good. The better way would be to shorten the time of working for adults as well as for children; and to prevent the introduction of the latter at a very early age. . . . The children . . . were prevented from growing to their full size. In consequence, Manchester, which used to furnish

numerous recruits for the army, was now wholly unproductive in that respect. . . .

Lord Lascelles. . . . The individuals who were the objects of the hon. gentleman's proposition were free labourers. This excited his jealousy; for, were the principle of interference with free labourers once admitted, it was difficult to say how far it might not be carried. . . .

Mr. Philips strongly objected to the adoption of any measure of this description, and denied that the employment of children in the cotton factories operated, as had been described, to stint their growth, impair their comfort, or scatter disease amongst them. . . . Small factories were often ill ventilated, and from that circumstance the health of a person might suffer more in six hours in one of these factories, than in fifteen hours in a factory which was well ventilated and properly constructed in other respects. But how could this evil be cured by any bill? The small factories generally went to ruin, and that was the cure for the evil. From the returns made to the House, out of 31,117, the number of persons employed in these returns, 1717, or 5½ per cent, were of the age of 10 and under, 13,203 from 10 to 18, and 16,197 of the age of 18 and upwards. Out of 27,827 persons, there were 1830 only who could not read. ”

EVALUATE THE EVIDENCE

1. What arguments for and against labor regulation do the two sides offer? What rhetorical strategies do they use to strengthen their arguments?
2. In what ways do these arguments reflect the changes in working and living patterns described in the text?

Source: Commons Sitting of 19 February 1818, Series 1, Vol. 37, Cotton Factories Bill, cc559-66, <http://hansard.millbanksystems.com/commons/1818/feb/19/cotton-factories-bill>.

tary reports to influence public opinion. For example, Robert Owen (1771–1858), a successful manufacturer in Scotland, testified in 1816 before an investigating committee on the basis of his experience. He argued that employing children under ten years of age as factory workers was “injurious to the children, and not beneficial to the proprietors.”⁵ Workers also provided graphic testimony at such hearings as reformers pressed Parliament to pass corrective laws.

These efforts resulted in a series of **Factory Acts** from 1802 to 1833 that progressively limited the workday of child laborers and set minimum hygiene and safety requirements. (“See Primary Source 20.1: Debate over Child Labor Laws,” above.) The 1833 act

installed a system of full-time professional inspectors to enforce the provisions of previous acts. Children between ages nine and thirteen could work a maximum of eight hours per day, not including two hours that must be devoted to education. Teenagers aged fourteen to eighteen could work up to twelve hours, while those under nine were banned from employment. The Factory Acts constituted a major victory in preventing the exploitation of children, especially those without families to protect them at the worksite. One unintended drawback of restrictions on child labor, however, was that they broke the pattern of whole families working together in the factory because efficiency required standardized shifts for

Living Conditions of the Working Classes

For the vast majority of European women, the realities of life still included long and hard toil for themselves and their children. As middle-class reformers began to investigate working-class living conditions, they were shocked at what they found. This excerpt comes from an 1845 interview of doctors by an economist and reformer in a German industrial city.

QUESTION: What is your usual experience regarding the cleanliness of these classes?

DR. BLUEMNER: Bad! Mother has to go out to work, and can therefore pay little attention to the domestic economy, and even if she makes an effort, she lacks time and means. A typical woman of this kind has four children, of whom she is still suckling one, she has to look after the whole household, to take food to her husband at work, perhaps a quarter of a mile away on a building site; she therefore has no time for cleaning and then it is such a small hole inhabited by so many people. The children are left to themselves, crawl about the floor or in the streets, and are always dirty; they lack the necessary clothing to change more often, and there is no time or money to wash these frequently. There are, of course, gradations; if the mother is healthy, active and clean, and if the poverty is not too great, then things are better.

QUESTION: What is the state of health among the lower class? . . .

DR. KALCKSTEIN: . . . The dwellings of the working classes mostly face the yards and courts. The small quantity of fresh air admitted by the surrounding buildings is vitiated by the emanations from stables and middens [garbage heaps]. Further, because of the higher rents, people are forced to share their dwellings and to overcrowd them. The adults escape the worst influences by leaving the dwellings during the day, but the children are exposed to it with its whole force. ”

EVALUATE THE EVIDENCE

1. Based on this document, what challenges confronted working-class women in their daily lives?
2. To what extent do the doctors seem to blame the women themselves for their situation? How might observations like these have affected the new sexual division of labor discussed in the text?

Source: Laura L. Frader, ed., *The Industrial Revolution: A History in Documents* (Oxford, U.K.: Oxford University Press, 2006), pp. 85–86.

all workers. After 1833 the number of children employed in industry declined rapidly.

The New Sexual Division of Labor

With the restriction of child labor and the collapse of the family work pattern in the 1830s came a new sexual division of labor. 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 high wages in the growing urban economy, wives were expected to concentrate on their duties at home.

This new pattern of **separate spheres** had several aspects. First, all studies agree that married women from the working classes were much less likely to work

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

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. Evolving gradually, but largely in place by 1850, the new sexual division of labor constituted a major development in the history of women and of the family. (See “Primary Source 20.2: Living Conditions of the Working Classes,” above.)

Several factors combined to create this new sexual division of labor. First, the new and unfamiliar discipline of the clock and the machine was especially hard on married women of the laboring classes. 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

ca. 1780–1850



Women Workers on Break This 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. (© Manchester Art Gallery, U.K./The Bridgeman Art Library)

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. This factor was less important in areas of continental Europe, such as northern France and Scandinavia, where women continued to rely on wet nurses instead of breast-feeding their own babies (see Chapter 18).

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. Shopping, washing clothes, and feeding the family constituted a never-ending challenge. Taking on a 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.⁶

Third, to a large degree the young, generally unmarried women who did work for wages outside the home were segregated from men and confined to certain “women’s jobs” because the new sexual division of

labor replicated long-standing patterns of gender segregation and inequality. In the preindustrial economy, a small sector of the labor market had always been defined as “women’s work,” especially tasks involving needlework, spinning, food preparation, and child care. This traditional sexual division of labor took on new overtones, however, in response to the factory system. Previously, at least in theory, young people worked under the watchful eye of a parent or the master or mistress of a small workshop. The growth of factories and mines brought unheard-of opportunities for girls and boys to mix on the job, free of familial supervision. Such opportunities 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. Thus segregation of jobs by gender was partly an effort by older people to control the sexuality of working-class youths.

Investigations into the British coal industry before 1842 provide a graphic example of this concern. (See “Primary Source 20.3: The Testimony of Young Mine Workers,” page 672.) The middle-class men leading the inquiry professed horror at the sight of girls and

The Testimony of Young Mine Workers

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.

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;

*An old English unit of weight equaling 112 pounds.

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. ²¹

Isabel Wilson, 38 years old, coal putter

²² 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. ²³

EVALUATE THE EVIDENCE

1. How does Payne's testimony compare with that of Ann Eggle and Patience Kershaw?
2. Describe the work of Eggle, 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?

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.

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, many 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 the mines were inappropriate and dangerous places for women and girls. 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."²⁷ The **Mines Act of**

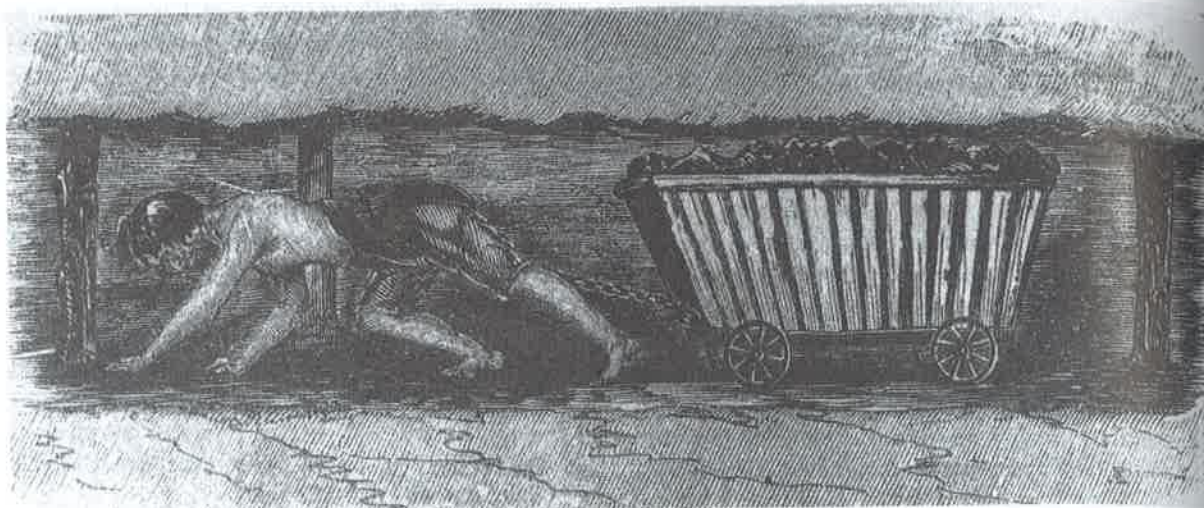
1842 prohibited underground work for all women and girls as well as for boys under ten.

Mines Act of 1842 English law prohibiting 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.⁸

A final factor encouraging working-class women to withdraw from paid labor was the domestic ideals emanating from middle-class women, who had largely embraced the "separate spheres" ideology. Middle-class reformers published tracts and formed societies to urge poor women to devote more care and attention to their homes and families.



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

Relations Between Capital and Labor

How did the changes brought about by the Industrial Revolution lead to new social classes, and how did people respond to the new structure?

In Great Britain, industrial development led to the creation of new social groups and intensified long-standing problems between capital and labor. A new class 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 demands of modern industry regularly brought the interests of the middle-class industrialists into conflict with those of the people who worked for them—the working class.

class-consciousness

Awareness of belonging to a distinct social and economic class whose interests might conflict with those of other classes.

Individuals experienced a growing sense of **class-consciousness**, or awareness of belonging to a distinct social and economic class whose interests might conflict with those of other classes. New questions about social relationships emerged. (See “Primary

Source 20.4: Ford Maddox Brown, *Work*,” at right.) Meanwhile, enslaved labor in European colonies contributed to the industrialization process in multiple ways.

The New Class of Factory Owners

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

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 families with rich networks 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 jumped at the new chances and often helped each other. 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 became more important for young men as a means of success and

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)

EVALUATE THE EVIDENCE

1. 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?
2. What does this painting and Ford's title for it (*Work*) suggest about the artist's opinion of the work of common laborers?

Advice for Middle-Class Women

*The adoption of steam-powered machines generated tremendous profits during the Industrial Revolution. Factory owners and managers enjoyed new wealth, and skilled male workers eventually began to hope for wages high enough to keep their wives and children at home. These social changes encouraged the nineteenth-century "separate spheres" ideology, which emphasized the importance of women's role as caretakers of the domestic realm. Sarah Stickney Ellis's *The Women of England: Their Social Duties and Domestic Habits*, excerpted below, was one of a flood of publications offering middle-class women advice on shopping, housekeeping, and supervising servants.*

“What shall I do to gratify myself—to be admired—or to vary the tenor of my existence?” are not the questions which a woman of right feelings asks awaking to the avocations of the day. Much more congenial to the highest attributes of woman's character, are inquiries such as these: “How shall I endeavor through this day to turn the time, the health, and the means permitted me to enjoy, to the best account? Is any one sick, I must visit their chamber without delay, and try to give their apartment an air of comfort, by arranging such things as the wearied nurse may not have thought of. Is any one about to set off on a journey, I must see that the early meal is spread, to prepare it with my own hands, in order that the servant, who

was working late last night, may profit by unbroken rest. Did I fail in what was kind or considerate to any of the family yesterday; I will meet her this morning with a cordial welcome, and show, in the most delicate way I can, that I am anxious to atone for the past. Was any one exhausted by the last day's exertion, I will be an hour before them this morning, and let them see that their labor is so much in advance. Or, if nothing extraordinary occurs to claim my attention, I will meet the family with a consciousness that, being the least engaged of any member of it, I am consequently the most at liberty to devote myself to the general good of the whole, by cultivating cheerful conversation, adapting myself to the prevailing tone of feeling, and leading those who are least happy, to think and speak of what will make them more so.”

EVALUATE THE EVIDENCE

1. What daily tasks and duties does Sarah Stickney Ellis prescribe for the mother of the family?
2. How does this document exemplify the changes in the sexual division of labor and ideals of domesticity described in the text?

Source: Sarah Stickney Ellis, *The Women of England: Their Social Duties and Domestic Habits*, in *The Past Speaks*, 2d ed., ed. Walter Arnstein (Lexington, Mass.: D. C. Heath, 1993), 2:173.

advancement, but studies at the advanced level were 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 parents 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.

Just like working-class women, the wives and daughters of successful businessmen 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 avoid work in offices and factories. Rather, a middle-class lady should concentrate on her proper role as wife and mother, preferably in an elegant residential area far removed from ruth-

less commerce and the volatile working class. (See “Primary Source 20.5: Advice for Middle-Class Women,” above.) As we have seen, this ideology of “separate spheres” spread to working-class men and women as well.

Debates over Industrialization

From the beginning, the British Industrial Revolution 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 factories in northern England in 1811 and later—smashed the new machines, which they believed were putting them out of work. Doctors and reformers wrote 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 (see Chapter 21). After studying conditions in northern England, this young son of a wealthy Prussian cotton manufacturer published in 1844 *The Condition of the Working Class in England*, a blistering indictment of the capitalist 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 capitalist exploitation and increasing worker poverty was embellished by Marx and later socialists (see Chapter 21).

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 we now call class-consciousness.

Despite the criticism unleashed over industrial working conditions and the broader concerns about new class structures, some observers believed that conditions were improving for the working people. In 1835 in his study of the cotton industry, Andrew Ure (yoo-RAY) wrote that conditions in most factories were not harsh and were even quite good. Edwin Chadwick, a 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.”⁹ Nevertheless, those who thought—correctly—that conditions were getting worse for working people were probably in the majority.

The Early British Labor Movement

Not everyone worked in large factories and coal mines during the Industrial Revolution. In 1850 more British people still worked on farms than in any other occupation, although rural communities were suffering from outward migration. The second-largest occupation was domestic service, with more than 1 million household servants, 90 percent of whom were women. Thus many old, familiar jobs outside industry lived on and provided alternatives to industrial labor.

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, 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 handicraft skills. Only gradually after 1850 did owners find ways to reorganize handicraft industries by increasing the division of labor (and thus undermining the skills and wages of workers) and also by increasing the speed and intensity of work.

Working-class solidarity and class-consciousness developed both in small workshops and in large factories. A general strike of adult cotton spinners in Manchester in 1810 testifies to the growth of anti-capitalist sentiment in Britain’s northern factory districts in the first decades of the nineteenth century. 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.”¹⁰ Even in trades that did not undergo mechanization, unemployment and stagnant wages contributed to class awareness.

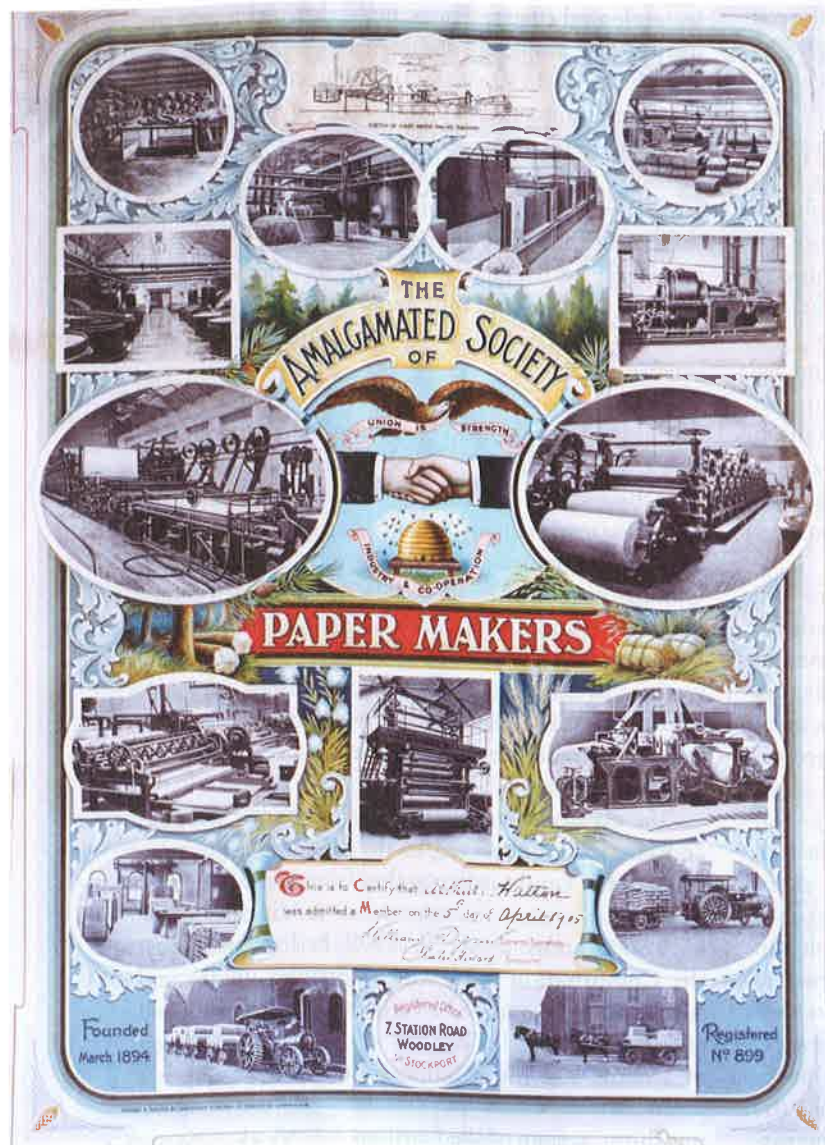
The classical liberal concept of economic freedom and laissez faire emerged in the late eighteenth century, and it continued to gather strength in the early nineteenth century in opposition to the rising tide of working-class anger. In 1799 Parliament passed the **Combination Acts**, which outlawed unions 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. 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 in defiance of the law.

Luddites Group of handicraft workers who attacked factories in northern England in 1811 and later, smashing the new machines that they believed were putting them out of work.

Combination Acts British 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.

ca. 1780–1850



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)

munities, including one at New Harmony, Indiana. Then in 1834 Owen was involved in the organization of one of the largest and most visionary of the early national unions, the Grand National Consolidated Trades Union.

When Owen's and other ambitious schemes collapsed, the British labor movement moved once again after 1851 in the direction of craft unions. The most famous of these 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

Unions sought to control the number of skilled workers, to limit apprenticeship to members' own children, and to bargain with owners over wages.

In the face of such widespread union activity, Parliament repealed the Combination Acts in 1824. Unions were subsequently tolerated, though they were not fully legal until 1867. The government also kept the army in readiness to put down any worker protests deemed too unruly or threatening.

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 669), 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 com-

millions of common 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.

The Impact of Slavery

Another mass labor force of the Industrial Revolution consisted of the millions of enslaved men, women, and children who toiled in European colonies in the Caribbean and in North and South America. Historians have long debated the extent to which revenue from slavery contributed to Britain's achievements in the Industrial Revolution.

ca. 1780–1850

Most now agree that profits from colonial plantations and slave trading were a small portion of British national income in the eighteenth century and were probably more often invested in land than in industry. Nevertheless, the impact of slavery on Britain's economy was much broader than its direct profits alone. In the mid-eighteenth century the need for items to exchange for colonial cotton, sugar, tobacco, and slaves stimulated demand for British manufactured goods in the Caribbean, North America, and West Africa. Britain's dominance in the slave trade also led to the development of finance and credit institutions that helped early industrialists obtain capital for their businesses. Investments in canals, roads, and railroads made possible by profits from colonial trade provided the necessary infrastructure to move raw materials and products of the factory system.

The British Parliament abolished the slave trade in 1807 and freed all slaves in British territories in 1833, but by 1850 most of the cotton processed by British mills was supplied by the labor of enslaved people in the southern United States. Thus the Industrial Revolution was deeply entangled with the Atlantic world and the misery of slavery.

Notes

1. N. F. R. Crafts, *British Economic Growth During the Industrial Revolution* (Oxford, U.K.: Oxford University Press, 1985), p. 32.
2. P. Baiocchi, "International Industrialization Levels from 1750 to 1980," *Journal of European Economic History* 11 (Spring 1982): 269–333.
3. Quoted in 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).
4. Quoted in Emma Griffin, *A Short History of the British Industrial Revolution* (Basingstoke, U.K.: Palgrave Macmillan, 2010), p. 126.
5. Quoted in E. R. Pike, "Hard Times": *Human Documents of the Industrial Revolution* (New York: Praeger, 1966), p. 109.
6. See especially J. Brenner and M. Rama, "Rethinking Women's Oppression," *New Left Review* 144 (March–April 1984): 33–71, and sources cited there.
7. 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): 941; Pike, "Hard Times," p. 266.
8. Quoted in Pike, "Hard Times," p. 208.
9. Quoted in W. A. Hayek, ed., *Capitalism and the Historians* (Chicago: University of Chicago Press, 1954), p. 126.
10. Quoted in D. Geary, ed., *Labour and Socialist Movements in Europe Before 1914* (Oxford, U.K.: Berg, 1989), p. 29.

LOOKING BACK LOOKING AHEAD

spreading to the European continent after 1815. The development of machines powered first by water and then by steam allowed for a tremendous growth in productivity, which enabled Britain to assume the lead in the world's production of industrial goods. Industrialization fundamentally changed the social landscape of European countries, creating a new elite of wealthy manufacturers and a vast working class of urban wage laborers whose living conditions remained grim until the mid-nineteenth century.

One popular idea in the 1830s, first developed by a French economist, was that Britain's late-eighteenth-century "industrial revolution" paralleled the political events in France during 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 had only begun industrialization, 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 not just in France but across Europe. It had brought into existence many of the political ideologies that would interact with the social and economic forces of 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.

The Industrial Revolution was a long process of economic innovation and growth occurring first in Britain around 1780 and

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