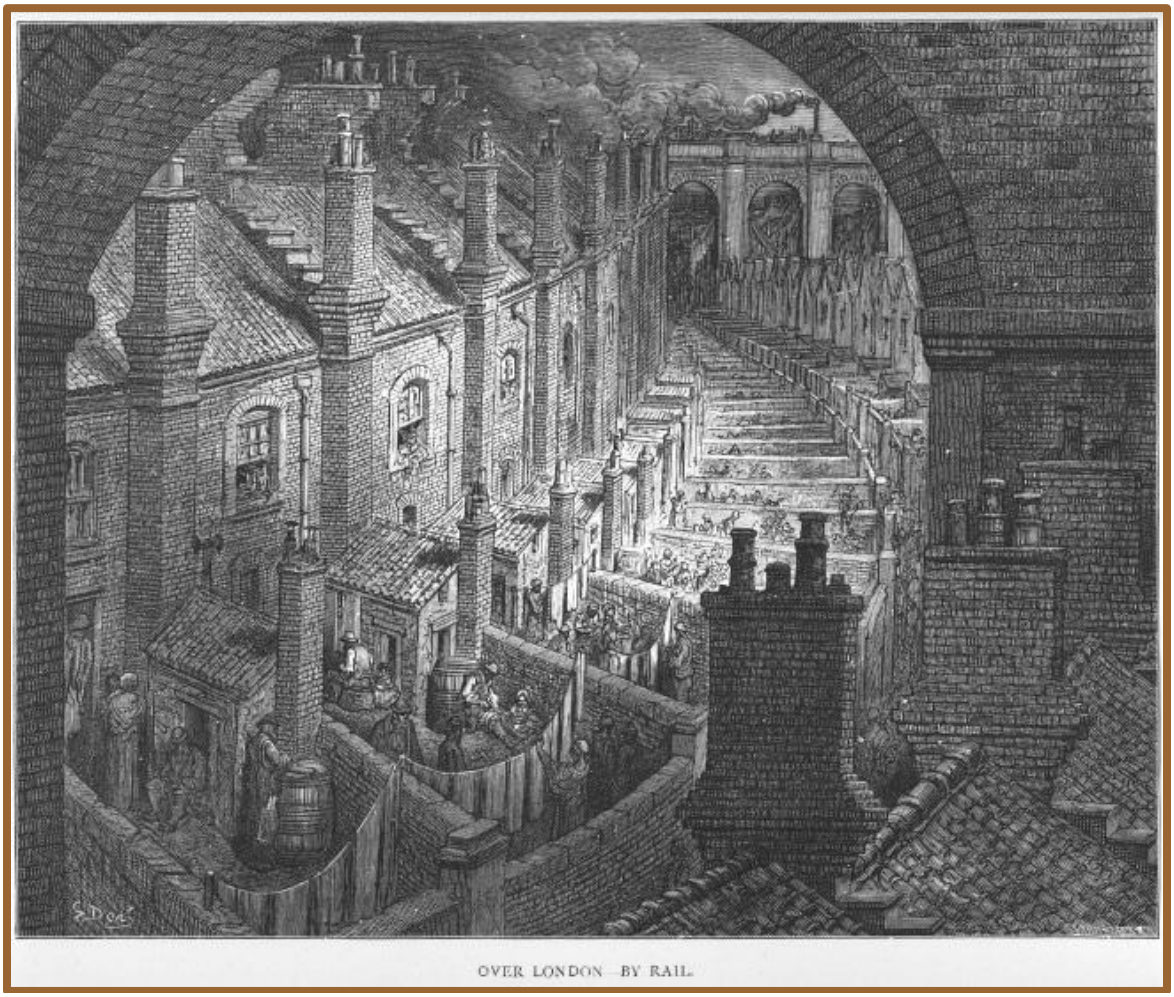

The image above, drawn by the artist Gustav Doré around 1870, is titled *Over London by Rail*, and vividly depicts the dense, squalid conditions of early industrial cities. Source: http://en.wikipedia.org/wiki/File:Dore_London.jpg.

NGCSU E-Text for History 1112
Essay Module
The Industrial Revolution

Unit Goals

After reading this essay module, you should be able to:

1) Outline and discuss the Industrial Revolution's causes, course, and effects.
2) Explain why the Industrial Revolution began in Britain, and identify its subsequent growth trajectories.
3) Discuss Karl Marx's analysis of the Industrial Revolution and understand the impact and influence of his arguments over the next one hundred years.
4) Describe the global impact of the Industrial Revolution.
5) Outline and explain the significance of the Opium Wars.

The second great revolution of the late eighteenth century, along with the political revolutions on both sides of the Atlantic, was the Industrial Revolution. Unlike the French Revolution, it doesn't start in a specific year. Rather, it was a long term process with revolutionary *consequences* for the lives of everyone in the world, right up to the present.

First, what defined it? The crucial change was the **application of mechanical sources of energy—in the beginning steam power—in place of human and animal power**. There is a reason motors are still measured in horse-power (hp): it was the best comparison at hand to express the amazing power of the new steam engine. The steam engine was invented by the Scottish Engineer **James Watt** (1736-1819). Or, more correctly, Watt *innovated and perfected* the steam engine, from a machine used to drain excess water out of coal mines that required so much coal that it had to sit next to its source of fuel, into a **modular, mobile internal combustion engine** that could be employed everywhere as a source of power. The fact that Watt was British (actually Scottish), and that Britain possessed large deposits of coal close to the surface, goes a long way to explain why the Industrial Revolution started in Britain.

[See an image of Watt's design at http://www.uh.edu/engines/watt2.gif. For more on Watt himself, see http://www.egr.msu.edu/~lira/supp/steam/wattbio.html.]

[See a map showing locations of early British industrial development, 1715-1815, at http://www.tc.umn.edu/~tmisa/102/images/map_industry-7.gif.]

Industrialization soon spread, and is in fact still spreading, to other countries. But this always happened by later adoptees imitating previous examples of industrialization. The Industrial Revolution occurred only once as an independent phenomenon: in Britain during the eighteenth century. This makes it much more difficult for historians to

explain why it occurred there and then, because we cannot compare the British experience with any of the later examples of industrialization which relied on previous examples. So, why Britain? It was blessed with **large coal deposits**, in mines which constantly faced the problem of flooding—an incentive to develop pumps fuelled by coal to drain mines, which developed into the steam engine. Another major element was that large parts of the British countryside had by the eighteenth century become the property of nobility that engaged in **capitalist agriculture**, both in Britain and abroad in its colonies, and who used their political clout to gain control of the land, particularly through legislation such as the **Enclosure Acts**, many of which were passed by Parliament between 1750 and 1850. These acts re-ordered traditional rural property rights and boundaries, particularly by enclosing formerly common lands and by asserting private property rights over common rights. As a result, by the mid-nineteenth century most of Britain's land was owned by this very small number of men. Over time, this property realignment, together with the appearance of labor-saving agricultural machinery, drove a lot of landless peasants to the cities, creating a pool of potential labourers to work in the new factories which were powered by the new steam engine.

[For another discussion on why Britain industrialized first, see the section in the E-text, Section 2, 1750-1900. For more on the Enclosure Acts, see the summary by Stephane Gray located at http://cla.calpoly.edu/~lcall/enclosures.html. For more analysis of the causes of the Industrial Revolution, see http://industrialrevolution.sea.ca/index.html.]

Industrialization started in Britain in the late eighteenth Century, but it took until after 1800 for people to realize an important change was going on. That was also because the Industrial Revolution did not change the whole British economy overnight. At first, it was limited to a few key sectors to which the new steam power could be applied: first textiles, and second metallurgy and ironworking.

[Look at the image at http://thereifixedit.files.wordpress.com/2010/09/dc0ac4d8-c8f3-4b7d-97c0-6ed56e5b4d64.jpg?w=500&h=398. Here, for instance, you can see a steam powered hammer shaping a hot iron bar in a British foundry—but this is in the 1830s, half a century after Watt improved the steam engine. By that time countries on the European continent, and also the eastern United States, had only just begun to industrialize.]

Industrialization's effects were immense. In the long run, it broke a ceiling on economic growth and human productivity that had existed since the invention of agriculture nine thousand years before. It is hard for us to imagine now, but before the Industrial Revolution, most production was subsistence-based. It is true that demand for *luxury* products, particularly from Asia, had increased since the seventeenth century, but the bulk of the population in most countries—eighty to ninety percent of the people—lived as farmers who produced just enough to get by from year to year. The Industrial

Revolution ushered in a period of surplus production and massive productivity increases which ultimately replaced the earlier subsistence economy. Work and living patterns shifted, resulting in sustained **urbanization**, as people migrated to cities in search of work. It also led to the growth of **suburbs**, as wealthier people moved out of the increasingly industrial city centers, and employed combustion engine technologies—first the railroad and tramcars, then automobiles—to commute to work. Today, more than eighty percent of the world's population in industrial economies resides in urban areas, an unprecedented development in world history.

While this break with the subsistence economy eventually resulted in higher standards of living, the first decades of the Industrial Revolution produced great human misery due to the rise of the **factory system**. The principle of the factory as a model of labor organization—a large place where each laborer has his own specific task in the production process—was itself not a product of the Industrial Revolution. When Europeans started to make porcelain, they adopted the system of a task-oriented **division of labor** that had been used by the Chinese for centuries. It was the application of the steam engine to produce things in the factory which pushed things in a new direction. This happened first in the production of cotton textiles.

[See an image of early industrialization in the British textile industry at http://4.bp.blogspot.com/-kjaKoJIOClY/TZ1Q9A5A5cI/AAAAAAAAAgg/dHChTVdh9Jg/s1600/british%2Bindustrial-revolution.jpg. Note the exclusive use of women as laborers.]

With mechanical power doing the heavy work, the steam-driven factory required only unskilled laborers, which meant that work was repetitive, dull, and boring. Until after 1850, whole families worked in the factories, and employers actually preferred women and children because they could be paid less, and were easier to discipline and control. Since the investment in steam engines required a large amount of initial capital to set up production, most factories were owned by a handful of wealthy people. Masses of unskilled laborers now became dependent on those factories.

[In many countries industrialization still relies on female labor; this is the case even today in Southeast Asian countries such as Vietnam and Indonesia that produce our clothes, computers, and many other commodities, and also across other regions of Asia, South America and Africa. For more information, see the following data within the following U.N. Report by Lin Lean Lim entitled "Female Labor Force Participation," located at http://www.un.org/esa/population/publications/completingfertility/RevisedLIMpaper.PDF and also see the World Bank datasets at http://data.worldbank.org/indicator/SL.TLF.CACT.FE.ZS.]

This economic situation led to a new social system, with a small group who owned the factories and a large mass who worked in them. The lot of the laborers was mainly misery. The industrial cities were almost always boom towns, which emerged near coal deposits—for instance, Manchester, England, the first industrial city. Not only were their skies filled with smoke, with massive amounts of toxic dust and smog falling on everything (and everyone), but they were also crowded and extremely unsanitary. Like any other European city of that age there was no running water, and no closed sewerage or sanitation system. People would throw their waste in rivers and streams, or just out into the streets. You can imagine how dangerous and unsanitary such an environment was, and disease outbreaks, particularly cholera, were common. Cities also expanded near transportation hubs, administrative centers, and financial centers.

[For a contemporary image of Manchester in the nineteenth century see the painting by William Wylde, *Manchester from Kersal Moor* (1857), located at http://en.wikipedia.org/wiki/File:Manchester_from_Kersal_Moor_William_Wylde_%281857%29.jpg.]

Laborers' families often had to survive on wages—partially or wholly brought in by wives and children—which only allowed for bare survival. There was no insurance or time off granted for accidents on the work floor, which were very common, and no considerations of any kind regarding workplace safety, toxic hazards, or other dangers that are regulated today.

[Examine the image located at http://www.newworldencyclopedia.org/entry/Image:Child_laborer.jpg. What does the image tell us about the use of industrial child labor? What about the image shows us why children might have been valued as workers in these circumstances?]

Children as young as four years of age worked in the factories, without ever getting any education. In the textile factories, small children were employed to crawl under the looms while they ran to ensure that no thread became stuck—but to do this they risked being crushed by the machine going back and forth, or losing fingers and limbs. Children who worked in the coalmines were known as "**hurriers**", as they hauled coal to the surface in harnesses with miniature rail carts strapped to them. They endured such long working days they would often not see any daylight. Underground, supervision and lighting were scarce, and abuse of all types was depressingly common. Children also developed mesothelioma from inhaling coal dust fumes, which led to a painful death. (If you had mesothelioma, your lungs filled with fluid and you drowned usually by the age of fifteen.) Because of the high child mortality rate, the average life expectancy in Manchester in the early nineteenth century was seventeen years of age!

[See a gallery of images related to child labor, including images of "hurriers," on the Esther M. Zimmer Lederberg Trust website, located at http://www.estherlederberg.com/EImages/Extracurricular/Cloth/Coal%20and%20Iron.html#M_TOP.]

The emergence of these miserable industrial boom towns soon led many elite and educated observers to worry about what they called the "Social Question," which was open-ended but usually referred to issues related to the poor, particularly the urban poor. Different remedies were developed: some tried to alleviate the lot of the workers through charity organizations, such as the Salvation Army; repression was also strengthened with the creation of the first police forces, such as the Metropolitan Police Service of London, which appeared in 1829. A new ideology also appeared as a reaction to the industrial misery: **socialism**. Using a term first coined in the 1820s, socialist thinkers developed alternative labor systems, many based around planned utopian communities, as a remedy for the unplanned, unjust nature of early industrial capitalism.

[Several of these communities appeared in the United States, such as Robert Owen's New Harmony—for more on Owen and his utopian visions, see the essay located at http://xroads.virginia.edu/~hyper/hns/cities/newharmony.html.]

The most important thinker to make sense of this new economic situation was **Karl Marx** (1818-1883). In his own time Marx was a relatively marginal figure, not known to many. But he would later become enormously influential as the founder of one of the major ideologies of the twentieth century: "scientific socialism," better known as **communism**. The essential power of Marx's writings—particularly for his later followers –was that he offered a great overarching story about the meaning of human history, and this story gave his followers the confidence that we can understand the course of history and where it will lead us in the future.

For Marx, history had always been the **history of class struggle**. Marx did not invent the idea that there are class divisions. There was an increasing sense shared widely among the elite of 1840s Europe that there were increasing class tensions. But Marx said this had always been the case in history: in antiquity there had been freemen and slaves; in the Middle Ages there had been lords and serfs; now in the modern period it was the **bourgeois capitalists** (those who owned the means of production) versus the **proletariat** (those whose labor enabled the means of production). The latter was Marx's term for the laboring urban poor (from the Latin for "those who only own the rags they are wearing"). For Marx, the shape of any society is determined by its underlying means of production. Each of these means, or modes of production gave way to another one—from ancient slavery to feudalism to capitalism. So Marx could be hopeful that capitalism too would be superseded. According to him, we were even going to reach the

end of history when the working class would emerge victorious in the struggle with the bourgeoisie and create a "communist utopia," free from poverty, war, monetary systems, and national tensions.

How was this going to happen, according to Marx? The growth of capitalism, which had become the growth of the factory system, would lead only to more misery for the laborers—because the capitalists would maximize exploitation of labor to maintain profit margins in an increasingly competitive marketplace. Cartelization and monopoly formation would also occur, Marx argued, as economies of scale forced companies to globalize their production facilities and cannibalize their competition. This would inevitably lead, according to Marx, to global revolution, as workers across the world recognized their mutual interests and used their superior numbers and command of industrial technology to forcefully overthrow the existing system. In effect, Marx brought together the processes of the industrial economic revolution and the French political revolution.

But in this prediction Marx was wrong. As it would turn out, industrialization would not continue to make the working class more miserable. Marx could not know this since he was writing at the height of the despair, when working-class living standards were declining. Partially this seems to be part of a rhythm inherent in the process of industrialization. In most countries the first decades of industrialization are so disruptive that many people are initially worse off, and regular living standards only improve gradually, after many decades of systemic development and industry-labor negotiations.

After 1860, the appearance of state-based welfare systems also proved effective antidotes against Marxist revolutionaries. The first welfare systems were set up in Europe in the late nineteenth century, by both liberal and conservative political leaders, to prevent the working class from becoming more miserable, and to preclude socialist revolution. Urban reform efforts also began, creating closed, sanitized running water and sewerage systems in many cities, leading to drastic reductions in disease outbreaks. From the 1850s on, workers' living standards generally rose, except for periodic crises. There were exceptions like Tsarist Russia—which tried to catch up with a huge industrialization effort around 1900—as well as the United States, where suppression of labor through violence continued to be preferred over schemes that favored welfare system creation. By the end of his life, even Karl Marx recognized the surprising adaptability of industrial capitalism, which had proved more elastic than his theories had contended.

One thing that was certainly true was that the factory system completely changed the nature of work. One aspect of this, which we now take for granted, was the time-discipline forced on people. At the factories, the working day would start and end at a precise time—people's time became now precisely regulated in a way which had been

unknown before to a society which had been mainly agricultural. In Europe before the Industrial Revolution, public clocks existed only on church towers. Now, they proliferated; you also had them at the factory to regulate labor. Later in the nineteenth century, individual time-pieces for the elite appeared: first on a chain, later as a wristwatch, now as a part of your smartphone. People's lives began to be shaped, and 'broken,' to the strict observance of the clock—a discipline once forced on the industrial laborers which we now accept completely and without reservation.

Industrialization not only transformed time, but also distance. The steam engine led to a new, much faster, form of transportation—the railroad, which first appeared in Britain in the 1820s. This was the first step in a continuous increase of speed which would continue, and accelerate, into and throughout the twentieth century, right through to the present.

[See an early example of the railroad's capacity to transform distance at http://upload.wikimedia.org/wikipedia/commons/3/30/Stephenson%27s_Rocket.jpg.]

Globally, industrialization also transformed the geopolitical map. As the pioneer of industrialization, Britain enjoyed an enormous advantage until 1850. For example, the mechanization of the production of textiles—a very basic commodity—made it possible to produce textiles so cheaply that British cotton textiles outcompeted all other players in the market. This not only generated repercussions in Europe, but globally. Britain, as the saying went, became the workshop of the world—but it forced its colonies to serve only as exporters of raw materials, creating economic distortions in colonial economies that persisted for decades. Eastern India, which fell under British domination in the late eighteenth century, had been one of the world's centers of artisanal manufacturing, but in the reconfigured colonial economic order under Britain, became simply one of the sources of cotton for the British textile industry. Existing textile manufacturing in India was destroyed by British policies, so that colonization actually brought economic decline to these regions.

This was not only true for British colonies. The newly independent countries in the Western hemisphere also became suppliers of raw materials in this new economic system. This was true for South America, but initially also the United States, whose southern slave-based economy was an important producer of cotton. The American Civil War would be fought not only over the issue of slavery, but also the related question of national economic orientation. The Southern agricultural elite in the United States profited from low taxes that fostered the export of cotton to Britain, while the Northern economy of industrialists and small farmers would profit from tax barriers to protect it from British competition. The latter approach mirrored the program of the Republican Party of Abraham Lincoln. When the Southern states invoked states' rights, they did so

to protect the foundation of their economic wealth: an economy based on slave-generated cotton exports.

Secondly, newly-harnessed mechanical power gave industrialized European nations, and later other imperial powers such as Japan and the United States, a military advantage which reinforced these economic re-orientations, and also facilitated another round of European-led imperialism, which many scholars term **industrial imperialism**. In the late 1830s–early 1840s the British fought the Qing Chinese Empire in the so-called **Opium Wars**. In this conflict, British steam-powered warships, armed with industrially-produced cannon, turned out to be the decisive weapon: they allowed the British to penetrate the Chinese river system, strangling the Qing Empire's major economic arteries. While the British had only a few of these ships, their power came as a completely unexpected shock to the Chinese. As a result, the Qing Empire had to sign treaties which gave enormous economic privileges to the British. Most importantly, they had to allow the import of the drug **opium** by the British, from British-controlled India, into Chinese markets.

[For an image of British steamships in action against Chinese naval ships, see the link at http://theformofmoney.blogharbor.com/OpiumWarChina.jpg. For more on the Opium Wars, see the brief but instructive essays at http://www.sacu.org/opium2.html and http://opioids.com/opium/opiumwar.html.]

This was an enormous economic change. Until that time the trade balance between Europe and China had been very uneven, to the disadvantage of Europe. There were very few Western goods that the Chinese—who had a very well developed material culture—were interested in. Since no European-produced bulk goods interested Chinese traders, their Western counterparts had to use silver to buy goods from China, such as tea and porcelain. Opium—produced in Britain's Indian territories, including what is now modern Afghanistan—was the first Western-controlled commodity for which a wide demand developed in China. Well aware of the addictive properties of the drug, and worried about the financial and social consequences of this new trend, the Qing Imperial government tried to stamp out the British opium trade. This "War on Drugs" by the Qing against British traders led to the Opium Wars of 1839-1842, as the British government intervened militarily to support its traders. After being defeated by Britain, China was forced to accept the import of opium, and also cede the territory of Hong Kong to the British; Hong Kong remained under British control until 1997. A second Opium War fought between 1856 and 1860 led to another British victory which forced the Qing to make more concessions.

Selling opium to China altered the balance in trade between the West and China for the first time in history. It also would create a huge social catastrophe in China: by the middle of the nineteenth century one in ten Chinese was addicted to this drug. Opium

addiction remained a major social problem in China until the 1950s, and is seen by scholars of Chinese history as one of the causes of the eventual collapse of the Qing Empire in 1911.

In conclusion, industrialization led to dramatic and permanent social, economic, and cultural changes, first in Britain and Europe, then across the world. Patterns of work, lifestyles, and living environments were permanently altered, as were perceptions of time, distance, and travel. The world we live in today, after two centuries of industrial development, has changed more dramatically in this period than in any previous era of human history. Few aspects of our lives remain untouched by industrialization's influence.